European Commission

ROLLING PLAN FOR ICT STANDARDISATION 2022

ICT Standardisation

European Commission
DG Internal Market, Industry, Entrepreneurship and SMEs
Standards for Growth

INTRODUCTION

The Rolling Plan for ICT Standardisation provides a unique bridge between EU policies and standardisation activities concerning information and communication technologies (ICT). This helps to increase convergence of standards makers' efforts towards achieving EU policy goals. This document is the result of an annual dialogue involving a wide-range of interested parties as represented by the European multi-stakeholder platform on ICT standardisation (MSP). The Rolling Plan focuses on actions that can support EU policies and does not claim to be as complete as the work programmes of the different standardisation bodies.

Standardisation actions identified in this document to support EU policies are complementary to other instruments, in particular the Annual Union Work Programme (AUWP). The Rolling Plan attempts to list all known areas where ICT standardisation could support EU policy objectives. It also details the requirements for ICT standardisation, translates them into actions and provides a follow-up mechanism for the actions.

The Rolling Plan 2022 identifies around 170 actions grouped into 37 technological or application domains under four thematic areas: key enablers and security, societal challenges, innovation for the single market and sustainable growth.

The 2022 edition gives a particular prominence to three horizontal "foundational topics" under the new section 3.0. This new section includes a completely new chapter on the data economy and the updated chapters on cybersecurity and e-privacy that have been moved from the section on "key enablers". These are all technology areas for standardisation that go right across the spectrum of standards-making, and may need to be referenced by many, even most, specific activities. Their challenges arise at every step of digitalisation and policy makers need to be more aware that ICT standardisation is the tool to tackle them.

Another area that increasingly needs careful attention by mainstream standards developers is accessibility, critical to allow equal distribution of the benefits of technological advancement in society. The European Accessibility Act requires a high level of accessibility to be ensured in a very large range of ICT related products and services. Dedicated standardisation is getting under way in advance of the EAA entering into force, and is referenced in chapter 3.1.10. But accessibility aspects, addressed where possible on a design-for-all basis, will need to be taken into account in standardisation work under many other chapters of the Rolling Plan.

THE COMMISSION WOULD LIKE TO THANK ALL MEMBERS OF THE EUROPEAN MULTI-STAKEHOLDER PLATFORM ON ICT STANDARDISATION FOR THEIR ACTIVE COLLABORATION AND FOR MAKING THIS DOCUMENT POSSIBLE: THE EU MEMBER STATES, EFTA STATES, STANDARDS DEVELOPING ORGANISATIONS (ETSI, CEN, CENELEC, ISO, IEEE, IEC, ITU, GS1, IETF/IAB, OASIS, ECMA, W3C/ERCIM, UN/CEFACT), INDUSTRY ASSOCIATIONS (BUSINESS EUROPE, CER, DIGITALEUROPE, ECIS, ECSO, ETNO, EUROSMART, FREE ICT EUROPE, GERMAN INSURANCE ASSOCIATION ,GSMA, OFE, ORGALIM) AND STAKEHOLDER ASSOCIATIONS (ANEC, ECOS, EDF, ETUC, SBS).

1. THE STRATEGIC ROLE OF STANDARDISATION IN THE CONTEXT OF EU POLICY MAKING

Standards[1] play a critical role in supporting EU policies and legislation. The European standardisation system is governed by the Regulation on European standardisation[2] and implemented through the public-private-partnership with the European Standardisation Organisations (ESOs) and their members. Its uniqueness lies in the use of harmonised European Standards. When referenced in the Official Journal and when used, harmonised European Standards provide manufacturers across the Single Market with a presumption of conformity with the requirements of harmonised EU legislation. The Commission stressed the importance of standardisation in the Communication "Shaping Europe's Digital Future" issued in February 2020 and it is working together with the ESOs to improve the efficiency, transparency and legal certainty of the system. In addition, the Commission is preparing a new standardisation strategy to help the European economy meet current challenges.

Innovation and technology adoption provide critical support to the EU to face the challenges of a changing geo-political landscape, ageing society, digital transformation and climate change. EU policy making relies on standards and technical specifications to reap the benefits of broader, more interoperable markets and systems, and greater network effects. ICT technical specifications ensure the interoperability of digital technologies and form the cornerstone of an effective Digital Single Market.

ICT standardisation has dramatically changed over the last decades. Alongside the traditional standardisation organisations, specialised and mostly global fora and consortia have emerged as world-leading ICT standard development bodies that have developed the vast majority of standards for the internet, the World Wide Web and more recently for cloud computing, data processing and analysis and blockchain.

The Rolling Plan addresses technology areas in need of ICT standards and explores the role that standards and technical specifications can play in achieving the policy objectives. It reaches out to the ESOs, CEN, CENELEC and ETSI and the global standard development organisations that can respond to the proposed actions and support the respective policy objectives with standardisation deliverables. The Commission publishes the Rolling Plan for ICT Standardisation to consolidate the different ICT standardisation needs and activities in support of EU policies into a single document.

The Annual Union Work Programme (AUWP) for European standardisation is another EU planning tool that is more high-level and not only focused on ICT. It is adopted by a Commission Decision in accordance with Article 8 of the EU regulation 1025/2012 and "shall identify strategic priorities for European standardisation, taking into account Union long-term strategies for growth. It shall indicate the European standards and European standardisation deliverables that the Commission intends to request from the European standardisation organisations in accordance with Article 10".

The European multi-stakeholder platform on ICT standardisation (MSP) is a group of experts set-up by Commission Decision 2011/C349/04 to advise the Commission on all matters related to ICT standardisation. The MSP comprises representatives of EU Member States and EFTA countries, together with other relevant stakeholders, including standards developing organisations, industry, SMEs and societal stakeholders in the area of ICT standardisation. Its tasks include, among other things, providing advice on the content of the Rolling Plan and on the ICT technical specifications to be identified by the Commission for referencing in public procurement (Regulation EU 1025/2012, Art. 13 and 14).

In addition there are a number of other Commission technical advisory groups that are involved in standardisation In a number of cases they come under sectorial regulation (e.g. energy, environment, trade and transport) and these are referenced in the Rolling Plan as appropriate.

BRIDGING RESEARCH AND STANDARDISATION

Research is a rich source for new standards or standards components and for applying available standards in advanced technology contexts. The new knowledge resulting from publicly funded research and innovation programmes can be included in new or improved standards, contributing both to the implementation of the research outcomes and the usage of standards. Over the years, many European ICT research and pilot projects under EU R&D Frame-

1 The term "standards" is used in this document in a generic way for all such deliverables from both recognised standards organisations and from standardisation fora and consortia – or the terms "standards and technical specifications" are used. Yet, whenever required in this document the terms are specified in a more detailed way drawing on the definitions given in the Regulation on European standardisation (1025/2012/EU).

2 Regulation (EU) No 1025/2012 of the European Parliament and of the Council of 25 October 2012 on European standardisation

work Programmes have used standards or contributed to their development. EU funded pilot projects are also an important tool to test standards and provide feedback to SDOs for improvement. Initiatives linking ICT standardisation and ICT R&I appear to be most effective when carried out at the research planning stage. Standardisation awareness is therefore essential in the research life cycle. Standardisation bodies have partially set up links into research activities for facilitating the uptake of standardisation deliverables in research projects and the transfer of research results into standardisation. Research support actions can also contribute to support standardisation activities, liaison between R&I projects and standardisation organisations, awareness and international cooperation.

With this in mind, each chapter of the Rolling Plan references current R&I projects that are relevant for ongoing standards efforts.

THE USE OF ICT STANDARDISATION IN SUPPORT OF POLICY MAKING

A key objective of the Rolling Plan is to create awareness of the importance of ICT standards in the context of policy making. Another objective is to promote the use and uptake of standards in general in order to increase ICT interoperability in those policy areas identified as needing ICT standardisation activities. Standards and technical specifications in ICT ensure interoperability and promote open ICT ecosystems. Standardisation may therefore play an important role in promoting the uptake of new technologies or the transformation of technologies and systems into new, innovative complex systems, including ICT technologies, and combining them with other technologies and technology layers.

With the emergence of new technologies and ICT domains like artificial intelligence, big data, robotics, blockchain/DLT cloud computing and IoT, the importance of standardisation goes beyond interoperability required for completing the Digital Single Market. Given the fast pace of change in our world and its possible implications for our societies and work force, EU policymaking aims to reap the maximum benefits from digital transformation, while protecting our European values from possible adverse effects. In some instances, the availability of standards can become a precondition for implementing policy or legislation. The safety and security of 'smart' products, automated devices, and IoT, together with the reliability and validity of artificial intelligence, data and privacy protection, are all challenges that may require standards to be developed and used for regulatory or public policy purposes.

Currently, ICT standards have played a paramount role in fighting the pandemic. They are also at the heart of the digital transformation that is needed to convert our economy to a low emission, circular one.

Once the relevant standardisation activities, specific standards or technical specifications needed to support a policy or legislation have been developed, it is important that they are widely disseminated, used and implemented. It is also important that the policy contexts, in which specific standards are to be used, are highlighted with broad stakeholder involvement, and that there is awareness of the importance, benefit and need of using the standards within the policy contexts. All this is essential to maintaining the continuous community conversation of innovation and improvement cycles that this living document is intended to facilitate.

2. DEVELOPMENT AND MAINTENANCE OF THE ROLLING PLAN

The Rolling Plan is a living document. It aims to cover as much as possible the broad range of standardisation activities, technical specifications and standards relevant for the respective policy objectives and topic areas.

The Rolling Plan is reviewed each year based on input from the Commission and advice from the MSP. In the interim periods between published versions of the Rolling Plan, factual updates are provided as needed in the form of specific addenda.

The Rolling Plan is based on broad stakeholder input on ICT standardisation topics and strategies. All stakeholders represented in the MSP provide regular input and feedback. They therefore help to paint a detailed picture on ongoing standardisation activities as well as standardisation needs and market/policy needs with a focus on public administration."

The Rolling Plan does not claim to be comprehensive or complete. It provides a perspective at a given point in time and relies on the contributions received and incorporated into it. The Commission services welcome feedback on any specific topics that may be missing or need correction.

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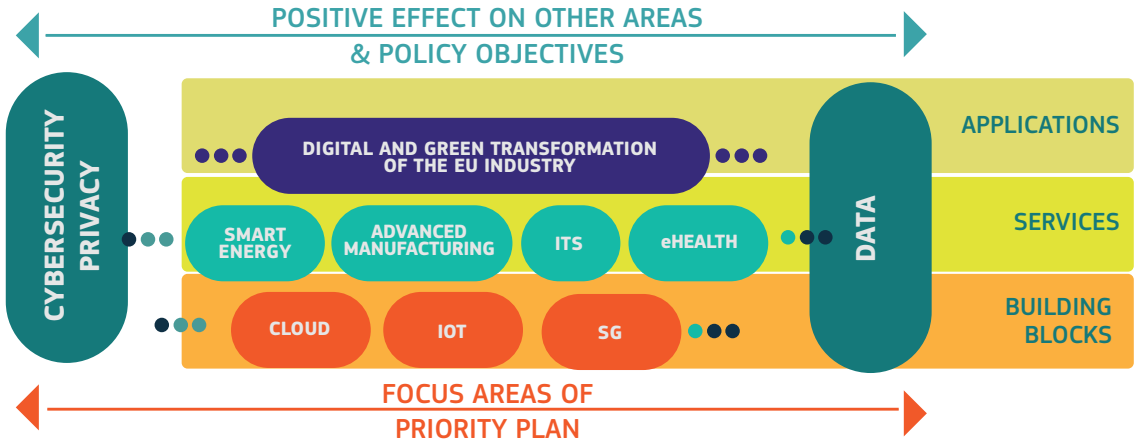
3. EU POLICIES SUPPORTED BY ICT STANDARDISATION

3.0 FOUNDATIONAL DRIVERS

3.0.1 DATA ECONOMY

(A.) POLICY AND LEGISLATION



(A.1) POLICY OBJECTIVES

Digital technologies are transforming the economy and society, and data is at the centre of this transformation. Data-driven innovation will be essential for the modernisation of Europe and the data economy which has the potential of bringing enormous benefits for citizens, for example in support to medicine, mobility, Green Deal. The key role of data is reflected in many chapters of the rolling plan outlining the respective sector specific aspects. On top of that, and addressed in this chapter, data is of foundational and horizontal relevance.

As stated in the Communication "A European strategy for data", policy initiatives aim to "create a single European data space – a genuine single market for data, open to data from across the world – where personal as well as non-personal data, including sensitive business data, are secure and businesses also have easy access to an almost infinite amount of high-quality industrial data, boosting growth and creating value, while minimising the human carbon and environmental footprint ... [and] where EU law can be enforced effectively, and where all data-driven products and services comply with the relevant norms of the EU's single market".

The right to the protection of personal data is guaranteed by the EU Charter of fundamental rights and, together with the single market, is one of the EU founding principles. The European Commission is committed to ensuring fairness in how the value from using data is shared among businesses, consumers and accountable public bodies.

The GDPR and the new ePrivacy Regulation, expected to replace the ePrivacy Directive, provide the basic legal framework for respecting the European Charter in terms of data protection. The collection and use of personal data in compliance with the rules on the one hand, and the availability of non-personal data on the other hand, are necessary conditions to maximise the benefits from innovation and competition.

The European strategy for data is essential to govern new technologies and create business opportunities, while respecting fairness and the EU fundamental rights. Standards are one of the key elements of the data strategy instruments to support its implementation enabling international competition in a geopolitical context and on the basis of European values and rights.

The following tasks are especially in the focus of policy initiatives and of needs for a thriving data economy:

- Availability of data
- Imbalances in market power
- Data interoperability and quality
- Data governance
- Data infrastructures and technologies
- Data lifecycle: collection, record keeping, archival and long-term preservation of information

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The main initiatives already adopted to date are:

- Regulation (EU) 2016/679 (GDPR) and ePrivacy Directive 2002/58/EC (to be replaced with ePrivacy Regulation), with regard to the processing of personal data - dealt with in chapter 3.0.3 on e-Privacy
- Regulation (EU) 2018/1807 on the free flow of non-personal data - dealt with in chapter 3.1.3 on Big Data, Open Data and Public sector information that covers data other than personal data as defined in the GDPR and introduces requirements on Member States not to introduce restrictions on their territory on the processing of non-personal data, with few exceptions;
- Regulation (EU) 2019/881 on the Cybersecurity Act (CSA) - dealt with in chapter 3.0.2 on Cybersecurity;
- Directive (EU) 2019/1024 on open data and re-use of public sector information - dealt with in chapter 3.1.3 on Big Data, Open Data and Public sector information and in chapter 3.2.4 on eGovernment;

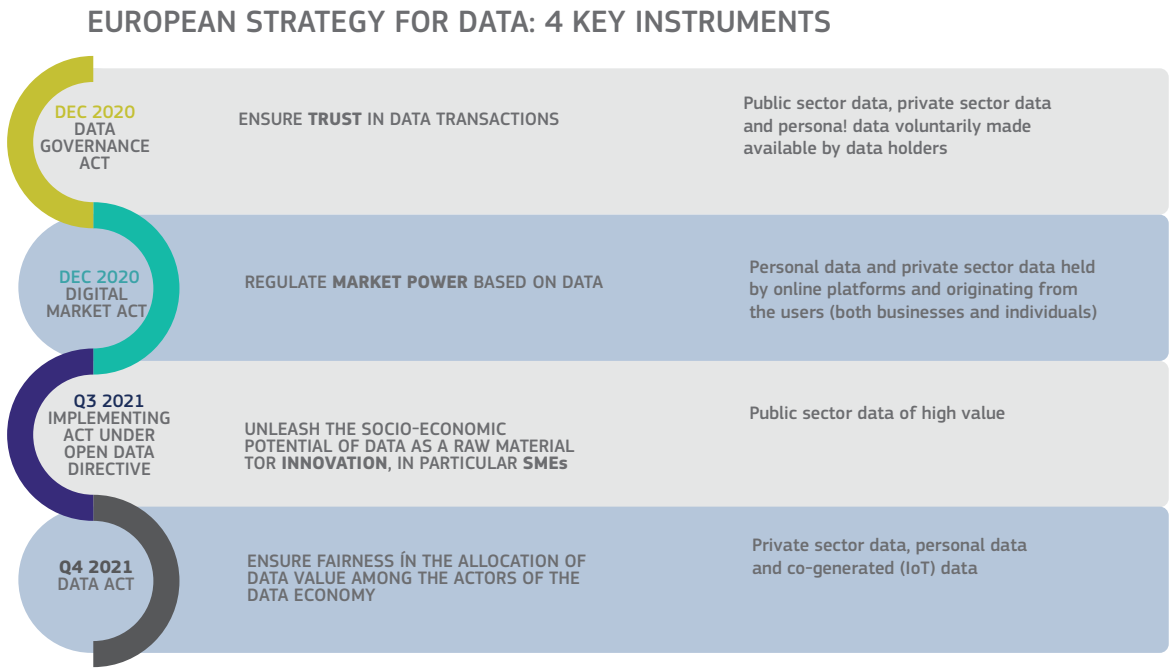
Building on what has already been achieved in recent years, the European Strategy for Data aims to achieve a genuine single market for data by providing for the introduction of policy measures and funding.

The four key instruments of the European Strategy for Data

The European Strategy for Data aims to identify rules to balance rights and obligations for online and offline services to respect the rights of the European Charter.

In particular, the European Strategy for Data has four key instruments at its core aiming at creating a fair and trusted environment, regulate market power and drive innovation with data as raw material:

- The Data Governance Act aims to foster the availability of data for use by increasing trust in data intermediaries and by strengthening data-sharing mechanisms across the EU;
- the Digital Market Act (DMA) aims to regulate large online platforms that qualify as gatekeepers, i.e. operators who control access to a certain market or platform;
- The Open Data Directive - this is dealt with in detail in chapter 3.1.3 on Big Data, Open Data and Public sector information
- The Data Act which is under development and intended to ensure fairness in the allocation of data value among the actors.



These four key instruments are complemented by other legal acts and policies. These include the Digital Services Act which addresses the context of the provision of digital services to citizens and businesses; the proposal aims to balance the responsibilities of users, platforms and public authorities by defining a common European framework that gives greater legal certainty to digital service providers while ensuring respect for European values.

The European Interoperability Framework (EIF) recommends that a long-term preservation policy is formulated for records and information in electronic form held by public administrations for the purpose of documenting procedures and decisions, to keep their legibility, reliability and integrity for as long as need be accessed.

Data lifecycle, including data collection, record keeping, archival and - when necessary - long term preservation of information, supports society's demand for trustworthy records and legal certainty associated with Data Strategy key instruments and application of AI algorithms.

The following section A.3 provides all relevant references.

(A.3) REFERENCES

- New European interoperability framework - Promoting seamless services and data flows for European public administrations
- COM(2020) 66 final Communication from the Commission "A European strategy for data"
- Proposal for a Regulation concerning the respect for private life and the protection of personal data in electronic communications and repealing Directive 2002/58/EC (Regulation on Privacy and Electronic Communications)
- Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)
- Regulation (EU) 2018/1807 on a framework for the free flow of non-personal data in the European Union
- Regulation (EU) 2019/881 on ENISA (the European Union Agency for Cybersecurity) and on information and communications technology cybersecurity certification and repealing Regulation (EU) No 526/2013 (Cybersecurity Act)
- Directive (EU) 2019/1024 on open data and the re-use of public sector information
- Proposal for a Regulation on European data governance (Data Governance Act)
- Proposal for a regulation on a Single Market For Digital Services (Digital Services Act) and amending Directive 2000/31/EC
- Proposal for a Regulation on contestable and fair markets in the digital sector (Digital Markets Act)
- Decision (EU) 2015/2240 on interoperability solutions and common frameworks for European public administrations, businesses and citizens (ISA2 programme) as a means for modernising the public sector (ISA2)
- Council recommendation of 14 November 2005 on priority actions to increase cooperation in the field of archives in Europe

(B) REQUESTED ACTIONS

ACTION 1 SDOs to identify and inform about standards that are available or under way and that are of relevance in supporting the digital transformation at the level of data-innovation and of the data economy.

ACTION 2 SDOs to collaborate on developing a programme for addressing standardisation needs around all the data lifecycle, from data collection to record keeping, archiving and long term preservation of information and start the respective standardisation activities.

ACTION 3 In the context of the MSP, start an analysis on the role of open source software complementing standardisation for the data economy, e.g. with APIs, protocols, service delivery and other platforms.

ACTION 4 SDOs to identify and inform about standards that are available or under way and that are of relevance in supporting the interoperability of data as well as data sharing services between different sectors and domains.

ACTION 5 SDOs to develop standards in support of the Data Governance Act, the Digital Services Act and the Digital Markets Act, taking into account the results of ISA2 program.

(C) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN AND CENELEC

CEN/TC 468 'Preservation of digital information'

CEN/TC 468 works on standardisation of the functional and technical aspects of the preservation of digital information. It will develop standards aiming at achieving a European harmonization on best digital preservation practices: interoperability, integrity, portability of information during its lifecycle, etc. The development of these standards will follow the principles of Security by Design and Privacy by Design, in order to ensure highest security requirements and privacy protection for European citizens. One of the main objectives for the TC will be to coordinate and share national approaches and knowledge, in order to identify similarities and common views that will help to elaborate, through consensus, a European approach to

the subject matter. As such, digital preservation can be part of the eIDAS-ecosystem, relying on a framework for eIDAS-based trust services and for European Digital Identities and preserving evidence.

CEN-CLC/WS DS 'Digital sovereignty'

This workshop, proposed by AFNOR, VDE/DKE and IEEE, aims at defining the concept of digital sovereignty with its associated terminology and framework. It will allow to identify and anticipate future associated standardisation requirements supporting the implementation of a European approach on Sovereignty, including promoting an open market through the development of interoperability standards.

ETSI

ETSI TS 119 511 Electronic Signatures and Infrastructures (ESI); Policy and security requirements for trust service providers providing long-term preservation of digital signatures or general data using digital signature techniques

ETSI TS 119 512 Electronic Signatures and Infrastructures (ESI); Protocols for trust service providers providing long-term data preservation services

ISO

ISO 14721:2012 Space data and information transfer systems — Open archival information system (OAIS) — Reference model

ISO 20614:2017 Information and documentation — Data exchange protocol for interoperability and preservation

ISO 15489 Information and documentation — Records management (multipart)

ISO 20104:2015 Space data and information transfer systems — Producer-Archive Interface Specification (PAIS)

ISO 20652:2006 Space data and information transfer systems — Producer-archive interface — Methodology abstract standard

ISO/IEC JTC 1

ISO/IEC JTC 1/SC 32 Data management and interchange

Standards for data management within and among local and distributed information systems environments

ISO/IEC JTC 1/SC 7 Software and systems engineering

ISO/IEC 25012 "Data quality model" defines a quality model for data in structured format, which can be used to establish requirements, to define measures or to plan and perform data quality assessments. The concept of "data quality" refers to the usefulness of the information derived from data.

ISO/IEC JTC 1/SC 40 IT Service Management and IT Governance

Published standards:

ISO/IEC 38500:2015 Information technology - Governance of IT for the Organization

ISO/IEC TS 38501:2015 Information technology - Governance of IT - Implementation Guide

ISO/IEC TR 38502:2017 Information technology - Governance of IT - Framework and Model

ISO/IEC TR 38504:2016 Governance of information technology — Guidance for principles-based standards in the governance of information technology

ISO/IEC 38505-1:2017 Information technology — Governance of data — Part 1: Application of ISO/IEC 38500 to the governance of data

ISO/IEC 38505-2:2018 Information technology — Governance of data — Part 2: Implications of ISO/IEC 38505-1 for data management

Standards under development:

ISO/IEC FDIS 38503 Information technology — Governance of IT — Assessment of the governance of IT

ISO/IEC PRF TS 38505-3 Information technology — Governance of data — Part 3: Guidelines for data classification

ISO/IEC WD TS 38508 Information technology— Governance of IT— Governance implications of the Use of Shared Digital Service Platform among Ecosystem Organizations

ISO/IEC JTC 1 SC 27 WG 5 Identity management and privacy technologies: Please see the chapter on cybersecurity

Relevant standards for data security and privacy are developed. Please see the respective chapters on "Cybersecurity and on "Privacy" in this Foundational Drivers section.

OASIS

The OASIS Open Data Protocol (Odata) standards support querying and sharing and re-use of data across disparate applications and multiple stakeholders. OASIS OData standards have been approved as ISO/IEC 20802-1:2016 and ISO/IEC 20802-2:2016.

The OASIS ebXML RegRep standards define service interfaces, protocols and information model for an integrated registry and repository. The repository stores digital content while the registry stores metadata that describes the content in the repository.

W3C

Selected List:

The Web of Things (WoT)

Data Catalog Vocabulary (DCAT) - Version 2 (2020-02-04) Recommendation and Working Draft on DCAT Version 3

JSON-LD 1.1 (2020-07-16)

Open Digital Rights Language (ODRL) Version 2.2. (2018-02-15)

Shapes Constraint Language (SHACL) (2017-07-20)

Web Annotation Data Model (2017-02-23)

Data on the Web Best Practices (2017-01-31)

Provenance (Overview with links to standards of the provenance familiy 2013-04-30)

Data Privacy Vocabularies and Controls CG

RDF-DEV CG developing RDFstar extends RDF with a compact way of annotating triples (and creates interoperability with property graphs)

See Data Activity Page for an overview.

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

THE EUROPEAN INTEROPERABILITY FRAMEWORK (EIF)

The European Interoperability Framework (EIF) adopted on 23 March 2017 provides specific guidance on how to set up interoperable digital public services. EIF is undertaken in the context of the Commission priority to create a Digital Single Market in Europe. It offers public administrations 47 concrete recommendations on how to improve governance of their interoperability activities, establish cross-organisational relationships, streamline processes supporting end-to-end digital services, and ensure that both existing and new legislation do not compromise interoperability efforts.

A related on going framework is under development i.e. the Smart Cities and Communities European Interoperability Framework (EIF4SCC). EIF4SCC aims to support local administrations and other actors with challenges that relate to providing interoperability services to citizens and businesses. The Framework intends to support primarily local administrations and, in particular, local policy makers. This work in progress is jointly managed by DG DIGIT as part of the ISA² Programme (2016-2020), and by DG CONNECT in the framework of the Living-in.eu movement.

CEF E-ARCHIVING

Important information should be kept accessible and reusable for years to come, regardless of the system used to store it. eArchiving provides core specifications, software, training and knowledge to help people preserve and reuse information over the long-term.

DILCIS BOARD

The Digital Information LifeCycle Interoperability Standards Board (DILCIS Board) develops, publishes and supports standards which provide practical interoperability in digital archiving. SIARD (Software Independent Archiving of Relational Databases) v2.2, August 31, 2021) https://dilcis.eu/content-types/siard

E-ARK PROJECT (EUROPEAN ARCHIVAL RECORDS AND KNOWLEDGE PRESERVATION)

E-ARK was a multinational big data research project that improved the methods and technologies of digital archiving, in order to achieve consistency on a Europe-wide scale. https://www.eark-project.com/

SWIPO

SWIPO (Switching Cloud Providers and Porting Data), is a multi-stakeholder association facilitated by the European Commission, in order to develop voluntary Codes of Conduct for the proper application of the EU Free Flow of Non-Personal Data Regulation / Article 6 "Porting of Data". See https://swipo.eu

GAIA-X

Gaia-X is the European Association for Data and Cloud AISBL founded with the goal to develop technical solutions and regulatory frameworks and ensure that necessary central facilities as well key federation services to guarantee the envisaged data infrastructure are made available. See https://www.gaia-x.eu/

The official portal for European data https://data.europa.eu/en

https://dataspaces4.eu/

https://i4trust.org/about/

3.0.2 CYBERSECURITY / NETWORK AND INFORMATION SECURITY

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The **EU's Cybersecurity Strategy for the Digital Decade (**JOIN/2020/18 final), aims to ensure a global and open Internet with strong guardrails to address the risks to the security and fundamental rights and freedoms of people in Europe. Following the progress achieved under the previous strategies, it contains concrete proposals for deploying three principal instruments –regulatory, investment and policy instruments – to address three areas of EU action – (1) resilience, technological sovereignty and leadership, (2) building operational capacity to prevent, deter and respond, and (3) advancing a global and open cyberspace. Furthermore, Cybersecurity must be integrated into all digital investments, particularly key technologies like Artificial Intelligence (AI), encryption and quantum computing, using incentives, obligations and benchmarks.

The NIS Directive (Directive concerning measures for a high common level of security of network and information systems across the Union, (EU) 2016/1148) introduces obligations on companies to appropriately manage the cybersecurity risks they face and also to notify cybersecurity incidents to competent authorities. In order to promote a convergent implementation cybersecurity risk management and incident notification requirements across the EU, Member States should encourage the use of European or internationally accepted standards and specifications relevant to the security of network and information systems.

The **EU Cybersecurity Act (Regulation EU 2019/881**) established the European Cybersecurity Certification Framework in order to improve the conditions for the functioning of the internal market by increasing the level of cybersecurity within the Union and enabling a harmonised approach at Union level to European cybersecurity certification schemes, with a view to creating a digital single market for ICT products, ICT services and ICT processes. The European cybersecurity certification framework

provides for a mechanism to establish European cybersecurity certification schemes and to attest that the ICT products, ICT services and ICT processes that have been evaluated in accordance with such schemes comply with specified security requirements for the purpose of protecting the availability, authenticity, integrity or confidentiality of stored or transmitted or processed data or the functions or services offered by, or accessible via, those products, services and processes throughout their life cycle. As also laid down in the mandate provided by the EU Cybersecurity Act, the European Union Agency for Cybersecurity (ENISA) can be requested to prepare candidate EU cybersecurity certification schemes. There is a close linkage between the tasks assigned by ENISA to that purpose, and the Rolling Plan for ICT Standardisation.

Commission Recommendation (EU) 2019/534 of 26 March 2019 on the Cybersecurity of 5G networks identifies a series of actions in order to support the development of a Union approach to ensuring the cybersecurity of 5G networks.

The communication setting up ICT standardisation priorities for the DSM refers to cybersecurity as a priority domain for Europe.

European Electronic Communications Code (Directive 2018/1972) provides for a possibility to require that providers make available free of charge calling line identification (CLI). Directive 2002/58/EC safeguards the privacy of users by giving them the means to protect their right to privacy when calling line identification is implemented.

Calling/Caller ID spoofing is a technique where the information displayed in the CLI field is manipulated with the intention of deceiving the called party into thinking that the call originated from another person, entity or location. It is very often used by fraudsters to take advantage of the inherent trust that end-users have in the integrity of CLI information to facilitate scams. Some operators use CLI spoofing for illegal rerouting/arbitrage schemes (e.g. roaming non EU- originated traffic). Manipulation of CLI can also be a part of a legitimate activity, which adds complexity to this issue.

Council Resolution on Encryption (EU) 13084/1/20, was adopted in November 2020 to enable EU "leveraging its tools and regulatory powers to help shape global rules and standards...to enhance the EU's ability to protect itself against cyber threats, to provide for a secure communication environment, especially through quantum encryption, and to ensure access to data for judicial and law enforcement purposes." The Resolution calls for joining forces with the tech industry to establish an active discussion with the technology industry, while associating research and academia, to ensure the continued implementation and use of strong encryption technology. It notes the need to develop a regulatory framework across the EU to enable authorities to use their investigative powers which are subject to proportionality, necessity and judicial oversight under their domestic legislation, while respecting common European values and upholding fundamental rights and preserving the advantages of encryption. Possible solutions should be developed in a transparent manner in cooperation with national and international communication service providers and other relevant stakeholders using technical solutions and standards.

Today, a substantial part of investigations against all forms of crime and terrorism involve encrypted information. Encryption is essential to the digital world, securing digital systems and transactions. It is an important tool for the protection of cybersecurity and fundamental rights, including freedom of expression, privacy and data protection. At the same time, it can also be used as a secure channel for perpetrators where they can hide their actions from law enforcement and the judiciary. The Commission will work with Member States to identify possible legal, operational, and technical solutions for lawful access and promote an approach which both maintains the effectiveness of encryption in protecting privacy and security of communications, while providing an effective response to crime and terrorism.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The Communication on ICT standardisation priorities for the digital single market proposes actions on cybersecurity, considered as priority domain for Europe:

- *For security and notification requirements for operators of essential services,* the focus will be on establishing a number of reference standards and/or specifications relevant to network and information security, including, where relevant, harmonised standards, to serve as a basis for encouraging the coherent adoption of standardisation practices across the EU.
- For security and notification requirements for digital service providers, in line with the objectives of the Digital single market strategy, the Directive aims to establish a harmonised set of requirements so that they can expect similar rules wherever they operate in the EU.

It is important that *all levels of an organisation* –particularly the strategic level and the management board - are aware of the need for standards and frameworks for cybersecurity. Moreover, between organisations that are partners in (vital) online chains, clear agreements will have to be made on the different standards. In general, organisations, manufacturers or providers involved in the design and development of ICT products, ICT services or ICT processes are encouraged to implement appropriate measures at the earliest stages of design and development to protect the security of those products, services and processes to the highest possible degree, in such a way that the occurrence of cyberattacks is presumed and their impact is anticipated and minimised ('security-by-design'). As the security-by-design principle is becoming also a legal obligation under certain sectors, there is the need to build on the existing measures to reach a common and agreed level of protection which will enable future technological developments. The need for security to be ensured throughout the lifetime of the ICT product, ICT service or ICT process by design and development processes that constantly evolve to reduce the risk of harm from malicious exploitation should also be considered in the context of relevant standardisation activities. It is therefore important to undergo an analysis of the existing standards that can mitigate the current risks and map the current and presumed future risks that still need to be addressed by specific standards.

CLI spoofing as such is a persistent problem that has been observed for a long time but is difficult to quantify. However, it may be more frequent in IP-networks and in the case of international calls (to bypass termination rates and to take advantage of the roaming regulation). Illegitimate CLI spoofing is to the detriment of all parties, be it end-users, providers, and regulators. There is no standardised solution to CLI spoofing in Europe. Some countries are working on national solutions, but this may result in fragmentation of the market if solutions are not interoperable. CLI spoofing should be looked into from the European perspective. Possible solutions should be analysed having regard to the specificities of the European markets and rules, concerning e.g. privacy. Lack of a common European approach may result in European operators being forced to adopt a reactive approach and implement solutions not designed for the conditions in which they are functioning.

Evolution of technologies, such as quantum, could provide further ways to improve cybersecurity, i.e., through the application of quantum cryptography.

(A.3) REFERENCES

- JOIN/2020/18 final – Joint **Communication The EU's Cybersecurity Strategy for the Digital Decade**
- Joint **Communication on Resilience, Deterrence and Defence**: Building strong cybersecurity for the EU, JOIN(2017) 450 final
- JOIN(2013) 1 final **Cybersecurity Strategy** of the European Union: An Open, Safe and Secure Cyberspace
- Regulation (EU) 2019/881 of the European Parliament and of the Council of 17 April 2019 on ENISA (the European Union Agency for Cybersecurity) and on information and communications technology cybersecurity certification and repealing Regulation (EU) No 526/2013 (Cybersecurity Act).
- Commission Recommendation (EU) 2019/553 of 3 April 2019 on cybersecurity in the energy sector (notified under document C(2019) 2400)
- **Directive (EU) 2018/1972** of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code (Recast)
- **Directive 2002/58/EC** of the European Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications)
- Regulation (EU) 2018/1807 of the European Parliament and of the Council of 14 November 2018 on a framework for the free flow of non-personal data in the European Union
- **Directive (EU) 2016/1148** of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the EU (NIS Directive)
- Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to personal data processing and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)
- Commission Recommendation (EU) 2017/1584 of 13 September 2017 on coordinated response to large-scale cybersecurity incidents and crises - C/2017/6100
- Commission Recommendation (EU) 2019/534 **of 26 March 2019 on the Cybersecurity of 5G networks** - C/2019/2335
- COM(2016)176 ICT Standardisation Priorities for the Digital Single Market
- COM(2015)192 A Digital single market strategy for Europe
- **COM(2017)228** Communication on the Mid-Term Review on the implementation of the Digital Single Market Strategy - A Connected Digital Single Market for All and accompanying Staff Working Document SWD(2017)155
- Cybersecurity of 5G networks - EU Toolbox of risk mitigating measures (01/2020)
- COM/2020/795 Communication on A Counter-Terrorism Agenda for the EU: Anticipate, Prevent, Protect, Respond

(B.) REQUESTED ACTIONS

ACTION 1 SDOs to develop standards for critical infrastructure protection and thus in support of and responding to the requirements laid down in the NIS Directive. Foster the application of EN 62443 series (base on IEC 62443 series) for the firm establishment of EU regulatory requirement operational technology (OT) security including critical infrastructures."

ACTION 2 SDOs to assess existing standards required to support the European Cyber-security Certification Framework to ensure that standards are available for providing the core of any certification activity. In particular, SDOs are encouraged to work on standards related to the specification and assessment of security properties in ICT products and services as well as those related to security in processes related to the design, development, delivery and maintenance of an ICT product or service.

ACTION 3 SDOs to investigate the issue of malware on personal computers. ENISA (the European union agency for network and information security) has concluded that many personal computers contain malware that is can monitor (financial) transactions. As we are becoming increasingly dependent on eBusiness and e-transactions, a European initiative should investigate this topic.

ACTION 4 SDOs to investigate requirements for secure protocols for networks of highly constrained devices and heavily constrained protocol interaction (low bandwidth/ ultra-short session duration (50ms)/low processing capabilities.

ACTION 5 SDOs to investigate the availability of standards as regards to the security and incident notification requirements for digital service providers as defined in the NIS Directive and in support of possible other pieces of EU law.

ACTION 6 SDOs to develop a "guided" version of ISO/IEC 270xx series (information security management systems including specific activity domains) specifically addressed to SMEs, possibly coordinating with ISO/IEC JTC1 SC27/ WG1 to extend the existing guidance laid out in ISO/IEC 27003. This guidance should be 100% compatible with ISO/IEC 270xx and help SMEs to practically apply it, including in scarce resource and competence scenarios.

ACTION 7 SDOs to assess gaps and develop standards on cybersecurity of consumer products in support of possible certification schemes completed under the European Cybersecurity Act and in support of possible other pieces of EU law.

ACTION 8 SDOs to prepare a report on measures to mitigate, prevent and/or detect CLI spoofing. The report should address the technical, operational, standardisation and cost aspects of the different possible solutions (STIR/ SHAKEN, blockchain, Solid, etc.) from the European perspective. It should also consider how such solutions could be deployed and managed at the European level.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN AND CENELEC

CEN-CLC/JTC 13 'Cybersecurity and Data Protection' focuses on Information Technology (IT) and develops European standards for data protection, information protection and security techniques, including: Organizational frameworks and methodologies; IT management systems; Data protection and privacy guidelines; Processes and products evaluation schemes; ICT security and physical security technical guidelines; smart technology, objects, distributed computing devices, data services. The ISO 27000 standards are adopted as European Standards by this Joint Technical Committee.

CLC/TC 65X 'Industrial-process measurement, control and automation' coordinates the preparation of European Standards for industrial process measurement, control and automation (e.g. EN IEC 62443-4-1 Security for industrial automation and control systems – Secure product development lifecycle requirements). The EN IEC 62443 series address Operational Technology (OT) found in industrial and critical infrastructure, including but not restricted to power utilities, water management systems, healthcare and transport systems. These are sectorial standards, which can also be applied across many technical areas.

Cybersecurity standards are also being developed in several vertical sectors, for example: CEN/TC 301 'Road Vehicles', CEN/TC 377 'Air-traffic management', CLC/TC 9X 'Electrical and electronic applications for railways', CLC/TC 57 'Power systems management and associated information exchange', CEN-CLC/JTC 19 'Blockchain and Distributed Ledger Technologies', CEN/TC 224 'Personal identification and related personal devices', CLC/TC 45AX 'Instrumentation, control and electrical power systems of nuclear facilities'.

ETSI

TC CYBER, is the ETSI centre of expertise for cybersecurity and produces standards for the cybersecurity ecosystem, consumer IoT/devices, protection of personal data and communication, network security, cybersecurity tools and guides, and in support of EU legislation (CYBER Roadmap). Work includes the first globally applicable standard on the security of the consumer Internet of Things (EN 303 645) and its assessment specification TS 103 701, a Protection Profile for consumer mobile device (including 5G devices),

Cybersecurity Standardisation Essentials for SMEs, the Middlebox Security Protocol TS 103 523 series to create the next generation of security-focused proxies, cryptography for access control and personally identifying information (Attribute-Based Encryption TS 103 458 and TS 103 532).

TC CYBER QSC: works on Quantum Cryptography with a focus on the practical implementation of quantum safe primitives, including performance considerations, implementation capabilities, protocols, benchmarking and practical architectural considerations for specific applications. Work covers the migration towards a post-quantum world (TR 103 619) and the specification of Quantum-Safe Hybrid Key Exchanges. (TC CYBER publications and TC CYBER work programme).

ISG QKD (Quantum Key Distribution): works to support the industrialisation of QKD technology to secure ICT networks. Its publications and work programme cover requirements for security proofs of QKD protocols and authentication, precise characterisation of QKD modules and components, and approaches to integrate QKD into networks. Work considers the security of system implementations and aims to assist the certification of QKD systems using the Common Criteria.

ISG MEC (Multi-access Edge Computing): led the publication of a White Paper on "MEC security: Status of standards support and future evolutions" written by several authors participating in ETSI ISG MEC, ETSI ISG NFV SEC and ETSI TC CYBER. The work identified aspects of security where the nature of edge computing leaves typical industry approaches to cloud security insufficient. As a follow-up, the MEC group started a related study on MEC Security in (ETSI GR MEC041).

ETSI also works on other specific security topics including the security of mobile communications including the 5G network equipment security assurance specifications (**3GPP SA3**), network functions virtualisation (**ETSI NFV ISG**), intelligent transport systems (**ITS WG5**), digital enhanced cordless telecommunications (DECT™), M2M/IoT communications (**oneM2M** published standards, latest drafts), reconfigurable radio systems (**RRS WG3**) and emergency telecommunications (including terrestrial trunked radio (**TETRA**)), smart cards and secure elements **(TC SCP)** and electronic signatures and trust service providers with a set of standards for the certification of trust services **TC ESI** (ESI activities).

IEC

Technical Committee IEC/TC 65 '*Industrial-process measurement, control and automation*' develops International Standards for systems and elements used for industrial-process measurement and control concerning continuous and batch processes.

Working Group IEC/TC 65/WG 10 '*Security for industrial process measurement and control - network and system security*' is responsible for the IEC 62443 series on Industrial communication networks, which addresses the prevention of illegal or unwanted penetration, intentional or unintentional interference with the proper and intended operation, or inappropriate access to confidential information in industrial automation and control systems.

IEC 62443-4-2:2019 '*Security for industrial automation and control systems - Part 4-2: Technical security requirements for IACS components*' was published in 2019 and IEC 62443-3-2:2020 '*Security for industrial automation and control systems - Part 3-2: Security risk assessment and system design*' was published in 2020. The publication of International Standard IEC 62443-2-1 (edition 2) '*Security for industrial automation and control systems - Part 2-1: Security program requirements for IACS asset owners*' is expected in 2021.

In Europe, IEC/TC 65 is mirrored by CLC/TC 65X '*Industrial-process measurement, control and automation*'. This CENELEC standardisation work is carried out for equipment and systems, and closely coordinated with IEC/TC 65.

Technical Committee IEC/TC 57 '*Power systems management and associated information exchange*' is responsible for the IEC 62351 standards series '*Power systems management and associated information exchange - Data and communications security*'. The different security objectives of this series include authentication of data transfer through digital signatures, ensuring only authenticated access, prevention of eavesdropping, prevention of playback and spoofing, and intrusion detection.

IECEE/ICAB

Conformity Assessment (CA) is any activity, which results in determining whether a product or other object corresponds to the requirements contained in a standard or specification. The IEC runs four CA systems, each of which operates Schemes based on third-party conformity assessment certification. They establish that a product is reliable and meets expectations in terms of performance, safety, efficiency, durability, etc. This is especially crucial for Cybersecurity.

IECEE, the IEC system for Conformity Assessment Schemes for Electrotechnical Equipment and Components, which issues internationally recognized certification on Cybersecurity, operates the CB scheme, facilitating cooperation among accepted National Certification Bodies (NCBs) worldwide. NCBs perform market surveillance functions, which ensure that the overall production line is constantly compliant with the initial testing/certification.

The IECEE Full Certification Scheme is an extension of the IECEE CB Scheme, where initial and/or periodic surveillance of production is performed. The Scheme provides the evidence that each certified product offers the same quality/safety level as type-tested sample.

The CAB (Conformity Assessment Board) is responsible for setting the IEC's conformity assessment policy, promoting and maintaining relations with international organizations on conformity assessment matters.

OASIS

The OASIS Cyber Threat Intelligence (CTI) TC defines a set of information representations and protocols to support automated information sharing for cybersecurity situational awareness, real-time network defence, and sophisticated threat analysis. The Structured Threat Information eXpression (STIX) language provides a common set of descriptors for security threats and events. The Trusted Automated Exchange of Indicator Information (TAXII) specification provides common message exchange patterns.

The OASIS Open Command and Control (OPenC2) TC provides a suite of specifications to administer command and control of cyber defence functions distributed across multiple systems. A JSON Abstract Data Notation (JADN) Version 1.0 specification was published in August 2021

The Collaborative Automated Course of Action Operations (CACAO) for Cybersecurity TC provides a standard to describe the prevention, mitigation, and remediation steps in a course of action "playbooks" in a structured machine-readable format that can be shared across organizational boundaries and technology solutions. CACAO Security

Playbooks v1.0 specification was published in January 2021.

The OASIS Common Security Advisory Framework (CSAF) TC provides standard structured machine-readable formats for security vulnerability-related advisories based on existing industry practice. The TC delivered CSAF Common Vulnerability Reporting Framework (#CVRF) V1.2 in 2017 and released a Common Security Advisory Framework Version 2.0 for review in August 2021

The OASIS Threat Actor Context (TAC) TC establishes a common knowledge framework that enables semantic interoperability of threat actor contextual information. This framework allows organizations to strategically correlate and analyze attack data, which could lead to a better understanding of their adversary's goals, capabilities, and trends in targeting and techniques. Updated versions 2.1 of STIX and TAXI were published in June 2021

The Open Cybersecurity Alliance OASIS Open Project aims to bring together vendors and end users in an open cybersecurity ecosystem where products can freely exchange information, insights, analytics, and orchestrated response. The OCA supports commonly developed code and tooling and the use of mutually agreed upon technologies, data standards, and procedures.

ISO/IEC JTC 1

Technical Committee ISO/IEC JTC 1/SC 27 *'Information security, cybersecurity and privacy protection'* produces the International Standards for the protection of electronic information assets and ICT. This includes generic methods, techniques and guidelines to address both security and privacy aspects, such as:

- Security requirements capture methodology;
- Management of information and ICT security; in particular information security management systems, security processes, and security controls and services;
- Cryptographic and other security mechanisms, including but not limited to mechanisms for protecting the accountability, availability, integrity and confidentiality of information;
- Security management support documentation including terminology, guidelines as well as procedures for the registration of security components;
- Security aspects of identity management, biometrics and privacy;
- Conformance assessment, accreditation and auditing requirements in the area of information security management systems;
- Security evaluation criteria and methodology.
- Included in the 198 published International Standards are the ISO 27000 *Information Security Management* Standards series.
- http://www.iso.org/iso/iso_technical_committee?commid=45306

ITU-T

ITU-T SG2 is currently developing a new Supplement on Countering Spoofing (E.sup.spoofing to E.157). Its purpose is not the development of anti-fraud and identity verification platforms, but rather it provides information that could assist in implementing measures to counter spoofing. It should be noted that Calling Party Number authentication mechanisms are not a global solution against fraud or spoofing, the study of which is covered in various technical standardisation bodies. https://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=15044

ITU-T SG17 (Security) develops globally harmonized standards on telecommunication and information security, application security, cyberspace security, identity management and authentication, data security including privacy-reserving technologies such as de-identification and multi-party compuation. On application security, currently ITU-T SG17 works specifically on software defined networking, cloud computing, intelligent transport systems, distributed ledger technologies, quantum key distribution networks etc. Nearly 300 ITU-T Recommendations have been developed including the security Recommendations under the ITU-T X-series.

More info: http://itu.int/ITU-T/go/tsg17

http://www.itu.int/ITU-T/recommendations/index_sg.aspx?sg=17

ITU-T SG20 under question Q6/20 studies aspects related to Security, Privacy, Trust and Identification for IoT and SC&C. ITU-T SG20 approved Recommendation ITU-T Y.4805 "Identifier service requirements for the interoperability of Smart City applications", Recommendation ITU-T Y.4459 "Digital entity architecture framework for IoT interoperability", Recommendation ITU-T Y.4807 "Agility by design for Telecommunications/ICT Systems Security used in the Internet of Things" and Recommendation ITU-T Y.4808 "Digital entity architecture framework to combat counterfeiting in IoT".

Currently, ITU-T SG20 is working on draft Recommendation "Requirements of data security for the heterogeneous IoT devices" (Y.Data.Sec.IoT-Dev) and draft Recommendation "Reference framework of cybersecurity risk management of IoT ecosystems on smart cities" (Y.IoT-Smartcity-Risk).

More info: http://itu.int/ITU-T/go/tsg20

ITU-T SG11 focuses on security of existing protocols including revision of SS7 stack and their impact on digital financial services (DFS). Following the Member States' demands on dealing with the spoofing of calling party number, SG11 revised ITU-T Q.731.3, which specifies an exceptional procedure for transit exchange connected to CPE (Customer Premises Equipment) with the purpose of providing predefined calling party number by the originating operator. ITU-T SG11 assumes that all calling party numbers delivered in the telecommunications network should be generated or verified by an operator. The security of existing signalling protocols is the cornerstone of the trust between financing entity and its customer as ICT network is used to provide access to customers' bank accounts.

In this regard, SG11 approved ITU-T Q.3057 "Signalling requirements and architecture for interconnection between trustable network entities" and a Technical Report QSTR-SS7-DFS "SS7 vulnerabilities and mitigation measures for digital financial services transactions". Also SG11 organized a "Brainstorming session on SS7 vulnerabilities and the impact on different industries including digital financial services" (Geneva, 22 October 2019) https://www.itu.int/en/ITU-T/Workshops-and-Seminars/102019/Pages/default.aspx

Currently, SG11 is developing signalling procedures and protocols for enabling interconnection between trustable network entities in support of existing and emerging networks (Q.Pro-Trust), signalling procedures of calling line identification authentication (Q.CIDA) and a technical report on low resource requirement, quantum resistant, encryption of USSD messages for use in Financial services (TR-USSD).

More info: http://itu.int/ITU-T/go/tsg11

ITU-T SG13 is carrying out work on trust in telecommunications and safe qu

W3C

W3C runs several groups in the area of Security :

- Web Cryptography working group, which is defining an API that lets developers implement secure application protocols for web applications, including message confidentiality and authentication services, by exposing trusted cryptographic primitives from the browser.

- Web Application Security "WebAppSec" working group, which is developing standards to ensure that web applications are delivered free from spoofing, injection, and eavesdropping.
- Hardware-based secure services community group, which analyses use-cases where browser (and web application)'s developers could benefit from secure services in the field of cryptographic operation, citizen identity and payment to native applications.
- Web bluetooth community group, which is developing a specification for bluetooth APIs to allow websites to communicate with devices in a secure and privacy-preserving way.
- Web NFC community group, which is creating a near field communication API that is browser-friendly and adheres to the web's security model.
- https://www.w3.org/Security

IEEE

IEEE has standardisation activities in the cybersecurity/network and information security space and also addresses anti-malware technologies, encryption, fixed and removable storage, and hard copy devices, as well as applications of these technologies for smart grids or in healthcare. The 'Security in Storage' Working Group of the Cybersecurity & Privacy Standards Committee standardizes cryptographic and data authentication procedures for storage devices. IEEE 1619.2, for example, specifies an architecture for encryption of data in random access storage devices. In June 2020 P2883 was approved to specify methods of sanitizing logical storage and physical storage as well as providing technology-specific requirements and guidance for the elimination of recorded data.

For securing wired LANs WG 802.1 of the IEEE LAN/MAN Standards Committee has developed the IEEE 802.1AE standard which defines a Layer 2 security protocol called Medium Access Control Security (MACSec) that provides point-to-point security on Ethernet links between nodes. IEEE actively develops security standards for healthcare and medical devices as well as wearables. The 'Personal Health Device' Working Group develops IEEE 11073-40101 to define processes for vulnerability assessment as part of the medical device interoperability series of standards. The 'Healthcare Device Security Assurance' Working Group develops a family of standards for wirelessly connected diabetes devices (P2621.x)

A new standards project focuses on authentication: IEEE P2989 – Standard for Authentication in Multi-Server Environment.

IEEE SA is taking a holistic view on cybersecurity and initiated several critical pre-standardisation Industry Connections programs in this area:

- IC20-011 IoT Ecosystem Security
- IC20-021 Meta Issues in Cybersecurity
- IC20-022 Disaster Recovery for Blockchain Nodes and Enterprise Workloads
- IC21-001 Cybersecurity in Agile Cloud Computing

A new area of work focused on "Human Augmentation" is also working on issues such as security, privacy and identity: IEEE P2049.2 - Standard for Human Augmentation: Privacy and Security and IEEE P2049.3 - Standard for Human Augmentation: Identity.

The IEEE Computer Society AI Standards committee is working on IEEE P2986 - Recommended Practice for Privacy and Security for Federated Machine Learning.

The 'Privacy and Security Architecture for Consumer Wireless Devices' Working Group standardizes a privacy and security architecture for wireless consumer devices (P1912). For more information visit https://ieeesa.io/rp-nis

IETF

The following IETF WGs are active in this area:

The Managed Incident Lightweight Exchange (MILE) WG develops standards to support computer and network security incident management. The WG is focused on two areas: IODEF (Incident Object Description Exchange Format, RFC5070), the data format and extensions to represent incident and indicator data, and RID (Real-time Inter-network Defense, RFC6545), the policy and transport for structured data.

The Security Automation and Continuous Monitoring (SACM) WG is working on standardising protocols to collect, verify, and update system security configurations that allow high degree of automation. This facilitates securing information and the systems that store, process, and transmit that information. The focus of the WG is the assessment of network endpoint compliance with security policies so that corrective measures can be provided before they are exposed to those threats.

The aim of DDoS Open Threat Signalling (DOTS) WG is to develop a standards based approach for the realtime signalling of DDoS related telemetry and threat handling requests and data between elements concerned with DDoS attack detection, classification, traceback, and mitigation.

The goal of the Interface to Network Security Functions (I2NSF) WG is to define a set of software interfaces and data models for controlling and monitoring aspects of physical and virtual NSFs. A Network Security Function (NSF) is a function used to ensure integrity, confidentiality, or availability of network communications, to detect unwanted network activity, or to block or at least mitigate the effects of unwanted activity. The hosted, or cloud-based, security service is especially attractive to small and medium size enterprises who suffer from a lack of security experts to continuously monitor networks, acquire new skills and propose immediate mitigations to ever increasing sets of security attacks.

The full list of IETF Working Groups in the Security Area is available here: https://datatracker.ietf.org/wg/#sec

https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#NISec

3GPP

SA WG3 is responsible for security and privacy in 3GPP systems, determining the security and privacy requirements, and specifying the security architectures and protocols. The WG also ensures the availability of cryptographic algorithms which need to be part of the specifications.

http://www.3gpp.org/specifications-groups/sa-plenary/sa3-security

ECMA

Secure ECMAScript (SES) is a runtime environment for running ECMAScript (JavaScript) strict-mode code under object-capability (ocap) rules. ECMA Technical Committee TC39 maintains and updates the general purpose, cross platform, vendor-neutral programming language ECMAScript (JavaScript).

ONEM2M

oneM2M's architecture defines a common middleware technology in a horizontal layer between devices and communications networks and IoT applications. This standardizes secure links between connected devices, gateways, communications networks and cloud infrastructure. The oneM2M SDS – System Design and Security working group is also responsible for security and privacy. The following non-exhaustive list highlights some specifications which

define and describe security features in oneM2M:

- TS-0001 Functional Architecture
- TS-0003 Security Solutions
- TS-0016 Secure Environment Abstraction
- TS-0032 MAF and MEF Interface Specification (MAF = M2M Authentication Framework; MEF = M2M Enrolment Function)
- ITU-T SG20 transposed oneM2M specifications in their Y.450x series. See also Y.oneM2M.SEC.SOL.
- All specifications are openly accessible at https://www.onem2m.org/technical.

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

ECSO

The European Cyber Security Organisation (ECSO) represents the contractual counterpart to the European Commission for the implementation of the Cyber Security contractual Public-Private Partnership (cPPP).

WG1 focuses on standardisation, certification, labelling and supply chain management.

https://www.ecs-org.eu/

ECSO WG1 has published the State of the Art Syllabus (SOTA) (December 2017), which lists all standards and specifications related to cyber security. The SOTA document gives a good overview of cyber security standards, initiatives and certification schemes, both at the European and international level (including national elements), for assessment and certification of items.

https://www.ecs-org.eu/documents/uploads/updated-sota.pdf

OIDF

Risk and incident sharing and coordination working group [RISC]

RISC (chartered 2015) provides data sharing schemas, privacy recommendations and protocols to share information about important security events in order to thwart attackers from using compromised accounts with one service provider to gain access with other service providers. RISC focuses on peer to peer sharing of information related to the state of individual accounts.

http://openid.net/wg/risc/charter/

NIST

NIST has started work in several areas, active documents with two reports already published which provide guidance on critical security controls and security by default for products and services. Other areas of work include critical infrastructure protection, privacy matters and cybersecurity issues.

Cyber-Physical Systems for Global Cities Project http://www.nist.gov/el/smartgrid/cpsforglobalcities.cfm

Cybersecurity for Smart Grid Systems http://www.nist.gov/el/smartgrid/cybersg.cfm

Cybersecurity for Smart Manufacturing Systems http://www.nist.gov/el/isd/cs/csms.cfm

National Institute of Standards and Technology Initiates Development of New Cybersecurity http://www.nist.gov/itl/cybersecurity-framework-021313.cfm

Reference Architecture for Cyber-Physical Systems Project Framework http://www.nist.gov/el/smartgrid/cpsarchitecture.cfm

CYBER SECURITY PPP

The cPPP will be instrumental in structuring and coordinating digital security industrial resources in Europe

https://ec.europa.eu/digital-single-market/en/cybersecurity-industry

(C.3) ADDITIONAL INFORMATION

The **Danish business community is** developing a prototype for a data ethics and cybersecurity seal for companies. The seal will create transparency for consumers and help ambitious companies gain a competitive advantage.

In the **Netherlands**, the national government has selected a group of security specifications for its comply-or-explain policy (e.g. DNSSEC, DKIM, TLS, SPF, DMARC, START-TLS, DANE, RPKI), and is actively using various adoption strategies to get the specifications implemented. An effective tool that was developed to drive adoption is the website www.internet.nl (available in English). Organisations and individuals can easily test whether websites offer support for modern Internet Specifications, and the code is open source.

Also in the **Netherlands**, a method to help improve secure software lifecycle management, including software development, was developed under the title Secure Software Framework (SSF). The framework is applied by software developers in innovative projects, where security of software is of the utmost importance. The framework was published by the Secure Software Alliance (SSA), a public-private program in which developers of software, end users, professional bodies, institutes for research and education and the Dutch Ministry of Economic Affairs and Climate cooperate to promote secure software and connect initiatives in this area. The SSF is part of the Roadmap for Digital Hard- and Software Security of the Ministry of Economic Affairs and Climate.

In September 2020 in the **Netherlands**, a public-private coalition called the Online Trust Coalition (OTC) was launched, with the purpose to provide an unambiguous, efficient method for cloud service providers to demonstrate that their services are reliable and secure. And by doing so, to help to implement the relevant laws and regulations (e.g. EU Cybersecurity Act)."

In **Germany**, the Federal Agency for Information Security (BSI) bases several national cyber-security standards -concerning both critical infrastructures and SMEs- on the ISO/IEC EN 270xx family and the Federal Network Agency (BNetzA) mandates the use of ISO/IEC 27019 (with a few additional requirements in the national IT Security catalogue) for grid network operators with mandatory certification.

ENISA and the European Computer Security Incident Response Team (CSIRT) community have jointly set up a task force with the goal of reaching a consensus on a 'Reference Security Incident Classification Taxonomy'. Following a discussion among the CSIRT community during the '51st TF-CSIRT meeting' (15 May 2017 in The Hague, Netherlands), it was concluded that there is an urgent need for a taxonomy list and name that serves as a fixed reference for everyone. This is where the so-called 'Reference Incident Classification Taxonomy Task Force' comes into play. The aim of this task force is to enable the CSIRT community in reaching a consensus on a universal reference taxonomy. Additionally, the task force covers the following objectives:

- Develop a reference document
- Define and develop an update and versioning mechanism
- Host the reference document
- Organise regular physical meetings with stakeholders

The ENISA NCSS Interactive Map lists all the documents of National Cyber Security Strategies in the EU: https://www.enisa.europa.eu/topics/national-cyber-security-strategies/ncss-map/national-cyber-security-strategies-interactive-map

3.0.3 E-PRIVACY

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The ePrivacy Directive and the General Data Protection Regulation provide the legal framework to ensure digital privacy for EU citizens. The European Commission proposed a Regulation3 in 2017 to modernise the ePrivacy Directive and provide stronger privacy protection to users of all electronic communications services. The EU General Data Protection Regulation ensures that personal data can only be gathered under strict conditions and for legitimate purposes. Organisations that collect and manage your personal information must also protect it from misuse and respect certain rights.

The ePrivacy Directive builds on the Charter of Fundamental Rights of the European Union and protects the privacy and confidentiality of electronic communications and the terminal equipment of the user of electronic communications networks and any information stored on such equipment.

The enforcement of the EU data protection and privacy legal framework would be made easier if data processing products and processes were designed and built from the beginning with legal requirements in mind. This is referred to as 'data protection by design'. Standards may lay out the basic requirements for data protection by design for products and processes, minimising the risk of (i) divergent national approaches, with their related risks to freedom of movement of products and services, and (ii) the development of several, potentially conflicting, private de-facto standards.This could be combined with the emergence of certification services: businesses who want their products and processes audited as being "privacy by design"-compliant, would have to fulfil a set of requirements defined through appropriate EU standards and robust, independent third-party certification mechanisms.

The principles of data protection by design and by default , as well as the need to undergo a data protection and privacy impact assessment are included in the General Data Protection Regulation 2016/679/EU (GDPR). This regulation replaced the Data Protection Directive 95/46/EC and has applied since 25 May 2018.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The focus will be on establishing a number of reference standards and/or specifications relevant to privacy in the electronic communications environment to serve as a basis for encouraging the consistent adoption of standardised practices across the EU and, where relevant, on developing harmonised standards.

The Commission has issued a standardisation request to European standards organisations seeking to routinely include privacy management methodologies in both the design and production phases of security technologies generally. (Privacy by design)

Proposal for a Regulation of the European Parliament and of the Council concerning the respect for private life and the protection of personal data in electronic communications and repealing Directive 2002/58/EC (Regulation on Privacy and Electronic Communications), 10.01.2017, COM (2017)10 final https://ec.europa.eu/digital-single-market/en/news/proposal-regulation-privacy-and-electronic-communications

(A.3) REFERENCES

The following legal instrument should be considered at European level:

Regulation (EU) 2016/679 on the protection of natural persons with regard to personal data processing and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation). Article 253 calls for data protection by design and by default.

Directive 2002/58/EC concerning the processing of personal data and the protection of privacy in the electronic communications sector (ePrivacy Directive)

The Directive 2014/53/EU on the harmonization of the laws of the Member States relating to the making available on the market of radio equipment and repealing the Radio Equipment and Telecommunications Terminal Equipment (R&TTE) Directive 1999/5/EC. Article 3(3)(e) of this Directive requires that radio equipment within certain categories or classes shall be so constructed that it [...] incorporates safeguards to ensure that the personal data and privacy of the user and of the subscriber are protected". The Commission is empowered to adopt delegated acts specifying which categories or classes of radio equipment are concerned by each of the requirements and there is ongoing work on the matter.

(B.) REQUESTED ACTIONS

In the light of the accountability and privacy by design principles, ICT standards generally should be created in order to ensure a high-level of protection of individuals with regard to personal data processing, and the free movement of such data, and the application of privacy by design methodologies. Privacy and data protection standards should thus be examined, developed or improved if necessary, so as to provide standardised methods that support that review and improvement in due respect of EU data protection rules.

Proposed specific areas for SDOs to focus on are:

ACTION 1 Continuing work on standardising browser functionalities and defaults to enable users to easily control whether they want to be tracked.

ACTION 2 SDOs to work on standardised solutions for location data used by mobile applications.

ACTION 3 SDOs to investigate standards for supporting compliance and certification of compliance with GDPR and possible other EU data privacy requirements. . Also a gap analysis should be run so to understand needed future work that may have to be prioritised.

ACTION 4 Promote EU-wide attention to standardisation of privacy statements and terms & conditions, given that there is mandatory acceptance of diverse, ambiguous and far-reaching online privacy conditions, and taking into account the GDPR. The Kantara CIS work and the data use statements described in ISO/IEC 19944 could be used as a basis for this action.

ACTION 5 SDOs to continue investigating technical measures apt to make personal data anonymous or pseudonymised (and therefore unintelligible by those who are not authorised to access them).

ACTION 6 SDOs to continue investigating how to warrant a user-centric approach in privacy & access management: see http://www.laceproject.eu/blog/give-students-control-data/ and http://www.lvm.fi/julkaisu/4440204/mydata-a-nordic-model-for-human-centred-personal-data-management-and-processing.

ACTION 7 **SDOs to prevent unwarranted pervasive monitoring by default when developing standards**. This is not only relevant in the context the internet but also the IoT.

ACTION 8 **SDOs to develop secure coding standards for secure application development:** EU-wide attention to standardisation of privacy statements and terms & conditions as far as possible, given the existing state of mandatory acceptance of diverse, ambiguous and far-reaching online privacy conditions, taking into account the GDPR and the emergence of the IoT, where (embedded) devices process the device owner›s personal data and possible different device users› personal data, creating additional challenges to transparency and informed consent.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

Various activities are in place, as detailed in the table below. Due account should also be taken of the activities of the DG GROW working group on "Privacy by Design", which includes standardisation participants and other stakeholders. The Commission issued in October 2014 the standardisation request M/530 "Standards for privacy & personal data protection management", in support of privacy management in design, development, production, and service provision processes of security technologies. The goal is that manufacturers & providers manage privacy & personal data protection issues through privacy-by-design.

ETSI

ETSI TC CYBER (TC CYBER work programme) is the most security-focused technical committee in ETSI and leads the response to European Commission (EC) Mandate M/530 on Privacy by Design. TC CYBER is recognized as a major trusted centre of expertise offering market-driven standardisation solutions that increase privacy and security for organizations and citizens across Europe and worldwide. TC CYBER published standards on cryptography for protecting personal data securely, with fine-grained access controls (Attribute-Based Encryption) and a practical introductory guide to Technical Standards for Privacy as well as mechanisms for privacy assurance. More generally, TC CYBER works on mechanisms for IoT discovery that prevent and restrict superfluous disclosure of device identity information to form a connection, which protects user and device privacy. TC CYBER's series on Middlebox Security Protocols creates protocols for a new generation of more privacy-focused proxies, whilst also providing robust security. Consumer IoT security and privacy EN 303 645, the first globally applicable standard for IoT security, covers data protection.

https://www.etsi.org/technologies-clusters/technologies/cyber-security

ETSI ISG CIM is working on requirements for enabling privacy and security when registering/exchanging context information which may contain identification of natural persons (ETSI GR 007).

3GPP TS 33.501 "Security architecture and procedures for 5G System" covers privacy for mobile.

CEN AND CENELEC

CEN-CLC/JTC 13 'Cybersecurity and Data protection' develops standards for data protection, information protection and security techniques with specific focus on cybersecurity covering all concurrent aspects of the evolving information society, including privacy guidelines. The JTC adopts international standards (such as JTC 1) as ENs, with additional specific European requirements in the context of specific European legislative and policy context (Cybersecurity Act, GDPR, NIS, sectoral legislation), to support privacy protection in the European context.

CEN-CLC/JTC 13 is finalizing the development of prEN 17529 'Data protection and privacy by design and by default'. The EN will provide the component and subsystems developers with an early formalized process for identification of privacy objects and requirements, as well as the necessary guidance on associated assessment. This project is being developed in response to the Standardisation Request M/530 on 'privacy and personal data protection management in the design and development and in the production and service provision and process in the security technologies'.

Moreover, CEN/TC 224 'Personal identification and related personal devices with secure element, systems, operations and privacy in a multi sectorial environment' develops standards for strengthening the interoperability, security and privacy of personal identification and its related personal devices and systems.

IEEE

IEEE has several standards activities in the ePrivacy space:
• Under the LAN/MAN Standards Committee a Recommended Practice (IEEE 802E-2020) has been developed to specify a privacy threat model for IEEE 802 technologies and provide recommendations on how to protect against privacy threats, which is important as IEEE 802 technologies play a major role in Internet connectivity.
• Several projects are ongoing in the area of personal data privacy, as an outcome of the IEEE Global Initiative for Ethical Considerations in Autonomous and Intelligent Systems. These projects include:
IEEE P1912 Privacy and Security Framework for Consumer Devices,
IEEE 2410-2021: Standard for Biometric Privacy,
IEEE P2876 Privacy in Online Gaming, and
IEEE P7002 - IEEE Draft Standard for Data Privacy Process,
IEEE P7012 - Standard for Machine Readable Personal Privacy Terms.

Some standards activities address privacy for children and youth, including:
IEEE P2089 standard for Age Appropriate Digital Services based on 5Rights Principles, and
IEEE P7004.1 - Recommended Practices for Virtual Classroom Security, Privacy and Data Governance.

Another area is privacy of data in healthcare:
- IEEE P2933 - Standard for Clinical Internet of Things (IoT) Data and Device Interoperability with TIPPSS - Trust, Identity, Privacy, Protection, Safety, Security,
- IEEE P2968.2 - Trial Use Recommended Practice for Decentralized Clinical Trials Threat Modeling, Cybersecurity, and Data Privacy,
- Industry Connections - Transforming the Telehealth Paradigm: Sustainable Connectivity, Accessibility, Privacy, and Security for All, and
- IEEE P2049.2 - Standard for Human Augmentation: Privacy and Security.• Pre-standardisation activities will develop frameworks towards solutions that facilitate digital inclusion, support privacy through trust, personal data agency, sovereignty, resilience, and security.

IEEE also has other new standardisation projects for privacy in consumer wireless devices and drones.

For more information please visit https://ieeesa.io/rp-eprivacy

W3C

An initiative to develop specifications by which Internet users may express their permission (or the withholding of their permission) to have their presence and activities on websites tracked (the "Do Not Track" concept), and to help Internet users to express their consent or refusal to be tracked on the internet. The working group will be closed towards year end 2018. Information will remain available at:

http://www.w3.org/2011/tracking-protection/

The W3C Data Privacy Vocabularies and Controls CG (DPVCG) develops a taxonomy of privacy terms, which includes in particular terms from the new European General Data Protection Regulation (GDPR), such as a taxonomy of personal data as well as a

classification of purposes (i.e., purposes for data collection), and events of disclosures, consent, and processing such personal data. This will help to create data protection aware data handling policies for systems based on linked data such as the Web of Things.

OASIS

The OASIS Privacy Management Reference Model (PMRM) TC provides a guideline or template for developing operational solutions to privacy issues. It also serves as an analytical tool for assessing the completeness of proposed solutions and as the basis for establishing categories and groupings of privacy management controls. One of its outputs is a Quick Start Guide for Data Protection to Support Regulatory Compliance.

The OASIS Classification of Everyday Living (COEL) TC provides a privacy-by-design framework for behavioral data collection and reporting. It provides a framework for implementing a distributed system capable of capturing data relating to an individual as discrete events.

The OASIS Context Server (CXS) TC was chartered to create specifications for Customer Data Platforms as a core technology for enabling the delivery of personalized user experiences. A CDP not only aggregates personal data from various sources, but can also manage consents and profiles. In specific cases, CDP may act as the source-of-truth across systems, and enable effective privacy management.

The OASIS Privacy by Design Documentation for Software Engineers (PbD-SE) TC provided privacy governance and documentation standards for software engineers. It enables software organizations to embed privacy into the design and architecture of IT systems, without diminishing system functionality.

IETF

The SIP Best-practice Recommendations Against Network Dangers to privacY (sipbrandy) WG will define best practices for establishing two-party, SIP-signaled SRTP sessions with end-to-end security associations, including a single, preferred SRTP key exchange mechanism. These practices are expected to be deployable across typical SIP networks, without the sharing of SRTP keying material with intermediaries or third parties. These practices should protect against man-in-the-middle attacks.

The DNS PRIVate Exchange (dprive) WG develops mechanisms to provide confidentiality to DNS transactions, to address concerns surrounding pervasive monitoring (RFC 7258). The set of DNS requests that an individual makes can provide an attacker with a large amount of information about that individual. DPRIVE aims to deprive the attacker of this information.

The DNS Over HTTPS (doh) WG standardised encodings for DNS queries and responses that are suitable for use in HTTPS. This enables the domain name system to function over certain paths where existing DNS methods (UDP, TLS [RFC 7857], and DTLS [RFC 8094]) experience problems. DNS Queries over HTTPS (RFC8484) was published in October 2018.

The Privacy Pass (privacypass) WG is standardising a protocol that provides a performant, application-layer mechanism for token creation and anonymous redemption. Servers (Issuers) create and later verify tokens that are redeemed by an ecosystem of clients, such that:

- An Issuer cannot link a redeemed token to one of N previously created tokens using the same key with probability non-negligibly larger than 1/N.
- Clients can verify that a token created by an Issuer corresponds to a committed keypair.
- Tokens are unforgeable.
- The token issuance and redemption mechanisms are efficient.

The QUIC (quic) WG is developing the QUIC protocol which provides end-to-end security for transport connections, including protection of header fields that are left unprotected by TLS. The QUIC working group's specifications are currently in last call, and will soon become recognised standards. The use of QUIC in the Internet is already quite high and growing.

Many network topologies lead to situations where transport protocol proxying is beneficial. For example, proxying enables endpoints to communicate when end-to-end connectivity is not possible, or to apply additional encryption where desirable (such as a VPN). Proxying can also improve client privacy, e.g., by hiding a client's IP address from a target server. The Multiplexed Application Substrate over QUIC Encryption (masque) WG is developing mechanism(s) that allow configuring and concurrently running multiple proxied stream- and datagram-based flows inside an HTTPS connection. These mechanism(s) are collectively called MASQUE.

The MAC address Device Identification for Network and Application Services (madinas) Working Group is documenting recommended means to reduce the impact of randomized and changing MAC addresses (RCM) while ensuring that the privacy achieved with RCM is not compromised. The Working Group will liaise with other relevant organizations, such as IEEE 802 and the Wireless Broadband Alliance (WBA), by coordinating on the different recommendations, as well as potential follow-up activities within or outside the IETF.

The Privacy Enhancements and Assessments Research Group (PEARG) in the IRTF is a general forum for discussing and reviewing privacy enhancing technologies for network protocols and distributed systems in general, and for the IETF in particular.

https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#ePrivacy

ISO/IEC JTC 1

ISO/IEC JTC 1 SC 7 on System and software engineering published a set of standards (ISO/IEC 25000 series and specifically 25024) that includes the possibility to design specific privacy measures.

https://www.iso.org/committee/45086.html

ISO/IEC JTC 1 SC 27 on IT Security Technologies published a Code of Practice for the protection of personally identifiable information (PII) in the public cloud (ISO/IEC 27018:2014), and is developing a draft international standard privacy capability assessment model (ISO/IEC DIS 29190). Another relevant working item is ISO/IEC 27552 - Enhancement to ISO/IEC 27001 for privacy management - Requirements.

http://www.iso.org/iso/iso_technical_committee?commid=45306

ISO/IEC JTC 1 SC 27 *WG 5 Identity management and privacy technologies*

Published standards:

ISO/IEC 29100:2011"Privacy framework"

Provides a general conceptual framework on the topic of privacy and personal data

ISO/IEC 24760 "IT Security and Privacy — A framework for identity management" (3 parts from 2019, 2015, and 2016)

Gives a framework to assess and influence, who individuals can be identified or not identified in the context of data and who can how

influence and control this

ISO/IEC 29101:2018 "Privacy architecture framework"

Provides a conceptual framework on the handling of privacy and personal data

ISO/IEC 20889:2018 "Privacy enhancing data de-identification terminology and classification of techniques"

Defines a terminology and classifies techniques to assess whether data are personal data or not

ISO/IEC 29134:2017 "Guidelines for privacy impact assessment"

Provides a conceptual framework to assess the impact of data (processing) on privacy and how data strategies can consider that

ISO/IEC 29146:2016 "A framework for access management"

Provides a conceptual framework to manage and strategize access to data

ISO/IEC JTC 1/SC 27/WG 5 SD4 "Standard Privacy Assessment (SPA)"

Provides guidance to consider privacy when and while developing standards, especially standards on handling data, freely available at https://www.din.de/en/meta/jtc1sc27/downloads

Standards under development:

ISO/IEC DIS 27559 "Privacy enhancing data de-identification framework" Provides a conceptual framework to assess whether data are personal data or not

ITU-T

ITU-T SG17 works on data security privacy-reserving technologies such as de-identification and multi-party computation. It has approved Recommendations ITU-T X.1058 "Information technology - Security techniques - Code of practice for Personally Identifiable Information protection", ITU-T X.1087 "Technical and operational countermeasures for telebiometric applications using mobile devices", ITU-T X.1148 "Framework of de-identification process for telecommunication service providers", ITU-T X.1171 "Threats and requirements for protection of personally identifiable information in applications using tag-based identification", ITU-T X.1212 "Design considerations for improved end-user perception of trustworthiness indicators", ITU-T X.1250 "Baseline capabilities for enhanced global identity management and interoperability", ITU-T X.1252 "Baseline identity management terms and definitions", ITU-T X.1275 "Guidelines on protection of personally identifiable information in the application of RFID technology", ITU-T X.1403 "Security considerations for using distributed ledger technology data in identity management", ITU-T X.1451 "Risk identification to optimize authentication", ITU-T X.1363 "Technical framework of personally identifiable information (PII) handling system in IoT environment", ITU-T X.1770 "Technical guidelines for secure multi-party computation" (under approval as of Sept 2021) and is developing many more draft Recommendation in this domain: (X.5Gsec-t, X.guide-cdd, X.sec-QKDN-tn, X.smsrc, X.scpa, X.sgos, X.rdda, X.vide, etc). More info: http://itu.int/ITU-T/go/tsg17

ONEM2M

Standardize secure links between connected devices, gateways, communications networks and cloud infrastructure. The oneM2M SDS – System Design and Security working group is also responsible for security and privacy. Potential required enhancements to oneM2M specifications, to support regulations like GDPR or PIPA, are investigated and defined in the current oneM2M work item: WI-0095 - oneM2M System Enhancements to Support Data Protection Regulations. All oneM2M Specifications are openly accessible under Specifications (onem2m.org).

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

Kantara

User-Managed Access (UMA)-UMA is an OAuth-based protocol designed to ensure the privacy of websites by giving web users a unified control point for authorising access to online personal data, content, and services, no matter where they are hosted. http://kantarainitiative.org/confluence/display/uma/Home

Consent & Information Sharing Workgroup (CIS)

People's capacity to manage their privacy is increased if they are able to aggregate and manage consent & information sharing relationships with consent receipts. Standardised consent receipts also provide the opportunity for organisations to advertise trust. The core receipt specification addresses general, or regulatory, consent requirements. More elaborate consent receipts can become a vehicle for trust networks, federations, trust marks, privacy icons, assurances, certifications and self-asserted community and industry reputations. https://kantarainitiative.org/confluence/display/infosharing/Home

C.3) ADDITIONAL INFORMATION

Management of controls over the access to and ownership of data should be considered essential for effective implementation of privacy measurements.

3.1 KEY ENABLERS
Login
****
Taxi
0000 0000 0000 0000

3.1.1 5G

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The 2015 digital single market (DSM) strategy and the communication "*Towards connectivity for a European gigabit society*" identify very high-capacity networks like 5G as a key asset for global competitiveness. In addition to fibre-like performance for mobile networks, the benefits of adopting 5G go beyond the telecom sector to enable a fully mobile and connected society and to empower socioeconomic transformations in a variety of ways (many of which are not possible at present. These transformations include higher productivity, sustainability, well-being and innovation opportunities for smaller actors and start-ups. 5G makes a new wave of convergence possible through digital business models reaching non-ICT-native industrial sectors. In that context, the EU sees 5G as a core infrastructure to support the DSM strategy's wider objectives for the digitisation of the industry.

The strategy for *Digitising European Industry* and the Communication on *ICT standardisation priorities for the digital single market* announced the European Commission's intention to develop a 5G action plan for EU-wide deployment, which was adopted in September 2016. The communication draws on multiple consultations, events[4] with stakeholders, a targeted survey[5], several studies, a 5G industry manifesto[6] and early results of the 5G-PPP. It presents a set of targeted actions for a timely and coordinated deployment of 5G networks in Europe through a partnership between the Commission, Member States, and industry. It leverages the new opportunities offered by the revised telecommunication regulatory framework by putting it in the context of a concrete European project of high added value for businesses and citizen.

Furthermore, Member States, in the Ministerial Declaration of Tallinn of July 2017[7] have identified the objective of preserving 5G global interoperability as key in order to make 5G a success for Europe. Standards are of paramount importance to ensure the competitiveness and interoperability of global telecommunication networks. Therefore Member States endorse a «comprehensive and inclusive approach to 5G standardisation as a priority for the DSM». Member States promote «cross-industry partnerships to support the timely definition of standards backed by industrial user experiments, including through the leveraging of international cooperation partnerships, in particular for the digitisation of industry. Encouraging innovation and development of products and services making use of 5G networks across the EU should be a priority».

In addition, the EU toolbox for 5G security constitutes an important milestone as it puts in place an EU coordinated approach to secure 5G networks calling notably on implementation of 5G standards across Europe as part of relevant tools.

Following the publication of the EU toolbox for 5G cybersecurity, the Commission launched in February 2020 the strategy "Shaping Europe's digital future", with the objective of making EU a global leader in the digital economy. Connectivity, and 5G in particular, is identified as one of the most fundamental building blocks.

The Communication on Europe's Digital strategy calls Europe to invest more in the strategic capacities that allow us to develop and use digital solutions at scale and to strive for interoperability in key digital infrastructures, such as extensive 5G (and future 6G) networks and deep tech.

In the Conclusions of the Special meeting of the European Council (1 and 2 October 2020), accelerating 5G deployment was identified as an area eligible for Recovery and Resilience Facility funding, (of which at least 20% will be made available for the digital transition). Furthermore, "to ensure the rapid deployment of 5G across the EU, the European Council also urges all Member States to submit their national plans on the roll-out of 5G to the Commission by the end of this year, as set out in the 5G Action Plan".

4 see: e.g. https://5g-ppp.eu/event-calendar/#

5 https://ec.europa.eu/digital-single-market/en/news/have-your-say-coordinated-introduction-5g-networks-europe

6 Industry Manifesto 7 July 2016: http://ec.europa.eu/newsroom/dae/document.cfm?action=display&doc_id=16579

7 Ministerial Declaration "Making 5G a success for Europe" signed during the informal meeting of competitiveness and telecommunications ministers on 18 July in Tallinn

*Despite the many anticipated benefits of 5G networks, there are a number of challenges and concerns pertaining to the area of public and internal security. In the context of a Europe that protects, the European Commission identified 5G networks as a strategic asset therefore requiring high cybersecurity standards*8 *and preserving lawful investigation capabilities*9*. To attain these objectives, the needs of the law enforcement and other relevant authorities in the area of public and internal security should be taken on board through a coordinated approach in view of the ongoing 5G standardisation activities*10*.*

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The Communication on ICT standardisation priorities as well as the 5G Action Plan identified 5G standards as key to competitiveness and the interoperability of global networks, with stakeholders from different standardisation cultures called upon to collaborate. It also details the actions required.

The first phase and the second phase of 5G standardisation have now been completed, with the publication of 3GPP Release-15 and Release-16 set of specifications. This first phase focused on enhanced mobile broadband while also supporting ultra-reliability and low latency. Release-16 provided the basis for 3GPP's IMT-2020 submission for an initial full 3GPP 5G system, and work on 3GPP Release-17 is ongoing.

Release 16 takes into account a number of functionalities needed for 5G deployment by vertical industry, as called for by the EU 5G strategy. This includes notably: Integrated access and backhaul (IAB), easing deployment where fiber is not accessible; NR in unlicensed spectrum, multi factories applications; Features related to Industrial Internet of Things (IIoT) and ultra-reliable low latency communication (URLLC); positioning; intelligent transportation systems (ITS) and vehicle-to-anything (V2X) communications with additional use cases taken into account. Release-16 delivered key standards for use-cases such as those related to industrial applications, and *transversal needs such as lawful interception* and lawful access to retained data. The availability of standards promoting open innovation and opportunities for start-ups is also key.

Release-17 has been delayed by 6 months due to the COVID-19 pandemic which has prompted SDO's to work exclusively online during the majority of 2020. It is now planned for completion end of 2021. It will again include additional features making the standards more widely applicable and with even better performance characteristics. It will for instance cover non Terrestrial networks (NTN), enhanced coverage capabilities (NR Light), higher positioning accuracy, RAN slicing, power saving options, applicability of NR up to 71 GHz, additional URLLC improvements for industrial applications, NR sidelinks for V2V applications.

The work on Release-18 has not yet started, but a large workshop to define its content was held by 3GPP in June 2021. Several topics will constitute a basket for intensive discussion in in order to have the main elements and timing for the following 18 months for Release-18 approved.

In support of EU industrial capabilities, the Commission launched a 5G public-private-partnership (5G PPP) in 2013 which entered its third phase in 2018. The 5G PPP is designed to deliver solutions, architectures, technologies and standards for the ubiquitous next generation communication infrastructures of the coming decade. It has recently successfully performed in depth piloting of 5G technology in critical industrial sectors, showing the usability of 5G for multiple use cases.

The European Commission has called on Member States and industry to commit to the following objectives:

- a standardisation approach that preserves future evolution capabilities and aims at availability of 5G global standards by end of 2019;
- a holistic standardisation approach encompassing both radio access and core networks as coordinated activities within global standardisation bodies, encompassing disruptive use-cases and promoting open innovation;
- establishment of cross-industry partnerships by 2017, at the latest, to support timely standard-setting, partly by leveraging international cooperation partnerships, in particular towards the digitisation of industry.

In October 2018 the European Commission hosted a 3GPP workshop in the context of the submission of the 3GPP 5G specifications to the ITU. The aim is to inform the ITU sanctioned Evaluation Groups, policy makers and interested experts on the progress of the 3GPP work to meet and exceed the performance requirements for IMT-2020 radio interface technologies. 3GPP's 5G standard has been submitted to the ITU evaluation process in July 2019, which was the target date to submit to ITU the candidate technologies to obtain acceptance as an IMT-2020 technology (the 5G label).

8 Commission Recommendation of 26 March 2019 on Cybersecurity of 5G networks

9 8268/19 11 April 2019, Position paper on 5G, Europol

10 8983/19 6 May 2019, Law enforcement and judicial aspects related to 5G, EU counter Terrorism coordinator

As part of the ITU process on the evaluation of candidate technologies (RIT/SRIT), the 5G PPP has provided the only European evaluation group that submitted its analysis and findings to ITU successfully in 2020.

The Commission is also taking steps, through the FPI Project on internationalisation of EU ICT standardisation, to support the organisation of more 3GPP meetings in Europe, in order to facilitate the active participation of a broad range of European delegates, from key industrial players, but also SMEs, academia and research institutions. This project intends to provide financial support for the organisation of 3GPP meetings in the EU, and echoes recurring requests from administration and smaller industrial stakeholders to have SDO meetings organised in Europe.

For Horizon Europe, the new Framework Programme starting in 2021, the Commission is preparing an industry-led European partnership on "Smart Networks and Services beyond 5G and towards 6G", to maintain technology leadership and sovereignty.

In addition, to ensure the ability of the law enforcement authorities to detect and investigate serious crime and terrorism, there is a need to provide for contingency on lawful interception and lawful disclosure of data in the course of judicial investigations. To this end, it is necessary to provide for adequate technical means for the judicial authorities to be able to request for legal interception also in the context of 5G networks, PIN (Personal IoT Network) and non-terrestrial networks (NTN).

Six main challenges have been identified that would benefit from an appropriate standardisation activity, namely:

- Being able to perform Mobile Subscriber Identification and Localisation by authorized LEAs on the radio interface with the assistance of Mobile Network Operators aside new strong 5G security features to get permanent digital IDs and precise localisation. Outside the field of the judicial investigations, ensuring the identification and positioning capabilities are also necessary to perform efficiently the Search And Rescue (SAR) activities.
- Being able to benefit from a complete copy of intercepted communications with precise location information despite fragmentation, slicing and virtualization of 5G e.g. multi-access edge computing systems and international private networks.
- Being able to benefit from a clear copy of intercepted communications, even if the target is an inbound roamer (encrypted S8HR and N9HR roaming agreement) or a user of encrypted new mobile messaging services such RCS.
- Ensuring the network based confidentiality and integrity of lawful interception systems considering that they will become logical components in 5G networks as well as in PIN, NTN and may move outside of European jurisdictions.
- Ensuring that data retention and access mechanisms duly take into account the principles of data minimization as recalled by the Court of Justice of the European Union (cf. judgement in Joined cases C-511/18 and C-512/18 and C-520/18, La Quadrature du Net and others).
- Ensuring a trusted access to electronic evidence by developing standardized electronic interfaces (e.g. from ETSI TC LI or 3GPP Sa3 LI working group) and supporting cross-border exchange of electronic evidence (e.g. the e-Evidence Digital Exchange System, eEDES) based on ETSI /3GPP standards.

These functional capabilities should be maintained without causing exorbitant impediments to the core functions and benefit of the 5G networks as well as of PIN, NTN and also be in line with current obligations on electronic communications networks and services to provide for such services to the law enforcement authorities.

(A.3) REFERENCES

- **Communicaton on** "Shaping Europe's digital future"
- COM(2016) 176 final ICT standardisation priorities for the digital single market
- COM(2016) 588 final 5G for Europe: An Action Plan and accompanying Staff Working Document
- SWD(2016) 306 on 5G Global Developments
- SWD(2016) 110 final Communication on digitising European Industry Reaping the full benefits of a Digital Single Market
- Next Generation Mobile Networks Alliance 5G White Paper, https://www.ngmn.org/de/5g-white-paper.html
- White paper on vertical sectors published by the 5G Public Private Partnership together with the European Commission https://ec.europa.eu/digital-single-market/en/blog/5g-empowering-vertical-industries-0
- 5G PPP Infrastructure -Trials and Pilots Brochure (N°2): https://5g-ppp.eu/the-5g-ppp-infrastructure-trials-and-pilots-brochure-n2-is-out/

(B.) REQUESTED ACTIONS

The Communication on ICT standardisation priorities for the digital single market proposes priority actions on 5G, some of which are reflected in section C.2.

ACTION 1 Global industry standards. Foster the emergence of global industry standards under EU leadership for key 5G/6G technologies (radio access network, core network) and network architectures notably through the exploitation of 5G public-private partnership results in key EU and international standardisation bodies (3GPP, ITU, ETSI).

ACTION 2 Ensure that 5G/6G standards are compatible with innovative use-cases of vertical industries and ensure sufficient spectrum-sharing capabilities, notably through broader participation of industries and authorities with sector-specific needs and in close collaboration with other industry specific standards developing organisations, in 5G standardisation organisations. Several projects funded by the European Commission, as well as the 5G PPP are dealing with 5G standardisation.

ACTION 3 Lawful interception and lawful disclosure related standards. Foster the emergence of standards that ensure proper provisions for enabling lawful interception mechanisms in the context of 5G networks by encouraging and coordinating law enforcement involvement in 5G standardisation related committees (e.g. (e.g. ETSI TC LI, ETSI NFV-SEC, 3GPP SA3-LI)) and promoting a European approach based on its legal system.

ACTION 4 SDOs to work with the stakeholders in standardisation to deliver a report on the standardisation needs and specific requirements for the uptake of 5G in vertical sectors (e.g. transportation, healthcare, manufacturing, energy).

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

3GPP

Release 16 is a major release for the project, not least because it brings our IMT-2020 submission - for an initial full 3GPP 5G system - to its completion (see details below).

In addition to that formal process, work has progressed on around 25 Release 16 studies, on a variety of topics: Multimedia Priority Service, Vehicle-to-everything (V2X) application layer services, 5G satellite access, Local Area Network support in 5G, wireless and wireline convergence for 5G, terminal positioning and location, communications in vertical domains and network automation and novel radio techniques. Further items being studied include security, codecs and streaming services, Local Area Network interworking, network slicing and the IoT.

As with previous generations of mobile technology, 3GPP will follow Release 16 with a continuous programme of 5G standardisation, delivering performance enhancements and new features required by the market in a series of periodic releases.

5G-ACIA

5G-ACIA is an alliance formed to ensure that the needs of the automation industry are considered, fostering developing a 5G technology that addresses industrial requirements. 5G-ACIA aims at being the central global forum for shaping 5G in the industrial domain. See https://www.5g-acia.org/

ETSI

TC LI: see ETSI TS102 656, and ETSI TS 102 657

TC EE (Environmental Engineering): https://www.etsi.org/committee/ee

TC MSG TFES: https://www.etsi.org/committee/MSG is responsible for identifying European regulatory requirements and creating harmonized standards to support the deployment of IMT family networks in Europe. ETSI TC MSG/TFES is so developing harmonized standards for 5G base stations and user equipment, updating the EN 301 908 series to include 5G support. ETSI TC MSG/TFES is continuously monitoring 3GPP activities to include the new relevant features and the major updates in the harmonized standards that ETSI TC MSG/TFES is maintaining.

SC SAGE (Security Algorithms Group of Experts):

ISG NFV (Network Functions Virtualisation): http://etsi.org/nfv/. Defines NFV as a key technology enabler for 5G. ETSI GR NFV-IFA 037 (reports on further NFV support for 5G) provides recommendations for enhancements to the NFV architectural framework and its functionality aiming to provide further support to address 5G network use cases. ETSI GR NFV-IFA 046 profiles and extends NFV capabilities to enhance the support for vRAN use cases and deployments.

OSM (Open Source MANO): http://osm.etsi.org/

ISG MEC (Multi-Access Edge Computing): https://www.etsi.org/committee/mec offers to application developers and content providers cloud-computing capabilities and an IT service environment at the edge of the network. https://www.etsi.org/technologies/multi-access-edge-computing ISG MEC published a report on "MEC 5G Integration (ETSI GR MEC 031) describing key issues, solution proposals and recommendations for MEC integration into 3GPP 5G system. The study addressed topics such as MEC System interactions with the 5G System, including the correspondence of the current MEC procedures to procedures available in 3GPP 5G system specification, options for the functional split between MEC and 5G Common API framework, and the realisation of MEC as 5G Application Function(s).

ISG ENI (Experiential Networked Intelligence): https://www.etsi.org/committee/ENI

ISG NIN (non-IP Networking): https://www.etsi.org/committee/NIN

ISG F5G (Fixed 5G): https://www.etsi.org/committee/F5G

ISG mWT (millimetre wave transmission): https://www.etsi.org/committee/mWT

ISG ZSM (Zero Touch Management): https://www.etsi.org/committee/ZSM. Provides a framework which enables the management of the network and services without any human involvement. The automation of operation will ensure that the complexity of the 5G network will be manageable.

ETSI TC DECT has published the first release of the new DECT-2020 NR (New Radio) technology (in ETSI TS 103 636 parts 1 to 4). The work on additional parts for the set of standards is ongoing with planned publication by end of 2021. The standardisation effort will continue in the coming years with further releases, additional functionality and Application Specific profiles addressing the needs of multiple vertical industries. The production of test specifications has also started with the work on the basic Harmonised Standard (HEN) for access to radio spectrum.

DECT-2020 NR is a new radio interface supporting Ultra Reliable Low Latency Communications (URLLC) and massive Machine Type Communications (mMTC) as specified for IMT-2020 usage scenarios. The technology supports multiple operating bands and radio channel bandwidths The new DECT-2020 air interface will co-exist with the existing DECT system. DECT-2020 has been submitted to ITU-R as an IMT-2020 candidate technology.

ETSI's TC DECT specification is the leading standard around the world for digital cordless telecommunications. Over 1 billion devices have been installed worldwide: the system has been adopted in over 110 countries and more than 100 million new devices are sold every year. DECT products now account for more than 90% of the world's cordless market. The DECT standard has already been accepted as an IMT-2000 radio interface technology.

GSMA

The GSMA (Global System for Mobile Communications) represents the interests of mobile operators worldwide, uniting nearly 800 operators with more than 300 companies in the broader mobile ecosystem, including handset and device makers, and software companies. Mobile operators will play a key role in 5G, as they will provide the infrastructure and services to a wide spectrum of 5G applications, from consumer mobile telephony to vertical industrial applications such as agricultural monitoring.

For more details see https://www.gsma.com/futurenetworks/technology/understanding-5g/

IEEE

IEEE has many efforts underway to develop next generation communications standards.

- to an evaluation of IEEE P802.11ax performance vis-a-vis IMT-2020 criteria, which was endorsed by the IEEE 802.11 Working Group.
- IEEE P802.11ay targets bonding 2GHz channels to achieve extremely high point to point throughput in IEEE P802.11ax is an extension of the current WLAN standards by improving aggregated throughput with high user density. IEEE P802.11ax targets Mid Band, sub 6GHz unlicensed spectrum. IEEE P802.11ax meets the requirements for Indoor Hotspot and Dense Urban Areas according excess of 20 Mb/s. IEEE P802.11ay is implemented in the unlicensed millimeter wave band (60GHz)
- IEEE P802.11bd is evolution of IEEE 802.11p for next generation V2X communication
- Packet-based fronthaul transport networks in support of dense deployments of very small cells (IEEE P1914.1)
- Radio over Ethernet (IEEE P1914.3) in support of backhaul and fronthaul over Ethernet
- Precision Timing Protocol (IEEE 1588) which enables phase synchronous wireless networks such as LTE TDD
- IEEE 802 access network (IEEE P802.1CF) and time sensitive networking for fronthaul (IEEE P802.CM)
- Tactile networking: IEEE P1918.1 covering application scenarios, architecture and functions, IEEE P1918.1.1 specifies Haptic Codecs
- Radio Regulatory Technical Advisory Group (IEEE 802.18) and Wireless Coexistence (IEEE 802.19)

IEEE 802.11 organised a Coexistence Workshop with 3GPP RAN, the Wireless Broadband Alliance and ETSI BRAN in Vienna, Austria, on 17th July 2019. More information is available at http://grouper.ieee.org/groups/802/11/Workshops/2019-July-Coex/2019-07-Coex-agenda-2.htm

For a list of these and other IEEE standardisation activities related to 5G and next generation communications technologies, please see: https://ieeesa.io/rp-5g

ITU

In ITU, 5G technologies are discussed under the IMT-2020 banner. ITU-T SG13, SG11, SG15 and SG5, complemented by ITU-R WP5D are driving the 5G standardisation in ITU.

ITU-R WP5D is responsible for the overall radio system aspects of International Mobile Telecommunications (IMT) systems, comprising the IMT-2000, IMT-Advanced and IMT for 2020 and beyond. It has developed several Recommendations and Reports on performance requirements, spectrum requirements, radio interfaces, frequency bands, spectrum sharing and compatibility, as well as IMT specifications and related technologies.

More info: https://www.itu.int/en/ITU-R/study-groups/rsg5/rwp5d

ITU-T Focus Group on IMT-2020 (FG-IMT) delivered (2016) a Gap Analysis document "overview of technical developments at the network part of the 5G networks" including 85 technical areas for future 5G standardisation and nine deliverables in the following areas:

- terms and definitions for IMT-2020;
- high-level network architecture for 5G; network softwarization;
- Information Centric Networking (ICN);
- Fixed and Mobile Convergence.

More info: http://www.itu.int/en/ITU-T/focusgroups/imt-2020/Documents/T13-SG13-151130-TD-PLEN-0208!!MSW-E.docx

See a related flipbook, capturing all the deliverables of this FG, at: http://www.itu.int/en/publications/Documents/tsb/2017-IMT2020-deliverables/mobile/index.html#p=1

Another flipbook "5G Proof-of-Concept Demonstrations" depicts the demonstrations run at two workshops organized by the FG-IMT2020 in 2016 and 2017.

ITU-T SG13 on Future networks, with focus on IMT 2020, has approved 48 standards on 5G, including IMT-2020-related terms and definitions, architecture, QoS functional requirements, slicing, orchestration, information-centric networking, FMC, machine learning in future networks including IMT-2020 etc. (e.g. ITU-T Y.3100, Y.3106, Y.3107, Y.3170, Y.3172, Y.3150), and 6 Supplements. It has ~50 work items under development. Current work includes: requirements and architecture for machine learning function orchestrator (Y.ML-IMT2020-MLFO),), capability exposure function (Y.IMT2020-CEFEC), Intent-based network management and orchestration for network

slicing in IMT-2020 networks (Y.IMT2020-IBNMO), edge computing in IMT-2020 network (Y.FMC-AAEC), requirements of fixed, mobile and satellite convergence in IMT-2020 network (Y.FMSC-req) etc.

More info: https://www.itu.int/itu-t/workprog/wp_search.aspx?isn_sp=3925&isn_sg=3932&isn_status=-1,1,3,2&pg_size=100&details=0&field=acdefghijo

A flipbook "5G Basics" is a collection of available ITU-T standardisation outcomes by end of 2017 that led to IMT-2020 standards.

ITU-T SG13 through the JCA-IMT2020 maintains the online Roadmap for IMT-2020. It captures the ongoing IMT-2020 and beyond (network aspects) standardisation efforts in different SDOs and ITU-T along with pointers to the actual specification/ Recommendation location. A snapshot of it was published in March 2020 as ITU-T Supplement 59 to Y.3100-series Recommendations "IMT-2020 standardisation roadmap".

More info: https://www.itu.int/en/ITU-T/studygroups/2017-2020/13

ITU-T SG11 set up new subcategories for ITU-T Recommendations dealing with signalling requirements and protocols for IMT-2020 – ITU-T Q.5000-Q.5049. Under this subcategory, SG11 approved several standards related to protocols and signalling requirements for intelligent edge computing (ITU-T Q.5001), media service entity attachment (ITU-T Q.5002), network slice lifecycle management (ITU-T Q.5020), capability exposure APIs in IMT-2020 networks (ITU-T Q.5021), energy efficient D2D communication for IMT-2020 network (ITU-T Q.5022), intelligent network slicing with AI-assisted analysis in IMT-2020 network (ITU-T Q.5023). Currently, there are 11 ongoing work items related to signalling requirements and protocols of IMT-2020 networks.

More info: https://www.itu.int/en/ITU-T/studygroups/2017-2020/11

ITU-T SG15 on Transport, Access and Home is developing Recommendations ITU-T G.8300-series "Mobile network transport aspects". SG15 approved the following 5G related Recommendations:

- ITU-T G.8300: Characteristics of transport networks to support IMT-2020/5G

In addition, ITU-T SG15 initiated the approval process for the following Recommendations:

- ITU-T G.8310: Functional architecture for metro transport network
- ITU-T G.8312: Interfaces for a metro transport network
- In addition, SG15 developed the following supplements:
- G Suppl.66: 5G wireless fronthaul requirements in a passive optical network context
- G Suppl.69: Migration of a pre-standard network to a metro transport network

More info: https://www.itu.int/en/ITU-T/studygroups/2017-2020/15

ITU- T Focus Group on Machine Learning for 5G network (FG ML5G) was active from January 2018 to July 2020 and worked towards application of the machine learning techniques to the IMT-2020 operation. The outputs of the FG-ML5G include:

Output of ITU-T SG13, based on FG ML5G specifications

- "Architectural framework for machine learning in future networks including IMT-2020" (ITU-T Y.3172, June 2019)
- "Machine learning in future networks including IMT-2020: use cases" (Supplement 55 to Y.3170 Series, October 2019)
- "Framework for evaluating intelligence levels of future networks including IMT-2020: (ITU-T Y.3173, February 2020)
- "Framework for data handling to enable machine learning in future networks including IMT-2020: (ITU-T Y.3174, February 2020)
- Machine learning marketplace integration in future networks including IMT-2020" (ITU-T Y.3176, September 2020)
- Deliverables FG ML5G submitted to ITU-T SG13 for consideration
- FG ML5G specification: "Requirements, architecture and design for machine learning function orchestrator"
- FG ML5G specification: "Serving framework for ML models in future networks including IMT-2020"
- FG ML5G specification: "Machine Learning Sandbox for future networks including IMT-2020: requirements and architecture framework"
- FG ML5G specification: "Machine learning based end-to-end network slice management and orchestration"
- FG ML5G specification: "Vertical-assisted Network Slicing Based on a Cognitive Framework"

More information at: https://www.itu.int/en/ITU-T/focusgroups/ml5g

ITU-T SG5 is responsible for studying methodologies for evaluating the effects of ICTs on climate change and the circular economy. It has developed a series of nine ITU-T Recommendations, Supplements and Technical Reports related to the environmental aspects of 5G, which cover aspects ranging from innovative energy storage (ITU-T L.1220) (ITU-T L.1221) (ITU-T L.1222), energy feeding (ITU-T L.1210), energy efficiency for future 5G systems (ITU-T L.Suppl.36), energy efficiency metrics and measurement for base station sites (ITU-T L.1350)(ITU-T L.1351) , smart energy solutions (ITU-T L.1380, ITU-T L.1381, ITU-T L.1382), smart energy saving of 5G base stations (ITU-T L.Suppl.43), 5G technology and human exposure to RF-EMF (ITU-T K.Supplements 1, 4, 9, 14 and.16), electromagnetic compatibility – EMC (ITU-T K.116, ITU-T K.Suppl.10 and ITU-T K.Suppl.26), resistibility analysis of 5G systems (ITU-T K.Suppl.8) and e-waste management (ITU-T L.1050).

More info: https://www.itu.int/itu-t/workprog/wp_search.aspx?sg=5 and https://www.itu.int/en/ITU-T/climatechange/Pages/ictccenv.aspx

https://www.itu.int/en/ITU-T/studygroups/2017-2020/05

For detailed information on the 5G standardisation work within ITU-T, see: https://www.itu.int/en/ITU-T/studygroups/2017-2020/13/Documents/5G/ITU-5G-Activities.pdf

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

EC

There are several projects funded by the European Commission, dealing with 5G standardisation. Also, the 5G PPP deals with some issues connected to 5G standardisation. https://5g-ppp.eu/

(C.3) ADDITIONAL INFORMATION

Interactions between IETF and 5G developments fall into several categories:

- New dependencies on existing IETF technology: For instance, introducing a flexible authentication framework based on EAP (RFC 3748, RFC 5448). This work is being

addressed in the EAP Method Update (EMU) Working Group. This working group has been chartered to provide updates to some commonly used EAP methods. Specifically, the working group shall produce documents to:

- Provide guidance or updates to enable the use of TLS 1.3 in the context of EAP TLS (RFC 5216). Update the security considerations relating to EAP TLS, to document the implications of using new vs. old TLS versions, any recently gained new knowledge on vulnerabilities, and the possible implications of pervasive surveillance.
- Update the EAP-AKA' specification (RFC 5448) to ensure that its capability to provide a cryptographic binding to network context stays in sync with what updates may come to the referenced 3GPP specifications through the use of EAP in 5G.
- Dependencies on ongoing IETF work: The IETF Deterministic Networking (DETNET) Working Group defines mechanisms to guarantee deterministic delays for some flows across a network. As one of the 5G use cases is time-critical communication and low-latency applications, this is a component technology that is being looked at. Similarly, IETF routing-related work such as traffic engineering, service chaining and source routing are likely tools for managing traffic flows in 5G networks, as they are for other large service provider networks. 5G-related topics are also discussed in the Distributed Mobility Management Working Group.
- There are many IETF tools already for dealing with virtualisation and separation of networks (see 3.1.2 Cloud computing, below), so the first order of business is mapping what can be done with those tools for the 5G use cases.
- https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#FiveG

3.1.2 CLOUD AND EDGE COMPUTING

(A.1) POLICY OBJECTIVES

Establishing a coherent framework and conditions for cloud computing was one of the key priorities of the digital agenda for Europe. The digital single market strategy confirmed the importance of cloud computing, which is driving a paradigm shift in the delivery of digital technologies, enhancing innovation, digital single market and access to content. The Communication «2030 Digital Compass: the European way for the Digital Decade» proposes that by 2030 75% of European enterprises have taken up cloud computing services, big data and Artificial Intelligence.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The key role of cloud computing is established through the European Cloud Initiative and through the initiative on Building a European Data Economy. Cloud computing is developing fast. Estimates indicate that these developments could lead to the growth of the European cloud market from €9.5bn in 2013 to €44.8bn by 2020, i.e. almost five times the market size in 2013. The latest Eurostat data available (end of 2020) shows the current state of play in the European Union regarding the use of cloud computing by enterprises. The main findings are summarised below:

- 36 % of EU enterprises used cloud computing in 2020, mostly for hosting their e-mail systems and storing files in electronic form.
- 55 % of those firms used advanced cloud services relating to financial and accounting software applications, customer relationship management or to the use of computing power to run business applications.
- Compared with 2018, the use of cloud computing increased by 12 percentage points.

The development of the cloud computing market and the efficient delivery of cloud services particularly depend on the ability to build economies of scale. The establishment of a Digital Single Market will unlock the scale necessary for cloud computing to reach its full potential in Europe. EU-based cloud providers have only a small share of the cloud market, which leaves the EU exposed to such risks and limits the investment potential for the European digital industry in the data processing market. Also, given the impact of data centers and cloud infrastructures on energy consumption, the EU should take the lead in making these infrastructures climate neutral and energy efficient by 2030, while using their excess energy to help heating homes, businesses and common public spaces.

In 2012, the Article 29 data protection working party issued on opinion on cloud computing . This opinion has outlined how the wide scale deployment of cloud computing services can trigger a number of data protection risks, mainly a lack of control over personal data as well as insufficient information with regard to how, where and by whom the data is being processed/sub-processed.

The proposed actions follow the direction as outlined in the EU Communication on ICT standardisation priorities which identified cloud as a key priority for Europe. The actions include a follow-up of cloud standards coordination started in 2012/2013 when the Commission asked ETSI to coordinate stakeholders to produce a detailed map of the necessary standards (e.g. for security, interoperability, data portability and reversibility).

The Cloud Select Industry Group (C-SIG) has been open to all organisations, groups and individuals having a professional interest in cloud computing matters and are active in the European cloud market. The Communication "Unleashing the Potential of Cloud Computing in Europe" (2012) identified key actions to be supported by Cloud Select industry Groups. See section C1 below.

The Commission is also pursuing international cooperation in the field of cloud computing, and a number of policy and joint research initiatives have been put in place with Japan, Brazil and South Korea and are ongoing with USA.

The Commission has also funded the CloudWatch2 project which, among others, reported on the status of interoperability and security standards, developed a catalogue of cloud services and mapped EU cloud services and providers.

When it comes to certification and ways for customers to know and be assured that their data is equally safe no matter where they are located or who provides the service, the Commission launched the study *Certification Schemes for Cloud Computing* (SMART 2016/0029) and a public consultation which ended in October 2017.

In the view of facilitating a fair market for the consumers, the Commission also launched a study on Switching cloud providers (SMART 2016/0032) to collect evidence on legal, economic, and technical issues when switching from provider.

In April 2018 the Commission launched two DSM (Digital Single Market) Cloud Stakeholder groups (https://ec.europa.eu/digital-single-market/en/news/cloud-stakeholder-working-groups-start-their-work-cloud-switching-and-cloud-security). The DSM Working Group on Cloud Certification Scheme will begin exploring an EU certification scheme on cloud security. The Group consists of national cyber security authorities, cloud service provider, cloud service customer as well as auditing entities.

The European Security Certification Framework (EU-SEC) strives to address the security, privacy and transparency challenges associated with the greater externalization of IT to Cloud services. EU-SEC will create a certification framework under which existing certification and assurance schemes can co-exist. EU-SEC is funded by Horizon 2020 and publishes its results at www.sec-cert.eu.

The other DSM Cloud Stakeholder group (working group on cloud switching/ porting data - SWIPO) has defined a self-regulatory codes of conduct to facilitate data portability and cloud switching.(https://swipo.eu/) These portability codes intend to support article 6 of the Regulation on the free-flow of non-personal data. The objective of SWIPO is to reduce the risk of 'vendor lock-in', as it will be easier to switch providers when it is clear which processes, technical requirements, time frames and charges apply in case a professional user wants to switch to another provider or port data back to its own IT systems.

On 15 October 2020 all EU Member States signed a Declaration on building the next generation European cloud. A key role in building the European cloud plays the launch of the European Alliance for Industrial Data and Cloud. The objective of the Alliance is to establish a competitive European cloud supply and to foster cloud adoption in the EU private and public sectors, in order to build technological autonomy and data sovereignty in Europe. The Alliance will bring together the key EU industrial actors on the supply side and the demand side with Member States' authorities. Its aim will be to substantially increase the share of EU suppliers on the European public cloud infrastructure market by 2030. More concretely the aim of the Alliance is to:

- Build the next generation cloud supply: the Commission is committed to co-invest in the interconnection and deployment across the EU.
- Deploy pan-European cloud marketplaces, which will offer users a single portal to cloud offerings meeting key EU standards and rules.
- Define common requirements for cloud services operating on the EU market. The future EU Cloud Rulebook will be developed by the Commission in close cooperation with Member States and in consultation with relevant stakeholders.

The JRC published a study on the relationship of open source software and standards setting at the end of 2019 (https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/relationship-between-open-source-software-and-standard-setting). The objective of the study was to identify possible commonalities and barriers for interaction between standardisation and open source (OSS) processes and in particular the interplay between OSS and FRAND licensing in standardisation.

(A.3) REFERENCES

- Regulation (EU) 2018/1807 of the European Parliament and of the Council of 14 November 2018 on a framework for the free flow of non-personal data in the European Union
- COM(2016)176 "ICT Standardisation priorities for the digital single market"
- COM(2016)178 "European cloud initiative — building a competitive data and knowledge economy in Europe" (Along with SWD(2016)106 and SWD(2016)107)
- COM(2012)529 "Unleashing the potential of cloud computing in Europe"
- COM(2015)192 "A digital single market strategy for Europe"
- **Directive (EU) 2016/1148** of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the EU (NIS Directive).
- COM(2021)118 "2030 Digital Compass: the European way for the Digital Decade"

The volume of data generated is greatly increasing. A growing proportion of data is expected to be processed at the edge, closer to the users and where data are generated. This shift will require the development and deployment of fundamentally new data processing technologies encompassing the edge, adding to those current and future developments concerning a centralised cloud-based infrastructure models

(B.) REQUESTED ACTIONS

The Communication on ICT Standardisation Priorities for the digital single market proposed priority actions in the domain of Cloud. Some actions are still relevant and mentioned below. Others come from the need to respond to the challenges of the Digital Decade Communication

ACTION 1 Identify needs for ICT standards and open source technologies to further improve the interoperability, data protection and portability of cloud services and continue or start respective development activities. This should also take into account available open source technologies and their role for interoperability, data protection and management of multiple clouds.

ACTION 2 Promote the use of the ICT standards needed to further improve the interoperability, data protection and portability of cloud services as well as multi-cloud management.

ACTION 3 Further strengthen the interlock between standardisation and open source in the area of Cloud and establish and support bilateral actions for close collaboration of open source and standardisation. Foster a level playing field that allows the use of Open Source procedures and deliverables where they make economic sense complementing or substituting standardisation.

ACTION 4 Promote international standards on service level agreements (SLAs) and usage of the cloud code of conduct (CoC).

ACTION 5 Promote the use of the ISO/IEC JTC 1 reference cloud architecture and define generic cloud architecture building blocks. Map available standards to the generic cloud architecture building blocks. Define privacy, security and test standards for each building block. This will also help determine which standards can be used for open cloud platforms and architectures taking into account the key role of open source for cloud infrastructure design and implementations.

ACTION 6 Promote the development of adequate standards/open source developments to ensure a competitive playing field for cloud services provision in Europe and contribute to the green agenda.

ACTION 7 SDOs and open source communities to foster their collaboration, mutual exchange, integration of Open Source outcomes in SDO deliverables and identification of technologies, e.g. APIs, that have been developed in open source and could be standardised.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN-CENELEC

When it comes to Cloud Security, CEN-CLC/JTC 13 'Cybersecurity and Data protection' mirrors the activities of ISO/IEC JTC 1 SC 38 'Cloud Computing and distributed platforms', and considers in this respect the potential adoption of International Standards as European Standards, where market relevant. CEN-CLC/JTC 13's scope covers the development of standards for cybersecurity and data protection covering all aspects of the evolving information society. This includes notably: Management systems, frameworks, methodologies; Data protection and privacy; Services and products evaluation standards suitable for security assessment for large companies and small and medium enterprises (SMEs); Competence requirements for cybersecurity and data protection; Security requirements, services, techniques and guidelines for ICT systems, services, networks and devices, including smart objects and distributed computing devices.

In 2021, CEN-CLC/JTC 13 started developing the following relevant deliverables:

- prCEN/CLC/TS XXX 'Multi-layered approach for a set of information security requirements for information/cyber security controls for Cloud Services'
- prCEN/CLC/TS XXX 'Requirements for Conformity Assessment Bodies certifying Cloud Services'

ETSI

ISG NFV (Network Functions Virtualisation): https://www.etsi.org/committee/NFV. NFV adapts standard IT virtualisation technologies, consolidating heterogeneous network infrastructures based on disparate, ad hoc equipment types onto industry standard servers, switches and storage.

ISG NFV develops and improves the NFV architectural framework to make more efficient the integration of edge computing and NFV,

GS NFV-EVE 011 documents the set of criteria to help characterize cloud-native VNFs.

GS NFV-IFA 029 documents enhancements of the NFV architecture for providing "PaaS"-type capabilities and supporting virtualised network functions (VNFs) which follow "cloud-native" design principles.

Specifications and reports on container infrastructure management:

GS NFV-IFA040 "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Requirements for service interfaces and object model for OS container management and orchestration specification"

GS NFV-IFA036 " Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Specification of requirements for the management and orchestration of container cluster nodes"

GR NFV-IFA038 "Network Functions Virtualisation (NFV) Release 4; Architectural Framework; Report on network connectivity for container based VNF"

GS NFV-SEC023 " Network Functions Virtualisation (NFV) Release 4; Security; Container Security Specification"

GS NFV-SOL 018 "Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; Profiling specification of protocol and data model solutions for OS Container management and orchestration"

Specifications and reports on multi-site / multi-domain deployments

GS NFV-IFA 032 " Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Interface and Information Model Specification for Multi-Site Connectivity Services"

GS NFV-IFA 030 "Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Multiple Administrative Domain Aspect Interfaces Specification"

GR NFV-SOL 017 "Network Functions Virtualisation (NFV) Release 3 Protocols and Data Models Report on protocol and data model solutions for Multi-site Connectivity Services"

Furthermore, within the framework of NFV Release 5, ISG NFV develops a report on methods and metrics for evaluating the reliability of cloud-native VNFs.

ISG MEC (Multi-access Edge Computing) offers to application developers and content providers cloud-computing capabilities and an IT service environment at the edge of the network. ISG MEC is developing a set of standardized Application Programming Interfaces (APIs) to enable MEC services. To application developers and content providers, the access network offers a service environment with ultra-low latency and high bandwidth and direct access to real-time network information that can be used by applications and services to offer context-related services. List of relevant documents from ISG MEC:

The group led the publication of a White Paper on "MEC security: Status of standards support and future evolutions" written by several authors participating in ETSI ISG MEC, ETSI ISG NFV SEC and ETSI TC

CYBER. The work identified aspects of security where the nature of edge computing leaves typical industry approaches to cloud security insufficient.

- As a follow-up of the above white paper, the MEC group started a study on MEC Security (ETSI GR MEC041).
- Also multi-MEC and MEC-Cloud environments can be relevant in this context. In the domain of Cloud Federation, ETSI ISG MEC published a study ETSI GR MEC 035.

As a follow-up of the previous study (MEC 035), the group started the related normative work (ETSI GS MEC 040) to standardize MEC Federation Enablement APIs. The work is done in alignment with GSMA OPG and 3GPP SA6.

ISG NIN (Non-IP Networking): is investigating communications and networking protocols to provide the scale, security, mobility and ease of deployment required for a connected society. It is developing a forwarding plane standard that, while still supporting traditional Internet protocols, will also natively support new forms of routing, with a clean interface between the forwarding plane and the control and management planes. Thus, when accessing a service that might be provided at the edge or centrally, a client no longer needs to discover an IP address which identifies an interface to the equipment that provides the service, but can identify the service, content, etc, directly.

ISO/IEC JTC 1

ISO/IEC JTC 1/SC 27 Information security, cybersecurity and privacy protection

ISO/IEC 27017 — Code of practice for information security controls based on ISO/IEC 27002 for cloud services

ISO/IEC 27018 — Code of practice for personally identifiable information (PII) protection in public cloud acting as PII processors

ISO/IEC 27036-4 — Information security for supplier relationships — Part 4: Guidelines for security of cloud services

ISO/IEC JTC 1/SC 38 Cloud computing and distributed platforms:

A full suite of standards is available and in progress in ISO/IEC JTC 1 SC 38 on cloud computing technologies including, most notably, the ISO Cloud Reference Architecture but also work on vocabulary, SLAs, etc. This is complemented by work in ISO/IEC JTC 1 SC27 on cybersecurity and on more specific work as on Virtualisation. Below is a non-exhaustive list of relevant ISO standards.

http://www.iso.org/iso/jtc1_sc38_home

ISO/IEC 19086-1 — Cloud computing — service level agreement (SLA) framework — Part 1: Overview and concepts

ISO/IEC 19086-2 — Cloud computing — Service level agreement (SLA) framework — Part 2: Metric model

ISO/IEC 19086-3 — Cloud computing — Service level agreement (SLA) framework — Part 3: Core conformance requirements

ISO/IEC 19086-4 — Cloud computing — Service level agreement (SLA) framework — Part 4: Components of security and of protection of PII

ISO/IEC 19941 Cloud Computing — Interoperability and portability

ISO/IEC 19944 Cloud Computing — Cloud services and devices: data flow, data categories and data use

ISO/IEC TR 22678 -- Cloud Computing -- Guidance for Policy Development

ISO/IEC TR 23186 -- Cloud computing -- Framework of trust for processing of multi-sourced data

ISO/IEC NP TR 23187 -- Cloud computing — Interacting with cloud service partners (CSNs) (work in progress)

ISO/IEC PDTR 23613 -- Cloud service metering and billing elements (work in progress)

ISO/IEC AWI 23751 -- Cloud computing and distributed platforms — Data sharing agreement (DSA) framework (work in progress)

ISO/IEC TR 23951 -- Cloud computing — Best practices for cloud SLA metrics (work in progress)

ISO/IEC 22624 -- Cloud Computing -- Taxonomy based data handling for cloud services (final stages of approval)

ISO/IEC CD 22123 -- Cloud Computing -- CONCEPTS AND TERMINOLOGY (work in progress)

ISO/IEC TS 23167 -- Cloud Computing -- Common Technologies and Techniques (work in progress)

ISO/IEC TR 23188 -- Cloud computing -- Edge computing landscape (work in progress)

ISO/IEC 17788 — Cloud computing — Overview and vocabulary

ISO/IEC 17789 Cloud computing — Reference architecture

ISO/IEC TR 3445 — Cloud computing — Audit of cloud services (Work in progress)

ISO/IEC 5140 — Cloud computing — Concepts for multi-cloud and other interoperation of multiple cloud services (Work in progress)

ITU

ITU-T SG13 leads ITU's work on standards for future networks and 5G and is the primary SG working on cloud computing and data handling. It approved 29 Recommendations and 2 Supplements and has 26 ongoing work items covering different aspects of cloud computing (e.g. terminology, overview, reference architecture, functional requirements for technologies supporting XaaS and inter-cloud computing, edge cloud for FMSC, and performance management framework in inter-cloud and data storage federation). Relevant URLs:

Y.Sup49 to ITU-T Y.3500-series (11/2018) - Cloud computing standardisation roadmap, including deliverables of various SDOs: https://www.itu.int/rec/T-REC-Y.Sup49/en .

Flipbook "Cloud computing: From paradigm to operation" with a collection of many ITU-T outputs on cloud computing: https://www.itu.int/en/publications/Documents/tsb/2020-Cloud-computing-From-paradigm-to-operation/index.html

In the domain of Big Data for Cloud, ITU-T related work is listed in the Big Data chapter of this Rolling Plan.

More info: https://www.itu.int/en/ITU-T/studygroups/2017-2020/13

ITU-T SG11 work on cloud and edge computing with regard to signalling, monitoring and interoperability testing. SG11 developed 7 Recommendations which cover monitoring of cloud computing, signalling requirements of intelligent edge computing, interoperability testing of cloud computing and testing requirements for virtual switches (ITU-T Q.3914, ITU-T Q.4040-Q.4059-series, ITU-T Q.5001). The ITU-T Q.Supplement 65 "Cloud computing interoperability activities", provides the summary information for cloud computing interoperability activities of existing standards development organizations (SDOs) and the groups, forums and

open sources developing the specifications that have the potential to utilize cloud computing interoperability testing tools.

Currently, the ongoing work items of SG11 focus on signalling requirements for federated multi-access edge computing, protocols for microservices based intelligent edge computing and intelligent control of cloud-network-converged networks gateway.

More info: https://itu.int/go/tsg11

ITU-T SG20 develops standards on Internet of things (IoT), smart cities and communities. It also studies aspects related to edge computing for the Internet of things (IoT) which allows IoT deployments to be enhanced through data processing closer to the end device. . ITU-T SG20 has approved the following Recommendations:

- Recommendation ITU-T Y.4122 "Requirements and capability framework of edge computing-enabled gateway in the IoT"
- Recommendation ITU-T Y.4208 "IoT requirements for support of edge computing"

More info: https://itu.int/go/tsg20

ITU-T SG17 works on cloud computing security. It has approved four Recommendations:

- ITU-T X.1603 "Data security requirements for the monitoring service of cloud computing",
- ITU-T X.1604 "Security requirements of network as a service (NaaS) in cloud computing"
- ITU-T X.1605 "Security requirements of public infrastructure as a service (IaaS) in cloud computing"
- ITU-T X.1606 "Security requirements for communication as a service application environments". . SG17 has is working on Security guidelines for container, distributed cloud, multi-cloud, edge cloud and Security requirements of cloud-based platform under low latency and high reliability application scenarios, network security situational awareness platform for cloud computing, etc.
- More details here: https://www.itu.int/en/ITU-T/studygroups/2017-2020/17

IEEE

Cloud computing:

IEEE recently published the IEEE 2301-2020 IEEE Guide for Cloud Portability and Interoperability Profiles (CPIP). It provides standards-based choices in areas such as application interfaces, portability interfaces, management interfaces, interoperability interfaces, file formats, and operation conventions for cloud computing ecosystem participants (cloud vendors, service providers, and users).

Fog/Edge Computing:

Work is going on in IEEE P1934.1 "Nomenclature and Taxonomy for Distributing Computing, Communications and Networking along the Things-to-Cloud Continuum" and IEEE P1935 "Standard for Edge/Fog Manageability and Orchestration".

More recently IEEE SA initiated a new family of standards on cloud-edge collaborative framework through its work on IEEE P2805.1 on "Self-Management Protocols for Edge Computing Node", IEEE P2805.2 on "Data Acquisition, Filtering and Buffering Protocols for Edge Computing Node", IEEE P2805.3 on "Cloud-Edge Collaboration Protocols for Machine Learning", and the IEEE P2961 on "Guide for an Architectural Framework and Application for Collaborative Edge computing".

More information is available at https://ieeesa.io/rp-cloudcomputing

IETF

The IETF has multiple groups working on standards for virtualization techniques, including techniques used in cloud computing and datacenters.

The Layer 2 Virtual Private Networks (L2VPN) Working Group produced specifications defining and specifying solutions for supporting provider-provisioned Layer-2 Virtual Private Networks (L2VPNs). They also addressed requirements driven by cloud computing services and data centers as they apply to Layer-2 VPN services. The L2VPN Service Model (L2SM) Working Group is tasked to created a data model that describes an L2VPN service.

The Layer 3 Virtual Private Networks (L3VPN) Working Group was responsible for defining, specifying and extending solutions for supporting provider-provisioned Layer-3 (routed) Virtual Private Networks (L3VPNs). These solutions provide IPv4, IPv6, and MPLS services including multicast.

The Layer Three Virtual Private Network Service Model (L3SM) Working Group was tasked to create a YANG data model that describes an L3VPN service (an L3VPN service model) that can be used for communication between customers and network operators, and to provide input to automated control and configuration applications.

The Network Virtualization Overlays (NVO3) Working Group develops a set of protocols and extensions that enable network virtualization within a datacenter environment that assumes an IP-based underlay. An NVO3 solution provides layer 2 and/or layer 3 services for virtual networks enabling multi-tenancy and workload mobility, addressing management and security issues.

The System for Cross-domain Identity Management (SCIM) Working Group worked on standardising methods for creating, reading, searching, modifying, and deleting user identities and identity-related objects across administrative domains, with the goal of simplifying common tasks related to user identity management in services and applications.

The Computing in the Network Research Group (coinrg) of the IRTF explores existing research and fosters investigation of "Compute In the Network" and resultant impacts to the data plane. The goal is to investigate how to harness and to benefit from this emerging disruption to the Internet architecture to improve network and application performance as well as user experience.

https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#Cloud

FRAUNHOFER INSTITUTE AND OFE

The Fraunhofer Institute and Open Forum Europe (OFE) have been carrying out a study on behalf of the European Commission, entitled "The impact of Open Source Software and Hardware on technological independence, competitiveness and innovation in the EU economy". The study is in latest stages of being published (foreseen September 2021). The analysis estimates a cost-benefit ratio of above 1:4 and predicts that an increase of 10% of OSS contributions would annually generate an additional 0.4% to 0.6% GDP as well as more than 600 additional ICT start-ups in the EU. Case studies reveal that by procuring OSS instead of proprietary software, the public sector could reduce the total cost of ownership, avoid vendor lock-in and thus increase its digital autonomy. The study also contains policy recommendations including the promotion OSS in addition to standardisation as a further channel of knowledge and technology transfer, e.g., as an explicit dissemination channel for Horizon Europe projects.

OGF

Open Grid Forum (OGF) is a leading standards development organisation operating in the areas of grid, cloud and related forms of advanced distributed computing. The OGF community pursues these topics through an open process for development, creation and promotion of relevant specifications and use-cases.

http://www.ogf.org/

OMG

Object Management Group (OMG): the OMG's focus is always on modelling, and the first specific cloud-related specification efforts have only just begun, focusing on modelling deployment of applications & services on the clouds for portability, interoperability & reuse. http://www.omg.org/

Hosted by the OMG is the Cloud Standards Customer Council, which has produced a series of customer-oriented white papers on diverse topics related to cloud computing, all of which are publicly accessible at: http://www.cloud-council.org/resource-hub.htm

ONEM2M

The oneM2M architecture is based on distributed computing capabilities, data management and storage, and it supports interworking with non-oneM2M entities and integrates with communication infrastructures. The oneM2M system operates in the cloud when the data are centralized. At the same time, separate oneM2M based cloud services may be federated as an alternative to the direct integration of dedicated data bases. The oneM2M standards also address edge related technologies for Automotive and Industry 4.0 domains. In 2018 oneM2M started a dedicated work item on Edge and Fog Computing (WI-0080). Different solutions have been developed, such as Edge/Fog offloading, dynamic service management, common service description /service-awareness, loosely/tightly coupled Edge/Fog Computing. The study of those solutions resulted in related normative work that contains advanced features and enhancements for oneM2M specifications TS-0001, TS-0004 and TS-0026. Specific studies are available as Technical reports as well as all specifications being made publicly accessible at: <https://onem2m.org/technical/published-specifications>.

Related guidelines are also provided in ETSI TR 103 527 V1.1.1 (2018-07) SmartM2M; Virtualized IoT Architectures with Cloud Back-ends.

OASIS

The Topology and Orchestration Specification for Cloud Applications (TOSCA) TC works to enhance the portability of cloud applications and services across their entire lifecycle. TOSCA enables the interoperable description of application and infrastructure cloud services, independent of the supplier creating the service, and any particular cloud provider or hosting technology. TOSCA is at the top of the list of "most used standards projects" in the Cloudwatch2 study. The OASIS TOSCA TC and ETSI NFV ISG cooperate to align their Network Functions Virtualisation (NFV) service models and specifications.

The Cloud Application Management for Platforms (CAMP) TC advances an interoperable protocol that cloud implementers can use to package and deploy their applications. CAMP defines interfaces for self-service provisioning, monitoring, and control. Common CAMP use cases include: moving on-premise applications to the cloud (private or public) or redeploying applications across cloud platforms from multiple vendors.

The OASIS Open Data Protocol (Odata) TC works to simplify the querying and sharing of data across disparate applications and multiple stakeholders for re-use in the enterprise, Cloud, and mobile devices. A REST-based protocol, OData builds on HTTP and JSON using URIs to address and access data feed resources. OASIS OData standards have been approved as ISO/IEC 20802-1:2016 and ISO/IEC 20802-2:2016.

The goal of the OASIS Virtual I/O Device (VIRTIO) TC is to simplify virtual devices, making them more extensible and more recognizable. It ensures that virtual environments and guests have a straightforward, efficient, standard, and extensible mechanism for virtual devices. Guest can use similar standard PCI drivers and discovery mechanisms for PCI devices of the VIRTIO family as for physical PCI devices.

OFE

Recently Open Forum Europe (OFE) carried out a study on behalf of the European Commission, entitled "Standards and Open Source: bringing them together". The aim of this study was to analyse and make practical progress on the collaboration models between SDOs and cloud open source software development initiatives, and to develop a roadmap of actions to improve the integration of open source communities in the standard setting process.

https://ec.europa.eu/digital-single-market/en/news/standards-and-open-source-bringing-them-together

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

BSI

Cloud Computing Compliance Controls Catalogue (C5)

The C5 defines a baseline for cloud security, divided into thematic sections (e.g. organisation of information security, physical security), using mostly recognised security standards. C5 outlines prerequisites for a conformity assessment using international standards (ISAE 3000, ISAE 3402), adding cloud specific requirements, especially for transparency.

C-SIGS

The cloud select industry groups as a contribution from Europe to the global cloud standardisation community.

- Cloud Select Industry Group on Code of Conduct: the European Commission has been working with industry to finalise a code of conduct for cloud computing providers. The code of conduct supports a uniform application of data protection rules by cloud service providers. The Code of Conduct for Protection of Personal Data in cloud services has been published in June 2016. Strong relationship with ISO/IEC 27018 standard.
- Cloud Select Industry Group on Service Level Agreements: the goal of this subgroup is to work towards the development of standardisation guidelines for SLAs for cloud services. Work was submitted to ISO/IEC SC38 committee as input to the work on the 19086 standards.
- Cloud Select Industry Group on Certification Schemes: the Digital Single Market Strategy 2015 (DSM) committed the European Commission to delivering a European Cloud Initiative, including certification.

GICTF

Global Inter-Cloud Technology Forum (GICTF) is promoting standardisation of network protocols and the interfaces through which cloud systems inter-work with each other, to promote international interworking of cloud systems, to enable global provision of highly reliable, secure and high-quality cloud services, and to contribute to the development Japan's ICT industry and to the strengthening of its international competitiveness.

http://www.gictf.jp/index_e.html.

GAIA-X

Gaia-X aims at developing common requirements for a European data infrastructure based on standards which ensure transparency and interoperability. GAIA-X addresses this requirement by aligning network and interconnection providers, Cloud Solution Providers (CSP), High Performance Computing (HPC) as well as sector specific clouds and edge systems. https://www.data-infrastructure.eu/ "

OCC

The Open Cloud Consortium (OCC) supports the development of standards for cloud computing and frameworks for interoperating between clouds; develops benchmarks for cloud computing; and supports reference implementations for cloud computing, preferably open source reference implementations. The OCC has a particular focus in large data clouds. It has developed the MalStone Benchmark for large data clouds and is working on a reference model for large data clouds.

https://www.occ-data.org/

TM FORUM

TM Forum: The primary objective of TM Forum's Cloud Services Initiative is to help the industry overcome these barriers and assist in the growth of a vibrant commercial marketplace for cloud-based services. The centrepiece of this initiative is an ecosystem of major buyers and sellers who will collaborate to define a range of common approaches, processes, metrics and other key service enablers.

https://www.tmforum.org/ioe/

SNIA

Storage Networking Industry Association (SNIA): The Cloud Work Group exists to create a common understanding among buyers and suppliers of how enterprises of all sizes and scales of operation can include cloud computing technology in a safe and secure way in their architectures to realise its significant cost, scalability and agility benefits. It includes some of the industry's leading cloud providers and end-user organisations, collaborating on standard models and frameworks aimed at eliminating vendor lock-in for enterprises looking to benefit from cloud products and services.

http://www.snia.org/cloud

(C.3) ADDITIONAL INFORMATION

Open source projects address particular aspects of cloud computing (e.g. OpenStack (IaaS), the Open Networking Foundation (ONF), Cloud Foundry (PaaS), Docker (Container technology) and kubernetes) and as such, open source communities should be encouraged to collaborate with standardisation and submit their APIs for standardisation.

3.1.3. BIG DATA, OPEN DATA AND PUBLIC SECTOR INFORMATION

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

With the continuously growing amount of data (often referred to as 'big data') and the increasing amount of open data, interoperability is increasingly a key issue in exploiting the value of this data. Interoperability is essential so that cooperation, development, integration and the rendering of services takes place in the best possible way. It also significantly facilitates the accomplishment of public policies, especially for the collaboration between different applications to enable the development of new services. It therefore allows for the development of e-governance and the information society.

In its **Data Strategy (COM (2020) 66 final**) , the Commission described the vision of a common European data space, a Single Market for data in which data could be used irrespective of its physical location of storage in the Union in compliance with applicable law. In order to turn that vision into reality, EU proposes to establish domain-specific common European data spaces, as the concrete arrangements in which data sharing and data pooling can happen. As foreseen in that strategy, such common European data spaces can cover areas such as health, mobility, manufacturing, financial services, energy, or agriculture or thematic areas, such as the European green deal or European data spaces for public administration or skills. In the same document, emphasis is given to data interoperability and quality. More specifically, data interoperability and quality, as well as their structure, authenticity and integrity are key for the exploitation of the data value, especially in the context of AI deployment. Further, under the Digital Europe Programme, a Data Spaces Support Centre will be set up, with the purpose of coordinating all relevant actions on sectorial data spaces and to make available technologies, processes, standards and tools that will allow reuse of data across sectors by the public sector and European businesses, notably SMEs.

In November 2020, the **proposal for Regulation on European data governance (Data Governance Act)** was published. In this proposal, the need to enhance data interoperability as well as data sharing services between different sectors and domains to act as an enabler to seamless and secure cross-border electronic communication, building on existing European, international or national standards is highlighted. The setting up of European Data Innovation Board is proposed - in the form of a Commission expert group - in order to successfully implement the data governance framework. This Board should support the Commission in coordinating national practices and policies on the topics covered by this Regulation, and in supporting cross-sector data use by adhering to the European Interoperability Framework (EIF) principles and through the utilisation of standards and specifications (such as the Core Vocabularies and the CEF Building Blocks), without prejudice to standardisation work taking place in specific sectors or domains. Among the Board's tasks the following are foreseen: (a) to advise the Commission on the prioritisation of cross-sector standards to be used and developed for data use and cross-sector data sharing, cross-sectoral comparison and exchange of best practices with regards to sectoral requirements for security, access procedures, while taking into account sector-specific standardisations activities; (b) to assist the Commission in enhancing the interoperability of data as well as data sharing services between different sectors and domains, building on existing European, international or national standards.

Standardisation at different levels (such as metadata schemata, data representation formats and licensing conditions of open data) is essential to enable broad data integration, data exchange and interoperability with the overall goal of fostering innovation based on data. This refers to all types of (multilingual) data, including both structured and unstructured data, and data from different domains as diverse as geospatial data, statistical data, weather data, public sector information (PSI) and research data, to name just a few.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

Overall, the application of standard and shared formats and protocols for gathering and processing data from different sources in a coherent and interoperable manner across sectors and vertical markets should be encouraged, for example in R&D&I projects and in the data.europa.eu portal (https://data.europa.eu.)

Studies conducted for the European Commission showed that businesses and citizens were facing difficulties in finding and re-using public sector information. The Communication on Open data states that "the availability of the information in a machine-readable format and a thin layer of commonly agreed metadata could facilitate data cross-reference and interoperability and therefore considerably enhance its value for reuse".

A common standard for the referencing of open data in the European open data portals would be useful. A candidate for a common standard in this area is the Application Profile for data portals in Europe (DCAT-AP) and the FIWARE open stack-based specification and open standards APIs. The FIWARE solution has now been integrated into the Connecting Europe Facility "Context Broker" building block (https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/Context+Broker). The CEF has agreed meanwhile to upgrade the "Context Broker" to use the ETSI NGSI-LD specification (ETSI GS 009 V1.3.1 of the NGSI-LD API), and also the FIWARE Foundation is evolving its API to the same ETSI standard for exchange of open data. Now further effort is needed to demonstrate good examples of proper usage of NGSI-LD. This has been promoted within the EC Large Scale Pilot project SynchroniCity, however more dissemination and training is required (as recognized by CEF efforts to promote training webinars).

The DCAT Application Profile is being developed as a common project from the ISA2 programme, the Publications Office (PO) and CNECT to describe public-sector data catalogues and datasets and to promote the specification to be used by data portals across Europe. Agreeing on a common application profile and promoting this among the Member States is substantially improving the interoperability among data catalogues and the data exchange between Member States. The DCAT-AP is the specification used by the data.europa.eu portal, which is part of the Connecting Europe Facility infrastructure, as well as by a growing number of Member States open data portals. The DCAT-AP related work, including its extensions to geospatial data (GeoDCAT-AP) and statistical data (StatDCAT-AP) also highlights the need for further work on the core standard. These are topics for the W3C smart descriptions & smarter vocabularies (SDSVoc) under the VRE4EIC Project https://www.w3.org/2016/11/sdsvoc/. Core Vocabularies (i.e., Core Person, Core Organization, Core Location, Core Public Event, Core Criterion and Core Evidence), Core Public Service Application Profile and Asset Description Metadata Schema (for describing reusable solutions), implemented by the ISA2 program, solve the problem of data exchange and interoperability by using uniform data representation formats. They were used in the TOOP-OOP (Once-Only Principle) project and now are currently used in the Once Only Principle (OOP) Technical System under the scope of the Single Digital Gateway Regulation EU 2018/1724.

The concept of the Once-Only Principle (OOP) focuses on reducing administrative burden for individuals and businesses by re-organising public sector internal processes, instead of making citizens and business users adjust to existing procedures. In view of its contribution to the realisation of the Digital Single Market in Europe, the European Commission is strongly promoting the implementation of the OOP across borders. Therefore, once-only is one of the underlying principles stated in the European Union's "eGovernment Action Plan 2016-2020" and is part of several initiatives related to the European Digital Single Market. This includes the following three pilot projects: SCOOP4C, The Once-Only Principle Project (TOOP), and Digital Europe for all (DE4A).

Furthermore, the Single Digital Gateway Regulation EU 2018/1724 includes a technical system for exchange of evidences based on OOP concepts and input from the TOOP project. This system will be supported by a new CEF Once Only Principle Building Block.

The mapping of existing relevant standards for a number of big data areas would be beneficial. Moreover, it might be useful to identify European clusters of industries that are with sufficiently similar activities to develop data standards. Especially for open data, the topics of data provenance and licensing (for example the potential of machine-readable licenses) need to be addressed, as encouraged in the current and proposed revision of the PSI Directive (see section B.1).

The new Open Data Directive encourages the use of standard licenses which must be available in digital format and be processed electronically (Article 8(2)). Furthermore, the Directive encourages the use of open licenses available online, which should eventually become common practice across the EU (Recital 44). In addition, to help Member States transpose the revised provisions, the Commission adopted guidelines which recommend the use of such standard open licenses for the reuse of PSI.

Currently, ISA2 vocabularies and solutions are used for the implementation of Single Digital Gateway Regulation (SDGR) in the design of common data models for evidences that are going to be exchanged between Member States. SDGR highlights the need to insure functional, technical and semantic interoperability in the exchange of evidences which can only be assured by using standard and shared data representation formats.

On 25 April 2018, the Commission adopted the 'data package' — a set of measures to improve the availability and re-usability of data, in particular publicly held or publicly funded data, including government data and publicly funded research results, and to foster data sharing in business-to-business (B2B) and business-to-government (B2G) settings. The availability of data is essential so that companies can leverage on the potential of data-driven innovation or develop solutions using artificial intelligence.

Key elements of the package are:

The Open Data Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information was adopted and published on 26 June 2019. It had to be transposed into national legislation by 17 July 2021

- enhancing access to and re-use of real-time data notably with the help of Application Programming Interfaces (APIs);
- lowering charges for the re-use of public sector information by limiting exceptions to the default upper limit of marginal cost of dissemination and by specifying certain high-value data sets which should be made available for free (via implementing acts);
- allowing for the re-use of new types of data, including data held by public undertakings in the transport and utilities sector and data resulting from publicly funded research;
- minimising the risk of excessive first-mover advantage in regard to certain data, which could benefit large companies and thereby limit the number of potential re-users of the data in question;
- defining through an implementing act a list of "high value datasets" belonging to six thematic categories (geospatial, earth observation and environment, meteorological, statistics, companies and company ownership, mobility) to be made available mandatorily free of charge, in machine readable format and through APIs.

Article 14 of the open data Directive empowers the Commission to adopt implementing acts laying down a list of specific high value datasets belonging to the six thematic categories set out in the Annex and held by public sector bodies and public undertakings. In order to make the reuse of these datasets more efficient, the Directive provides that they shall be available free of charge, machine-readable, provided via APIs and, where relevant, as a bulk download. The implementing acts may also specify the arrangements for the publication and re-use of high value datasets, which shall be compatible with open standard licences. They may include terms applicable to re-use, formats of data and metadata and technical arrangements for dissemination. Work on the definition of high value datasets, including an impact assessment study, stakeholder consultations and a public consultation and hearing, took place in 2020. An implementing regulation on high value datasets will be adopted in the second half of 2021.

2. REVIEW OF THE 2012 RECOMMENDATION ON ACCESS TO AND PRESERVATION OF SCIENTIFIC INFORMATION, FOCUSING ON:

- evaluating the uptake of the 2012 Recommendation as well as its effectiveness in creating a level playing field for Member States, researchers and academic institutions;
- updating and reinforcing the overall policy with the development of guidelines on opening up research data and the creation of incentive schemes for researchers sharing data;
- ensuring coherence with the European Open Science Cloud.

3. DEVELOPMENT OF GUIDANCE ON PRIVATE SECTOR DATA SHARING

The Commission has proposed guidance to companies that wish to make data available to other companies or to public authorities, which lays down principles of fair data sharing practices and includes guidance on legal, business and technical aspects of B2B and B2G data sharing.

Following an open selection process, the Commission appointed in November 2018 23 experts to an Expert Group on Business-to-Government Data Sharing. The conclusions and recommendations of the Expert Group were published in a report released end of 2019; the report findings are used as input for possible future Commission initiatives on B2G data sharing (https://digital-strategy.ec.europa.eu/en/news/experts-say-privately-held-data-available-european-union-should-be-used-better-and-more).

The report underlines several times the importance of standardisation for facilitating data sharing. "The expert group recommends that the Digital Europe Programme invests in the development of common standards for data, metadata, representation and standardised transfer protocols. Building on existing EU programmes, initiatives and working groups, such as the CEF and ISA2 programmes and the "Multi-stakeholder platform for ICT standardisation", the expert group recommends prioritising those standards that are most generally used over creating new ones. The chosen standards should then be further developed, possibly in cooperation and with the support of a European standardisation body. Agreeing on a (set of) common standard(s) and promoting this among the Member States will substantially improve the interoperability among data catalogues and the data exchange between Member States and private companies and civil-society organisations."

On 19 February 2020, the Commission adopted the Communication on "A European strategy for data" — a set of measures aiming at making the EU a leader in a data-driven society. Creating a single market for data will allow it to flow freely within the EU and across sectors for the benefit of businesses, researchers and public administrations.

A first priority for operationalising its vision is to put in place an enabling legislative framework for the governance of common European data spaces. Such governance structures should support decisions on what data can be used in which situations, facilitate cross-border data use, and prioritise interoperability requirements and standards within and across sectors, while taking into account the need for sectoral authorities to specify sectoral requirements. The framework will reinforce the necessary structures in the Member States and at EU level to facilitate the use of data for innovative business ideas, both at sector- or domain-specific level and from a cross-sector perspective.

On 25 November 2020 the Commission adopted the proposal for a Regulation on European data governance. (COM(2020) 767 final). It aims to foster the availability of data for use by increasing trust in data intermediaries and by strengthening data-sharing mechanisms across the EU. The Regulation will facilitate data sharing across the EU and between sectors to create wealth for society, increase control and trust of both citizens and companies regarding their data, and offer an alternative European model to data handling practice of major tech platforms.

(A.3) REFERENCES

- Proposal for Regulation on European data governance (COM(2020) 767 final)
- Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information (recast)
- Regulation (EU) 2018/1807 of the European Parliament and of the Council of 14 November 2018 on a framework for the free flow of non-personal data in the European Union
- COM(2020) 66 final "A European strategy for data"
- **COM(2018) 232 final** "Towards a common European data space"
- COM(2014) 442 Towards a thriving data-driven economy
- COM(2016) 176 ICT Standardisation Priorities for the Digital Single Market
- **COM(2017) 9 Building a European Data Economy:** A Communication on Building a European Data Economy was adopted on 10 January 2017. This Communication explores the following issues: free flow of data; access and transfer in relation to machine generated data; liability and safety in the context of emerging technologies; and portability of non-personal data, interoperability and standards. Together with the Communication the Commission has launched a public consultation.
- Decision (EU) 2015/2240 on interoperability solutions and common frameworks for European public administrations, businesses and citizens (ISA2 programme) as a means for modernising the public sector (ISA2)
- The PSI Directive (2013/37/EU) on the re-use of public sector information (Public Sector Information Directive) was published in the Official Journal on 27 June 2013. The Directive requests to make available for reuse PSI by default, preferably in machine-readable formats. All Member States transposed it into national legislation.
- **COM(2011) 882** on Open data
- **COM(2011) 833** on the reuse of Commission documents
- **C(2018) 2375 final** "Recommendation on access to and preservation of scientific information"

(B.) REQUESTED ACTIONS

The Communication on ICT Standardisation Priorities for the Digital Single Market proposes priority actions in the domain of Big Data. Actions mentioned herein below reflect some of them.

ACTION 1 SDO's to undertake the DCAT-AP standardisation process, considering:

- Specifications for metadata records to meet the specific application needs of data portals in Europe while providing semantic interoperability with other applications on the basis of reuse of established controlled vocabularies and mappings to existing metadata vocabularies (e.g. SDMX, INSPIRE metadata, Dublin Core, etc.).
- Geo/DCAT-AP extension to cover geospatial datasets.
- Stat/DCAT-AP extension to describe statistical datasets.

ACTION 2 Promote standardisation in/via the open data infrastructure, especially the European Data Portal being deployed in 2015-2020 as part of the digital service infrastructure under the Connecting Europe Facility programme,

ACTION 3 Support of standardisation activities at different levels: H2020 R&D&I activities; support for internationalisation of standardisation, in particular for the DCAT-AP specifications developed in the ISA2 programme (see also action 2 under eGovernment chapter), and for specifications developed under the Future Internet public-private-partnership, such as FIWARE NGSI-LD and FIWARE CKAN. Standardisation can also be enhanced by using Core Vocabularies, as well as Core Public Service Application Profile implemented by the ISA2 program; new activities launched by the first implementations of the Digital Europe Programme and the legal framework progressively put in place following the Commission Communication on "A European strategy for data".

ACTION 4 Bring the European data community together, including through the H2020 Big Data Value public-private partnership, to identify missing standards and design options for a big data reference architecture, taking into account existing international approaches, in particular the work in ISO/IEC JTC 1 SC 42. In general attention should be given to the four pillars of (semantic) discovery, privacy-by-design, accountability for data usage (licensing), and exchange of data together with its metadata, through the use of Asset Description Metadata Schema (for describing reusable solutions) implemented by the ISA2 program.

ACTION 5 CEN to coordinate with W3C on standardising the DCAT-AP as well as the other vocabularies provided by the ISA2 programme and to prevent incompatible changes as well as concerning the conditions for availability of the standard(s).

ACTION 6 The European Commission together with EU funded pilots and projects that develop technical specifications for the provision of cross-border services (e.g., from ISA², CEF/DEP pilots), which need to be referenced in public procurement, to liaise with SDOs to consider how to address their possible standardisation.

ACTION 7 The European Commission to initiate broad exchanges with SDOs and all stakeholders, in particular with those in relation with the European Data Spaces, on the role of standards and open source in the context of the improvement of data interoperability within and across sectors, the data economy including in particular consideration of the twin transitions. This should inter alia aim for the identification of the possible functional or standardisation gaps and promote further coordination amongst different SDOs

ACTION 8 SDOs to look into possible standardisation needs arising from the proposed European Data Governance Act.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN CENELEC

The CEN-CENELEC JTC 21 on Artificial Intelligence (AI) has been set up to mirror, the work of other SDOs (mainly ISO/IEC/ETSI), and thereby facilitate the ongoing technical cooperation. The JTC 21 also addresses the related use of data.

The JTC 21 shall produce standardisation deliverables to address European market and societal needs and to underpin primarily EU legislation, policies, principles, and values.

The committee has initiated the following activities:

Mapping of current European and international standardisation initiatives on AI

Identifying specific standardisation needs

Monitoring potential changes in European legislation

Liaising with relevant TCs and organizations in order to identify synergies and, if possible, initiate joint work

Acting as the focal point for the CEN and CENELEC TCs

Encouraging further European participation in the ISO and IEC TCs

Prior to the establishment of JTC 21, the CEN-CENELEC Focus Group on AI explored the possibilities for a dedicated CEN-CENELEC TC on AI. The Focus Group published two documents: a response to the EC white paper on AI as well as the CEN-CENELEC Roadmap for AI standardisation. Both documents are available here. After having completed its tasks the Focus Group on AI was disbanded and documents and assets were transferred to the CEN-CENELEC JTC 21.

CEN/TC 468 'Preservation of digital information' works on the functional and technical aspects of the preservation of digital information. In this field, the committee will develop a structured set of standards, specifications and reports, addressing business requirements, including compliance with the European legislative and regulatory framework (e.g. GDPR, eIDAS).

ETSI

ETSI TC SmartM2M is developing a set of reference ontologies, mapped onto the oneM2M Base Ontology. This work has commenced with the SAREF ontology, for Smart Appliances, but is being extended to add semantic models for data associated with smart cities, industry and manufacturing, smart agriculture and the food chain, water, automotive, eHealth/aging well and wearables (https://saref.etsi.org/).

ETSI's ISG for cross-cutting Context Information Management (CIM) has developed the NGSI-LD API (GS CIM 004 and GS CIM 009) which builds upon the work done by OMA Specworks and FIWARE. NGSI-LD is an open framework for exchange of contextual information for smart services, aligned with best practice in linked open data. Ongoing activities involve increased interoperability with oneM2M data sources and features to attest provenance of information as well as options for fine-grained encryption of information.

ETSI's ISG MEC is developing a set of standardized Application Programming Interfaces (APIs) for Multi-Access Edge Computing (MEC). MEC technology offers IT service and Cloud computing capabilities at the edge of the network. Shifting processing power away from remote data centres and closer to the end user, it enables an environment that is characterized by proximity and ultra-low latency, and provides exposure to real-time network and context information.

ETSI's TC ATTM committee has specified a set of KPIs for energy management for data centres (ETSI ES 205 200-2-1). These have been combined into a single global KPI for data centres, called DCEM, by ETSI's ISG on Operational energy Efficiency for Users (OEU), in ETSI GS OEU 001.

SC USER: has produced a set of documents related to "User-Centric approach in the digital ecosystem". Note: this body of work also applies to several other sections of the ICT rolling plan, such as, IoT, eHealth, Cyber security, e-privacy, accessibility, but are documented only once.

ETSI TR 103 438 User Group; User centric approach in Digital Ecosystem ETSI EG 203 602 User Group; User Centric Approach: Guidance for users; Best practices to interact in the Digital EcosystemETSI TR 103 603 User Group; User Centric Approach; Guidance for providers and standardisation makersETSI TR 103 604 User Group; User centric approach; Qualification of the interaction with the digital ecosystem ETSI TR 103 437 Quality of ICT services; New QoS approach in a digital ecosystem

SC USER has initiated an action to finalise the project by defining and implementing a proof of Concept of a "Smart interface for digital ecosystem", which is a user interface that meets the needs and expectations of the user at his request, and is an "Intelligent", "highly contextualised" personalisation, agile and proactive interface with an integrated QoS. This project will be based on the Smart Identity concept.

ISO

ISO/TC 46/SC 4 Technical interoperability

ISO 15836 Information and documentation — The Dublin Core metadata element set

ISO/IEC JTC1

In 2018 JTC 1/SC 42 Artificial Intelligence was formed, and contains a WG 2 which is responsible for the Big Data work program.

SC 42 has published the following big data standards:

ISO/IEC 20546:2019 Information technology -- Big Data -- Overview and Vocabulary (https://www.iso.org/standard/68305.html?browse=tc)

ISO/IEC TR 20547-2:2018 Information technology -- Big data reference architecture -- Part 2: Use cases and derived requirements (https://www.iso.org/standard/71276.html?browse=tc)

ISO/IEC TR 20547-5:2018 Information technology -- Big data reference architecture -- Part 5: Standards roadmap (https://www.iso.org/standard/72826.html?browse=tc)

ISO/IEC 20547-1: Information technology -- Big Data reference architecture -- Part 1: Framework and application process

ISO/IEC 20547-3: Information technology -- Big Data reference architecture -- Part 3: Reference architecture

SC 42 is progressing the following current big data projects, which are expected to complete in the next year:

ISO/IEC 24688: Information technology -- Artificial Intelligence -- Process management framework for Big data analytics

See for further information: https://www.iso.org/committee/6794475.html

Built on its foundation standard that is ISO/IEC 38500 (Information technology - Governance of IT for the Organization), JTC 1/SC 40 IT service management and IT governance has developed or is developing the following standards on Governance of Data:

38505-1: Information technology - Governance of IT - Part 1: Application of ISO/IEC 38500 to the governance of data

38505-2: Information technology - Governance of IT - Part2: Implications of ISO/IEC38505-1 for Data Management

38505-3: Information technology - Governance of Data - Part3: Guidelines for Data Classification

See for further information https://www.iso.org/committee/5013818.html

ISO/IEC JTC1 SC32 on "Data management and interchange" work on standards for data management within and among local and distributed information systems environments. SC 32 provides enabling technologies to promote harmonization of data management facilities across sector-specific areas. https://www.iso.org/committee/45342.html

ITU-T

ITU-T SG13 Recommendation ITU-T Y.3600 "Big data - Cloud computing based requirements and capabilities" covers use-cases of cloud computing based big data to collect, store, analyse, visualize and manage varieties of large volume datasets: https://www.itu.int/rec/T-REC-Y.3600/en

Also, SG13 published Y.3600-series Supplement 40 "Big Data Standardisation Roadmap" which will be revised in 2022: https://www.itu.int/rec/T-REC-Y.Sup40/en

SG13 has 10 ongoing work items on big data, in particular, it is working on big data functional requirements for data integration (Y.bdi-reqts). It approved

Recently approved ITU-T Recommendations on big data, includes Y.3605 (09/2020) with big data reference architecture and functional architecture of big data-driven networking Y.3653 (04/2021).

See a flipbook "Big Data - Concept and application for telecommunications": https://www.itu.int/en/publications/Documents/tsb/2019-Big-data/mobile/index.html.

The work programme of SG13 is available at: http://itu.int/itu-t/workprog/wp_search.aspx?sg=13

More info: https://www.itu.int/en/ITU-T/studygroups/2017-2020/13

ITU-T SG20 "Internet of things (IoT) and smart cities & communities (SC&C)" is studying big data aspects of IoT and SC&C. ITU-T Study Group 20 developed Recommendation ITU-T Y.4114 "Specific requirements and capabilities of the IoT for big data" which complements the developments on common requirements of the IoT described in Recommendation ITU-T Y.4100/Y.2066 and the functional framework and capabilities of the IoT described in Recommendation ITU-T Y.4401/ Y.2068 in terms of the specific requirements and capabilities that the IoT is expected to support in order to address the challenges related to big data. This Recommendation also constitutes a basis for further standardisation work such as functional entities, application programming interfaces (APIs) and protocols concerning big data in the IoT.

ITU-T SG20 also published Recommendation ITU-T Y.4461 "Framework of open data in smart cities" that clarifies the concept, analyses the benefits, identifies the key phases, roles and activities and describes the framework and general requirements of open data in smart cities, Recommendation ITU-T Y.4473 "SensorThings API - Sensing" that specifies the SensorThings application programming interface (API) which provides an open standard-based and geospatial-enabled framework to interconnect Internet of things (IoT) devices, data, and applications over the Web, Recommendation ITU-T Y.4472 "Open data application programming interface (APIs) for IoT data in smart cities and communities" which presents a complete set of Open APIs dedicated to smart cities offering different features covering the needs of interoperable smart city framework development, and Supplement ITU-T Y.Suppl.61 "Features of application programming interface (APIs) for IoT data in smart cities and communities" which studies the concept and potential of developing a secured open and interoperable APIs in the context of IoT deployment and open data management in smart cities.

The work programme of SG20 is available at: https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=20

More info: https://itu.int/go/tsg20

The ITU-T Focus Group on Data Processing and Management (FG-DPM) to support IoT and Smart Cities & Communities was set up in 2017. The Focus Group played a role in providing a platform to share views, to develop a series of deliverables, and showcasing initiatives, projects, and standards activities linked to data processing and management and establishment of IoT ecosystem solutions for data focused cities. This Focus Group concluded its work in July 2019 with the development of 10 Technical Specifications and 5 Technical reports. The complete list of deliverables is available here https://itu.

int/en/ITU-T/focusgroups/dpm

ITU-T SG17 has approved six standards on big data and open data security:

ITU-T X.1147 "Security requirements and framework for big data analytics in mobile internet services"

ITU-T X.1376 "Security-related misbehaviour detection mechanism based on big data analysis for connected vehicles"

ITU-T X.1603 "Data security requirements for the monitoring service of cloud computing"

ITU-T X.1750 " Guidelines on security of big data as a service for Big Data Service Providers"

ITU-T X.1751 "Security guidelines on big data lifecycle management for telecom operators"

ITU-T X.1752 "Security guidelines for big data infrastructure and platform" (under approval as of Sept 2021).

More info: https://www.itu.int/en/ITU-T/studygroups/2017-2020/17

ITU-T Focus Group on Artificial Intelligence (FG-AI4H), established in partnership with ITU and WHO, is working towards establishing a standardized assessment framework for the evaluation of AI-based methods for health, diagnosis, triage or treatment decisions.

https://www.itu.int/en/ITU-T/focusgroups/ai4h/

IEEE

IEEE has a series of standards projects related to Big Data (mobile health, energy efficient processing, personal agency and privacy) as well as pre-standardisation activities on Big Data and open data. Some relevant standards activities include:

IEEE 1752 Series of standards on mobile health data, IEEE 3652.1-2020, IEEE Guide for Architectural Framework and Application of Federated Machine Learning, IEEE P7002, IEEE Draft Standard for Data Privacy Process, IEEE P7004, IEEE Draft Standard for Child and Student Data Governance, IEEE P7005, IEEE Draft Standard for Transparent Employer Data Governance.

For more information, see: https://ieeesa.io/rp-open-big-data .

OASIS

The OASIS Open Data Protocol (Odata) TC works to simplify the querying and sharing of data across disparate applications and multiple stakeholders for re-use in the enterprise, Cloud, and mobile devices. A REST-based protocol, OData builds on HTTP and JSON using URIs to address and access data feed resources. OASIS OData standards have been approved as ISO/IEC 20802-1:2016 and ISO/IEC 20802-2:2016.

The OASIS ebCore TC maintains the ebXML RegRep standard that defines the service interfaces, protocols and information model for an integrated registry and repository. The repository stores digital content while the registry stores metadata that describes the content in the repository. RegRep was used in the EU TOOP project, which was concluded in 2021.

RegRep can be used in conjunction with ebXML Messaging including AS4 using a recently developed binding for the Registry Services of the OASIS ebXML RegRep Version 4.0 OASIS Standard. This binding is compatible with the AS4 profile of ebXML Messaging as used, for example, in the European Commission's eDelivery Building Block, and complements the existing protocol bindings specified in OASIS RegRep Version 4.0. This AS4 binding is also of relevance to the Once-Only Technical System for the Single Digital Gateway (see section 3.2.4, eGovernment).

OGC

The Open Geospatial Consortium (OGC) defines and maintains standards for location-based, spatio-temporal data and services. The work includes, for instance, schema allowing description of spatio-temporal sensor, image, simulation, and statistics data (such as "datacubes"), a modular suite of standards for Web services allowing ingestion, extraction, fusion, and (with the web coverage processing service (WCPS) component standard) analytics of massive spatio-temporal data like satellite and climate archives. OGC also contributes to the INSPIRE project.

http://www.opengeospatial.org

ONEM2M

The oneM2M Partnership Project has specified the oneM2M Base Ontology (oneM2M TS-0012, ETSI TS 118 112) to enable syntactic and semantic interoperability for IoT data. The oneM2M standard defined a middleware layer, residing between a lower layer, comprising IoT devices and communications technologies, and an upper layer of IoT applications. Thus, it enables a wide range of interactions between applications and the underlying technologies needed to source data from connected devices and sensors as well as sharing of data from many sensors that are managed by different device owners and service providers. All oneM2M specifications are publicly accessible at at Specifications (onem2m.org).

W3C

DCAT vocabulary (done in the linked government data W3C working group)

http://www.w3.org/TR/vocab-dcat/

After a successful Workshop on Smart Descriptions & Smarter Vocabularies (SDSVoc) (www.w3.org/2016/11/sdsvoc/) W3C created the Dataset Exchange Working Group (https://www.w3.org/2017/dxwg) to revise DCAT, provide a test suite for content negotiation by application profile and to develop additional relevant vocabularies in response to community demand.

Work on licence in ODRL continues and has reached a very mature state: https://www.w3.org/TR/odrl-model/ and https://www.w3.org/TR/vocab-odrl/

The Data on the web best practices WG has finished its work successfully (https://www.w3.org/TR/dwbp) also issuing data quality, data usage vocabularies (https://www.w3.org/TR/vocab-dqv; https://www.w3.org/TR/vocab-duv)

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

ISA AND ISA² PROGRAMME OF THE EUROPEAN COMMISSION

The DCAT application profile (DCAT-AP) has been defined. DCAT-AP is a specification based on DCAT (a RDF vocabulary designed to facilitate interoperability between data catalogues published on the web) to enable interoperability between data portals, for example to allow metasearches in the European Data Portal that harvests data from national open data portals.

Extensions of the DCAT-AP to spatial (GeoDCAT-AP: https://joinup.

ec.europa.eu/node/139283) and statistical information (StatDCAT-AP: https://joinup.ec.europa.eu/asset/stat_dcat_application_profile/home) have also been developed.

https://joinup.ec.europa.eu/asset/dcat_application_profile/description

https://joinup.ec.europa.eu/collection/semantic-interoperability-community-semic/solution/dcat-application-profile-data-portals-europe/release/201-0

Core Vocabularies can be used and extended in the following contexts:

- Development of new systems: the Core Vocabularies can be used as a default starting point for designing the conceptual and logical data models in newly developed information systems.
- Information exchange between systems: the Core Vocabularies can become the basis of a context-specific data model used to exchange data among existing information systems.
- Data integration: the Core Vocabularies can be used to integrate data that comes from disparate data sources and create a data mesh-up.
- Open data publishing: the Core Vocabularies can be used as the foundation of a common export format for data in base registries like cadastres, business registers and public service portals.

The Core Public Service Vocabulary Application Profile allows harmonised ways and common data models to represent life events, business events and public services across borders and across-sectors to facilitate access.

ADMS is a standardised vocabulary which aims at helping publishers of semantic assets to document what their assets are about (their name, their status, theme, version, etc) and where they can be found on the Web. ADMS descriptions can then be published on different websites while the asset itself remains on the website of its publisher.

More info can be found in the following links:

https://joinup.ec.europa.eu/collection/semantic-interoperability-community-semic/core-vocabularies

https://ec.europa.eu/isa2/solutions/core-public-service-vocabulary-application-profile-cpsv-ap_en

https://joinup.ec.europa.eu/collection/semantic-interoperability-community-semic/adms

CEF

Under the framework of the Connecting Europe Facility programme support to the interoperability of metadata and data at national and EU level is being developed through dedicated calls for proposals. The CEF group is also promoting training and webinars for using the "context broker", in collaboration as appropriate with the NGSI-LD standards group ETSI ISG CIM.

AQUASMART

AquaSmart enables aquaculture companies to perform data mining at the local level and get actionable results. The project contributes to standardisation of open data in aquaculture. Results are exploited through the Aquaknowhow business portal. www.aquaknowhow.com

AUTOMAT

The main objective of the AutoMat project is to establish a novel and open ecosystem in the form of a cross-border Vehicle Big Data Marketplace that leverages currently unused information gathered from a large amount of vehicles from various brands.This project has contributed to standardisation of brand-independent vehicle data. www.automat-project.eu

BODYPASS

BodyPass aims to break barriers between **health sector** and **consumer goods** sector and eliminate the current data silos.

The main objective of BodyPass is to **foster exchange**, linking and re-use, as well as to integrate **3D data assets** from the two sectors. For this, BodyPass adapts and **creates tools** that allow a secure exchange of information between data owners, companies and subjects (patients and customers). The project aims at standardizing 3D data www.bodypass.eu

EU COMMISSION

A smart open data project by DG ENV led directly to the establishment of the Spatial Data on the Web Working group, a collaboration between W3C and the OGC.

G8 OPEN DATA CHARTER

In 2013, the EU endorsed the G8 Open Data Charter and, with other G8 members, committed to implementing a number of open data activities in the G8 members' collective action plan (publication of core and high-quality datasets held at EU level, publication of data on the EU open data portal and the sharing of experiences of open data work).

FUTURE INTERNET PUBLIC PRIVATE PARTNERSHIP PROGRAMME

Specifications developed under the Future Internet public-private-partnership programme (FP7):

FIWARE NGSI extends the OMA Specworks NGSI API for context information management that provides a lightweight and simple means to gather, publish, query and subscribe to context information. FIWARE NGSI can be used for real-time open data management. ETSI's ISG for cross-cutting Context Information Management (CIM) has developed the NGSI-LD API (GS CIM 004 and GS CIM 009) which builds upon the work done by OMA Specworks and FIWARE. The latest FIWARE software implements the newest ETSI NGSI-LD specification.

FIWARE CKAN: Open Data publication Generic Enabler. FIWARE CKAN is an open source solution for the WG10 publication, management and consumption of open data, usually, but not only, through static datasets. FIWARE CKAN allows its users to catalogue, upload and manage open datasets and data sources. It supports searching, browsing, visualising and accessing open data

BIG DATA VALUE CPPP TF6 SG6 ON BIG DATA STANDARDISATION

In the big data value contractual public-private-partnership, a dedicated subgroup (SG6) of Task Force 6: Technical deals with big data standardisation.

3.1.4. INTERNET OF THINGS

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The Internet of Things (IoT) is a key priority area of the digital single market. The IoT is a cross domain technology that connects more objects to the internet — including industrial processing machines and the items industrially processed (cyber-physical systems), household equipment, wearable electronics, vehicles, and sensors. The number of connected devices are exceeding 20 billions and forecast steadily to grow to 50 billion of devices in use around the world by 2030, creating a massive web of interconnected devices spanning, is expected to generate 79.4 zettabytes (ZB) of data. Besides the innovation potential in many industrial sectors, the IoT also has the potential to help address many societal challenges including climate change, resource and energy efficiency and ageing.

A large number of proprietary or semi-closed solutions to address specific problems have emerged, leading to non-interoperable concepts, based on different architectures and protocols. Consequently, the deployment of truly IoT applications, i.e. where information of connectable "things" can be flexibly aggregated and scaled, has been limited to a set of "intranets of things — or goods".

In the emerging IoT economy, voluntary global standards can accelerate adoption, drive competition, and enable cost -effective introduction of new technologies. Standardisation facilitates the interoperability, compatibility, reliability, security and efficiency of operations on a global scale among different technical solutions, stimulating industry innovation and providing greater clarity to technology evolution. Interoperability between IoT networks operated by different companies along the value chain opens up opportunities to address EU policy objectivSDOs to continue ongoing work for existing standards (e.g. ISO 13584-1 or IEC 61360/ Common Data Dictionary) on semantics. Concepts for digital twins require additional property types for operational use compared to the purely descriptive properties of an asset. These are states and parameters of the assets as well as their measured and actor values (dynamic data). Commands and entire functions (often called technical functions) must also be described using the same concepts. The concept of properties in today's standards is to extend such semantics in the data models to be able to represent dynamic values correctly. Models for functions/commands are to be developed or existing ones defined in standards.es, e.g. greater resource efficiency for a more circular economy, sustainable and responsible supply chains through transparency and traceability, and others.

Industry is in the best position to develop the technological standards and solutions to address global IoT ecosystem opportunities and challenges. There is a need for a secure solution that is interoperable and scales across a global IoT ecosystem. In this context, the European large-scale pilots (LSP), which were the subject of a call for proposals in 2016, are supporting the deployment of IoT solutions, by enhancing and testing their acceptability and adoption by users and the public, and by fostering new market opportunities for suppliers to the EU.

Large-scale pilots are providing the opportunity to demonstrate actual IoT solutions in real-life settings and should make it possible for providers to test business opportunities. The concept has now been broadened and further extended to more vertical sectors in the context of the 'Digitising and transforming European industry and services' focus area for cross-programme integrated activities around major challenges. The final Horizon 2020 calls for proposals resulted in the launch of more large scale projects and pilots to notably address the digital transformation of manufacturing, health and care, rural area, agriculture, and smart energy, paving the way toward the integration of European data spaces and associated platforms.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The proposed actions on IoT in previous rolling plans followed the direction as outlined in the EU communication on ICT standardisation priorities which identified Internet of Things as a key priority for Europe.

One of the major achievements over the last years has been the gradual building of cooperation amongst all actors involved in IoT standardisation, the organisation of high level events on strategic IoT standardisation issues and initiatives have been proven to be successful instruments and are now common practice in several sectors.

ETSI TC Smart M2M has developed a mapping of standards for IoT and gap analysis taking into account the most promising business models and use-cases, published in ETSI TS 103 375 and TS 103 376,

IoT standards are notably supporting the emergence of business models unleashing the commercial capabilities of systems and devices integrations. Beyond identifying standards, it is also important to identify reference models of implementation that businesses can share. This approach which was initially followed in the Future Internet PPP (FI-PPP), has now been adopted in other industrial organisations, such as the Alliance for Internet of Things Innovation (AIOTI), and PPPs such as, the Big Data Value Association (BDVA) and Open & Agile Smart Cities (OASC), which are now cooperating on common standardisation subjects. AIOTI is also maintaining the High Level Architecture reference model by incorporating new results from priority topics (e.g. semantic interoperability, security, privacy, ...)

There is need to correctly position IoT standardisation in relation to existing global initiatives such as ISO/IEC JTC 1/SC 41 '*Internet of Things and Digital Twin*', oneM2M, and the ITU Study Group 20. Agreement to cooperate on common topics and take up of European results in global action are very encouraging results.

Semantic interoperability, security, privacy, and 5G/IoT interactions are emerging as priority topics.

With the broadening of the vertical foot-prints of IoT the main challenge is to work in cooperation across partnerships (PPPs and other alliances), and to ensure dissemination and adoption of best practices across domains, by continuing and deepening the cooperation towards common objectives to ensure all standardisation efforts converge. As a concrete first step, a joint working group between the DEI stakeholder governance and MSP has been created to work on coordination of platform building and piloting activities and synchronisation and acceleration of standardisation efforts.

(A.3) REFERENCES

- COM(2020) 66**:** A European strategy for data
- **COM(216) 176:** ICT standardisation priorities for the digital single market
- **COM(2016) 180**: Digitising European industry reaping the full benefits of a digital single market
- **SWD(2016) 110/2**: Advancing the internet of things in Europe
- **COM(2009)278**: "Internet of Things — An action plan for Europe": Standardisation will play an important role in the uptake of IoT, by lowering entry barriers to newcomers and operating costs for users, by being a prerequisite for interoperability and economies of scale and by allowing industry to better compete at international level. IoT standardisation should aim at rationalising some existing standards or developing new ones where needed.
- **BEREC BoR (16)39** , Report on enabling the Internet of Things

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN

CEN/TC 224 'Personal identification and related personal devices' addresses IoT privacy-related standardisation solutions (e.g. EN 419212-4:2018 on 'Application *Interface for Secure Elements for Electronic Identification, Authentication and Trusted Service*').

https://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:6205&cs=1FB1CC5B5F03F85F0ECCECA7598551CFC

CEN/TC 225 '*Automatic Identification and Data Capture (AIDC) technologies*' works in the field of automatic identification and data capture techniques such as 1D and 2D optical data carriers, RFID and RTLS. The Technical Committee develops application-oriented European standards with the aim to promote the use of open and interoperable ways to identify objects, locations and industrial items. These identifiers and data carriers centred standards will serve as a corner stone for the development of interoperable solutions for data sharing in the context of the IoT.

https://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:6206&cs=1E12277AECC001196A7556B8DBCDF0A1C

Within CEN and CENELEC, vertical sectors further address sector-specific IoT solutions, for example: CEN/TC 251 '*Health Informatics*', CEN/TC 278 '*Intelligent Transport Systems*', CEN/TC 294 '*Communication systems for meters*', CEN/TC 442 '*Building Information Modelling (BIM)*'

CENELEC

CLC/TC 57 *'Power systems management and associated information exchange'* has notably developed European Standards for data models in power systems (EN IEC 61850-x), Application Program interfaces (EN IEC 61970-x) and Data and Communication security (EN IEC 62351-x).

CLC/TC 205 *'Home and Building Electronic Systems (HBES)'* has started, in 2018, to develop a European Standard on IoT Semantic Ontology Model Description (prEN 50090-6-2), which will explain the HBES IoT Model structures, semantically expressing the current HBES Open System solutions, with the goal of improving the semantic information HBES IoT gateways or HBES IoT devices provide.

ECMA

ECMA Technical Committee TC53 is standardising software APIs for embedded systems defining standard APIs for areas that include input/output, sensors, networking, communication, energy management, and displays. These APIs are organized into ECMAScript modules, rather than an operating system. ECMA-419 defines such APIs that support programs executing on embedded systems. See https://www.ecma-international.org/technical-committees/tc53/.

ETSI

TC smartM2M: ETSI, with the support of the Commission, has developed the SAREF standard ETSI TS 103 264, a reference ontology for smart appliances, which is a first ontology standard in the IoT ecosystem and sets a template and a base for development of similar standards for other industries, to unlock the full potential of IoT. SAREF is mapped onto the oneM2M Base Ontology. The SAREF model is being extended to add semantic models for data associated with smart cities, industry and manufacturing, smart agriculture and the food chain, water, automotive, eHealth/aging well and wearables. SAREF allows appliances, of any type, make or manufacturer, to exchange energy related information, with any energy management system (at home or in the cloud) for energy management and keeping the user informed.

ISG CIM (cross-cutting Context Information Management): is developing Group Specifications (GSs) for applications to publish, discover, update and access context information, initially for a broad range of smart city applications and later for other areas. A particular focus is enabling exchange of linked data and context information, using a simple API, NGSI-LD (ETSI GS CIM 009 V1.2.1) based on JSON-LD, and a high-level data model (ETSI GS CIM 006 V1.1.1) referencing existing (or new) taxonomies and ontologies.

TC DECT (Digital Enhanced Cordless Telecommunications DECT): has developed Ultra-Low Energy (ULE) (ETSI TS 102 939-1 and TS 102 939-2), a low-power wireless technology providing optimal radio coverage in indoor scenarios for data services suitable for many home automation applications. DECT ULE reuses the DECT physical layer, spectrum and channel structure, but with significant differences in the Medium Access Control (MAC) layer, security algorithms and channel selection. Target applications include home automation and energy control, remote switches, the control of smart appliances, smart metering and temperature controls, security, alarms and eHealth.

ETSI TC DECT has published the first release of the new DECT-2020 NR (New Radio) technology (ETSI TS 103 636 parts 1 to 4). The work on additional parts for the set of standards are ongoing with planned publication by end of 2021. The standardisation effort will continue in next years with further releases, additional functionality and Application Specific profiles addressing the needs of multiple vertical industries. DECT-2020 NR is a new radio interface supporting Ultra Reliable Low Latency Communications (URLLC) and massive Machine Type Communications (mMTC) as specified for IMT-2020 usage scenarios. The standards support multiple operating bands and radio channel bandwidths. The new DECT-2020 air interface can co-exist with the existing DECT system. The production of test specifications has also started with the work on the basic Harmonised Standard (HEN) for access to radio spectrum. DECT-2020 has been submitted to ITU-R as an IMT-2020 candidate technology. Several vertical applications have been considered for DECT-2020 NR, including home automation, industry automation and smart metering.

https://www.etsi.org/technologies/dect

MSG TFES has developed Harmonized Standards for LTE-M and NB-IoT equipment (Base Stations and devices) to facilitate and accelerate Machine Type Communication deployments in E-UTRA and NR bands.

TC CYBER: ETSI Sandard EN 303 645 for «Cyber Security for Consumer Internet of Things» can be used in a certification scheme to be developed under the Cybersecurity Act, and has already led to the development of an accompanying test specification (TS 103 701 published in August 2021) and implementation guide as well as cyber security requirements for residential Smart Door Locking Devices within TC CYBER (see Consumer IoT security roadmap).

ETSI SC USER: has developed a set of documents "User-Centric approach in digital ecosystem", focusing of the roles, expectations and potential solutions for users.

ETSI has a number of other activities related to radio systems for the IoT. These activities include Smart Body Area Networks developed in **TC SmartBAN,** and standards for ultra-narrowband radio technology in the **TC ERM LTN (Low Throughput Networking)** working group. These are used in existing commercial LPWAN networks.

(B.) REQUESTED ACTIONS

The Communication on ICT standardisation priorities for the digital single market proposes priority actions in the domain of internet of things. Actions mentioned below reflect some of them.

ACTION 1 SDOs to complement ongoing gap analysis by analysis of gaps in wireless technologies required by IoT, including URLL (Ultra Reliable Low Latency) technologies required by Industry Automation.

ACTION 2 SDOs to continue ongoing work in the area of semantic standards for better data interoperability. Special focus should be put on further extending the SAREF ontology both in number of extensions and the content of each extension. The results of European projects (such as the large scale IoT pilots and similar) could be used to achieve this. SDOs should also continue ongoing work for existing standards (e.g. ISO 13584-1 or IEC 61360/ Common Data Dictionary) on semantics. Concepts for digital twins require additional property types for operational use compared to the purely descriptive properties of an asset. These are states and parameters of the assets as well as their measured and actor values (dynamic data). Commands and entire functions (often called technical functions) must also be described using the same concepts. The concept of properties in today's standards is to extend such semantics in the data models to be able to represent dynamic values correctly. Models for functions/commands are to be developed or existing ones defined in standards.

ACTION 3 SDOs to provide standards that can be used for compliance for IoT products, systems, applications and processes.

ACTION 4 Develop a European standard for cyber security compliance of products that is aligned with the current compliance framework of organisations based on the ISO 27000 *Information Security Management* Standards series and the GDPR regulation. Preferably the standard could be used to harmonise the requirements set out in the NIS directive.

ACTION 5 Promote the development and foster the adoption of the international Reference Architecture for IoT developed in ISO/IEC JTC 1/SC 41 as well as the OneM2M architecture.

ACTION 6 SDOs to assess further gaps and develop standards on the safety and cybersecurity of IoT consumer products under the European Cybersecurity Act or sectorial legislation.

ACTION 7 SDOs should consider further inclusion of and outreach to verticals.

ACTION 8 SDOs should get involved in the definition of the technical common ground of the Common European Data Spaces to be developed and deployed under the Digital Europe and Horizon Europe programmes and leverage the IoT interoperability standardisation assets for that purpose.

ACTION 9 SDOs should look in the standardisation needs of the new edge paradigm and investigate the impact on it of the specific use cases of the verticals (such as energy, mobility, agriculture and other)

IEC

IEC SyC Smart Energy has a Joint Working Group, JWG 3, with ISO/IEC JTC 1/SC 42

IEC has the following projects underway on IoT:

Due for publication in 2024, the International Standard, IEC/IEEE 60802 'Time-sensitive networking profile for industrial automation', is a joint project between standards committees IEC/TC 65/SC 65C 'Industrial Networks' and IEEE 802 'LAN/MAN Standards Committee'. It will allow IoT wide connectivity without disturbing the Industrial Automation critical control traffic.

Due for publication in 2023, the International Standard, IEC 62872-2..., the International Standard, IEC 62872-2 "Internet of Things (IoT) – Application framework for industrial facility demand response energy management' is a project in IEC/TC 65/JWG 17, a joint working group between IEC/TC 65 and ISO/IEC JTC 1/SC 41, that promotes the development and fosters the adoption of the international Reference Architecture for IoT developed in ISO/IEC JTC 1/SC 41 (see also clause B. Action 5).

IEEE

IEEE has a number of existing standards (current and under development), activities, and events that are directly related to creating the environment needed for a vibrant IoT, recognising the value of the IoT to industry and the benefits this technology innovation brings to the public. Some key standards activities are:

- Architectural framework:
- The focus of IEEE 2413-2019 provides an architectural framework for the IoT, which includes descriptions of various IoT domains, definitions of IoT domain abstractions, and identification of commonalities between different IoT domains. It promotes cross-domain interaction, aids system interoperability and functional compatibility.
- The focus of IEEE P1931.1, the standard for an architectural framework for Real-time Onsite Operations Facilitation (ROOF) is to define how an end user is able to securely provision, commission and decommission devices.
- Harmonization and security of IoT: The IEEE 1451-99 is focused on developing a standard for harmonization of IoT devices and systems. This standard defines a method for data sharing, interoperability, and security of messages over a network, where sensors, actuators and other devices can interoperate, regardless of underlying communication technology.

Sensor Performance and Quality: Sensors are fundamental to IoT

ecosystem with large volume of different sensors integrated into a complex framework. IEEE 2700 proposes a common framework for sensor performance specification terminology, units, conditions and limits is provided. IEEE P2510 defines quality measures, controls, parameters and definitions for sensor data related to IoT implementations.

Smart Manufacturing and Smart Factories: New standardisation efforts on IEEE P2879 - General Principles for Assessment of a Smart Factory, IEEE P2934 - Standard for Logistics Operation Process in a Smart Factory, IEEE P2806 - System Architecture of Digital Representation for Physical Objects in Factory Environments and IEEE P2806.1 - Standard for Connectivity Requirements of Digital Representation for Physical Objects in Factory Environments.

IEEE, through its LAN/MAN Standards Committee, has initiated a collaborative activity with the IEC SC65C committee on the IEC/IEEE 60802 TSN Profile for Industrial Automation, which will define time-sensitive networking profiles for industrial automation.

IEEE also has focused initiatives on sensor interfaces to cyber-physical systems through its IEEE 2888 family of standards, including the specification of sensor interface for cyber and physical world, standard for actuator interface, orchestration of digital synchronization between cyber and physical world, and architecture for virtual reality disaster response training system with six degrees of freedom (6 DoF).

For a list of these and other IEEE standardisation activities on IoT, please see: https://ieeesa.io/rp-iot.

IETF

The IETF has a number of Working Groups chartered to develop standards to support the Internet of Things.

The IPv6 Over Low Power WPAN (6LOWPAN) Working Group developed standards to ensure interoperability between smart object networks and defining the necessary security and management protocols and constructs for building such networks.

The IPv6 over Networks of Resource-constrained Nodes (6LO) Working Group develops IPv6 adaptation mechanisms to a wider range of radio technologies including "Bluetooth Low Energy" (RFC 7668), ITU-T G.9959 (as used in Z-Wave, RFC 7428), and the Digital Enhanced Cordless Telecommunications (DECT) Ultra Low Energy (ULE) cordless phone standard and the low-cost wired networking technology Master-Slave / Token-Passing (MS/TP) that is widely used over RS-485 in building automation.

The IPv6 Over Low Power Wide-Area Networks (lpwan) WG focuses on enabling IPv6 connectivity over the following selection of Low-Power Wide-Area networking technologies: SIGFOX, LoRa?, WI-SUN and NB-IOT.

The Light-Weight Implementation Guidance (LWIG) Working Group focuses on helping the implementors of the smallest devices. The goal is to be able to build minimal yet interoperable IP-capable devices for the most constrained environments.

The Routing over Low Power and Lossy Networks (ROLL) Working Group is developing standards to support the routing of communications within low-power and lossy networks.

The Constrained RESTful Environments (CORE) Working Group specifies protocols that allow applications running in resource-constrained environments to interoperate with each other and the rest of the Internet. CORE is one of the most active IoT groups. Its main output centres around the "Constrained Application Protocol" (CoAP, RFC 7252), a radically simplified UDP-based analog to HTTP. Extensions to CoAP enable group communications (RFC 7390) and low-complexity server-push for the observation of resources (RFC 7641). This is complemented by a discovery and self-description mechanism based on a weblink format suitable for constrained devices (RFC 6690). Current WG activities focus on extensions that enable transfer of large resources, use of resource directories for coordinating discovery, reusable interface descriptions, and the transport of CoAP over TCP and TLS. CoRE is also looking at a data format to represent sensor measurements, which will benefit from the "Concise Binary Object Representation" (CBOR) (RFC 7049), a JSON analog optimised for binary data and low-resource implementations.

Security aspects of the IoT are being addressed in the following Working Groups:

The Trusted Execution Environment Provisioning (TEEP) WG is working on standardising protocols for provisioning applications into secure areas of computer processors.

The Software Updates for Internet of Things (SUIT) WG is working on mechanisms for securely updating the firmware in IoT devices.

The Authentication and Authorisation for Constrained Environments (ACE) WG is working on a standardised solution for authentication and authorisation to enable authorised access to resources on a device in constrained environments. In such environments, typical for the IoT, the network nodes are limited in CPU, memory and power. This work was supported by the COSE WG that built simplified CBOR analogs for the JSON object signing and encryption methods that were developed in the JOSE WG.

The DTLS In Constrained Environments (DICE) WG focused on supporting the use of DTLS Transport-Layer Security in these environments. Such constrained environments, including constrained devices (e.g. memory, algorithm choices) and constrained networks (e.g. PDU sizes, packet loss), are typical for the IoT, Smart grids, etc.

The Lightweight Authenticated Key Exchange (LAKE) WG is developing a 'lightweight' authenticated key exchange (LAKE) that enables forward security. 'Lightweight' refers to:

- resource consumption, measured by number of round-trips to complete, bytes on the wire, wall-clock time to complete, or power consumption
- the amount of new code required on end systems which already have an OSCORE stack

but the LAKE must still provide the security properties expected of IETF protocols, e.g., providing confidentiality protection, integrity protection, and authentication with strong work factor.

The A Semantic Definition Format for Data and Interaction of Things (asdf) Working Group is developing Semantic Definition Format (SDF) into a standards-track specification for thing interaction and data modelling. In the process of developing this specification, further functional requirements that emerge in the usage of SDF for model harmonization will be addressed.

The IOT Operations (iotops) Working Group is discussing and documenting operational issues related to IoT devices, in particular related to device onboarding and lifecycle management. This group is also tackling issues related to IoT operational security.

While the IoT-oriented IETF working groups have already produced the first wave of mature standards for IoT, new research questions are emerging based on the use of those standards. The IRTF Thing-to-Thing Research Group (T2TRG) was chartered in 2015 to investigate open research issues in IoT, focusing on issues that exhibit standardisation potential at the IETF.

https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#IOT

ISO/IEC JTC 1

ISO/IEC JTC 1/SC 41 *'Internet of Things and Digital Twin'*, has published 34 International Standards specific to IoT and continues to develop more. ISO/IEC JTC 1/SC 41 has developed ISO/IEC 30141 (IoT reference architecture) and ISO/IEC 20924 (IoT vocabulary), and ongoing work includes the following:

- IoT trustworthiness framework (ISO/IEC 30149)
- Methodology for trustworthiness of IoT system/device (ISO/IEC 30147)
- Data exchange platform requirements for IoT services (ISO/IEC 30161)
- Compatibility requirements and model for devices within industrial IOT systems (ISO/IEC 30162)
- Diverse use-cases covered by IoT
- Monitoring the ongoing regulatory, market, business and technology IoT requirements
- Development of IoT standards that build on the foundational standards in relevant ISO/IEC JTC 1 Sub-Committees

The list of ISO/IEC JTC 1/SC 41 projects can be found here:

https://www.iec.ch/dyn/www/f?p=103:23:3095716894820::::FSP_ORG_ID,FSP_LANG_ID:20486,25 and ISO - ISO/IEC JTC 1/SC 41 - Internet of things and digital twin

ISO/IEC JTC 1/SC27 *'Information security, cybersecurity and privacy protection'*, deals with a broad set of standards in the areas of security and data protection ("privacy"). Many of the existing standards can be applied to IoT systems, such as the ISO/IEC 27001 standard on information security management. Three standards are currently being developed, that are specifically related to IoT Cybersecurity (ISO/IEC 27400, ISO/IEC 27402 and ISO/IEC 27403)

ITU

ITU-R

A variety of radio technologies is used to implement the Internet of Things, extending from short range devices (SRDs) to wide area sensor networks (WASN) and global terrestrial IMT systems as well as satellite systems. The ITU-R Study Groups are developing technical and operational standards to facilitate the deployment of IoT on a global basis, including harmonized frequency spectrum and appropriate regulatory regimes.

Resolution ITU-R 66 invites ITU-R Study Groups to conduct studies on the technical and operational aspects of radio networks and systems and to develop ITU-R Recommendations, Reports and/or Handbooks, as appropriate.

In response to this Resolution, ITU-R Working Party 1A is the main responsible group to carry out studies on Power Line Telecommunication (PLT).

To satisfy the demand of Question ITU-R 221-2/1 that calls for studies of acceptable levels of radiation from telecommunication systems utilizing wired electrical power supply so as not to impair the performance of radiocommunication systems, Reports ITU-R SM.2158 and ITU-R SM.2212 on "Impact of PLT systems on radio systems operating below 80 MHz and in the VHF and UHF bands above 80 MHz" were approved. These Reports illustrate the potential for interference to various radiocommunication services in the presence of emissions/radiation from PLT systems and devices and discuss potential methods for mitigating the interference from PLT emissions.

Resolution ITU-R 54 calls for studies to achieve harmonization for short-range devices (SRDs).

ITU-R WP 1B is responsible for the studies relating to spectrum management methodologies and economic strategies. Among its current studies, WP 1B deals with the harmonization of SRDs.

Report ITU-R SM.2153 on "Technical and operating parameters and spectrum use for short-range radiocommunication devices" provides SRD definitions and short descriptions of different applications using SRDs, e.g.: Telecommand, Telemetry, Voice and video, Detecting avalanche victims, RLANs, Railway applications, among others. This Report also indicates the typical technical characteristics and limitations such as the common frequency ranges or the antenna requirements, and it explains administrative requirements like the mutual agreements between countries and/or regions and the licences requirements.

ITU-R WP 1B has carried out studies with the aim to globally and regionally harmonize the frequency bands used by SRDs. Recommendation ITU-R SM.1896 on "Frequency ranges for global or regional harmonization of short-range devices" and Recommendation ITU-R SM.2103 on "Global harmonization of short-range devices categories" are the reference documents on this matter.

ITU-R WP 5A cover studies on Wide-area Sensor and Actuator Network (WASN) Systems that support machine-to-machine (M2M) communications to a large number of sensors and/or actuators.

ITU-T

ITU-T SG20 "Internet of things (IoT) and smart cities & communities" is responsible for IoT-related studies including smart cities and communities (SC&C).

Definition of IoT can be found in Recommendation ITU-T Y.4000/Y.2060 "Overview of the IoT" http://itu.int/itu-t/Y.4000

Some of the approved standards by ITU-T SG20 include: "Framework of wireless power transmission application service" (Recommendation ITU-T Y.4202), "Requirements of things description in the Internet of Things" (Recommendation ITU-T Y.4203), "Accessibility requirements for the Internet of things applications and services" (Recommendation ITU-T Y.4204), "Service functionalities of self-quantification over Internet of things" (Recommendation ITU-T Y.4555), "Requirements and functional architecture of smart street light service" (Recommendation ITU-T Y.4458), "Requirements and reference model of IoT-related crowdsourced systems", (Recommendation ITU-T Y.4205) "Requirements and capabilities of user-centric work space service" (Recommendation ITU-T Y.4206), "Requirements and capability framework of Smart Environmental Monitoring " (Recommendation ITU-T Y.4207), "Architectural reference model of devices for IoT applications" (Recommendation ITU-T Y.4460), "IoT requirements for support of edge computing" (Recommendation ITU-T Y.4208), "Requirements and use cases for universal communication module of mobile IoT devices" (Recommendation ITU-T Y.4210), "OID-based resolution framework for transaction of distributed ledger assigned to IoT resources" (Recommendation ITU-T Y.4476), and "Framework of IoT based monitoring and management for Lift" (Recommendation ITU-T Y.4420), etc.

The complete list of Recommendations developed by ITU-T SG20 is available at: https://www.itu.int/ITU-T/recommendations/index_sg.aspx?sg=20.

The work items under study is available at: https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=20.

More info: http://itu.int/go/tsg20

ITU-T SG20 closely collaborates with oneM2M, LoRa Alliance and TM

Forum. ITU-T SG20 also closely collaborates with ISO and IEC in the framework of the Joint IEC-ISO-ITU Smart Cities Task Force (J-SCTF).

The joint coordination activity on IoT and smart cities and Communities (JCA-IoT and SC&C) continues its role of promoting international coordination among SDOs in this area of IoT standardisation. http://itu.int/en/ITU-T/jca/iot. JCA-IoT and SC&C maintains the global online IoT standards roadmap: http://itu.int/en/ITU-T/jca/iot/Documents/deliverables/Free-download-IoT-roadmap.doc. The IoT and SC&C Standards Roadmap is also available as Supplement ITU-T Y.Suppl.58 "Internet of Things and smart cities and communities standards roadmap".

ITU-T Focus Group on Data Processing and Management to support IoT and Smart Cities & Communities (FG-DPM) was established in 2017 and completed its activity in 2019. The FG provided a platform to develop deliverables, share views and showcase initiatives, projects, and standards activities linked to data processing and management and establishment of IoT ecosystem solutions for data focused cities.

The deliverables developed under the purview of FG-DPM) can be found here: https://itu.int/en/ITU-T/focusgroups/dpm. Some of the FG-DPM deliverables have been transposed as ITU-T Recommendations and Technical Reports.

ITU-T SG11 continues its role in developing testing specifications of IoT, its applications and identification systems. SG11 approved six Recommendations which specify testing requirements for IoT. Among them, there is a new Recommendation ITU-T Q.4068 "Open application program interfaces (APIs) for interoperable testbed federations" which describes a set of open APIs for interoperable testbed federation able to manage not only the interconnection and the interoperability of testbeds in a federation, but also to handle the resources advertisement, allocation and provision. It is designed for different domains including IoT and it contains a technical framework, which provides a common reference for developers to facilitate the implementation and promotion of interoperability of testbeds.

More info: https://www.itu.int/en/ITU-T/studygroups/2017-2020/11

ITU-T SG13 approved a new Recommendation ITU-T Y.2243 "A service model for risk mitigation service based on networks" (08/2019) dealing with risk mitigation service based on networks (monitors risk events, stores the data in real time and analyses the associated data, provides mitigation services for the identified risks).

More info: https://www.itu.int/en/ITU-T/studygroups/2017-2020/13

ITU-T SG17 approved Recommendations ITU-T X.1361 "Security framework for the Internet of things based on the gateway model", ITU-T X.1362 "Simple encryption procedure for Internet of things (IoT) environments", ITU-T X.1363 "Technical framework of personally identifiable information (PII) handling system in Internet of things (IoT) environment", ITU-T X.1364 "Security requirements and framework for narrow band Internet of things ", ITU-T X.1365 "Security methodology for use of identity-based cryptography in support of Internet of Things (IoT) services over telecommunication networks", ITU-T X.1366 "Aggregate message authentication scheme for IoT environment", ITU-T X.1367 "Standard format for Internet of things (IoT) error logs for security incident operations", ITU-T X.1368 "Secure firmware/software update for Internet of things devices", Supplement to ITU-T X.660 - Guidelines for using object identifiers for IoT and is approving ITU-T X.1369 "Security requirements and framework for IoT service platform" (X.ssp-iot)and working on "Security requirements for IoT devices and gateway " (X.iotsec-4), "Security risk analysis framework for IoT devices" (X.ra-iot), "Security controls for Internet of Things (IoT) systems" (X.sc-iot), and "Security methodology for IoT service platform" (X.ssp-iot) and "Security methodology for zero-touch massive IoT deployment"(X.ztd-iot).

More info: https://www.itu.int/en/ITU-T/studygroups/2017-2020/17

OASIS

The OASIS *Message Queuing Telemetry Transport* (MQTT) TC has produced a standard M2M/IoT connectivity protocol designed to support messaging transport from remote locations/devices involving small code footprints (e.g. 8-bit, 256KB ram controllers), low power, low bandwidth, high-cost connections, high latency, variable availability, and negotiated delivery guarantees. MQTT also has been approved as ISO/IEC 20922:2016. A variant MQTT-SN protocol is being developed for very constrained devices often operating within unstructured sensor networks.

The OASIS *Advanced Message Queuing Protocol* (AMQP) TC provides a ubiquitous, secure, and reliable internet protocol for high-speed transactional messaging. AMQP also has been approved as ISO/IEC 19464:2014. A major cloud platform uses AMQP to connect to its cloud IoT hub.

The OASIS *Open Building Information Exchange* (oBIX) TC enables mechanical and electrical control systems in buildings to communicate with enterprise applications, and provides a platform for developing new classes of applications that integrate control systems with other enterprise functions.

3GPP

3GPP, since Release 13, offers three new Low Power Wide Area Network (LPWAN) radio access technologies for long-range, power efficient, massive machine-type communications:

- Extended Coverage GSM Internet of Things (EC-GSM-IoT),
- LTE for Machine-Type Communications (LTE-M) and
- Narrowband Internet of Things (NB-IoT).

Each has been standardized to ensure that increasingly diverse device and application types are supported by 3GPP networks, around the world. An overview is available here: http://www.3gpp.org/news-events/3gpp-news/1805-iot_r14 and more details here: http://www.3gpp.org/news-events/3gpp-news/1906-c_iot

3GPP has been adding IoT-centric features, including capabilities to avoid network congestion, use networks more effectively, enhance security and, crucially, enable IoT devices to manage power resources efficiently, to its specification set in Release 13 and Release 14.

Massive IoT support is one of the key objectives of future 5G systems. This will be a focus of future work in 3GPP, given the already extensive IoT support in 4G.

ONEM2M

oneM2M partnership project, launched by several SDOs and industry representatives in 2012 as a global initiative to ensure the most efficient deployment of Machine-to-Machine (M2M) communications systems and the Internet of Things (IoT) The latest technical specifications can be found on Specifications (onem2m.org).

oneM2M opens up the IoT ecosystem by creating an abstraction layer that simplifies the exchange of cross-silo data. It offers a common IoT Service Layer which can be readily embedded within different hardware and software, connecting the numerous devices in the field with IoT application servers worldwide. To do this, oneM2M offers interworking with the most common technologies and protocols used in the IoT today. Additionally, oneM2M supports access control based

discovery and communication across deployments (addressing problem statement above that said we have "Intranet of Things").

oneM2M has published Release 2A in March 2018 and its Release 3 in September 2018. oneM2M Release 4 will be finalized in Q3 2021, work on Release 5 commenced and is ongoing.

oneM2M includes specifications covering requirements, architecture, protocols, security, and management, abstraction and semantics. Release 2 added new functionality, particularly by expanding management, abstraction and semantics, security, and interworking with underlying technologies. oneM2M Release 3 adds seamless interworking with 3GPP network services for IoT, while Release 4 adds, for instance, time management, process management, semantic reasoning, software campaigning, enhanced and new interworking, security enhancements, discovery based operations as well as semantic ontology mapping. Some of the new features under discussion for Release 5 include the topics of AI for Internet of Things (IoT) systems, tools for data licensing and, controls to guarantee adherence to privacy regulation such as GDPR and PIPA (Korea).

OIC

OIC works on defining the connectivity requirements for devices including the definition of the specification, certification and branding to deliver reliable interoperability; IP protection; and providing an open source implementation of the standard. https://openconnectivity.org/developer

UNECE

The United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) has developed a library of clearly defined semantic data elements called the Core Component Library in order to enable clear understanding of electronic information between source and receiver of the information. UNECE would encourage consideration of the UN/CEFACT Core Component Library in trade-related applications of Internet of Things. See: http://www.unece.org/cefact/codesfortrade/unccl/ccl_index.html

UN/CEFACT has also developed standards and clear guidance related to Smart Containers. This includes a White Paper to explain the potential use cases and a Business Requirement Specification in order to clearly define the processes and information relevant to each potential use case. See: White Paper (available also in French and Russian): http://www.unece.org/fileadmin/DAM/cefact/GuidanceMaterials/WhitePapers/WP-SmartContainers_Eng.pdf and BRS: http://www.unece.org/uncefact/mainstandards.html

Further work is continuing on Trade Facilitation applications of Internet of Things. See: https://uncefact.unece.org/display/uncefactpublic/Internet+of+Things+for+Trade+Facilitation

W3C

W3C continues to push for the use of Linked data to help manage data streams in IoT and Smart City scenarios. The latest developments were discussed at the Second W3C Workshop on the Web of Things.

Currently, there are two active Groups:

The Web of Things Interest Group brings together stakeholders interested in the Web of Things to explore ideas prior to standardisation together with collaboration with external groups, e.g. standards development organizations and industry alliances.

The Web of Things Working Group has recently advanced two specifications to Candidate Recommendation and aims to advance them to W3C Recommendations. The Web of Things (WoT) Architecture describes the abstract architecture for the W3C Web of Things. The architecture can be mapped onto a variety of concrete deployment scenarios, several example patterns of which are given, including the RAMI reference architecture. The Web of Things (WoT) Thing Description describes a formal model and a common representation for a Web of Things (WoT) Thing Description. A Thing Description describes the metadata and interfaces of Things, where a Thing is an abstraction of a physical or virtual entity that provides interactions to and participates in the Web of Things. Because it is Linked data, things can thus be combined with other semantics, e.g. the GDPR vocabulary from the Data Privacy Community Group.

OGC

The Open Geospatial Consortium (OGC) defines and maintains standards for location-based, spatio-temporal data and services. Some of the work is related to IoT, e.g. a modular suite of standards for web services allowing ingestion, extraction, fusion, and (with the web coverage processing service (WCPS) component standard) analytics of massive spatio-temporal data like satellite and climate archives.

ISO/TC 211 '*Geographic information*' and OGC have a strong relation and cooperation in the development of standards for the geospatial domain, and particularly geospatial data. ISO/TC 211 activities are mirrored at European level by CEN/TC 287 *'Geographic Information'*.

http://www.opengeospatial.org

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

AIOTI

The Alliance for Internet of Things Innovation (AIOTI) was initially created under the Commission's auspices in 2015. Its goals are to promote interoperability and convergence between standards, to facilitate policy debates and to prepare a Commission's initiative for large scale testing and experimentation, tabled for 2016. AIOTI has meanwhile been transformed and set up as a stand-alone organisation. Forging new alliances between IoT sectors, stakeholders, large companies, SMEs and start-ups help Europe get a global lead in this field and will foster a digital single market for IoT.

AIOTI Working group 3 focuses on standardisation.

The Commission published a EUR 51 million call (H2020 ICT-30). The initiative cuts across several technological areas (smart systems integration, cyber-physical systems, smart networks, big data), and targets SME and IoT innovators for to create an open IoT environment.

Among AIOTI's European largest technical and digital companies are:

- Alcatel, Bosch, Cisco, Hildebrand, IBM, Intel, Landis+Gyr, Nokia, ON Semiconductor , Orange , OSRAM, Philips, Samsung , Schneider Electric, Siemens, NXP Semiconductors, STMicroelectronics, Telecom Italia, Telefonica, Telit, Vodafone, Volvo, and start-ups (SIGFOX)…
- Representatives of different industries: nanoelectronics/ semiconductor companies, telecom companies, network operators, platform providers (IoT/Cloud), security, service providers, sectors: energy, utilities, automotive, mobility, lighting, buildings, manufacturing, healthcare, supply chains, cities etc.

https://ec.europa.eu/digital-agenda/en/news/launch-alliance-internet-things-innovation

EC

Several projects funded by the European Commission, integrated in the Internet of Things Research in Europe Cluster (IERC), deal with aspects of standardisation in IoT: CALIPSO, GAMBAS, IOT.EST, OPENIOT, UIOT6, SPRINT and PROBE-IT. In particular:

- OPENIOT deals with standardisation of open source solution for creating utility/cloud-based environments of internet-connected objects,
- SPRINT has an active contribution to W3C (web services), OMG (e.g. on exchange formats, APIs) and OASIS (data exchange formats),

PROBE-IT validates standards or pre-standards at European and international level and performs pre-standardisation research work on standardisation requirements.

The Future Internet PPP (FI-PPP) also deals with some issues connected to standardisation for the IoT.

IVA

IVA is a subproject of ´ICT for Sweden´, with the objective of supporting the entire value chain, from business benefits to sensors.

http://www.iva.se/IVA-seminarier/Internet-of-Things-IoT---fran-affarsnytta-till-sensorer/

UK

The KTN (Knowledge Transfer Network) has an IoT interest group

https://connect.innovateuk.org/web/internet-of-things

FINLAND

An IoT cluster supports investment in IoT

http://www.investinfinland.fi/industries/rd-and-innovation/internet-of-things-in-finland/124

LORA ALLIANCE

Specifications intended for wireless battery-operated things in regional, national or global networks. LoRaWAN targets key requirements of the IoT such as secure bi-directional communication, mobility and localisation services

IIC

Works on promoting the uptake of technologies around the industrial internet including:

- building confidence around new and innovative approaches to security;
- developing use-cases and test beds;
- influencing global standards development; and facilitating open forums to share and exchange best practices.

DENMARK

The Nordic IoT center is supported by the Danish Agency for Science and Higher Education, enabling partnerships in the Nordic region, completing the value chain for IoT products and services and documenting compliance to international standards http://www.nordiciotcentre.com/

(C.3) ADDITIONAL INFORMATION

There are a number of global activities ongoing in the area of IoT standardisation. In particular there are: the oneM2M partnership project, to which ETSI contributes and of which ITU-T SG20 transposed the oneM2M specifications; relevant standardisation activities in IEC; a focus group in ISO/IEC JTC 1; the standards project on MQTT in OASIS; the IoT reference architecture; and the IoT Interoperability standards at ISO/IEC JTC 1/SC 41.

The IoT requirements of e.g. from retail manufacturing, the automotive, aeronautics, pharmaceutical, and medical equipment industries and the medical sector in general should be taken fully into consideration. Security, privacy, and management of control of the access to and ownership of data are essential for the development of IoT. Without acceptance by commercial users and consumers, the role of IoT would be limited to specific vertical markets. Wide acceptance is essential in commoditising IoT mechanisms and make them accessible e.g. to manufacturing and for manufactured products, or into m/e/Health applications.

IoT requires the interlinking of often disparate standards. These standards are often the product of different SDOs. There is a need to bring these bodies and their standards together to achieve the often small changes needed to allow products and services to interoperate.

Existing standards should be checked to take account of the protection of individuals with regard to personal data processing and the free movement of such data in the light of the proposal for a General Data Protection Regulation. Specific privacy by design standards should be identified and where necessary developed.

3.1.5 ELECTRONIC IDENTIFICATION AND TRUST SERVICES INCLUDING E-SIGNATURES

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

This relates to Regulation (EU) No 910/2014 of the European Parliament and of the Council of 23 July 2014 on electronic identification and trust services for electronic transactions in the internal market and repealing Directive 1999/93/EC.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The eIDAS Regulation adopted on 23 July 2014 addresses in one comprehensive piece of legislation, electronic identification, electronic signatures, electronic seals, electronic time stamping, electronic registered delivery services, electronic documents and certificate services for website authentication as core instruments for electronic transactions. On 3rd of June 2021 the Commission adopted a proposal to amend the eIDAS Regulation, It proposes a Digital identity framework with European Digital Identity Wallets offering secure and easy access to different services, both public and private. The wallet is required to support privacy by design allowing users full control over personal data including identity attributes that may be revealed through the wallet. Also, the wallet is to be certified to a high level of security. In addition, it creates a new qualified trust service for attestation of attributes concerning information related to identity, such as addresses, age, gender, civil status, family composition, nationality, educational and professional qualifications and titles, licenses, other permits and payment data, that can be offered, shared and exchanged across borders, in full security, data protection and with legal effect across borders. In addition, the proposed European Digital Identity Framework introduces also additional trust services for management of a remote electronic qualified signature creation device, electronic archiving and electronic ledgers.

The Commission will work with Member States and the private sector to establish technical and operational specifications, and reference standards for the requirements of the proposed European Digital Identity framework. The requirements include issuance and exchange of selected attestation of attributes, the functionality and security of the European Digital Identity Wallets, the assurance of the European Digital Identity framework including certification of the wallet, identity proofing and governance. Standardisation Bodies will be consulted and existing international and European standards and technical specifications should be re-used where appropriate.

For the European Digital Identity Framework and also to support the remainder of the eIDAS regulation, further standardisation work will be needed, because the planned secondary legislation may refer to the availability of standards as possible means to meet the regulatory requirements. Existing standards that meet the requirements of the proposed framework should therefore be identified and new standards and guidelines are likely to have to be drafted to facilitate the implementation of the proposed new trust services of electronic archiving, attestation of attributes, the management of remote electronic signature and seal creation devices, and electronic ledgers.

(A.3) REFERENCES

- **Regulation (EU) No. 910/2014** of the European Parliament and of the Council of 23 July 2014 on electronic identification and trust services for electronic transactions in the internal market and repealing Directive 1999/93/EC
- **Commission Implementing Regulation (EU) 2015/1501** of 8 September 2015 on the interoperability framework
- Commission Implementing Regulation (EU) 2015/1502 of 8 September 2015 on setting out minimum technical specifications and procedures for assurance levels for electronic identification means
- Commission Implementing Decision (EU) 2015/1984 of 3 November 2015 defining the circumstances, formats and procedures of notification
- **Commission Implementing Regulation (EU) 2015/806** of May 2015 laying down specifications relating to the form of EU trust mark for qualified trust Services
- **Commission Implementing Decision (EU) 2015/1506** of 8 September 2015 laying down specifications relating to formats of advanced electronic signatures and advanced seals to be recognised by public sector bodies
- **Commission Implementing Decision (EU)**

2015/1505 of 8 September 2015 laying down technical specifications and formats relating to trusted lists

- Commission Implementing Decision (EU) 2016/650 of 25 April 2016 laying down Standards for the security assessment of qualified signature on seal creation devices
- **CommissionRecommendationC(2021)2021/3968** of 3rd June 2021 on a common Union Toolbox for a coordinated approach towards a European Digital Identity Framework
- Commission proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) No 910/2014 regarding establishing a framework for a European Digital Identity COM/2021/281 final

(B.) REQUESTED ACTIONS

ACTION 1 Take ongoing EU policy activities into account in standardisation, e.g. in ISO/IEC JTC 1/SC 27/WG 5 (identity management and privacy technologies) and other working groups of ISO/IEC JTC 1/SC 27. Furthermore, in order to promote the strengths of the European approach to electronic identification and trust services at global level and to foster mutual recognition of electronic identification and trust services with non-EU countries, European and international standards should be aligned wherever possible. The promotion and maintenance of related European approaches, which especially take into account data protection considerations, in international standards should be supported.

ACTION 2 As required by the framework established under the proposed regulatory framework for European Digital Identities prepare standards for

- interfaces between the European Digital Identity Wallet and trust services as well as services for signing by means of electronic signatures and seals
- interfaces between the European Digital Identity Wallet and relying parties
- security evaluation and certification of the European Digital Identity Wallet
- Protocol and security standards for new trust services including electronic attestation of attributes , electronic archiving and electronic ledgers.
- Supporting additional requirements for identity proofing and validation of attributes.
- Adapting existing standards to take into account new provisions of eIDAS 2.0 including alignment with NIS2 and ensuring that the requirements of privacy by design are met.

ACTION 3 SDOs to cooperate and work in the areas of identifiers, vocabularies, semantics, taxonomies, ontologies for electronic attestations

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN AND CENELEC

CEN/TC 224 *'Personal identification and related personal devices with secure element, systems, operations and privacy in a multi sectorial environment'* develops standards for strengthening the interoperability and security of personal identification and its related personal devices, systems, operations and privacy. CEN/TC 224 addresses sectors such as Government/Citizen, Transport, Banking, e-Health, as well as Consumers and providers from the supply side such as card manufacturers, security technology, conformity assessment body and software manufacturers.

https://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:6205&cs=1FB1CC5B5F03F85F0ECCECA7598551CFC

CEN-CLC/JTC 19 *'Blockchain and Distributed Ledger Technologies'* focuses on European requirements for Distributed Ledger Technologies and proceeds with the identification and possible adoption of standards already available or under development in other SDOs (especially ISO TC 307), which could support the EU Digital Single Market and/or EC Directives/Regulations. In the context of the revision of the rules on electronic identification and trust services for electronic transactions in the internal market (eIDAS Regulation), CEN/CLC/JTC 19/WG 1 was established to address the development of standards in support of decentralized identity management.

https://standards.cen.eu/dyn/www/f?p=204:22:0::::FSP_ORG_ID,FSP_LANG_ID:2702172,25&cs=1C5DF4D2E1D80EA24F5896718E20EA6F3

ETSI

Under the standardisation mandate M/460 on e-signatures, ETSI TC ESI provided an initial set of upgraded and new standards within a rationalized framework. ETSI TC ESI provides standards for introducing the overall framework of standards, for trust service providers supporting digital signatures but also preservation services, edelivery services, for (remote) signature creation and validation, for cryptographic suites and for trust service status lists providers.

A summary of ETSI TC ESI publications and ongoing work can be found at https://portal.etsi.org/TBSiteMap/ESI/ESIActivities.aspx

ETSI has published the document SR 019 003 "Possible Standards for eIDAS 2.0" that identifies the potential impact on the framework of standards already published in relation to the proposal to amend the eIDAS Regulation and establish a framework for a European Digital Identity. The document is available at: https://docbox.etsi.org/esi/open/latest_drafts/ESI-0019003v002%20Public%20review%20draft_SR_019_003_Possible_Standards_for_eIDAS_2_0.pdf

ISO

The ISO Technical Committee, **ISO/TC 154** *Processes, data elements and documents in commerce, industry and administration*, addresses standardisation and registration of business, and administration processes and supporting data used for information interchange between and within individual organizations and supports standardisation activities in the area of industrial data. https://www.iso.org/committee/53186.html

Ongoing work:

- Requirements and roles & responsibilities for fulfilling trusted e-communications in commerce, industry and administration
- Qualified trust services for long-term signature of kinds of electronic documents
- Validation of long-term signature
- Trusted (or qualified) electronic registered delivery services (or platform)
- Dematerialisation and proof of dematerialisation
- Requirements for providing trusted e-communications in the mobile environment
- Requirements for providing trusted e-communications in the cloud environment

Projects include the ISO 14533 series of standards for *Processes, data elements and documents in commerce, industry and administration -- Long term signature profiles.*

The ISO Technical Committee **ISO/TC 321** *Transaction Assurance in e-Commerce*, addresses standardisation in the field of "transaction assurance in e- commerce related upstream/downstream processes", including the following:

- Assurance of transaction process in e-commerce (including easier access to e-platforms and estores);
- Protection of online consumer rights including both prevention of online disputes and resolution process;
- Interoperability and admissibility of inspection result data on commodity quality in cross-border e-commerce;
- Assurance of e-commerce delivery to the final consumer.
- https://www.iso.org/committee/7145156.html

ISO/IEC JTC 1/SC 37, *Biometrics*, is responsible for the standardisation of generic biometric technologies pertaining to human beings to support interoperability and data interchange among applications and systems. Generic human biometric standards include: common file frameworks, biometric application programming interfaces, biometric data interchange formats, related biometric profiles and other standards in support of technical implementation of biometric systems, evaluation criteria to biometric technologies, methodologies for performance testing and reporting, cross-jurisdictional and societal aspects of biometric implementation. The complete list of standards published or under development, can be found in on the SC 37 homepage:

https://www.iso.org/committee/313770.html

Published standards and ongoing projects related to the topics include the series of biometric data interchange standards for different biometric modalities, biometric technical interfaces, related biometric profiles and other standards in support of technical implementation of biometric systems, and cross jurisdictional and societal aspects of biometric implementation. Representative projects include revisions to some of the ISO/IEC 19794 series for *Biometric data interchange formats,* ISO/IEC 29794 series for *Biometric sample quality* and ISO/IEC 39794 series for *Extensible biometric data interchange formats.* These projects include generic extensible data interchange formats for the representation of data, a tagged binary data format based on an extensible specification in ASN.1 and a textual data format based on an XML schema definition (both capable of holding the same information). The ISO/IEC 30107 series for *Biometric presentation attack detection* and ISO/IEC 24779 series for *Cross-Jurisdictional and societal aspects of implementation of biometric technologies - pictograms, icons and symbols for use with biometric systems* are multi-part standards of relevance.

ISO/IEC JTC 1/SC 27, *Information security, cybersecurity and privacy protection,* is responsible for international IT security. The most relevant standards to electronic identification and trust services are developed by SC 27/WG 5 *Identity Management and Privacy Technologies*. After completion of foundational frameworks, specifically, the ISO/IEC 24760 series *A framework for identity management* and ISO/IEC 29100 for *Privacy framework*, priorities for WG 5 are related standards and Standing Documents on supporting technologies, models, and methodologies. WG 5's Projects include:

- A framework for identity management – Part 1: Terminology and concepts (ISO/IEC 24760-1, 2nd edition:2019)
- A framework for identity management – Part 2: Reference framework and requirements (ISO/IEC 24760-2, 1st edition:2015)
- A framework for identity management – Part 3: Reference framework and requirements (ISO/IEC 24760-3, 1st edition:2016)
- Privacy framework (ISO/IEC 29100, 1st edition:2011; Amendment 1:2018)
- Privacy architecture framework (ISO/IEC 29101, 2nd edition:2018)
- A framework for access management (ISO/IEC 29146, 1st edition:2016)
- Requirements for partially anonymous, partially unlinkable authentication (ISO/IEC 29191, 1st edition:2012)
- Privacy enhancing data de-identification terminology and classification of techniques (ISO/IEC 20889, 1st edition:2018)
- Privacy impact assessment – methodology (ISO/IEC 29134, 1st edition:2017)
- Extension to ISO/IEC 27001 and ISO/IEC 27002 for privacy management – Requirements and guidelines (ISO/IEC 27701, 1st edition:2019)
- WG 5 Standing Document 2 – "Privacy references list"
- WG 5 Standing Document 4 – "Standards Privacy Assessment"

ISO/IEC JTC 1 SC 27 is working in close collaboration with CEN/CLC/JTC 13 *'Cybersecurity and Data protection'* on eIDAS related standardisation activity.

ISO/JTC 1/SC 17 *Cards and security devices for personal identification* is responsible for standardisation and interface associated with their use in inter-industry applications and international interchange in the area of:

- Identification and related documents,
- Cards,
- Security devices and tokens
- https://www.iso.org/committee/45144.html

ITU-T

ITU-T SG2 is responsible for studies related to numbering, naming, addressing and identification, and resource assignment. SG2 is currently working on: updates to Recommendation ITU-T E.118, "The international telecommunication charge card" to reflect current and future use of Issuer Identifier Numbers (IINs); a new Recommendation ITU-T E.IoT-NNAI, "Internet of Things Naming Numbering Addressing and Identifiers"; and a new Technical Report TR.OTTnum, "Current use of E.164 numbers as identifiers for OTTs". More info: http://itu.int/ITU-T/go/tsg2

ITU-T SG3 is responsible, *inter alia*, for studying international telecommunication/ICT policy and economic issues and tariff and accounting matters (including costing principles and methodologies). SG3 has approved ITU-T D.1140/X.1261, "Policy framework including principles for digital identity infrastructure".

More info: http://itu.int/ITU-T/go/tsg3

ITU-T SG17 is responsible for the study and coordinate the work on ICT security and identity management. It has approved Recommendations ITU-T X.1058 "Information technology - Security techniques - Code of practice for Personally Identifiable Information protection", ITU-T X.1087 "Technical and operational countermeasures for telebiometric applications using mobile devices", ITU-T X.1148 "Framework of de-identification process for telecommunication service providers", ITU-T X.1171 "Threats and requirements for protection of personally identifiable information in applications using tag-based identification", ITU-T X.1212 "Design considerations for improved end-user perception of trustworthiness indicators", ITU-T X.1250 "Baseline capabilities for enhanced global identity management and interoperability", ITU-T X.1252 "Baseline identity management terms and definitions", ITU-T X.1275 "Guidelines on protection of personally identifiable information in the application of RFID technology", ITU-T X.1403 "Security considerations for using distributed ledger technology data in identity management", ITU-T X.1451 "Risk identification to optimize authentication", ITU-T X.1363 "Technical framework of personally identifiable information (PII) handling system in IoT environment", ITU-T X.1770 "Technical guidelines for secure multi-party computation" and is developing many more draft Recommendation in this domain: (X.5Gsec-t, X.guide-cdd, X.sec-QKDN-tn, X.smsrc, X.scpa, X.sgos, X.rdda, X.vide, etc). More info: http://itu.int/ITU-T/go/tsg17

Under the Security, Infrastructure and Trust Working Group led by ITU under the Financial Inclusion Global Initiative (a joint programme of the ITU, World Bank and Bank for International Settlements and supported by the Gates Foundation), studies on strong authentication technologies applications for digital financial services are being undertaken. The use of identity verification and authentication system based on DLT are also being studied. See Report:

https://www.itu.int/en/ITU-T/extcoop/figisymposium/Documents/ITU_SIT_WG_Implementation%20of%20Secure%20Authentication%20Technologies%20for%20DFS.pdf

UNECE

The United Nations Economic Commission for Europe in its Recommendation 14 outlines base elements to take into account in the use of electronic authentication methods. It recommends that the authentication methods should be chosen in light of the nature of the electronic transaction and the relationship between the parties involved in the exchange. Not all electronic exchanges require the highest level of reliability.

See: (available also in French and Russian) http://www.unece.org/fileadmin/DAM/cefact/recommendations/rec14/ECE_TRADE_C_CEFACT_2014_6E_Rec14.pdf

Further work is being developed on this topic within UN/CEFACT. See:

http://www.unece.org/fileadmin/DAM/cefact/cf_plenary/2018_plenary/ECE_TRADE_C_CEFACT_2018_7E.pdf

OASIS

The OASIS Security Services (SAML) TC maintains and extends the widely used Security Assertion Markup Language (SAML, also ITU-T Recommendation X.1141) standard. A profile of SAML is used for cross-border identification and authentication of citizens in the eIDAS nodes provided by the eID Building Block of the Connecting Europe Facility (CEF). SAML is also used at national level in Member States.

The OASIS Trust Elevation TC defines a set of standardized protocols that service providers may use to elevate the trust in an electronic identity credential presented to them for authentication.

The OASIS DSS-X TC defines standard Digital Signature Service Core Protocols, Elements, and Bindings. The latest version provides both JSON- and XML-based request/response protocols for signing and verifying, including updated timestamp formats, transport and security bindings and metadata discovery methods. This TC works in close liaison with the ETSI Electronic Signatures and Infrastructures (ESI) TC.

The OASIS ebXML Message TC maintains the OASIS ebMS3 (also ISO 15000-1) standard and the AS4 standard (also ISO 15000-2). AS4 is profiled as the message exchange protocol of the European Commission's eDelivery Building Block. Several dozens policy domains use eDelivery for cross-border secure and reliable exchange of documents and data. AS4 is also used in the EESSI system for digitalisation in social security coordination.

The OASIS Business Document Exchange TC provides complementary eDelivery specifications for service location and capability lookup.

The OASIS ebCore TC has delivered version 3 of the CPPA specification. CPPA3 provides standard data definitions, and formats for electronic, XML-based protocol profiles and business collaboration agreements, as well as algorithms for formation, matching, discovery and registration. Version 3 is an evolution of work done in the joint ebXML project with UN/CEFACT. It complements other ebXML standards for messaging including AS4.

OIDF

Set of standards and related certification profiles addressing identity transactions over the internet. Active working groups in this area include: the OpenID Connect WG, AccountChooser WG, Native Applications WG, Mobile operator Discovery, Registration and Authentication WG (MODRNA), Health Related Data Sharing WG (HEART), and Risk and Incident Sharing and Coordination WG (RISC)

http://openid.net/wg/

IETF

The Web Authorization Protocol (OAUTH) WG developed a protocol suite that allows a user to grant a third-party Website or application access to the user's protected resources, without necessarily revealing their long-term credentials, or even their identity. It also developed security schemes for presenting authorisation tokens to access a protected resource.

The ongoing standardisation effort within the OAUTH Working Group is focusing on enhancing interoperability of OAUTH deployments.

The Public Notary Transparency (TRANS) WG develops a standards-track specification of the Certificate Transparency protocol (RFC6962) that allows detection of the mis-issuance of certificates issued by CAs or via ad-hoc mapping by maintaining cryptographically verifiable audit logs.

The Automated Certificate Management Environment (ACME) WG specifies conventions for automated X.509 certificate management, including validation of control over an identifier, certificate issuance, certificate renewal, and certificate revocation. The initial focus of the ACME WG is on domain name certificates (as used by web servers), but other uses of certificates can be considered as work progresses.

https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#eIdentity

W3C

Verifiable Credentials provide a mechanism to express credentials, e.g. driving licenses, on the Web in a way that is cryptographically secure, privacy respecting, and machine-verifiable. Currently, the following Specifications and Notes have already been issued:

- Verifiable Credentials Data Model 1.0 https://www.w3.org/TR/vc-data-model/
- Verifiable Credentials Implementation Guidelines 1.0 https://www.w3.org/TR/vc-imp-guide/
- Verifiable Credentials Use Cases https://www.w3.org/TR/vc-use-cases/

Decentralized Identifiers (DIDs) are a new type of identifier that enables verifiable, decentralized digital identity. A DID refers to any subject (e.g., a person, organization, thing, data model, abstract entity, etc.) as determined by the controller of the DID. In contrast to typical, federated identifiers, DIDs have been designed so that they may be decoupled from centralized registries, identity providers, and certificate authorities:

- Decentralized Identifiers (DIDs) v1.0 https://www.w3.org/TR/did-core/
- Use Cases and Requirements for Decentralized Identifiers https://www.w3.org/TR/did-use-cases/
- DID Implementation Guide v1.0 https://www.w3.org/TR/did-imp-guide/
- DID Specification Registries https://www.w3.org/TR/did-spec-registries/
- DID Method Rubric v1.0 https://www.w3.org/TR/did-rubric/

Web Authentication defines an API enabling the creation and use of strong, attested, scoped, public key-based credentials by web applications, for the purpose of strongly authenticating users. The current work is on Web Authentication: An API for accessing Public Key Credentials - Level 3 https://www.w3.org/TR/webauthn-3/

Web payments: An important goal of Secure Payment Confirmation (SPC) is to streamline strong customer authentication (SCA). One way to reduce friction is to allow many authentications for a given registration. In other words, ideally the user registers once and can then authenticate "everywhere" (consistent with the policies of the relying party; they have to opt-in). The following Specifications are relevant:

- Secure Payment Confirmation https://www.w3.org/TR/secure-payment-confirmation/
- Payment Request API http://www.w3.org/TR/payment-request/
- Payment Method IDs http://www.w3.org/TR/payment-method-id/
- Payment Handler API https://www.w3.org/TR/payment-handler/
- Payment Method Manifest https://www.w3.org/TR/payment-method-manifest/

Work on **Soc**ial Networking includes identity schemes that can play a role:

- ActivityPub https://www.w3.org/TR/activitypub/
- Social Web Protocols https://www.w3.org/TR/social-web-protocols/
- IndieAuth https://www.w3.org/TR/indieauth/

The **Web Crypto API** describes a JavaScript API for performing basic cryptographic operations in web applications, such as hashing, signature generation and verification, and encryption and decryption: https://www.w3.org/TR/WebCryptoAPI/ See also the note on use cases: http://www.w3.org/TR/webcrypto-usecases/ narrowing the scope of the Web Crypto API.

Identity for WebRTC 1.0 defines a set of ECMAScript APIs in WebIDL to allow and application using WebRTC to assert an identity, and to mark media streams as only viewable by another identity. This specification is being developed in conjunction with a protocol specification developed by the IETF RTCWEB group. https://www.w3.org/TR/webrtc-identity/

IEEE

IEEE has standards and pre-standards activities relevant to Electronic Identification and Trust Services, including dealing with blockchain technology, authentication, and biometric identification. More information can be found at:

IEEE P2049.3-Standard for Human Augmentation: Identity,
IEEE 2410-2019, IEEE Standard for Biometric Open Protocol,
IEEE P2733, Standard for Clinical Internet of Things (IoT) Data and Device Interoperability with TIPPSS - Trust, Identity, Privacy, Protection, Safety, Security,
IEEE P2790, Standard for Biometric Liveness Detection,
IEEE P2799, Standard for Confirming and Conveying Identity Over the Internet,
IEEE P2989–Standard for Authentication in Multi-Server Environment, and
IEEE P3210 - Standard for Blockchain-based Digital Identity System Framework.

There are also several pre-standards activities looking at digital identity, including guidelines for the provision and use of digital identities for digital resilience.

For more information, see: https://ieeesa.io/rp-eidentification .

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

Related important projects ordered by date:

2023-08-23 OntoChain https://ontochain.ngi.eu
OntoChain aims to enable trustworthy transactions of services and contents. The project defines innovative decentralised reputation models that reveal the hidden quality/types of services and credibility of data sources, keeping a balance between privacy and trust.

- 2022-10-31 eSSIF-Lab https://essif-lab.eu
  Self-sovereign identity (SSI) supports identity management in a safe and reliable internet allowing secure transactions and eliminating logins. SSI aims to empower EU organisations to make secure and innovate transactions with stakeholders saving billions of euro on administrative expenses.
- 2020-12-31 AMBER https://www.amber-biometrics.eu
  AMBER addresses issues facing biometric solutions on mobile devices and develop solutions and theory to ensure secure, ubiquitous and efficient authentication whilst protecting privacy of citizen.
- 2020-08-31 SMOWL https://smowl.net/en/
  SMOWL is a practical and reliable solution for online user identification and monitoring. It consists in a new cyber-security service covering the need for a continuous, automatic and scalable authentication of online user's identity and monitoring.

- 2020-03-31 Smart-Trust https://web.archive.org/web/20201230011033/https://smart-trust.eu/
  Smart-Trust introduces a new technological enabler for Mobile ID which drastically increases the reliability and trust levels of identity verification at European borders, thus increasing the security of member states.
- 2019-12-31 DECODE https://decodeproject.eu
  DECODE provides tools that put individuals in control of whether they keep their personal information private or share it for the public good.
- 2019-02-28 ARIES - A ReliAble euRopean Identity EcoSystem https://www.aries-project.eu/
  ARIES aims to set up a reliable identity ecosystem combining mature technologies for high level of assurance, such as biometrics or use of secure elements, with innovative credential derivation mechanisms.
- 2018-12-31 SAFEcrypto https://www.safecrypto.eu
  SAFEcrypto will provide a new generation of practical, robust and physically secure post quantum cryptographic solutions that ensure long-term security for future ICT systems, services and applications. Novel public-key cryptographic schemes (digital signatures, authentication, public-key encryption, identity-based encryption) will be developed using lattice problems as the source of computational hardness.
- 2018-09-30 CREDENTIAL - Secure Cloud Identity Wallet https://credential.eu
  The goal of CREDENTIAL is to develop, test and showcase innovative cloud based services for storing, managing, and sharing digital identity information and other critical personal data.
- 2018-04-30 ReCRED http://www.recred.eu
  ReCRED's ultimate goal is to promote the user's personal mobile device to the role of a unified authentication and authorization proxy towards the digital world.

3.1.6 E-INFRASTRUCTURES FOR DATA AND COMPUTING INTENSIVE SCIENCE AND THE EUROPEAN OPEN SCIENCE CLOUD

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

Research data and computing infrastructures fostering a paradigm shift in science (Open Science) Data driven science today pervades all research fields blurring geographical and disciplinary boundaries. The technological and digital progress unfolding over the last few decades produced more effective scientific instruments, which generated a rapid increase in research data volumes and availability across a wide range of scientific disciplines. The European Commission in FP6, FP7 and Horizon 2020 funded several projects to establish and consolidate a European e-infrastructures environment and to build the European Open Science Cloud, a federated and open multi-disciplinary environment where research data can be found and re-used, with tools and services for research, innovation and educational purposes. Underpinning the efforts of the research communities, e-infrastructures have fostered innovation and scientific progress across disciplines and between the private and public sector. A large number of data e-Infrastructures, mixing the capabilities of scientific communities and technology providers, have been launched in domains of astronomy, earth and ocean observation, climate, environment and biodiversity, etc. Moreover, pan European e-Infrastructures initiatives were launched across disciplinary domains providing a participatory network of open access repositories at European scale. These initiatives fill the gap between user-application and generic e-Infrastructure layers for high-volume storage, data interoperability, high-performance computing and connectivity layers. This framework of e-science services enabled the progress of Open Science practices to improve the quality, efficiency and responsiveness of research.

Despite the greater possibilities of sharing and accessing research data and the Commission policies on open research data, promotion of "openness" is not sufficient to realise the full potential of communication and re-use of research data. The vast amounts of research generated data are still dispersed across thousands of venues. A March 2016 article in Nature proposed guiding principles for scientific data management and stewardship by introducing the FAIR acronym, which stands for Findable, Accessible, Interoperable and Re-usable. Soon after the publication, the FAIR Principles became one of the cornerstones of EU's Open Science policy and have been rapidly adopted by publishers, funders, and other stakeholders from across the research community.

Building on the existing EU-funded e-Infrastructures and to enable the development and uptake of Open Science in Europe the EC proposed and is promoting the creation of a European Open Science Cloud (EOSC), as presented in the Communication "European Cloud Initiative". EOSC essentially involves the federation of existing research data infrastructures and the realisation of a Web of FAIR Data and Related Services for Science, making research data interoperable and machine actionable. It fosters the definition, implementation and further development of advanced solutions for the effective provisioning and use of high quality scientific data, with metadata descriptors, ease of access, interoperability and reusability, fully implementing the FAIR principles. Therefore, the application of standards and recommendations is of utmost importance in order to allow for interoperability, avoid fragmentation and improve the efficiency and effectiveness of research.

The European Commission, with the European data strategy, aims to make the EU a leader in a data-driven society. Among other actions, the Strategy intends to foster the rollout of common European data spaces in crucial sectors such as industrial manufacturing, green deal, mobility or health: EOSC has been recognised as the European digital space for research. The work that has been conducted within EOSC to enable interoperability across research domains and data discovery to support multi-disciplinary reuse is critical to supporting collaboration with the European data spaces. Research infrastructures within the ESFRI roadmap already play a key role in EOSC. Engaging further with the research communities will be key to developing an EOSC for and by the researchers. Strong links with research domains will naturally foster opportunities for collaboration with the data spaces.

To complement the access to the wealth of European research data, with the new Regulation for the European High Performance Computing Joint Undertaking and the Coordinated Plan on Artificial Intelligence (AI) the European Commission is also ensuring the capacity to process large volumes of information with services closer to European researchers and innovators.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

Research/science funders have a common problem when tackling the area of research data infrastructure. The landscape is geographically fragmented and different disciplines have different practices. It is difficult to build critical mass and provide common services to different scientific disciplines and to take advantage of economies of scale. Some scientific communities are pushing the envelope and adopting new technologies while others are lagging behind. Scientists are, at the end of the day, the generators and users of research data in their experiments, simulations, visualization of complex data arrays, etc. There is a need to bring together capabilities from different scientific fields and also the competences of technology and service providers to use the potential of ICT.

Interoperable data infrastructures will allow researchers and practitioners from different disciplines to access and process the data they need in a timely manner. The implementation of the FAIR principles as standard practice for research data will enable collaborations across different domains of science.

Today, EU-funded e-Infrastructures and EOSC resources play a fundamental role in the life of European researchers.

In the initial phase of development of EOSC from 2016 to 2020, the EC made a financial investment of approximately €350 million to begin building the foundations of EOSC through project calls in Work Programmes in Horizon 2020. This investment was targeted to develop a new pan-European access mechanism to public e-infrastructures, to coordinate related national activities, to connect European research infrastructures (RIs) to EOSC, to set up and begin the implementation of the FAIR guiding principles, and to start a FAIR-compliant certification scheme for research data infrastructures. These projects have involved the community of stakeholders of EOSC and have been steadily developing the broader EOSC ecosystem.

The initial development phase under Horizon 2020 supported more than 35 projects, laying the foundations of EOSC and showcasing its diversity and complexity. The EOSCpilot project engaged extensively with stakeholders and proposed a governance framework and policies, as well as developing interoperability pilots across scientific domains. EOSC-hub brought together service providers to create a single contact point to discover, access and use a wide range of resources for data-driven research. Five ongoing cluster projects will connect the European Strategy Forum on Research Infrastructures (ESFRI) projects and landmarks to EOSC in the domains of environmen-

tal sciences, life sciences, astronomy and particle physics, photon and neutron sciences, and social sciences and humanities. Five regional projects aim to coordinate the efforts of national and thematic initiatives in contributing to EOSC through groupings of European countries.

Under the first implementation phase of EOSC projects have been actively working on recommendations for the adoption of practices models and standards. Relevant examples are:

- the work of OpenAIRE and EuroCRIS initiatives to expand the CERIF model to also include research outputs. CERIF was initially conceived to document and exchange research information (funding programmes and projects, researchers and research institutions, etc.) and has since been adopted by many Member States and institutions
- in the context of FAIR data, the project FAIRsFAIR is coordinating an analysis of the European Framework for audit and certification of digital repositories that comprise three certification instruments, with increasing degrees of complexity and depth:
- CoreTrustSeal (CTS): this is based on Data Seal of Approval (DSA)and World Data System (WDS) van ICSU. All digital repositories that have one or more of these certifications are listed at https://www.coretrustseal.org/why-certification/certified-repositories/
- Nestor Seal: verification according to DIN 31644
- ISO 16363 certification) are contribution to harmonise and promote standards in metadata
- several EOSC related projects (notably the 5 ESFRI Cluster projects) are strongly contributing in promoting practices and standards in disciplinary metadata for description and re-use of research data
- the RDA FAIR Data Maturity Model Working Group has developed a common set of core assessment criteria for FAIRness and a generic and expandable self-assessment model for measuring the maturity level of a dataset.

The second implementation phase under Horizon Europe sees the establishment of a European Co-programmed partnership between the EC and a new legal entity called EOSC Association that represents (and it is open to) all European stakeholders. In June 2021 the European Commission signed with the EOSC Association a Memorandum of Understanding that starts the Co-programmed European Partnership on EOSC under the Horizon Europe Framework Programme. The EOSC Association and the Horizon Europe projects funded under the Co-programmed partnership topics will play a pivotal role in the harmonisation and the adoption of practices and standards that will govern the federating core of EOSC an the development of new services.

The Strategic Research and Innovation Agenda is a key directional document that sets the objectives that will drive the Horizon Europe calls on EOSC and the activities that will be developed by the members of the Association and other institutions in the EU Member States and Associated Countries.

(A.3) REFERENCES

- **EOSC Strategic Research and Innovation Agenda - SRIA [version 1.0] (2021** https://op.europa.eu/s/vRXa**)**
- **Memorandum of Understanding for the Co-programmed European Partnership for the European Open Science Cloud (EOSC)** https://ec.europa.eu/info/sites/default/files/research_and_innovation/funding/documents/c_2021_4113_f1_annex_en_v3_p1_1213802.pdf
- **European Open Science Cloud (EOSC) main background documents (**https://ec.europa.eu/info/sites/default/files/research_and_innovation/strategy_on_research_and_innovation/documents/ec_rtd_eosc-main-background-documents.pdf**)**
- **EOSC strategic implementation plan (2019** https://publications.europa.eu/s/mIli**) and EOSC Work Plan 2019-2020 (2019** https://op.europa.eu/s/ngwM**)**
- Turning FAIR into reality**. Final report and action plan from the European Commission (EC) Expert Group (EG) on FAIR data (2018)**
- **Prompting an EOSC in practice. Final report and recommendations of the Commission 2nd High Level EG on the EOSC (2018)**
- Council conclusions **on European Open Science Cloud (EOSC) (ST 9291 2018 INIT, ST 9291 2018 INIT (2018))**
- **Commission Recommendation (EU) 2018/790 of 25 April 2018 on access to and preservation of scientific information:**
- Commission Staff Working Document **(SWD) - Implementation Roadmap for the EOSC (SWD(2018) 83 final (2018))**
- Realising the EOSC**. First report and recommendations of the Commission highlevel EG on the EOSC (2016)**
- COM(2016) 178 final European Cloud Initiative — Building a competitive data and knowledge economy in Europe.
- COM(2016) 180 Digitising European Industry - Reaping the full benefits of a Digital Single Market.
- **COM(2016) 176** ICT Standardisation Priorities for the Digital Single Market.
- COM(2012) 401 final: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions — Towards better access to scientific information: Boosting the benefits of public investments in research.
- **COM(2012) 4890 final**: Commission Recommendation on access to and preservation of scientific information.

(B.) REQUESTED ACTIONS

ACTION 1 Supporting standardisation within Horizon Europe INFRAEOSC Destination. The attention on standardisation will be included in the Destination INFRAEOSC, part of the Horizon Europe Work programme for Research Infrastructures (Pillar 1 Excellent Science). Notably for topics related to building the federating core of EOSC, creating FAIR enabling services and supporting the implementation of the FAIR principles, the European Commission will strengthen the objective of contribution to the adoption of practices and standards applicable to the EOSC and that will potentially have a larger impact on other data initiatives such as the European common Data Spaces.

ACTION 2 Recognising RDA as a fundamental contributor to standards on data.The Research Data Alliance (RDA) is not primarily a standardisation body but is a mechanism to speed-up the adoption of standards for research data and computing infrastructures. The RDA, with its form of Multi-Stakeholder Platform, develops recommendations that have the potential of becoming ICT specifications. There is also an ongoing effort of promoting industrial participation within the RDA processes

ACTION 3 SDOs to work closely with EOSC and e-infrastructures service providers and RDA. Practices adopted by research digital infrastructures respond to needs that most likely will be valid for wider user communities and operators and will determine new standards on technologies that are emerging through the scientific use and soon will be widespread. Therefore identifying standards needs and developing them in the area of research data (notably in the context of the European Open Science Cloud) will accelerated the uptake of data intensive technologies.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

RESEARCH DATA ALLIANCE (RDA)

Supports the Commission's strategy to achieve global scientific data interoperability in a way that real actors (users and producers of data, service providers, network and computing infrastructures, researchers and their organisations) are in the driving seat. It has memorandums of understanding (MoUs) with related standardisation activities/organisations: IETF, W3C, ICSU/CODATA. Synergies with other organisations/activities will need to be identified in the future.

ITU-T

Regarding the global e-Infrastructure, the ITU is using the digital object architecture (DOA), on which the recommendation ITU-T X.1255 "Framework for discovery of identity management information" is based.

SG11 is addressing the growing problem of counterfeited telecommunication/ICT products and devices, which is adversely affecting all stakeholders in the ICT field (vendors, governments, operators and consumers). Within this activity, SG11 developed number of Recommendations which describe approaches on how to combat the circulation of counterfeit equipment. The Recommendation ITU-T Q.5050 "Framework for solution to combat counterfeit ICT Devices", which is the first one in the Q.5050-Q.5069-series "Combating counterfeiting and stolen ICT devices", describes a reference framework with high-level challenges and requirements that should be considered when deploying solutions to combat the circulation and use of counterfeit ICT devices. SG11 developed four Recommendations and five technical reports/supplements on this subject matter. There are six ongoing work items which will define use cases, guidelines as well as the interfaces for data exchange between CEIR and EIR. All details are available on dedicated web page at: https://www.itu.int/en/ITU-T/studygroups/2017-2020/11/Pages/counterfeit.aspx.

SG11 continues developing standards related to combating stolen ICT equipment. SG11 approved Recommendation ITU-T "Framework for Combating the use of Stolen Mobile ICT Devices".

SG11 set up a new Question 17/11 "Combating counterfeit or tampered telecommunication/ICT software" which initiated a first technical report dedicated to use cases on the combat of multimedia content misappropriation.

http://itu.int/ITU-T/go/sg11

SG20 approved Recommendation ITU-T Y.4808 "Digital entity architecture framework to combat counterfeiting in IoT". The intent of this Recommendation is to provide solutions to deter the spread of counterfeit IoT devices worldwide.

More info: https://itu.int/ITU-T/go/sg20

SG13 approved new standards on trust for ICT infrastructures and services:

- Recommendation ITU-T Y.3051 "The basic principles of trusted environment in ICT infrastructure" provides the definition, common requirements and the basic principles of creating trusted environment.
- Recommendation ITU-T Y.3052 "Overview of trust provisioning for information and communication technology infrastructures and services" describes the key characteristics of trust. In addition, the trust relationship model and trust evaluation based on the conceptual model of trust provisioning are introduced.
- Recommendation ITU-T Y.3053 "Framework of trustworthy networking with trust-centric network domains"
- Recommendation ITU-T Y.3056 "Framework for bootstrapping of devices and applications for open access to trusted services in distributed ecosystems"
- Recommendation ITU-T Y.2501 "Computing power network - Framework and architecture"
- Recommendation ITU-T Y.2623 "Requirements and framework of industrial Internet networking based on future packet based network evolution"

SG13 continue working on the attributes that can represent trustworthiness, which can be applied to ICT infrastructures and services. There are several on-going work on architecture for trust

enabled service provisioning, trust index to evaluate and quantify trustworthiness for ICT infrastructures and services etc. From the perspectives of standardisation, trust should be quantitatively and/or qualitatively calculated and measured, which is used to evaluate the values of physical components, value-chains among multiple stakeholders, and human behaviors including decision making.

FG NET2030 technical report "Network 2030- Additional representative use cases and key network requirements for Network 2030" deals with the key network requirements for huge scientific data applications (astronomical telescopes) and accelerators (Large Hadron Collider).http://itu.int/ITU-T/go/sg13

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

Related topics in H2020 WP on research infrastructures including e-Infrastructures (proposals selected within these calls may contribute to standardisation):

EINFRA-1-2014: Managing, preserving and computing with big research data

EINFRA-3-2014: Towards global data e-Infrastructures — research data alliance

EINFRA-8-2014: Research and education networking — GÉANT

INFRASUPP-7-2014: e-Infrastructure policy development and international cooperation

EINFRA-22-2016: User driven e-infrastructure innovation

EINFRA-21-2017: Platform-driven e-infrastructure innovation

EINFRA-12-2017: Data and Distributed Computing e-Infrastructure for Open Science

INFRASUPP-02-2017: Policy and International cooperation measures for research infrastructures (RDA)

(C.3) ADDITIONAL INFORMATION

RDA will be a good support to turn the proposed framework for action for data infrastructures into practice. The Commission run a public consultation on the key priority areas for H2020 on data Infrastructures which received an excellent feedback. Stakeholders are motivated and, above all, ready to come together and turn the identified priorities into real action. Europe will consolidate its role of a global partner and a global leader in research data infrastructures.

3.1.7 BROADBAND INFRASTRUCTURE MAPPING

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The *digital single market* must be built on reliable and trustworthy data. In this context, the European Commission has launched a project to map fixed and mobile quality of broadband services in Europe. The tool went live in May 2020. It consists of an interactive online mapping application that aggregates and visualizes various dimensions of quality of service (QoS) delivered by broadband networks (fixed and mobile) in the European Union. The project constitutes a crucial instrument to assess and monitor the achievement of the new connectivity goals as described in the Communication on Connectivity for a Competitive Digital Single Market – Towards a European Gigabit Society and the 5G action plan. However data-collection is on a voluntary basis and therefore the data set is not yet complete.

In 2017, in order to complement the deployment of the EU broadband mapping platform, the Commission has launched a new study on Fixed and Mobile Convergence in Europe (SMART 2016/0046)11. On the basis of the datasets collected in the EU broadband mapping platform, the study supports the EU policy-making process by assessing the technical/political/economic obstacles that prevent the definition of common (fixed and mobile) network performance measurements in the Union. In 2019 BEREC started work on the development of Guidelines on Geographic Surveys of the new CODE for Electronic Communication. In march 2020 the guidelines were adopted with a second phase on the identification of areas for investment due to be completed by end 2020. In parallel the European Commission has started the development of a mapping broadband coverage methodology based on the BEREC guidelines with a view to meet the mapping requirement of EU level needs on monitoring, programming of funds and state aid assessment. The mapping methodology is due to be tested and finalised in 2021.

11 https://ec.europa.eu/digital-single-market/en/news/study-fixed-and-mobile-convergence-europe-2017

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

Telecom manufacturers, operators and other stakeholders have an interest in assuring a minimum of interoperability of broadband infrastructure mapping to facilitate the deployment of next-generation networks, simplify their operation, reduce cost and finally open up a single market dimension.

In order to achieve the EU broadband objectives of the Digital Agenda Europe, it is fundamentally important that there is reliable and valid data on existing and planned broadband infrastructures, services offered; and demand and investment. A standardised mapping of broadband infrastructures and services as well as of other related data will help identify gaps of broadband coverage and quality of service level and identify suitable areas of investment. Increasing the reliability of coverage data (QS1) will be particularly useful to avoid duplication of financing as subsidies can be allocated to areas truly affected by market failure and regulatory needs linked to market regulation. Gathering reliable quality of service data (QS2 and QS3) based on common methodologies will feed into other regulatory aspect linked to net neutrality and consumer protection as well as assisting in the provision of reliable 5G services to vertical industries.

The Broadband mapping project has revealed that in the absence of a commonly agreed methodologies for all three aspects, Member States administrations have developed a variety of different methodologies to map coverage and quality of service resulting in multiple mapping initiatives using different data sets and attributes (which NRAs, Ministries, regional agencies are sometimes running in parallel). Mapping data is not comparable across the EU and often public authorities lack detailed and reliable data to set policies, to ensure that public funding is compliant with relevant regulation, to programme funds and successfully monitor the execution of these actions at regional, national and European level. This lack of reliable data risks resulting in policy paralysis, in regulatory uncertainty, and poor planning of broadband projects.

The EU mapping platform collects three data sets concerning fixed and wireless services including:

- QoS-1: Calculated availability of service, network performance of existing infrastructure (coverage);
- QoS-2: Measured provision of service, excluding end user's environment;
- QoS-3: Measured experience of service, including end user's environment
- **BEREC Guidelines on Geographic Surveys**
- Article 22 of the new CODE calls on BEREC to develop guidelines on Geographic Surveys in full cooperation with the EC and relevant MS authorities with a view to collect mapping data to satisfy a number of policy and regulatory functions at EU and MS level.
- **Phase 1: January 2019- March 2020:** BEREC carried out task1 and 2 and delivered the Guidelines regarding verification of QoS1 information, including - the possibility to verify by QoS2 and QoS3 information and adopted and published the guidelines - in March 2020. The BEREC Guidelines *foster also state aid compliance but* it is not their main objective to ensure compliance with state aid rules. NRAs/OCAs can use information collected under Art 22 to assist the state aid process but may also need to collect complementary information in line with the State Aid guidelines rules.
- **Phase 2: March 2020-1st Quarter 2021:** In phase 2 BEREC is due to carry out task 3 in order to develop the Guidelines on the procedures to invite undertakings and public authorities to declare their intention to deploy VHCN over the duration of the relevant forecast period for (Art 22.3 and Art 22.4). Work is expected to be finalised in Q2 2021. Similarly to phase I also these Guidelines *foster also state aid compliance but* it is not their main objective to ensure compliance with state aid rules. NRAs/OCAs can use information collected under Art 22 to assist the state aid process but may also need to collect complementary information in line with the State Aid guidelines rules.

Broadband Mapping Methodology

In January 2020 the EC has launched a study aimed at the development of common methodology on broadband coverage for fixed and mobile infrastructures and services . The methodology aims at including key data, not foreseen within the BEREC Guidelines, in order to allow an easy application in the field of State Aid: The broadband mapping methodology developed by the three experts concerns the specific application of the BEREC guidelines within the context state aid with possible repercussions on the monitoring of the achievement of EU objectives and the negotiation of EU funds. The work is expected to feed the update of the forthcoming Guidelines on State Aid for Electronic Communication Networks to be finalised and adopted by Q1 2022.

A.3 REFERENCES

- Directive 2002/22/EC of the European Parliament and of the Council on universal service user's rights relating to electronic communication networks and services (**Amended by Directive 2009/136/EC**)
- COM(2016) 590 final/2 European Electronic Communication Code
- Directive 2002/ 21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services **(amended by** Directive 2009/140/EC)
- **Directive 2007/2/EC** of the European Parliament and of the Council establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)
- BEREC Net neutrality measurement tool (October 2017)
- BEREC Common Position on monitoring of mobile network coverage (July 2018)
- RSPG and BEREC joint report on mobile connectivity in 'challenge areas' (December 2017)
- Study from the EC commissioned to IMIT - Fixed and Mobile Convergence in Europe: SMART 2016/0046
- BEREC Common Position on information to consumers on mobile coverage (December 2017)
- **DIRECTIVE (EU) 2018/1972** establishing the European Electronic Communications Code: article 22.
- BoR (20) 42 BEREC Guidelines on Geographical surveys of network deployments
- C(2020) 6270 final on a common Union toolbox for reducing the cost of deploying very high capacity networks and ensuring timely and investment-friendly access to 5G radio spectrum, to foster connectivity in support of economic recovery from the COVID-19 crisis in the Union.

(B.) REQUESTED ACTIONS

ACTION 1 SDOs to further develop a standardised methodology and guidelines to assess and map availability and quality of fixed and wireless/mobile broadband services (including coverage, QoS and QoE, key quality indicators - KQI) also in view of the development of VHC (very high-capacity) and 5G services for a range of public and private users including the large industries such as vertical industrial sectors.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN-CENELEC

CLC/TC 209 has developed and maintains a complete set of European standards in the field of cable networks for television signals, sound signals and interactive services. This EN series, EN 60728, deals with cable networks, including equipment and associated methods of measurement for headend reception, processing and distribution of television and sound signals and for processing, interfacing and transmitting all kinds of data signals for interactive services using all applicable transmission media. These signals are typically transmitted in networks by frequency-multiplexing techniques.

These include:

a) regional and local broadband cable networks (i.e. based on optical fibre and coaxial cables)

b) extended satellite and terrestrial television distribution networks or systems

c) individual networks or systems that receive satellite and terrestrial television, and all kinds of equipment, systems and installations used in such cable networks, distribution and receiving systems.

The extent of this standardisation work is from the antennas and/or special signal source inputs to the headend or other interface points to the network up to the terminal input of the customer premises equipment.

The standardisation takes into account coexistence with users of the RF spectrum in wired and wireless transmission systems.

Typical data rates for internet access in these kind of networks range from 30 Mbit/s to 200 Mbit/s, with cable network operators now starting to introduce gigabit services to their customers.

CLC/TC 215 have published, among others, EN 50173-4 on broadband cabling of private homes (both copper and optical fibre cabling) and EN 50700 on fibre optic access network cabling design. CLC/TC 46X 'Communication cables' have published and will maintain cable standards to support those different systems (e.g. EN 60966 series, EN 50117 series, EN 50288 series, EN 50441 series, EN 50407 series).

ETSI

ETSI has continually developed an extensive set of standards aimed at measurement, testing, quality assurance and quality of service in communications networks.

ETSI TC STQ (Speech and Multimedia Transmission Quality) is responsible for standardisation relating to terminals and networks for speech and media quality, end-to-end single media and multimedia transmission performance, Quality of Service (QoS) parameters for networks and services and Quality of Experience (QoE) descriptors and methods. STQ have developed a series of standards dealing with quality of service as perceived by the user, performance metrics and measurement methods. STQ are developing a Technical Report on best practices for robust network QoS benchmark testing and ranking (TR 103 559). They have also developed TRs and ETSI Guides on throughput measurement guidelines.

ETSI TC INT (Core Network and Interoperability Testing) is responsible for the development of core network test specifications for interoperability, conformance, performance and security. TC INT is developing a TS for a methodology for end to end internet related customer experience measurements for fixed and mobile networks. It will describe the concept, the requirements, the parameters and the procedures which should be used for Internet speed quality measurements, and is being developed in cooperation with ITU-T SG.11.

- ETSI TC CABLE is responsible for standardisation related to integrated broadband cable telecommunication network technologies. TC CABLE is developing a TS on measurement methods for the network performance of broadband data services. The focus is on measurement of QoS performance in the access network. While the TS is taking the cable access network into account, the methods are designed in a network agnostic way such that their applicability to other delivery networks of broadband data services is not precluded. TC CABLE is engaging with stakeholders on the European level to establish standardized methodology enabling consumers to compare the performance of different service providers.

ITU-R

ITU-R Working Party (WP) 5C is responsible for studies related to fixed wireless systems and HF systems in the fixed and land mobile services. It studies performance and availability objectives, interference criteria, RF channel/block arrangements, system characteristics and sharing feasibility. It should be noted that for fixed wireless access (FWA) systems, work related to public access systems for potentially large deployment coverage is carried out in ITU-R Working Party 5A.

Some of the deliverables regarding the fixed and mobile quality of broadband services include:

- Recommendation ITU-R M.1079 on "Performance and quality of service requirements for International Mobile Telecommunications-2000 (IMT-2000) access networks"
- Report ITU-R F.2058 on "Design techniques applicable to broadband fixed wireless access systems conveying Internet protocol packets or asynchronous transfer mode cells"
- Report ITU-R F.2086 on "Technical and operational characteristics and applications of broadband wireless access in the fixed service"
- Report ITU-R F.2393 on "Use of fixed service for transport of traffic, including backhaul, for IMT and other terrestrial mobile broadband systems"
- Report ITU-R M.2243 on "Assessment of the global mobile broadband deployments and forecasts for International Mobile Telecommunications"
- Report ITU-R M.2378 on "Operational guidelines for the deployment of broadband wireless access systems for local coverage operating below 6 GHz"

ITU-R SG6 studies and develops issues associated with what is termed the "presentation layer" for radio and television broadcasting including these programmers which are delivered by broadband systems. This includes signal formats for the making and exchange of television and radio programmes, and also ways to evaluate picture and sound quality that are a critical element in the choice of the parameters for the "presentation layer" end-to-end. One of the historical standards is Recommendation ITU-R BT.500 "Methodologies for the subjective assessment of the quality of television images".

More information : Working Party 6C (WP 6C) - Programme production and quality assessment (itu.int)

ITU-T

ITU-T Study Group 12, on Performance, Quality of Service (QoS) and Quality of Experience (QoE), continues studying performance of packet-based networks and other networking technologies.

The 2019 edition of Recommendation ITU-T Y.1540 *Internet protocol data communication service – IP packet transfer and availability performance parameters* recognizes many changes in the design of IP services and in the protocols employed by end-users.

ITU-T Y.1540 (2019) introduced new Annexes A and B that defines IP-layer Capacity parameters in ways that cater toward assessment, and provides requirements for reliable methods of measurement of IP-layer Capacity.

The updated international standard, available at https://itu.int/ITU-T/Y.1540 is aligned with related relevant work in ETSI TC STQ, BBF, IETF, among others. An open source implementation of the Y.1540 methodology for UDP-based IP capacity measurements is available. A Supplement accompanying Y.1540 provides guidance on the interpretation of IP-layer capacity measurements, examples of testing campaigns and a brief introduction to the open source implementation. It is available at https://www.itu.int/rec/T-REC-Y.Sup60/en.

Recommendation ITU-T E.806 (2019) (https://itu.int/ITU-T/E.806) provides guidance on measurement campaigns, monitoring systems and sampling methodologies to monitor the quality of service in mobile networks.

Recommendation ITU-T E.812 (2020) (https://itu.int/ITU-T/E.812) introduces the crowdsourcing approach for the assessment of end-to-end quality of service in fixed and mobile broadband networks. Use cases of the crowdsourcing approach include the assessment of mobile network coverage of mobile networks, as well as performance monitoring and benchmarking for fixed and mobile networks.

Recommendation ITU-T Y.1545.1 (2017) (https://itu.int/ITU-T/Y.1545.1) provides guidance on monitoring the QoS of Internet services to regulators, network service providers and subscribers.

ITU-T SG11 approved a new Recommendation ITU-T Q.3960 "Framework for Internet related performance measurements". It aims to enable the customers of telecom networks' to estimate their Internet performance access: http://www.itu.int/itu-t/q.3960 . Also, testing procedures are described in Supplement 71 to ITU-T Q.3960 "Testing methodologies of Internet related performance measurements including e2e bit rate within the fixed and mobile operator's networks ". https://itu.int/ITU-T/workprog/wp_item.aspx?isn=13819

SG11 developed several Recommendations related to broadband network gateway, including Recommendations ITU-T Q.3713 "Signalling requirements for broadband network gateway pool", ITU-T Q.3715 "Signalling requirements for dynamic bandwidth adjustment on demand on broadband network gateway implemented by software-defined networking technologies", ITU-T Q.3719 "Signalling requirements for the separation of control plane and user plane in a virtualized broadband network gateway (vBNG)", ITU-T Q.3720

"Procedures for vBNG acceleration with programmable acceleration card", ITU-T Q.4064 "Interoperability testing requirements of virtual Broadband Network Gateway" and ITU-T Q.3915 "Set of parameters of vBNG for monitoring". SG11 also developed Recommendation ITU-T Q.3405 "IPv6 protocol procedures for broadband services" which defines the Internet Protocol version 6 (IPv6) procedures which support broadband services with IPv6 transition. Currently, SG11 focuses on the development of signalling requirements for telemetry of virtual broadband network services and procedures for programming protocol-independent Packet Processors(p4) switch-based vBNG.

ITU-T SG13 created the ITU-T Focus Group on Technologies for Network 2030 (FG NET-2030) to look at the enhanced broadband, low latency and guaranteed type of communications to be available on the networks of far future around 2030 - 2035. This implies dealing with fixed, mobile, satellite and many networks operation. More about the area of expertise, study and objectives of the group is elaborated in the White Paper, "Network 2030 - A Blueprint of Technology, Applications and Market Drivers Towards the Year 2030 and Beyond" (05.2019): https://www.itu.int/en/ITU-T/focusgroups/net2030/Documents/White_Paper.pdf

https://www.itu.int/en/ITU-T/focusgroups/net2030

ITU-T SG15 is responsible in ITU-T for the development of standards for the optical transport network, access network, home network and power utility network infrastructures, systems, equipment, optical fibres and cables. This includes related installation, maintenance, management, test, instrumentation and measurement techniques, and control plane technologies to enable the evolution toward intelligent transport networks, including the support of smart-grid applications.

More info: http://www.itu.int/ITU-T/go/sg15

IETF

The Large-Scale Measurement of Broadband Performance (LMAP) Working Group standardised the LMAP measurement system for performance measurements of broadband access devices such as home and enterprise edge routers, personal computers, mobile devices, and set top boxes, whether wired or wireless.

Measuring portions of the Internet on a large scale is essential for accurate characterisations of performance over time and geography, for network diagnostic investigations by providers and their users, and for collecting information to support public policy development. The goal is to have the measurements (made using the same metrics and mechanisms) for a large number of points on the Internet, and to have the results collected and stored in the same form.

https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#BImap

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

INSPIRE

Thematic working group utility and government services from European Commission Joint Research Centre set out on 2013 "Data Specification on Utility and Government Services — Technical Guidelines", a "non-paper" document.

SMART 2012/2022

A "Broadband and infrastructure mapping study" contracted by the European Commission.

http://www.broadbandmapping.eu.

SMART 2016/0046

"Study on Fixed and Mobile Convergence in Europe"

The project is expected to facilitate the identification of key elements to define a common European standard to measure network performance taking into account on-going international standardisation activities for network performance measurements with a view to align European and international efforts in this domain while ensuring the involved of relevant stakeholders.

https://ec.europa.eu/digital-single-market/en/news/study-fixed-and-mobile-convergence-europe-2017

VIRGO

In the context of standards-based infrastructure mapping, a European project VIRGO (Virtual Registry of the Ground Infrastructure) began in 2014 with a focus on mapping cloud computing. It is coordinated by Infratel Italia which is active in broadband mapping in Italy.

ECC REPORT 195

The Electronic Communications Committee (ECC) drafted Report 195, ´Minimum Set of Quality of Service Parameters and Measurement Methods for Retail Internet Access Services´.

http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP195.PDF

ECC recommendation (15)03, ´Provision of Comparable Information on Retail Internet Access Service Quality´.

http://www.erodocdb.dk/Docs/doc98/official/pdf/REC1503.PDF

ITU-T PROJECTS

The ITU-T reference guide G.1011: ITU-T has a suitable recommendation for the QoS of different types of most important services in its reference guide G.1011, Table 9-1.

https://www.itu.int/rec/T-REC-G.1011/en

ITU-T interactive transmission maps of backbone broadband connections worldwide. The scope of this ITU project is to research, process and create maps of core transmission networks (optical fibres, microwaves, submarine cables and satellite links) for the following ITU regions: Arab region, CIS region, the EUR region, the Asia-Pacific region, the North America region, Latin America and the Caribbean region, and the Africa region.

http://www.itu.int/en/ITU-D/Technology/Pages/InteractiveTransmissionMaps.aspx

3.1.8 ACCESSIBILITY OF ICT PRODUCTS AND SERVICES

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

Accessibility of ICT products and services includes telecommunications, audio-visual media services, **digital services and platforms**, the web and new emerging technologies. ICT accessibility is complemented by assistive technology. Interoperability of the two is required to ensure access by persons with disability to ICT and ICT based services on equal basis with others. **Due to rapid digitalisation of all aspects of life due to European Union's digital agenda and COVID-19, accessibility of e-education, teleworking, e-governance, e-health and other digital aspects of private and public services is essential for persons with disabilities to participate in society at equal level with other citizens.**

In this specific policy area, the Directive on the accessibility of public sector bodies' websites and mobile applications is covered by a harmonised standard based on globally agreed web accessibility guidelines. This area also relates to the Directive on accessibility of products and services, also referred to as the European Accessibility Act. In addition to the possibility to adopt harmonised standards the European Accessibility Act, adopted in 2019, allows for the adoption of technical specifications that would provide presumption of conformity with the accessibility requirements of the Directive. Relevant EU policies also include the European Electronic Communication Code (EECC), Audiovisual Media Services Directive, EU Digital Education Action Plan, as well as future EU policies on Digital Services (DSA, DMA), and Artificial Intelligence (AI Regulation).

The above mentioned policies are in support of the EU implementation of the UN Convention on the Rights of Persons with Disabilities to which the EU and Member States are a party. It is important to note that under the Convention state parties are obliged to remove accessibility barriers and to adopt and promote a design for all approach in the development of standards and guidelines **(Article 9 – accessibility).**

On 14 January 2020 the Commission adopted a Communication on a Strong Social Europe for Just Transitions, to prepare the way for an action plan to reinforce the implementation of the European Pillar of Social Rights. In the context of Pillar Principle 17 on the inclusion of persons with disabilities, the Communication recognises that people with disabilities continue to face difficulties in accessing education and training, employment, social protection systems and health care in the Member States.

In March 2021, the Commission adopted Strategy for the Rights of Persons with Disabilities 2021-2030, an aim of which is to support the implementation of the UN Convention within the EU.

The Strategy recognizes the "*limited accessibility of ICT tools necessary for teleconferencing, telework arrangements, distance learning, online shopping, and access to COVID-19 related information*" (p.5). To solve some of the accessibility gaps, the Strategy has proposed several measures for the coming years, including:

- the foundation of a European resource centre called AccessibleEU to increase coherence in accessibility policies and facilitate access to relevant knowledge;
- providing guidance to Member States to support the implementation of the accessibility obligations under the public procurement Directives, and promote training for public procurers to buy accessible
- ensuring accessibility and inclusiveness in the reinforced EU digital government strategy, focusing on human-centric and user-friendly digital public services across Europe that respond to the needs and preferences of European citizens, including the needs of persons with disabilities
- evaluating the effectiveness of the Web Accessibility Directive (p.8).

The Strategy also highlights the importance and aims of ensuring accessible digital education, healthcare, art, culture, recreation, leisure, sport, and tourism; ensuring accessible EU policy-making for all citizens; and continuous removal and prevention of barriers by all services for staff and public with disabilities (e.g. accessible ICT equipment and tools for online meetings) of EU institutions.

Regulation 1025/2012 on European standardisation states:

"(24) The European standardisation system should also fully take into account the United Nations Convention on the Rights of Persons with Disabilities. It is therefore important that organisations representing the interests of consumers sufficiently represent and include the interests of people with disabilities. In addition, the participation of people with disabilities in the standardisation process should be facilitated by all available means".

(A.2) EC perspective and progress report

Standardisation needs arise, for instance from the UN Convention, Article 9 of which requires the development of accessibility standards, and from the general obligations to promote universal design when drafting standards. Work on this area needs to advance at European level, where possible in coordination with related work at international level, and to support harmonised market requirements within Europe.

In October 2016, Directive (EU) 2016/2102 on the accessibility of public sector bodies' websites and mobile application was published in the Official Journal. This directive, also referred to as the Web Accessibility Directive (WAD), includes a presumption of conformity with the accessibility requirements set out in Article 4 for content of websites and mobile applications which meet the relevant harmonised standards. At the time of publication, this presumption of conformity was provided by the relevant clauses of the European standard EN 301 549 v1.1.2 (2015-04). This standard was the result of the policy Mandate 376.

In April 2017, the European Commission issued standardisation request M/554 to the European standardisation organizations, CEN, CENELEC and ETSI. The purpose of this request was to develop an appropriate harmonised European standard (hEN), based on the standard EN 301 549 V1.1.2 (2015-04), covering the essential requirements included in the WAD. This standardisation request was accepted in June 2017, with the creation of the CEN-CENELEC-ETSI Joint Working Group on eAccessibility (including collaboration of the W3C). The working group revised EN 301 549 accordingly, leading to EN 301 549 V2.1.2 (2018-08) being adopted and published by the ESOs .

Subsequently, following the fitness checks required under the standardisation Regulation, and in line with its obligations under the WAD, the Commission published the references to this new European standard on December 20, 2018 in the Commission Implementing Decision (EU) 2018/2048.

The standard EN 301 549 V2.1.2 (2018-08) on the "Accessibility requirements for ICT products and services" thus became a harmonised standard and now provides a presumption of conformity to the Directive. The Directive also requires drafting of a methodology for monitoring the conformity of websites and mobile applications with the requirements, as well as a model accessibility statement to be used by public sector bodies to provide in a comprehensive and clear manner, details on the compliance of their websites and mobile applications with the Directive. This has been realised, respectively, through the Commission Implementing Decision (EU) 2018/1524 of 11 October 2018 establishing a monitoring methodology and the arrangements for reporting by Member States in accordance with the WAD and the Commission Implementing Decision (EU) 2018/1523 of 11 October 2018 establishing a model accessibility statement in accordance with Directive (EU) 2016/2102 .

The first draft of the Standardisation Request to support the implementation of the Directive (EU) 2019/882 of the European Parliament and of the Council of 17 April 2019 on the accessibility requirements for products and services, also referred to as the European Accessibility Act (EAA) asks for a new revision of EN 301 549.

In March 2021 a new version of the standard was published: EN 301 549 V3.2.1 (2021-03). This version was submitted to the Commission for referencing in the Official Journal. According to Commission Implementing Decision (EU) 2021/1339 of 11 August 2021 amending Implementing Decision (EU) 2018/2048 as regards the harmonised standard for websites and mobile applications, EN 301 549 V3.2.1 (2021-03) is the new harmonised standard conferring a presumption of conformity with the corresponding essential requirements of the Web Accessibility Directive (WAD).

In April 2019, Directive (EU) 2019/882 of the European Parliament and of the Council of 17 April 2019 on the accessibility requirements for products and services, also known as the European Accessibility Act (EAA) was adopted by the European Union. The Act is subject to national transposition by Member States by June 2022. A draft Standardisation Request to the ESOs is under discussion and targetted to be finalised by the end of 2021.

In the meantime, in June 2021, as required by Article 15 (presumption of conformity), the European Commission has in accordance with Article 10 of Regulation (EU) No 1025/2012, submitted a first draft request to the European standardisation organisations to draft harmonised standards for the product accessibility requirements set out in Annex I of the Act.

Namely, the Commission has requested

- the development of:

- Harmonised standard(s) setting up requirements on the accessibility of non ICT information related to products
- Harmonized standard for the accessibility of support services related to products and services (help desks, call centres, technical support, relay services and training services)
- Harmonized standard for the accessibility of emergency communications and for the answering of emergency communications by the PSAPs (including to the single European Emergency number 112)

- the revision of:

EN 301 549 Accessibility requirements for ICT products and services

EN 17161:2019 Design for All - Accessibility following a Design for All approach in products, goods and services - Extending the range of users

EN 17210Accessibility and usability of the built environment - Functional requirements

(A.3) REFERENCES

- **Directive (EU) 2016/2102**of the European Parliament and of the Council of 26 October 2016 on the accessibility of the websites and mobile applications of public sector bodies. The Web Accessibility Directive.
- Commission Implementing Decision (EU) 2018/1524 of 11 October 2018 establishing a monitoring methodology and the arrangements for reporting by Member States. The monitoring and reporting requirements.
- Commission Implementing Decision (EU) 2018/1523 of 11 October 2018 establishing a model accessibility statement. The model Accessibility Statement.
- Commission Implementing Decision (EU) 2021/1339 of 11 August 2021 amending Implementing Decision (EU) 2018/2048 as regards the harmonised standard for websites and mobile applications
- **Directive (EU) 2019/882**of the European Parliament and of the Council of 17 April 2019 on the accessibility requirements for products and services. - The European Accessibility Act.
- The UN Convention on the Rights of Persons with Disabilities (UN CRPD).
- General comment No. 2 (2014) Article 9: Accessibility.
- **Directive (EU) 2018/1808**of the European Parliament and of the Council of 14 November 2018 amending Directive 2010/13/EU on the coordination of certain provisions laid down by law, regulation or administrative action in Member States concerning the provision of audiovisual media services (Audiovisual Media Services Directive) in view of changing market realities
- **Directive (EU) 2018/1972**of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code (Recast)**,** which builds on the Tallinnand Berlin Declarations and refers to the WAD and the EAA as references also for the implementation.
- **,** which refers to the principles of universal design and accessibility.
- Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on roaming on public mobile communications networks within the Union(recast), which highlights supporting aim of Directive (EU)2018/1972 to ensure that access for end-users with disabilities to emergency services is available through emergency communications and is equivalent to that enjoyed by other end-users.
- **The Commission's eGovernment Action Plan 2016 - 2020**, which also refers to accessibility.Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement (esp. Articles 42 and 62). that contains the obligation to "buy accessible".
- The Digital Education Action Plan (2021-2027) is a renewed European Union (EU) policy initiative to support the sustainable and effective adaptation of the education and training systems of EU Member States to the digital age. It highlights accessible and inclusive digital educations for all, including learners with disabilities.
- **The Disability Strategy 2010-2020** (PDF).
- The Commission's **Strategy for the Rights of Persons with Disabilities 2021-2030**.

(B.) REQUESTED ACTIONS

ACTION 1 SDOs to produce a technical report describing requirements for ICT products and services to be designed to meet the needs of persons with cognitive and learning disabilities; the report should propose enhancements to relevant existing standards and identify needs for further standardisation such as the development of measurable requirements for cognitive accessibility to be included in the standards implementing relevant legislation. Special focus should be on ICT products and services that are based on emerging technologies, such as natural language processing, wearables, virtual and augmented reality, as well as biometrics and enhanced ICT security that should be designed to meet the needs of persons with cognitive and learning disabilities.

ACTION 2 SDOs to continue work on the implementation of the methodology developed under M/473, providing that new standardisation deliverables including the European standards comply with the methodology for mainstream accessibility in standardisation processes and the revision of existing standards in line with what it was agreed in the Mandate deliverable 3.1

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

M/554

M/554 has been issued in April 2017 and requests the development of a Harmonized Standard (hEN) covering the essential requirements included in the Directive on the accessibility of the websites and mobile application of public sector bodies, based on the EN 301 549 V1.1.2 (2015-04). CEN, CENELEC and ETSI accepted this standardisation request in June 2017. As a consequence of this mandate, EN 301 549 has been revised accordingly by the CEN-CENELEC-ETSI Joint Working Group on eAccessibility (with collaboration of W3C). EN 301549 V2.1.2 and was adopted and published at https://www.etsi.org/deliver/etsi_en/301500_301599/301549/02.01.02_60/en_301549v020102p.pdf. The hEN also refers to the recent W3C standard WCAG 2.1, which include accessibility requirements useful for mobile application accessibility.

The mandate also foresaw a revision of the hENbeyond web and mobile accessibility requirementswhich led to the publication of EN 301 549 V3.1.1 in November 2019, andpublished with some corrections in March 2021. EN 301 549 V3.2.1 is available at https://www.etsi.org/deliver/etsi_en/301500_301599/301549/03.02.01_60/en_301549v030201p.pdf

M/376

This addressed ICT accessibility standardisation at European level; it takes into consideration relevant national and international standards on accessibility, e.g. those adopted by the US Access Board, W3C WAI and some related ISO work. The resulting EN 301 549 standard and other related deliverables have been published and contains the requirements of WCAG 2.1. This standard will be revised under the standardisation request for the European Accessibility Act.

http://ec.europa.eu/enterprise/standards_policy/mandates/database/index.cfm?fuseaction=search.detail&id=333#; http://webapp.etsi.org/WorkProgram/Report_WorkItem.asp?WKI_ID=30873

M/473

This is standardisation work aiming to mainstream accessibility following `design for all' principles in relevant European standardisation initiatives (other than M/376); in addition the required development of a standard to support manufacturers and service providers including accessibility following design for all, and to facilitate the implementation of the accessibility provisions in European standards, has been successfully completed with the adoption of EN 17161. This EN is relevant for mainstreaming accessibility in the majority of the standardisation work covered by this Rolling Plan. This EN will be revised under the standardisation request for the European Accessibility Act.

http://www.etsi.org/images/files/ECMandates/m473.pdf

M/420

This mandate, while focusing on accessibility of the built environment, also includes ICT that is used in that context. The EN 17210 has been published in 2021. This EN will be revised under the standardisation request of the European Accessibility Act.

http://ec.europa.eu/enterprise/standards_policy/mandates/database/index.cfm?fuseaction=refSearch.search#

in preparation Standardisation Request addressing requirements of the EAA

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN-CENELEC-ETSI

A further version of the EN has been published by CEN, CENELEC and ETSI in March 2021 solving some errors detected in the previous edition and improving its usability. This new edition, EN 301 549 V3.2.1 (2021-03) (EN 301549:2021) was developed to meet the essential requirements included in the Directive on the accessibility of the websites and mobile application of public sector bodies. Currently, further revisions are being planned in response to the standardisation request to the European standardisation organizations as regards the accessibility requirements of products and services in support of Directive (EU) 2019/882 of the European Parliament and of the Council. The 1st draft of this Standardisation Request, launched in June 2021, asks for a revision of EN 301 549 to describe the technical solutions for accessibility to ensure conformity with the accessibility requirements of the EAA, as well as to cover the accessibility specifications to be followed when designing, constructing, maintaining and updating websites and mobile applications according to the Web Accessibility Directive.

CEN-CENELEC

CEN-CENELEC/TC 11 recently published the standardisation deliverables in relation with M/420, which include the following deliverables:

EN 17210:2021 Accessibility and usability of the built environment - Functional requirements

CEN/TR 17621:2021 Accessibility and usability of the built environment - Technical performance criteria and specifications

CEN/TR 17622:2021 Accessibility and usability of the built environment - Conformity assessment"

ISO/IEC JTC1

The work ISO/IEC JTC1 SWG-A was doing (TR 29138-2) was passed to JTC1 SC35.

A framework for personalization and adaptation of user interfaces at runtime, based on the context of use (consisting of a user's needs and preferences, their envisioned tasks, their equipment, and environmental parameters of interaction). The framework is based on the well-known REST protocol, and JSON and XML formats. A registry-based approach is employed for the definition of terms

describing a user's personal preferences and needs.

Published standards:

ISO/IEC JTC 1 SC36

ISO/IEC 24571-1 Information Technology – Individualised adaptability and accessibility in e-learning, education and training – Part 1: Framework and reference model

ISO/IEC JTC 1 SC 35

ISO/IEC DIS 24752-8 Information technology -- User interfaces -- Universal remote console -- Part 8: User interface resource framework

CEN

CEN formed a Strategic Advisory Group on Accessibility (SAGA) to consider how to address accessibility throughout the standardisation process; this group includes representatives of national standards bodies, CENELEC and ETSI, and organisations representing persons with disabilities and older people.

DIN

DIN is preparing a national standard DIN 13278 "Smart mobility for people with reduced mobility". The idea is that people with disabilities can communicate in public spaces, e.g. with public transport or traffic lights. It is planned to submit the finished document as a national project proposal at European level.

ETSI

ETSI continues to produce accessibility standards on specific ICT topics. The effort will focus on standardisation related to the EAA. Revisions of the EN 301 549 and a range of other relevant standards and reference documents will be central, along with a series of plugtests to ensure interoperability and quality of total conversation, exploring and defining the concept of reference terminal from EN 301 549; a guide to user-centred terminology for existing and upcoming devices and services is underway as well as work on recommendations for development of ICT to meet the needs of people with cognitive disabilities; initial early investigations are being made into transmission quality and its possible link to reported intelligibility problems for some hearing-impaired people; see also EG 202 952, a set of guidelines to identify "Design for All" aspects in ETSI deliverables.

ETSI has initiated a programme to develop methods for objective assessment of Listening effort, in particular for speech in the presence of background noise. The results are available in TS 103 558". STF 575 (closed) produced results of subjective tests and of objective model at the acoustical interface. Current STF 590 is dedicated to the electrical interface and will provide results of subjective tests for different types of terminals and several network impairments.

This database, built with normal hearing people, gives a reference to develop further studies dedicated to hearing impaired people. As there are a lot of different hearing impairments, it will be needed to define typical types of hearing impairments and reference signal amplifications (level and frequency enhancement) in order to compute loudness and listening effort, in association with subjective tests."

http://www.etsi.org/technologies-clusters/technologies/human-factors/accessibility;
http://webapp.etsi.org/WorkProgram/Report_WorkItem.asp?WKI_ID=35174;
http://webapp.etsi.org/WorkProgram/Report_WorkItem.asp?WKI_ID=37153;
http://webapp.etsi.org/WorkProgram/Report_WorkItem.asp?WKI_ID=35796
https://portal.etsi.org/webapp/WorkProgram/Report_WorkItem.asp?WKI_ID=58838

IEC

IEC TC 100/TA 16 is producing international publications addressing aspects of active assisted living (AAL), including issues related to accessibility, usability and specific user interfaces related to audio, video and multimedia systems and equipment within the scope of TC 100.

http://www.iec.ch/dyn/www/f?p=103:7:0::::FSP_ORG_ID,FSP_LANG_ID:11009,25

IEEE

IEEE has standards and pre-standards activities that support greater accessibility of ICT products and services, including making certain diagnostic tools more available to underserved communities (https://standards.ieee.org/project/2650.html), measuring the accessibility user experience (https://standards.ieee.org/project/2843.html), for building accessible applications (https://standards.ieee.org/project/2998.html), and ethical and inclusion considerations (Digital Inclusion, Identity, Trust, and Agency (DIITA): https://standards.ieee.org/industry-connections/diita/index.html).

https://ieeesa.io/rp-accessibility

IETF

Relevant work may be found in the ART area. For instance RFC 3551 identifies the requirements for SIP to support the hearing impaired and RFC4103 defines the RTP payload for text conversation.

RFCs 4103 and 5194 are being referenced in various accessibility regulations being proposed in the US (Section 255/508) and EU (e.g. M376).

https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#ICTAccess

ISO

ISO/IEC Guide 71, Guidelines for standards developers to address the needs of older persons and persons with disabilities was published in 2014 and adopted by CEN and CENELEC as CEN/ CENELEC guide 6:2014. ITU also adopted it as H-Series Supplement 17.

JTC1 SWG-A (special working group on accessibility) has been disbanded. Work has been transferred to ISO/IEC/JTC1 SC35 (User Interfaces). https://www.iso.org/standard/57385.html

ISO/TC 59/SC 16 has approved ISO 21542:2021, Building construction — Accessibility and usability of the built environment. This documents withdraws ISO 21542:2011, which was the main base for the drafting of EN 17210.

ISO/TC 59/SC 16 is working on ISO/NP 5727, Accessibility and usability of the built environment — Accessibility of immovable culturalheritage — General criteria and methodology for interventions.

ITU

ITU-T and ITU-R have produced relevant work on accessibility and human factors. Relevant information is found in the ITU Accessibility

Portal:

https://itu.int/en/ITU-T/accessibility

Additionally, more details on the Radiocommunication Sector contribution to Bridging the Digital Disabilities Divide can be found at: https://www.itu.int/en/ITU-R/information/Pages/disabilities-divide.aspx

Within ITU-T SG16, related technical groups include Question 26/16 on accessibility and Question 24/16 on human factors, which include various experts with disabilities and cooperate with advocacy organizations (such as the G3ict, WFD and RNIB), in addition to other technical groups such as ITU-T, D, R Study Groups and ISO/IEC JTC1 SC35.

More info on Q26/16: https://itu.int/itu-t/workprog/wp_search.aspx?Q=26/16

More info on Q24/16: https://itu.int/itu-t/workprog/wp_search.aspx?Q=24/16

Recommendation ITU-T F.790 on accessibility guidelines for older persons and persons with disabilities is complemented by ITU H-series Supplement 17 (2014), which mirrors the new edition of ISO/IEC Guide 71 containing guidelines for standards developers to address the needs of older persons and persons with disabilities.

More info on ITU-T F.790: https://itu.int/rec/T-REC-F.790

More info on ITU H-series Supplement. https://itu.int/rec/T-REC-H.Sup17

ITU-T F.791 contains recommended terminology for accessibility for use in the international context and assists in defining context for procurement activities of accessible systems and services: https://itu.int/rec/T-REC-F.791

The checklist in ITU-T FSTP-TACL describes how to prepare ICT standards that include accessibility from their inception. Two other ITU-T technical papers describe arrangements for accessible meetings and for accessible remote participation in meetings (FSTP-AM — Guidelines for accessible meetings; and FSTP-ACC-RemPart — Guidelines for supporting remote participation in meetings for all) that aim at increasing the participation of persons with disabilities at real and virtual meetings. ITU-T technical papers on accessibility: https://itu.int/pub/T-TUT-FSTP

ITU-T F.921 (08/2018) "Audio-based network navigation system for persons with vision impairment" explains how to accommodate the users' experience of inclusive audio-based network navigation systems and ensure their interoperability: https://itu.int/rec/T-REC-F.921.

ITU-T F.930 (03/2018) "Multimedia telecommunication relay services", which provides a functional description of four common types of relay services in use today: text relay, video relay, captioned telephone service relay and speech-to-speech relay. Telecommunications relay services enable persons who have hearing or speech disabilities and who otherwise would be unable to engage in voice telecommunications, to make voice telephone calls to other persons: https://www.itu.int/rec/T-REC-F.930

Recent completed work includes ITU-T H.871 (07/2019) "Safe listening guidelines for personal sound amplifiers (PSAs)" which provides characteristics of PSAs and suggests ways of informing consumers about the potential unacceptable noise levels when using these devices for prolonged periods of time: https://www.itu.int/rec/T-REC-H.871

systems for broadcasting and the latest umbrella document is Report ITU-R BT 2207-4 "Accessibility to broadcasting services for persons with disabilities": https://www.itu.int/pub/R-REP-BT.2207-4-2018

ITU-D SG1 Question 7 on "Access to telecommunication/ICT services by persons with disabilities and other persons with specific needs"" also works on providing access to telecommunication/ICT services by persons with disabilities and other persons with specific needs.

There are coordination mechanisms within ITU sectors as well as with organizations outside ITU in terms of accessibility activities:

- Intersector Rapporteur Group Audiovisual Media Accessibility (IRG-AVA) for joint work between ITU-T and ITU-R on audiovisual media accessibility: https://www.itu.int/en/irg/ava
- Joint Coordination Activity on Accessibility and Human Factors (JCA-AHF) for coordination and awareness raising on accessibility and human factors in standardisation in ITU each sectors and groups outside ITU: https://www.itu.int/en/ITU-T/jca/ahf

W3C

W3C Web Content Accessibility Guidelines (WCAG) - accessibility of content, including text, images, audio, video, coding and markup, forms, and other types of media https://www.w3.org/WAI/intro/wcag

W3C Authoring Tool Accessibility Guidelines (ATAG) - accessibility of code editors, content management systems (CMS), and other software used to create web content https://www.w3.org/WAI/intro/atag

W3C User Agent Accessibility Guidelines (UAAG) - accessibility of web browsers, media players, and some types of assistive technologies and mobile applications https://www.w3.org/WAI/intro/uaag

W3C Accessible Rich Internet Applications (WAI-ARIA) - accessibility of dynamic content and applications https://www.w3.org/WAI/intro/aria

Both WCAG 2.0 and WCAG 2.1 continue to co-exist as operational W3C standards. To support harmonization and interoperability, WCAG can also be obtained as:

ISO/IEC 40500:2012 - currently the same as WCAG 2.0 (update to WCAG 2.1 is being explored by W3C);

EN 301 549 includes all WCAG 2.1 Success Criteria and Conformance Requirements (fully harmonized). It also applies WCAG 2.1 requirements to Non-Web Software (eg. mobile applications) and Non-Web Documents (e.g. electronic files).

W3C is currently working on WCAG 2.2 as well as a third generation of the guidelines (commonly referred to with project name "Silver"). Specific focus continues to be on areas including mobile, cognitive, and low-vision accessibility, personalisation, pronunciation, and conformance testing – see https:/www.w3.org/WAI

W3C also provides non-normative technical guidance, such as Techniques for WCAG 2 and Understanding WCAG 2, and WCAG Evaluation Methodology (WCAG-EM)

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

AALIANCE2

Next Generation European Ambient Assisted Living Innovation; FP7 repository of existing standards

http://www.aaliance2.eu/

WAI ACT

A cooperation framework for guidance on advanced technologies, evaluation methodologies, and research agenda setting to support eAccessibility

http://www.w3.org/WAI/ACT/

WAI-COOP

Supporting implementation of the EU web accessibility directive and international standards for digital accessibility, including the W3C Web Content Accessibility Guidelines (WCAG) and the EN 301 549. Project in January 2021. https://www.w3.org/WAI/about/projects/wai-coop/

WAI DEV

Developing strategies to support mainstream production of inclusive components and services and showcasing good practice in inclusive design http://www.w3.org/WAI/DEV/

WAI-TOOLS

Develops W3C Accessibility Conformance Testing (ACT) Rules to facilitate harmonized accessibility testing across EU Member States and internationally, and develops demonstrator monitoring in Portugal and Norway as examples for other EU Member States https://www.w3.org/WAI/about/projects/wai-tools/

WAI-GUIDE

Develops open curricula on web accessibility to help organizations across EU Member States and internationally to develop their own courses, promotes accessibility of authoring tools with focus on specific industries, and develops accessibility use cases for emerging technologies https://www.w3.org/WAI/about/projects/wai-guide/

EASY READING

Researches user needs for cognitive and learning disabilities and develops tooling using personalization techniques in close cooperation with end-users, and exchanges research findings with W3C standardisation on cognitive accessibility and personalization

EIII

European Inclusion Internet Initiative: partners among others including Dutch, Danish, Italian and Iceland governments. The initiative was completed in December 2015

PROSPERITY4ALL

Develops the infrastructure and ecosystem that will allow for a ubiquitous auto-personalisation of interfaces and materials, based on user needs and preferences, to grow; it builds on the infrastructure provided by Cloud4All in order to create more parts of the GPII http://www.prosperity4all.eu; http://www.cloud4all.info/; http://gpii.net/

RAISING THE FLOOR CONSORTIUM

Mission is to make the web and mobile technologies accessible to everyone with disability, literacy and ageing-related barriers, regardless of their economic status http://raisingthefloor.org

SMART 2014 /0061

Monitoring methodologies for web accessibility in the European Union. The objective of the study is to collect information on the monitoring methodologies for verification of compliance with web accessibility requirements in the different Member States www.monitor-wa.eu

EDF'S "PLUG AND PRAY"

A disability perspective on artificial intelligence, automated decision-making and emerging technologies" report looks at the impact of emerging technologies on the lives of persons with disabilities. It also provides recommendations to industry, policy makers, organisations of persons with disabilities and academia on how to best ensure that the gains of emerging technologies are equally distributed and potential risks avoided/minimised. http://www.edf-feph.org/newsroom/news/edf-launches-report-plug-and-pray

EDF

Plug and Pray? A disability perspective on artificial intelligence, automated decision-making and emerging technologies" report looks at the impact of emerging technologies on the lives of persons with disabilities. It also provides recommendations to industry, policy makers, organisations of persons with disabilities and academia on how to best ensure that the gains of emerging technologies are equally distributed and potential risks avoided/minimised. https://www.edf-feph.org/publications/plug-and-pray-2018/

WE4AUTHORS PROJECT

We4authors is the acronym of "Pilot on web accessibility for web authoring tools producers and communities", a European Pilot Project led by Funka.

It consists of a set of focused initiatives with the most relevant and used licensed and open source CMS in public sector in Europe, that fosters and facilitates the incorporation of accessibility features as the default option in authoring tools. https://www.funka.com/en/projekt/we4authors/what-is-we4authors/

(C.3) ADDITIONAL INFORMATION

Accessibility needs to be ensured in ICT and many other areas (such as emergency communication, digital cinema, e-health, ICT used in public transport, ICT used in tourism, and e-learning, Internet of Things, emerging technologies/ artificial intelligence, e-identification and e-governance systems, e-call, e-procurement, e-invoicing, e-payments, smart cities, European electronic toll service, intelligent transport/automated vehicles, advanced manufacturing, robotics, audiovisual media and telecommunications, etc.) both for users with disabilities in the general public and for staff/entrepreneurs with disabilities in industry or public administration.

For this purpose, accessibility priorities raised in this chapter (3.1.10 Accessibility of ICT products and services) should be mainstreamed in relevant chapters of the Rolling Plan 2022.

The following list has been compiled from views expressed by some Member States and experts in the field. The list is intended to trigger further discussion with all stakeholders on possible future actions*:

- Investigating accessibility features in standards for e-voting.
- Investigating harmonisation of quality standard for access services in audiovisual media services (subtitles for the deaf and hard of hearing, spoken subtitles, audio description and sign language interpretation).
- Investigating how mobile devices are useful to people with dexterity problems and reduced mobility and other type of disability when interacting with other ICT products and services; widening the scope (i.e. beyond mobile devices) of guidelines related to diminished motor control e.g. people with advanced Parkinson or similar disorders who can hardly or no longer write is also needed
- Applying standardisation of broadcasters accessible interfaces to IP (and other) systems.
- Convergence and interoperability of video relay services.
- Accessible hybrid TV services.

Specification of requests for translation among languages, image and text representations, particularly those overcoming accessibility issues, e.g voice to text like automation of relay services for telephony and capturing/subtitling TV transmissions for hearing-impaired people.

Text to voice, like automatically generated audio description for blind citizens.

Text to sign language, like automatically generated sign language** for deaf and hard of hearing people.

Identification of accessibility issues, requirements and associated standardisation needs related to:

- non-literate and dyslexic users; these requirements may turn out to be equally applicable for foreign users unable to understand available user interface languages.
- security and privacy features of ICT services and devices (see below and sections security and ePrivacy) .

Users have to use increasingly complex security procedures to access the services that they rely on. Attempts to increase security frequently include mechanisms that many users, particularly those with physical and cognitive disabilities, are unable to successfully handle without adopting highly insecure strategies such as writing down complex usernames and passwords. There is a need to provide standards and guidance on accessible security mechanisms that are compatible with human abilities, and appropriate to the type of service being used. In this context, the benefit of using of new technologies like biometrics or RFID could be evaluated.

This accessibility component of privacy and security issues could be addressed in general development following M/473 or, preferably, be mainstreamed in general privacy and security work.

Standards could be evaluated to produce a guide to user-centred terminology for all potential users in several EU languages, focusing on the benefits for those with learning and cognitive disabilities. The preponderance of different names for the same ICT features and functions is confusing for all people, but this can be a significantly more important problem for older users or users with learning and cognitive disabilities. This has a negative impact on individual citizens and on the size of the ICT market. A guide would provide benefits for all potential users, particularly older users and users with learning and cognitive impairments who are currently partly excluded from benefiting from the use of modern ICT.

*mentioned future actions should be done in close cooperation with users and organisations representing users relevant accessibility measures are aiming to address.

** So long as quality of automatically generated sign language interpretation remains lower than quality of trained human interpreters, these are not preferred measure of ensuring accessibility for deaf and and other sign language users. https://2tdzpf2t7hxmgqqhq3njno1y-wpengine.netdna-ssl.com/wp-content/uploads/2017/02/WFD-and-WASLI-Statement-on-Avatar-FINAL-14032018-Updated-14042018-1.pdf"

3.1.9 ARTIFICIAL INTELLIGENCE

Although there is no generally accepted definition of Artificial intelligence (AI), in 2019, the Organisation for Economic Co-operation and Development (OECD) adopted the following definition of an AI system: 'An AI system is a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments. AI systems are designed to operate with varying levels of autonomy.'

AI-based systems can be purely software-based, acting in the virtual world (e.g. voice assistants, image analysis software, search engines, speech and face recognition systems) or AI can be embedded in hardware devices (e.g. advanced robots, autonomous cars, drones or Internet of Things applications) or a combination of both.

We are using AI on a daily basis, e.g. to translate languages, generate subtitles in videos or to block email spam. Beyond making our lives easier, AI is helping us to solve some of the world's biggest challenges: from treating chronic diseases or reducing fatality rates in traffic accidents to fighting climate change or anticipating cybersecurity threats. Like the steam engine or electricity in the past, AI is transforming our world, our society and our industry.

The term AI was coined in 1956. Since then, the research on AI included a large variety of computing techniques and spread over many different application areas. Historically the development of AI has alternated some periods of fast development, called 'AI springs', with other periods of reduced funding and interest, called AI winters. Currently, AI is experiencing another spring, which is motivated by three main driving factors: the huge amount of available data generated by the world-wide-web and sensor networks, the affordability of high-performance processing power, even in low-cost personal devices, and the progress in algorithms and computing techniques. Another characteristic of the present AI wave is that it goes far beyond the research community and targets product innovations and business-oriented services with high commercial potential, which assures its sustainability.

The way of approaching AI will shape the digital future. In order to enable European companies and citizens to reap the benefits of AI, we need a solid European strategy and framework.

A new EU strategy on AI was published on 25th April 2018, in the Commission Communication on Artificial Intelligence for Europe. One of the main elements of the strategy is an ambitious proposal to achieve a major boost in investment in AI-related research and innovation and in facilitating and accelerating the adoption of AI across the economy.

The target was to reach a total of €20 billion in AI-related investment, including both the public and the private sector, for the three years up to 2020. For the decade after, the set goal is to reach the same amount as an annual average. This is of crucial importance if we want to ensure that the EU can compete on a global scale with regard to AI development and uptake. .

In December 2018, the Commission presented a Coordinated Plan on AI with Member States to foster the development and use of AI. It represents a joint commitment that reflects the understanding that, by working together, Europe can maximise its potential to compete globally. The main aims set out in the plan are: to maximise the impact of investments at EU and national levels, to encourage synergies and cooperation across the EU, including and to foster the exchange of best practices.

In February 2020 the Commission issued a White Paper on AI. The overall EU strategy proposed in the White Paper on AI proposes an ecosystem of excellence and trust for AI. The concept of an **ecosystem of excellence** in Europe refers to measures which support research, foster collaboration between Member States and increase investment into AI development and deployment. The **ecosystem of trust** is based on EU values and fundamental rights, and foresees robust requirements that would give citizens the confidence to embrace AI-based solutions, while encouraging businesses to develop them. The European approach for AI 'aims to promote Europe's innovation capacity in the area of AI, while supporting the development and uptake of ethical and trustworthy AI across the EU economy. AI should work for people and be a force for good in society.

Following a public consultation, the objectives of the White Paper translated into a key AI package adopted by the Commission on 21 April 2021. This package includes proposal for the first ever legal framework on AI, which addresses the risks of AI and positions Europe to play a leading role globally and 2021 review of the Coordinated Plan.

The proposal for a legal framework is aimed at laying down rules to ensure that AI systems used in the EU are safe and do not compromise fundamental rights. The key elements of the proposal are:

- the definition of AI, which builds on the one elaborated by the OECD

- rules for the definition of high-risk AI systems

- compliance and enforcement mechanisms for the high-risk AI use cases

- rules on the use of remote biometric identification

- mandatory obligations for providers and users of high-risk AI systems

- certain notification obligations for systems posing certain specific transparency risks

The proposal is complementary and applies in conjunction with all existing EU acquis on data protection and fundamental rights.

The 2021 Review of the Coordinated Plan on AI puts forward a concrete set of joint actions for the European Commission and Member States on how to create EU global leadership on trustworthy AI. The proposed key actions reflect the vision that to succeed, the European Commission together with Member States and private actors need to:

accelerate investments in AI technologies to drive resilient economic and social recovery facilitated by the uptake of new digital solutions;

act on AI strategies and programmes by implementing them fully and in a timely manner to ensure that the EU reaps the full benefits of first-mover adopter advantages; and

align AI policy to remove fragmentation and address global challenges

Standardisation activities are one of the action areas identified in the 2021 Coordinated Plan as an area for joint action between European Commission and Member States.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

AI is a field that has had little standardisation activities in the past. However, the big increase in interest and activities around AI in the latest years brings together a need for the development of a coherent set of AI standards. In response to this, ISO and IEC has created a standardisation committee on AI, namely ISO/IEC JTC 1/SC 42, which is most active in the field of AI and big data. A CEN-CENELEC Focus Group on Artificial Intelligence (AI) was also established in December 2018 and roadmap for AI standardisation was published. Subsequently, CEN-CENELEC has created a Joint technical committee, namely CEN-CENELEC JTC 21, which has started its activities on June 1 2021. The professional association IEEE is also very active in investigating and proposing new standards for AI, particularly in the field of ethics.

In addition, ETSI is active in the use of AI in ICT and a summary of current work on AI can be found in a dedicated white paper. In October 2019 ETSI created the ISG on Securing Artificial Intelligence (ISG SAI) focusing on three key areas: using AI to enhance security, mitigating against attacks that leverage AI, and securing AI itself from attack. ISG SAI collaborates closely with ENISA.

The proposal for the new AI Regulation is set as a New-Legislative Framework-type legislation. Hence, the role of harmonised standards will be key to provide the detailed technical specifications through which economic operators can achieve compliance with the relevant legal requirements. Harmonised standards are thus a key tool for the implementation of the legislation and contribute to the specific objective to ensure that that AI systems are safe and trustworthy.

As a consequence of this, the European Commission intends to intensify the elaboration of standards in the area of AI to ensure that standards are available to operators on time ahead of the application date of the future AI framework. In this respect, the Commission intends to issue a first standardisation request in accordance with Regulation (EU) 1025/2012 in the course of 2022. The most likely areas where new AI standards will be required are the ones which are addressed by the future requirements of the AI framework. They will be primarily: Data governance and data quality, Record keeping, provision of information and transparency, trustworthiness, robustness, accuracy and cybersecurity, human oversight, risk management and testing, conformity assessment, quality management system, lifecycle monitoring, users'conduct.

(A.3) REFERENCES

- COM(2020) 65 final**:** White Paper On Artificial Intelligence - A European approach to excellence and trust
- COM(2018) 237**:**Artificial Intelligence for Europe
- **EC** High-Level Expert Group on Artificial Intelligence **(AI HLEG):** Ethics Guidelines for Trustworthy Artificial Intelligence (AI)
- **COM(2021) 206 final**: Proposal for a Regulation laying down harmonised rules on artificial intelligence (Artificial Intelligence Act)
- Coordintated plan on artificial intelligence, 2021 review

B.) REQUESTED ACTIONS

ACTION 1 SDOs should establish coordinated linkages with, and adequately consider European requirements or expectations from initiatives, including policy initiatives, and organisations contributing to the discourse on AI standardisation. This in particular includes the contents of the EU proposal for an AI Regulation and of the standardisation request on AI issued by the European Commission in 2022 as well as the orientations set in the 2021 review of the Coordinated Plan

ACTION 2 SDOs should further increase their coordination efforts around AI standardisation both in Europe and internationally in order to avoid overlap or unnecessary duplication of efforts and aim to the highest quality to ensure a trustworthy and safe deployment of this technology.

ACTION 3 ESOs should coordinate with the Commission and appropriately direct their activities to ensure that the objectives set in the standardisation request on AI issued in 2022 are adequately and timely fulfilled

ACTION 4 Taking into account the cross-sectorial aspects of the proposed AI Regulation and the interactions between the AI Regulation and existing or future sectorial safety legislation (for example the proposed new EU Regulation on machinery products), ESOs shall devote specific attention to the elaboration of standards on the methodology of risk assessment of cyber-physical products powered by AI and on the testing framework.

ACTION 5 SDOs should appropriately consider cybersecurity and related aspects of artificial intelligence, to identify gaps and develop the necessary standards on safety, privacy and security of artificial intelligence, to protect against malicious artificial intelligence and to use artificial intelligence to protect against cyber-attacks

ACTION 6 EC/JRC to coordinate with SDOs and other initiatives on developing a standardisation landscape and gap analysis for AI. This work should include recommendations for an action plan.

ACTION 7 Stakeholders in open source to identify relevant open source projects in the field of AI, e.g. providing tools for testing, benchmarking etc.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN-CENELEC

The CEN-CENELEC JTC 21 on Artificial Intelligence addresses AI standardisation in Europe, both through a bottom-up approach (similar to ISO/IEC JTC 1 SC 42), and a top-down approach concentrating on a long-term plan for European standardisation and future AI regulation.

The JTC shall produce standardisation deliverables in the field of Artificial Intelligence (AI) and related use of data, as well as provide guidance to other technical committees concerned with Artificial Intelligence. The JTC shall also consider the adoption of relevant international standards and standards from other relevant organisations, like ISO/IEC JTC 1 and its subcommittees, such as SC 42 Artificial intelligence. Finally, the JTC shall produce standardisation deliverables to address European market and societal needs and to underpin primarily EU legislation, policies, principles, and values.

The JTC 21 has initiated the following activities:

- Mapping of current European and international standardisation initiatives on AI
- Identifying specific standardisation needs
- Monitoring potential changes in European legislation
- Liaising with relevant TCs and organizations in order to identify synergies and, if possible, initiate joint work
- Acting as the focal point for the CEN and CENELEC TCs
- Encouraging further European participation in the ISO and IEC TCs

Prior to the establishment of JTC 21 the CEN-CENELEC Focus Group on AI explored the possibilities for a dedicated CEN-CENELEC TC on AI. The Focus Group published two documents: a response to the EC white paper on AI as well as the CEN-CENELEC Roadmap for AI standardisation. Both documents are available here. After it completed its tasks the Focus Group on AI was disbanded and documents and assets were transferred to the CEN-CENELEC JTC 21.

ETSI

A summary of ETSI work on AI can be found in a dedicated white paper .

The ETSI ISG on Experiential Networked Intelligence (ENI ISG) is defining a Cognitive Network Management architecture. This is using Artificial Intelligence (AI) techniques and context-aware policies to adjust offered services based on changes in user needs,

environmental conditions and business goals. created in March 2017.

ISG ENI outputs centre around network optimization & Cognitive Network Management architecture highlighted in https://eniwiki.etsi.org/index.php?title=ISG_ENI_Activities this is described further in the whitepaper (https://www.etsi.org/images/files/ETSIWhitePapers/etsi-wp44_ENI_Vision.pdf)

The ETSI ISG on Securing Artificial Intelligence (ISG SAI), created in October 2019, focuses on three key areas: using AI to enhance security, mitigating against attacks that leverage AI, and securing AI itself from attack. ISG SAI collaborates closely with ENISA.

ISG SAI first outputs have centred around six key topics and the following have been published or are in development to date in part in response to Action 5 above:

- Problem Statement, Published in December 2020
- Mitigation Strategy, Published in March 2021
- Data Supply Chain, Published in August 2021
- Threat Ontology for AI, to align terminology
- Security testing of AI
- Role of hardware in security of AI
- Explainability and transparency of AI processing
- Privacy aspects of AI/ML systems

Further details of the current SAI work programme can be found at: https://portal.etsi.org/Portal_WI/form1.asp?tbid=877&SubTB=877

ETSI has other ISGs working in the domain of AL/ML (Machine Learning). They are all defining specifications of functionalities that will be used in technology.

- ISG on Experiential Networked Intelligence (ISG ENI) develops standards that use AI mechanisms to assist in the management and orchestration of the network.
- ISG ZSM is defining the AI/ML enablers in end-to-end service and network management.
- ISG F5G on Fixed 5G is going to define the application of AI in the evolution towards 'fibre to everything' of the fixed network
- ISG NFV on network functions virtualisation studies the application of AI/ML techniques to improve automation capabilities in NFV management and orchestration.

Under the areas of the Rolling Plan where new AI standards are needed, ETSI ISG CIM has published specifications for a data interchange format (ETSI CIM GS 009 V1.2.1 NGSI-LD API) and a flexible information model (ETSI CIM GS 006 V1.1.1) which support the exchange of information from e.g. knowledge graphs and can facilitate modelling of the real world, including relationships between entities.

- ISG on Experiential Networked Intelligence (ISG ENI) develops standards that use AI mechanisms to assist in the management and orchestration of the network. This work will make the deployment of future 5G networks more intelligent and efficient.
- ISG ENI is defining AI/ML functionality that can be used/reused throughout the network, cloud and end devices.
- ISG ZSM is defining the AI/ML enablers in end-to-end service and network management.
- ISG NFV has published a report on enabling autonomous management in NFV-MANO (ETSI GR NFV-IFA 041), which provides recommendations on standardisation work to be carried out on Management Data Analytics (MDA) assisted management in NFV-MANO.

IEC

SEG 10 Ethics in Autonomous and Artificial intelligence Applications

https://www.iec.ch/dyn/www/f?p=103:186:0::::FSP_ORG_ID,FSP_LANG_ID:22827,25

ISO/IEC JTC 1

SC 42 (Artificial Intelligence) is looking at the international standardisation of the entire AI ecosystem. With 8 published standards and 22 current projects under development and 6 working groups, the program of work has been growing rapidly and continues to grow in 2021. Key items within the work programme include:

The following is the list of published SC 42 standards:

- ISO/IEC 20546:2019 Information technology — Big data — Overview and vocabulary
- ISO/IEC TR 20547-1:2020 Information technology — Big data reference architecture — Part 1: Framework and application process
- ISO/IEC TR 20547-2:2018 Information technology — Big data reference architecture — Part 2: Use cases and derived requirements
- ISO/IEC 20547-3:2020 Information technology — Big data reference architecture — Part 3: Reference architecture
- ISO/IEC TR 20547-5:2018 Information technology — Big data reference architecture — Part 5: Standards roadmap
- ISO/IEC DTR 24027 Information technology -- Artificial Intelligence (AI) -- Bias in AI systems and AI aided decision making
- ISO/IEC TR 24028:2020 Information technology — Artificial intelligence — Overview of trustworthiness in artificial intelligence
- ISO/IEC TR 24029-1:2021 Artificial Intelligence (AI) — Assessment of the robustness of neural networks — Part 1: Overview
- ISO/IEC TR 24030:2021 Information technology — Artificial intelligence (AI) — Use cases
- ISO/IEC 24372 Information technology -- Artificial Intelligence (AI) -- Overview of computational approaches for AI systems

The following is the list of SC 42 projects under development:

WG 1 – Foundational AI standards

- ISO/IEC DIS 22989 Artificial Intelligence Concepts and Terminology
- ISO/IEC 23053 Framework for Artificial Intelligence Systems Using Machine Learning
- ISO/IEC 42001 Artificial Intelligence - Management System

WG 2 – Big data ecosystem

- ISO/IEC 24688 Information technology -- Artificial Intelligence -- Process management framework for Big data analytics
- ISO/IEC 5259-1 Data quality for analytics and ML - Part 1: Overview, terminology, and examples
- ISO/IEC 5259-2 Data quality for analytics and ML - Part 1: Data quality measures
- ISO/IEC 5259-3 Data quality for analytics and ML - Part 1: Data quality management requirements and guidelines
- ISO/IEC 5259-4 Data quality for analytics and ML - Part 1: Data quality process framework

WG 3 - AI Trustworthiness

- ISO/IEC 23894 Information technology -- Artificial intelligence -- Risk management

- ISO/IEC 24368 Information technology -- Artificial Intelligence (AI) -- Overview of Ethical and Societal Concerns
- ISO/IEC 25059 Software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Quality Model for AI systems
- ISO/IEC 8200 Information technology — Artificial intelligence — Controllability of automated artificial intelligence systems

WG 4 – AI Use cases and applications

- ISO/IEC 24030 Information technology -- Artificial Intelligence (AI) -- Use cases (2nd ed.)
- ISO/IEC 5338 Information technology -- Artificial Intelligence (AI) – AI system life cycle processes
- ISO/IEC 5339 Information technology -- Artificial Intelligence (AI) – Guidelines for AI applications

WG 5 – Computational approaches and computational characteristics of AI systems

- ISO/IEC 4213 Information technology — Artificial Intelligence — Assessment of machine learning classification performance
- ISO/IEC 5392 Information technology — Artificial intelligence — Reference architecture of knowledge engineering

ISO/IEC JTC 1/SC 40 & 42 JWG 1

- ISO/IEC 38507 -- Information technology -- Governance of IT -- Governance implications of the use of artificial intelligence by organizations

In addition to the above projects under development, a number of ad hoc groups in the SC 42 WGs are studying topics that cross multiple areas such as:

a) machine learning computing devices

b) ontologies, knowledge engineering, and representation

c) data quality governance framework

d) testing of AI systems

e) AI standards landscape and roadmap

f) coordination with JTC 1 SC 27 on AI security and privacy proposed standards

g) data quality visualization

In addition, SC 42 has developed over 30 active liaisons with ISO and IEC committees, SDOs and industry organizations to encourage collaboration and building out the industry ecosystem around AI and Big Data.

ISO/IEC JTC 1 SC 7 - Software and systems engineering

ISO/IEC 25012:2008 Software engineering — Software product Quality Requirements and Evaluation (SQuaRE) — Data quality model

ISO/IEC TR 29119-11:2020 Software and systems engineering — Software testing — Part 11: Guidelines on the testing of AI-based systems.

IEEE

IEEE has a significant amount of activity in both the fields of Autonomous and Intelligent Systems (A/IS) as well as in related vertical industry domains.

In 2016 the IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems ("The IEEE Global Initiative") started a project called 'Ethically Aligned Design: A Vision for Prioritizing Human Wellbeing with Autonomous and Intelligent Systems. The EAD work was also used by Future of Life Institute (FLI) and Organisation for Economic Co-operation and Development (OECD) to create their AI principles, as well as some companies.

The IEEE 7000 Series (see: https://ethicsinaction.ieee.org/p7000/) address ethical considerations in a broad range of issues regarding autonomous and intelligent systems, including transparency, privacy, algorithmic bias, children's data, employee data, creating an algorithmic agent for individuals, creating an ethical robotic ontological framework, dealing with robotic nudging, creating a uniform fail-safe standard for A/IS, defining well-being metrics relating to A/IS, assessing news sources to keep them accountable and objective in reporting, creating machine-readable privacy terms for all individuals, and considering the ethical implications of emulated empathy in AI System.

In 2020, IEEE released the first of the 7000 series, IEEE 7010-2020, IEEE Recommended Practice for Assessing the Impact of Autonomous and Intelligent Systems on Human Well-Being

In 2021, IEEE released IEEE 7000-2021, IEEE Standard Model Process for Addressing Ethical Concerns During System Design

Along with EAD and these standards projects, IEEE has created other resources related to AI:

- EAD for Business: A Call to Action for Businesses Using AI
- The IEEE Trusted Data and Artificial Intelligence Systems (AIS) Playbook for Financial Services · Addressing Ethical Dilemmas in AI: Listening to Engineers (see:
- Measuring What Matters in the Era of Global Warming and the Age of Algorithmic Promises
- The Ethics Certification Program for Autonomous and Intelligent Systems (ECPAIS)

Other aspects of ML and other AI techniques are addressed by other standardisation projects including:

- IEEE P2807, Framework of Knowledge Graphs
- IEEE P2807.1, Standard for Technical Requirements and Evaluating Knowledge Graphs
- IEEE P2830, Standard for Technical Framework and Requirements of Shared Machine Learning
- IEEE P2841, Framework and Process for Deep Learning Evaluation
- IEEE P2863 Recommended Practice for Organizational Governance of Artificial Intelligence
- IEEE 3652.1-2020, Guide for Architectural Framework and Application of Federated Machine Learning

More information is available at https://ieeesa.io/rp-ais and https://standards.ieee.org/initiatives/artificial-intelligence-systems/index.html .

IETF

- The IETF Autonomic Networking Integrated Model and Approach Working Group will develop a system of autonomic functions that carry out the intentions of the network operator without the need for detailed low- level management of individual devices. This will be done by providing a secure closed-loop interaction mechanism whereby network elements cooperate directly to satisfy management intent. The working group will develop a control paradigm where network processes coordinate their decisions and automatically translate them into local actions, based on various sources of information including operator-supplied configuration information or from the existing protocols, such as routing protocol, etc.

Autonomic networking refers to the self-managing characteristics (configuration, protection, healing, and optimization) of distributed

network elements, adapting to unpredictable changes while hiding intrinsic complexity from operators and users. Autonomic Networking, which often involves closed-loop control, is applicable to the complete network (functions) lifecycle (e.g. installation, commissioning, operating, etc). An autonomic function that works in a distributed way across various network elements is a candidate for protocol design. Such functions should allow central guidance and reporting, and co-existence with non-autonomic methods of management. The general objective of this working group is to enable the progressive introduction of autonomic functions into operational networks, as well as reusable autonomic network infrastructure, in order to reduce operating expenses.

https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#AI

ITU

AI for Good Global Summit is the leading United Nations platform for global and inclusive dialogue on AI. The Summit is hosted each year in Geneva by the ITU in partnership with UN Sister agencies, XPRIZE Foundation and ACM. More info: https://aiforgood.itu.int

ITU-T Study Group 13 approved various ITU-T Recommendations covering AI-based networks as well as machine learning in future networks and IMT-2020, including use cases, architectural frameworks, quality of service assurance, service provisioning, data handling, learning models, network automation for resource and fault management, marketplace integration, cloud computing, Quantum key distribution networks (e.g. Recommendations ITU T Y.3170, Y.3172; Y.3173, Y.3174, Y.3175, Y.3176, Y.3177, Y.3178, Y.3179, Y.3531, Sup 55 to Y.3170-series and Sup 70 to Y.3800-series. More info: https://www.itu.int/en/ITU-T/focusgroups/ml5g/Pages

SG13 continues development of Recommendations on the above topics as well as ML for big data driven networking, ML as a tool to better shape traffic, man-like networking. Also, in the framework of 5G, SG13 studies ML and AI to enhance QoS assurance, network slicing, operation management of cloud services, integrated cross-domain network architecture, network automation, framework of user-oriented network service provisioning. It also maintains the AI standards roadmap, which has a matrix of different document types per vertical versus the related technologies for supporting AI. For more info contact tsbsg13@itu.int.

ITU has been at the forefront to explore how to best apply AI/ML in future networks including 5G networks. To advance the use of AI/ML in the telco industry, ITU launched the AI/ML in 5G Challenge in March 2020. The Challenge rallies like-minded students and professionals from around the globe to study the practical application of AI/ML in emerging and future networks. It also enhances the community driving standardisation work for AI/ML, creating new opportunities for industry and academia to influence international standardisation. The Challenge solutions can be accessed in several repositories on the Challenge GitHub: https://github.com/ITU-AI-ML-in-5G-Challenge.

More info: https://aiforgood.itu.int/about/aiml-in-5g-challenge/

AI for Road Safety: The ITU, together with the UN Secretary-General's Special Envoy for Road Safety and the Envoy on Technology, agreed to launch a new initiative on ***AI for Road Safety, which is in line with the UN General Assembly Resolution (***UN A/RES/74/299) on Improving global Road Safety, which highlights the role of innovative automotive and digital technologies. AI for Road Safety aims to leverage the use of AI for enhancing the safe system approach to road safety.

The new initiative will also support achieving the UN SDG target 3.6 to halve by 2030 the number of global deaths and injuries from road traffic accidents, and the SDG Goal 11.2 to provide access to safe, affordable, accessible and sustainable transport systems for all by 2030. See:

https://aiforgood.itu.int/event/ai-for-road-safety/

https://aiforgood.itu.int/about/ai-ml-pre-standardisation/ai4roadsafety/

ITU-T SG20 approved Recommendation ITU-T Y.4470 "Reference architecture of artificial intelligence service exposure for smart sustainable cities" that introduces AI service exposure (AISE) for smart sustainable cities (SSC), and provides the common characteristics and high-level requirements, reference architecture and relevant common capabilities of AISE, and agreed Supplement ITU-T Y.Suppl.63 "Unlocking Internet of things with artificial intelligence" that examines how artificial intelligence could step in to bolster the intent of urban stakeholders to deploy IoT technologies and eventually transition to smart cities.

More info: https://itu.int/go/tsg20

ITU-T Study Group 5 approved Recommendation ITU-T L.1305 "Data centre infrastructure management system based on big data and artificial intelligence technology". This standard contains technical specifications of a data centre infrastructure management (DCIM) system, covering: principles, management objects, management system schemes, data collection function requirements, operational function requirements, energy saving management, capacity management for information and communication technology (ICT) and facilities, other operational function requirements and intelligent controlling on systems to maximize green energy use. Other aspects such as maintenance function requirements, early alarm and protection based on big data analysis and intelligent controlling on systems to decrease the cost for maintenance are also considered.

More info: https://itu.int/go/tsg5

The Focus Group on Environmental Efficiency for Artificial Intelligence and other emerging technologies (FG-AI4EE) for identifies the standardisation needs to develop a sustainable approach to AI and other emerging technologies. The FG-AI4EE is developing technical reports and specifications on requirements, assessment and measurement and implementation guidelines of AI and other emerging technologies.

More info: https://itu.int/go/fgai4ee

The ITU-T Focus Group on AI for Autonomous and Assisted Driving (FG-AI4AD) aims to develop a definition of minimal performance threshold for AI systems that are responsible for the driving tasks in vehicles, so that an automated vehicle always operates safely on the road, at least as a competent and careful human driver.

More info: https://itu.int/go/fgai4ad

ITU-T Focus Group on Artificial Intelligence (FG-AI4H), established in partnership with ITU and WHO, is working towards to establishing a standardized assessment framework for the evaluation of AI-based methods for health, diagnosis, triage or treatment decisions. https://www.itu.int/en/ITU-T/focusgroups/ai4h/

The Focus Group on Artificial Intelligence for Natural Disaster Management (FG-AI4NDM) aims to underscore best practices for leveraging AI for supporting data collection modelling across spatiotemporal scales, and providing effective communications in the advent of disasters of natural origin. The activities of this Focus Group are conducted in collaboration with the World Meteorological

Organization (WMO) and United Nations Environment Programme.

More info: https://itu.int/go/fqai4ndm

ITU-R

AI in Radiocommunication Standards: ITU Radiocommunication (ITU-R) Study Groups and forthcoming reports examine the use of AI in radiocommunications:

- ITU-R Study Group 1 covers all aspects of spectrum management, including spectrum monitoring. Question 241/1 looks at "Methodologies for assessing or predicting spectrum availability".
- ITU-R Study Group 6, dedicated to broadcasting services, is also studying AI and ML applications:
- Question ITU-R 144/6, "Use of AI for broadcasting", considers the impact of AI technologies and how can they be deployed to increase efficiency in programme production, quality evaluation, programme assembly and broadcast emission.
- Recommendation ITU-R BS.1387: "Method for objective measurements of perceived audio quality". The first application of neural networks, which is now called AI (artificial intelligence), in the field of broadcasting.
- Report ITU-R BT.2447, "AI systems for programme production and exchange", discusses current applications and near-term initiatives. This Report is being revised regularly to reflect the latest progresses on AI for the applications in broadcasting industry chains.

OASIS

RECITE (REasoning for Conversation and Information Technology Exchange) is a new OASIS Open Project dedicated to developing a standard for dialogue modelling in conversational agents. It aims to establish interoperability between software vendors.

ONEM2M

oneM2M provides a standardized IoT data source for AI/ML applications. Furthermore, the oneM2M work item on "System enhancements to support AI capabilities" (WI-0105) aims to enable oneM2M to utilize Artificial Intelligence models and data management for AI services. All oneM2M specifications are publicly accessible at Specifications (onem2m.org). See also the section on IoT in the Rolling plan.

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

THE EUROPEAN AI ALLIANCE

https://ec.europa.eu/digital-single-market/en/european-ai-alliance

THE HIGH-LEVEL GROUP ON ARTIFICIAL INTELLIGENCE

https://ec.europa.eu/digital-single-market/high-level-group-artificial-intelligence

AI ON DEMAND PLATFORM

http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/ict-26-2018-2020.html

H2020

R&D&I projects funded within topics ICT-26 from the H2020-ICT-Work Programme 2018-20 can produce relevant input for standardisation.

http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/ict-26-2018-2020.html

(C.3) ADDITIONAL INFORMATION

EUROPEAN AI ALLIANCE

European AI Alliance is a forum set up by the European Commission engaged in a broad and open discussion of all aspects of Artificial Intelligence development and its impacts. Given the scale of the challenge associated with AI, the full mobilisation of a diverse set of participants, including businesses, consumer organisations, trade unions, and other representatives of civil society bodies is essential. The European AI Alliance will form a broad multi-stakeholder platform, which will complement and support the work of the AI High-Level Group in particular in preparing draft AI ethics guidelines, and ensuring the competitiveness of the European Region in the burgeoning field of Artificial Intelligence. The Alliance is open to all stakeholders. It is managed by a secretariat, and it is already open for registration.

High-Level Expert Group on Artificial Intelligence (AI HLG)

The group has now concluded its work by publishing the following four deliverables:

Deliverable 1: Ethics Guidelines for Trustworthy AI
The document puts forward a human-centric approach on AI and lists 7 key requirements that AI systems should meet in order to be trustworthy.

Deliverable 2: Policy and Investment Recommendations for Trustworthy AI
Building on its first deliverable, the HLEG put forward 33 recommendations to guide trustworthy AI towards sustainability, growth, competitiveness, and inclusion. At the same time, the recommendations will empower, benefit, and protect European citizens.

Deliverable 3: Assessment List for Trustworthy AI (ALTAI)
A practical tool that translates the Ethics Guidelines into an accessible and dynamic self-assessment checklist. The checklist can be used by developers and deployers of AI who want to implement the key requirements. This list is available as a prototype web-based tool and in PDF format.

Deliverable 4: Sectoral Considerations on the Policy and Investment Recommendations
The document explores the possible implementation of the HLEG recommendations, previously published, in three specific areas of application: Public Sector, Healthcare and Manufacturing & Internet of Things.

AI WATCH

The the Commission's AI Watch prepared a report titled "National Strategies on Artificial Intelligence: A European Perspective" ***that was presented during a*** joint webinar with the OECD, which took place today. It monitors the AI national strategies of all EU countries, as well as Norway and Switzerland, and this year's update focuses on areas of cooperation for:

- strengthening AI education and skills;
- supporting research and innovation to drive AI developments into successful products and services, improving collaboration and networking;

- creating a regulatory framework to address the ethics and trustworthiness of AI systems;
- establishing a cutting-edge data ecosystem and ICT infrastructure.

CAHAI

In September 2019, the Committee of Ministers of the Council of Europe set up an Ad Hoc Committee on Artificial Intelligence – CAHAI. The Committee will examine the feasibility and potential elements on the basis of broad multi-stakeholder consultations, of a legal framework for the development, design and application of artificial intelligence, based on Council of Europe's standards on human rights, democracy and the rule of law. The committee, which brings together representatives from the Member States, will have an exchange of views with leading experts on the impact of AI applications on individuals and society, the existing soft law instruments specifically dealing with AI and the existing legally binding international frameworks applicable to AI.

AI ON DEMAND PLATFORM

The European Commission has launched a call for proposals to fund a large €20 million project on Artificial Intelligence (AI) under the framework programme on R&D Horizon 2020. It aims to mobilise the AI community in Europe in order to combine efforts, to develop synergies among all the existing initiatives and to optimise Europe's potential. The call was closed on 17th April 2018, and the received proposals have been evaluated. The awarded project started on 1st January 2019.

Under the next multi-annual budget, the Commission plans to increase its investment in AI further, mainly through two programmes: the research and innovation framework programme (Horizon Europe), and a new programme called Digital Europe.

UNESCO INTERNATIONAL RESEARCH CENTRE ON ARTIFICIAL INTELLIGENCE (IRCAI)

UNESCO has approved the establishment of IRCAI, which will be seated in Ljublijana (Slovenia). IRCAI aims to provide an open and transparent environment for AI research and debates on AI, providing expert support to stakeholders around the globe in drafting guidelines and action plans for AI. It will bring together various stakeholders with a variety of know-how from around the world to address global challenges and support UNESCO in carrying out its studies and take part in major international AI projects. The centre will advise governments, organisations, legal persons and the public on systemic and strategic solutions in introducing AI in various fields.

AI STUDIES

In addition to the previous initiatives, the Commission is planning to conduct some technical studies about AI. Among them, there will be one specifically targeted to identify safety standardisation needs.

STANDARD SHARING WITH OTHER DOMAINS

AI is a vast scientific and technological domain that overlaps with other domains also discussed in this rolling plan, e.g. big data, e-health, robotics and autonomous systems and so forth. Many of the standardisation activities of these domains will be beneficial for AI and the other way around. For more details, please refer to section

3.1.10 EUROPEAN GLOBAL NAVIGATION SATELLITE SYSTEM (EGNSS)

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The European Global Navigation Satellite System (EGNSS) encompasses the Global Satellite Navigation System established under the Galileo programme and the European Geostationary Overlay Service (EGNOS).

Galileo entered Initial Operational Capability (IOC) phase in 2016. Since then, anyone with a Galileo-enabled device is able to use its signals for positioning, navigation and timing. Currently there are more than 200 Galileo-ready models of smartphones and tablets available in the market contributing to an installed base greater than 2 billion. Galileo is also adopted in additional users' domains such as transportation and the professional one (e.g. surveying or agriculture applications).

The Galileo system is currently providing three types of services:

- **Open Service (OS)**: Galileo open and free of charge service set up for positioning and timing services.
- **Public Regulated Service (PRS)**: Service restricted to government-authorised users, for sensitive applications that require a high level of service continuity.
- **Search and Rescue Service (SAR)**: Europe's contribution to COSPAS-SARSAT, an international satellite-based search and rescue distress alert detection system.

Once the system reaches its Full Operational Capability it will also offer a **High Accuracy Service (HAS)**, a service complementing the OS by providing an additional navigation signal and added-value services in a different frequency band. The HAS signal will provide a precision down to 20 cm, globally on Earth.

EGNOS is Europe's regional satellite-based augmentation system (SBAS) that is used to improve the performance of global navigation satellite systems, such as GPS and Galileo. It has been deployed to provide safety of life navigation services to aviation, maritime and land-based users over most of Europe. EGNOS improves the accuracy and reliability of satellite navigation positioning information, while also providing a crucial integrity message regarding the continuity and availability of a signal.

Both Galileo and EGNOS services create extensive socio-economic benefits, and the range of its applications is wide, spanning across numerous market segments and generating value for both, public and private sectors. The links between Galileo services and ICT are particularly strong, as satellite navigation services are considered one of the key enabling technologies for ICT, and are becoming increasingly important for the digital agenda.

The objective of the EU is to ensure that Galileo and EGNOS are widely used, and standardisation plays an important role in this process, especially when it comes to downstream market of EGNSS services, which is still emerging. Standards are a powerful tool to support safety-related applications as well as to ensure the interoperability of Galileo services. Introducing or updating standards related to EGNSS downstream applications is therefore a priority.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The importance of standardisation in relation to space has been evoked during the public consultation on the Space Strategy for Europe, which ranked standardisation as most important for the market uptake of Galileo and EGNOS. In reaction to this, the European Commission's Space Strategy for Europe, adopted on 26 October 2016, states that "*in longer term, the Commission will encourage the uptake of space solutions through standardisation measures and roadmaps*".

In 2017, a study on the overview of EGNSS downstream standardisation and assessment of gaps and future needs has been finalised. The study, after consultations with industry stakeholders, standard setting organisations, governments and civil society representatives, identified the most important areas for EGNSS downstream standardisation and outlined some 50 proposals for action. Based on that, DG GROW has identified three priority areas:

- **Intelligent transport (aviation, drones, road, maritime, rail),**
- **Intelligent interconnectivity (location-based services, IoT, 5G), and**
- **Intelligent infrastructures (timing and synchronisation of critical infrastructures, such as energy grids)**

On 3 October 2018, a workshop with Member States and standardisation organisations took place, in which the Commission services discussed the priorities for the EGNSS downstream standardisation. A Staff Working Document taking stock of the various activities in the field of EGNSS downstream standardisation was adopted in December 2019.

EGNSS downstream standardisation has also been highlighted in the EGNSS Work Programme for 2019 and 2020, as well as in the Management Plan 2021 of the Directorate-General for Defence Industry and Space.

(A.3) REFERENCES

- COM(2016) 705 final *Space Strategy for Europe*
- Staff Working Document "EGNSS downstream standards development" SWD(2019) 454 final
- Management Plan 2021 DG Defence Industry and Space, https://ec.europa.eu/info/system/files/management-plan-defis-2021_en.pdf
- *GNSS Market Report*, Issue 6
- Overview of EGNSS downstream standardisation and assessment of gaps and future needs to facilitate the integration of Galileo and EGNOS user applications, Valdani Vicari & Associati (VVA), GMV and Lexjus Sinacta (LS), November 2017,
- "*Use Galileo*" website with the latest information on the Galileo-ready devices in all market segments, https://www.usegalileo.eu/

(B.) REQUESTED ACTIONS

ACTION 1 **-5G-** SDOs to include the support for signal authentication and position integrity (EGNSS differentiators) in 5G reference architecture, for example through updating of 3GPP Technical Specifications TS 23.501 or TS 22.071

ACTION 2 **-IoT-** SDOs to update standards related to the IoT reference architecture in order to include signal authentication and position integrity in information exchange and sensor description standards, for example OneM2M TS-001-V2.10.0

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

EC M/496

CEN, CENELEC and ETSI have a mandate from the EC establishing a programme for space related standards, now in phase 3 of the process. CEN and CENELEC manage standardisation activities related to the space industry via joint CEN-CENELEC Technical Committee 'Space' (CEN-CLC/TC 5).

http://ec.europa.eu/growth/tools-databases/mandates/index.cfm?fuseaction=search.detail&id=499

CEN

- CWA 16874:2015 Verification of performance levels of EGNOS Enabled mass-market receivers:
- https://standards.cen.eu/dyn/www/f?p=204:110:0::::FSP_PROJECT,FSP_ORG_ID:59362,1923139&cs=19FC4E69741D-67095B636AF741017E2E7
- CWA 16390:2018 Interface control document for provision of EGNOS/EDAS/multi-GNSS based services for tracking and tracing the transport of goods

https://standards.cen.eu/dyn/www/f?p=204:110:0::::FSP_PROJECT,FSP_ORG_ID:66264,2238989&cs=15C2D155C664EC72312D4BB-69624DEBFB

Draft CWA xxxx Verification of performance levels of Galileo Enabled mass-market receivers (under development in CEN-CENELEC Workshop 17):

ETSI 3GPP

Working Group 4 under the Radio Access Network (RAN) Technical Specifications Group (TSG) - Radio performance and protocol aspects (system) - RF parameters and BS conformance, deals with standards concerning GNSS.

ITU

ITU-R SG4 is the responsible group for all systems and networks in the fixed, mobile, broadcasting, radiodetermination services.

More info: https://www.itu.int/en/ITU-R/study-groups/rsg4/Pages/default.aspx

Different aspects related to the development and operation of applications belonging to the radiodetermination service (including radiolocation and radio-navigation) are also part of the ITU-R WP 5B agenda. Systems belonging to the radiodetermination service are being employed not only by the aeronautical, maritime and meteorological industries but to an ever-increasing degree by other industries as well as the general public.

More info: https://www.itu.int/en/ITU-R/study-groups/rsg5/rwp5b/Pages/default.aspx

ITU-T SG15 Question 13/15 is working on "Network synchronization and time distribution performance", which is an important technology for satellite networks. It is working on realizing robust and reliable network synchronization solutions (e.g. as related to GNSS back-up). Technical Report: "GSTR-GNSS - Considerations on the use of GNSS as a primary time reference in telecommunications" was published in July 2020.

More info: https://www.itu.int/en/ITU-T/studygroups/2017-2020/15/Pages/q13.aspx

https://itu.int/go/tsg15

ITU-T SG2 Question 3/2 is working on a technical report "identify call location for emergency service". GNSS data can help to implement handset based AML(Advanced Mobile Location) solution.

More info: https://itu.int/go/tsg2

ONEM2M AND AIOTI

oneM2M is one of the most relevant IoT architecture definition standards organisation and the EC can address it through its members, such as ETSI or AIOTI, to include the options to support EGNSS differentiators in the reference architectures.

The Alliance for the Internet of Things Innovation (AIOTI) associates key IoT industrial players, as well as well-known European research centres, universities, associations and public bodies, and promotes convergence and interoperability of IoT standards. Through its working groups, such as WG03, AIOTI can support the EC to promote the use of authentication and integrity of EGNSS within IoT reference architectures.

On the other hand, the EC may also choose to address ETSI, who is the founding partner of Technical Specification TS-0001, containing information on how to manage location. All oneM2M Technical Specifications and Technical Reports are publicly accessible at: Specifications (onem2m.org)

3.2 SOCIETAL CHALLENGES

3.2.1 EHEALTH, HEALTHY LIVING AND AGEING

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The digital transformation of health and care is one of the priority areas in the modernisation of public services identified in the midterm Review of the DSM strategy. Towards this direction, the Commission adopted a Communication in April 2018 (COM(2018) 233) on enabling the digital transformation of health and care in the Digital Single Market. This Communication addresses the need and scope for further measures in the area of digital health and care, in line with legislation on the protection of personal data, patient rights and electronic identification and in particular as regards the following three priorities:

- Citizens ´ secure access to electronic health records and the possibility to share it across borders.
- Supporting data infrastructure, to advance research, disease prevention and personalised health and care in key areas including rare, infectious and complex diseases.
- Facilitating feedback and interaction between patients and healthcare providers, to support prevention and citizen empowerment as well as quality and patient-centred care, focussing on chronic diseases and on a better understanding of the outcomes of healthcare systems.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The Commission announced the creation of a European Health Data Space in 2019 that will enable secure and trustworthy accessibility to health data across EU borders. To this end, the Commission plans to make legislative proposals by the end of 2021.To facilitate the interoperability of health data in the EU, the Commission adopted a **Recommendation for a European Electronic Health Record exchange format (EEHRxF) in February 2019.**

The EEHRxF Recommendation sets out the current consensus with regard to technical specifications for patient summary reports, and e-prescriptions. The eHealth Network adopted these specifications in guidelines in June 2019.

The **X-eHealth** project will provide draft interoperability specifications for new health domains (lab tests, hospital discharge letters, medical images and image reports) by September 2022.

InteropEHRate and **Smart4Health** will devise interoperability protocols and technologies for health data exchange centred on the citizen.

The new Commission proposal for a trusted and secure Digital Identity for all Europeans will provide a framework for all EU citizens, residents, and businesses in the EU to prove their identity and share electronic documents from their European Digital Identity wallets with the click of a button on their phone.

H2020 projects on eHealth standardisation, harmonisation and interoperability are ongoing:

- **InteropEHRate, complementing and integrating the current interoperability infrastructures with new technologies for health data exchange centred on the citizen;**
- **Smart4Health,** enabling the citizen-centred EU-EHR exchange for personalised health;

(A.3) REFERENCES

- **COM/2018/233** final COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS on enabling the digital transformation of health and care in the Digital Single Market; empowering citizens and building a healthier society
- Commission Recommendation on a European Electronic Health Record exchange format (C(2019)800)
- eHealth Network Guidelines
- https://www.x-ehealth.eu/
- https://www.interopehrate.eu/
- https://smart4health.eu/en/

(B.) REQUESTED ACTIONS

ACTION 1 For the further development of the citizens' electronic health records, evaluate and address standardisation needs of high relevance for the citizen in technical reports and beyond regarding terminological and technological profiles for the cross-border digital single European market.

ACTION 2 Evaluate the needs, produce a report on necessary key types of identifiers and identification processes needed as components in a European eHealth digital single market. In this context, a special emphasis on the items listed below, which go beyond the key types of identifiers and identification processes, should be provided.

Standardised *medicinal products identifiers* to support national and international interoperability of health services (online or other), while complying with the legislation protecting patients, and including specific rules of enforcement of delivery on medical prescriptions. Agreements on standards in this field should take into account the needs of cross-border exchange of electronic health records since their medication part faces similar terminological challenges.

Agreements 1. on a terminological profile for minimum sets of fields included in the patient summary, and 2. on technical profiles for the cross-border exchange of electronic health record information with identified socioeconomic importance. The consent of patient and the citizen shall be considered in the development of the standard.

The needs for standards supporting the ICT services provided through the *European reference networks (ERNs)* for rare diseases regarding communication and data sharing addressing areas such as fast and easy sharing of digital medical images through picture archive and communication systems (PACS) in the context of the eStandards project and its focus area description for ERN, as well as the ValueHealth project with its use case for Chronic Diseases;

Agreements on a terminological profiles for Telemedicine application, allowing healthcare providers to share real-time knowledge and decisions; sharing of best practices and clinical decision-making tools (i.e. guidelines); solutions to support collaborative research between healthcare providers, through the development of clinical trials and/or epidemiological studies; and establishment of shared databases and registries.

The move towards personalised medicine requires standardisation of data related to the field of biology and biomarkers. In particular, clinical laboratories are subject to a process of accreditation according to ISO 15 189 that should be supplemented by standardisation processes in ICT.

CEN proposes to build on this work in 2020-2023, in collaboration with ISO and IEC, to develop a new Technical Specification: "Digital Representation of Requirements for Quality and Reliability of Health and Wellness Apps". The Digital Representation of the set of questions used for collecting information on and evidence of conformity to the requirements (Quality Requirements Conformity Assessment) would be developed with end users and:

- allow profiles and extensions to be authored, maintained, distributed, filtered, sorted, compared and checked more easily;

- enable issuing and having both manufacturers and distributors publish a digital easily administrable up-to-date Standardised Label, to increase transparency and enable consumers to make informed decisions. Its contents would be derived from the answers and evidence provided by the manufacturers in the Quality Requirements Conformity Assessment. The label could include an acknowledgement that the information provided is checked or certified by a specified app checker.

The development of the Digital Representation would be supported by stakeholder engagement and research, in particular exploring uptake of the Technical Specification for Quality and Reliability Requirements for Health and Wellness Apps by citizens, healthcare providers, authorities, payers, app checkers and app developers, including SME's, to identify success factors that further secure transparency, uptake and conformity.

ACTION 3 Evaluate and report on the opportunities and needs for standardisation supporting active living and ageing with special emphasis on:

- Open service platforms APIs taking into account progress made under H2020 on the top smart homes and smart cities
- Service robotics for assisted working, and independent living including regulatory acceptance:
- Identify standardisation needs to support specific issues, e.g. occupational health and safety, memory deficiency, mental health issues.
- Ensuring interoperability of devices to enable plug-and-play connectivity of the different devices and services for personal management and delivery of the actual services for an active and healthy ageing.

Whereas:

it is necessary to facilitate the involvement of societal stakeholders in the development of standards in the field of active and healthy ageing; ensure user participation from the beginning to avoid purely technical-driven innovation, e.g. by involving specific user groups in SDOs.

given the challenge of the aging population, the standardisation work must also take into account aspects of personal services dedicated to the autonomy including ICT solutions in order to promote secure and harmonised solutions at the European level;

it is important to consider the synergies between standardisation and active and healthy ageing with similar standards in the areas of ambient assisted living and eHealth as proposed by the H2020 PROGRESSIVE project and referenced in the eStandards project and activities undertaken by the Task Force 'Ageing in community' in ISO/TC 215;

all the standardisation work on active and healthy ageing should ensure a high-level of privacy protection and of security.

ACTION 4 'Data protection by design' (GDPR, Article 25) in eHealth products and services

It is recommended to check whether a standardisation request might be needed pursuant to Regulation 1025/2012 for one or more European standardisation deliverable(s) concerning data protection by design for the development of eHealth products and services.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

BSI

PAS 277:2015 Health and wellness apps — Quality criteria across the life cycle — Code of practice

CEN

CEN/TC 251 provides a focal point for the development of standards in the Health Informatics domain, in close collaboration with ISO/TC 215. CEN/TC 251 is taking forward the eHN guidelines, contributing to international standardisation solutions, while providing Europe with a Patient Summary standard and an implementation guide. The technical committee is also responsible for the development, publication and maintenance of the ISO-EN IDMP series (Health informatics - Identification of medicinal products): EN-ISO 11238, 11239, 11240, 11615 and 11616 (and their accompanying implementation guides, as CEN ISO/TS 20440, 20443, 20451, 19844), which also refer to the openMedicine results: http://www.open-medicine.eu/downloads.html CEN/TC 251 maintains the "DICOM" standards (and notably EN ISO 12052: Health informatics - Digital imaging and communication in medicine (DICOM) including workflow and data management).

In the frame of the standardisation request M/530 on privacy and personal data protection management, CEN/TC 251 will liaise with CEN-CLC/TC 8 (Privacy in products and services) and CEN-CLC/TC 13 (Cybersecurity and data protection) to address the particular requirements of eHealth

CENELEC

CENELEC has adopted as European Standards IEC 62304 (Medical device software -- Software life cycle processes) and IEC 82304-1 (Health software – Part 1: General requirements for product safety)

CEN-CENELEC

CEN-CENELEC/JTC 11 has just ended the works related to the standardisation of the built environment, which is a key issue regarding older people:

- EN 17210:2021 Accessibility and usability of the built environment - Functional requirements
- CEN/TR 17621:2021 Accessibility and usability of the built environment - Technical performance criteria and specifications
- CEN/TR 17622:2021 Accessibility and usability of the built environment - Conformity assessment

CEN, CENELEC, ETSI

CEN-CENELEC-ETSI are starting to work on the revision of EN 301 509, which deals with the accessibility of ICT products and services (CEN-CENELEC-ETSI Joint Working Group on eAccessibility). The purpose of this revision is to meet the essential requirements included in the Directive on the accessibility of the websites and mobile application of public sector bodies. This work will have an impact on the life of older people, easing the use of ICT products and services. Work under the Web-Accessibility Directive and under EN 301 549 has impact on life of older people. Please see the chapter on Accessibility for details.

ISO

The European Medicines Agency is part of a project to finalise the implementation guides to support the adoption of the ISO standards for the identification of medicinal products (IDMP).

This set of standards and implementation guides are being developed jointly by ISO/TC 215 and CEN/TC 251, where this work started originally.

http://www.ema.europa.eu/ema/index.jsp?curl=pages/regulation/general/general_content_000645.jsp&mid=WC0b01ac058078fbe2

There is a newly-formed ISO/TC 215 subcommittee in the area of Genomic Informatics (https://www.iso.org/committee/7546903.html). This is collaborating with other SDOs

ISO/IEC JTC 1

A framework for personalization and adaptation of user interfaces at runtime, based on the context of use (consisting of a user's needs and preferences, their envisioned tasks, their equipment and environmental parameters of interaction). The framework is based on the well-known REST protocol, and JSON and XML formats. A registry-based approach is employed for the definition of terms describing a user's personal preferences and needs.

Currently, the following standards have been published as part of this framework:

ISO/IEC CD 24571-1 Information Technology – Individualised adaptability and accessibility in e-learning, education and training – Part 1: Framework and reference model

ISO/IEC DIS 24752-8 Information technology -- User interfaces -- Universal remote console -- Part 8: User interface resource framework

ISO/IEC

The standard 62304 Health software - Software life cycle processes is being updated, by ISO and IEC. One of the issues to be addressed is about the improvement of the security aspects that relate to health software. This has also led to the onset of the development of a new standard ISO/IEC 80001-5-1 Safety, Security and Effectiveness

in the implementation and use of connected medical devices or connected health software - Part 5: Security -Sub-Part 5-1: Activities in the Product Lifecycle in ISO/TC215/JWG 7

ETSI

ETSI eHealth: In addition to the activity jointly with CEN and CENELEC noted above ETSI through the efforts of the eHEALTH group, acting within ETSI as a "Hub for Health", have prepared a number of documents to bring the efforts across ETSI into focus for responding to the actions of the plan listed above. Of particular note with respect to Actions 1 and 2 the eHealth group has published a short series of white papers, a Special Report into the role of ICT on recovery from COVID, and is maintaining and extending its work programme developing use cases and data models. This is closely aligned to the work in ETSI CYBER on further development of the "secure by design", "privacy by default" paradigms (particularly with respect to IoT in EN 303 645), and with integration to the semantic identification frameworks developed in SmartM2M for SAREF. Thus as a "hub for health" ETSI is actively promoting the implementation of the driver that "*Very little of ICT is eHealth specific, all of eHealth depends on ICT*" with a view to ensuring that all of ETSI's output is societally and eHealth relevant for enabling Health crisis management and recovery as well as for the core operation of all health operations. https://www.etsi.org/technologies/ehealth

Published and in further development:

TR 103 477: eHEALTH; Standardisation use cases for eHealth

TR 103 817: eHEALTH; Presence preserving proximity function trigger (3PFT)

ES 203 668: eHEALTH Data recording requirements for eHealth

SR 003 809: eHEALTH; The role of ICT to enable Health crisis management and recovery; Responding to the 2019 SARS-CoV-2 Pandemic

White paper 29: The argument in favour of eHealth standardisation in ETSI

White paper 33: The role of SDOs in developing standards for ICT to mitigate the impact of a pandemic

ETSI TC DECT: is developing digital enhanced cordless telecommunications (DECT) ultra-low energy (ULE), a low-power wireless technology providing optimal radio coverage in indoor scenarios for reliable audio and data services suitable for many eHealth applications, e.g. health monitoring, emergency alarms for vulnerable people and remote medical monitoring.

ETSI TC smartBAN: is working on smart body area networks. Standards for a dedicated radio technology for these networks are being developed.

ETSI SC USER: In the series of documents "User-centric approach in digital ecosystem", SC USER has worked on use cases including e-health. ETSI is one of the SDOs listening the voice of users, their expectations, behaviors and requests through the User Group.

ETSI TC smartM2M: The SAREF ontology, which makes use of oneM2M as communication framework (ETSI TS 103 264 (Reference Ontology and oneM2M Mapping), was enhanced with a specific extension i.e. SAREF4EHAW: extension for the eHealth/Ageing-well domain. Sources: https://saref.etsi.org/sources/saref4ehaw/. ETSI Technical Specification: ETSI TS 103 410-8 V1.1.1 (2020-07): "SmartM2M; Extension to SAREF; Part 8: eHealth/Ageing-well Domain"

IEC

IEC SC 62B is developing standard IEC 61910-1, which describes a high-level data exchange language between systems making medical imagery. IEC Systems Committee on Active Assisted Living (SyC AAL) fosters standardisation which enables usability, accessibility and cross-vendor interoperability of AAL systems and services. The work has started with the collection use cases, definition of the terminology and the design of an architecture model for AAL systems

IEEE

IEEE standards address a wide range of technology components and applications, related to different aspects of the healthcare and related domains, including standards for software, management, guidance and recommended practices. There is an increasing focus on addressing challenges utilizing devices and services in the form of remote patient monitoring and care. Inclusive in these programs are solutions for addressing the portability, interoperability, verification and validation for data to be utilized for clinical research, healthcare delivery and monitoring and precision medicine.

- IEEE P1752 is a draft Standards Series for mobile health data for different measures (sleep activity, Cardiovascular, Respiratory, and Metabolic Measures)
- IEEE P2727 (two standards) covers medical devices with measurement functions, including cardiac defibrillators
- IEEE P2731 is a draft standard for a unified terminology for brain-computer interfaces, based on input from IEEE P2794 "Reporting Standards for in Vivo Neural Interface Research"
- IEEE P2933 is a draft standard for clinical IoT data and device interoperability with TIPPSS (Trust, Identity, Privacy, Protection, Safety, Security)
- IEEE P2801 is a draft recommended practice for the quality management of datasets for medical AI for datasets
- IEEE P2802 is a draft standard for the performance and safety evaluation of AI based medical devices including terminology
- IEEE P3333 standards series defines criteria for 3D medical applications and printing
- The IEEE 11073 standards series enables service-oriented (medical) device connectivity including semantic interoperability.
- IEEE P2791 Optimized Drug Discovery for Precision Therapeutics–Moving Towards the Reality of Precision Medicine for All
- IEEE P2673 - Standard for Patient Digital Biomedical Data Files with 3D Topological Mapping of Macroanatomy and Microanatomy for Use in Big Data and Augmented Intelligence Systems
- IEEE P2968 Standards Series for Decentralized Clinical Trials, on Patient Safety, as well as Thread Modeling, Cybersecurity, and Data Privacy

Pre-standards activities

- Technology and Data Harmonization for Enabling Decentralized Clinical Trials Industry Connections Program
- Transforming the Telehealth Paradigm: Connectivity, Accessibility, Privacy and Security for ALL pre-standards activity
- WAMIII (Wearables & Medical IoT Interoperability & Intelligence) Program which seeks to incubate potential standards that will enable trust in the seamless, secure personal patient area network and bioinformatics highway for connected medical devices in, on or around the human body.

Further information is at: https://ieeesa.io/rp-ehealth

ITU

World Telecommunication Standardisation Assembly (WTSA) Resolution 78 "Information and communication technology applications and standards for improved access to e-health services" drives ITU-T's work in this domain.

The ITU published the Continua Design Guidelines in the ITU-T H.810 series (2019), Interoperability design guidelines for personal health systems (which is complemented by 46 conformity testing specifications); ITU-T H.860 (4/2014), Multimedia e-health data exchange services; Y.4110/Y.2065, Service and capability requirements for e-health monitoring services; Y.4408/Y.2075, Capability framework for e-health monitoring services; technical papers HSTP-H810 (7/2014) and HSTP-H810-XCHF (2017) with an introduction to the H.810 series and data exchange within it. Updated editions of the ITU-T H.810 series architecture are produced regularly (annually or so). More info: https://itu.int/en/ITU-T/e-Health

SG13 is developing a new Recommendation on "QoS requirements for smart healthcare supported by IMT-2020" (Y.IMT2020-qos-req-sh). In addition, SG13 published Supplement 66 to Y.3000-series "Network 2030 Services: Capabilities, performance and design of new communications services for the Network 2030 applications" that depicts the requirements for the telesurgery and robotics surgery for future around year 2020+. Supplement 67 to Y.3000-series of ITU-T Recommendations "Representative use cases and key network requirements for Network 2030" describes the use case with remote robotic surgery

ITU-T SG16 (Multimedia) and ITU-T SG20 (IoT, smart cities and communities) are developing further standards addressing e-health services and systems.

Some of the standards approved under SG16 include:

Framework for telemedicine systems using ultra-high definition imaging (Recommendation ITU-T F.780.1)

Guidelines for safe listening devices/systems (Recommendation ITU-T H.870), a joint standard with WHO.

More standards on this topic within SG16 are developed under Q28/16 on "Accessibility to multimedia systems and services": https://itu.int/itu-t/workprog/wp_search.aspx?Q=28/16

The ITU Product Conformity Database contains information on health devices that passed conformance tests against the corresponding ITU-T Recommendations. More info: https://itu.int/go/tcdb

ITU-T Focus Group on Artificial Intelligence (FG-AI4H), established in partnership with ITU and WHO, is working towards to establishing a standardized assessment framework for the evaluation of AI-based methods for health, diagnosis, triage or treatment decisions. https://www.itu.int/en/ITU-T/focusgroups/ai4h/ More info: https://www.itu.int/go/fgai4h.

ITU-T SG20 approved Recommendation ITU-T Y.4908 on "Performance evaluation frameworks of e-health systems in the IoT". ITU-T SG20 is also developing a draft Recommendation on "Framework to support semantic mediation of eHealth services" (Y.eHealth-Semantic) under Q4/20: https://itu.int/itu-t/workprog/wp_search.aspx?Q=4/20. *More info:* https://itu.int/go/tsg20

JIC

Joint Initiative Council for Global Health Informatics Standardisation in which CEN/TC 251, ISO/TC 215, HL7 International, GS1, SNOMED International, CDISC, IHE, DICOM, and PCHA participate as members

OASIS

The OASIS Security TC and the OASIS Web Security Services TC developed and maintain foundational Web Services security standards such as SAML (also ITU-T Recommendation X.1141) and WS-Security, which are used in the Integrating the Healthcare Enterprise (IHE) technical framework used in the eHealth Digital Service Infrastructure, the initial deployment and operation of services for cross-border health data exchange under the Connecting Europe Facility (CEF).

The OASIS Emergency Management TC developed, in cooperation with ITU-T, the World Meterological Organisation, Health Level Seven (HL7) and emergency agencies, standards for data exchange across emergency-related systems. Emergency Data Exchange Language (EDXL) specifications include EDXL-HAVE, an XML messaging standard primarily for exchange of health facility availability information. EDXL-Situation Reporting (SitRep) supports data sharing of information on situations, incidents, events and responses. EDXL Tracking Emergency Patients (TEP) supports sharing of emergency patient and tracking information from the point of patient encounter through definitive care admission or field release.

ONEM2M

Data Structures like the Electronic Health Records EHR can by exchanged safely, reliable and securely over wide area data networks, between ICT components (oneM2M CSE's), on site (e.g. in Hospitals) and Data centers.

oneM2M standard based technology enables a multivendor interoperable data exchange framework between clinics, doctors, medicinal products and health care providers and hence enables an eHealth Interoperability Framework.

The SAREF ontology makes use of oneM2M as communication framework (ETSI TS 103 264 (Reference Ontology and oneM2M Mapping) and a specific extension of SAREF i.e. SAREF4EHAW: extension for the eHealth/Ageing-well domain is available. Sources: https://saref.etsi.org/sources/saref4ehaw/ . The related ETSI Technical Specification is : ETSI TS 103 410-8 V1.1.1 (2020-07): "SmartM2M; Extension to SAREF; Part 8: eHealth/Ageing-well Domain"

All oneM2M specifications are publicly available at: Specifications (onem2m.org)

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

ACT PROJECT (PHILIPS / LONDON HOSPITAL)

Advancing Care Coordination and Telehealth Deployment http://www2.med.auth.gr/act/news.php

ASSESS CT

Investigating the fitness of the clinical terminology SNOMED CT as a potential standard for EU-wide eHealth deployments, scrutinising clinical, technical, financial, and organisational aspects.

http://assess-ct.eu/

JASEHN

Joint Action to Support the eHealth Network (Member States), followed by eHAction, the third Joint Action, as of July 2018

http://jasehn.eu/

EESSI

Electronic exchange of social security information (EESSI). EESSI is an IT system that will help social security bodies across the EU to exchange information more rapidly and securely, as required by EU regulations on social security coordination.

http://ec.europa.eu/social/main.jsp?catId=869&langId=en

ENGAGED

European innovation partnership on active and healthy ageing; thematic network on innovative and sustainable active and healthy ageing services that make best use of new technologies.

http://www.engaged-innovation.eu/

UNICOM PROJECT

The Horizon 2020 UNICOM project helps to ensure that any medicine and what it contains can be accurately identified anywhere in the world. https://unicom-project.eu/

EUROPEAN INNOVATION PARTNERSHIP ON ACTIVE AND HEALTHY AGEING

Action plan B3 (integrated care)
http://ec.europa.eu/research/innovation-union/pdf/active-healthy-ageing/b3_action_plan.pdf

Action plan C2 (independent living)
http://ec.europa.eu/research/innovation-union/pdf/active-healthy-ageing/c2_action_plan.pdf

Action plan D4 (innovation for age-friendly buildings, cities & environments)
http://ec.europa.eu/research/innovation-union/pdf/active-healthy-ageing/d4_action_plan.pdf#view=fit&pagemode=non

EHEALTH GOVERNANCE INITIATIVE — SEHGOVIA

Supporting the European eHealth Governance Initiative and Action http://ec.europa.eu/information_society/apps/projects/factsheet/index.cfm?project_ref=270941

EHR4CR PROJECT

IMI project with a focus on the use of electronic Health Records for Clinical Research http://www.ehr4cr.eu/

ESTANDARDS

Support the optimisation of standardisation processes and development of roadmaps http://www.estandards-project.eu/

EURECA

Enabling information re-Use by linking clinical REsearch and Care http://eurecaproject.eu/about/

EU-US EHEALTH WORK

The collection of eHealth related competencies and the provision of educational material, (including eHealth standards) for the health care work force in the EU and USA

EXPAND

Aims to exploit a number of selected eHealth assets developed in various initiatives http://www.expandproject.eu/

NB: The EXPAND project is also a continuation of esSOS which created a pilot (www.epsos.eu)

HAIVISIO

European project which aims to identify and enhance awareness of the results generated by eHealth, active ageing and independent living European projects.

http://haivisio.eu/

LINKED2SAFETY

A next-generation, secure linked data medical information space for semantically-interconnecting electronic health records and clinical trials systems advancing patients safety in clinical research http://www.linked2safety-project.eu/node/23

MOMENTUM

Momentum is a platform where key players in telemedicine share their knowledge and experience in deploying telemedicine services in routine care. http://telemedicine-momentum.eu/

OPENMEDICINE

Supporting a common EU, standards-based, database of medicinal products http://www.open-medicine.eu/home.html

PHS FORESIGHT (PERSONAL HEALTH SYSTEMS FORESIGHT PROJECT)

This ongoing project has been researching indicators and milestones for key areas of transformation required by the implementation of eHealth systems http://www.phsforesight.eu/

PONTE PROJECT

Efficient Patient Recruitment for Innovative Clinical Trials of Existing Drugs to other Indications http://www.ponte-project.eu/

RENEWING HEALTH

REgioNs of Europe WorkINg toGether for health (Renewing health): a European project which aims at implementing large-scale real-life test beds for the validation and subsequent evaluation of innovative telemedicine services using a patient-centred approach and a common rigorous assessment methodology. http://www.renewinghealth.eu

SALUS PROJECT

Scalable, standard-based interoperability framework for sustainable pro-active post market safety studies https://www.i-hd.eu/index.cfm/resources/ec-projects-results/salus/

SEMANTICHEALTHNET

Network of excellence in semantic interoperability www.semantichealthnet.eu

TRANSFORM PROJECT

Translational research and patient safety in Europe http://www.transformproject.eu/

TRILLIUM BRIDGE

The Trillium Bridge support action extends the European patient summaries used in epSOS and Meaningful Use II, Transitions of Care in the United States, to establish an interoperability bridge between the EU and the US systems. http://www.trilliumbridge.eu/

UNITED4HEALTH

European project which aims to adapt and tailor telehealth services from regions and institutions in Europe to large scale deployment within other regions and institutions and maximise the transferability of services and knowledge among European healthcare providers at large scales and in collaboration. http://ec.europa.eu/information_society/apps/projects/factsheet/index.cfm?project_ref=325215

VALUEHEALTH

To address how interoperability of health information can consistently create, capture and deliver value for all stakeholders. http://www.valuehealth.eu/

(C.3) ADDITIONAL INFORMATION

Guidelines, code of conduct

The following links provide additional information of ongoing work.

Guidelines on:

- On the electronic exchange of health data under Cross Border Directive 2011/24/EU revised in 2016
- On an Organisational Framework for eHealth National Contact Points (2015)

http://ec.europa.eu/health/ehealth/key_documents/index_en.htm

- Report of the Working Group on mHealth assessment guidelines

https://ec.europa.eu/digital-single-market/en/news/report-working-group-mhealth-assessment-guidelines

- Code of Conduct on privacy for mobile health apps,

https://ec.europa.eu/digital-single-market/en/news/code-conduct-privacy-mhealth-apps-has-been-finalised

- Consultation on safety of apps

https://ec.europa.eu/digital-single-market/en/news/public-consultation-safety-apps-and-other-non-embedded-software

3.2.2 EDUCATION, DIGITAL SKILLS AND DIGITAL LEARNING

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The development of digital skills is currently a political priority for the European Commission and for Member States. In her political guidelines, President von der Leyen highlighted the need to unlock the potential of digital technologies for learning and teaching and to develop digital skills for all. Digital is one of the 6 Commission priorities for 2019-2024 with a dedicated digital strategy to empower people with a new generation of technologies, named "A Europe Fit for the Digital Age". The policy objectives are:

- to ensure that all citizens can develop their digital skills;
- to support the development of advanced and specialised digital skills;
- to support education and training in their digital transition.

The Digital Education Action Plan (2021-2027) is a renewed European Union (EU) policy initiative adopted in September 2020 to support the sustainable and effective adaptation of the education and training systems of EU Member States to the digital age. It offers a long-term strategic vision for high-quality, inclusive and accessible European digital education and supports the development of digital skills for all in a lifelong learning perspective. The Action Plan seeks stronger cooperation at the EU level on digital education and underscores the importance of working together across sectors.

The Skills Agenda, adopted in July 2020, is a five-year plan to help individuals and businesses develop more and better skills for resilience, recovery and for a fair and just green and digital transition. The Skills Agenda supports the development of digital skills with specific initiatives such as, among others, Digital Crash Courses for SMEs and "digital volunteers" programme to upskill the current workforce in digital areas, and ICT-Jump-Start trainings to provide short-term intensive training to tackle ICT skills shortages, with a focus on gender-balanced participation.

The Digital Education Action Plan and the Skills Agenda contribute to achieving the objectives of the Digital Compass, which translates the EU's digital ambitions for the next decade into clear, concrete targets, setting out a European way for the digital decade. Specifically, the Digital Compass puts forward the target of reaching by 2030 20 million ICT specialists (with convergence between man and women) and the minimum of 80% of the population to have acquired digital skills.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

REGARDING DIGITAL SKILLS:

Pan-European digital competences (e-competences) frameworks and tools, as well as efficient and interoperable digital-learning solutions are indispensable for reducing digital skills shortages, gaps and mismatches. Similar activities are under development in the United States, Russia, Japan, Australia, Canada, South Africa and Latin America, and other parts of the world. In the early 2000s, the development of national frameworks had already begun in the UK, Germany, France, Italy and other European countries. In the Council Conclusions of 23 November 2007, Member States supported the Commission's intention to continue to provide a platform for the exchange of best practices, and to promote a regular dialogue on digital skills (e-skills) and develop a European e-Competence Framework.

Progress has been made with the development of the European e-Competence Framework for ICT professionals being available and with the establishment of a CEN technical committee (CEN/TC 428 on ICT Professionalism and Digital Competences). CEN/TC 428 published the standard EN 16234. See details in D.2 below.

Launched in 2016, the Digital Skills and Jobs Coalition is bringing together Member States, companies, social partners, non-profit organisations and education providers, who take action to tackle the lack of digital skills in Europe.

REGARDING DIGITAL LEARNING: Efficient, accessible, affordable and interoperable digital learning solutions are necessary to promote the development of a large digital learning and technology-enhanced learning market in Europe. It is vital to ensure everyone's right to access education and lifelong learning.

The forced closure of schools and campus buildings in spring 2020 due to the Covid-crisis has pushed educators and students into teaching and learning with technology at a scale never seen before. This shift to remote teaching and learning has shown major flaws and weaknesses regarding digital skills and competences levels in the population, access to infrastructure and the availability and usability of quality digital resources and platforms. Many teachers are also lacking experience and training - technical and pedagogical – for teaching with digital technologies, including in remote settings. Students too faced new challenges learning at home, including being able to use digital tools and resources independently, efficiently and safely.

In this context, digital learning should be made understandable, pedagogically sound, usable and accessible for all learners, including those with with additional needs. Digital learning also provides an opportunity to foster skills regarding accessibility using a design for all approach.

EUROPEAN EDTECH ALLIANCE:

The European Edtech Alliance (EEA) is a consortium of national trade associations and clusters working with founders and providers of education technology (Edtech).

The European EdTech alliance's mission is to support the growth of the European Edtech sector, and to connect and strengthen the pan-European Edtech ecosystem. https://www.edtecheurope.org

(A.3) REFERENCES

COM(2020) 624 **Communication "***Digital Education Action Plan 2021-2027 — resetting education and training for the digital age*" outlining the European Commission's vision for high quality, inclusive and accessible digital education in Europe. It is a call to action for stronger cooperation at EU level to learn from the COVID-19 crisis and make education and training systems fit for the digital age.

COM(2020) 274 Communication "*The European Skills Agenda — for sustainable competitiveness, social fairness and resilience*" which is a five-year plan to help individuals and businesses develop more and better skills, by strengthening sustainable competitiveness; ensuring social fairness; and building resilience to react to crises, based on the lessons learnt during the COVID-19 pandemic

COM (2018) 22 On 17 January 2018 the Commission published the "*Digital Education Action Plan*" to support technology-use and digital competence development in education. A new Action Plan is foreseen for adoption in September 2020.

Council Recommendation (2018/C 189/01) *on key competences for lifelong learning*

COM(2016) 381 On 10 June 2016 the European Commission published *"A new skills agenda for Europe — Working together to strengthen human capital, employability and competitiveness"*. It presents a number of actions and initiatives aiming to tackle the digital skills deficit in Europe. One of these actions is the launch in December 2016 of the Digital Skills and Jobs Coalition to develop a large digital talent pool and ensure that individuals and the labour force in Europe are equipped with adequate digital skills. This new coalition builds on the work already done under the *Grand Coalition for Digital Jobs* and the EU e-skills strategy, and will bring together a broader set of stakeholders beyond ICT-sector, including ICT-using sectors, training organisations, academia, social partners and Member States.

COM(2016) 180 On 18 April 2016 the European Commission published the Communication *Digitising European industry*, which introduced a set of coherent policy measures as part of a digital single market technologies and public service modernisation package. Part of the communication is devoted to digital skills. In particular, it calls for human capital ready for the digital transformation with the necessary skills.

COM(2013)654 Communication *Open up education: innovative teaching and learning for all through new technologies and open educational resources*".

IP/13/182 *Grand coalition for digital jobs*

(B.) REQUESTED ACTIONS

General recommendation: Standardisation proposals must be based on clear and well-defined market needs and be developed in full coherence with multi-stakeholder initiatives and public policies in this area. These include relevant European Commission's Communications: *"e-Skills for the 21st Century" (2007)*; *"Digitising European Industry" (2016)*;*"European Skills Agenda"* (2020) as well as the on-going *Digital Skills and Jobs Coalition and a Blueprint for Sectoral Cooperation on Skills; and "Digital Education Action Plan" (2020).* The aim is to reduce skills shortages, gaps and mismatches; foster ICT professionalism and digital competence; and further mature the ICT profession, building on the European e-competence framework for ICT professionals and the digital competency framework for citizens.

Relevant stakeholders from the education sector, EdTech industry and policy makers are encouraged to join and engage into standardisation activities to ensure that the European EdTech standards developed support how schools would like to use technology to reach their educational and pedagogical goals. At the same time we need to ensure that requirements are implementable by the EdTech industry, where EdTech products developed, based on developed standards supports the goal of the Commission.

REGARDING DIGITAL SKILLS:

The public and private sectors need to collaborate on the following topics :

ACTION 1 **SDO to make further progress towards a comprehensive framework for ICT professionals** integrating four building blocks: (1) European e-competence framework (e-CF) and related job profiles, (2) foundational body of knowledge, (3) qualifications and certifications, and (4) ethics. This should be complemented by relevant methods and tools for the further development, efficient implementation and regular maintenance of this framework to strengthen ICT professionalism in Europe and foster balanced international dialogue and cooperation on this subject

- The standard (EN 16234-1:2016) was adopted in 2016. It provides a common European description about the knowledge, skills and competences of the ICT professional workforce in all sectors. Its review - CEN/TC 428 project (SA 2017-03) - was successfully completed and a new version was released in 2019 (EN 1634-1:2019). Based on proposals received in 2018, new projects started in 2019 to address the other building blocks.
- To boost successful and consistent implementation, it is important to provide and maintain standards and supporting technical reports related to the four building blocks in a coherent and integrated manner. It is also necessary to reflect and address issues such as assessment and guidance tools, compliance, validation, recognition, and accreditation aspects etc. The aim is to provide an efficient solution to stakeholders, ICT and digital related user, supply and service organisations, businesses of all sizes in all sectors (multinationals and SMEs), Chief Information Officers (CIOs), Human Resources departments, ICT professionals and digital leaders, managers and workers, and education and training organisations on how to apply standards and implement a comprehensive framework. It is necessary to provide case studies to illustrate practical implementation.
- Taking into account that digital technologies are rapidly evolving, the framework will need regular review and update in a consistent and integrated manner. This update of EN16234-1 will become due in 2022.
- Consideration must also be given to the competence areas identified in the Blueprint for Sectoral Cooperation on European Skills Agenda plans for specific ICT areas, software skill, blockchain and cybersecurity. Significant projects are underway in these topics and these can form the basis of further work to supply urgently required skills, and to attract more entrants to the profession.

ACTION 2 **Digital organisational capability and maturity** take stock of initiatives (such as the report on Digital organisational frameworks and IT professionalism) and their benefits regarding the digital capability of organisations, including education organisations, in liaison the individual competences of their staff. Make progress towards the development of synergy with the framework for ICT professionals with a view to match personnel digital competence with digital organisational processes and procedures to ensure best return on investment in digital technologies.

ICT professionalism is defined in terms of the four building blocks of competence, body of knowledge, competence indicators and common metrics, education and training, and a code of ethics, and these should be standardised in a coherent, holistic way to ensure that there is an appropriate context for the standards supported development of the ICT profession. This coordinated approach should also consider employers, wider society and organisational capability.

ACTION 3 International cooperation: European SDOs need to coordinate and establish a regular dialogue and cooperation with international level with relevant associations (IEEE, ACM etc.) and standardisation bodies (ISO, NIST, IEEE etc.) in the field of ICT professionalism and digital competence.

ACTION 4 Organisational capability: take stock of ongoing assessments, initiatives and their impacts regarding the capability of organisations in the context of the digital skills/e-competence of the personnel. Match personnel competence with organisational processes and procedures to ensure best return on investment in ICT.

ACTION 5 The consolidation of ICT professional framework that includes the European e-Competence Framework (EN 16234-1:2019) will be advanced following the publication of the outputs of additional work items (prCEN/TR 17748-1, (Foundational Body of Knowledge for the ICT Profession (ICT BoK), prCEN/TR 17802 (e-Competence performance indicators and common metrics), prCEN/TS 17699 (Guidelines for developing ICT Professional Curricula as scoped by EN16234-1 (e-CF) and prCEN/TS XXX (European Professional Ethics Framework for the ICT Profession (EU ICT Ethics)).

This work should be the basis for a new coherence in the definition and promotion of digital user skills (non-professional). Definition of digital skills at all levels, via a common language, avoids confusion and facilitates a progression in skills development that is appropriate for citizens in all walks of life, and also for addressing the skill and competence needs of the ICT profession. A planned coordination of outputs, like the e-Competence Framework and DigComp can broaden the influence of both constituencies, and the resulting beneficial impact on the development of high level professional skills, and is therefore an essential part of this work. New standards work items in this regard will be particularly important to leverage this synergy.

REGARDING DIGITAL LEARNING:

ACTION 6 **European digital learning standards to facilitate large scale adoption of best practices and solutions on a voluntary basis.** The focus should be on specifications and guidelines for digital learning opportunities designed for all kinds of users, learning outcomes, credit points, assessment and e-portfolios.

ACTION 7 **Standardisation potential around digital learning serveces and tools:** SDO to investigate digital learning courses and resources, content repositories and exchange mechanisms with a focus on data privacy metadata, learning design and structure, technical and semantic interoperability supported by agreed protocols, exchange formats and vocabularies and data governance. Interoperability should include context-aware, adaptable and mobile/ambient e-learning systems and cross-domain aspects. This may include the learning trajectory or learning route including, e.g. the didactic approach, aimed learning & learner›s profiles and the availability of additional tools that support digital learning. End users (learners and educators) should be involved in the design, testing and development of digital learning solutions and digital pedagogical services to ensure adoption in the different educational practices.

ACTION 8 **Standardisation potential around interoperability and transfer of learners› data:** SDOs to investigate the possible standardisation of the exchange of learning & learners activity data which may be generated in the different learning spaces. By the use of a Caliper or xAPI-like framework, the exchange and therefore effective usage might be facilitated.

ACTION 9 **European guidelines on ensuring accessible and inclusive digital learning:** These guidelines should be based on a design-for-all approach to facilitate learning for diverse range of users, including learners with disabilities ensuring everyone has equal access to equivalent digital learning tools and services.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

REGARDING DIGITAL SKILLS:

CEN

CEN/TC 428 'ICT Professionalism and Digital Competences' is responsible for the standardisation of a common language of professional ICT and digital competences, skills and knowledge applied in all domains. A non-exhaustive list of areas where CEN/TC 428 can develop its activity follows:

- EN 16234:2019 (e-CF) maintenance and evolution
- Interaction with different Frameworks
- Curricula guidance
- Professional profiles
- Provide guidance for the assessment against EN 16234 (e-CF)

See: CEN/TC 428 - ICT Professionalism and Digital Competences published standards

The CEN workshop on ICT Skills has been definitively replaced by the CEN/TC 428.

ISO/IEC JTC1

SC 27 "Competence requirements for information security management systems professionals"

SC 7/WG 20 "Software and Systems Bodies of Knowledge and Professionalisation and related activities"

SC 36 "Information Technology for Learning Education and Training" has in particular the following published standards of relevance:

- ISO/IEC 2382-36: Information Technology - Vocabulary - Part 36: Learning, Education and Training
- ISO/IEC 19788 All parts: Information technology — Learning, education and training — Metadata for learning resources
- ISO/IEC 20013: Information technology for learning, education and training — Reference framework of e-Portfolio information
- ISO/IEC 22602: Information technology — Learning, education and training — Competency models expressed in MLR
- ISO/IEC 23126: Information technology for learning, education and training — Ubiquitous learning resource organization and description framework
- ISO/IEC 23127: Information technology — Learning, education, and training — Metadata for facilitators of online learning
- ISO/IEC TR 20748: Information technology for learning, education and training — Learning analytics interoperability
- ISO/IEC TR 20821: Information technology — Learning, education and training — Learning environment components for automated contents adaptation
- ISO/IEC TR 23842: Information technology for learning, education and training — Human factor guidelines for virtual reality content

See https://www.iso.org/committee/45392/x/catalogue/p/1

Regarding digital learning:

CEN

CEN/TC 428 - "ICT Professionalism and Digital Competences" is responsible for all aspects of standardisation related to maturing the ICT Profession in all sectors, public and private. This includes, at a minimum, activity related to four major building blocks of ICT Professionalism (competences, education and certification, professional ethics, body of knowledge). A non-exhaustive list of areas where CEN/TC 428 develops its activity:

- EN 16234 (e-CF) - a common European e-Competence Framework for ICT Professionals in all industry sectors': maintenance and evolution
- interaction with different international Frameworks
- curricula guidance
- professional role profiles
- guidance for the assessment against EN 16234 (e-CF): Body of Knowledge (BoK), development of an education and certification model related to the e-CF, development of a sustainable framework for ICT professional of ethics

CEN/TC 353 - "Information and Communication Technology for Learning, Education and Training" has the following published standards of relevance:

- EN 15981: European Learner mobility - Achievement information (EuroLMAI)
- EN 16425: Simple Publishing Interface
- EN 15982: Metadata for Learning Opportunities (MLO) - Advertising
- EN 15943: Curriculum Exchange Format (CEF) - Datamodel

see https://itprofessionalism.org/

IEEE

IEEE/LTSC - "Learning Technology Standards Committee"

- IEEE 1484.1 - IEEE Standard for Learning Technology - Learning Technology Systems Architecture (LTSA)
- IEEE 1484.11.2 - IEEE Standard for Learning Technology-- ECMAScript Application - Programming Interface for Content to Runtime Services Communication
- IEEE 1484.12.1 - IEEE Standard for Learning Object Metadata
- IEEE 1589 - IEEE Standard for Augmented Reality Learning Experience Model
- Adaptive Instructional Systems (AIS) (IEEE P2247)
- Augmented Reality Learning Experience Model (AR-LEM) (IEEE P1589)
- Child and Student Data Governance(CSDG) (IEEE P7004)
- Collaborative Edge Computing (CED)
- Conceptual Model for Learning Technology Systems (CM4LTS) (IEEE P1484.1)
- Computer-Managed Instruction (CMI) (IEEE P1484.11.2)
- Digital Literacy, Skills and Readiness (DLSR) (IEEE P3527.1)
- Data & AI Literacy, Skills and Readiness (IEEE P7015)
- Experience API Base Standard (xAPI) (IEEE P9274)
- Explainable Artificial Intelligence (XAI) (IEEE P2894)
- Federated Machine Learning (FML) (IEEE P3652.1)
- Interoperable Learner Records (ILR) (IEEE P1484.2)
- Learning Object Metadata (LOM) (IEEE P1484.12)
- Mobile Learning Platforms (Mobile) (IEEE P7919.1)
- Recommended Practices for Defining Competencies (IEEE P1484.20)
- Resource Aggregation Models for Learning, Education, and Training (RMLTWG) (IEEE P1484.13)
- Renewing SCORM Standards (SCORM) (IEEE P1484.11.1 IEEE P1484.11.2 IEEE P1484.12.1, IEEE P1484.12.3)

- Standard for Learning Metadata (LMeta) (IEEE P2881)

There also are relevant IEEE pre-standards activities, including:

- Industry Consortium on Learning Engineering (ICICLE) (https://standards.ieee.org/industry-connections/industry-consortium-learning-engineering.html)
- Digital Resilience—Tools and Methods to Support Response and Recovery from Crises, and specifically its sub-committee on eResilience in Education Systems (https://ieee-sa.imeetcentral.com/digres/doc/WzIsNzQzMDU5OTRd/w-ScEresilienceInEducationSystems)
- Digital Intelligence (https://standards.ieee.org/industry-connections/digitalintelligence/index.html)

For more information, please visit https://ieeesa.io/rp-elearning

ISO/IEC JTC 1 SC 36

Subcommittee (SC) 36 on Information Technology for Learning, Education and Training (ITLET) has the following work programme underway:

http://www.iec.ch/dyn/www/f?p=103:22:0::::FSP_ORG_ID:3410

Standards to ensure interoperability between information technology systems used in ITLET;

The identification of generic LET requirements for information technology systems and services used in ITLET situations (example: types of digital content)

Standards projects being addressed:

The description of metadata for learning resources

- ITLET vocabularies
- the personalization of the IT-enabled educational environment (individualized accessibility)
- models for describing competency
- the creation of an ITLET quality framework
- the advancement of e-Assessments, e-textbooks and related learning services, virtual experiments
- Future work planned
- learning analytics
- massive open online course (MOOC) standardisation
- how existing standards and specifications may work together to better the LET environment
- ISO TR 20514: EHR Definition scope and context

http://www.iso.org/iso/home/standards_development/

list_of_iso_technical_committees/iso_technical_committee.htm?commid=45392

ITU-T

ITU-T SG16 on multimedia has produced a series of standards that enable remote collaboration, e.g. Recommendation ITU-T F.742 on service description and requirements for distance learning services.

http://itu.int/ITU-T/go/tsg16

The Recommendation ITU-T Y.2241 "Service framework to support web objects based ubiquitous self-directed learning" was approved by ITU-T SG13 in 2017.

ITU-T SG13 has developed the Recommendation on application of a u-learning environment to the smart farming (Y.2246). Additionally, SG13 is also working on the Recommendation on QoS requirements for smart education supported by IMT-2020 (Y.IMT2020-qos-req-se).

http://itu.int/ITU-T/go/tsg13

The ITU also published a technology watch report on technology-based learning

http://itu.int/en/ITU-T/techwatch/Pages/learning-standards.aspx

(C.2) ADDITIONAL INFORMATION

REGARDING DIGITAL SKILLS:

This topic is suitable for standardisation for well-documented needs. Fostering ICT professionalism is a challenging task and is essential to ensure that the European economy has the supply of professional skills that it needs and that are currently not being delivered in sufficient numbers. Digital skills must also be provided, at appropriate levels, to the whole population, including those who usually find more barriers in accessing ICT, such as old people and people with disabilities. Efforts to facilitate this cohort of people could include accessible e-learning environments, such as accessible MOOCs. As new technologies and new areas of their application emerge rapidly, establishing standardised skill sets is a great challenge requiring timely and regular updates. Since the 1990s, this topic has primarily been addressed by public-private partnerships with the ICT industry. More recently, many countries around the world have launched standardisation efforts. There is a need to maintain a European platform for exchanging best practices, implementing a master plan and coordinating across Europe. The existing structure of the CEN TC 428 - ICT Professionalism and Digital Competences - constitutes a good place for such a piece of work — following the already successful development of the e-CF.

The **e-Skills Manifesto** also contains contributions from various stakeholders. See: http://ec.europa.eu/DocsRoom/documents/21341/attachments/1/translations/en/renditions/pdf

EN 16234-1 is the only existing standard in the field of ICT professionalism, focusing on e-Competences at the European and national level. Though several European organisations have started promoting and using the e-CF, those local implementations do not always fully comply with EN 16234-1, and local adaptations and application platforms make the standard more attractive to clients not accustomed to standardised approaches. Since 2019, new initiatives to produce standards, pre-standards and supportive documentation in the area of digital competences are ongoing e.g. development of a professional Body of Knowledge, IT Certifications and Qualifications, Curriculum Development Guidelines, development of an ICT Professional Ethics Framework, and specification of Common Metrics for e-Competences. Alongside this work, there is work underway to update the EN-16234-1, incorporating a mapping with SFIA of the UK (Skills Framework for the Information Age). All of this takes place in the context of the ICT professionalism framework project. At the same time, new initiatives on ICT competences are ongoing internationally as well, e.g. in ISO/IEC JTC 1/SC 7 and ISO/IEC JTC 1/SC 27. New standards may be developed, which

might conflict with European standards. The fragmentation of the global digital market could undermine interoperability, which so far has led the European action. There is the need to support initiatives, which assure European governance and influence in the ISO.

REGARDING DIGITAL LEARNING:

European Agency for Special Needs and Inclusive Education/DAISY Consortium/European Schoolnet/Global Initiative of Inclusive ICTs/International Association of Universities/UNESCO

The ICT4IAL project is a multi-disciplinary network of European and international partners that represent both learning and ICT communities. This network was co-funded by the European Commission under the Lifelong Learning Transversal Programme, Key Activity 3: Information and Communication Technologies. The project aims to:

1. Raise awareness and increase the visibility of the issue of accessible information provision and its relevance for equitable lifelong learning opportunities;

2. Support accessible information provision within organisations through the development, trialling and evaluation of guidelines that build upon already existing work in the field. https://www.ict4ial.eu/project-aims

3.2.3 EMERGENCY COMMUNICATIONS AND PUBLIC WARNING SYSTEMS

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

EMERGENCY COMMUNICATIONS

Emergency communications are defined primarily as means communication by means of interpersonal communications services between an end-user and the PSAP with the goal to request and receive emergency relief from emergency services

Emergency communications should ensure effective access to emergency services for all, including end-users living with disabilities and roaming customers. Caller location is the most important contextual data that should be made available to Public Safety answering Point and should be accurate enough to enable the effective intervention of emergency services.

PUBLIC WARNING SYSTEMS

Article 110 of the European Electronic Communication Code requires that by 21 June 2022, Member States shall ensure that, when public warning systems regarding imminent or developing major emergencies and disasters are in place, public warnings are transmitted by providers of mobile number-based interpersonal communications services to the end-users concerned.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The lack of commonly agreed standards in support of electronic communications networks for emergency communications in Europe is a barrier to implementing future proof solutions which meet the requirements of Directive (EU) 2019/882 of 17 April 2019 on the accessibility requirements for products and services and Directive (EU) 2018/1972 on the European Electronic Communications Code.

Standards for real time text and total conversation access to emergency services are required to meet special needs for users living with disabilities and to ensure equivalence of access under Directive (EU) 2018/1972. Directive (EU) 2019/882 in addition entail the availability of real time text and total conversation for emergency communication by using the European emergency number '112'.

The lack of harmonised approach to establishing criteria for location accuracy and reliability hampers Member State's efforts to develop adequate solutions that ensure that emergency services benefit from caller location that is useful to effectively intervene in case of an emergency.

(A.3) REFERENCES

- **Directive (EU) 2018/1972** of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code.
- **COMMISSION DELEGATED REGULATION (EU) 2019/320** of 12 December 2018 supplementing of Directive 2014/53/EU of the European Parliament and of the Council with regard to the application of the essential requirements referred to in Article 3(3)(g) of that Directive in order to ensure caller location in emergency communications from mobile devices.
- **Directive 2002/58/EC** of the European Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications).
- Recommendation 2003/558/EC of the Commission of the European Communities of 25 July 2003 on the processing of caller location information in electronic communication networks for the purpose of location-enhanced emergency call Services.

(B.) REQUESTED ACTIONS

ACTION 1 SDOs to address data protection and privacy requirements (privacy by design) in ongoing standardisation activities concerning emergency communications and processing and transmission of caller location information.

ACTION 2 Identify standardisation needs for the deployment of emergency applications enhanced with caller location information and accessibility features for the widest range of users, including end-users living with disabilities.

ACTION 3 SDOs to identify the applicable specifications and standardisation needs for the transmission of handset derives caller location to the most appropriate PSAPs by mobile network operators in both, user plane and control plane modes.

ACTION 4 SDOs to define dictionaries for warning messages for emergency communication service based on the input of various civil protection agencies.

ACTION 5 SDOs to identify standardisation needs for the establishment of a Union wide public warning system in line with recital 294 of Directive (EU) 2018/1972.

ACTION 6 SDOs to define requirements for emergency communications involving IoT devices in all types of emergency situations.

ACTION 7 SDOs to elaborate the standards on the architecture (currently named Next Generation Emergency Communication architecture), the core elements and corresponding technical interfaces for network independent access to emergency services.

ACTION 8 SDOs to set requirements, functional architecture, protocol and procedures specification for a Pan European mobile emergency application.

ACTION 9 ESOs to elaborate standards on accessibility of emergency communications as arising under the European Accessibility Act.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

ETSI

Work in response to European Commission Mandate M/493 on the location enhanced emergency call has been completed, with the development of protocol specifications for retrieving and transporting emergency caller location. This service is intended to cover situations where different service providers and network operators must co-operate to determine the location of an emergency caller – such as when a user makes an emergency call using a Voice-over-IP service instead of a conventional mobile or fixed telephone.

Work on total conversation access to emergency services resulted in the publication of TS 101 470, total conversation for emergency communications, implementation guidelines.

SC EMTEL completed its work on a TR to prepare requirements for communications involving IoT devices in all types of emergency situations (e.g. communications of individuals with authorities/organizations, between authorities/organizations, from authorities/

organizations to the individuals, amongst individuals). The next step is to include the requirements in the appropriate Technical Specifications.

ETSI has published to the description of the architecture (currently named 'Next Generation Emergency Communication architecture'), the core elements and corresponding technical interfaces for network independent access to emergency services. ETSI TS 103 479 describes the architecture, core elements and corresponding technical interfaces. This work is complemented by a group of TSs describing test cases and scenarios for related interoperability and conformance testing.

ETSI has completed work on the requirements, the functional architecture, the protocol and the procedures for implementing the Pan-European Mobile Emergency Application. There are presently hundreds of emergency calling applications in use across Europe, but their use is constrained to the boundaries of the Public Safety Answering Point (PSAP) with which they are integrated. The resulting TS, updated in March 2020, makes it possible for data to arrive at the most appropriate PSAP, wherever the call is made.

The concept of 'Next Generation 112' (NG112) has been identified as a potential solution to the increasing requirements and demands of content-rich emergency calling. ETSI has developed conformance and interoperability tests specifications for NG112.

ITU-T

ITU-T Focus Group on "Disaster relief systems, network resilience and recovery" produced several technical specifications that were published (http://www.itu.int/pub/T-FG/e) and were refined in ITU-T SG2 and SG15:

Recommendation ITU-T L.392 "Disaster management for improving network resilience and recovery with movable and deployable ICT resource units' was approved by ITU-T SG15 in April 2016.

Supplement ITU-T Suppl.35 "Framework of disaster management for network resilience and recovery" was approved by ITU-T SG15 in June 2017.

Recommendation ITU-T E.108 "Requirements for a Disaster Relief Mobile Message Service" was approved by ITU-T SG2 in January 2016.

Recommendation ITU-T E.119 (ex. E.rdr-scbm) «Requirements for Safety Confirmation and Broadcast Message Service for Disaster Relief" was approved by ITU-T SG2 in April 2017.

Draft new Recommendations ITU-T E.102 (ex. E.TD-DR) «Terms and definitions for disaster relief systems, network resilience and recovery « is under approval process by ITU-T SG2.

E.Suppl.1 to ITU-T E.100 series (ex E.sup.fdr) "Framework of disaster management for disaster relief systems" was agreed by ITU-T SG2 in February 2019.TR.CLE, "Identify call location for emergency service" was agreed by ITU-T SG2 in June 2020, and provides an overview of technical solutions available for this purpose.

ITU-T SG2 also produced an amendment to its E.123 standard for quickly identifying next-of kin (or other emergency contact) in a mobile handsets' directory, for use in case of emergency, and has established a framework for international emergency call priority (ITU-T E.106 and E.107).

SG2 has also developed the following:

Recommendation ITU-T E.161.1 on "Guidelines to select Emergency Number for public telecommunications networks"

TR.CLE, "Identify call location for emergency service" was agreed by ITU-T SG2 in June 2020

At its meeting in December 2020, under its role as lead study group on telecommunications for disaster relief/early warning, network resilience and recovery, ITU-T SG2 established the new Focus Group on Artificial Intelligence for Natural Disaster Management (FG-AI4NDM). The activities of the FG-AI4NDM are being conducted in close collaboration with the World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP). Within FG-AI4NDM, the Working Group on "Effective Communications", which focuses on the role of AI in facilitating effective communications before and during natural disasters, including at sociological/demographical aspects. More information about the ITU/WMO/UNEP FG-AI4NDM is available at: https://itu.int/go/fgai4ndm

ITU-T SG17 has transposed the OASIS Common Alerting Protocol versions 1.1 and 1.2 into ITU-T X.1303 and X.1303bis.

ITU-T SG13 developed a number of Recommendations including ITU-T Y.2074, Y.2222, Y.2705, Y.1271, Y.2205 and Supplement 19 to the ITU-T Y.2200-series —covering different aspects of emergency communication operation. ITU-T draft Y.ccrm "Cloud computing - Framework of risk management" addresses framework of risk management in cloud computing, including risk assessment, risk treatment etc.

ITU-T FG NET2030 White Paper «Network 2030 - A Blueprint of Technology, Applications and Market Drivers Towards the Year 2030 and Beyond» elaborates on the critical infrastructure enable people to survive in emergency situations.

https://www.itu.int/en/ITU-T/focusgroups/net2030/Documents/White_Paper.pdf

ITU-T SG11 approved ITU-T Q.3615 which describes the Open GeoSMS Standard, which was developed by the Open Geospatial Consortium (OGC); geo-localisation is a key part of rapid and effective emergency responses. SG11 also drafted a number of Supplements to the Q-series Recommendations (e.g. Supplements 47, 53, 57, 61, 62, 63, 68, 69, 70 and 72) to support emergency telecommunications. SG11 developed a new Recommendation ITU-T Q.3060 "Signalling architecture of fast deployment emergency telecommunication networks to be used in a natural disaster" which defines a general framework for fast deployment emergency telecommunication networks (fdETNs) to be used in a natural disaster. It describes different technologies that might be used as a part of such a network including: self-organizing communication technologies (ubiquitous sensor network; USN); unmanned aerial vehicles (UAVs); Internet of things (IoT); and flying ubiquitous sensor network (FUSN). This Recommendation also specifies functional elements of such emergency telecommunication networks and contains requirements for services and protocols. Currently, SG11 is developing signalling requirements for emergency telecommunication service in IMS roaming environment.

ITU-T SG12 developed Recommendation ITU-T P.1140 (ex P.emergency) "Speech Quality Requirements for Emergency Calls" in March 2017. SG12 is updating this Recommendation.

ITU- T SG16 developed Recommendation ITU-T H.785.1 (ex H.DS-PISR) «Digital signage: Service requirements and a reference model on information services in public places via an interoperable service platform". This technology can be used for early warning to lessen damages, reporting up-to-the-minute situations and announcing traffic status/evacuation sites.

ITU-T SG20 developed the following:

- Recommendation ITU-T Y.4119 "Requirements and capability framework for IoT-based automotive emergency response system",
- Recommendation ITU-T Y.4467 "Minimum set of data structure for automotive emergency response system"
- Recommendation ITU-T Y.4468 "Minimum set of data transfer protocol for automotive emergency response system".

SG20 is developing Recommendations on "Framework of smart evacuation during emergencies in smart cities and communities" and "Requirements and reference architecture of smart service for public health emergency".

ITU-R

The ITU's Radiocommunication Sector (ITU-R) is also carrying out studies on emergency communications. Resolution ITU-R 55 (Radiocommunication Assembly, 2019) instructs all ITU-R Study Groups to carry out studies on the use of radiocommunications in disaster prediction, detection, mitigation and relief.

https://www.itu.int/en/ITU-R/information/Pages/emergency.aspx

Report ITU-R M.2291 on "The use of International Mobile Telecommunications (IMT) for broadband Public Protection and Disaster Relief (PPDR) applications", prepared by ITU-R Working Party 5A, addresses the current and possible future use of International Mobile Telecommunications (IMT) including the use of Long-Term Evolution (LTE) in support of broadband public protection and disaster relief (PPDR) communications. It also provides examples for deploying IMT for PPDR radiocommunications, case studies and scenarios of IMT systems to support broadband PPDR applications such as data and video.

ITU-D

ITU-D SG2 Question 5/2 has developed a report on Utilization of telecommunications/ICTs for disaster preparedness, mitigation and response: https://www.itu.int/pub/D-STG-SG02.05.1-2017

W3C

WebRTC, the web's real-time communication service is currently being developed and specified jointly between the IETF and W3C. The IETF is working on the protocol level. The group heading this effort is called RTCweb.

W3C specifies the necessary API to connect the service to the web — application framework created by, among others, by HTML5. The group working on this part is called WebRTC. A good overview of the technology developed can be found in the STREWS project's security report on WebRTC.

IETF

The Emergency Context Resolution with Internet Technologies (ECRIT) Working Group has developed a general architecture for enabling IP applications to discover and connect to emergency services.

The Geographic Location/Privacy (GEOPRIV) Working Group developed protocols that allow IP networks to inform end devices about their geolocation, a critical pre-requisite for emergency calling.

The application-specific working groups in the IETF (for example, the Session Initiation Protocol Core (SIPCORE) Working Group) have developed extensions to support emergency calling as required.

The Secure Telephone Identity Revisited (STIR) WG is developing Internet-based mechanisms that allow verification of the calling party's authorisation to use a particular telephone number for an incoming call. The main focus is on the SIP as one of the main VoIP technologies used by parties that want to misrepresent their origin, in this context the telephone number of origin. See, for example, RFC7375 "Secure telephone identity threat model".

https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#Emergency

ISO

ISO/TC 204: intelligent transport systems (ITS). This covers standardisation of information, communication and control systems in the field of urban and rural surface transportation, including intermodal and multimodal aspects thereof, traveller information, traffic management, public transport, commercial transport, emergency services and commercial services in the intelligent transport systems (ITS) field.

Projects include:

ISO/AWI 19083-2: ITS — Public transport — Emergency evacuation and disaster response and recovery — Part 2: Data flow

ISO/PRF TR 19083-1: ITS — Public transport — Emergency evacuation and disaster response and recovery Part 1: Framework

ISO/NP 20530: ITS — Information for emergency service support via personal ITS station — General requirements and technical definition

ISO/PWI 21344: ITS– Public transport — Emergency services E-Call device for emergency on connected vehicles using ITS station

ISO 22951:2009 (Ed. 1): Data dictionary and message sets for pre-emption and prioritisation signal systems for emergency and public transport vehicles (PRESTO)

ISO 24978:2009 (Ed. 1): ITS Safety and emergency messages using any available wireless media — Data registry procedures

ISO/DTR 18317: ITS — Pre-emption of ITS communication networks for disaster relief and emergency communications

http://www.iso.org/iso.iso_technical_committee%3Fcommid%3D54706

ONEM2M

Some examples of features of oneM2M to enable communication in emergency situations are access controls, message prioritization, network congestion alleviation, group communication, subscription/Notification and location tracking.

For more details see the oneM2M Technical Report in "TR-0046-Study_on_Public_Warning_Service_Enabler" and the oneM2M Technical Specification "TS-0037-IoT_Public_Warning_Service_Enablement".

All oneM2M specifications and reports are publicly available at: Specifications (onem2m.org)

OASIS

The OASIS Emergency Management TC created the Common Alerting Protocol (CAP), used by crisis responders, weather prediction agencies and emergency management stakeholders for broadcasting data about crisis conditions and locations, over various media including SMS, police radio and weather radio. CAP also is approved as ITU-T Rec X-1303. A suite of related Emergency Data Exchange Language (EDXL) resource and crisis management XML standards have also been developed, supporting exchange of health facility availability information (HAVE), data sharing of information on situations, incidents, events and responses (SitREP) and sharing of emergency patient and tracking information (TEP)

3.2.4 E-GOVERNMENT

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

In the digital single market strategy, interoperability appears as an important enabler for boosting competitiveness. Cross-border interoperability is also considered key for modernising public administrations. At the European level, the Once Only Principle has for the first time been mandated by the implementation, as established by the Single Digital Gateway Regulation, of a technical system that allows the cross-border exchange of evidence relevant for the procedures under such regulation. The **Once Only Principle** entails that public administrations do not request from citizens and businesses to provide data that are already held by any public competent authority -even foreign authorities-, but take actions to share these data always in respect of data protection regulations and other applicable legal requirement, so citizens and businesses are requested to provide data of each type at most only once.

In addition to the multilingual challenge, semantic interoperability is compromised by the lack of commonly agreed and widely used data models, divergent interpretations of the same data and the absence of common reference data (e.g. code-lists, identifiers, taxonomies, references to organisations, geospatial references, license collections, etc.).

The European Commission, in the context of the ISA2 programme (Interoperability solutions for European Public Administrations, Businesses and Citizens), undertook a number of initiatives to achieve semantic interoperability in Europe.

The ISA2 programme contributed in this area through several streams of work, focusing on the development, promotion and management of common data specifications, further described in the relevant subsections: DCAT-AP as a data standard to describe open data catalogues and datasets; ADMS-AP 2.0 as metadata description of reusable solutions, such as legal templates, data specifications and standards, technical protocols and open source software; European Legislation Identifier (ELI) to facilitate the exchange of legislation data in Europe; and Core Vocabularies as generic, simplified and reference data models of important master data types used across public administration information systems and applications, such as persons, businesses, locations, public organisations and public services. Work performed by the ISA2 programme is continued through the Digital Europe Programme Regulation (Regulation (EU) 2021/694). In the Digital Europe Programme, the need for sematic interoperability is highlighted for the creation of the common European data spaces, a concept introduced by the European Strategy for Data as well as an enabler to seamless and secure cross-border electronic communication.

A new interoperability policy and governance will also work on defining a platform of shareable resources for cross-border and cross-domain services. Govtech incubators will also develop and test new components and specifications.

In all of these work streams, care is taken to ensure compatibility between the public sector and what the private sector can achieve, noting existing standards and specifications. There are accordingly some main technology areas that need to be addressed further and where standards are important for supporting the implementation of EU policy objectives:

- DCAT-AP — This is addressed in detail in the section on Public Sector Information (PSI), Open Data and Big Data including a number of proposed actions;
- Exchange of metadata on re-usable interoperability assets among national and international repositories: The Asset Description Metadata Schema (ADMS) is a metadata description of interoperability solutions;
- Core Vocabularies to facilitate the development of interoperable IT solutions by ensuring a minimum level of interoperability for public administration master data usually stored in base registries.
- The CPSVP-AP aims at describing public services in the same way across different Service Catalogues, to enable federation and search across such catalogues.

The European interoperability framework is a commonly agreed approach to the delivery of European public services in an interoperable manner that defines basic interoperability guidelines in the form of common principles, models and recommendations. It is expected that many recommendations can help also the private sector for B2B, B2G and B2C services. For example, the European standard on electronic invoicing is based on the concept of semantic interoperability and supports B2B and B2G transactions.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

In the Digital Single Market strategy, interoperability and reduction of administrative burden appear as important enablers for boosting competitiveness. Cross-border interoperability and data exchange are also considered key for modernising public administrations. At the European level, the Once Only Principle has for the first time been included in the eGovernment Action Plan 2016-2020, where it is one of the underlying principles. Subsequently, Member States have committed themselves to the Once Only Principle, such as in the Tallinn Declaration on eGovernment and the Berlin Declaration on Digital Society and Value-Based Digital Government. Furthermore, the Once Only Principle has been included in article 14 of the Single Digital Gateway Regulation adopted on 2 October 2018. Moreover, the recent Digital Decade Communication, sets that by 2030, everyone should benefit from "a best–in-class digital environment providing for easy-to-use, efficient and personalised services and tools with high security and privacy standards". The implementation of the Once Only Principle is key to reaching this goal.

DCAT-AP

DCAT-AP is a specification based on W3C's Data Catalogue vocabulary (DCAT) for describing public sector datasets in Europe. For more information, see chapter 3.1.3 Public sector information

Exchange of metadata on re-usable interoperability assets (eGovernment)

Public administrations, businesses, standardisation bodies and academia are already producing interoperability solutions that, if (re) used, can facilitate interoperability among public administrations' services. However, these are not always easy to find. ADMS-AP 2.0 is a common way to describe interoperability solutions making it possible for everyone to search and discover them once shared through the forthcoming federation of repositories containing solutions for promoting interoperability.

With the intention to facilitate the visibility and re-usability of interoperability solutions across-borders and sectors, the Commission has made available a large set of interoperability solutions described using ADMS-AP 2.0, through a federation of asset repositories of Member States, standardisation bodies and other relevant stakeholders. Through this federation, accessible through the Joinup[12] platform, semantic interoperability solutions may be searched and are made available through a single point of access.

12 https://joinup.ec.europa.eu/collection/semantic-interoperability-community-semic/solution/asset-description-metadata-schema-adms/release/20

CORE VOCABULARIES TO FACILITATE THE DEVELOPMENT OF INTEROPERABLE IT SOLUTIONS

The Commission's ISA programme is reducing semantic interoperability conflicts in Europe.

Agreement on definitions for the fundamental concepts should come firstly. These concepts are simplified data models which capture the minimal, global characteristics/attributes of an entity in a generic, country- and domain-neutral manner. Using a different terminology, these specifications are data models for important master data types used by numerous information systems and applications. These specifications are called "Core Vocabularies" in the ISA2 Programme.

Working together with relevant stakeholders from public administration, industry and academia, the Commission has made available a series of core vocabularies with high reusability potential: the core business, the core location, the core public service, the core public organisation, the core criterion and core evidence, and the core public service vocabularies.

In 2015, the core public service vocabulary application profile (CPSV-AP) also became available. Activities on financial reporting are under consideration.

LEGISLATION INTEROPERABILITY

The European Legislation Identifier (ELI) to make legislation available online in a standardised format including technical specifications on:

- legislation URI - Uniform Resource Identifier
- legislative resource metadata
- information exchange format ontology

Akoma Ntoso for European Union (AKN4EU) is the future machine-readable structured format for the exchange of legal documents in the EU decision-making process.

(A.3) REFERENCES

- **Decision (EU) 2015/2240** on interoperability solutions and common frameworks for European public administrations, businesses and citizens (ISA2 programme) as a means for modernising the public sector (ISA2)
- Communication 2017/134 on the European Interoperability Framework - Implementation Strategy
- **Directive 2003/98/EC** of the European Parliament and of the Council of 17 November 2003 on the re-use of public sector information (public service information directive)
- National eGovernment strategies are in place in many EU Member States and the EFTA countries. Please also see Annex I.
- eGovernment Action Plan 2016-2020
- Tallinn Declaration on eGovernment(06.10.2017)
- The **Berlin Declaration on Digital Society and Value-based Digital Government**
- **Regulation (EU) 2018/1724** of the European Parliament and of the Council of 2 October 2018 establishing a single digital gateway to provide access to information, to procedures and to assistance and problem-solving services and amending Regulation (EU) No 1024/2012 (Text with EEA relevance.)
- Regulation (EU) 2021/694 of the European Parliament and of the Council of 29 April 2021 establishing the Digital Europe Programme and repealing Decision (EU) 2015/2240, establishing a new EU funding programme focused on bringing digital technology to businesses, citizens and public administrations.
- Proposal for Regulation on European data governance (Data Governance Act) (EU)2020/0340. The proposal is the first of a set of measures announced in the 2020 European strategy for data. The instrument aims to foster the availability of data for use by increasing trust in data intermediaries and by strengthening data-sharing mechanisms across the EU.
- Europe's Digital Decade: digital targets for 2030
- The European Interoperability Framework (EIF)
- The European Legislation Identifier (ELI)

(B.) REQUESTED ACTIONS

ACTION 1 Following the Covid-19 situation and the experience gained with the current level of digitalisation of government services, the European Commission and SDOs to cooperate on analysing the current level of digitalisation and identifying gaps and needs regarding standards to support and further accelerate digitalisation. This should also include best practices.

ACTION 2 European Commission together with SDOs to facilitate a broad exchange with stakeholders and public authorities on standardisation and interoperability for eGovernment services.

ACTION 3 SDOs to identify and inform about standards that are available or under way and that are of relevance in supporting the European Interoperability Framework.

ACTION 4 SDOs to consider with ISA2 and Digital Europe programme the development of a set of standards around the EIF based on the specifications produced by the ISA2 and the Digital Europe programmes.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

W3C

The Registered Organization Vocabulary which is based on the Business Core Vocabulary has been published as a W3C Note by the W3C Linked Government Data Working group. http://www.w3.org/TR/vocab-regorg/

The W3C Data Exchange Working Group is chartered to create DCAT Version 3. Latest Draft is always at https://www.w3.org/TR/vocab-dcat-3/ DCAT has known gaps in coverage, for example around time series and versions. DCAT has been successful and is in wide use, but these gaps must be addressed if usage is to continue to grow across different communities and the variety of metadata schemas is to reduce. Maximizing interoperability between services such as data catalogs, e-Infrastructures and virtual research environments requires not just the use of standard vocabularies but of *application profiles*, initially created by DIGIT. This will also affect some of the Core Vocabularies produced by the Commission.

The Working Group is also tasked to deliver Content Negotiation by Application Profile and guidance on publishing application profiles of vocabularies, but those are not mature yet. More information can be found on the page of the Data Exchange WG: https://www.w3.org/2017/dxwg/wiki/Main_Page

ITU

ITU-T Focus Group on Data Processing and Management (FG-DPM) was created in March 2017. FG-DPM concluded its work with the development of several deliverables covering a variety of topics including the following:

- DPM Framework for Data-driven IoT and Smart Cities and Communities
- Technical enablers for open data platform
- Data interoperability
- Data quality management for trusted data

The complete list of deliverables is available here: https://www.itu.int/en/ITU-T/focusgroups/dpm

ITU-T SG20 are currently developing draft Recommendations and draft Supplements based on the FG-DPM deliverables. ITU-T SG20 approved Recommendation ITU-T Y.4473 "SensorThings API – Sensing", Recommendation ITU-T Y.4560 "Blockchain-based data exchange and sharing for supporting Internet of things and smart cities and communities", Recommendation ITU-T Y.4561 "Blockchain-based Data Management for supporting Internet of things and smart cities and communities" and agreed Supplement ITU-T Y.Suppl.69 "Web based data model for IoT and smart city systems and services", Supplement ITU-T Y.Suppl.62 "Overview of blockchain for supporting Internet of things and smart cities and communities in data processing and management aspects".

More info: https://itu.int/go/tsg20

OASIS

The OASIS Transformational Government TC Framework (TGF) advances an overall framework for using information technology to improve the delivery of public services.

The OASIS Legal Document XML (LegalDocML) TC advances worldwide best practices for the use of XML within parliaments, assemblies, or congresses, within courts and tribunals, and generally for legal documents including contracts. The work is based on the Akoma Ntoso UN project. OASIS Akomo Ntoso is the basis of the future machine-readable structured format for the exchange of legal documents in the EU decision-making process, Akoma Ntoso for European Union (*AKN4EU*).

The OASIS Code List Representation TC is defining an XML format for interchange, documentation and management of code lists.

The Single Digital Gateway regulation includes a system for once-only electronic exchange of evidences for electronic cross-border procedures. The regulation references the European Commission's eDelivery Building Block, which uses the OASIS/ISO standards ebXML Messaging and AS4, the eID Building Block, which uses OASIS/ITU SAML.

IEEE

Relevant IEEE activities include:

Standards activities:

- The IEEE P2141 series of standards on blockchain technology for enterprise information systems and anti-corruption applications for centralized organizations.
- IEEE P3119 Standard for the Procurement of Artificial Intelligence and Automated Decision Systems is a new IEEE standards activity.
- IEEE P2863 - Recommended Practice for Organizational Governance of Artificial Intelligence

Pre-standards activities:

- IEEE SA Industry Connection Program on AI-Driven Innovation for Cities and People; this program is focused on providing cities a governance mechanism to support responsible artificial intelligence systems (AIS);

IEEE SA Industry Connection Program on Alliance for Best Practices and Standards in Smart Cities; this program aims to develop close collaboration between the technology industry and city leaders and stakeholders towards smart city solutions across cities and regions.

- The Ethics Certification Program for Autonomous and Intelligent Systems (ECPAIS)

For more information, please visit https://ieeesa.io/rp-egovernment

(C.2) ADDITIONAL INFORMATION

Exchange of metadata on re-usable interoperability assets (eGovernment):

Several Member States already use ADMS-AP 2.0 to export interoperability solutions from national catalogues (e.g. Germany).

The Open Geospatial Consortium (www.opengeospatial.org) has also standardisation work available relevant to e-Government.

Core Vocabularies to facilitate the development of interoperable IT solutions:

The DG DIGIT and the DG CONNECT have developed other vocabularies and technical specifications to provide interoperability solutions under the ISA2 Programme and the CEF Telecom Programme. The use of these vocabularies and technical specifications is being promoted by the European Commission through funding programmes so public and private organizations are developing pilot projects and solutions that use them. In this context, some common standardisation action will be required to allow the use of these vocabularies and technical specifications in compliance with the public procurement legislation. Currently, Core Vocabularies are used in the **Once Only Principle** technical infrastructure.

3.2.5 E-CALL

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The pan-European in-vehicle emergency call, 'eCall', is an interoperable service to be available in all new M1 and N1 model types of vehicles in order to reduce the consequences of accidents, i.e. fatalities and severity of injuries. Since 1 April 2018, regulation is in force and all new M1 and N1 model types of vehicles shall be equipped with eCall service. Since 1st October 2017, EU Members States shall deploy eCall Public Safety Answering Points (PSAPs) equipped to handle the eCalls.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

In the event of an accident, in-vehicle sensors will automatically trigger an eCall. An audio connection is made with the European emergency number 112 and routed to the PSAP. At the same time, an emergency message is sent, providing information (the minimum set of data, or MSD) including the time, location and driving direction and other data. The emergency call can also be triggered manually.

Further conformance, performance and periodic tests need to be developed and innovative solutions found for situations (such as low cost, low powered 2 wheel vehicles- P2WVs) where normal full eCall provisions are not practical.

The European eCall Implementation Platform is making recommendations to ensure the best operation of the service and to take full advantage of all its possibilities. eCall is regulated for the life of the vehicle, and further provisions may be required in respect of periodic technical inspection (PTI) and test, and at end-of-life decommissioning.

Recognising that introducing the service via new vehicle models will mean taking considerable time to equip all cars, EU regulation has already encouraged automotive manufacturers to voluntarily introduce eCall in existing models. However, now that the public land mobile network (PLMN) and PSAP support networks are in place and operational, there is a considerable aftermarket opportunity to bring the benefits of eCall to the current stock of vehicles throughout Europe, and several equipment vendors (both from within Europe and abroad) have already shown interest to fill this market niche, in some cases directly for 112-eCall, and in others for third-party service-supported eCall. Other entrants are expected. However, as it will prove more difficult to control the performance and quality of such aftermarket devices, there is an urgent need to develop standards for the physical parameters, installation and operational performance of such aftermarket devices, to enable adequate certification and PTI provisions. This will be essential to avoid PSAPs to be potentially inundated with false messages from such devices, and to increase the reliable and safe operation of such devices.

Subsequently (voluntary) specifications have been developed to extend the benefits of eCall to all categories of vehicles, and to migrate from 2G/3G communications to any wireless IP Multimedia Subsystem (IMS) communications media, and in special circumstances, to be supported over satellite communications. As soon as the new IMS specifications are validated it is desirable to upgrade them to EN's as soon as possible, so that they may be referenced in extensions to the current regulations. Integration with C-ITS units is also under consideration

(A.3) REFERENCES

- **Regulation (EU) 2015/758** of the European Parliament and of the Council of 29 April 2015 concerning type-approval requirements for the deployment of the eCall in-vehicle system based on the 112 service and amending Directive 2007/46/EC
- **Commission delegated regulation** (EU) of 26 November 2012 305/2013 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the harmonised provision for an interoperable EU-wide eCall
- Commission Implementing Regulation (EU) 2017/78 of 15 July 2016 establishing administrative provisions for the EC type-approval of motor vehicles with respect to their 112-based eCall in-vehicle systems and uniform conditions for the implementation of Regulation (EU) 2015/758 of the European Parliament and of the Council with regard to the privacy and data protection of users of such systems
- Commission Delegated Regulation (EU) 2017/79 of 12 September 2016 establishing detailed technical requirements and test procedures for the EC type-approval of motor vehicles with respect to their 112-based eCall in-vehicles systems, of 112-based eCall in-vehicle separate technical units and components and supplementing and amending Regulation (EU) 2015/758 of the European Parliament and of the Council with regard to the exemptions and applicable standards
- **COM 2011/750/EU**: Commission Recommendation of 8 September 2011 on support for an EU-wide eCall service in electronic communication networks for the

transmission of in-vehicle emergency calls based on 112 (eCalls)

- **Directive 2010/40/EU** of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport
- **COM(2009) 434 final**: eCall: Time for Deployment
- Directive 2002/22/EC of the European Parliament and of the Council of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive).
- Decision 585/2014 of the European Parliament and of the Council of 15 May 2014 on the deployment of the interoperable EU-wide eCall service Text with EEA relevance

Note: As an eCall is an emergency call, all relevant regulations applicable to emergency communication apply as well. See emergency communications section.

(B.) REQUESTED ACTIONS

ACTION 1 SDOs to develop technical specification and standards for the implementation of eCall in vehicles of categories other than M1 and N1 and for other user types, taking into account requirements included within type-approval regulation and ongoing activities in this area (pilots, the Connecting Europe Facility (CEF), etc).

ACTION 2 SDOs to lay down physical and operating requirements for aftermarket in-vehicle devices.

ACTION 3 SDOs to draft guidelines on certification of eCall Systems including aftermarket in-vehicle devices.

ACTION 4 SDOs to provide conformance and performance tests to the recently developed standards for packet-switched networks (HLAP E-UTRAN — LTE/4G and migration to further generations by use of an IMS sublayer).

ACTION 5 SDOs to develop conformance and performance tests for recently developed technical specifications / standards for the provision of the eCall service eCall via shared vehicle platforms (C-ITS).

ACTION 6 SDOs to produce detailed conformity test specifications in support of certification schemes and periodic testing on IVS equipment.

ACTION 7 SDOs to carry out plugtest interoperability events, taking into account the technological evolution of the system [1].

ACTION 8 SDOs to collect feedback about the early versions of the standards and their implementation with technical representatives from vendors and implementers.

ACTION 9 SDOs to collect feedback from the relevant stakeholders on the real operation of the eCall service and when needed improve the standards, including through the European eCall Implementation Platform.

ACTION 10 SDOs to consider any changes to eCall that may be relevant in a 5G paradigm.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN

CEN/TC 278 WG 15 has developed several technical specifications (TS), EN standards, and other deliverables to define the MSD structure and the application protocols to transfer it from the vehicles to the PSAP, and the E2E test suites for Category M1 and N1 vehicles.

CEN/TC 278 WG 15 has developed several technical specifications (TS), EN standards, and other deliverables to enable and support eCall for all other categories of vehicle.

CEN/TC 278 WG15 has developed several technical specifications (TS), EN standards, and other deliverables to enable eCall via IMS networks, eCallvia C-ITS equipped vehicles, and eCall via satellite networks.

CEN/TC 278 WG15 has developed several technical specifications (TS), EN standards, and other deliverables to provide optional additional data while retaining the privacy requirements of the eCall Regulation and GDPR in order to provide better useful information to assist PSAPs to manage the response to the incident.

- EN 15722:2015 Intelligent transport systems - ESafety - ECall minimum set of data
- EN 16062:2015 Intelligent transport systems - ESafety - eCall high level application requirements (HLAP) using GSM/UMTS circuit switched networks
- EN 16072:2015 Intelligent transport systems - ESafety - Pan-European eCall operating requirements
- EN 16454:2015 Intelligent transport systems - ESafety - ECall end to end conformance testing
- TS 16405:2017 Intelligent transport systems - Ecall - Additional data concept specification for heavy goods vehicles
- EN 16102:2011 Intelligent transport systems - eCall - Operating requirements for third party support
- CEN/TS 17148 Intelligent Transport Systems - eSafety - ProForma eCall Agreement between TPSP and ERO

- CEN/TS 17182 Intelligent transport systems - eSafety - eCall via an ITS-station
- CEN/TS 17184 Intelligent transport systems - eSafety - eCall High level application Protocols (HLAP) using IMS packet switched networks
- CEN/TS 17240 Intelligent transport systems - eSafety - eCall end to end conformance testing for IMS packet switched based systems
- CEN/TS 17312 Intelligent transport systems - eSafety - eCall via satellite telecommunications
- CEN/TS 17234 Intelligent transport systems - eSafety - eCall: Tests to enable PSAPs to demonstrate conformance and performance
- CEN/TR 17249-1 Intelligent transport systems - eSafety - extending eCall to other categories of vehicle
- CEN/TS 17249-2 Intelligent transport systems - eSafety:Part 2: eCall for HGVs and other commercial vehicles
- CEN/TS 17249-3 Intelligent transport systems - eSafety - Part 3:eCall for Coaches and busses
- CEN/TS 17249-4 Intelligent transport systems - eSafety - Part 4: eCall for UNECE Category T, R, S agricultural/forestry vehicles
- CEN/TS 17249-5 Intelligent transport systems - eSafety - Part 5: eCall for UNECE Category L1 and L3 powered two wheel vehicles (vehicle based)
- CEN/TS 17249-6 Intelligent transport systems - eSafety - Part 6: eCall for UNECE Category L2, L4, L5, L6 and L7 Tricycles and Quadricycles (vehicle based)

Currently in approval procedures:

Intelligent transport systems - eSafety - eCall OAD for multiple Optional Additional Datasets

Intelligent transport systems - eCall optional additional data - Linked mobile phone number data concept

Intelligent transport systems - ESafety - Interoperability and user choice in 112 eCall aftermarket and third party eCall services

http://www.itsstandards.eu/

ETSI

ETSI TC MSG (via 3GPP) has defined the transport protocol to send MSD from the vehicle system to the PSAP, via the GSM/UMTS network in several ETSI TS along with the service principles.

Its STF 456 has looked at the issue of the migration of the Networks and has adopted and published ETSI TR 103 140.

ETSI TC MSG (via 3GPP) has defined the mechanism to send MSD from the vehicle to the PSAP via LTE using IMS.

ETSI TC MSG has produced interoperability and conformance testing specifications for the eCall HLAP and in-band modem, and is developing guidelines for eCall IVS conformity assessment.

ETSI has support the organisation of several eCall Test Fests.

PILOTS

CIP Pilots HeEROs (Harmonised eCall European Pilot) tested the standards in real conditions.

The iHeERO pilof under the 2014 CEF call for proposals is expected to produce relevant contributions for eCall standardisation.

http://iheero.eu/

ITU

Recommendation ITU-T P.1140 (2017): *Speech communication requirements for emergency calls originating from vehicles.* https://www.itu.int/rec/T-REC-P.1140/en

ITU-T SG2 revised Recommendation ITU-T E.212 "The international identification plan for public networks and subscriptions". Under the revised E.212, mobile network code may be assigned to other applicants (e.g. for GSM-R networks) and these assignments are to be made according to procedures and criteria set by the national numbering plan administrator. It also encourages applications to the ITU's shared mobile country and network codes if networks and services are provided in more than one country. Use of global numbering resources for In Car Emergency Communication is under discussion in ITU-T Study Group 2. A statement on "global numbers used for the European eCall service" was published in ITU Operational Bulletin No.1155 of 1.IX.2018; TSB Circular 249 provides detailed background on in-car emergency services, such as eCall, and alerts national administrations, regulators and network operators that the ranges 883 130, 882 39 and 882 37 are being used for this service.

https://www.itu.int/md/T17-TSB-CIR-0249/en

The issue of ITU ranges for eCall services was also the subject of a recent ITU news article at https://news.itu.int/why-itu-assigned-numbering-ranges-are-critical-to-road-safety/ and video interview at https://youtu.be/VhA2S2ScJrw

ITU-T SG20 developed Recommendation ITU-T Y.4119 "Requirements and capability framework for IoT-based automotive emergency response system, Recommendation ITU-T Y.4467 "Minimum set of data structure for automotive emergency response system" and Recommendation ITU-T Y.4468 "Minimum set of data transfer protocol for automotive emergency response system".

More info: https://itu.int/go/tsg20

ISO

ISO/TC 204: ITS. These cover standardisation of information, communication and control systems in the field of urban and rural surface transportation, including intermodal and multimodal aspects, traveller information, traffic management, public transport, commercial transport, emergency services and commercial services in the intelligent transport systems (ITS) field.

The project includes:

ISO/DIS 15638-10: ITS– Framework for cooperative Telematics Applications for Regulated commercial freight Vehicles (TARV) — Part 10: Emergency messaging system/eCall (EMS)

ISO/PWI 21344: ITS– Public transport — Emergency services eCall device for emergency on connected vehicles using ITS station

http://www.iso.org/iso/iso_technical_committee%3Fcommid%3D54706

IETF

The Emergency Context Resolution with Internet Technologies (ECRIT) Working Group has developed a general architecture for enabling IP applications to discover and connect to emergency services.

The Geographic Location/Privacy (GEOPRIV) Working Group has developed protocols that allow IP networks to inform end devices about their geolocation, a critical pre-requisite for emergency calling.

The application-specific working groups in the IETF (for example, the Session Initiation Protocol Core (SIPCORE) Working Group) have developed extensions to support emergency calling as required.

https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#eCall

(C.2) ADDITIONAL INFORMATION

In respect of commercial vehicles and public transport vehicles, new recently developed Technical Specifications provide the possibility to link relevant related information (such as passenger numbers, commercial cargo type and detail, etc.), but further work may be required to enable and provide and exchange such information in a consistent manner to and between PSAPS, and provide additional information from sensors etc. In respect of public transport, innovative technologies may provide better assessment of the number of passengers involved, and additional specifications/standards may be needed to collect and present this detail to PSAPs in consistent and usable form.

Considerations need to be made for the provision of eCall in CCAM vehicles, especially to segregate eCalls from unmanned vehicles travelling between assignments from those where passengers are being transported in the vehicle.

As part of HeERO, EUCARIS (the European car and driving licence information system) has developed a module with which vehicle information can be exchanged internationally.

On the basis of the vehicle identification number (VIN), this module enables a link between the national vehicle registration authorities of the participating countries. When a foreign vehicle is involved in an accident, this module enables an instant Europe-wide search via EUCARIS to support the respective national 112 emergency centre(s).

3.2.6 COVID-19

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The corona virus has shaken Europe and the world to its core, testing our healthcare and welfare systems, our societies and economies and our way of living and working together. The European Commission is coordinating a **common European response** to the coronavirus outbreak, aiming in particular at reinforcing our public health sectors and mitigating the socio-economic impact in the European Union.

Digital technologies and data have a valuable role to play in combating the COVID-19 crisis. Those technologies and data can offer an important tool for informing the public and helping relevant public authorities in their efforts to contain the spread of the virus or allowing healthcare organisations to exchange health data. However, a fragmented and uncoordinated approach risks hampering the effectiveness of measures aimed at combating the COVID-19 crisis, whilst also causing serious harm to the single market and to fundamental rights and freedoms.

It is therefore necessary to develop a common approach to the use of digital technologies and data in response to the current crisis. That approach should be effective in supporting competent national authorities by providing them with sufficient and accurate data to understand the evolution and spread of the COVID-19 virus as well as its effects. Similarly, these technologies may empower citizens to take effective and more targeted social distancing measures. At the same time, the proposed approach aims to uphold the integrity of the single market and protect fundamental rights and freedoms, particularly the rights to privacy and protection of personal data.

Mobile devices and their applications can support health authorities at national and EU level in monitoring and containing the ongoing COVID-19 pandemic. They can provide guidance to citizens and facilitate the organisation of the medical follow-up of patients. Warning and tracing applications play an important role in contact tracing, limiting the propagation of disease and interrupting transmission chains. In particular, in combination with appropriate testing strategies and contact tracing, the applications can be particularly relevant in providing information on the level of virus circulation, in assessing the effectiveness of physical distancing and confinement measures, and in informing de-escalation strategies.

In accordance with the principle of data minimisation, public health authorities and research institutions should process personal data only where adequate, relevant and limited to what is necessary, and should apply appropriate safeguards such as pseudonymisation, aggregation, encryption and decentralization.

Effective cybersecurity and data security measures are essential to protect the availability, authenticity integrity and confidentiality of data.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

With this purpose, the EU Members states with the support of the European Commission are working within the eHealth Network (eHN) to develop common approaches towards protection-effective app solutions that also minimise the processing of personal data, whilst providing for interoperability of the different solutions, including cross-border.

The eHN has issued a first version of a common EU toolbox as well as interoperability guidelines, which includes a first set of essential requirements for such applications, namely that they shall be: - voluntary; - approved by public health authorities; - anchored in accepted epidemiological guidance; - compliant with GDPR/ePrivacy regulations; - based on proximity technology (Bluetooth), not in geolocation technology (GPS); - based on anonymised data; - Interoperable [across the EU]; - [cyber] Secure & effective. The Commission, at the invitation by EU Member States, has set up an EU-wide system to ensure interoperability contact tracing and warning apps – a so-called 'gateway'.

The pan-European approach for COVID-19 mobile applications by Member States and the Commission considers requirements for accessibility for persons with disabilities as a priority. Specifically, content of tracing apps is recommended to meet the accessibility requirements set out in the transposition legislation of the Web Accessibility Directive, which include reference to Harmonised European Standard EN 301 549 V2.1.2. Also, "Inclusiveness" is acknowledged as a foundational principle not only from a fundamental rights perspective, but also from an effectiveness perspective. Further, it highly encourages the publication/sharing of the source code for the apps supported by the national authorities, as an indicator of effectiveness, in particular in terms of security, auditability and interoperability requirements, as a way to maximise re-use, and also to address the need to enhance both national authorities' but also citizens' trust in the proper functioning of the applications and to provide transparency. Independent testing of the applications, access to source code and a policy for vulnerability handling and disclosure are in this respect deemed necessary.

Other technologies, such as blockchain/DLT have also the potential to support effective solution to cope with pandemics and support de-escalation strategies, in particular regarding decentralised and secure access to data. Such solutions shall also comply with EU values and provide for interoperability.

Both EU relevant institutions and bodies (see A.2) and SDOs (see C.1) have developed several works and initiatives. Among the formers, the eHN continues its work to provide further guidelines and recommendations for the different applications and solutions that could help dealing with pandemics and with COVID-19 in particular. These guidelines and recommendations will design new requirements for solutions that could be deployed effectively and operate across the EU whilst responding to the EU pandemic recovery strategies, and respecting the EU values.

The European Recovery Plan focuses on concrete lines of actions: - The European Green Deal as Europe's sustainable growth strategy; - A deeper and more digital single market, including a deeper digital recovery helping to stimulate competitive innovation and to provide users with greater choice. This will include actions to support strategic digital capacities and capabilities, common European data spaces in key sectors and areas, a fairer and easier business environment in particular for online environment, digitisation of public procurement and justice systems and boosting the EU's overall cybersecurity; - A fair and inclusive recovery, including reinforcing digital skills for children, students, teachers, trainers and all of us to communicate and work. These lines of actions will require ICT standardisation activities to support their take up and implementation.

With the availability of vaccination and the focus on providing the citizens of Europe with safe and effective vaccines fast, the situation around the pandemic has improved. Moreover, several measures have been taken and need to be continued in order to be prepared in case of any new waves of the Covid-19 pandemic occurring and in case of similar threats occurring in the future.

(A.2) REFERENCES

- Common EU response - overview
- Commission Recommendation (EU) 2020/518 of 8 April 2020 on a common Union toolbox for the use of technology and data to combat and exit from the COVID-19 crisis, in particular concerning mobile applications and the use of anonymised mobility data ()
- Commission Communication 2020/2523 of 16 April 2020 on Guidance on Apps supporting the fight against COVID-19 pandemic in relation to data protection ()
- eHealth Network Guidelines to the EU Member States and the European Commission on interoperability specifications for cross-border transmission chains between approved apps
- COM/2020/112: Coordinated economic response to the COVID-19 Outbreak
- COM/2020/143: Coronavirus Response Using every available euro in every way possible to protect lives and livelihoods
- Commission Communication on the Recovery Plan COM 2020/456: Europe's moment: Repair and Prepare for the Next Generation
- European Parliament resolution on EU coordinated action to combat the COVID-19 pandemic and its consequences. (2020/2616(RSP)
- European Data Portal: specific section dedicated to COVID-19 related open data and applications:
- Open Data Portal: specific section is dedicated to COVID-19 related open data of the European Institutions and bodies.
- ECDC TECHNICAL REPORT Guidelines for the use of non-pharmaceutical measures to delay and mitigate the impact of 2019-nCoV:
- ECDC TECHNICAL REPORT Contact tracing: public health management of persons, including healthcare workers, having had contact with COVID-19 cases in the European Union
- EDPB - Guidelines 04/2020 on the use of location data and contact tracing tools in the context of the COVID-19 outbreak
- eHealth network - Mobile applications to support contact tracing in the EU's fight against COVID-19 - Common EU Toolbox for Member States and inventory of mobile apps related to COVID-19, Interoperability guidelines for approved contact tracing mobile applications in the EU and other documents in relation to the European gateway for interoperability of tracing applications are available at
- European gateway for interoperability of tracing applications
- Commission Implementing Decision (EU) 2020/1023 of 15 July 2020 amending Implementing Decision (EU) 2019/1765 as regards the cross-border exchange of data between national contact tracing and warning mobile applications with regard to combatting the COVID-19 pandemic
- Regulation (EU) 2021/953 on a framework for the issuance, verification and acceptance of interoperable COVID-19 vaccination, test and recovery certificates (EU Digital COVID Certificate) to facilitate free movement during the COVID-19 pandemic ELI

(B.) REQUESTED ACTIONS

(B.1) ACTIONS IN SUPPORT OF BEING BETTER PREPARED FOR FUTURE WAVES OF COVID-19 OR FUTURE PANDEMICS

ACTION 1 SDOs to identify ICT standards available or needs for new ICT standards for improving the processes and management of supply chains for products and services that are critical in the situation of an epidemic or pandemic. This may include standards for supporting the functioning and logistics of the distribution of vaccines, tasks like supply and capacity planning of medical supplies, hospital supplies, but also capacity planning and supply chains for vaccines and other medical equipment. If required, start activities to revise the respective standards, close functional gaps, or to develop new or additional standards to improve logistics and processes. Innovative technologies like AI, telemedicine and Blockchain/DLT may be considered in this context as well.

ACTION 2 SDOs to develop standards for tracing virus spread and contacts through small, cheap personal devices, respecting security and privacy requirements, easily worn and carried also by the elderly and people with disabilities and interoperable with smartphone apps.

ACTION 3 SDOs and stakeholders to review ongoing work regarding standards for providing care and assistance (i.e. tele-assistance) to citizens in non-hospital premises. Consider extending available standards or work if required, or starting the development of new standards, in particular for interoperability, security and privacy. Stakeholders should also consider activities on promoting the respective technologies and their uptake for being better prepared in future emergency situations like a pandemic.

ACTION 4 Healthcare data availability and integration - SDOs to update and, if needed, develop standards addressing the collection, storage of, and access to sensitive personal data. Topics to be addressed may be seen in the

context of the European Commission's data strategy for Europe, e.g. regarding interoperability, portability, APIs, ontology, and for European data spaces, in this case in the area of health. The standards should be fully compliant with EU legislation, in particular GDPR, and give the individual full control regarding usage and access rights.

ACTION 5 Digital Skills - SDOs to review and update available standards like the eCompetence Framework in order to address a situation like confinement and to better equip citizens with needed digital skills and technologies for use cases like remote working, e-learning and distance learning including in particular online teaching of schools, universities, online exams, training - and in general use cases around the digital transformation including the topic of security and privacy.

ACTION 6 SDOs and stakeholders to analyse standards for processes and technologies around additive manufacturing and for agile re-focusing of production efforts in case of specific needs in an epidemic or pandemic. This may include development of a reference architecture or architecture and process guidelines.

ACTION 7 Specifications related to interoperability, where meta-data specifications need to be agreed to identify food suppliers and food supply value chains. As a consequence of the COVID-19 lockdowns, supply chains should be enabled for 'flexible rerouting', e.g if global food supply chains are to be replaced with shorter chains for more local suppliers. Retail platforms should be able to instantly discover alternative tracks and resources via 'metadata discovery'.

ACTION 8 Prepare a horizontal cross-domain IoT standard, with the specification of minimum requirements on all professional and general public IoT devices, to ensure that the devices themselves can be used according to their initial objectives (e.g. easy installation and configuration) and that the data they provide can easily be understood and acted upon by non-ICT users (e.g. medical teams and their patients in the medical sector, mechanics in the automotive sector, first responders in the emergency sector, etc.). As a basis existing standards like ISO 9241should be used.

ACTION 9 Analyse whether HL7 FHIR Implementation Guide: Electronic Case Reporting (eCR) may be used or may have to be updated to better support public health surveillance as well as the delivery of relevant public health information to clinical care. This may be important with the adoption and maturing of Electronic Health Records (EHRs) and with Electronic Case Reporting (eCR) providing more complete and timely case data, support disease / condition monitoring, and assist in outbreak management and control. (See http://hl7.org/fhir/us/ecr/index.html)

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

Standards Development Organisations have reacted to COVID-19. Special activities, including concrete technical standards development projects, were started to support any action to help combat the virus, protect people, prepare for coming challenges and support the recovery of the economy.

Many of the ongoing standards projects will naturally assist and support ICT related initiatives, e.g. by providing basic technologies that are used in ICT infrastructures and applications. This includes many of the activities listed in the EU Rolling Plan for ICT Standardisation in general, and in the Rolling Plan chapter on eHealth in particular. As standards are maintained, reviewed and standardisation activites are undertaken, all stakeholders are encouraged to look at possible changes or additions to the standards based on the experience of the current pandemic and requirements for technologies and solutions to assist reacting to the challenges of such an exceptional situation. The list below provides an overview of Covid-19 focused initiatives that have been undertaken:

European Commission

The Commission, in particular the JRC Coronavirus Task Force, is collaborating with CEN and CENELEC to prepare a short report listing opportunities and specific standardisation needs in relevant sectors linked to COVID-19 and other pandemics. This will include a stakeholder survey on (1) Existing standards, methodologies, procedures and guidelines relevant to confronting the present and future pandemics; and (2) Standardisation needs according to three different timelines: Short term (less than 1 year), Medium term (between 1-3 years), Long term (more than 3 years).

CEN/CENELEC

A CEN-CENELEC COVID-19 Crisis Management Network was established, bringing together national representatives from each Member to facilitate a direct exchange of information between National Standards Bodies and National Committees - a fast tracked response at the European level.

CEN/TC 251 (linked with ISO/TC 215) in relation to DTS 82304-2 "Health Software — Part 2: Health and wellness apps — Quality and reliability" (the DTS that was born also taking as main inputs the Italian UNI/TR 11708 and BSI's PAS277). https://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:6232&cs=18CA078392807EDD402B798AAEF1644E1

DP-3T

Decentralized Privacy-Preserving Proximity Tracing (DP-3T) https://github.com/DP-3T

ECMA INTERNATIONAL

Ecma Technical Committee TC51 works on access systems and information exchange between systems and developed ECMA-417, which specifies the architecture for a distributed real-time access system taking into account many technologies. This includes the layer concept of the system, the functionalities of each layer and the interfaces. ECMA-417 3rd edition (also published as ISO/IEC 24643) introduces vaccine passports as additional examples of complicated authentication.

ETSI

EP eHealth

EP eHealth acts as coordinating body for ETSI's wider response and management of standards for eHealth. https://portal.etsi.org/tb.aspx?tbid=696&SubTB=696#/

EP eHealth White Paper: The role of SDOs in developing standards for ICT to mitigate the impact of a pandemic https://www.etsi.org/media-library/white-papers

ISG E4P: "Europe for Privacy-Preserving Pandemic Protection"

The ISG E4P has delivered a set of specifications for proximity tracing systems. The work included the development of backward compatible and interoperable proximity tracing applications to be used to combat pandemics by helping to break virus transmission chains. Activities focus on technical documents to define "Requirements for Pandemic Tracing Systems", the "Proximity Detection", and the "Proximity Tracing System" https://portal.etsi.org/tb.aspx?tbid=890&SubTB=890#/

ETSI Report comparing worldwide COVID-19 contact-tracing systems https://www.etsi.org/newsroom/press-releases/1879-2021-02-etsi-unveils-its-report-comparing-worldwide-covid-19-contact-tracing-systems-a-first-step-toward-interoperability

TC ATTM SDMC

Standards on the relationship between deployment of ICT systems and implementation of services including COVID-19 and other health related services for cities and communities.
https://portal.etsi.org/tb.aspx?tbid=851&SubTB=851#/

SC USER Group is involved in the analysis of the impact of the lockdown on the use of electronic and numeric tools and is working, in the project « User-centric approach in the digital ecosystem » on the Smart Identity which may be a significant improvement for the personal data and access to services.

HL7

Central websites set up informing about specific projects around COVID-19.

https://confluence.hl7.org/display/CR/COVID-19+Response+Home
https://confluence.hl7.org/display/CR/COVID-19+Related+Projects

ISO/HL7 10781:2015 Health Informatics—HL7 Electronic Health Records-System Functional Model, Release 2 (EHR FM); also EN ISO 10781:2015 Voting on release 2.1 currently in progress in HL7. Further updating may be done to improve the functional requirements to support the needs of RWD(real-world-data)-based pandemic management.

https://www.hl7.org/implement/standards/product_brief.cfm?product_id=269
https://www.iso.org/standard/57757.html

IEEE

Please replace the IEEE entry in C.1. with the following text (it adds new information, and also streamlines and reorders some of the previously existing information):

Information about IEEE members developing technologies to fight the virus, the resources available from across IEEE, coping strategies from engineers around the world, and opportunities to get involved: https://spectrum.ieee.org/static/covid19-ieee-resources
https://standards.ieee.org/content/dam/ieee-standards/standards/web/documents/other/gieais-covid.pdf

11073 series (Health Informatics): IEEE/ISO 11073 is a family of Health Informatics/ Device Communication for data interoperability and architecture standards intended to support interoperable communications for health care and wellness devices to assist healthcare product manufacturers and integrators create devices and systems for disease management, health and fitness, and independent living. Some are adopted as EN under the EN ISO 11073 series.

Covid-19 opened the conversation and catalyzed a movement towards innovative forms of healthcare monitoring, therapeutics and clinical research in a remote environment while exposing the many unaddressed challenges of utilizing connected technologies. The current pre-standards programs feature multidisciplinary experts from around the globe supporting innovation through open and standardized means for the benefit of equitable, sustainable and protected right to care.

The IEEE SA WAMIII Program develops consensus for solutions to establish stakeholder trust in the use of connected wireless medical devices that have the potential to bring myriad benefits to pharmaceutical manufacturers, patients, and healthcare providers, especially with the pandemic.

Papers on contact tracing from the 2020 21st IEEE International Conference on Mobile Data Management (MDM) are in the proceedings https://ieeexplore.ieee.org/xpl/conhome/9153070/proceeding

The IEEE SA Transforming the Telehealth Paradigm: Sustainable Connectivity, Accessibility, Privacy, and Security for All pre-standards activity seeks to address the challenges impeding trust and accessibility of telemetry services and devices for non-urgent care to enable ALL individuals with right to care, protection and privacy of their health and their data.

The IEEE SA Technology and Data Harmonization for Enabling Decentralized Clinical Trials (DCT) pre-standards activity. The goal of the program is to prioritize the areas DCT using DHT (Digital Health Toolkits) standards can accelerate adoption, mitigate risks, and optimize efficiencies with sponsors, regulators, sites, technologists, service providers, patient advocacy organizations, and other relevant stakeholders.

IEEE SA Ethical Assurance of Data-Driven Technologies for Mental Healthcare pre-standards activity. Even prior to the global pandemic, the use of data-driven technologies in mental healthcare was increasing. The use of such technologies also poses a series of well-known ethical, social, and legal risks for matters such as data privacy, explainability of automated decisions, and respect for mental integrity that must be addressed.

IEEE Digital Resilience - Tools and Methods to Support Response and Recovery from Crises pre-standards activity proposes plans to develop

a framework that enables communities, villages, cities, regions, and countries to deploy architectures and select standardized technologies so they may address immediate and urgent needs during a crisis without sacrificing the long-term wellbeing and rights of people. Current subcommittees focus on Logistics and Supply Chain, e-Health and Telemedicine, Building Human Digital Resilience, and e-Resilience in Education Systems, etc. https://standards.ieee.org/industry-connections/digital-resilience.html

For more information, please visit https://ieeesa.io/rp-covid-19

IHE

Contribution on European Commission recommendation "On a common Union toolbox for the use of technology and data to combat and exit from the COVID-19 crisis, in particular concerning the application mobile applications and the use of anonymized mobility data" https://www.ihe-europe.net/ihe-in-europe/EU-policies

IHE also issued a public call for information about situations where IHE Profiles are used in addressing COVID-19. See https://www.ihe-europe.net/

ISO

Several drafts relevant for e-health are developing in ISO, and even if not focused on covid-19, because they started before, they are reported as "affected" by Covid-19.

JTC 1/SC38 NP 5195 Technical requirements of community service system based on cloud computing in major public health emergencies

JTC 1/WG11 NP 5153 Smart City — City Service Platform for Public Health Emergency

JTC 1/SC 41 AHG 23 Study report on IoT Personnel positioning management system (PPMS)

For system, software, data quality models see ISO/IEC 25000 series

ITU

Overview page on activities to address Covid19 challenges https://www.itu.int/en/Pages/covid-19.aspx

Series of webinars providing insights on how the application of digital financial services can help governments and private sector, in emerging economies especially, to implement measures related to social distancing during a lockdown caused by pandemic, e.g. Covid19. The objective is to provide insights on the innovative applications of telecommunications services, digital payments and fintech in addressing COVID-19 triggered social distancing and lockdown as well as to share lessons learned from governments and DFS stakeholders on the measures that they are implementing. https://www.itu.int/en/ITU-T/webinars/Pages/dfs.aspx.

The **"United for Smart Sustainable Cities" (U4SSC)** is a UN initiative coordinated by ITU, UNECE and UN-Habitat, and supported by other 14 UN bodies to achieve Sustainable Development Goal 11: "Make cities and human settlements inclusive, safe, resilient and sustainable". A thematic group on *"Emergency response of cities to COVID-19"* has been recently established to address the urban dimension of cities in response to the COVID-19 pandemic. https://www.itu.int/en/ITU-T/ssc/united/Pages/emergency-response.aspx

OASIS

Special and regularly maintained and updated website informing about OASIS specifications that can help governments, businesses and projects in the fight against COVID-19. https://www.oasis-open.org/covid

PEPP-PT

Pan-European Privacy-Preserving Proximity Tracing - enabling tracing of infection chains across national borders. https://www.pepp-pt.org/

ROBERT

ROBust and privacy-presERving proximity Tracing protocol - protocol for robust and privacy-preserving proximity tracing https://github.com/ROBERT-proximity-tracing/

W3C

Clearinghouse for experience and guidelines for people who are suddenly called to avoid travel or meetings, work-at-home or do classes online. Focus on current capabilities and future needs. https://www.w3.org/community/covid-19/

Community Group for achieving the following objectives: (1) to create a repository of already existing Web resources related to covid19 (2) to identify other Web-based initiatives which are on-going (3) to share Web-based initiatives of CG Members in order to get on-board other Members and achieve the maximum impact https://www.w3.org/community/web-vs-covid19/

COVID-19 CREDENTIALS INITIATIVE (CCI)

Hosted by Linux Foundation Public Health (LFPH). CCI has adopted an open-standard-based open-source development approach to public health. CCI is looking to deploy and/or help deploy privacy-preserving verifiable credential projects in order to mitigate the spread of COVID-19. The community builds on Verifiable Credentials (VCs), an open standard and emerging technology.

(C.2) ADDITIONAL INFORMATION

SMALL AND MEDIUM ENTREPRISES - SMES (SBS/EUROPEAN DIGITAL SME ALLIANCE)

Although European SMEs were hit the hardest during this crisis, they played a vital role in combating COVID-19 in different industries. Utilising ICT technologies and standards, many European Digital SMEs have offered their solutions to citizens and enterprises for free, reflecting on European Solidarity during the crisis. Digital SMEs should be supported during the post COVID-19 recovery plan in order to scale up their technologies and be better prepared for future crises. The use of and access to ICT standards enabled Digital SMEs to provide their services. It is important for SMEs to be part of the standardisation making process, i.e actively engaged in drafting of standards, and be perceived as standards makers. Since SMEs are under-represented in this process, SDOs should proactively seeks to engage SMEs and/or take their needs into account.

In the context of contact tracing apps and other technologies to combat COVID-19 or to offer solutions for the recovery phase,

standards that define security, privacy, access to and storage of data, and interoperability are important for SMEs. Although SMEs are aware of these solutions, they need to be made aware of ICT standards behind them. These solutions were possible because of ICT standards that supported the backbone for ICT services in smart working, E-learning, e-Health, E-Banking, logistic, smart cities, tourism, and other industries. Therefore, standards are key to access and use new technologies that are made available to SMEs in an open and interoperable way. In addition, there is a need to raise awareness among SMEs on the use of ICT Standards. For example ETSI has already started the ETSI Technology Awareness Roadshow for SMEs. ESOs should initiate standards raising awareness actions towards SMEs. Not only SMEs need awareness actions, but they also need practical guides for the use of ICT standards. As most SMEs suffer from limited capacities, it is essential for them to have specific and adapted instructions. SMEs associations such as SBS and the European DIGITAL SME Alliance, are well placed to support the development of such SME guides as they did for instance in the ISO27001 Guide for SMEs or the current development of SME Guides on (1) Industrial IoT and (2) Information Security Controls.

https://www.digitalsme.eu/ict-standards-will-help-save-the-economy-from-covid-19/

CONSUMERS (BEUC/ANEC)

Although the effectiveness of deploying technologies, such as tracing applications, has generally not been evaluated, these could be helpful tools to keep pandemics under control and allow a progressive lift of the lockdown. Nevertheless, it then becomes more important than ever to protect the fundamental rights and freedoms of consumers.

Standards can play a fundamental role in not only ensuring the effectiveness of the technology, but in ensuring the entitlement of consumers to data privacy and protection, and in making the technology accessible to consumers of all ages and abilities.

ENVIRONMENT (ECOS)

Although the challenges posed by the pandemic are understood, environmental legislation and targets must not be compromised and de-prioritised. The climate emergency poses serious threats and therefore citizens' health should remain a priority even after the pandemic. This means that post-COVID recovery plans should be based on the Green Deal and help to make the economy become more resilient to such shocks. In fact, environmental laws, taking for example those under the ecodesign framework, not only help the planet but also achieve cost savings and create jobs through innovation, all necessary in the situation we currently find ourselves in.

WORKERS (ETUC)

ETUC policy at European level has been set out in a public letter from the General Secretary to the Presidents of the EU institutions, which states: "Our priority at the moment is to save the enterprises, making sure that they can survive the lockdown and come back to the markets when it will be finished. And to protect the jobs of our members, making sure that those who are suspended from work do not become unemployed, but can keep their job and receive decent income compensation."

ETUC has established a web resource, at https://www.etuc.org/en/trade-unions-and-coronavirus, with comprehensive links to briefing material at European and national levels.

DIGITAL EUROPE

Digital Europe's White Paper on "How to relaunch manufacturing in a post-COVID-19 world" inter alia addresses standardisation needs: https://www.digitaleurope.org/wp/wp-content/uploads/2020/05/DIGITAL-EUROPE_How-to-relaunch-manufacturing-in-a-post-COVID-19-world.pdf

ECSO - EUROPEAN CYBER SECURITY ORGANISATION

ECSO Recommendations. Cybersecurity in light of the COVID-19 crisis https://www.ecs-org.eu/documents/uploads/ecso-recommendations-in-light-of-covid-19.pdf

COVID-19 CYBERSECURITY RESPONSE PACKAGE - An ECSO Cyber Solidarity Campaign. Updates from the home page: https://www.ecs-org.eu/

OTHER INFORMATION

The European Data Portal, where Open data from Member States open data portals are referenced, has implemented a specific section dedicated to COVID-19 related open data and applications: https://www.europeandataportal.eu/en/covid-19/overview

Overview on role of open source and robotics in the context of COVID-19: https://opensource.com/article/20/5/robotics-covid19

3.2.7 SAFETY, TRANSPARENCY AND DUE PROCESS ONLINE

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The initiative relates to the Commission's policy and regulatory intervention to ensure a safe online environment and the respect of fundamental rights online. Meaningful transparency to users, regulators and third parties is a key enabler for this objective.

The clear, harmonised and, where appropriate, interoperable approach across services is key for a well-functioning single market for digital services, where start-ups can emerge and scale by proposing responsible innovations.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

A new regulatory framework addressing these objectives will be proposed through the Digital Services Act. The regulatory proposal includes harmonised obligations for content moderation processes and user redress, as well as a series of other due diligence obligations for meaningful transparency of platforms' algorithmic systems, including online advertising. Standardisation work may facilitate interoperability and is needed to ensure that the technical design of systems and processes is efficiently and effectively implemented across all platforms and regulatory compliance in particular for newcomers is easily translated into technical requirements.

Such standards would need to rest on a broad and deep involvement of diverse stakeholders, including digital services and other businesses, and prominently including civil society focusing on digital and consumer rights. The availability of standards should facilitate the application of the regulatory provisions shortly after the entry into force.

(A.3) REFERENCES

- Recommendation of 1.3.2018 on measures to effectively tackle illegal content online (C(2018) 1177 final)
- **COM/2020/825 final** Proposal for a Digital Services Act

(B.) REQUESTED ACTIONS

ACTION SDOs to look into standardisation needs that may arise from the Commission's proposal for a new Digital Services Act.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

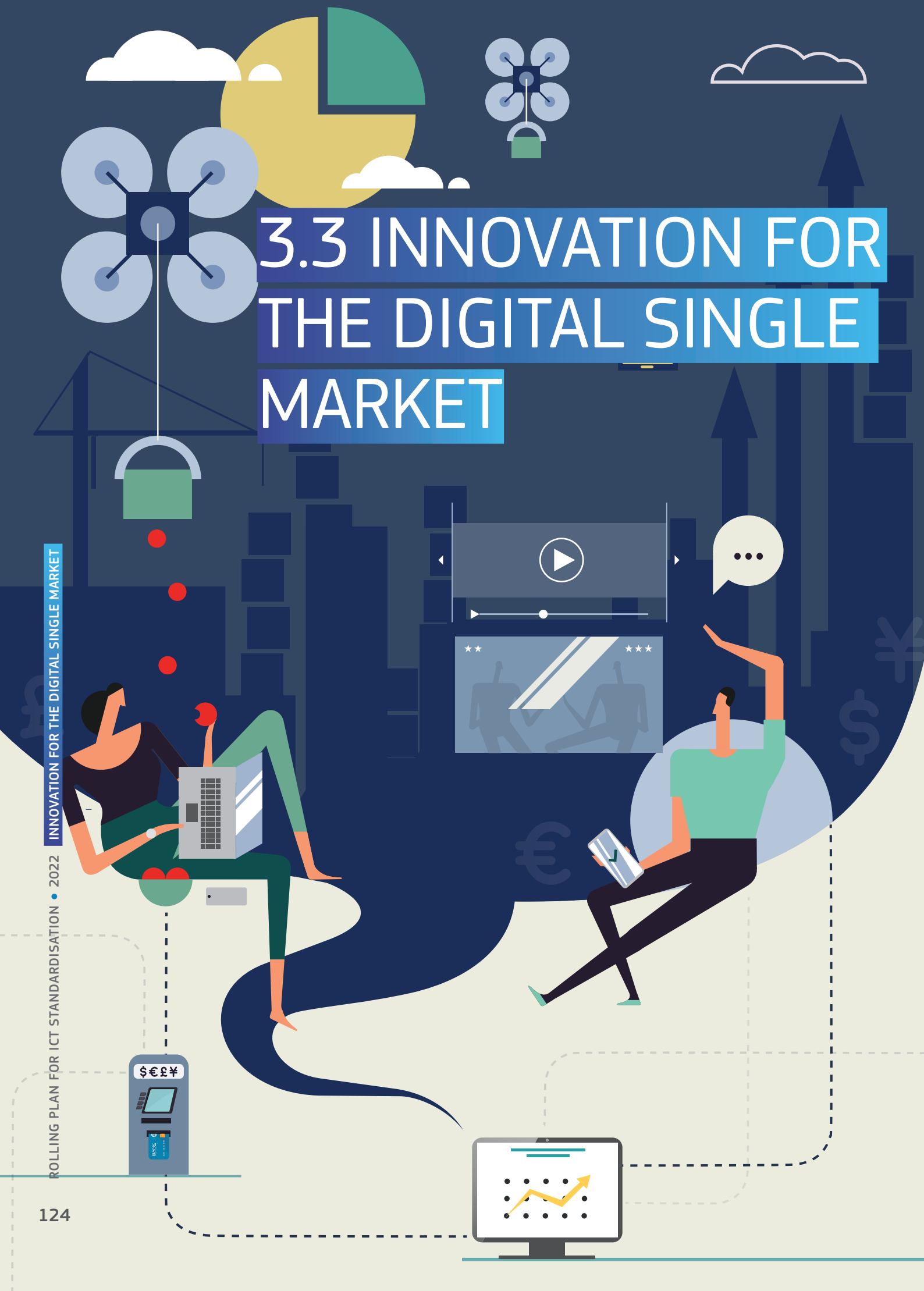
(C.1) RELATED STANDARDISATION ACTIVITIES

IEEE

IEEE has various standards and pre-standards activities that contribute to safety, transparency and due process online. The P7000 Series has relevant activities, including IEEE 7000-2021 - IEEE Standard Model Process for Addressing Ethical Concerns during System Design and IEEE P7001™ - Standards for Transparency of Autonomous Systems.

IEEE P2089 focuses on providing age appropriate digital services, and is based on the 5Rights principles which were developed with youth and children involved. It is based on the recognition that the user is a child, has considered the capacity and upholds the rights of children, offers terms appropriate to children, presents information in an age appropriate way, and thereby offers a level of validation for service design decisions.

3.3 INNOVATION FOR THE DIGITAL SINGLE MARKET



3.3.1 E-PROCUREMENT – PRE- AND POST AWARD

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

Public procurement must ensure best value for money, while being transparent and simple as well as meeting environmental, innovative and social objectives. E-procurement is a key tool to achieve these goals.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The 2014 Public Procurement Directives make e-Procurement the main method for carrying out public procurement. Since April 2016, electronic notification and electronic access to tender documents have been mandatory; e-submission of tenders became mandatory for all buyers in October 2018.

The procurement Directives also require the Commission to adopt implementing regulations on procurement standard forms and on the European Single Procurement Document. Furthermore, the Commission is empowered to mandate the use of technical standards in other areas of e-procurement as long as these are "thoroughly tested and proved their usefulness in practice".

E-procurement in the EU is driven by a thriving ecosystem of private and public e-procurement solution providers. Being able to choose between multiple systems can bring better services and lower prices. However, it can also bring challenges such as lock-in with particular eTendering providers and having to learn to work with multiple e-Tendering systems to access documents, submit bids, etc.

"Standards can offer solutions to these problems, as they can improve data portability, reduce the costs of understanding new systems and enable communication across systems. This has been recognized on various occasions, for example in 2013 by the Commission's Expert Group on e-Tendering (eTEG) and in 2016 by the Commission's Multi-Stakeholder Expert Group on eProcurement (EXEP). Such benefits will be available not only to public entities acting in the role as buyers, but also for private sector entities and service providers."

However, the practical development and use of standards for e-Procurement is not without its difficulties. First, products of CEN (a main driver of e-procurement standardisation activities within the CEN-BII workshop and CEN/TC 440) have faced several practical challenges in their implementation into software, relating to their availability and copyright licensing requirements. In this context, CEN and CEN/TC 440 are working on the possibility to integrate Free and Open Source solutions into eProcurement standards.

Second, a number of questions have come up regarding e-procurement standardisation in a fast-paced digitally transforming world. These questions include:

- what technical form should standards have (e.g. semantic only, syntactic, reusable code);
- how should market needs (and their fulfilment) be reliably assessed;
- how should standards be developed to meet rapidly changing needs;
- which phases of eprocurement should be standardised.

The Commission plans to launch a standardization request in 2022, to help providing standards in the domain of eProcurement. The European Innovation Council and SME Executive Agency (EISMEA), which was established in April 2021, is managing the operational and financial aspect of the standardization grants. EISMEA will make calls for proposals (grants) on a regular basis.

Besides this, the Publications Office started in 2016 the action to work on a freely available eProcurement Ontology, which will be used as a semantic model for the area of Public Procurement.

(A.3) REFERENCES

- **Commission Implementing Regulation (EU) 2019/1780 of 23 September 2019** establishing standard forms for the publication of notices in the field of public procurement and repealing Implementing Regulation (EU) 2015/1986 (eForms) (Text with EEA

relevance)

- **COM(2012) 179 final** — Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on a strategy for e-Procurement
- **COM(2013) 453 final** on end-to-end e-Procurement to modernise public administration
- **Directives 2014/23/EU** (concessions), **2014/24/EU (general)** and **2014/25/EU (sectoral)** on public procurement
- **Directive 2014/55/EU** of the European Parliament and of the Council on electronic invoicing in public procurement (especially the part on contract management which is linked to e-Procurement; please note there is a separate chapter on e-Invoicing).
- **Commission Implementing Regulation 2016/7** establishing the standard form for the European Single Procurement Document
- **Commission Implementing Regulation 2015/1986** establishing standard forms for the publication of notices in the field of public procurement

(B.) REQUESTED ACTIONS

ACTION 1 In 2022 two priorities for standardization are already identified on the two phases regarding eSubmission, which is legally mandatory, and eOrdering.

ACTION 2: Continue the development of the e-Procurement ontology. The action owner for the ontology is the Publications Office of the EU together with stakeholders from Member States.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN

CEN/TC 440 — "Electronic public procurement" — established to standardise e-procurement in support of the electronic public procurement process and the related information flows in the physical and financial supply chain. This facilitates end-to-end e-procurement, including both pre- and post-award processes. It succeeded the CEN workshop WS/BII3, which was closed on the 9 March 2016. CEN/TC 440 decided in June 2020 to temporarily refocus its activities to developing standardization deliverables covering the supply chain management (SCM) and activities of the post-award process only. They decided to make use of the e-procurement ontology semantic layer in their specifications and they are engaged in a collaboration with the e-procurement working group to ensure that their specific post award semantic requirements are met by the e-procurement ontology. The deliverables from CEN/TC 440 will be made available under a licensing regime that allows "Derivative Use" to mitigate some of the challenges identified in A.2.

CEN/TC 461 — "Integrity and accountability in public procurement" — established to define requirements/recommendations for how organizations ensure integrity and accountability in public procurement activities and processes. Work on this is at an early stage and ongoing.

OASIS

The OASIS Universal Business Language (UBL) TC defines a common XML library of business document types supporting digitization of the commercial and logistical processes for domestic and international supply chains. Version 2.1 (UBL v2.1), used in several Member States and in OpenPEPPOL, was adopted as ISO/IEC 19845:2015. UBL includes document schemas that support e-Procurement (e-Tendering) processes.

The new eForms to be used for publishing e-Procurement notices on TED (Tenders Electronic daily) will use UBL v2.3 which became an OASIS standard in June 2021.

The OASIS ebCore TC maintains the ebXML RegRep standard that defines the service interfaces, protocols and information model for an integrated registry and repository. The repository stores digital content while the registry stores metadata that describes the content in the repository. RegRep is used in OpenPeppol, in pre-award eTendering BIS profiles:

BIS P006 – Search Notices (ebXML RegRep as container for query definition in search notices to public repositories such as Notification Platforms)

BIS P008 – Publish Notice (ebXML RegRep as container for publishing notices)

The inspiration was from TOOP which also included an eProcurement pilot.

ETSI

ETSI TC Human Factors is responsible for all Human Factors matters related to the usability and accessibility of ICT products, applications and services. Special care is paid to all aspects related to interfaces and interaction with the user. Human Factors is the scientific application of knowledge about human capacities and limitations in order to make products, systems, services and environments effective, efficient and easy for everyone to use.

UNECE

The United Nations Economic Commission Recommendation 43 on Sustainable Procurement underlines that the cost aspects of procurement should not be the only factors to determine the final attribution. Further aspects of social and environmental sustainability should be taken into consideration. This recommendation outlines these factors and provides a checklist to evaluate vendors as well as a supplier code of conduct. The UNECE suggests that these elements should be taken into consideration in the solutions which are deployed for eProcurement.

See: (available also in French and Russian) http://www.unece.org/fileadmin/DAM/cefact/cf_plenary/2019_plenary/ECE_TRADE_C_CEFACT_2019_07E.pdf

IEEE

Some relevant activities with a focus on AI include:

IEEE P3119 Standard for the Procurement of Artificial Intelligence and Automated Decision Systems is a new IEEE standards activity.

IEEE P2863 Recommended Practice for Organizational Governance of Artificial Intelligence.

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

ISA2 ACTIONS

SEMIC action on CCEV (Core Criteria/Evidence Vocabulary) to help make the ESPD data model domain independent like the other Core Vocabularies

E-Procurement ontology to enable the rationalisation and interoperability within the public procurement workflow for the various actors concerned and facilitate the creation, exchange, dissemination and reuse of the resulting data.

Under the ISA2 program the ESPD data model as well eCertis was developed. Through the CEF eProcurement DSI services were financially supported to implement ESPD services. Currently, almost all EU countries have at least one ESPD service in place and a high number are connected through eCertis. ISA2 provides the test bed which is used to validate ESPD XML files which are based on UBL as well as eInvoices to check compliance with the standard on eInvoice (EN 16931-1:2017).

See the work programme http://ec.europa.eu/isa/library/documents/isa2-work-programme-2016-detailed-action-descriptions_en.pdf

OPENPEPPOL

PEPPOL was a EU large-scale pilot project (LSP) from 2008-2012. It provided a set of technical specifications that can be implemented in existing e-Procurement solutions, and enables trading partners to exchange standards-based e-Procurement documents.

Following the closing of the PEPPOL-project, OpenPEPPOL AISBL took over governance of the solutions developed.

The PEPPOL transport infrastructure is now implemented by hundreds of service providers throughout Europe, servicing thousands of public and private entities, including the post-award processes of e-procurement.

http://www.peppol.eu.

E-SENS

The 'Electronic Simple European Networked Services' (e-SENS), ended in 2017, was an EU LSP project integrating results from PEPPOL and other eGovernment LSPs. The e-SENS Work Package 5.1 focused on e-Procurement. An important milestone was reached in January 2015. Phase I in work package 5.1 was processed successfully, allowing for the first time, to interchange a publication and an application for participation between the Netherlands (Tendernet), Denmark (ETHICS) and Germany (XVergabe) Gateway to e-Vergabe from BeschA) with PEPPOL infrastructure, consisting of access points from IBM Denmark and the University of Piraeus Greece. Part of the work is based on specifications from CEN WS/BII3.

http://www.esens.eu

EXEP

The multi-stakeholder expert group on e-Procurement (EXEP) assists and advises the Member States and the Commission on implementing the provisions of the new public procurement Directives relating to electronic procurement. It contributes to monitoring the uptake of e-Procurement across the EU, sharing best practices, following new developments in the field, and addressing interoperability issues. The EXEP liaised closely with the now closed European multi-stakeholder forum on e-invoicing (EMSFEI) and with national forums to further promote the uptake of end-to-end e-Procurement across the EU, including in the post-award phase. The group is responsible for ensuring the coherence between the recommendations arose from the EMSFEI and broader policies on end-to-end e-Procurement. In addition, EXEP provides governance and support for initiatives like CEF and governs the standardisation process in the area of e-Procurement.

TOOP

The Once-Only Principle Project (TOOP) was launched by the European Commission in January 2017 as an initiative of more than 50 organisations.

The main objective of TOOP is to explore and demonstrate the once-only principle across borders, focusing on data from businesses. Doing this, TOOP wants to enable better exchange of business related data or documents with and between public administrations and reduce administrative burden for both businesses and public administrations.

The TOOP will also have implications for the Single Digital Gateway project.

http://www.toop.eu/

(C.3) ADDITIONAL INFORMATION

The Netherlands facilitates a National community for e-Invoicing and e-Procurement by providing 3 public/private platforms (STPE.NL, Netherlands Peppol Authority Communities NPAC & NMBF).

This community aims to:

- Maintain and update the current and future national standards on e-procurement through public/private involvement. (STPE, NPA Communities)
- Facilitate long-term community feedback on current and future policies. (NMBF)
- Maintain and update the infrastructure standards on e-procurement. (NPA Communities)

This community furthermore voices the Dutch position on e-Procurement towards Europe.

(1) See 2014/24/EU Art. 22 last paragraph.

3.3.2 E-INVOICING

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

Electronic invoicing (e-Invoicing), as defined in Directive 2014/55/EU, is an invoice that has been issued, sent and received in a structured electronic format which allows for its automatic and electronic processing, brings numerous benefits to all users (senders, and recipients, service providers, tax authorities, etc). By automating the relevant business processes, e-Invoicing leads to cost savings, increased efficiency, faster payments, and a reduced environmental impact especially if other business documents like order and dispatch advice are also available in electronic format. Its deployment is a strong tool in support of enterprise and financial policies as it makes enterprises more efficient and generates potentially significant savings for Member States' governments. "Electronic invoicing can improve tax compliance and is an effective tool to reduce tax frauds, in fact its adoption also in the private sector transactions (B2B) is increasing worldwide, often by legal obligation and with proprietary formats. Benefits include also B2C, see section C.3. The broadest take-up of eInvoicing in Europe, possibly the extension of the use of the European Standard to B2B, B2C and at an international level and making the European standard fit for all upcoming Commission e-Invoicing related issues, , such as the potential use of e-Invoicing for VAT reporting, are the main objective for the coming period.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

By specifying the semantic data model of the core elements of an electronic invoice, the published European standard EN 16931-1 is intended to tackle the semantic fragmentation that is a side effect of the vast number of e-invoicing standards, data formats, and usage requirements that exists across the EU and globally. The standard model preserves the necessary flexibility through Core Invoice Usage Specifications (CIUS) and extensions. It is important to promote the standards in order to facilitate interoperability while respecting different sector needs and practices. On the same basis, it should also be possible, by new standardisation activities, to support the adoption of e-invoicing for B2B and B2C (e-receipts) and at an international level; while ensuring the potential use of eInvoicing for VAT reporting obligations.

The Commission has addressed the issues around e-Invoicing also on the political and legal level:

- Communication COM(2012)573 identified 12 key actions, one of which is to "adopt legislation to make e-invoicing standard billing mode in public procurement".
- Directive 2014/55/EU obliges central government bodies of the Member States to accept electronic invoices in public procurement.
- In its work programme for 2022, Annex II under the section REFIT Initiatives, the Commission announced that it will put forward a legislative proposal for 2022 under the heading 'VAT in the digital age', also covering VAT reporting obligations and e-invoicing.
- The Commission will review the effects of Directive 2014/55/EU on the internal market and uptake of eInvoicing in public procurement and submit a report to the European Parliament and to the Council (as foreseen in Article 12 of the Directive).

(A.3) REFERENCES

- **Directive 2014/55/EU** of the European Parliament and of the Council on electronic invoicing in public procurement. This Directive obliges central government bodies of the Member States of the European Union to accept electronic invoices in public procurement from 18 April 2019 onwards; and Member States were able to postpone the obligation for local authorities until 18 April 2020. These electronic invoices must comply with the European standard on electronic invoicing (EN 16931-1), and with one of the syntaxes on a limited list specified in CEN/TS 16931-2.
- **Council Directive 2010/45/EU** amending Directive 2006/112/EC on the common system of value added tax as regards the rules on invoicing.
- **SWD(2013) 222** — *Impact Assessment accompanying the document `Proposal for a Directive of the European Parliament and of the Council on electronic invoicing in public procurement´*
- **COM(2013) 453 final** *on end-to-end e-Procurement to modernise public administration*
- **Explanatory Notes on VAT-invoicing rules** (Council Directive 2010/45/EU)
- **Council Directive 2006/112/EC** on the common system of value added tax.
- **COM(2010)712** "Reaping the benefits of electronic invoicing for Europe" describes a number of actions in different areas, including standardisation, needed to facilitate the deployment of e-invoicing in Europe.
- COM(2012)179 "A strategy for e-procurement" states that the ultimate goal is "straight through e-procurement" with all phases of the procedure from notification (e-notification) to payment (e-payment) being conducted electronically.

- Commission Implementing Decision (EU) 2017/1870 of 16 October 2017 on the publication of the reference of the European standard on electronic invoicing and the list of its syntaxes pursuant to Directive 2014/55/EU
- Commission work programme 2022, Annex II, includes the "VAT in the digital age" initiative, which aims to modernise the current VAT rules, taking into account the opportunities offered by digital technologies. The initiative covers 1) VAT reporting obligations and e-invoicing 2) VAT treatment of the platform economy and 3) single EU VAT registration.

Several European countries already introduced rules whereby public authorities could only accept electronic invoices from suppliers, and all these initiatives will need to align with the ongoing standardisation activities carried out by CEN/TC 434 according to the Annex of the standardisation request M/528.

(B.) REQUESTED ACTIONS

The deliverables defined in standardisation mandate M/528 have been published. EN16931-1 and its complementary technical specifications and reports are available. TC/434 should discuss further follow up activities leading to wider adoption and implementation of e-Invoices / automated processes.

ACTION 1 Continue the work in CEN TC/434, which includes the following aspects and standardisation deliverables, currently under development:

- investigation of future activities (the TC has already agreed on the topics to be addressed on a short and medium term)
- maintenance activities
- preparation of the Amendment to the European Standard
- development of standardisation documents that support and encourage the uptake of the European Standard and its ancillary deliverables
- communication activities (Capacity building) also addressing third countries at global level
- development of a standard supporting e-receipts, based on the European Standard on electronic invoicing.
- ensure the EU standard is "fit for purpose" to serve a coherent eInvoicing policy in the EU, especially in line with the new requirements coming from the EU legislation for tax reporting potentially based on eInvoicing, which is under preparation.

ACTION 2 For e-invoices related to ICT services addressing end users, attention should be paid to the relevant Human Factors requirements (e.g. language understandability and consistency and accessibility). Aspects such as clarity and ability to perceive of information structures and content, use of unambiguous, harmonised terminologies and standardised formats and information attributes and details should be considered for current and upcoming ICT services. ETSI has already addressed certain aspects related to the usability and accessibility of the basic elements (e.g. in Smart City environments) and on the general level; the ESOs, MSP, consortia and standards bodies should coordinate and initiate work to develop recommendations addressing the requirements and user experience of e-invoicing in digitised environments (covering applicable usability and accessibility aspects related to those attributes and context of use).

Usability ensures the accuracy of the information content of e-invoices and e-receipts which are main documents for real time economy. Usability make invoice and receipt data reliable and so allows automatic processing of invoice and receipt information in the buyer's various financial management systems and reporting (once only principle) without manual processing.

General remark: Overall, the actions should be part of an agreed standardisation strategy shared by the Commission, the ESOs, MSP, consortia and standards bodies supplying specifications in use, and Member States which actively implement them. The Commission may launch further broad, neutral fact-finding inquiries (perhaps via the MSP) to identify appropriate shared needs and goals.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN

CEN/TC 434 — "Electronic Invoicing" — was established to provide standardisation for e-Invoicing and to undertake the standardisation activities required by the Directive 2014/55/EU

CEN/TC 440 — "Electronic public procurement" — was established in order to provide standardisation in the field of e-procurement including post-award processes.

CEN/TC 445 — "Digital information Interchange in the Insurance Industry" — has started the development of a new standard for the electronic invoice of the insurance premium, based on EN16931-1.

OASIS

The OASIS Universal Business Language (UBL) TC defines a common XML library of business document types supporting digitization of the commercial and logistical processes for domestic and international supply chains. Version 2.1 (UBL v2.1), used in several Member States and in OpenPEPPOL, was adopted as ISO/IEC 19845:2015. An updated UBL version 2.3 was published as a OASIS Standard in June 2021. It provides standards for service location (BDXL 1.0) and capability lookup (SMP 2.0) that can be used together with a message protocol like AS4 (as used in the European Commission's eDelivery Building Block and in OpenPEPPOL) and an Exchange Header Envelope schema (XHE 1.0).

The OASIS Business Document Exchange (BDXR) TC is defining specifications for a federated document transport infrastructure for business document exchange.

UNECE

The United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) Cross Industry Invoice version 16A is a maximum data set invoice model which aims to cover all potential needs of any industry and any transaction. Each implementation is therefore a subset of the overall standard, but extensions should not be necessary as every aspect is intended to be covered by the standard. This standard is re-released twice a year, but always backwards compatible with the official 16A version.

This standard is based on an overall Reference Data Model which brings direct links to electronic messages for all other supply chain operations.

See:https://www.unece.org/uncefact/mainstandards.html#ui-accordion-jfmulticontent_c66359-panel-1

ETSI

ETSI TC Human Factors is responsible for all Human Factors matters related to the usability and accessibility of ICT products, applications and services. Special care is paid to all aspects related to interfaces and interaction with the user. Human Factors is the scientific application of knowledge about human capacities and limitations in order to make products, systems, services and environments effective, efficient and easy for everyone to use.

SC USER Group has published TS 102 845 Requirements for Check-up on Metering and Billing Processes and associated documents for the implementation of this TS.

IEEE

IEEE P2142.1 - Recommended Practice for E-Invoice Business Using Blockchain Technology. For further details please see https://standards.ieee.org/content/dam/ieee-standards/standards/web/documents/other/blockchain.pdf

ITU

Under ITU-T SG3, Recommendation ITU-T D.198, "Principles for a unified format of price/tariffs/rates lists used for exchanging telephone traffic", recognizes the right of any operator to present price/tariffs/rates charged for telecommunications services in any form deemed convenient for the operator. It additionally recommends that telecommunications companies offering international connections/exchange of traffic make use as far as possible of the same templates/forms/format of data to represent traffic destinations and offered price/tariffs/rates including if required optional clarifying information or quality of service criteria. ITU-T D.198 also identifies the mandatory and optional specifications of price list electronic spreadsheets and advocates for the coordination between parties not only to define QoS information but also to ensure smooth spreadsheet processing.

See: https://www.itu.int/rec/T-REC-D.198-201905-I

Under ITU-T SG16 a new work item to draft a new Recommendation H.DLT-INV "General framework of DLT-based invoices" was approved, aiming to publish it during 2021.

See: https://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=16367

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

OPENPEPPOL

E-Invoice developer community to implement the PEPPOL (and e-SENS) programmes. The PEPPOL transport infrastructure is today implemented by hundreds of service providers throughout Europe, servicing thousands of public and private entities, specifically in the post-award processes of e-procurement, where e-Invoicing is predominantly used.

http://www.peppol.eu/about_peppol/about-openpeppol-1

(C.3) ADDITIONAL INFORMATION

The emergence of an abundance of internet and mobile based payment services for both online and over-the-counter purchases makes it increasingly important to also standardise formats and delivery methods for business-to-consumer (B2C) e-billing. Business-to-government (B2G) and business-to-business (B2B) e-invoicing formats are not directly applicable to invoices and receipts issued to consumers. Most importantly, there are privacy issues to be considered with respect to content and delivery. Standardised e-billing for B2C commerce could have a number of benefits including faster and simpler payments and reduced environmental impact for mobile over-the-counter purchases; more readily accessible to users with disabilities; consumers can collect invoices in a single location, easily accessible for warranty and ODR purposes; easily accessible and portable e-invoices may be used to increase trust in relation to second-hand C2C trading. However, e-invoicing in multiple formats, where the consumer would have to register in many different ways with various vendors and/or data mining third-party services to receive invoices in various formats or become embedded in proprietary apps, would be detrimental to the objectives of the digital single market.

3.3.3 RETAIL PAYMENTS

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The speed at which technological change in payments is happening requires targeted policy measures. The European Union aims to be a highly competitive payments market, allowing all players to compete on fair and equal terms to offer innovative digital payment solutions.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

Directive 2015/2366/EU (PSD2) set the foundation for safer and more innovative European payments. It aims at better protecting consumers when they pay online, promoting the development and use of innovative online and mobile payments, and making cross-border European payment services safer.

Payments have become strategic for the EU's economic and financial autonomy. Digitalisation and innovation are quickly changing the way payments are made Electronic (cashless) payments are becoming increasingly popular and the Covid-19 pandemic has further reinforced their importance, in particular with regard to contactless payments.

Today, the EU's electronic payments market is dominated by a few large global players providing nearly all cross-border payments in the European market, in particular when the payments at the point of sale (such as in shops) are concerned. Payment solutions provided by European payment service providers and fintechs are often very successful but only at national level. One of the reasons why these solutions have been so far failing to expand across the European Union and beyond is that they are not interoperable with one another. An increasing number of these payment solutions rely on technologies such as QR-codes, Bluetooth (BLE) or Near Field Communication (NFC). The absence of common technical standards is one of the obstacles to achieving the interoperability of these solutions and QR-codes in particular suffer from an absence of EU-level standardisation.

In recognition of these problems, several initiatives led by the European Retail Payments Board (ERPB) and the European Payments Council (EPC) have been launched, aimed at adopting common European schemes and rules. This standardisation and harmonisation work aims to ensure the interoperability of instant payment solutions in shops and e-commerce. In particular, the ERPB Working Group on instant payments at the point of interaction (physical point of sale and e-commerce) has recognised the need for a standardised QR-code for both merchant-presented and consumer-presented use cases. The Working Group will develop the minimum data set to be exchanged in standardized QR-codes between the merchant and the consumer.

Provided that the market factors are duly taken into account, resolving the issue of missing standards will make it easier for payment services providers and merchants alike to reach critical mass by making use of the digital single market and committing to make the necessary investments.

(A.3) REFERENCES

- Directive 2015/2366/EU of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market:
- **ERPB Interim report of the Working Group on a** Framework for interoperability of instant payments at the point of interaction **(IPs at the POI)**

(B.) REQUESTED ACTIONS

ACTION 1 ESOs to work with stakeholders on a single, open and secure European technical standard for QR-codes to support the uptake and interoperability of instant payments.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN

CEN/TC 224 'Personal identification and related personal devices with secure element, systems, operations and privacy in a multi sectorial environment' develops standards for strengthening the interoperability, security and privacy of personal identification and its related personal devices. CEN/TC 224 addresses providers from the supply side such as card manufacturers, security technology, conformity assessment body and software manufacturers.

https://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:6205&cs=1FB1CC5B5F03F85F0ECCECA7598551CFC

EMVCO

EMV® QR Code Specification for Payment Systems: Merchant-Presented Mode and EMV® QR Code Specification for Payment Systems: Consumer Presented Mode are ISO 18004 compliant. The current versions of these specifications are available from: https://www.emvco.com/emv-technologies/qrcodes/

ETSI

ETSI's Smart Card Platform committee (TC SCP) develops and maintains specifications for the Secure Element (SE) and its interfaces with the outside world for use in telecommunication systems including the Internet of Things (IoT) and other industry sectors.

The technical realisation of the SSP consists of a multi-part specification. Our first deliverable addresses generic portions of the SSP, regardless of its form factor and the physical interfaces it supports. The second and third address specific classes of the SSP – the SSP integrated on a System on Chip (SoC) and a specific type of an embedded Secure Element. All three documents have been published. The next step is the development of the SSP for the other embedded as well as for the removable form factors. In addition, a new protocol (SPI) for the Secure Element has been published. This will then provide a future oriented technology to replace existing UICC technology. ETSI has also developed the respective test documents for the SSP specifications to facilitate conformance and interoperability of the products.

ISO

ISO/IEC JTC 1/SC 9- Information exchange for financial services. ISO 12812 has been published. This includes five parts:

ISO 12812-1: General Framework

ISO 12812-2: Security and data protection for Mobile Financial Services

ISO 12812-3: Financial Application Management

ISO 12812-4: Mobile Payments to Persons

ISO 12812-5: Mobile Payments to Businesses

ISO/IEC JTC1/SC31 Automatic identification and data capture techniques:

ISO/IEC 18004:2015 Automatic identification and data capture - QR code bar code symbology specification

ITU-T

ITU-T SG3 continues work in the area of tariffs, economic and policy issues pertaining to Mobile Financial Services (MFS) through Question 12/3, including charging for MFS, Mobile Financial Services Transaction Cost Model, Consumer Protection in MFS and Interoperability for Competition in Mobile Financial Services.

ITU-T Focus Group Digital Financial Services (FG DFS) has published 85 recommendations for policymakers and DFS stakeholders and deliverables addressing the DFS ecosystem challenges and provide best practices for consumer protection regulators, key performance indicators for quality of service for DFS and merchant acceptance for DFS. There are also deliverables related to DFS in the areas of - interoperability, security, privacy, role of postal networks, competition, and enhancing digital credit. https://itu.int/en/ITU-T/focusgroups/dfs/Pages/deliverables.aspx

The Financial Inclusion Global Initiative (FIGI) was set up jointly by ITU, the World Bank, the Bank for International Settlements (BIS) and the Bill & Melinda Gates Foundation in 2017. The main objective of FIGI is to implement the recommendations of the FG DFS, the high-level principles of the Payment Aspects of Financial Inclusion (PAFI) report of the World Bank and the BIS at a country level over the next three years (see https://figi.itu.int). ITU established a Digital Financial Services (DFS) Security Lab under FIGI to conduct security audit of mobile payment applications operating under USSD, STK and Android environments (see https://figi.itu.int/figi-resources/dfs-security-lab/). The DFS Security Lab methodology for testing of Android mobile payment applications is based on the OWASP Mobile Top 10 Security risks method. The FIGI Security, Infrastructure and Trust Working Group which is led by ITU published a number of reports on security for digital financial services on topics such as strong authentication methodologies, addressing SS7 vulnerabilities, eKYC use cases for DFS, security assurance framework for DFS, security tests for USSD and STK applications, security audit of Android DFS applications, DLT Security aspects and DFS Consumer Competency Framework amongst others. More details about the reports are available here : https://figi.itu.int/figi-resources/working-groups/.

In March 2020, ITU-T SG11 finalised and consented the baseline text of ITU-T Q.3057 (ex. Q.SR-Trust) "Signalling requirements and architecture for interconnection between trustable network entities".

ITU-T SG11 started a draft technical report on low resource requirement, quantum resistant, encryption of USSD messages for use in financial services, which purpose is to examine new technologies for encryption of USSD in End-to-End manner and estimate its applicability to be integrated into existing USSD technology, suggesting new recommendation and signalling requirements for the integration of such technology into the existing reference architecture.

Relevant ITU work around digital currency is found in the Rolling Plan chapter on Blockchain.

ITU-T SG13 has approved two Recommendations on secure mobile payments and mobile banking solutions.

- ITU-T Y.2740 elaborates on approaches to develop system security for mobile commerce and mobile banking.
- ITU-T Y.2741 specifies the general architecture of a security solution for mobile commerce and mobile banking in modern telecommunication networks.

ITU-T SG12 is studying QoS and QoE aspects of digital financial services, including a methodology to test QoE. Two new ITU-T Recommendations were approved in ITU-T SG12 on digital financial services:

- New Recommendation ITU-T G.1033 highlights important aspects related to quality of service (QoS) and quality of experience (QoE) that require consideration in the context of digital financial services.
- New Recommendation ITU-T P.1502 introduces a methodology for testing the quality of experience (QoE) of digital financial services.

The Recommendations are based on the results of the ITU-T Focus Group on Digital Financial Services and the FIGI Security, Infrastructure and Trust Working Group. A new question (Q.13) was created in ITU-T SG12 on Perceptual and field assessment principles for quality of service (QoS) and quality of experience (QoE) of digital financial services (DFS) – all DFS QoS recommendations including the interoperability and cross border QoS testing will be standardized in this question.

W3C

The open web platform offers tremendous potential as the driver behind the transformation of the web Payments industry. The platform forms the foundation of how online and in-store payments can be made easy on the web in the future. See https://www.w3.org/Payments/

The web payments working group , chartered to make payments easier and more secure on the web, through the development of new web standard protocols and APIs related to the initiation, confirmation, and completion of a payment. This serves to increase interoperability between payer and payee systems. The group is chartered to standardise programming interfaces, not user interfaces and not a new digital payment scheme. See https://www.w3.org/Payments/WG/

The web payments interest group, chartered to provide a forum for web payments technical discussions to identify use-cases and requirements for existing and/or new specifications to ease payments on the web for users (payers) and merchants (payees). It is also chartered to establish a common ground for payment service providers on the web platform. See https://www.w3.org/Payments/IG/

Other chartered groups (doing standards) are of course coordinated closely with web payments, such as security, crypto, privacy or authentication (also accessibility and internationalisation) and a number of other community-driven groups at W3C are doing work related to payments, or that will improve the web overall including payments. These include:

- the Interledger payments community group, which seeks to connect the many payment networks (ledgers) around the world via the web,
- the financial industry business ontology (FIBO) community group, which is developing extensions to schema.org related to financial industries,
- the Blockchain Community Group, which is studying and evaluating technologies related to blockchain, and use-cases such as interbank communications.

NEXO AND EPCNEXO

NEXO and EPCNEXO and the European Payment Council (EPC) currently focus on the protocols for card payment protocols in the Eurozone and aim to replace the current mess of proprietary protocols. The EPC is also involved in SEPA and sees itself as the decision-making and coordination body for the European banking industry in relation to payments

(C.2) ADDITIONAL INFORMATION

In general regarding card, internet and mobile payments, some stakeholders believe that the following issues should in particular be addressed: security, access and accessibility, management and portability of customer data, and transparency.

Card, internet and mobile payments are already standardised by a large number of organisations. This creates a diversity which may prevent the use of common infrastructures and common security standards. A common series of standards would be beneficial to all players in the market. A global view on standards in these areas is important as the payment market is global as are most existing standards.

The Web Payment Security Interest Group was launched on 17 April 2019 to enable W3C, EMVCo, and the FIDO Alliance to collaborate on a vision for Web payment security and interoperability. They are especially discussing how the Payment Services Directive 2 (PSD2) regulations in Europe, that took effect in September 2019 will affect Web payments and what will be the role of EMVCo, W3C, and FIDO technologies.

3.3.4 PRESERVATION OF DIGITAL CINEMA

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The 2005 European Parliament and Council Recommendation on film heritage recommended Member States to ensure preservation of cinematographic works. The fourth application report on this Recommendation, published on 3 October 2014, shows that very few Member States are implementing digital workflows to preserve digital or digitised cinema. Those that have done it have used diverging standards.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The film heritage sector would benefit from European standards that describe the most efficient digital workflows and data formats for preservation of digital films. The resulting standards for digital preservation of films could also be of interest for digital preservation of other type of documents in public administrations. Some Member States, as Germany and France, are planning to adopt national standards.

(A.3) REFERENCES

- Recommendation of the European Parliament and of the Council of 16 November 2005 on film heritage and the competitiveness of related industrial activities, OJ L 323 of 9.12.2005, p.57.
- Council conclusions on "European film heritage, including the challenges of the digital era", adopted in November 2010
- Council conclusions on "European Audio-visual Policy in the Digital Era" adopted on 25 November 2014
- 4th Application report of the Film Heritage Recommendation, from 2.10.2014
- Archival Policy of the Swedish Film Institute
- British Film Institute Strategy "2012-2017"
- Results of the EU-funded research project EDCine
- Recommendations from the International Federation of Film Archives (FIAF):
- FIAF Technical Commission Recommendation on the deposit and acquisition of D-Cinema elements for long-term preservation and access
- FIAF Technical Commission Recommendation on the Principles of Digital Archiving

(B.) REQUESTED ACTIONS

ACTION 1 SDOs to develop and adopt a European standard and the related guidelines on preservation of digital films, based on existing standardisation activities at national and international level.

ACTION2 SDOs to promote awareness and implementation of the European standard among relevant stakeholders (e.g. European film heritage institutions). Relevant stakeholders are invited to participate in the development of standards within CEN/TC 457 'Digital preservation of cinematographic works'. CEN/TC 457 will ensure a proper information exchange between stakeholders and will actively seek cooperation.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN

CEN/TC 457 'Digital preservation of cinematographic works' was created late 2017. The scope of the TC includes the definition and standardisation of digital long-term archive formats for cinematographic works. The work on a dedicated standard is nearly complete. The standard defines a Preservation Package, to be published in a TR, to facilitate the digital preservation of cinematographic works. It addresses methods to describe the relationship of components of the cinematographic work and delivers the syntax to describe the package content. The standard itself defines the structure of the package and specifies the constraints that are necessary to enable compliance and interoperability.

The Enquiry Draft of the Standard was published as prEN 17650:2021, which has been adopted based on the comments received. The Standard, and the corresponding Technical Report, should be finalised and published in 2022. Together with both documents a reference software will be provided.

ISO - OAIS

OAIS (Open Archive Information System) — ISO 14721:2012

http://www.iso.org/iso/iso_catalogue/catalogue_ics/catalogue_detail_ics.htm?csnumber=57284

GERMANY

Germany has started standardisation activities at national level that resulted in the publication technical report on digitalization of analogue films (DIN SPEC 15587 "Guidelines for digitization of cinematographic film", 2019 edition) it gives guidelines for the digitalization to make a digital preservation possible. It will be revised according to the results of CEN/TC 457's work.

CST/FRAUNHOFER

CST/Fraunhofer started a new "Society of Motion Picture and Television Engineers" (SMPTE) activity for a mezzanine file format of digitised movies based on the interoperable master format (IMF) which can be extended to a preservation format of digital films

ITU

ITU-T Study Group 16 on multimedia services and applications. Developed with ISO/IEC JTC 1/SC29/WG1 Recommendation T.802 (Motion JPEG-2000) that is used for digital cinema. Additionally, SG16 is developing studies on cultural heritage under its Question 21/16 "Multimedia framework, applications and services".

Resolution ITU-R 60 (Reduction of energy consumption for environmental protection and mitigating climate change by use of ICT/radiocommunication technologies and systems) resolves "that ITU-R Study Groups should develop Recommendations, Reports or Handbooks on best practices in place to reduce energy consumption within ICT systems, equipment or applications operating in a radiocommunication service" and "possible development and use of radio systems or applications which can support reduction of energy consumption in non-radiocommunication sectors". ITU-R Study Groups have produced several outputs on climate change, but there is not much literature within ITU-R Study Groups regarding the environmental impact of ICT itself.

ITU-R Study Group 6 had approved Report ITU-R BT.2385 on "Reducing the environmental impact of terrestrial broadcasting systems". Like all industries, the broadcasting sector has a responsibility to improve its environmental performance. The main environmental impacts of the broadcasting industry are greenhouse gas (GHG) emissions, energy use, raw material consumption and electronic waste. This Report presents analyses of several case studies.

More info: https://www.itu.int/pub/R-REP-BT.2385

3.3.5 FINTECH AND REGTECH STANDARDISATION

(A.) POLICY AND LEGISLATION

The way financial data is exchanged across institutions and companies worldwide is becoming more and more automated and complex. The financial sector is playing a crucial and systemic central role, being affected by new and emerging trends such as digitalisation and new business models. The financial services and insurance industries have seen profound technology-led changes over the past few years.

"Fintech" innovators and entrepreneurs are redefining the way we save, borrow, invest, spend and protect our money. They not only bring new financial services to the market, but also pioneer an innovative culture, introducing software, technology and business practices beyond those traditionally associated with the financial services sector. These changes again impact business operation communication flows on financial data.

Business operations benefit from standardised solutions to support and foster a more competitive and innovative European financial sector. The use of standards and technical specifications enables seamless information exchange among financial service providers, lowers barriers, underpins trust of consumers, boosts innovation and enables compliance with financial laws in a cost-effective way.

It is a challenge to find the right standardisation axis in such a rapidly transforming industry.

In parallel, regulatory efforts are trying to keep pace with the impact of digitalisation on systemic risk management, resulting in supervisory reporting obligations imposed on the entire financial sector, while stock listed companies are guided into transparency reporting obligations to leverage transparency for investors. In general, "reporting" is summarizing in various ways the recording of what happened in business operations.

Access to standardised data is essential to perform supervision of financial institutions, monitoring of systemic risk, and market oversight and ensure orderly markets, financial stability, investor protection and fair competition.

Current reporting obligations are perceived as costly and burdensome due to potentially duplicative and overlapping reporting requirements, but in reality, more due to insufficient standardisation and lack of clarity on what needs to be reported.

"Regtech" initiatives are ramping up in this domain, seeking among others digital ways to shrink the time-to-supervisor while maintaining control of business operations and understanding the details of the supervisory reporting obligations. It is imperative to standardise regulatory dictionary definitions on a European level and enable digital linking between regulation and supervisory reporting obligations.

Reporting obligations, or "prudential reporting" is not the only field where "Regtech" solutions are changing the financial services sector. Regtech solutions are also available and are already used by financial institutions in the field of AML/CFT, ICT security, fraud prevention and creditworthiness assessment (CWA).

The standardisation of data sharing and data protection is another area where standardisation could potentially be beneficial.

(A.1) POLICY OBJECTIVES

Traditional financial institutions realize they have a lot to lose or gain from the Fintech revolution and invest huge effort and money to adapt their technology and processes to adjust to a new environment, find a place in this new ecosystem, compete with new business models and respond to new consumer needs and behaviours. Across Europe, there has been considerable uptake of new digital channels: over 58% of Western Europeans (85% for Northern Europeans) prefer to use digital over physical branches, compared to 52% of US bank customers. These trends have grabbed the attention of investors who have made massive investments, growing by 75% in 2015 to $22.3bn, five times higher than in 2013.

Fintech start-ups appear with innovative solutions challenging existing financial services business models, markets and regulation. The existing legal framework is being reviewed at EU level and the concept of regulatory experimentation frameworks (or sandboxes) explored to help address this transformation and enable innovation.

Some regulatory adjustments have already been adopted such as amendments to the Anti-Money Laundering directive and the use of electronic identification. Since July 2016, the Electronic Identification and Trust Services Regulation can give e-transactions and other e-signed documents the same legal status as those that are paper-based. The Capital Requirement Regulation CRR2 package adopted in 2016 takes technological innovations into consideration, and so is the 2017 Action Plan for Retail Financial Services.

Following several public consultations regarding financial services and the EU Parliament report on blockchain and virtual currencies, the Commission has set-up a horizontal Financial Technology Task Force to explore the impact of new financial technologies on consumers and businesses and the possible risks for financial stability. One of the work streams of the Task Force focuses on Interoperability and Standardisation.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The interoperability and standards work stream of the Financial Technology Task Force was kicked off in January 2017. A consultation on FinTech took place from 23 March to 15 June 2017. The results have been published during the summer 2017.

Since 2012, the European securities and market authority (ESMA) has defined, on a yearly basis, European common enforcement priorities (ECEP) in order to promote the consistent application of European securities and markets legislation and the IFRS, and especially the provisions of the Transparency Directive. Those priorities are a key focus of the examination of issuers' financial statements. They are made public so that listed companies and their auditors take due account of these areas when preparing and auditing IFRS financial statements.

In terms of technical standards, the EU adopted in May 2019 an RTS on the European Single Electronic Format (ESEF) for the digital format (XHTML) and structure (inline eXtensible Business Reporting Language-iXBRL) of annual financial reports enabling both human and machine readable financial reports as required by the Transparency Directive. Whilst numerous annual financial reports were published in this new format in 2021, the ESEF becomes mandatory for listed companies throughout the entire Union for financial years beginning on or after 1 January 2021. The extensible Business Reporting Language (XBRL) 2.1 was identified by the Commission for referencing in public procurement according to the provisions of Regulation (EU) 1025/2012 on European standardisation. In

addition, the European Commission adopted in September 2020 the new Action Plan on the Capital Markets Union. The plan contains 16 legislative and non-legislative actions towards completing the CMU, among which is setting up an EU-wide platform – the European Single Access Point (ESAP). An EU-wide access to company data in digital formats will reduce information search costs for cross-border investors and will widen the investor base for companies. The ESAP will also improve the availability and accessibility of sustainability-related data. In April 2021, in its proposal for a Corporate Sustainability Reporting Directive (CSRD) as part of the Sustainable finance package, the Commission proposed to make companies' sustainability reporting machine readable, by applying the ESEF.

In addition, the European Commission adopted a digital finance package on 24 September 2020 , including a digital finance strategy and legislative proposals on crypto-assets and digital resilience, for a competitive EU financial sector that gives consumers access to innovative financial products, while ensuring consumer protection and financial stability. The digital finance strategy sets out general lines on how Europe can support the digital transformation of finance in the coming years, while regulating its risks. The strategy sets out four main priorities: removing fragmentation in the Digital Single Market, adapting the EU regulatory framework to facilitate digital innovation, promoting a data-driven finance and addressing the challenges and risks with digital transformation, including enhancing the digital operational resilience of the financial system. A general approach in the European Council was reached regarding the pilot regime for market infrastructures based on Distributor Ledger Technology (DLT) that wish to try to trade and settle transactions in financial instruments in crypto-asset form. In addition, the implementation of the Digital Operational Resilience (DORA) proposal, which is part of the digital finance strategy, will require some degree of data standardisation processing in the context of establishing a potential central database/hub/or registry connecting other national registries.

On Artificial Intelligence (AI), the Commission proposed on 21 April 2021 a draft Regulation on a European Approach for Artificial Intelligence, which aims to develop standards on the use of Artificial Intelligence in the assessment of consumers' creditworthiness. Such standards could help market participants and developers of relevant applications implement the new rules (such as setting up, monitoring and documenting risk management systems, as well as requirements on data governance, technical documentation and record keeping). They could also support supervisors with carrying out ex-ante conformity assessments and ensure compliance with requirements which means that in the future the area will require some form of standardisation.

(A.3) REFERENCES

- COM/2021/189 final Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2013/34/EU, Directive 2004/109/EC, Directive 2006/43/EC and Regulation (EU) No 537/2014, as regards corporate sustainability reporting
- COM/2020/590 final A Capital Markets Union for people and businesses-new action plan
- **Commission SWD "**Fitness check of EU supervisory reporting requirements"
- Commission Delegated Regulation (EU) 2018/815 of 17 December 2018 supplementing Directive 2004/109/EC of the European Parliament and of the Council with regard to regulatory technical standards on the specification of a single electronic reporting format
- Directive 2004/109/EC (Transparency Directive) aims to ensure transparency of information for investors through a regular flow of disclosure of periodic and ongoing regulated information and the dissemination of such information to the public. Regulated information consists of financial reports, information on major holdings of voting rights and information disclosed pursuant to the Market Abuse Directive (2003/6/EC).
- **Commission Communication on the** CfE**:** EU regulatory framework for financial services of 23 November 2016
- **Commission Staff Working Document** on the Call for Evidence on EU financial services of 23 November 2016 to assess the cumulative effect of the new financial sector rules put in place since the crisis
- Ministerial Declaration on eGovernment - **the** Tallinn Declaration
- **The Parliament has written a report** on the influence of technology on the future of the financial sector
- **The Commission has launched a public consultation** on FinTech
- **The Commission set up an** internal Task Force on Financial Technology
- **The Commission published a** FinTech Action Plan https://ec.europa.eu/info/publications/180308-action-plan-fintech_en
- EBA Analysis of RegTech in the EU Financial Sector
- Proposal for a Regulation laying down harmonized rules on artificial intelligence (Artificial Intelligence Act) and amending certain Union legislative Acts

(B.) REQUESTED ACTIONS

ACTION 1 Ensure EU level coordination on FinTech standardisation, with CEN/CENELEC, European Supervisory Authorities, Fora Consortia, Industry, and with Standards Setting Organisations (such as ISO). Also ensure proper coordination with Open Source Projects working on Blockchain.

ACTION 2 Develop one 'Common Terminology' which is uniquely defined and provides a linking method between Regulation and Supervisory Reporting following the "define once" principle. The EU ISA² Programme Core Vocabularies methodology will be used as a guideline.

ACTION 3 Create an external subject matter experts network on Supervisory Reporting, contributing to and validating the 'Common Terminology'.

ACTION 4 Set up a governance structure to maintain the 'Common Terminology'.

ACTION 5 ESMA shall continue extending the XBRL-based reporting (actually inline XBRL) of listed companies under the Transparency Directive. In this context, additional (i.e. yet uncovered) parts of the annual financial report and other regulated information of listed companies should be marked up. The taxonomy for these newly marked up parts should be developed in order to achieve standardisation at EU level.

ACTION 6 consider further standardisation in the future based on proposals currently being negotiated on finance-related ICT solutions in areas such as reporting, risk assessments, data sharing, identification, digital operational resilience.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

ISO AND IEC

ISO/TC 68 "Financial Services" develop standards in the field of banking, securities and other financial services, relevant to FinTech, with the following sub-committees:

- Financial services, security
- Securities and related financial instruments
- Core banking
- Reference data for financial services
- Information exchange for financial services

ISO/TC 68 is responsible for the development and maintenance of the ISO 20022 "Financial services - Universal financial industry message scheme" series, the ISO 17442 "Financial services — Legal entity identifier (LEI)" series and ISO 23897 "Financial services — Unique transaction identifier (UTI)".

Furthermore, ISO/IEC JTC 1/SC 27 "IT Security techniques" develops standardisation solutions relevant to FinTech, including generic methods, techniques and guidelines to address both security and privacy aspects.

EUROFILING

Eurofiling is a collaborative environment created in 2005, bringing together the public and private sector: Regulators, Supervisors, financial institutions, providers, academic and private individuals. The common theme is European and National regulatory reporting versus the financial ecosystem. Eurofiling's objective is to improve collaboration and awareness to leverage interoperability. The Eurofiling community gathers in "Workshops" dedicated to interoperability in dictionaries, data point modelling, reporting standards, taxonomies, related know-how, academic research, interchange of experiences, future changes, best practices and materials for supervisory reporting frameworks.

Eurofiling is governed by the Board of Eurofiling Foundation p.f.

Standardisation resources on Supervisory Reporting: http://www.eurofiling.info.

CEN

CEN/WS XBRL: CEN workshop on improving transparency in financial and business reporting, including CWA 16744-3:2014 (European DPM-based XBRL taxonomy architecture), CWA 16746-1:2014 (standard regulatory roll-out package for better adoption: XBRL supervisory roll-out guide) and CWA 16746-2:2014 (standard regulatory roll-out package for better adoption: handbook for declarers). CWA 16744-1:2014 European Data Point Methodology for Supervisory Reporting, CWA 16744-2:2014 Guidelines for Data Point Modelling and CWA 16744-5:2014 Mapping between Data Point Model and Multidimensional Data Model, were promoted in August 2021 to the ISO standards ISO 5116-1:2021 , ISO 5116-2:2021 and ISO 5116-3:2021 respectively. The Data Point Model is widely used in Banking and Insurance reporting in Europe, and this promoting would contribute to widespread its use in other regions. European Authorities as EBA, EIOPA, ECB are currently developing the project "Data Point Model refit" to update it

The CEN XFS Workshop maintains multi-vendor device access specifications with a technical commitment to the Win 32 API. The related specifications are available here: https://www.cencenelec.eu/areas-of-work/xfs_cwa16926_340_release/

Moreover, the CEN/BT WG 220 'Fintech' was established to map the current standardisation landscape. The mapping provides an opportunity to identify European, international and national standards and other initiatives related to Fintech, with the potential to release growth and innovation in the financial sector, evaluate their market impact and facilitate new paths to increase the competitiveness of the Fintech sector. CEN will further engage with financial services and insurance industries, Fintech start-ups and technology developers to define a comprehensive analysis of Fintech-related topics.

In the follow-up to this study, CEN will look into new standards and supporting protocols for the broad adoption and use of new technologies which contribute to the establishment of industry, consumer and market confidence

IEEE

IEEE Standards Association has ongoing standardisation activities in

the areas of FinTech, e-Invoices and Cryptocurrency.

The "Blockchain in Supply Chain Finance" Working Group runs IEEE P2418.7 to develop a Standard for the Use of Blockchain in Supply Chain Finance. It defines a baseline architectural framework and functional roles for blockchain-driven supply chain finance (SCF) implementations, e.g. core enterprise, suppliers, buyers, banks, blockchain platform providers and so on. In addition, this standard outlines uses cases and business flows for SCF based on blockchain, and specifies the functional and security requirements.

The "Knowledge Graph" Working Group develops a - Guide for Application of Knowledge Graphs for Financial Services (IEEE P2807.2).

There is also focused standardisation activities around E-Invoice. The "E-Invoice Business Using Blockchain Technology" Working Group of the IEEE Consumer Technology Society "Blockchain" Standards Committee develops a Recommended Practice for E-Invoice Business Using Blockchain Technology (IEEE P2142.1)

The "Cryptocurrency Exchange" Working Group of the IEEE Consumer Technology Society "Blockchain" Standards Committee develops the P2140.x family of standards addressing general requirements, user identification, anti-money laundering, a DLT exchange framework, and a custodian framework.

The IEEE Computer Society Blockchain and Distributed Ledgers Standards Committee has several active projects focused on cryptocurrency and performance metrics for cryptocurrency payments.

The IEEE Trusted Data and Artificial Intelligence Systems (AIS) Playbook for Financial Services.

The IEEE Computer Society Blockchain and Distributed Ledgers Standards Committee has several active projects focused on digital assets, electronics contracts and e-commerce through its work on

- IEEE P3206 - Standard for Blockchain-based Digital Asset Classification
- IEEE P3207 - Standard for Blockchain-based Digital Asset Identification
- IEEE P3208 - Standard for Blockchain-based Digital Asset Exchange Model
- IEEE P3209 - Standard for Blockchain Identity Key Management
- IEEE P3801 - Standard for Blockchain-based Electronic Contracts
- IEEE P3802 - Standard for Application Technical Specification of Blockchain-based E-Commerce Transaction Evidence Collecting

The Consumer Technology Blockchain Standards Committee focused on several cryptocurrency standards which include

- IEEE 2140.1-2020 - IEEE Standard for General Requirements for Cryptocurrency Exchanges
- IEEE 2140.5-2020 - IEEE Standard for a Custodian Framework of Cryptocurrency
- IEEE P2140.2 Standard for Security Management for Customer Cryptographic Assets on IEEE Cryptocurrency Exchanges
- IEEE P2140.3 Standard for User Identification and Anti-Money Laundering on Cryptocurrency Exchanges
- IEEE 2143.1-2020 - IEEE Standard for General Process of Cryptocurrency Payment
- IEEE P2143.2 Standard for Cryptocurrency Payment Performance Metrics
- IEEE P2143.3 Standard for Risk Control Requirements for Cryptocurrency Payment
- IEEE P2418.9 - Standard for Cryptocurrency Based Security Tokens

There are also focused standardisation activities around E-Invoice.

The "E-Invoice Business Using Blockchain Technology" Working Group of the IEEE Consumer Technology is developing IEEE P2142.1 - Recommended Practice for E-Invoice Business Using Blockchain Technology

More information is available at blockchain.ieee.org/standards.

ITU-T

ITU-T Focus Group on Digital Financial Services (FG DFS) for Financial Inclusion (FG-DFS) closed in December 2016 with 85 policy recommendations and 28 supporting thematic reports. The main recommendations can be accessed here: https://www.itu.int/en/ITU-T/focusgroups/dfs/Documents/201703/ITU_FGDFS_Main-Recommendations.pdf

ITU-T Focus Group Digital Currency, including Digital Fiat Currency (FG DFC) closed in June 2019. It considered the regulatory issues for Central Bank Digital Currency and developed two main reports addressing the legal and regulatory issues: – Digital Currency Implementation Checklist for Central Banks; – Regulatory Challenges and Risks for Central Bank Digital Currency. https://www.itu.int/en/ITU-T/focusgroups/dfc/.

The Digital Currency Global Initiative (a collaboration between ITU and Stanford University) was set up in July 2020 to continue the dialogue and research initiated by the ITU-T FG DFC. It aims to compile case studies on implementations of central bank digital currency, stablecoins, emoney and cryptocurrencies in all aspects. Its activities are focused on three main pillars: engagement, innovative use and standardisation. Three working groups have been set up under the Standardisation pillar:

- Architecture, Interoperability Requirements and Use Cases (AIRU)
- Policy and Governance (PG)
- Security and Assurance (SA)

ITU-T Focus Group on Application of Distributed Ledger Technology (FG-DLT) concluded in August 2019. Its deliverables include a discussion of regulatory aspects of DLT, and a description of DLT use cases in the regulatory technologies space. See for more details chapter 3.3.6 on Blockchain and DLT. All FG-DLT deliverables are available here: https://itu.int/en/ITU-T/focusgroups/dlt

ITU-T SG17 approved ITU-T X.1149 "Security framework of open platform for FinTech services" https://www.itu.int/rec/T-REC-X.1149/en and is working on more standards including "Security threats and requirements for digital payment services based on distributed ledger technology" (X.str-dlt), "Security assurance framework for digital financial services"(X.saf-dfs).

XBRL INTERNATIONAL

Base specifications and related resources: http://www.xbrl.org/

XBRL International is currently developing a syntax-independent version of XBRL: the open information model. This will facilitate the exchange of information between different systems, without loss of the agreed semantics.

XBRL EUROPE

XBRL Europe is a non-profit organization and has been set up to foster European XBRL efforts and to implement and share common XBRL projects between its members and to liaise with European authorities and organizations. XBRL Europe has existing working groups on:

- supervisory reporting (Corep/Finrep)
- SBR (tax, annual reports, statistics)
- http://xbrleurope.org

IFRS

International Financial Reporting Standards taxonomies and related resources:

http://www.ifrs.org/XBRL/Resources/Pages/Resources.aspx

IASB

International Financial Reporting Standards taxonomies and related resources:

http://www.ifrs.org/XBRL/Resources/Pages/Resources.aspx

(C.2) ADDITIONAL INFORMATION

XBRL allows governments, regulators, institutions, private sector, etc. to build vocabularies and rules (called taxonomies) to report on different subjects, like the financial position, performance and economic viability of businesses, sustainability, gov-to-gov reporting, mortgage reporting and so on. XBRL permits the publication of structured digital financial reports, specifically matching predefined taxonomies. These may then be processed and retrieved by market participants, including analysts, supervisors, enterprise regulators, tax offices, clients, suppliers, creditors and investors.

The Netherlands standard business reporting (SBR) program, using XBRL taxonomies for business-to-government (tax-filings, annual accounts, statistics), business-to-business (especially Banks) and government-to-business interactions: see http://www.sbr-nl.nl/english/.

CEN established in 2017 the CEN/BT WG 220 'Fintech'. The group published a report in 2018 consisting of a standardisation mapping with some recommendations for future standardisation work. The mapping provides an opportunity to identify European, international and national standards and other initiatives related to Fintech. In the follow-up to this study, CEN will look into new standards and supporting protocols for the broad adoption and use of new technologies which contribute to the establishment of industry, consumer and market confidence. Considering that the tasks of CEN/BTWG 220 are accomplished and that there is no additional work for the working group, the CEN Technical Board has decided to disband CEN/BTWG 220 'FinTech'.

3.3.6 BLOCKCHAIN AND DISTRIBUTED LEDGER TECHNOLOGIES

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

Blockchain has great potential in providing an infrastructure for trusted, decentralised and disintermediated services beyond the financial sector.

While the FinTech industry has been an early adopter because of its early use case of Bitcoin, blockchain is benefiting and has the potential to transform many other industries. It is considered a foundational technology that some compare to the rise of the Internet in the early 90s. More than a technology, it could lead to a major institutional innovation by redefining the way we operate transactions, store and access information and share data (e.g. empowering patients to securely share e-health records and decide who to grant access to their data).

Many possible applications are being envisaged to deliver efficiency, immutability and transparency to the financial services industry, Fintech/Suptech actors, trust funds (e.g., for development or humanitarian programmes), eHealth, education, eGovernment, public registries, security certification of Internet of Things, Trusted Artificial Intelligence, food safety, managing intellectual property rights, extending eIDAS framework for eID management, etc.

It has also great potential for the private sector, in trading, contracting, supply chain management, traceability along industrial supply chains (e.g. on social & environmental conditions of work, on material composition or on the maintenance history of the item) and much more. It may also transform the governance of private organisations and of companies (concept of Decentralised Autonomous Organisation - DAO). Furthermore, from a regulatory and supervisory point of view, it could provide regulators with the same view into the data as the companies they are regulating, thereby reducing fraud and compliance costs and facilitating auditing.

Provisions must be taken at all stages to comply with the GDPR, AML regulations and other legal requirements.

However, this process is hindered by a lack of coherent harmonisation and interoperability that constitute obstacles to cross border and cross sector transactions. The responsibility for public policy-makers would be to support innovation within a safe and future-proof technological and regulatory environment, ensuring appropriate interoperability, transparency, accessibility, monitoring and governance.

In the context of the European Digital Single Market where the amount of online transactions and data is exploding, setting the right conditions for the advent of an open, trustworthy, transparent, compliant and authenticated transaction system is a real challenge for the EU. Existing decentralised environments lack trust, accountability, interoperability, regulatory certainty and mature governance models to interact among themselves and also with centralised systems.

Since 2018 the European Commission has been developing a proposal for the Regulation of Markets in Crypto-assets (MiCA) regulatory framework, which currently has achieved a status of an official document (COM/2020/593 final) and is being discussed with the European Parliament and the Council. The MiCA Regulation is a part of The European Commission's "Digital Finance package" adopted on 24 September 2020 which comprises updated strategy for digital finance and retail.

On June 3rd 2021 the Commission has published a proposal for a Regulation "amending Regulation (EU) No 910/2014 as regards establishing a framework for a European Digital Identity" (eIDAS2) that introduces, a new trust service for electronic ledgers, and the European Digital Identity Walled, an identification means for European physical and legal persons, based on Self Sovereign Identity principles.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

In order to engage in and contribute to the development of the needed standards, starting from September 2017, the Commission is organising workshops on blockchain standardisation and follows up the standardisation activities related to Blockchain and Distributed Ledger Technologies carried out by the different SDOs, such as ISO, ITU-T, ETSI or CEN-CENELEC.

These workshops bring together standards development organisations, fora and consortia active in international BC/DLT standardisation, as well as key stakeholders, and representatives of PPPs like INATBA and deployment initiatives like the EBP.

On 17 June 2020 the European Commission organised "Joining Forces for Blockchain Standardisation" webinar to encourage collaboration and cohesion of ongoing standardisation activities and prevent emergence of conflicting standards. This webinar has been well received by blockchain standardisation community, it brought together more than 400 global blockchain standardisation experts together to discuss advances in standardisation of Identity, Interoperability, Governance, Smart Contracts. During this webinar the European Commision has run a survey to identify the most critical areas of blockchain standardisation where more cohesion is needed. Results were that "interoperability" would benefit the most, followed by "identity", "smart contracts", "governance" and "security".

To bring together Horizon 2020 and blockchain standardisation communities the European Commission has set up a set of roundtable discussions "ICT Verticals and Horizontals for Blockchain Standardisation". These roundtables took place During the second half of 2020 and the start of 2021 within the following theme groups:

- Fintech, Digital Assets and Smart Grids
- Digital Society, Identity and Privacy
- Digital Economy, SME's, Industry and Supply chains
- Cybersecurity
- IoT
- eHealth
- Future Internet, Media and Big data
- Sustainable Development Goals
- Smart-Contracts
- Artificial Intelligence

More than 70 Horizon 2020 projects have participated as well as standardisation experts of ISO, CEN/CENELEC, ETSI, ITU-T, IEEE, W3C and IETF.

The European Commission launched the EU Blockchain Observatory and Forum in February 2018, involving private stakeholders and public authorities in technical and regulatory discussions about the future development and applications of blockchain technology. Among its important tasks, it is gathering the best European experts in thematic workshops on important subjects such as Blockchain and GDPR, or blockchain innovation, and producing reports which will help European stakeholders to deploy blockchain based services in Europe.

On the 10th of April 2018, the European Blockchain Partnership (EBP) was launched, with 28 European countries agreeing, through a joint declaration to cooperate in the establishment of a European blockchain services infrastructure (EBSI) that will support the delivery of cross-border public services, through interoperability and open interfaces and with the highest standards of security. Today the EBP includes all EU Member States, Norway and Liechtenstain.

On 3rd April 2019 the Commission supported the launch of the International Association of Trusted Blockchain Applications – INATBA -, which brings together representatives of the stakeholders across the value chain. INATBA offers developers and users of DLT a global forum to interact with regulators and policy makers and bring blockchain technology to the next stage. It will support the development and adoption of interoperability guidelines, specifications and global standards, to enhance trusted, traceable, user-centric digital services, via a working group on standardisation to interact with standardisation organisations. On 11-13 November 2019 INATBA together with EU Blockchain Observatory and forum, Alastria and the European Commission co-organised the Global blockchain congress CONVERGENCE. INATBA has a dedicated Blockchain Standardisation working group.

The European Commission has already invested more than € 80 million in projects supporting the use of blockchain in technical and societal areas. Up to € 300 million should be further invested until the end of the EU funding programme Horizon 2020. Furthermore, the European Commission is launching the AI/Blockchain fund, which finances a portfolio of innovative AI/blockchain companies and contributes towards development of a dynamic investor community. Expected investment is up to € 300 million. In addition, more funding will be available through Horizon Europe R&I and the Digital Europe (DEP) Programmes.

(A.3) REFERENCES

- Proposal for a Regulation amending Regulation (EU) No 910/2014 as regards establishing a framework for a European Digital Identity
- COM(2017) 228 final Mid-Term Review on the implementation of the Digital Single Market Strategy
- EU Blockchain Observatory and Forum
- European Blockchain Partnership
- International Seminar on Joining Forces on Blockchain Standardisation
- The European Commission's Digital finance package, 24 September 2020: Digital finance package
- COM/2020/593 final Proposal for a Regulation of the European Parliament and of the Council on Markets in Crypto-assets, and amending Directive (EU) 2019/1937
- COM/2020/594 final Proposal for a Regulation of the European Parliament and of the Council on a pilot regime for market infrastructures based on distributed ledger technology
- COM/2020/595 final Proposal for a Regulation of the European Parliament and of the Council on digital operational resilience for the financial sector and amending Regulations (EC) No 1060/2009, (EU) No 648/2012, (EU) No 600/2014 and (EU) No 909/2014
- Proposal for a Directive of the European Parliament and of the Council amending Directives 2006/43/EC, 2009/65/EC, 2009/138/EU, 2011/61/EU, EU/2013/36, 2014/65/EU, (EU) 2015/2366 and EU/2016/2341 {SEC(2020) 309 final} - {SWD(2020) 203 final} - {SWD(2020) 204 final}

(B.) REQUESTED ACTIONS

ACTION 1 The standardisation community should continue analysing possible standardisation gaps and reflect on best way to fill them. Activities may focus on governance and interoperability, organisational frameworks and methodologies, processes and products evaluation schemes, Blockchain and distributed ledger guidelines, smart technologies, objects, distributed computing devices and data services.

ACTION 2 Regularly update the white paper on the EU perspective on blockchain/DLT standardisation.

ACTION 3 Continue identifying use cases which are relevant for EU (including EU regulatory requirements like from GDPR, ePrivacy, eIDAS, TOOP, etc..) and submit them to relevant standardisation bodies, including CEN-CENELEC and ETSI, and also ISO, ITU

ACTION 4 Continue identification of actual blockchain/DLT implementations in the EU and assess the need for standardisation, harmonisation and workforce training or adaptation.

ACTION 5 Standardisation of the operation and reference implementation of permissioned distributed ledgers and distributed applications, with the purpose of creating an open ecosystem of industrial interoperable solutions.

ACTION 6 Standards Development Organisations active in blockchain/DLT standardisation to liaise and coordinate to take advantage of synergies and maximise resources, including with relevant public and private partnerships

ACTION 7 A general framework for Governance of the European networks based on DLT should be developed to allow the flow of smart contracts between different networks.

ACTION 8 ESOs to develop the standards needed for the introduction of a programmable Euro (CBDC) and token economy (upcoming MiCA Regulation), in particular to ensure interoperability with smart-contracts, legacy systems, etc.

ACTION 9 SDOs to develop standards to support the eIDAS2 proposal requirements related to DLT

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

ISO

ISO/TC 307: Blockchain and distributed ledger technologies has wide global outreach and involves majority of the EU Member States. The technical commity and works with reference architecture, taxonomy and ontology, cybersecurity, identity, use-cases, interoperability and other aspects of blockchain standardisation.

Four standardisation technical reports have been already published:

- ISO 22739:2020 Blockchain and distributed ledger technologies — Vocabulary (under revision), text accessible online free of cost: https://www.iso.org/obp/ui/#iso:std:iso:22739:ed-1:v1:en
- ISO/TR 23244:2020 Blockchain and distributed ledger technologies — Privacy and personally identifiable information protection considerations
- ISO/TR 23455:2019 Blockchain and distributed ledger technologies — Overview of and interactions between smart contracts in blockchain and distributed ledger technology systems
- ISO/TR 23576:2020 Blockchain and distributed ledger technologies — Security management of digital asset custodians

For more information please see: https://www.iso.org/committee/6266604/x/catalogue/

IEEE

The IEEE Computer Society Blockchain and Distributed Ledgers (BDL) Standards Committee focuses on developing standards for blockchain-based digital asset management, digital asset classification, a digital asset exchange model, blockchain identity key management and on a digital identity system framework. In addition, the "Blockchain" Working Group develops a family of horizontal and vertical blockchain standards, address interoperability of blockchains, naming, cross-chain transaction consistency as well as data authentication and communication. IEEE also runs a pre-standardisation project on digital inclusion and agency, which leverages blockchain technology.

The IEEE Consumer Technology Society Blockchain Standards Committee (CTS/BSC) is focused on "Standardizing the decentralized world" from a consumer perspective. The scope of the Standards Committee is to develop and maintain standards, recommended practices and guides for blockchain technologies and applications, especially from the consumers' perspective, using an open and accredited process, and to advocate them on a global basis.

For more information please visit https://blockchain.ieee.org/standards and https://ieeesa.io/rp-blockchain

ITU-T

The ITU-T Focus Group on Application of Distributed Ledger Technology (FG-DLT) was established in May 2017

- to identify and analyse DLT-based applications and services;
- to draw up best practices and guidance which support the implementation of those applications and services on a global scale; and
- to propose a way forward for related standardisation work in ITU-T Study Groups.

The FG-DLT concluded its work on 1 August 2019 and produced a number of deliverables, which were transferred to ITU-T Study Groups 16 (Multimedia) and 17 (Security). More info at:

https://www.itu.int/en/ITU-T/focusgroups/dlt/Pages/default.aspx

ITU-T SG20 developed Recommendation ITU-T Y.4476 "OID-based resolution framework for transaction of distributed ledger assigned to IoT resources", Recommendation ITU-T Y.4464 "Framework of blockchain of things as decentralized service platform", Recommendation ITU-T Y.4560 "Blockchain-based data exchange and sharing for supporting Internet of things and smart cities and communities", Recommendation ITU-T Y.4561 "Blockchain-based Data Management for supporting Internet of things and smart cities and communities" and Recommendation ITU-T Y.4907 "Reference architecture of blockchain-based unified KPI data management for smart sustainable cities".

ITU-T SG20 is also working on "Framework of decentralized service by using DLT and edge computing technologies for IoT devices" (Y.IoT-DES-fr), "Reference architecture of service exposure for decentralized services for IoT applications" (Y.IoT-DSE-arc) and etc.

More info: https://itu.int/go/tsg20

ITU-T SG11 is developing signalling requirements and protocol for providing network-oriented Data Integrity Verification Service based on Blockchain in IMT-2020 network (Q.DIVS-IMT2020). Also, SG11 is developing interoperability testing requirements of blockchain as a service (Q.BaaS-iop-reqts).

More details are available at: www.itu.int/go/tsg11.

ITU-T SG13 works on requirements of network-oriented data integrity verification service based on blockchain in future network (Y.frd), functional architecture, scenarios and requirements of network resource sharing based on distributed ledger technology (Y.NRS-DLT-arch, Y.NRS-DLT-reqts), Requirements and converged framework of self-controlled identity based on blockchain (Y.SCid-fr), requirements and functional framework of Information Centric Networking for supporting Distributed Ledger Technology in IMT-2020 and beyond (Y.ICN-DLT), requirements and framework of mobile network sharing based on distributed ledger technology for IMT-2020 and beyond (Y.MNS-DLT-fr) and distributed ledger technology for fixed, mobile and satellite convergence in IMT-2020 networks and beyond (Y.FMSC-DLT).

ITU-T SG17 works on security of DLT and its applications. It has

approved Recommendations ITU-T X.1400 "Terms and definitions for distributed ledger technology", ITU-T X.1401 "Security threats of distributed ledger technology", ITU-T X.1402 "Security framework for distributed ledger technology", ITU-T X.1403 "Security guidelines for using DLT for decentralized identity management", ITU-T X.1404 "Security assurance for distributed ledger technology", ITU-T X.1405 "Security threats and requirements for digital payment services based on distributed ledger technology", ITU-T X.1406 "Security threats to online voting system using distributed ledger technology", ITU-T X.1407 "Security requirements for digital integrity proofing service based on distributed ledger technology" and is developing many more standards in this domain: (X.das-mgt, X.sa-dsm, X.sc-dlt, X.srscm-dlt, X.ss-dlt, etc).

More info: http://itu.int/ITU-T/go/tsg17

W3C

W3C has formed a Blockchain Community Group, which is studying and evaluating technologies related to blockchain and use-cases such as interbank communications. Its work is complemented by a group on Blockchain and Decentralized Apps and one on Digital Assets.

W3C created the Decentralized Identifier Working Group (DID WG) https://www.w3.org/2019/did-wg/ URL-based identifiers (URIs) in use on the Web today (2019) require that the identifier be leased from an authority such as a Domain Name Registrar. A Decentralized Identifier (DID) is an identifier that does not need to be leased; its creation and use is possible without a central authority to manage it.

In addition to the "Blockchain Community Group" W3C has also a "Credential Community Group" (https://www.w3.org/community/credentials/) which has developed key standards for SSI (Self-Sovereign Identity) including Decentralized Identifiers (DID) Data model and Syntax and Verifiable Claims Use Cases and Data Model.

IETF IRTF

The Decentralized Internet Infrastructure Research Group (DINRG) will investigate open research issues in decentralizing infrastructure services such as trust management, identity management, name resolution, resource/asset ownership management, and resource discovery. The focus of DINRG is on infrastructure services that can benefit from decentralization or that are difficult to realize in local, potentially connectivity-constrained networks. Other topics of interest are the investigation of economic drivers and incentives and the development and operation of experimental platforms. DINRG will operate in a technology- and solution-neutral manner, i.e., while the RG has an interest in distributed ledger technologies, it is not limited to specific technologies or implementation aspects.

More details of the DIN RG are available.

https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#Ledger

CEN/CENELEC

CEN and CENELEC established a Focus Group on Blockchain and Distributed Ledger Technologies to identify specific European standardisation needs (for example in the context of EU regulations such as GDPR and eIDAS), to map these standardisation needs with the current work items in ISO/TC 307 and to encourage further European participation in ISO/TC 307. https://www.cencenelec.eu/news/articles/Pages/AR-2018-04.aspx

Following the conclusions of the Focus Group, CEN CENELEC set up the Joint Technical Committee JTC19 on Blockchain and Distributed Ledger Technologies CLC/JTC 19, working on the identification and adoption of international standards already available or under development and to pay attention towards specific European legislative and policy requirements supporting the development of the EU Digital Single Market. JTC 19 has established the first Working Group dedicated to Decentralised Identity Management. The JTC works in close contact with ISO/TC 307 Blockchain and distributed ledger technologies.

Website: https://standards.cen.eu/dyn/www/f?p=204:7:0::::FSP_ORG_ID:2702172&cs=1465AF26367A9ECE85D149F31EF39162E

ETSI

Permissioned distributed ledgers are the kind of DLT best qualified to address most of the use cases of interest to the industry and governmental institutions.

The ETSI ISG PDL is committed to analyse and provide the foundations for the operation of permissioned distributed ledgers, with the ultimate purpose of creating an open ecosystem of industrial solutions to be deployed by different sectors, fostering the application of these technologies, and therefore contributing to consolidate the trust and dependability on information technologies supported by global, open telecommunications networks. The ISG PDL incorporates research and new development results in the field as they become available. The group is actively working to facilitate the coordination and cooperation between relevant standardisation bodies and open source projects.

OASIS

The EEA Community Projects, formerly known as the Ethereum OASIS Open Project, is the hub for open source-based standards development in the Ethereum industry. It aims to facilitate Ethereum's longevity, interoperability, and ease of integration and intends to develop documentation and shared test suites that facilitate new features and enhancements to the Ethereum protocol. The projects seek to address interoperability of implementations. EEA projects include Ethereum projects like the Baseline Protocol and JSON-RPC API documentation under its stewardship.

The Baseline Protocol OASIS Open Project combines advances in cryptography, messaging, and blockchain to deliver secure and private business processes at low cost via the public Ethereum Mainnet.

UNECE

The United Nations Center for Trade Facilitation and Electronic Business (UN/CEFACT) has developed two White Papers on Blockchain and a Sectoral Use Case paper. The first White Paper provides an overview of the base principles of Distributed Ledger Technology; the second explores the needs for standardisation in this area and concludes a strong needs for semantic data standards in order to ensure clear understanding between the issuer of information on a Blockchain and all users of that data. The UN/CEFACT Core Component Library can cover the data needs in trade transactions. The final UN/CEFACT Blockchain paper explores the specific needs of each sector (Maritime Transport, Suppy Chain, Agriculture, etc.) and provides a number of use cases.

See: White Paper 1 (available also in French and Russian): https://www.unece.org/fileadmin/DAM/cefact/GuidanceMaterials/WhitePaperBlockchain.pdf

White Paper 2 (available also in French and Russian): https://www.unece.org/fileadmin/DAM/cefact/GuidanceMaterials/

WhitePaperBlockchain_TechApplication.pdf

Use Case paper: https://www.unece.org/fileadmin/DAM/cefact/cf_plenary/2019_plenary/CEFACT_2019_INF03.pdf

UN/CEFACT CCL: https://www.unece.org/cefact/codesfortrade/unccl/ccl_index.html

UN/CEFACT continues work on interoperability of ledgers. See: https://uncefact.unece.org/display/uncefactpublic/Cross+border+Inter-ledger+exchange+for+Preferential+CoO+using+Blockchain

INATBA

INATBA, the International Association of Trusted Blockchain Applications, brings together industry, startups and SMEs, policy makers, international organisations, regulators, civil society and standard setting bodies to support blockchain and Distributed Ledger Technology (DLT) to be mainstreamed and scaled-up across multiple sectors. INATBA has a Working Group on standardisation to liaise with standards development organisations and to develop contributions to standardisation, such as use cases and requirements. Relevant for standardisation are also the interoperability and governance working groups https://inatba.org/

(C.2) ADDITIONAL INFORMATION

One direction of blockchains technology innovation in recent years was towards highly promising area of secure persistent public data, eliminating the need for initial trust among involved stakeholders.

The clarification and mutual definition of several aspects of blockchain technology (such as blockchain interoperability, governance, trust, security of blockchain and of the underlying cryptographic mechanisms, blockchain compliance to legislation, impact of blockchain on different sectors, etc) are crucial prerequisites to introducing the technology to society.

Global blockchain congress CONVERGENCE: https://blockchainconvergence.com/

3.4 SUSTAINABLE GROWTH

3.4.1 SMART GRIDS AND SMART METERING

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The energy system is undergoing considerable changes, mainly driven by decarbonisation, decentralisation and digitalisation, calling for smarter, flexible, responsive networks and markets that empower consumers and place them at the heart of it all.

Important policy milestones for this green and digital transformation are the EU's energy and climate targets for 2030 which also underpin Europe's leading role in the fight against climate change. The newly proposed Fit for 55 and Delivering the European Green Deal strategy is setting a 55% reduction target in net EU greenhouse gas emissions compared to 1990, and is increasing the current EU-leel target of at least 32%[13] (for the share of renewable energy consumed in the EU), to at least 40% by 2030 doubling the current renewables share of 19.7% in just a decade. In this context, the electricity networks have a central role to play. In 2018, electricity represented 21% of the EU's final energy consumption with renewables making up a share of 34% of gross production (reference: Eurostat)

Moreover, the European Commission proposed a Path to the Digital Decade , a concrete plan to achieve the digital transformation of our society and economy by 2030. This will pave the way for the twin digital and green transformation of the energy sector to benefit from state-of-the-art digital solutions with lower environmental footprint and higher energy and material efficiency, leading to a more resilient, efficient and greener energy system.

The consumer position in the energy value chain is also very different now compared to what it used to be. The consumer is not the passive end ring in this chain anymore, paying without question the bills of incumbent's utilities. Instead, the consumer has the opportunity to choose between many energy suppliers and service providers to obtain the best deal and benefits. When dynamic pricing becomes available, then consumers will also be able to opt for it and accordingly change their energy behaviour, consuming when the prices are low. Furthermore, consumers can be really active players by directly or through a third party providing services, e.g. flexibility to network operators when they ask either to increase or decrease consumption, if it is needed for system balancing or grid congestion management (demand response). Additionally they can also become (micro) generators themselves (the so-called prosumers) and switch their premises, if necessary, into island mode. Standardisation in the energy sector should consider the physical limitations of the grid, the data privacy, cybersecurity, the market aspects and the resilience of the energy sector.

In this digital transformation of the energy sector, the sector and cross-sector sharing of data, in a customer-centric, secure and trustworthy manner, as well as the deployment of technologies facilitating that, are key. This makes the need more relevant than ever to set out the interoperability requirements and non-discriminatory and transparent procedures for access to data at the energy sector level, and beyond. Big Data and the Internet of Things, 5G and artificial intelligence, smart grids and smart meters, smart homes, smart storage and smart charging data sharing platforms, distributed ledger technologies (DLT) will be key drivers for a successful digitalisation of energy. To succeed, we will need to build on achievements in the three pillars of the Digital Single Market – better access to digital goods and services, an environment where digital networks and services can prosper, and digital as a driver for growth. Energy and digital will come together most closely if we enable European companies to deliver energy intelligent products and services across Europe without undue restrictions and if the energy sector actively contributes to horizontal Digital Single Market policies. The single energy market and the digital single market must go hand-in-hand, as in reality they feed each other.

13 With the potential for an upward revision in 2023

Smart grids are a clear example of digital meeting energy, as they are about information exchange and making necessary data available to interested parties. Smart grids will enable improved energy efficiency and the integration of vast amounts of Renewable Energy Sources (RES) from an increasingly decentralised generation and new loads such as electric vehicles and energy storage; provide an opportunity to boost the retail market competitiveness and worldwide technological leadership of EU technology providers, and a platform for traditional energy companies or new market entrants such as ICT companies, including SMEs, to develop new, innovative energy services. That dynamic should enhance competition in the retail market, incentivise reductions in greenhouse gas emissions and provide an opportunity for economic growth.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

Standards are needed to cover the communication requirements of grid management, balancing and interfacing with the millions of new renewable energy sources, as well as for the complex interactions of the new distributed energy market which is also enriched with demand-side response services.

Communication standards will also be crucial for the deployment of electric vehicles and the establishment of smart cities. Harmonised communication protocols will provide standard components and interfaces giving 'plug-and-play' capability for any new entrant to the network, such as renewables or electric vehicles, or the use of open architectures based on global communication standards. Testing and profiling should also be considered in addition to standardisation, to further promote interoperability.

A major challenge is engaging the right stakeholders to cooperate and undertake the standardisation work, while taking into account the different requirements for smart grid management (of relevance to energy producers, the utility network operators, etc.) and smart consumption (involving the end consumer).

The EC has been working towards interoperability of the solutions and standardisation for several years now. The main coordination reference for smart grids at European level is the Smart Grids Task Force, which was given the mission to advise the European Commission on policy and regulatory directions at European level and to coordinate the first steps towards the implementation of Smart Grids under the provision of the Third Energy Package. Nine DGs are participating: ENER and CNECT (co-chair), CLIMA, GROW, COMP, JUSTICE, JRC, RTD and SANTE, along with more than thirty associations representing all relevant stakeholders, from both sectors – energy and telecommunications, and more than 350 experts from national regulatory agencies and industrial market actors, as well as consumer associations and other relevant stakeholders.

The mandate M/490 on smart grids given to CEN-CENELEC-ETSI by the Commission in March 2011 can be considered as completed. In October 2014 the CEN-CENELEC-ETSI Coordination Group on Smart Grid (SG-CG) produced the following reports and thus successfully completed the requirements of the M/490 mandate: Extended Set of Standards support Smart Grids deployment; Overview Methodology; General Market Model Development; Smart Grid Architecture Model User Manual and Flexibility Management; Smart Grid Interoperability and its tool; Smart Grid Information Security. The completion of this work was equally confirmed by the conclusions of the validation conference the Commission services organised on 26 February 2015 in Brussels, during which industry representatives confirmed their will to take over and implement the results of the Expert Group 1 work on standards. Consequently, EG1 of the Smart Grids Task Force assessed during 2015-2016 the interoperability, standards and functionalities applied in the large scale roll out of smart metering in Member States and in particular the status of implementation of the required standardised interfaces and of the EC recommended[14] functionalities related to the provision of information to consumers. A report summarising the main findings was published in October 2015 and August 2016[15].

During 2017-2018, the Smart Grids Task Force engaged in activities to help prepare the ground for the development of secondary legislation complementary to the Clean Energy Package, and specific to the issue of data interoperability, and also for network codes on demand-response, and cybersecurity.

14 Commission Recommendation 2012/148/EU
15 https://ec.europa.eu/energy/en/topics/markets-and-consumers/smart-grids-and-meters/smart-grids-task-force

Regarding data interoperability, the experts worked on procedures for electricity (and gas) data access and exchange, with the task of collecting information and investigating the way towards interoperable practices in the EU. The respective findings and recommendations are summarised in a report published in March 2019[16]. Similarly, the Task Force findings on the necessary further steps for facilitating demand side flexibility in the EU and what to potentially consider in a network code was published in April 2019.

As from June 2020, the Task Force engaged in a new working activity, aimed at advising the Commission of its expert knowledge and proposing interoperability requirements as well as transparent and non-discriminatory procedures for access and exchange of electricity (and gas) data in the EU. The outcome of this work, amongst others, will inspire the Commission's drafting of the Implementing Acts on data as provided for in Article 24 of the Electricity Directive (EU) 2019/944 .

On cybersecurity, the Smart Grids Task Force experts have been developing a comprehensive sector-specific strategy on how to reinforce the implementation of the NIS directive at energy sector level (see their respective report published in September 2019). This activity falls under the overall effort to increase cybersecurity awareness and preparedness in the energy sector, as also illustrated by the latest Commission recommendation[17] in this field and also fosters synergies between the Energy Union and the Digital Single Market agendas.

The coordination of standardisation efforts related to Smart Meters was is in the hands of the Smart Meters Coordination Group (SM-CG), which was created when the European Commission issued the M/441 mandate. This multi-stakeholder group overlooks the standardisation related to the Smart Metering Infrastructure. It has already successfully completed its original mandate and has produced a reference architecture (TR 50572), a glossary of terms, an overview of available standards, Smart Metering Use Cases and an overview of technical requirements including those for privacy and security. The SM-CG was always in close contact with the SG-CG (Smart Grids Coordination Group), and continues to liaise with its successor the EN-CENELEC-ETSI Coordination Group on Smart Grid (CG-SG); since end 2016, the CG-SG is the focal point and continues to also cooperate with the EC Smart Grids Task Force (EC SGTF). The SM-CG developed a protection profile for minimum security requirements for the specific case of smart meters. (https://esmig.eu/news/esmig-announces-first-approved-european).

In 2021 the Smart Meters Coordination Group (SM-CG) and the Smart Energy Grid Coordination Group (CG-SEG) were merged to the Coordination Group on Smart Grids (CG-SG). The CG-SG is a joint CEN/CENELEC/ETSI Coordination Group which is open to the relevant stakeholders. Its aim is to promote the deployment of open and interoperable data architectures, based on European and international standards. The scope also includes any standards needed to design, operate and maintain electrical grids securely and efficiently. In the specific area of metering, its scope includes electricity, water, gas and heat/cooling metering devices and systems, and associated architectures.

16 https://ec.europa.eu/energy/en/topics/markets-and-consumers/smart-grids-and-meters/smart-grids-task-force

17 Commission Recommendation C(2019)240 final on cybersecurity in the energy sector, and supporting Staff Working Document SWD(2019)1240 final

Moreover, benefiting from valuable contributions from our stakeholders, the EC fostered the creation of a common interoperability language called SAREF (Smart Appliances REFerence ontology), which became a standard of ETSI and OneM2M (the Global initiative for Internet of Things standardisation) in 2015. This was a first step and we are now moving forward in order to fully enable, on a technical interoperability level, the smart grid and its demand-response mechanism. This work was supported via an EC funded study, which delivered a live demo in the autumn of 2017 and final results and recommendations in July 2018. The results of the study are currently incorporated in the standards along the full demand-side flexibility chain and are being piloted on a European scale (multiple sites in 7 member states) in the large scale IoT pilot project Interconnect on smart grids and homes. In parallel work has been completed on extending SAREF to other verticals (e.g. automotive, water, health, etc.) allowing thus the creation of a smart city interoperable ecosystem. Cooperation with CEN and CENELEC is foreseen to further align SAREF with the data models developed at ISO and IEC.

Within the general framework of the Internet of Things and 5G, the EC is looking at all other communication aspects and needs of smart energy and including the necessary conditions in the development of said communication domains as well as aligning with the other domains such as automotive, health, smart cities, etc.

Last but not least, in line with the Communication on Energy System Integration, the Commission is currently working on a Digitalisation of Energy Action Plan (to be adopted in 2022) which is needed to ensure the shift towards renewables, connected mobility, smart buildings, and a more integrated, responsive energy system with smart energy grids as its backbone and consumers at its core.

See also the work of the International Agency on Energy, particularly its recommendations in terms of interoperability18.

(A.3) REFERENCES

- COM(2020) 299 final Powering a climate-neutral economy: An EU Strategy for Energy System Integration
- **COM(2020) 66 final** A European strategy for data
- COM(2019) 640 final The European Green Deal
- R**egulation (EU) 2019/941** on risk –preparedness in the electricity sector
- **Regulation (EU) 2019/943** on the internal market for electricity
- **Directive (EU) 2019/944** on common rules for the internal market for electricity
- **Commission Recommendation C(2019)240 final** on cybersecurity in the energy sector, and supporting Staff Working Document SWD(2019)1240 final
- **COM(2017) 228 final:** Mid-Term Review on the implementation of the Digital Single Market Strategy - A Connected Digital Single Market for All
- **Directive 2014/94/EU** on the deployment of alternative fuels infrastructure
- **Recommendation 2014/724/EU** on the data protection impact assessment template for smart grid and smart metering systems
- **COM(2014) 356** Benchmarking smart metering deployment in the EU-27 with a focus on electricity; and accompanying SWD(2014) 188 and SWD(2014) 189
- C (2013) 7243 Delivering the internal electricity market and making the most of public intervention; and accompanying SWD (2013) 442 Incorporating demand side flexibility, in particular demand response, in electricity markets
- Recommendation COM 2012/148/EU on preparations for the roll-out of smart metering systems
- COM(2012) 663 Making the internal energy market work
- **COM(2011) 202** Smart Grids: from innovation to deployment
- COM(2010) 245 "A Digital Agenda for Europe": actions 71 & 73 address respectively minimum functionalities to promote smart grid interoperability and a common set of functionalities for smart meters and are directly related to the standardisation activities at CEN/CENELEC/ETSI.
- Directives 2009/72/EC **and 2009/73/EC**: Internal market in electricity and natural gas;
- Directive 2009/29/EC amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community;
- **Directive 2009/28/EC** of the European Parliament and of the Council on the Use of Energy from renewable sources.
- Directive 2003/87/EC of the European Parliament and of the Council establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC(1)
- **Mandates M/490**(2), **M/441**(3) and **M/468**(7) from EU/EFTA to the ESOs
- COM(2015) 192: A Digital Single Market Strategy for Europe
- COM(2015) 339: Delivering a new deal for energy consumers
- Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing

18 https://www.iea.org/publications/freepublications/publication/smartgrids_roadmap.pdf

Directive 95/46/EC (General Data Protection Regulation)

- Regulation (EU) 2013/347 on guidelines for trans-European energy infrastructure
- Directive 2012/27/EU on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC
- COM(2016)176**:** ICT Standardisation Priorities for the Digital Single Market

(B.) REQUESTED ACTIONS

ACTION 1 Based on the successful development of smart grids standards at the end of 2014, in May 2017 the Commission has launched three stakeholder working groups (i.a. CEN/CENELEC experts) under the Smart Grids Task Force to prepare the ground for network codes on demand response, energy-specific cybersecurity as well as implementing acts on interoperability requirements and transparent and non-discriminatory procedures for access and exchange of data. The Commission has reported on the structure, scope and progress of the groups in December 2017, and made publicly available their findings and recommendations in 2019. Specifically for data interoperability, and building upon this work, the Task Force has recently launched (June 2020) a follow-up activity aiming at further investigating the issue at hand and looking at specific business use cases when it comes to access and exchange of data. These Task Force findings on data interoperability, demand side flexibility and cybersecurity will be feeding into the reflection on the next steps towards the drafting of secondary legislation covering the aforementioned topics. The reports, minutes, presentations and meeting agendas are available on the smart grids task force dedicated webpage (CIRCA BC), which is a collaborative platform that gives access to all task-force documents, via the platform library".

ACTION 2 The EC is developing a comprehensive energy-sector strategy on how to reinforce the implementation of the NIS directive at energy sector level and also foster synergies between the Energy Union and the Digital Single Market agendas. In addition, a Work Stream on energy has been created under the Cooperation Group of the NIS Directive.

ACTION 3 Benefiting from valuable contributions from our stakeholders, the EC fostered the creation of a common interoperability language called SAREF (Smart Appliances REFerence ontology), which became a standard of ETSI and OneM2M (the Global initiative for Internet of Things standardisation) in 2015. This was a first step after which we moved forward to fully enable, on a technical interoperability level, the smart grid and its demand-response mechanism. This work was supported via an EC funded study, which delivered a live demo in the autumn of 2017 and final results and recommendations in July 2018. The results of the study were subsequently incorporated in the standards along the full demand-side flexibility chain. The end-to-end interoperability is now being piloted on European scale by the Interconnect large-scale pilot project. In parallel work has been done to extend SAREF to other verticals (e.g. automotive, water, health, etc.) allowing thus the creation of a smart city interoperable ecosystem. ETSI/CEN/CENELEC and the other relevant SDOs and related organisations (such as DLMS, KNX and others) should combine their efforts to further enrich and extend the SAREF4ENER extension as well as the main SAREF ontology. The ETSI SAREF portal, which was launched recently, could be one of the tools to be leveraged for this purpose. Security aspects should be investigated. All new additions to the SAREF specifications should be transposed into the OneM2M specifications. A number of European projects could contribute to a larger scale deployment of SAREF-based solutions such as the Operational Digital Platforms under CEF Digital and the deployment of a common European data space in the DIGITAL programme, which will be prepared in Horizon Europe.

ACTION 4 CEN, CENELEC, IEEE and OASIS to foster their cooperation to ensure complementary parallel standardisation efforts, to avoid serious conflicts between their respective standardisation deliverables. This action should notably be undertaken in the context of H2-type standards (the interface used for smart grid communication), distributed energy resources and the smart grids architecture model as developed under M/490.

ACTION 5 ETSI/CEN/CENELEC should collaborate with the H2020 IoT Large Scale Pilot on Smart Grids and Smart Homes INTERCONNECT to include the outcomes and recommendations from the project into the SAREF4ENER and SAREF4BLDG standards. All new additions to the SAREF specifications should be transposed into the OneM2M specifications.

ACTION 6 ETSI/CEN/CENELEC should collaborate with (or participate in) the Horizon Europe projects, which will establish the foundations for a Common European Energy Dataspace, and help identify, develop and standardise a set of common technical specifications for it. They should also collaborate with an upcoming Horizon Europe project on establishing an interoperable ecosystem in the energy area through creating a set of Minimum Interoperability Mechanisms for the energy sector.

List of included standards groups:

- Smart Grids
- Smart grid security certification in Europe - Challenges and recommendations, December 2014
- CEN-CENELEC-ETSI Coordination Group on Smart Energy Grids (CG-SEG)
- Final reports of the CG-SEG under M/490 and its iteration;
- "Set of Standards" and "Privacy and Security" CG-SEG reports The Interoperability Tool (IOP-Tool) of the CG-SEG, which is an extremely useful tool for finding the standards used;
- Building energy management system
- Building automation and control systems (ISO)

Smart Meters

- Interoperability, Standards and Functionalities applied in the large scale roll out of smart metering - European Smart Grids Task Force Expert Group 1 – Standards and Interoperability, October 2015
- Interoperability of interfaces for the large scale roll out of smart metering systems in EU Member States - European Smart Grids Task Force Expert Group 1 – Standards and Interoperability, August 2016
- CEN-CENELEC-ETSI Coordination Group on Smart Meters (CG-SM)
- Final reports of the CG-SM under M/411
- CG-SM "Privacy and Security approach" reports CG-SM 2017 Work Programme
- European Commission Office for Infrastructure and Logistics – Manual Of Standard Building Specifications

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

On the level of technical standardisation and coordination of work, CEN and CENELEC (notably through the CEN-CENELEC-ETSI Coordination Group on Smart Energy Grids), IEEE and OASIS will foster their collaboration including identifying whether there are serious conflicts between their respective standardisation deliverables which may have a negative impact on interoperability and the market adoption of smart grid solutions. *This especially concerns the relation between H2-type standards (notably EN 50491-12-1), the EN IEC 61850 series (Distributed Energy Resources), EN IEC 62746, EN IEC 61689-5, EN IEC 62325 with IEEE Std 2030.5-2013 and OASIS OpenADR.*

Standards development

CEN, CENELEC, ETSI

At present mandate M/490 given to CEN-CENELEC-ETSI by the Commission in March 2011 can be considered as completed.

The three ESOs have agreed to continue their collaboration in relation to smart grids following the completion of the work under the standardisation request, under the CEN-CLC-ETSI Coordination Group on Smart Energy Grids (CG-SEG). This group will focus on security and interoperability, follow up new developments in the field of smart grids and actively promote the results of its work at European and international levels.

In this context, two reports have been prepared by the CG-SEG to maintain transverse consistency and promote continuous innovation in the field of Smart Grids:

The Smart Grid Set of Standards report is the new release of the original "First set of standards" and proposes an updated framework of standards which can support Smart Grids deployment in Europe. It provides a selection guide setting out, for the most common Smart Grid systems the relevant set of existing and upcoming standards to be considered, from CEN, CENELEC, ETSI and further from IEC, ISO, ITU or even coming from other bodies when needed. It also explains how these are able to be used, where, and for which purpose. Standardisation gaps have been identified and the related standardisation work program has been defined. The results of these activities will be included in future releases of this report.

Cyber Security and Privacy report: **In this report, security standardisation specific to Smart Energy Grid and security standardisation targeting generic standards are further monitored and analysed with the focus on two specific use cases: decentralized energy resource (DER) and substation automation. It shows the applicability and interrelationship between these two groups of standards. Furthermore, the Smart Grid Information Security approach has been followed to show the applicability of different standards on the selected, specific use cases for Smart Energy Grid deployments.**

Regarding electromobility, a work programme and a list of relevant standards for the charging of electric vehicles was last updated in November 2014. Regarding charging points for electric vehicles of interest to the eMobility coordination group, and in support of the implementation of the alternative fuels infrastructure Directive 2014/94/EU, a new standardisation request was issued to the ESOs in March 2015. ETSI and the oneM2M Partnership project are active in the area of machine-to-machine (M2M) with some relation to smart grids. ETSI is also developing radio technologies for wireless interconnection in home automation networks with applications such as smart metering and energy control in the scope of the technology.

CENELEC

CLC/TC 57 'Power systems management and associated information exchange' develops European standards, in collaboration with the IEC, for power systems control equipment and systems including EMS (Energy Management Systems), SCADA (Supervisory Control And Data Acquisition). CLC/TC 57 is providing amendments to the ENs on 'Communication networks and systems for power utility automation' (EN 61850 series). CLC/TC 57 will also publish European Standards related to the Application integration at electric utilities (prEN 61968 series), energy management system application program interface (EMS-API) (prEN 61970 series) and on Power systems management and associated information exchange (EN 62351 series).

CLC/TC 205 'Home and Building Electronic Systems (HBES)' is responsible for the *development of the EN 50090 series (Home & Building Electronic Systems protocol suite) and the EN 50491 series 'General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS)', and notably:*

- *EN 50491-11:2015 'General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) - Part 11: Smart Metering - Application Specifications - Simple External Consumer Display';*
- *EN 50491-12-1:2018 'General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) - Smart grid - Application specification - Interface and framework for customer - Part 12-1: Interface between the CEM and Home/Building Resource manager - General Requirements and Architecture'*

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- *EN 50491-11:2015 'General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) - Part 11: Smart Metering - Application Specifications - Simple External Consumer Display';*
- *EN 50491-12-1:2018 'General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) - Smart grid - Application specification - Interface and framework for customer - Part 12-1: Interface between the CEM and Home/Building Resource manager - General Requirements and Architecture'*
- *prEN 50491-12-2 'General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) - Part 12-2: Smart grid – Application specification - Interface and framework for customer - Interface between the Home / Building CEM'*

CLC/TC 205 is progressing work items on:

- *prEN 50090-6-2 'Home and Building Electronic Systems (HBES)- Part 6-2 IoT Semantic Ontology_Model_Description'*

prEN 50491-12-x 'General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) CLC/TC 205 further activities:

- Under the banner of CLC/TC 205, WG19 has been created, open, to relevant experts from other TCs e.g:
- *CLC/TC 82 'Solar photovoltaic energy systems';*
- *CLC/TC 69X 'Electrical systems for electric road vehicles';*
- *CLC/SR 120 'Electrical Energy Storage (EES) Systems';*
- *CLC/TC 57 'Power systems management and associated information exchange';*
- *CLC/TC 13 'Electrical energy measurement and control'*
- ETSI

Focusing on the S2 link (within a building, between customer energy management and energy resources including PV, storage, E-vehicle, white goods,...) these experts will work on producing a common ontology, defining the potential data at the interface with these energy resources, based on already known use cases, but in a "technology agnostic manner". This work will also feed the current activities of CLC/TC 205/WG 18 on Smart Grid/Smart Home Data Modelling.

In 2018, **CLC/TC 8X** *'System aspects of electrical energy supply'* will continue the development of the EN 50549 series (on Requirements for generating plants to be connected in parallel with distribution networks). The standards developed under that series are important as they could be used as a technical reference for connection agreements between Distributed Networks Operators and electricity producers. In addition, these standards are supporting the Commission Regulation 2016/631/EU (Requirements for Generators).

CLC/TC 82 *'Solar photovoltaic energy systems'*, **CLC/ 88** *'Wind turbines'* and **CLC/SR 117** *'Solar thermal electric plants'* will continue to develop European Standards on Electric Generation, in close collaboration with the IEC.

CLC/TC 38 *'Instrument transformers'* will continue to maintain the EN 61689 series on Instrument transformers.

CLC/TC 17AC *'High-voltage switchgear and controlgear'* is responsible for the maintenance of the EN 62271 series on High-voltage switchgear and control gear.

CLC/TC 13 Communications protocol standards continue to be expanded to cover developments in technology, including LoRa, WiSUN, CoAP and 5G as well as further enhancements to power line carrier based communications. New metering standards to cater for DC networks will be developed specific for EV charging, micro generation and other emerging low carbon energy applications, required for changes to the MID as specified in M541.

CLC/TC 59X *'Performance of household and similar electrical appliances'* is responsible for EN 50631-x:2017 'Household appliances network and grid connectivity', the successor of the outdated EN 50523:2009 'Household appliances interworking'. TC59X is already working on the edition 2 of EN50631-x, which will be submitted to enquiry in autumn 2021.

CLC/TC 85X *'Measuring equipment for electrical and electromagnetic quantities'* develops, in collaboration with the IEC, European Standards for equipment and systems for measuring, testing, monitoring, generating, and analysing simple and complex electrical and electromagnetic quantities, as well as their calibrators. In 2018, CLC/TC 85X will further develop European Standards on Electrical Safety in Low Voltage distribution systems and on Electrical Test after repair of electrical equipment. These standards will apply with the aim to preserve the quality and safety as well as to avoid overheating and malfunction of power supply and the connected equipment.

CEN

CEN/TC 92 *'Water meters'*, **CEN/TC 176** *'Heat meters'* and **CEN/TC 237** *'Gas meters'* develop standards in response to the Standardisation Request (M/541) in the frame of Directive on Measuring Instruments (2014/32/EU), relevant to Smart Grid standardisation. In 2018, these technical committees will finalize the revisions of standards on the following topics:

- CEN/TC 92 – the series on water meters for cold potable water and hot water;
- CEN/TC 176 – the series on heat meters
- CEN/TC 237 – the standard on ultrasonic domestic gas meters

CEN/TC 294 'Communication systems for meters' deals with the standardisation of communication interfaces for systems and remote reading of meters for all kind of fluids and energies distributed by the energy network. CEN/TC 294 will complement the EN 13757 series with standards on Wired and Wireless M-Bus communication, Application protocols and Transport and security services.

DLMS (DEVICE LANGUAGE MESSAGE SERVICE)

DLMS/COSEM (EN IEC 62056 series), the most widely deployed smart meter protocol is not listed as the state of the art protocol for smart metering and demand side control applications. In the forthcoming roadmap due for release next year, gaps in standards will be identified that will need to be addressed in order to support Demand-Size Flexibility. These will include adhoc profiles for smart meters as well as Industrial/Residential/Commercial Appliances, Residential EV Charging Stations and Energy and Water Health & Usage Monitoring Systems. This will allow standards based solutions to be developed delivering to market security, interoperability and compatible devices that can be controlled from an energy consumption view point to address the most important challenge of managing the consumption demand.

DLMS/COSEM specifies the data model, the messaging protocol and media-specific communication profiles. Since 2002, DLMS/COSEM has been internationally standardised as part of the IEC 62056 series *Electricity metering data exchange - The DLMS/COSEM suite* and the EN 13757 standards suites. DLMS/COSEM is under constant development to ensure it remains compatible with all current and emerging communications technologies and the latest demand side management applications.

ETSI

ETSI TC DECT has published the first release of the new DECT-2020 NR (New Radio) technology (ETSI TS 103 636 parts 1 to 4). The work on additional parts for the set of standards are ongoing with planned publication by end of 2021. DECT-2020 NR supports Ultra Reliable Low Latency Communications (URLLC) and massive Machine Type Communications (mMTC).

TC DECT is defining application profiles for various uses cases. One of the application profiles proposed in TC DECT is considering the Electricity Meters use. The requirements to electricity meter profile definition is currently under work in TC DECT.

IEC

IEC has a number of technical committees dealing with smart grids and smart metering:

- IEC SyC Smart Energy: Smart Energy
- IEC/TC 8: Systems Aspects for Electrical Energy Supply
- IEC/TC 8/SC 8A: Grid Integration of Large-capacity Renewable Energy (RE) Generation
- IEC/TC 8/SC 8B: Decentralized electrical energy systems
- IEC/TC 13: Electrical Energy Measurement and Control (including Smart Metering and demand side management))
- IEC/TC 17: High-voltage switchgear and controlgear
- IEC/TC 23: Electrical Accessories
- IEC/TC 23/WG12: Home and Building Electronic Systems (HBES)
- IEC/TC 38: Instrument transformers
- IEC/TC 57: Power Systems Management and Associated Information Exchange
- IEC/TC 64: Electrical installations and protection against electric shock
- IEC/TC 65: Industrial-process measurement, control and automation
- IEC/TC 69: Electric road vehicles and electric industrial trucks
- IEC/TC 82: Solar photovoltaic energy systems
- IEC/TC 85: Measuring equipment for electrical and electromagnetic quantities
- IEC/TC 88: Wind energy generation systems
- IEC/TC 95: Measuring relays and protection equipment
- IEC/TC 120: Electrical Energy Storage (EES) Systems
- IEC/TC 121: Switchgear and controlgear and their assemblies for low voltage
- ISO/IEC JTC 1: Information technology
- IEC/TC23/SC23K /WG3: Customer Energy Management Systems is progressing work items on:
- IEC 63345 ED1: Energy Efficiency Systems - Simple External Consumer Display
- IEC 63402 ED1: Energy Efficiency Systems - Smart Grid - Customer Energy Management Systems - General Requirements and Architecture

The IEC SyC Smart Energy published a new version of the Smart Grid roadmap as IEC TR 63097:2017 *'Smart grid standardisation roadmap'*.

Systems committee on smart energy (SyC Smart Energy) provides systems level standardisation and coordination in the areas of smart grids and smart energy, including interactions in the fields of heat and gas. http://www.iec.ch/dyn/www/f?p=103:186:0::::FSP_ORG_ID,FSP_LANG_ID:11825

The IEC smart grid mapping tool provides a graphical and interactive overview of all smart grid related standards: http://smartgridstandardsmap.com/

ISO/IEC JTC 1

ISO/IEC JTC 1/SC 27 has started the review of ISO/IEC TR 27019:2013 'Information technology - Security techniques-– Information security management guidelines based on ISO/IEC 27002 for process control systems specific to the energy utility industry'. ISO/IEC TR 27019:2013 provides guiding principles based on ISO/IEC 27002 for information security management applied to process control systems as used in the energy utility industry.

IEEE

The standardisation work of IEEE not only covers ICT, but also aspects of electrical power generation and distribution, including demand response, renewable energy sources, security, reliability and systems engineering. ICT standards work in Smart Grid includes:

- Smart Grid Interoperability: The IEEE 2030 series is based on an interoperability reference model that defines data flows for reliable, secure, bi-directional flow of electric power and identifies the necessary communication infrastructure, incl. for electric vehicles.

- Networking and Communications: The IEEE 1901 series of standards addresses broadband/narrowband over powerline; the 802 family of standards addresses many other aspects of networking.

- Cyber Security for Smart Grid: Multiple standards addressing cybersecurity for Intelligent Electronic Devices (IEEE 1686), Substation Automation (IEEE C37.240, IEEE 1711 series).

- Smart Metering and Demand Response: Multiple standards including IEEE 170X series and IEEE 1377 for communication protocols, 2030.5 for smart energy profiles, and IEEE 1901 series for smart metering functionality.

- Substation Automation: Standards include time protocol, synchronization work, and electric power system communication, such as IEEE 1815 (DNP3), IEC/IEEE 61850-9-3, IEEE C37.238, IEEE C37.118 series, etc.

- Electric Vehicle Charging: Standards include IEEE 2030.1.1, which specifies the design interface of electric vehicles as well as direct current and bi-directional chargers that utilize battery electric vehicles as power storage devices

For a list of these and other IEEE standardisation activities on Smart Grid, please see: https://ieeesa.io/rp-smartgrid

ITU-R

ITU-R Working Party 1A on "Spectrum engineering techniques" deals with spectrum engineering techniques, including unwanted emissions, frequency tolerance, technical aspects of sharing, computer programs, technical definitions, Earth-station coordination areas and technical spectrum efficiency. Among the current study topics, ITU-R Working Party 1A deals with the impact on radiocommunication systems from wireless and wired data transmission technologies used for the support of power grid management systems.

In June 2021, a revision to Report ITU-R SM.2351 on "Smart grid utility management systems" was published. This document provides an overview of Smart Grid systems and details of the wide array of technologies that are available for the monitoring and control of Smart Grid networks and Smart Meter networks. These technologies include wired, e.g., power line telecommunications (PLT), and wireless communications, e.g. 6.25 / 12.5 / 25 kHz narrow band technologies up to multiple-MHz broadband technologies. This Report focuses principally on the electricity industry where the changes are most rapid and extensive, but similar developments are taking place in gas and water infrastructure (including clean water, wastewater and sewerage, and hot water). The main text includes an overview of the spectrum available in various countries for Smart Grids and Smart Meter systems.

ITU-T

ITU-T Focus Group Smart Grid completed its work in December 2011 and adopted deliverables at http://itu.int/en/ITU-T/focusgroups/smart. The work was taken over by ITU-T SG15, which leads and coordinates this issue within ITU and with other organizations. ITU-T SG15 developed standards on power line communication (PLC, Recommendation ITU-T G.990x-series), which is one of the most important technologies for smart grid. ITU-T SG15 recently approved the following technical paper:

- Use of G.hn technology for smart grid

Detailed information is described in the document "smart grid standardisation overview and work plan" developed by ITU-T SG15 and available at: http://www.itu.int/en/ITU-T/studygroups/Pages/sg15-sg.aspx

ITU-T Study Group 5 on Environment, Climate Change and Circular Economy, within Question 6/5 and Q11/5 is working on environmental efficiency of digital technologies and climate change mitigation and smart energy solutions. As part of its work, ITU-T SG5 has approved a set of Recommendations on Smart energy solutions for telecom sites (ITU-T L.1380), data centres (L.1381), telecommunication rooms (L.1382) and cities and homes applications (L.1383).

ITU-T SG13 developed Recommendation ITU-T Y.2070 "Requirements and architecture of the home energy management system and home network services", ITU-T Y.2071 "Framework of micro energy grid" as well as ITU-T Y.2072 "Framework for an energy-sharing and trading platform". In addition, SG13 is working on QoS requirements for smart grid supported by IMT-2020 (Y.IMT2020-qos-req-sg), the distributed and virtualized energy storage systems (Y.dv-ess) and framework of trusted electricity brokerage for distributed energy resources (Y.energy-brokerage): https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=13977

https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=15063

ITU-T SG17 approved Recommendations ITU-T X.1331 " Security guidelines for home area network (HAN) devices in smart grid system" and ITU-T X.1332"Security guidelines for smart metering services in smart grid" .

ITU-T SG20 approved Recommendation ITU-T Y.4209 "Requirements for interoperation of the smart port with the smart city", Recommendation ITU-T Y.4419 "Requirements and Capability Framework of Smart Utility Metering (SUM)" and is working on the development of a Recommendation on "Data format requirements and protocols for remote data collection in smart metering systems" (Y.DFR-SM).

OASIS

The OASIS Energy Interoperation TC defines interaction between Smart Grids and their end nodes, including Smart Buildings, Enterprises, Industry, Homes, and Vehicles. The TC developed data and communication models that enable the interoperable and standard exchange of signals for dynamic pricing, reliability, and emergencies.

The OASIS Energy Market Information Exchange (eMIX) supports exchanging price information and product definitions in energy

markets and to those following markets. Energy Interoperation relies on the EMIX Specification for communication of price and product defintion. EMIX defines the information for use in messages that convey this actionable information.

The OASIS Web Services Calendar (WS-Calendar) defines a cross-domain standard for services to enable machine-based scheduling of human-centric activities. An essential distinction between energy and other markets is that price is strongly influenced by time of delivery. EMIX conveys time and interval by incorporating WS-Calendar into tenders, contracts, and performance calls.

IETF

RFC6272 identifies the key infrastructure protocols of the Internet Protocol Suite for use in the Smart Grid. The target audience is those people seeking guidance on how to construct an appropriate Internet Protocol Suite profile for the Smart Grid. In practice, such a profile would consist of selecting what is needed for Smart Grid deployment from the picture presented here.

The Energy Management (EMAN) WG has produced several specifications for an energy management framework, for power/energy monitoring and configuration. See http://datatracker.ietf.org/wg/eman/documents/ for the details. The framework focuses on energy management for IP-based network equipment (routers, switches, PCs, IP cameras, phones and the like).

Many of the IETF Working Groups listed under section 3.1.4 Internet of Things above are developing standards for embedded devices that may also be applicable to Smart grids.

https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#SmartGrid

ONEM2M

oneM2M has published Release 2A in March 2018 and its Release 3 in September 2018. Work is ongoing on Release 4.

The oneM2M includes specifications covering requirements, architecture, protocols, security, and management, abstraction and semantics. Release 2 added new functionality, particularly by expanding management, abstraction and semantics, security and privacy, and interworking with underlying technologies. oneM2M Release 3 adds seamless interworking with 3GPP network services for IoT.

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

EEBUS

The EEBUS Initiative is a non-profit organisation, based in Germany, with international members from the automotive, heating, ventilation, air conditioning, white goods, PV, energy storage as well as energy management sector. On behalf of the industry EEBUS, describes the communication interface (= application, data model, transport protocol) to enable the connection between energy management relevant devices as well as corresponding control systems.

To achieve a standardised communication interface EEBUS is active in several national, European and international standardisation bodies. In particular, EEBUS was and is significantly involved in the creation of the ontology SAREF4ENER, driven by the European Commission, with its toolbox SPINE as a data model for energy management relevant applications. SPINE is used today within EN 50631 (Household appliances network and grid connectivity) for White Goods as well as HVAC devices. Furthermore, SPINE is the relevant data model for the national application rule concerning the grid connection in Germany and has been introduced into IEC PT63380 in the context of electromobility.

OPEN CHARGE ALLIANCE

The Open Charge Alliance is an industry alliance, based in the Netherlands, of EV charging hardware and software vendors, and charging network operators and service providers. OCA's mission is to foster global development, adoption, and compliance of the Open Charge Point Protocol (OCPP) and related standards through collaboration, education and testing. The Open Charge Alliance has promoted the benefits of the Open Charge Point Protocol (OCPP) in order to make Electric Vehicle (EV) networks open and accessible.

NIST

The US government sponsored a Smart Grid Interoperability Panel from 2009-2012 to spur cooperative industry and public agency development of open data standards for smart grid functionality: http://www.nist.gov/smartgrid/priority-actions.cfm. In 2013, the management of this project was turned over to industry stakeholders as a continuing standards cooperation project: http://sgip.org/

JISC

Japanese Industrial Standards Committee (JISC) created a roadmap for international standardisation for smart grid.

SGCC

The State Grid Corporation of China (SGCC) Framework. A lot of further national activities and roadmaps could be mentioned as well, such as those of Austria, Spain, the United Kingdom, the Netherlands, France, South Korea and others.

KNX

KNX Association is a non-profit-oriented organization. Members are manufacturers developing devices for several applications for home and building control based on KNX like lighting control, shutter control, heating, ventilation, air conditioning, energy management, metering, monitoring, alarm/intrusion systems, household appliances, audio/video and more. Next to manufacturers, also service providers (utilities, telecom, etc.) can become a member of the KNX Association.

KNX is approved as an International Standard (ISO/IEC 14543-3) as well as a European Standard (CENELEC EN 50090 and CEN EN 13321-1) and Chinese Standard (GB/T 20965) for Home and Building Control.

Demand Side Management white paper: https://www.knx.org/media/docs/downloads/Marketing/Flyers/KNX-Demand-Side-Management-White-Paper/KNX-Demand-Side-Management-White-Paper.pdf Smart Metering with KNX: https://www.knx.org/media/docs/downloads/Marketing/Flyers/Smart-Metering-With-KNX/Smart-Metering-With-KNX_en.pdf

(C.3) ADDITIONAL INFORMATION

Security, privacy and management of control of the access to and ownership of data are essential for the development of smart grids. Without wide acceptance by commercial users and consumers, the role of smart grids would be limited to specific vertical markets only.

Mechanisms that allow users and providers to negotiate optimised usage, including planning and scheduling of availability and use of energy resources are addressed by CG-SEG and covered by CLC TC205, CLC TC13 and CLC/TC 57 IEC TC57 amd IEC TC13 have a joint working group (JWG16) to ensure the CIM and COSEM models are compatible thereby ensure interoperability of protocols across grid control and metering systems.

- The part of the grid inside the home domain is also an element that has a significant impact on energy efficiency. Several elements are needed: local protocols for home automation networks; a multidisciplinary standardised approach covering all aspects of the problem, from application semantics to indoor interconnection wired or wireless technologies. An extensive semantic-level for building (and possibly applicable for home) already exists and is provided by CENELEC TC 205 within the EN 50491 series which is also compatible with EN IEC 62056 (DLMS/COSEM).

Applications include lighting and energy control, appliances control, power monitoring, smart metering and buildings energy management; provision of elements for a global solution on smart appliances and home energy control, such as suitable radio protocols for indoor coverage.

3.4.2 SMART CITIES AND COMMUNITIES/ TECHNOLOGIES AND SERVICES FOR SMART AND EFFICIENT ENERGY USE

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

Smart urban technologies can make a significant contribution to the sustainable development of European cities. 75% of the EU population lives in urban areas, a proportion that is growing as the urbanisation trend continues, both in Europe and worldwide.

A smart city is an entity that uses ICT effectively, to integrate the requirements of its urban community, in terms of energy and other utilities (production, distribution and use), environmental protection, mobility and transport, services for citizens (healthcare, education, emergency services etc.) and with proper regard for security, both of individuals and their personal data, and use it as a driver for economic and social improvements. This would also increase the deployment of smart technologies and solutions in rural communities, contributing to the development of businesses and creating conditions for making smart communities attractive to the population.

In standards terms, there are some over-arching requirements, concerning standards for common terminologies, for citizens' interface with their local authority, etc. But mainly, smart city standards topics relate to the need to ensure commonalities —as far as these are appropriate and cost-effective— between the approaches taken by the different application areas, to enable the city to derive the best horizontal advantage from its overall approach and above all benefit from interoperability. The standards requirements as such for these application areas are specified in the Rolling Plan elsewhere at the appropriate points.

The core components in such a complex system are the frameworks that assist companies, cities and other actors to provide appropriate solutions that prioritise economic, social and environmental outcomes. Solutions should address the whole lifecycle, optimising environmental, social and economic outcomes through the seamless transfer of information.

Beyond engagement in European standardisation activities, ensuring a strong, common European voice in international standardisation fora is also very important.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The Commission has created the European Innovation Partnership on Smart Cities and Communities (EIP SCC) which has established a smart cities stakeholder platform, with ESO participation, and a high-level group advising the Commission. The high-level group released in early 2014 a strategic implementation plan (SIP) setting out a joint vision, a common target and proposals for implementation, which contain standardisation aspects. The EIP-SCC has not prolonged its mandate. However, the initiative's stakeholder platform is continuing as Smart Cities Marketplace on the EUROPA domain.

Within the Smart Cities Marketplace, the Action Cluster on Integrated Infrastructures and Processes, an initiative of 110 cities and 93 industry partners, created, among other deliverables, a reference architecture and design principles for an open urban platform, which became a standard of DIN and is moving towards a standard in the international SDOs. Complementing their work, the European project SynchroniCity developed the Minimal Interoperability Mechanisms (MIMs) consistent with the Smart Cities & Communities guidelines and comprised of commonly agreed industry standards and best practice and tested their validity on a large scale (more than 50 implementations), now overseen by the Open & Agile Smart Cities network. There are now 10 MIMs at different stages, including Personal Data Management and Fair AI (championed by the cities of Helsinki and Amsterdam, respectively). Adopting the EIP-SCC goal to scale up these solutions into a real life deployment in the majority of EU cities with 300 million citizens benefiting from services running via urban platforms, the stakeholder community with the support of the European Commission launched the Living-in.EU initiative and declaration bringing together like-minded cities and communities as well as supporters for the digital transformation 'the European way'. Within it, a technical group drafted a consolidated report setting a technical common ground of specifications. It is referred to as MIMs Plus and it consolidated in one place the above-described achievement plus the work of relevant standard initiatives such as OneM2M for a holistic interoperability reference for smart cities. The work continues to evolve the MIMs Plus with relevant European policy and technical elements, and the current version is v4, while a new version is in preparation.

Benefiting from valuable contributions from our stakeholders, the Commission fostered the creation of a common interoperability language called SAREF (Smart Appliances REFerence ontology), which became a standard of ETSI and OneM2M (the Global initiative for Internet of Things standardisation) in 2015. Since then a new version of the SAREF standard has been released that made SAREF modular and extensible via extensions. The initial SAREF became the first extension for Energy together with two more extensions (Buildings and Environment) followed at the beginning of 2019 with standardisation of three more extensions (Smart Cities, AgriFood and Manufacturing) and now four new extensions are in the pipeline and under development (automotive, health, water and wearables) turning SAREF into the IoT smart city ontology. SAREF and SAREF4City are part of the MIMs and the MIMs plus set of specifications, together with INSPIRE and other key policies

It is important to ensure the cooperation between the different initiatives that bring together cities with the work of the SDOs , in particular for the definition of (high) level requirements and feedback about their implementation. Example initiatives are:

- The (EIP-SCC) memorandum of understanding (MoU) on urban platforms (18/09/2017)
- List of signatories of the EIP-SCC MoU on urban platforms (18/09/2017)
- The Open & Agile Smart Cities (OASC) initiative and the actual implementation of technical specifications through Living-in.eu.
- Urban Agenda for the EU and the recently adopted New Leipzig Charter
- Smart Cities Marketplace

(A.3) REFERENCES

- Strategic Implementation Plan of the EIP-SCC
- COM(2012) 4701: *Smart Cities and Communities — European Innovation Partnership*
- **COM(2017) 228 final**: Mid-Term Review on the implementation of the Digital Single Market Strategy - A Connected Digital Single Market for All
- COM(2016) 176**:** ICT Standardisation Priorities for the Digital Single Market
- **COM(2015) 192**: A Digital Single Market Strategy for Europe
- **COM(2021) 205 final**: Fostering a European approach to Artificial Intelligence

The "United for smart sustainable cities" (U4SSC) initiative coordinated by ITU, UNECE and UN-Habitat and supported by 13 other UN agencies and programmes to advocate for public policy to emphasize the importance of ICT in enabling the transition to smart sustainable cities (see the ITU section below for more details).

(B.) REQUESTED ACTIONS

ACTION 1 SDOs to consider the recommendations of the ETSI Technical Report 103 455 "Smart cities and communities; Standardisation for citizens and consumers" and review how they could incorporate the proposals for organizational improvements to benefit smart city standardisation's coverage of citizen/consumer issues, and for guidance material, codes of conduct and standards

ACTION 2 Taking into account the results of the EU funded projects ESPRESSO and SynchroniCity, and in cooperation with city-led initiatives like the Smart Cities Marketplace demand-side group on Urban Platforms, the Open and Agile Smart Cities (OASC) network and Living-in.EU, SDOs should continue developing standards and technical specifications needed for a global market of open service platforms and applications for cities and communities, aligning their activities and integrating different standards and complementing protocols and communication standards. Possible actions in this sense could be:

- An open catalogue of the best practise and lessons learned of Smart Cities in using standards
- More promotion at local and regional level of the existing standards and their functionalities ("outreach to the grass roots"), levering Living-in.EU.
- Guidelines or specifications for federating Smart City data spaces (selective access) and for data marketplaces across cities and communities
- Referencing of ITU-T FG DPM work in ETSI work, to reduce "parallel evolution" between the ESOs and ITU
- Interworking of NGSI-LD on top of the oneM2M platform
- Further recommendations for SAREF extensions and evolutions to cover wider applications in different (urban) vertical applications and across applications.
- Operational guidelines on modelling of real-world systems in ways that are extensible and shareable so that Smart City engineers and technical decision-makers have blueprints to speed their work and ease re-use of Big Data.
- Activities to promote standardised ontologies (as is beginning in the SmartGrid area) to improve cross-border efficiencies
- Guidelines or specifications to ensure NGSI-LD could be installed with SAREF family of ontologies
- Guidelines or specifications for NGSI-LD on how to add the provenance of information to each dataset, so that licensing, GDPR information, and appropriate security/confidentiality features can be enabled.
- Development of open Test Suites for standards-based solutions, not limited to particular software implementations, to allow improved efficiency in procurement ("does it meet the Tests?") and assessment ("does the system run as expected?")

ACTION 3 Define a set of standards and related criteria, value proposition and applicability statements for the deployment of platforms for cities and communities under the Digital Europe Programme. The set will be based on the EIP-SCC Reference architecture and design principles for urban platforms, the OASC Minimum Interoperability Mechanisms, OneM2M, NGSI-LD and SAREF and will further specify the minimum standardisation requirements to be met to achieve the goal of Interoperable European ecosystem of platforms and applications.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN

CEN/TC 465 'Sustainable and Smart Cities and Communities' has been created by CEN in October 2019. The TC is intended to address specific European needs through a consistent approach with the activities of ISO/TC 268 'Sustainable Cities and Communities'.

CEN, CENELEC, ETSI

The Coordination Group on Smart and Sustainable Cities and Communities has published a report and is now following up the recommendations, through a series of five specific activities. It proposes to lead in relation to the EIP action cluster on standards. It was proposed that the SSCC-CG activities will be taken over by the new CEN-CENELEC-ETSI Sector Forum on Smart and Sustainable Cities and Communities (SF-SSCC).

The SF-SSCC, created in January 2017, is a long-term joint group of the ESOs that acts as an advisory and coordinating body for the European standardisation activities related to Smart and Sustainable Cities and Communities.

Coordination efforts by the SDOs, shown at the World Smart City Forum (July 2016 Singapore), further developed in 2017.

The CEN-CLC-ETSI Sector Forum on Smart Cities and Communities created a mapping, which aims at listing relevant standardisation activities and published standards, relevant for the development of Smart Cities. It lists also the different policy and research initiatives in this context. This mapping is designed as a living document, to which any interested stakeholder can contribute.

ETSI

ETSI is providing specifications relevant to city needs and service scenarios for their citizens and infrastructure, including concrete examples that reflect the importance of environmental factors and sustainability objectives.

ETSI's Human Factors committee (TC HF) has published a technical report (TR 103 455) to assess the needs of consumers and citizens that must be addressed by smart city standardisation, including accessibility, usability, personalization, interoperability and personal data protection.

ETSI's Access, Terminals, Transmission and Multiplexing committee (TC ATTM) is developing standards for sustainable digital multi-service cities to support the deployment and roll-out of smart city infrastructures. This work includes a TS detailing measures to ease the deployment of smart new services and their multiservice street furniture within the IP network of a single city or cluster of cities.

From digitizing industrial processes to creating smart services for citizens, it is essential to accurately record data together with its context information, the so-called metadata, and to transfer these without misinterpretation to other systems. Single-purpose solutions work well within a known context but are not suitable for multi-system interoperability.

ETSI's ISG on cross-cutting Context Information Management (ISG CIM) has published Group Specifications (GSs) for applications to publish, discover, update and access context information (ETSI ISG CIM GS009 V1.2.), initially for a broad range of smart city applications and later for other areas, facilitated by a high-level information model for capturing the structure of physical environments as a graph which can be efficiently serialized as linked data (ETSI ISG CIM GS 006 V1.1.1).

ETSI's ISG F5G is looking at the needed advance in technology to enable the deployment of fibre for smart-city applications, reaching the used devices with fast, reliable and secure connections.

In 2021 ETSI expects to complete a number of specifications on security and privacy issues, and on interworking with important IoT frameworks such as oneM2M.

ETSI published an extension to the SAREF ontology for Smart Cities in July 2019.

ETSI's ISG on Operational energy Efficiency for Users (ISG OEU) has published a specification which defines global KPI modelling for green smart cities.

ETSI SC USER has worked, within the project "User-Centric approach in digital ecosystem". Also see section 3.1.3 on use cases for Smart cities. The next step is the Smart Interface based on the Smart Identity. This approach aims to improve the access and use of all the services provided by Smart Cities.

ETSI TC DECT has published the first release of the new DECT-2020 NR (New Radio) technology (ETSI TS 103 636 parts 1 to 4). The work on additional parts for the set of standards are ongoing with planned publication by end of 2021. DECT-2020 NR supports Ultra Reliable Low Latency Communications (URLLC) and massive Machine Type Communications (mMTC). TC DECT is defining application profiles for various uses cases. These application profiles may consider various metering and sensor applications. One of the application profiles under work is Smart the electricity meter profile.

ONEM2M

The oneM2M standard defines a middleware layer, providing common services for connecting IoT devices and IoT applications. With its data sharing capabilities, interworking capabilities (e.g. OGC), semantic interoperability, security and privacy functionalities oneM2M enables a wide variety of smart city use cases. Public authorities in Korea and India reference the oneM2M standard in their smart city projects. Interoperability and compliance testing as well as a Certification Program (onem2m.org) complement the standardisation activities. To focus on the sustainability aspects of IoT and Smart Cities, oneM2M established a Sustainability committee in 2021. All oneM2M specifications are publicly accessible at https://www.onem2m.org/technical.

ISO, IEC

ISO TC 268 "Sustainable development in communities" is directly working on smart city-relevant issues, including terminology, management systems and indicators https://www.iso.org/committee/656906.html

- ISO/DIS 37122 Sustainable cities and communities - Indicators for smart cities (under development)
- ISO/FDIS 37104 Sustainable cities and communities -Guidance for practical implementation in cities (under development)
- ISO/DIS 37105 Sustainable cities and communities - Descriptive framework for cities and communities (under development)

ISO-IEC/JTC 1 WG11 "Smart cities"

JTC1 has established a Working Group on Smart Cities which serves as the focus of and proponent for JTC 1's Smart Cities

standardisation program, focusing in particular on standardisation around the strategic topics on Semantic Interoperability of City Data, Software Platform for Open City Data, Urban Operation System and City planning and smart modelling and simulation.

Current projects:

ISO/IEC 30146:2019, Information technology — Smart city ICT indicators (Published)

ISO/IEC 21972:2020, Information technology — Upper level ontology for smart city indicators (Published)

ISO/IEC DIS 30145-1, Information technology — Smart City ICT reference framework — Part 1: Smart city business process framework (DIS)

ISO/IEC 30145-2:2020, Information technology — Smart City ICT reference framework — Part 2: Smart city knowledge management framework (Published)

ISO/IEC 30145-3:2020, Information technology — Smart City ICT reference framework — Part 3: Smart city engineering framework (Published)

ISO/IEC 24039, Information Technology — Smart city digital platform (WD)

ISO/IEC 5087-1, Information technology — City data model — Part 1: Foundation level concepts (WD)

ISO/IEC 5087-2, Information technology — City data model — Part 2: City level concepts (WD)

ISO/IEC 5087-3, Information technology — City data model — Part 3: Service level concepts -Transportation planning (WD)

ISO/IEC 5153, Information Technology — Smart city — City service platform for public health emergency (WD)

ISO/IEC PWI 5217, Guidance on smart city digital infrastructure design (PWI)

ISO, IEC, ITU

The IEC-ISO-ITU Joint Smart Cities Task Force was set up by all three SDOs with the key objectives:

- To build synergies and to promote minimization of overlap as applicable on ongoing works in ITU-T, IEC and ISO related to smart cities and communities;
- To maximize efforts in order to identify new areas of cooperation related to smart cities and communities;
- To develop a holistic view on smart cities and communities taking into consideration the scope, areas of work and expertise of ITU-T, IEC and ISO to support smart cities and communities' development.

IEEE

Smart City applications include smart energy/grid, intelligent transportation, water management, waste management, smart streetlights, smart parking, environment monitoring, smart community, smart campus, smart buildings, eHealth, eLearning, eGovernment, etc. Many standards in all these different domains are also relevant in a Smart City.

The 'IoT Architecture' Working Group develops a standard for a Reference Architecture for a Smart City (RASC). This standard provides an architectural blueprint for Smart City implementations leveraging cross-domain interaction and semantic interoperability among various domains and components of a Smart City (IEEE P2413.1).The plan is to also specify a Smart City Intelligent Operations Center (IoC).

The 'Smart Cities Architecture' WG under the IEEE Communications Society standardises an architectural and functional communication framework for Smart Cities. The framework addresses the communications systems aspects for Smart city ecosystems and key components of each ecosystem. The standard also includes Smart City relevant terms and definitions (P1950. 1).

The 'Discovering and Intent Sharing between Smart City Component Systems' Working Group develops a standard for a process to discover smart city component systems deployed in the city. It proposes a classification mechanism to describe the component system based on the resources and data elements it exposes (such as Internet of Things (IoT) system, E-Government system, Geo-spatial system, Collaboration system, or similar component systems.) The standard defines a common identity scheme for entities (such as assets, things, spaces, service providers and people) and the data exchange format and interfaces for each class. The standard also describes the city command center, its role in setting intents and the mechanism to propagate the intent (P1951.1).

The 'Smart Cities Technology Framework' Working Group under the Standards Development Board of the IEEE Communications Society specifies a process framework for planning a smart city. This framework provides a methodology for municipalities and technology integrators to plan innovative technology solutions for Smart Cities (IEEE P2784).

Fixed wireless infrastructure is a core component of emerging smart cities. The IEEE LAN/MAN standards committee through the IEEE 802.11 (Wi-Fi standards development) is also enabling interoperable connectivity in a smart cities ecosystem. The IEEE P2872 standard describes a protocol that enables interoperable, semantically compatible connections between connected hardware (e.g. autonomous drones, sensors, smart devices, robots) and software (e.g. services, platforms, applications, AIS).

Apart from the above, IEEE SA has focused on couple of key pre-standards industry connections program:

- IEEE SA Industry Connection Program on AI-Driven Innovation for Cities and People; this program is focused on providing cities a governance mechanism to support responsible artificial intelligence systems (AIS);
- IEEE SA Industry Connection Program on Alliance for Best Practices and Standards in Smart Cities; this program aims to develop close collaboration between the technology industry and city leaders and stakeholders towards smart city solutions across cities and regions.

For more information please visit https://ieeesa.io/rp-smartcities

ITU-R

Recent developments in the Internet of Things (IoT), Artificial Intelligence (AI) and smart grids and meters are driving and supporting the development of smart sustainable cities throughout the world. Several ITU-R Working Parties contribute to the development of ITU-R Reports and ITU-R Recommendations that contribute to the improvement of smart sustainable cities.

Among the current study topics, ITU-R Working Party (WP) 1A studies the impact on radiocommunication systems from wireless and wired data transmission technologies used for the support of power grid management systems.

Resolution ITU-R 54 calls for studies to achieve harmonization for short-range devices (SRDs).

ITU-R WP 1B is responsible for the studies relating to spectrum

management methodologies and economic strategies. Among its current studies, WP 1B deals with the harmonization of SRDs.

Report ITU-R SM.2153 on Technical and operating parameters and spectrum use for short-range radiocommunication devices provides SRD definitions and short descriptions of different applications using SRDs, e.g.: Telecommand, Telemetry, Voice and video, Detecting avalanche victims, RLANs, Railway applications, among others. This Report also indicates the typical technical characteristics and limitations such as the common frequency ranges or the antenna requirements, and it explains administrative requirements like the mutual agreements between countries and/or regions and the licences requirements. Finally, it also provides useful information on national and regional rules including technical and operational parameters and spectrum use.

ITU-R WP 1B has carried out studies with the aim to globally and regionally harmonize the frequency bands used by SRDs. Recommendation ITU-R SM.1896 on "Frequency ranges for global or regional harmonization of short-range devices" details the frequency ranges appropriate for global and regional harmonization. On the other hand, Recommendation ITU-R SM.2103 on "Global harmonization of short-range devices categories" contains guidelines for the categories recommended for SRDs requiring operation on a globally harmonized basis.

International Mobile Telecommunications (IMT) are the on-going enabler of new trends in communication devices – from the connected car and intelligent transport systems to augmented reality, holography, and wearable devices, and a key enabler to meet social needs in the areas of mobile education, connected health and emergency telecommunications.

In this context, ITU-R Working Party 5D is responsible for carrying studies related to the development and enhancement of International Mobile Telecommunications (IMT).

In February 2021, Recommendation ITU-R M.2150 containing the "Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2020 (IMT-2020)" was approved. Similar to previous mobile generation technologies, this work is the basis for the development of 5G systems that provides great improvements and benefits to several ICT applications, including e-health, e-agriculture, e-manufacturing, intelligent transport systems, smart cities and traffic control, etc., to facilitate the development of the digital economy.

ITU-T

ITU-T SG20 "IoT and smart cities and communities" is developing a series of standards that coordinate the development of IoT technologies in cities, including machine-to-machine communications and ubiquitous sensor networks. Some of these standards include sensor control networks in NGN environment (ITU-T Y.4250), platform interoperability for smart cities (ITU-T Y.4200) reference model of IoT-related crowdsourced systems (ITU-T Y.4205), Requirements and capability framework of smart environmental monitoring (ITU-T Y.4207), self-organization network in IoT environments (ITU-T Y.4417). https://www.itu.int/ITU-T/recommendations/index_sg.aspx?sg=20

ITU-T SG20 "IoT and smart cities and communities" is working on a draft Recommendation on Framework of smart greenhouse service (Y.ISG-fr), which elaborates on an IoT-based approach toward food production. More info: https://itu.int/go/tsg20

U4SSC is a United Nations initiative coordinated by ITU, UNECE and UN-Habitat and supported by 14 other UN agencies and programmes, to help cities and communities become smarter and more sustainable.

U4SSC is currently working on several thematic groups including (but not limited to) city platform, economic recovery in cities in time of COVID-19, innovative financing instruments for SSC, guiding principles for artificial intelligence in cities, procurement guidelines for SSC and etc, to support the transition to smart sustainable cities in view of the Sustainable Development Goals (SDGs). More info: https://www.itu.int/en/ITU-T/ssc/united/Pages/default.aspx

Several U4SSC deliverables have been launched (since September 2020) including City Science Application Framework (containing 8 Case Studies), Guide to Circular Cities (containing 8 Case studies), Accelerating city transformation using frontier technologies, Blockchain for smart sustainable cities, Simple ways to be smart and Guidelines on tools and mechanisms to finance smart sustainable cities projects.

See the U4SSC deliverables available at: https://www.itu.int/en/ITU-T/ssc/united/Pages/publications-U4SSC.aspx

The U4SSC Implementation Programme (U4SSC-IP) has also been created to support the implementation of the U4SSC KPIs for SSC project. For more information on the U4SSC-IP, see: https://www.itu.int/en/ITU-T/ssc/united/Pages/U4SSC-IP.aspx

ITU-T Recommendations (ITU-T Y.4900, ITU-T Y.4901, ITU-T Y.4902, ITU-T Y.4903/L.1603) have become the foundation of the United for Smart Sustainable Cities (U4SSC) initiative's Key Performance Indicators (KPIs) for Smart Sustainable Cities project. Over 150 cities worldwide have already partnered with the U4SSC to pilot these indicators.

More info: https://www.itu.int/en/ITU-T/ssc/united/Pages/publication-U4SSC-KPIs.aspx
https://www.itu.int/en/publications/Documents/tsb/2017-U4SSC-Collection-Methodology/index.html

Three case studies (Dubai, Singapore and Moscow) related to the implementation of the KPIs for SSC have been published.

In addition, City Snapshots and City Verification Reports have been developed on U4SSC KPIs. Five City Factsheets have been also published.

Find the published City Snapshots, Verification Reports, Factsheets and Case Studies available at: https://www.itu.int/en/ITU-T/ssc/united/Pages/publication-U4SSC-KPIs.aspx

ITU-T SG17 is working on "Security measures for location enabled smart office services" (X.sles), "Security measure for digital twin system of smart cities" (X.smdtsc) and "Security measure for smart residential community" (X.smsrc). https://itu.int/go/tsg17IETF

IETF

The Energy Management (EMAN) WG has produced several specifications for an energy management framework, for power/energy monitoring and configuration. See http://datatracker.ietf.org/wg/eman/documents/ for the details. The framework focuses on energy management for IP-based network equipment (routers, switches, PCs, IP cameras, phones and the like).

A recently published standards track specification (RFC7603) presents the applicability of the EMAN information model in a variety of scenarios with cases and target devices. These use cases are useful for identifying requirements for the framework and MIBs. Further, it describes the relationship of the EMAN framework to other relevant energy monitoring standards and architectures.

Many of the IETF Working Groups listed under section 3.1.4 Internet

of Things above are developing standards for embedded devices that may also be applicable to this section.

https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#SmartEnergy

OASIS

The OASIS Transformational Government TC Framework (TGF) advances an overall framework for using information technology to improve the delivery of public services. It is used in BSI›s PAS 181:2014 as mentioned above.

AENOR

- Over 20 Spanish standards at AENOR's CTN 178 on e.g. platforms interoperability, open data in smart cities, smart ports, rural communities and smart tourist destinations, basis for ITU-T SG20 recommendations on these topics
- http://www.aenor.es/descargasweb/normas/aenor-Spanish-standardisation-on-Smart-Cities-CTN-178.pdf

BSI

BSI's PAS 181:2014 Description: British Smart City Framework. A good practices framework for city leaders to develop, agree and deliver smart city strategies. Uses OASIS TGF (below).

http://www.bsigroup.com/en-GB/smart-cities/Smart-Cities-Standards-and-Publication/PAS-181-smart-cities-framework/

BSI has adopted and published the deliverables of the Demand-side group on Urban Platforms initiative of the European Innovation Partnership on Smart Cities and Communities:

- Leadership Guide: a 'train read' document for city leaders (this now published under BSI logo)
- Management Framework: helping integrate across the functional silos (published under BSI logo)

BSI, FUTURE CITIES

Cities Standards Institute (CSI) was a joint activity to develop a strong network of cities, companies and SMEs that develop the next stage of the BSI's Smart City Catapult Framework. This was completed in 2017, the whole series include DIN SPEC 91347 (humble lampposts), 91357 (OUP), 91367 (mobile urban data), 91387, and lately 91397 (district level management systems – to be published in 2021).

DIN/DKE/VDE

The German Standardisation Roadmap Smart City

https://www.dke.de/resource/blob/778248/d2afdaf62551586a54b3270ef78d2632/the-german-standardisation-roadmap-smart-city-version-1-0-data.pdf

The DIN PAS Reference Architecture adopted from the Reference Architecture deliverable of the Urban platform initiative of the European Innovation Partnership on Smart Cities and Communities and the ESPRESSO project is anticipated to be complete in summer 2017.

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

ADAPT4EE/READY4SMARTCITIES

Activity related to eeSemantics: group was running a series of vocabulary camps addressing specific sub-areas.

HORIZON 2020 CALL SCC-03-2015 ESPRESSO

Development of system standards for smart cities and communities solutions.

The process for developing, maintaining and promoting smart cities and communities standards to ensure the interoperability of solutions, i.e. the adaptability of solutions to new user requirements and technological change and the avoidance of entry barriers or vendor lock-in through promoting common metadata structures and interoperability using /open standards as opposed to proprietary ones, together with open and consistent data. It should make relevant data and information as widely available as possible —including to third parties for the purpose of applications development— while using common, transparent measurement and data collection standards to ensure meaningfulness and comparability of performance/outcome measurements. The project together with the EIP SCC urban platform initiative is promoting the use of DIN SPEC 91357, freely available for the DIN website, by bringing it to the attention of European cities as well as promoting it worldwide. It is helping to bring DIN SPEC 91357 to CEN/CELELEC and ISO for international consideration. It also contributed to other standards such as the DIN smart "humble" lamppost standard.

INDUSTRY MEMORANDUM OF UNDERSTANDING ON URBAN PLATFORMS

93 organisations from industry and research have signed a Memorandum of Understanding on interoperable urban platforms. The group is led by SAP and developed a set of principles and a joint reference architecture framework to enable interoperability, scalability and open interfaces to integrate different solutions and to develop a joint data and service ontology to be used by individual Smart cities. In addition, they are working to accelerate the adoption of the developed framework by standardisation bodies and other stakeholders. The deliverables of the group (and most notably the reference architecture) have been standardised by DIN in DIN91357. The group is promoting the use of DIN SPEC 91357, freely available for the DIN website, by bringing it to the attention of European cities as well as promoting it worldwide. It is helping to bring DIN SPEC 91357 to CEN/CELELEC and ISO for international consideration.

https://ec.europa.eu/digital-single-market/en/news/memorandum-understanding-towards-open-urban-platforms-smart-cities-and-communities

DEMAND-SIDE GROUP (CITY-LED) ON URBAN PLATFORMS (WITHIN THE SMART CITIES MARKETPLACE)

A total of 110 cities — individual cities and two city networks — have already agreed to cooperate more strongly in the area of urban platform by signing a Letter of Intent. The group is working within the urban platforms initiative of the Smart Cities Marketplace. This group is led by London and has already produced a requirements document for smart city interoperability (urban platform), which is currently being tested. The requirements document is being used by the industry group of the MoU on urban platforms within the Smart Cities Marketplace to create a reference architecture framework and standards landscape. The members of the group are committed to implement commonly agreed open standard urban platforms and foster the deployment of smart city solutions. Two other deliverables of the demand-side group are:

- Leadership Guide: a 'train read' document for city leaders
- Management Framework: helping integrate across the functional silos

BSI has adopted and published the latter two deliverables under the BSI logo.

https://europa.eu/!ugqhnB

OPEN & AGILE SMART CITIES (OASC)

City-led initiative to create a market which addresses the complex needs of smart cities and communities, especially interoperability, portability, replaceability and comparability, in order to avoid vendor lock-in and to support local digital entrepreneurship. OASC maintains a set of technical Minimal Interoperability Mechanisms (MIMs) which are open and free. Launched in March 2015, a current total of more than150 cities in 30 countries, representing 100 million citizens and a combined GDP of 3.5t€, mainly in Europe, have already committed to adopting the OASC principles. OASC promotes standards-based innovation and procurement across application domains, and the MIMs are directly linked to the existing standardisation processes on national, European and international level, including CEN TC465, ISO TC268/JTC1 and ITU-T SG20. OASC also maintains the consolidated Open Standards Library, the Connected Smart Cities (CSCC) Catalogue of standards-based services and suppliers, the SynchroniCity Guide and the OrganiCity Experimentation-as-a-Service model, and operates the OASC Academy for training.

www.oascities.org

SYNCHRONICITY

European IoT Large-Scale Pilot on Smart Cities (part of the 104m€ H2020 IoT-LSP Programme) with 8 core European cities (some are also EIP-SCC-01 Lighthouse Cities), 38 partners in total, a budget of 20m€ (15m€ EC contribution) and a running period of 36 months (2017-19). SynchroniCity aims to establish an open market for IoT-enabled urban services based on the Open & Agile Smart Cities (OASC) Minimal Interoperability Mechanisms (MIMs). The project validates the MIMs as well as other existing and emerging standards through around 20 pilots involving at least two cities, including an open call for new cities and companies to join. SynchroniCity actively builds upon and contributes to initiatives such as EIP-SCC, FIWARE and oneM2M, and both the validation results and new specifications are contributed to the relevant European and global SDOs, such as ETSI and ITU-T. Specifically, SynchroniCity partners are leading and contributing to the ETSI ISG CIM and to the ITU-T SG20 Open API work item and FG-DPM-IOTSCC.

www.synchronicity-iot.eu

LIVING-IN.EU

A bottom-up initiative of major stakeholders such as OASC, Eurocities, ENoLL and EIP SCC supported by the European Commission and the Committee of the Regions to support the roll out of urban platforms and digital services and solutions based on the data provided by the platforms and a European communities data space. The technical group within the initiative, which consists not only of signatory cities but also of stakeholders from major standards developing organisations, industry and others, has developed a consolidated report of standards and specifications for vendor-agnostic interoperable roll out of digital infrastructure and services for smart communities unifying outcomes from the EIP SCC urban platform initiative, the SynchroniCity/OASC MIMs and specifications from standardisation initiatives and bodies such as OneM2M, TM Forum, OGC, etc. The report will be used as technical common ground by the European communities and within the Digital Europe Programme.

FUTURE INTERNET PUBLIC PRIVATE PARTNERSHIP

Specifications and technologies developed under the Future Internet Public Private Partnership programme (FP7) that can be used within the context of smart cities:

FIWARE has developed an open source implementation of the ETSI ISG CIM GS 009 V.1.2.1 NGSI-LD API that provides a lightweight and simple means to gather, publish, query and subscribe to context information. This is an API for context information management. Such information can be indeed open data and/or linked data and consumed through the query and subscription API. It is possible to publish real-time or dynamic data and offer it as open data for the reuse by applications.

FIWARE CKAN: Open data publication generic enabler. FIWARE CKAN is an open source solution for the publication, management and consumption of open data, usually, but not only, through static datasets. FIWARE CKAN allows to catalogue, upload and manage open datasets and data sources, while supports searching, browsing, visualising or accessing open data. FIWARE CKAN is an Open Data publication platform that is used by many cities, public authorities and organisations.

www.fiware.org/

EUROCITIES AND GREEN DIGITAL CHARTER (GDC)

A strategic, city-led initiative aiming to improve cities and citizens' quality of life through the use of open and inclusive digital solutions. GDC is a EUROCITIES initiative launched in 2009 and currently signed by 52 major European cities. It works at the highest level with CEN/CENELEC SF-SSCC, ETSI SDMC, the MoU on urban platforms and OASC.

Apart from GDC, EUROCITIES works with its member-cities for "Data" and "Standards & Interoperability" through the two respective working groups of its Knowledge Society Forum, a networking and collaboration mechanism for more than 70 European cities. http://www.greendigitalcharter.eu

H2020 CITYKEYS

Following the SCC-02-2014 call of H2020, nine partners, among which five cities, developed the first public European framework for the performance measurement of smart cities and smart city projects. A set of around 100 key performance indicators (KPIs) and a framework of open-architecture, interfaces and standards help cities design, select, monitor, evaluate and promote smart city solutions. The smart city KPIs of CITYkeys were used by ETSI SDMC for the creation of TS 103 463, "Key Performance Indicators for Sustainable Digital Multiservice Cities". http://www.citykeys-project.eu/

H2020 SMART CITIES LIGHTHOUSE PROJECTS

Following the directions of the Strategic Implementation Plan of the European Innovation Partnership on Smart Cities and Communities (EIP-SCC), a yearly Horizon2020 Smart Cities call for lighthouse innovation projects has been in place since 2014. The yearly budget is fluctuating, but it is in the ballpark figure of 100 M€/year and the funding of the individual calls is around 25 million per project. There are now 18 lighthouse projects at the moment (see also https://europa.eu/!u6YbvV). Within each project there are two to three leading cities implementing smart city solutions in the areas of energy and transport with the help of digital solutions, and a number of follower and observer cities that replicate the solutions developed for the leading cities. The projects are implementing among other things ICT urban platforms and are working together with their sister project ESPRESSO and the urban platform group within the Smart Cities Marketplace to implement open-standards based interoperable platforms.

https://europa.eu/!ugqhnB

FED4IOT

The Fed4IoT project faces the interoperability issue, focusing on large-scale environments and addressing the problem at different and synergic levels: device, platform and information. The goal of the project is to federate IoT and Cloud infrastructures to provide scalable and interoperable Smart Cities Applications by introducing novel IoT virtualization technologies. https://fed4iot.org/

AIOTI:

AIOTI (Alliance for the Internet of Things innovation) is a member driven alliance which objectives include: fostering experimentation, replication and deployment of IoT, supporting convergence and interoperability of IoT standards, gathering evidence on market obstacles for IoT deployment and mapping and bridging global, EU, and member states' IoT innovation activities. AIOTI welcomes membership input on any and all issues – from internal governance to future work streams.

WG 3: IOT STANDARDISATION

This Working Group identifies and, where appropriate, makes recommendations to address existing IoT standards, analyses gaps in standardisation, and develops strategies and use cases aiming for (1) consolidation of architectural frameworks, reference architectures, and architectural styles in the IoT space, (2) (semantic) interoperability and (3) personal data & personal data protection to the various categories of stakeholders in the IoT space.

WG 8: SMART CITIES

The topic for this Working Group refers to IoT solutions used by a city in order to enhance performance, safety and wellbeing, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens. Key 'smart city' sectors may include transport, energy, healthcare, lighting, water, waste and other city related sectors.

(C.3) ADDITIONAL INFORMATION

There are already many activities going on around smart cities in various standards development organisations around the globe. Industry, therefore, welcomes that the Commission does not see a need to trigger further standards development at this point in time but relies on the industry initiatives which have started in organisations around the globe.

Broad coordination, including stakeholders, Member States, and the Commission, is important for making consistent progress in this area which covers a large field of sub-domains. The Commission supports and encourages the efforts of the International and European SDOs to move towards common standards in the area of Smart Cities within as short timeframes as producing viable results allows.

The Spanish Secretary of State has identified the need to establish certain requirements for city platforms to allow interoperability. This is an opportunity for specific European standardisation work which could be developed by CEN-CENELEC and ETSI.

Spanish national plan on smart cities, with a governance model including an innovative advisory board on smart cities http://www.agendadigital.gob.es/planes-actuaciones/Paginas/plan-nacional-ciudades-inteligentes.aspx

ITU and UNECE "United for smart sustainable cities" (U4SSC) initiative to advocate for public policy to emphasize the importance of ICT in enabling the transition to smart sustainable cities.

3.4.3 ICT ENVIRONMENTAL IMPACT

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

ICT is currently one of the fastest growing greenhouse gas-emitting and energy management sectors.

At the level of ICT, multiple methodologies are available to assess the environmental impact of ICT itself, but they do not provide a consistent methodological framework for this assessment. A solution to this is the work developed in various European and International standardisation bodies such as ETSI, ITU-T, IEC, ISO and others, around methodologies to assess this environmental impact, currently focused on energy management including energy consumption and greenhouse gas (GHG) emissions, with the achievement of good consensus. This work is performed in collaboration with industry, standardisation bodies and public authorities. The criteria for measuring the impact of ICT on the environment will be extended to other environmental sectors, like water and raw materials.

A key challenge is achieving transparency around claims relating to the environmental performance of ICT products and services, and setting an effective basis to drive competition.

The Commission is looking at the environmental impact of ICT from various fronts:

- To analyse further the current situation of the ICT-sector and to consider possible options for future action, the Commission, DG CNECT, commissioned a study on the practical application of the new framework methodology for measuring the environmental impact of ICT (including a cost/benefit analysis for companies) and has organised, among other things, a workshop on policy measures, metrics, and methodologies in the context of environmentally-sound data centres.
- With CNECT playing the chief editor role under ITU-T the "ICT in Cities" methodology to assess the environmental impact of ICT at the city level is now finished (http://www.itu.int/rec/T-REC-L.1440-201510-P)
- With a life cycle approach (or cradle to grave), it provides:
- a basis to help cities take the right decisions as regards their ICT infrastructure and the relevant energy costs/environmental effects;
- a level playing field for industry to compete and innovate in providing the most sustainable solutions to cities.
- DG ENV launched conducted a pilot on product environmental footprint on category rules. It is looking at various ICT products such as IT equipment, uninterruptible power sources (UPS) and batteries. https://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR_en.htm
- DG GROW is looking at an ecodesign measure for enterprise servers that are found among others in data centers at potential ecodesign measures for enterprise servers and data storage devices, products that can be normally found in data centres or in server rooms. The definition of global key performance indicators (KPIs) is essential to this objective.

(A.3) REFERENCES

- COM(2019) 64 The European Green New Deal
- COM/2020/80 Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing the framework for achieving climate neutrality and amending Regulation (European Climate Law)
- First Circular Economy Action Plan
- **Regulation (EU) 2019/424** laying down ecodesign requirements for servers and data storage products pursuant to Directive 2009/125/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 617/2013
- COM(2015) 614: Closing the loop – An EU Action Plan for the Circular Economy
- **COM(2010) 245**: *A Digital Agenda for Europe,* Key Action 12:
- (a) Assess whether the ICT sector has developed common measurement methodologies (b) Propose legal measures if appropriate
- Directive 2005/32/EC on eco-design of products
- Recommendation 2013/105/EC: *Mobilising Information and Communications Technologies to facilitate the transition to an energy-efficient, low-carbon economy*
- **Directive 2012/27/EU** on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC
- Directive 2010/31/EU of the European Parliament and of the Council on Energy Performance of Buildings
- Directive 2010/30/EU on Labelling and Information
- Regulation (EU) No. 347/2013 on guidelines for trans-European energy infrastructure
- **COM(2009) 7604**: *Recommendation (9.10.2009) on mobilising Information and Communication Technologies to facilitate the transition to an energy-efficient, low-carbon economy*
- COM(2009) 519 final: *Investing in the Development of Low Carbon Technologies* (SET Plan)
- COM(2008) 30 final: *20 20 by 2020, Europe's climate change opportunity*
- COM(2008) 241: *Addressing the challenge of energy*

efficiency through Information and Communication Technologies

- **Directive 2003/96/EC** of the Council on Energy Taxation
- **M/462** Standardisation mandate addressed to CEN, CENELEC and ETSI in the field of ICT to enable efficient energy use in fixed and mobile information and communication networks
- **Directive 2009/125/EC** (Ecodesign) plus its Implementing Regulations and Standardisation Requests
- **Regulation (EU) 2017/1369** (Energy Consumption)
- **M/543** Standardisation Request with regard to ecodesign requirements on material efficiency aspects for energy-related products

(B.) REQUESTED ACTIONS

ACTION 1 Definition of Global KPIs for Energy Management of Fixed and Mobile access, and Core networks, as per Mandate M/462.

ACTION 2 Guidelines for the use of Global KPIs for Data Centres as per Mandate M/462.

ACTION 3 Definition of Global KPIs for Data Services as per Mandate M/462.

ACTION 4 Guidelines for the definition of Green Data Services.

ACTION 5 Definition and guidelines of KPIs for ICT networks as per Mandate M/462.

C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

ESOS

Standardisation request M/462 on efficient energy use within broadband deployment was accepted by the ESOs to provide standards for measurement and monitoring, including the definition of energy-efficient KPIs. This standardisation request is not only limited to networks, but extends as well to data centres and other ICT nodes associated with broadband deployment. It is currently in phase 2.

Energy and more general resource management in data centres are addressed by a cross-ESO coordination group (Coordination Group Green Data Centres – CG-GDC). This group monitors European and international standardisation for data centre resource management (including energy) and maintains a live executive summary of that activity.

The CEN-CLC-ETSI CG-GDC encourages and coordinates standardisation activities to support Commission objectives.. Further to a recommendation of the CG-GDC, CENELEC continues to maintain CLC/TR 50600-99-1, which links the DG JRC Best Practice Guidelines for the Code of Conduct for Energy Efficient Data Centres into the EN 50600 series.

CENELEC

CLC/TC 215 is responsible for a holistic series of ENs for the design, operation and resource efficiency of data centres (including KPIs) from a system point of view. This work is undertaken in response to EC Mandate M/462. Several CENELEC Technical Committees are responsible for energy efficient products deployed in data centres.

CLC/TC 111X 'Environment'

CEN/CLC/JTC 10 Energy-related products - Material Efficiency Aspects for Ecodesign

ETSI

ETSI's technical committees for Access, Terminals, Transmission and Multiplexing (TC ATTM), Cable (TC CABLE) and Environmental Engineering (TC EE), collaborate to develop standards in response to EC Mandate M/462 on enabling efficient energy management (efficient use of energy) in fixed and mobile information and communication networks and sites. The resulting standards cover global KPIs for energy management covering ICT sites (e.g. data centres, transmission nodes), mobile broadband access networks, fixed broadband access networks and cable access networks. These global KPIs are to support the deployment of eco-efficient networks and sites and to monitor the energy management of deployed broadband. These new KPIs, which will be used to define green sites and networks for all industrial and commercial users, are outlined in a series of ENs (EN 305 200 Series) based on ETSI's existing KPIs and TSs for energy efficiency in broadband deployment. The KPIs will provide ICT users with tools to monitor the energy management of networks and sites in full compliance with the Kyoto Protocol on climate change and the reduction of greenhouse gas emissions. EN 305 174 Series defines the most efficient engineering of ICT networks and sites in order to support the efficient deployment of these networks and sites. Also available are a range of standards for measurement methods for energy efficiency of fixed and mobile networks.

Recent work includes new ENs for energy efficiency Key Performance Indicators (KPIs) for servers and for Radio Access Network equipment, a focus on evaluating energy efficiency of future 5G networks, and work on multiservice street furniture, outlining processes to improve energy efficiency and to ease the deployment of smart new services in digital multiservice cities. EN 305 174-8 on broadband deployment and lifecycle resource management for the end of life of ICT equipment (efficient waste management) was also finalized. This EN will support future standards on field implementation of ICT waste management.

Furthermore, TC-EE is developing standards for the energy and material efficiency of ICT network equipment and this includes the standard for the implementing Regulations of the eco-design directive 2009/125/EC. In this contest, ETSI has already published the standard EN 303 423 "Environmental Engineering (EE); Electrical and electronic household and office equipment; Measurement of networked standby power consumption of Interconnecting equipment; Harmonised Standard covering the measurement method for EC Regulation 1275/2008 amended by EU Regulation 801/2013"

Based on the response to EC Mandate M/462, TC CABLE is extending

the EN 305 200 series with a set of ENs standardizing an approach to energy efficiency in communication networks based on the assessment of network design and architecture. Taking into account current practices of the stakeholders represented in TC CABLE, this enables efficient design and operation of communications infrastructures end-to-end from the core network to the end user. Furthermore, the Industry Specification Group on NFV (ISG NFV) develops a report (GR NFV-EVE 021) on "green NFV" within the framework of NFV Release 5. The report aims at providing design and runtime operation guidelines for optimizing energy consumption and at identifying standards enhancements to enable NFV management and orchestration to operate according to power saving policies.

ITU AND ETSI

Starting at the level of `good, networks and services´, they have approved methodologies for environmental impact assessment. These will make it possible to assess in a transparent, qualitative, accurate and consistent way the footprint and other aspects of various products and services that are part of everyday digital life, such as email, telephone services, laptops, broadband access. In addition, companies, public bodies and other organisations will be able to assess and report their ICT footprint based on ITU's "ICT in Organisation".

ITU and ETSI have also agreed a new standard to measure the energy efficiency of mobile radio access networks (RANs), the wireless networks that connect end-user equipment to the core network.

The standard (Recommendation ITU-T L.1330) is the first to define energy-efficiency metrics and measurement methods for live RANs, providing a common reference to evaluate their performance. Its application will build uniformity in the methodologies employed by such evaluations, in parallel establishing a common basis for the interpretation of the results.

ITU and ETSI has a close collaboration in the developing on standards related to Energy Efficiency, Data Centres, and circular economy.

some of the international standards developed are listed on this site:

https://www.itu.int/net/ITU-T/lists/standards.aspx?Group=5&Domain=28

ITU

ITU-T SG5 is also developing a series of standards aimed at reducing electronic waste and transitioning to a circular economy (ITU-T L.1015, ITU-T L.1020, ITU-T L.1021, ITU-T L.1030, ITU-T L.1031, ITU-T L.1100, ITU-T L.1101, ITU-T L.1102, , ITU-T L.1022, ITU-T L.1023, ITU-T L.1024, ITU-T L.Suppl.4, ITU-TL.Suppl.5, ITU-T L.Suppl.20, ITU-T L.Suppl.27, ITU-T L.Suppl.28). Moreover, it is working to set the environmental requirements for 5G. There are four key aspects: Electromagnetic compatibility (EMC); Electromagnetic fields (EMF); Energy feeding and efficiency; and Resistibility. A series of standards on this topic have already been developed (ITU-T L.1220, ITU-T L.1221, ITU-T L.1222 , ITU-T K. Suppl.4, ITU-T K. Suppl.8, ITU-T K. Suppl.9, ITU-T K. Suppl.10, ITU-T K.Suppl.14, ITU-T K.Suppl.16, ITU-T K.Suppl.36).

In addition, ITU-T SG5 also develops standards that aim to assess the sustainability impacts of ICTs and adapt ICT infrastructure to the effects of climate change within the framework of the Sustainable Development Goals (SDGs), including Recommendation ITU-T L.1440 - Methodology for environmental impact assessment of information and communication technologies at city level. The European Commission through CNECTH5 acted as chief editor.

ITU-T has developed Recommendations ITU-T L.1371 "A methodology for assessing and scoring the sustainability performance of office buildings, ITU-T L.1470 "Greenhouse gas emissions trajectories for the information and communication technology sector compatible with the UNFCCC Paris Agreement" and ITU-T L.1471 "Guidance and criteria for information and communication technology organisations on setting Net Zero targets and strategies".

Some of the international standards developed by ITU are listed on this site:

https://www.itu.int/net/ITU-T/lists/standards.aspx?Group=5&Domain=28

For more standards developed by SG5 on related topics, see: https://www.itu.int/ITU-T/recommendations/index_sg.aspx?sg=5
More info: https://itu.int/go/tsg5

ITU developed two reports, entitled "Turning digital technology innovation into climate action" and "Frontier technologies to protect the environment & tackle climate change", to highlight the emerging role of ICTs and digital technologies in accelerating climate actions.

ITU-T Focus Group "Environmental efficiency for artificial intelligence and frontier technologies" (FG-AI4EEE) was created in May 2019 to identify the standardisation gaps related to the environmental performance of AI and other emerging technologies including automation, augmented reality, virtual reality, extended reality, smart manufacturing, industry 5.0, cloud/edge computing, nanotechnology, 5G, among others. The focus group develops technical reports and technical specifications to address the environmental efficiency, as well as water and energy consumption of emerging technologies. The focus group has already produced six technical reports and specifications available for download on FG-AI4EE homepage:https://www.itu.int/en/ITU-T/focusgroups/ai4ee/Pages/default.aspx

IEC

IEC TC 111 'Environmental standardisation for electrical and electronic products and systems'

IEC TC23 WG9. This WG is responsible for a holistic view of energy efficiency within the scope of TC23.

ISO/IEC JTC 1

ISO/IEC JTC 1 SC 39 'Sustainability, IT & Data Centres:

- has published International Standard ISO/IEC 21836 for Server Energy Effectiveness Metric (SEEM);
- has published International Standard ISO/IEC 23544 on Application Platform Energy Effectiveness (APEE);
- is working on further data centre KPIs (currently, ISO/IEC 30134-8 on Carbon Usage Effectiveness (CUE) and ISO/IEC 30134-9 on Water Usage Effectiveness (WUE) are in their final development phase)

http://www.iso.org/iso/standards_development/technical_committees/list_of_iso_technical_committees/iso_technical_committee.htm?commid=654019

IEEE

IEEE has standardisation activities that contribute to assessing and reducing the environmental impact of ICT such as the electronic product environmental assessment series, energy efficient Ethernet and a new "Green ICT" series of projects.

https://ieeesa.io/rp-envr

IETF

The Energy Management (EMAN) Working Group has produced several specifications for an energy management framework, for

power/energy monitoring and configuration. See http://datatracker.ietf.org/wg/eman/documents/ for the details. The framework focuses on energy management for IP-based network equipment (routers, switches, PCs, IP cameras, phones and the like).

A recently published standards track specification (RFC7603) presents the applicability of the EMAN information model in a variety of scenarios with cases and target devices. These use cases are useful for identifying requirements for the framework and MIBs. Further, it describes the relationship of the EMAN framework to other relevant energy monitoring standards and architectures.

https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#ICTenvironment

ECMA INTERNATIONAL

ECMA-328 on determination of Chemical Emission Rates from Electronic Equipment and has been adopted by JTC 1 (ISO/IEC 28360). Ecma Technical Committee TC38 identifies and describes the environmental attributes related to ICT and CE (Consumer Electronics) products. TC38-TG1 specifically covers chemical emissions.

ECMA-74, the primary acoustic standard developed by Ecma Technical Committee TC26, defines ITTE and ICT product categories for noise measurements and specifies operating and mounting conditions for each product category. The methods and transition guidelines for the EU Regulation 617/2013 implementing the Energy Related Products (ErP) Directive 2009/125/EC include ECMA-74 and ECMA-109 for acoustic noise and ECMA-383 (EN Journal C110/113 11.04.2014, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:JOC_2014_110_R_0005&from=FR)."

Energy saving measures

CENELEC

Other ongoing work includes EN50523:2009 Household appliances interworking.

ISO

Energy model terminology is specified in:

- ISO/IEC CD 13273 (Energy efficiency and renewable energy sources)
- ISO/DTR 16344 (Common terms, definitions and symbols for the overall energy performance rating and certification of buildings)
- ISO/CD 16346 (Assessment of overall energy performance of buildings)
- ISO/DIS 12655 (Presentation of real energy use of buildings)
- ISO/CD 16343 (Methods for expressing energy performance and for energy certification of buildings)
- ISO 50001:2011 (Energy management systems — Requirements with guidance for use).

ISO/TC 257 General technical rules for determination of energy savings in renovation projects, industrial enterprises and regions` is currently working on a standard on "energy efficiency and savings calculation for countries, regions and cities" (ISO/CD 17742)

ITU-T

Report "Intelligent sustainable buildings for smart sustainable cities", which provides technical guidance on environmentally-conscious design, maintenance, repair and operating principles and best practices from construction through to lifetime use and decommissioning http://www.itu.int/en/ITU-T/focusgroups/ssc/Documents/website/web-fg-ssc-0136-r6-smart-buildings.docx and other reports from the FG-SSC: http://www.itu.int/en/ITU-T/focusgroups/ssc/Pages/default.aspx

Data centers

CEN/CENELEC/ETSI

Coordination Group *Green Data Centres*

CENELEC

CLC/TC 215 'Electrotechnical aspects of telecommunication equipment' continues to revise the EN 50600 series of standards 'Information technology - Data centre facilities and infrastructures'. The 2nd editions of EN 50600-2-1 (on building construction) and EN 50600-2-5 (on security systems) were published in 2021. Furthermore, new KPI standards EN 50600-4-6 (Energy Reuse Factor, ERF) and EN 506004-7 (Cooling Efficiency Ratio, CER) have been published. Currently, the first edition for the „Data Centre Maturity Model for energy management and environmental sustainability" is under formal vote as CLC/TS 50600-5-1. This document uses the recommended practices of CLC/TR 50600-99-1 for energy management (based on JRC's Best Practices document) and CLC/TR 50600-99-2 on environmental sustainability as a means to achieve defined maturity levels. CLC/TC 215 intends to publish additional KPIs standards for water usage effectiveness and carbon usage effectiveness by the end of 2022.

ETSI

TC ATTM has developed Global KPIs for Energy Management of Data Centres.

ETSI's industrial specification group (ISG) operational energy efficiency for users (OEU) gathers ICT users from the whole industry (all sectors, e.g. aircraft factories, banks, insurances, energy providers) and communities (e.g. European metropolises) and issues position papers and referential specifications on global KPIs and implementation sustainable standardisation. These position papers are issued to support the development of needed standards by standardisation technical committees.

ISO/IEC JTC 1

ISO/IEC JTC 1/SC 39 'Sustainability, IT & Data Centres' Working Group 1 deals with resource-efficient data centres, including the following tasks:

- Development of a data centre resource efficiency taxonomy, vocabulary and maturity model
- Development of a holistic suite of metrics and key performance indicators (KPI) for data centres
- Development of guidance for resource efficient data centres
- Development of an energy management system standard specifically tailored for data centres

ISO/IEC JTC 1/SC 39 Working Group 3 deals with the design and operation of sustainable data centre facilities and infrastructures.

https://www.iso.org/committee/654019.html

The ongoing standardisation activities by CEN/CENELEC/ETSI on data centres and other ICT nodes may be referenced in possible future legislation.

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

EUROPEAN COMMISSION

With the support of ICT companies, concluding the piloting of various methodologies for goods, networks, services & organisations. Elements such as compatibility and the workability of different standards have been assessed with a positive outcome regarding these two elements. The results can serve as an example, for ITU & ETSI in their common work to further align their methodologies for "goods, networks and services".

CLUSTER COLLABORATION FP7-SMARTCITIES-2013

Objective ICT-2013.6.2.

Data Centres in an energy-efficient and environmentally friendly Internet define common KPIs and ratios (metrics) and methodology for measuring them, to characterize the energy & environmental & economic behaviour of data centres. They disseminate the results and create a proper bidirectional communication channel between the Commission, the standardisation bodies and the cluster, to facilitate information sharing and to push a relevant shortlist of KPIs.

H2020 CITYKEYS

H2020 support action which coordinates projects in several cities piloting the L.Cities methodology (Recommendation ITU-T L.1440). Results of these pilots may provide feedback to improve the standard. The project piloted the L.Cities methodology (Recommendation ITU-T L.1440) in Tampere and Rotterdam. Results of these pilots can provide feedback to improve the standard.

http://www.citykeys-project.eu/

SEMANCO

For the first time developing a Semantic Energy Information Framework (SEIF) to model the energy-related knowledge planners and decision makers need.

EESEMANTICS

Stakeholder group on Energy Efficient Buildings Data Models. Building on the standards promoted by Building Smart Alliance.

WORKING GROUP ON ENERGY CONSUMPTION

In the area of smart appliances (white goods, HVAC systems, lighting, etc.) a working group has been established bringing together energy consuming and producing products (EupP) manufacturers and stakeholders with the objective of creating a roadmap towards agreed solutions for interoperability. The focus is on communication with smart appliances at the information level in smart homes. The long-term perspective is M2M solutions in the context of IoT.

EUROPEAN COMMISSION (GROW)

The guidebook "*Stimulating industrial innovation in the construction sector through the smart use of ICT: connecting SMEs in digital value chains*" (2012)

- provides a market analysis of the construction industry in terms of the current and foresight integration of ICT and eBusiness solutions and systems;
- develops a framework for digital value networks in the construction sector.

https://ec.europa.eu/growth/sectors/digital-economy/ebsn_en

H2020 ICTFOOTPRINT.EU

This support action is the European platform promoting the adoption of carbon footprint methodologies in the ICT sector. Among other activities, it has mapped all standards related to ICT energy & environmental efficiency (EN, ETSI, IEC, ITU, GHG, etc.).

https://ictfootprint.eu/

JRC

JRC - Best Environmental Management Practice

In Spetember 2020 a document on Best Environmental Management Practice (BEMPs) for the Telecommunications and ICT services sector was published, with references to various standards. https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/best-environmental-management-practice-telecommunications-and-ict-services-sector

EURECA

EURECA project

The "Data Center EURECA project" provides valuable information on "resource efficient procurement" of data centers.

https://www.dceureca.eu/

The impact will strongly depend on the uptake of these methodologies and associated regulation, if defined. Once this point is clarified the progress could be measured in, for instance, the number of companies reporting their footprint calculated using these methodologies.

3.4.4. EUROPEAN ELECTRONIC TOLL SERVICE (EETS)

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The European electronic toll service (EETS), as required by Directive (EU) 2019/520 (recast), repealing Directive 2004/52/EC and Commission Decision 2009/750/EC , is aimed at achieving interoperability of the electronic road toll systems in the EU. EETS involves two main stakeholders:

- Toll chargers, which operate either on behalf of a Member State or in the framework of a concession contract with a Public Authority of a Member State, levy the tolls for the circulation of vehicles on the road network in which they operate.
- EETS providers, supplying drivers or vehicle owners with the necessary equipment and services to access tolled infrastructures in the EU and ensuring the payment to the toll chargers of the fees due for use of their network.

The Directive (EU) 2019/520 of the European Parliament and of the Council of 19 March 2019 on the interoperability of electronic road toll systems and facilitating cross-border exchange of information on the failure to pay road fees in the Union (recast) started to apply on 19 October 2021. The Commission adopted on 28 November 2019 a Delegated and an Implementing Act which will started to apply on the same date as the Directive.

Directive 2004/52/EC and Decision 2009/750/EC were repealed on 20 October 2021.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

It is necessary to further develop standards, and to revise and update existing standards, to define communication between Toll Chargers and EETS providers, to define profiled requirements for interoperable electronic fee collection (EFC), and support the effective assessment of conformity to specifications, certification and suitability for use of EETS-related standards (underpinned by test standards).

(A.3) REFERENCES

- **Directive (EU) 2019/520** of the European Parliament and of the Council of 19 March 2019 on the interoperability of electronic road toll systems and facilitating cross-border exchange of information on the failure to pay road fees in the Union on the interoperability of electronic road toll systems and facilitating cross-border exchange of information on the failure to pay road fees in the Union (recast).
- C/2019/9080
- Commission Implementing Regulation (EU) 2020/204of 28 November 2019 on detailed obligations of European Electronic Toll Service providers, minimum content of the European Electronic Toll Service domain statement, electronic interfaces, requirements for interoperability constituents and repealing Decision 2009/750/EC
- Commission Delegated Regulation (EU) 2020/203of 28 November 2019 on classification of vehicles, obligations of European Electronic Toll Service users, requirements for interoperability constituents and minimum eligibility criteria for notified bodies
- Directive 2004/52/EC of the European Parliament and of the Council on the interoperability of electronic road toll systems in the Community;
- **Commission Decision 2009/750/EC** on the definition of the EETS and its technical elements;
- **COM(2012)474** Implementation of the EETS;
- M/338 Standardisation request to CEN, CENELEC and ETSI in support of interoperability of electronic road toll systems in the EU.
- C(2021)8130 Commission Implementing Decision on a standardisation request to the European Committee Standardisation as regards automatic number plate recognition (ANPR) in support of Directive (EU) 2019/520

(B.) REQUESTED ACTIONS

ACTION 1 Technical support to keep the EETS legislation fit for purpose and, notably, advice on relevant new editions or standards that the legislator ought to consider when updating the Commission Implementing and Delegated Regulations.

ACTION 2 Periodic review and update, when necessary, of technical standards that support the EETS[19]. That includes improvement of technical standards based on feedback from actual implementation in tolling systems and maintaining consistency between these standards.

19 http://ec.europa.eu/growth/tools-databases/mandates/index.cfm?fuseaction=search.detail&id=216

ACTION 3 Support the EC with advice and expertise in technical standards-related activities in the field of the EETS. Support the Notified Bodies Coordination Group in its activities defined in Article 20 of Directive (EU) 2019/520, related to Recommendations for Use (incl. listing of applicable standards). Support the Electronic Toll Committee and the ITS-CG in matters related to technical standards for electronic tolling and the EETS.

ACTION 4 Monitor and support relevant activities and update, when necessary, relevant technical standards to ensure long-term availability of DSRC tolling technology and improve its robustness against other radio technologies. This action also includes relevant support activities in interference and mitigation technique studies to enable sharing between EFC using DSRC and avoid interferences on EFC using DSRC by ITS-G5 and 5 GHz Radio Local Area Network devices, and other services operating in the 5GHz band.

ACTION 5 In accordance with Article 3(2) of Directive (EU) 2019/520, the Commission has requested CEN to revise the existing European standards to include information related to the automatic number plate recognition (ANPR) technology.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN

CEN/TC 278 — standardisation of Intelligent Transport Systems in Europe. CEN/TC 278/WG 1 standardises EFC. An overview of EFC standards and links to the standardised data structures and test suites may be consulted at https://www.itsstandards.eu/25-2/wp-1/

The following CEN EFC standard deliverables are referenced in the Directive (EU) 2019/520 and the associated European Commission Draft Implementing and Delegated Acts:

Dedicated Short-Range Communication (DSRC) charging transactions: EN 15509:2014 and EN 15876-1:2016

Real-time compliance checking transactions: EN ISO 12813:2019 and EN ISO 13143-1:2016

Localisation augmentation: EN ISO 13141:2015 and EN ISO 13140-1:2016

The electronic interfaces for DSRC- and GNSS-based schemes between the toll charger and the EETS provider: CEN/TS 16986:2016/AC:2017

Vehicle classification parameters: EN ISO 14906:2018

The standards mentioned above are periodically maintained, as all standards. The following are newly revised standards of documents, whose previous versions are cited in the recast of the EETS legislation; EN ISO 13143-1:2020 and EN ISO 14906:2018/Amd 1:2020

The following are ongoing or shortly upcoming revisions of relevant standards:

Review of EN 15509:2014 is ongoing

CEN/TS 16986 is being updated and converted into an EN. The CEN Enquiry is expected to be launched early 2022. The corresponding test standard CEN/TS 17154- parts 1 and 2 will be revised once prEN 16986 has been launched for CEN Enquiry.

A CEN preliminary new work item is being proposed entitled *EFC - Pre-study on the use vehicle license plate information and automatic number plate recognition (ANPR) technology*, in response to Directive (EU) 2019/520. It should notably lead to recommendations for extensions or new standards to close identified gaps in this proposed pre-study.

ETSI

ETSI TC ITS standardisation of Intelligent Transport System communication protocols in Europe

http://www.etsi.org/technologies-clusters/technologies/intelligent-transport

ISO

ISO TC 204 standardisation of Intelligent Transport Systems globally. ISO/TC204/WG5 standardises Electronic Fee Collection in close co-operation with CEN/TC278/WG1.

Systematic Review of ISO 12855:2015 – Information exchange between service provision and toll charging.

Revision of ISO 12813:2015 - Compliance check communication for autonomous systems.

(C.2) ADDITIONAL INFORMATION

It is required to further develop standards to support (i) maintenance of existing EFC standards, (ii) assessment and monitoring of key performance indicators for EETS (iii) conformity assessment of implementations to standards, EETS suitability for use and product certification (supported by test standards). It is also necessary to provide support for EFC standardisation activities in form of (iv) targeted technical standards as support for EETS-related activities.

CEN/TC 278 has identified a number of activities that fall within the scope of M/338 and support the further development of EETS. CEN/TC 278 has also identified a potential need for updating the CEN DSRC in order to ensure its continuous suitability and its consistency with the Radio equipment directive.

3.4.5 INTELLIGENT TRANSPORT SYSTEMS - COOPERATIVE, CONNECTED AND AUTOMATED MOBILITY (ITS-CCAM) AND ELECTROMOBILITY

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

Intelligent transport systems apply ICT to the mobility sector. ITS services and applications help to significantly improve road safety, traffic efficiency and comfort, by helping transport users to take the right decisions and adapt to the traffic situation. They also help to increase the number of multimodality options and improve travel and traffic management. contributing to the EU's single market, competitiveness and the Green Deal objectives.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

To take full advantage of the benefits that ICT-based systems and applications can bring to the mobility sector it is necessary to ensure interoperability and continuity of the services among the different systems throughout Europe. The existence of common European standards and technical specifications is paramount to ensure the interoperability of ITS services and applications and to accelerate their introduction and impact. International cooperation aiming at global harmonisation should be pursued.

(A.3) REFERENCES

- Directive (EU) 2019/1161 of the European Parliament and of the Council of 20 June 2019 amending Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles.
- **Directive 2014/94/EU** of the European Parliament and Council on the deployment of alternative fuels infrastructure (AFI).
- COM(2018)283 final: On the road to automated mobility: An EU strategy for mobility of the future
- **COM (2016) 766** A European strategy on Cooperative Intelligent Transport Systems, a milestone towards cooperative, connected and automated mobility.
- **Directive 2010/40/EU** of the European Parliament and of the Council on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport
- Commission Proposal for a Directive amending Directive 2010/40/EU on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport
- **COM(2019) 464 final** Report to the European Parliament and the Council on the implementation of Directive 2010/40/EU.
- **Commission Delegated Regulation (EU) No 305/2013** supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the harmonised provision for an interoperable EU-wide eCall
- **Commission Delegated Regulation (EU) No 885/2013** supplementing ITS Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of information services for safe and secure parking places for trucks and commercial vehicles
- Commission Delegated Regulation (EU) No 886/2013 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to data and procedures for the provision, where possible, of road safety-related minimum universal traffic information free of charge to users
- Commission Delegated Regulation (EU) No 962/2015 supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide real-time traffic information services
- **Commission Delegated Regulation (EU) No 2017/1926** supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the provision of EU-wide multimodal travel information services
- **Commission Implementing Regulation (EU) 2018-732** on a common methodology for alternative fuels unit price comparison in accordance with Directive 2014/94/EU of the European Parliament and of the Council.
- Commission Delegated Regulation (EU) 2019/1745 supplementing and amending Directive 2014/94/EU as

regards recharging points for L-category motor vehicles, shore-electricity supply for inland waterway vessels.

- Commission Implementing Regulation (EU) 2020/858 Amending Commission Implementing Regulation (EU) 2018/732 as regards postponing its date of application
- **SWD(2019) 373 final** Commission Staff Working Document on the analysis of the Member States reports.
- Commission Decision 2008/8455/EC final on the conclusion of an Implementing Arrangement between the European Commission and the Department of Transportation of the United States of America in the field of research on Intelligent Transport Systems and Information and Communication Technologies applications to road transport
- **COM(2008)886 final**: Commission Communication *Action Plan for the deployment of intelligent transport systems in Europe*
- Commission Implementing Decision (EU) 2020/1426 of 7 October 2020 on the harmonised use of radio spectrum in the 5 875-5 935 MHz frequency band for safety-related applications of intelligent transport systems (ITS) and repealing Decision 2008/671/EC (notified under document C(2020) 6773)
- Recommendation C/2006/7125: Safe and efficient in-vehicle information and communication systems: update of the European statement of principles on human machine interface (EsoP).
- COM(2016)787 final**:** Reporting on the monitoring and assessment of advanced vehicle safety features, their cost effectiveness and feasibility for the review of the regulations on general vehicle safety and on the protection of pedestrians and other vulnerable road users
- RSCOM17-26 rev.3 : Standardisation Request to CEPT to study the extension of the Intelligent Transport Systems (ITS) safety-related band at 5.9 GHz
- Standardisation mandate **M/453** addressed to CEN, CENELEC and ETSI in the field of information and communication technologies to support the interoperability of co-operative systems for intelligent transport in the European community.
- Standardisation Request M/546**:** Commission Implementing Decision of 12.2.2016 on a standardisation request to the European standardisation organisations as regards Intelligent Transport Systems (ITS) in urban areas in support of Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport.
- Standardisaion request M/533 - Commission Implementing Decision of 12/03/2015 on a standardisation request addressed to the European standardisation organisations, in accordance with Regulation (EU) No 1025/2012 of the European Parliament and of the Council, to draft European standards for alternative fuels infrastructure.

(B.) REQUESTED ACTIONS

(B.1) GENERAL ACTIONS

ACTION 1.1 Work to organise and lay down governance principles to enable the development of a coherent set of domain ontologies (to enable re-use and extension, instead of replication, or even worse: different models) for datasets within scope of the delegated regulation and directly adjoining ones based on the linked data principles.

ACTION 1.2 Building on the work of the DATEX II PSA and foreseen work of NAPCORE, undertake actions to revise DATEX II standards to support a wider range and approaches to publishing data.

B.2 COOPERATIVE, CONNECTED AND AUTOMATED MOBILITY (CCAM)

ITS to support the development of cooperative, connected and automated mobility. ITS services in general, and C-ITS (cooperative ITS) services in particular, along with the introduction of driving automation functionalities in vehicles are generally seen as converging paths: vehicles being connected to the mobility ecosystem in their immediate vicinity (other vehicles, infrastructure) and to the wider mobility ecosystem (central traffic management systems, other modes of transport, etc.), and to the internet.

As stated in the GEAR 2030 report1, vehicle-to-everything (V2X) connectivity should act as an additional enabler for the operation of highly and fully automated vehicles that will hit EU roads by 2030. Connectivity and cooperation can add collective intelligence and action to automation, thus improving the overall efficiency of transport flows, including in an intermodal perspective. For some functionalities and operations, it will even be essential.

ACTION 2.1 To complete the minimum set of standards required for the interoperable deployment of CCAM services based on V2X communication, connecting all road users and infrastructure, including vulnerable road users (VRU), and ensuring the overarching principles set out in the ITS Directive, in particular by: - achieving the Release 2 of ETSI TC ITS and CEN/CENELEC C-ITS standards; - updating the Release 1 of the ETSI TC ITS and CEN/CENELEC C-ITS standards taking into account the feedback from pilots and early deployments.

ACTION 2.2 Plugtest activities for conformity and interoperability testing, including guidelines with methods for assessing the conformity of the identified minimum set of standards.

ACTION 3 SDOs are invited to develop and perform an in-depth scrutiny of CCAM services from the standardisation standpoint, taking into account existing architectures, current standards and technical specifications. The analysis should identify missing complementary standards and identify possibly conflicting standards with the overarching objective of delivering full application and service interoperability. The analysis should be based on currently implemented technologies (notably those recognised by 17 Member States and other countries within the C-Roads platform, and subject to automotive deployment in line with COM (2016) 766) while also considering newly emerging technologies (in line with the 5G Action Plan) and build upon the principles and results of the RSCOM Mandate to CEPT (RSCOM17-26 rev.3) with the aim at achieving interoperability between various services.

ACTION 4 To support the implementation of a pan-European usable trust policy and processes to support multi-stakeholder business cases, SDOs should address the following misbehaviour detection and revocation of trust for ITS-Ss stations including requirements definition, standardisation of the data transmitted to the misbehaviour detection decision nodes and format of the certificate revocation list (CRL).

In particular SDO should address the following areas: 1) misbehaviour detection and revocation of trust for C-ITS stations including requirements definition, standardisation of the data transmitted to the misbehaviour detection decision nodes, format of the certificate revocation list (CRL) or other revocation protocols that might satisfy the objectives of scalability, security and interoperability. Some research projects have developed revocation techniques which will allow to revoke the enrollment certificates or there might be other response or recovery solutions e.g. to enable a "self-revocation" by the misbehaving ITS-S to cancel or block the preloaded AT keys stored in its secure HW or via a configuration management protocol (SW updates in compliance with UN R156 regulation). . 2) Standards for protocols and profiles for enrolment credential requests or authorisation ticket requests are also a priority starting from the recently updated definitions of these protocols in the ETSI TS 102 941; EN.ISO TS 21177; EN.ISO TS 21184; EN.ISO TS 21185; EN.ISO TR 21186.

ACTION 5 To continue international cooperation in the field of ITS-CCAM standardisation, in particular with the USA and Japan, but also with other regions, including participation of the relevant SDOs.

OPEN IN-VEHICLE PLATFORM ARCHITECTURE AND HMI

The development, operation and user acceptance of vehicle-based intelligent transport systems and services will benefit from an agreed open in-vehicle platform architecture enabling a 'single platform —multiple services' approach and ensuring interoperability/interconnection with legacy in-vehicle communication networks (e.g. CAN-bus) and (generic) infrastructure systems and facilities.

The issue so far has been addressed in a fragmented way, providing building blocks (e.g. the research projects CVIS, GST, OVERSEE, the eSafety working group on SOA and the recommendations of the EeIP Task Force OPEN, and the ITS study) but an overall logical and cost-effective synthesis seems to be lacking. C-ITS standards should also be taken into account. A study launched under the ITS Action plan (action 4.1) focused on synergies among legal provisions and obligations for heavy goods vehicles (HGV).

Currently, significant efforts are to be made on the messages and information within different platforms and how it will be displayed in the vehicle.

Working group 6 ("Access to in-vehicle data and resources") of the C-ITS Platform identified 3 possible technical solutions (on-board application platform, in-vehicle interface, data server platform) for accessing and sharing in-vehicle data. The following related standardisation needs have been identified:

ACTION 6 SDOs to continue developing standards for an advanced physical/electrical/logical interface (e.g. evolution of OBD2), including the necessary minimum level of security (i.e. integrity, authentication and availability) and the minimum data sets and standardised data protocols which enable ITS services, taking also into account, if appropriate, the existing ISO standard for access to in-vehicle data under the concept of Extended Vehicle (ISO 20077-1:2016). This would include aspects on information via HMI or any other device regarding traffic related safety information.

ELECTRIC VEHICLES (EVS)

Following the development of the electric vehicle market, new elements must be included in the deployment of the e-mobility infrastructure to facilitate the market uptake of EVs. The infrastructure must be fully integrated into the electricity system, allowing for smart charging and bidirectional V2G services within a smart electricity system. New actors such as e-mobility service providers (EMSPs) and e-roaming platforms are developing a relevant market. Such service providers need fair market access, which in turn requires interoperability also in terms of charging infrastructure, e.g. when it comes to payments.

ACTION 7 ESOs to consider the development of the needed standards in support of the proposal for Alternative Fuels Infrastructure (AFI) Regulation.

To support the development of standards for alternative fuels, DG MOVE is in the process of launching a standardisation request which includes the development of European standards considering the following communication domains:

- In the EV Charging ecosystem:
- EV-CP
- CP-CPO
- back-end (management system)
- CPO-e-Roaming platform-EMS
- Grid interface (link with the energy system, i.e., distribution and transmission system operators)
- European standard containing technical specifications with a unified solution on a supply connector for recharging heavy duty vehicles (DC charging)
- European standard containing technical specifications with a unified solution for wireless recharging for passenger cars and light duty vehicles
- European standard containing technical specifications with a unified solution for wireless recharging for electric buses
- European standard containing technical specifications with a unified solution on inductive static wireless recharging for heavy duty vehicles
- European standard containing technical specifications on electric road systems (ERS) with a unified solution for inductive dynamic wireless recharging for passenger cars, light and heavy duty vehicles
- European standard containing technical specifications on electric road systems (ERS) with a unified solution for dynamic overhead power supply via a pantograph, for heavy duty vehicles
- European standard containing technical specifications on electric road systems (ERS) with a unified solution for dynamic ground level power supply through conductive rails for passenger cars, light duty vehicles and heavy duty vehicles
- European standard containing technical specifications with a unified solution for battery swapping for heavy duty vehicles
- European standard containing technical specifications with a unified solution for battery swapping for L category vehicles

These standards shall comply with the following requirements:

All standards must support an open market development. They must create a level playing field between all market actors and allow for fair competition between them, without inhibiting any risk of favouring one or more market actors. The future standards should converge current open protocols in the market (such as OCPP - Open Charge Point Protocol or OCPI - Open Charge Protocol Interface), aiming to achieve a simplification of the communication domain.

All standards must take into account and, insofar as possible and useful, build upon, standards developed at international level (e.g. ISO/IEC), taking account of market support (use and acceptance by market parties) and maturity (can be implemented quickly while requiring only limited changes to existing systems)

All communication standards must include a specific part related to cybersecurity, ensuring the adequately level of security for e-mobility IT infrastructure.

ACTION 8 SDOs to consider the development of standards on data collection of recharging/refuelling points for alternative fuels, taking into account the results of the PSA IDACS.

The Programme Support Action (PSA) for Alternative Fuels Infrastructure (AFI) in the framework of the Connecting Europe Facility (CEF) so-called IDACS (Data collection related to recharging/refuelling points for alternative fuels and the unique identification codes related to e-Mobility actors) has two main objectives:

- Develop an approach to set up e-mobility Identification codes (thereafter the e-mobility ID codes) for Charging Point Operators and EMSPs and collect the codes already in use. During the programme it will be agreed an approach to implement "a common ID registration repository" for exchanging information on these e-mobility ID codes across the Member States and for cross-referencing the assignment of new unique ID codes.
- Ensure that data (static and dynamic) of infrastructure for electricity and hydrogen are made available through the National Access Points, which are defined

in the Directive 2010/40/EU on Intelligent Transport Systems (ITS Directive) and the Commission Delegated Regulations in the format specified therein. Optionally, gather missing data for compressed natural gas (CNG), liquefied natural gas (LNG), liquefied petroleum gas (LPG) and high blended bio fuels and ensure that all data are made available through the National Access Points, which are defined in the Directive 2010/40/EU on Intelligent Transport Systems and the Commission Delegated Regulations in the format specified therein.

This PSA is being implemented by 15 Member States and has already agreed a format to set up e-mobility ID codes for CPOs and EMSPs. In this regard, the SDOs should work in the adoption of the format agreed in a standard. Discussion has been established on this aspect in the WP related to ISO 15118. The correct alingment must be ensured.

It is important to remark that the associated standardisation activity is fundamental in order to give certainty and support a structured market development of an EU-wide approach for the assignments of ID codes to e-mobility actors of alternative fuels and better information about the location/availability of the infrastructure. This will also contribute to digital maps and location features.

Finally, in terms of access to battery data, ESOs are requested to carry out standardisation work on the determination of State of Health (SoH) and State of Charge (SoC) for batteries for EVs. The determination of this parameters should cover both calculation associated to the period of functioning of the vehicle as well as end of life of batteries.

DIGITAL MAPS & LOCATION FEATURES:

It may be relevant to many services and applications to make use of a high precision location reference beyond current global navigation satellite systems aiming at enabling more effective and advanced services. To achieve this, all functional and technical methods need to be used (e.g. crowd sourcing, high precision objects and radio communications).

ACTION 9 SDOs to standardise data and communication aspects to ensure interoperable implementation and data sharing system for increased location accuracy.

Digital maps:

ACTION 10 SDOs to develop standards / specifications to steer and manage the exchange of accurate (public) road data in navigation-oriented maps, and of the timely integration of such updates in ITS digital maps for navigation and more advanced in-vehicle applications, including ITS applications for CCAM services and automated driving support, and for non-vehicle ITS applications. As far as possible, it will be significant to address the largest alignment with the technical framework for infrastructure for spatial information in the European community (INSPIRE).

Digital local dynamic maps:

ACTION 11 SDOs to extend the local dynamic map standards to integrate mechanisms supporting the use of high precision positioning and related objects, in particular for some relevant safety related applications. This may require additional specific object definition standardisation.

(URBAN) ITS - MULTIMODAL SERVICES

Standardisation request on urban ITS M/546 (Commission Implementing Decision of 12/2/2016)

A pre-study on Urban ITS was carried out by CEN/TC 2782 to identify further standardisation needs. It identified several actions, which were used as input to the EC Standardisation request M546:

ACTION 12 As possible further activities in relation to standardisation work on Urban ITS, the Commission will also discuss the following aspects with the ESOs and stakeholders:

The requested European standards and European standard deliverables should reuse, harmonise or interface as far as possible with existing standards, specifications (incl. priority actions A and B within the ITS Directive) and projects (CIVITAS, POSSE and smart cities projects etc.). In the domain of public transport, and particularly with respect to multimodal information and smart ticketing, the need for consistency will affect a broad set of standards and technical specifications, namely:

- Transmodel the European Public Transport Reference Data Model (EN 12896);
- SIRI (System Interface for Real-time Information EN 15531 1-4 & CEN TS 15531-5), largely based on Transmodel: defines standard exchanges of real- time public transport information and being extended to include new mobility services (sharing, pooling, rental and taxis);
- NeTEx (Network and Timetable Exchange, CEN TS 16614 1-3), based on Transmodel parts 1,2,3 and 5: defines a physical data model and standard exchanges

of planned public transport information and being extended to include new mobility services (sharing, pooling, rental and taxis);

- Standards supporting the emerging interoperable fare management (IFM) systems: Public Transport interoperability (IOPTA) standard ISO EN 15320, currently under revision, defining the functional system architecture and the application scenarios; the EN 1545 standard describing the data elements and the ISO EN 24014-1 standard, currently under revision, defining functional system architecture and the application scenarios.
- OpRa (Operating Raw data and statistics exchange): supports the identification of Public Transport raw data to be exchanged, gathered and stored in order to support the study and control phase of Public Transport Service and to enable Quality of Service evaluation. The work is compliant with Transmodel.

Necessary actions, in particular to fully satisfy the requirements of the Delegated Regulation EU 2017/1926 (priority action A): Public Transport:

ACTION 12 A continue defining data exchange formats and publication services related to OpRa in compliance with Transmodel and NeTEx.

ACTION 12 B continue developing NeTEx and SIRI European minimum profiles in order to support the requirements of the priority action A.

ACTION 12 C continue developing data models for alternative fuels infrastructure, including the emerging needs concerning the communication of recharging stations with the grid. Concretely, new data models should cover the exchange of information regarding price, demand response, load control, metering and capacity forecast The work shall be in coherence with existing standards, Transmodel/ NeTEx/SIRI/ DATEX II – CEN/prTS 16157-10 and -12

Link Road Transport / Public transport

ACTION 12 D to complete the infrastructure data model/data exchange format for the entire cycle network (i.e. entire cycling network and of roads in which cycles are allowed together with other vehicles or are forbidden) together with detailed cycle network attributes (e.g. surface quality, side-by-side cycling, etc) and the entire pedestrian network with accessibility features. The work shall take into account the existing results of INSPIRE. It shall also consider the achievements of the GDF standard and possibility of Open Street Map and shall be linked to Transmodel/NeTEx (in particular to trip/route representation).

ACTION 12 E to develop clear interoperability between key data modelling concepts for the parking domain, bringing alignment between existing standards (Transmodel/NeTEx, DATEX II and ISO/prTS 5206-1).

ACTION 12 F to develop the data model/data exchange format of the overall typology of Points of Interest to support the requirements of priority Action A.

ACTION 12 G to develop clear interoperability between Transmodel/NeTEx service network and the INSPIRE infrastructure network in order to respond properly to the provisions of priority Action A.

ACTION 13 SDOs, to consider, in cooperation with the Commission and relevant stakeholders, possible further actions addressing the following aspects:

To develop a glossary of terms with their definitions in the contextof ITS, based as far as possible on the Public Transport Reference Data Model (Transmodel)

To provide standardized means to define the content and applicability of traffic regulations and to provide standardized means to exchange Traffic Regulations robustly and securely between interested parties (METR). It is also necessary to provide mechanisms to support verification of content for Electronic Traffic Regulations.

To provide standards to manage operations and enforcement in controlled traffic zones.

To consider standards to manage services that impact or part of urban transport, e.g. management of road gritters, road maintenance operations, buses, waste collection, social service visits, etc. ITS technologies can be used to assist administrations to manage such services.

With respect to Mobility platforms, including Mobility as a Service (MaaS), SDOs to provide further deliverables, in coherence and coordination with sectorial standards developed, related to the specification of “sales with and without reservation, fulfilment, after sales and payments”.

To deliver interface specifications for roadside sensors to roadside controllers.

To integrate app based new mobility services and vulnerable road users into the overall traffic planning by providing Standardised APIs for smartphone data collection and distribution.

ACTION 14 SDOs to develop standards supporting the emerging IFM, taking into account the findings from the smart ticketing alliance. This should include the development of:

technical specifications and test procedures for the quality assurance of the interoperable fare medium;

technical specifications and standards for profiles of information exchange between the operational entities in IFM; and

a technical report for a security architecture framework.

DATA EXCHANGE AND REUSE

Action 15: Further development of the DATEX II standard taking into account input from road operators. The Programme Support Action (PSA) for Intelligent Transport Services for Road (ITS) in the framework of the Connecting Europe Facility (CEF) focused on the maintenance and further development of DATEX II for the provision of interoperable intelligent transport systems and services for road transport, in compliance with European specifications developed under the ITS Directive. Additional developments include the Systematic Reviews and revisions of Parts 8 and 9 of CEN 16157, adaptation and extensions to support additional datasets and provisioning of support for Linked (open) Data. Developments include the standardisation of developments made by the DATEX II PSA supporting the use of alternative encoding protocols (JSON, ASN.1)

Action 16: European standardisation deliverables on reference data models, common data dictionaries and metadata structure across the three domains and specific European standards:

Multimodal information services: new mobility services, alternative fuels infrastructure;

Traffic management: static/dynamic road data, traffic and traffic control data, weather data and traffic prioritisation and access regulations; and

Urban logistics: intelligent parking for light vehicles/commercial vehicles/trucks and loading bays information and reservation services for special freight vehicles and logistic sectors

ACTION 17 Take action to improve harmonization between existing standards, most notably TN ITS (CEN/TS 17268) and DATEX II (CEN 16157 series), especially in relation to the carrying of information concerning road traffic regulations, taking into account European activities in this field (e.g. TN-ITS GO and NAPCORE sub-activity 4.1 DATEXII) and European specifications developed under the ITS Directive.

Action 18: Another issue is related to on board weighing systems for trucks, where different providers may equip the tractor and the trailers that it will tow. ESOs should develop an interface standard between the different suppliers to ensure that the on board weighing computer in the tractor will be able to receive the weights per axle of any trailer, store them, secure them, and then calculate the total weight of the vehicle. This standard could be based on cooperative intelligent transport systems (C-ITS).

ACTION 19 SDOs to consider standardisation activities in support of EU-wide data privacy policies (e.g. GDPR) in the area of ITS-CCAM, in compliance with European regulation and recommendations.

ACTION 20 building on the collaboration between the DATEX PSA and the Alliance for Parking Data Standards, finalise the revision of the DATEX II on parking data publication standard (CEN/TS 16157-6) and address the necessary harmonisation with Transmodel/NeTEx.

ACTION 21 continue actions to specify global common standards for the exchange of traffic management and road-related data, noting the collaboration between the DATEX PSA/NapCore, CEN/TC278/WG8 and ISO/TC204/WG9. This includes developments to support API specification.

ACTION 22 Provisioning of messaging structures and content complementary to the DATEX II standard (CEN 16157 series) to provide information about energy related infrastructure together with dynamic information on its availability (for example of electric charging station slots) is essential for vehicle drivers to determine their optimal routes and stops. This work will also take into account new forms of vehicles

SECURITY in the context of C-ITS

ACTION 23 SDOs to investigate security aspects of co-operative, connected and Automated Mobility (CCAM) and intelligent transportation systems. SDOs are invited to analyse the evolution of C-ITS 'Day1' standards from a security angle to support automated vehicles design and deployment. In particular, SDOs are invited to expand standards based on the already defined C-ITS security mechanisms to achieve appropriate levels of authenticity and integrity of messages being exchanged between fixed and mobile C-ITS stations for higher levels of automation use cases. Standards shall provide suitable mechanisms to support C-ITS services going beyond information services, building upon the C-ITS certificate & security policy published on the European C-ITS Point of Contact4 for the implementation of the EU C-ITS security credential management system according to COM (2016) 766 and COM(2018)283.

In addition, to perform a mapping and the respective gap analysis in the context and the respective work of the foreseen ISA/SAE 21434 standard and the upcoming UNECE Regulations on Cybersecurity and OTA updates. The purpose will be to identify the way-forward in concrete terms and in regards with the elements missing for a comprehensive coverage of Cybersecurity issues in the CCAM ecosystem. In the scope of this action should be included relevant policy-driven initiatives like the new ENISA study on the security of Smart Cars and V2X communications.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN, ISO, ETSI

CEN/CENELEC and ETSI have been working together on a basic set of standards for Cooperative Intelligence Transport Systems (C-ITS) since 2014 on the so-called 'Release 1 specifications'. Work is currently underway in both CEN/CENELEC and ETSI to develop the next package of standards (Release 2).

CEN/TC 278 www.itsstandards.eu with ISO TC 204 and ETSI TC ITS [3]. Cooperation is also ensured through the ITS Standardisation Coordination Group (ITS-CG)

Release 1 has been finalised — see ETSI TC ITS technical report TR 101 067 with the Release 1 standards and the development of ISO TR 17465-3 with the CEN/ISO Release 1 list. A joint document listing Release 1 standards also includes relevant standards from other SDOs such as SAE and IEEE. Development of Release 2 is well advanced with all of the key documents in revision.

The progress of 3GPP and LTE V2X is also relevant, noting the impending completion of Release 14, given that this access technology may also serve C-ITS purposes. The co-existence of technologies from 3GPP with those from ITS is being actively addressed in collaboration between ETSI and 3GPP SA6 in the context of the ETSI TVRA revision and updates in all of the ETSI TC ITS WG5 security documents.

ISO

ISO TC22 & ISO TC204 (CEN/TC278 WG16 & TC 301), SAE: In-vehicle Platform.

HLC & JWG between TC204 and TC22 discussing how to continue activities.

SAE looks at electrical connections related activities.

ETSI, CEN, ISO, SAE, IEEE Evaluation of the application of existing standards is an ongoing activity.

Harmonisation task groups (HTGs) are looking into harmonisation needs between the standards developed by the different organisations.

CEN, ETSI

CEN and ETSI are working, in consultation with main stakeholders (such as ASECAP and C2C CC), to find an appropriate solution to ensure non-detrimental interference from ITS-G5 and 3GPP-based direct communication systems onto CEN DSRC technology at 5.8 GHz.

See also CEN/TR 16690 on Electronic fee collection — Guidelines for EFC applications based on in-vehicle ITS stations

CEN

CEN/TC 278 develop standards in the field of telematics to be applied to road traffic and transport, including those elements that need technical harmonization for intermodal operation in the case of other means of transport. It shall support: vehicle, container, swap body and goods wagon identification; communication between vehicles and road infrastructure; communication between vehicles; vehicle man machine interfacing as far as telematics is concerned; traffic and parking management; user fee collection; public transport management; user information.

CEN/TC278/WG8: DATEX data exchange standards. DATEX II is a standardised e-language for traffic and travel data exchange between traffic control centres, traffic information centres and service providers. Further standardisation activities address new domains like energy infrastructure and traffic regulations, in particular for Urban Vehicle Access Regulations.

CEN/TC 278 WG17 has been created specifically to address standardisation requirements for Urban ITS, initially focussing on the priority areas identified in M/546 but not limited only to these aspects. WG17 is not only a standards development group, but provides a cross cutting workspace to liaise with other SDOs.

ETSI

ETSI TC ITS have made separation between access layers (potentially with examples ETSI ITS-G5, 3GPP LTE-V2X PC5 etc.) and upper layer protocols. Considering the continues improvements of access technologies, e.g. LTE-V2X PC5, NR-V2X PC5, IEEE 802.110p and IEEE 802.11bd It is important that this independence is maintained in future standardisation.

More in details, since edge computing is a key priority area for V2X services, ETSI ISG MEC (Multi-access Edge Computing) has established a collaboration with 5GAA (5G Automotive Association). Recently 5GAA also joined ETSI ISG MEC membership.

ETSI, IEEE

ETSI, in close collaboration with IEEE (for 1609.2 and 1609.2.1), maintain development of protocols for ITS Security. In 2021 the

primary developments for C-ITS Release-2 Security have been completed and extensions to address misbehaviour reporting (TS 103 759), as well as developing a wider understanding of the risk environment are at the forefront of the security workplan. This includes extension of risk analysis to address the roles and risks from RSUs, Central ITS authorities, data on vehicles and remote access to that data, and to more fully address any security requirements arising from integration of multiple radio connectivity options (LTE/5G-V2X, ITS-G5/DSRC, others).

ISO/IEC JTC1

SC 37 is responsible for the standardisation of generic biometric technologies pertaining to human beings to support interoperability and data interchange among applications and systems. Generic human biometric standards include: common file frameworks, biometric application programming interfaces, biometric data interchange formats, related biometric profiles and other standards in support of technical implementation of biometric systems, evaluation criteria to biometric technologies, methodologies for performance testing and reporting, cross jurisdictional and societal aspects of biometric implementation. SC 37 Biometrics home page: http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/jtc1_home/jtc1_sc37_home.htm . The complete list of standards published or under development can be found in ISO Standards Catalogue of ISO/IEC JTC 1/SC 37 — Biometrics.

Published standards and ongoing projects related to the topics include the series of biometric data interchange standards for different biometric modalities, biometric technical interfaces, related biometric profiles and other standards in support of technical implementation of biometric systems, and cross jurisdictional and societal aspects of biometric implementation. Representative projects: amendments of ISO/IEC 19794-x: 2011/Amd. 2:2015 data format standards specifying XML encoding, extensible biometric data interchange formats ISO/IEC 39794-x (e.g. generic extensible data interchange formats for the representation of data: a tagged binary data format based on an extensible specification in ASN.1 and a textual data format based on an XML schema definition (both capable of holding the same information), ISO/IEC 30107-x Biometric presentation attack detection multi-part standard and ISO/IEC 24779-x — Cross-Jurisdictional and societal aspects of implementation of biometric technologies — Pictograms, Icons and Symbols for use with Biometric Systems multi-part standard.

Standards developed and in development in support of e-mobility include:

- ISO 15118 Road vehicles - Vehicle to grid communication interface
- IEC 62840 Electric vehicle battery swap system
- IEC 61851 Electrical systems for electric road vehicles and electric industrial trucks
- IEC 62196 Plugs, socket-outlets, vehicle connectors and vehicle inlets - Conductive charging of electric vehicle
- IEC 63110 Protocol for the management of EVs charging and discharging infrastructures
- IEC 63119 Information exchange for electric vehicle charging roaming service
- IEC 61850 Exchange of information with distributed energy resources

WGs/technical committees relating to the above e-mobility standards include:

- IEC TC 69 (Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks)
- IEC TC18
- IEC TC 23 and SC 23H

ITU

ITU has various standardisation activities in the area of ITS communications.

ITU-R:

- ITU-R Working Party (WP) 5A is responsible for ITS studies in the Radiocommunication Sector and contributed to the World Radiocommunication Conference (WRC-19) on AI 1.12 "to consider possible global or regional harmonized frequency bands"(Resolution 237 (WRC-15)). See WRC-19 final acts: https://www.itu.int/en/ITU-R/conferences/wrc/2019/Pages/default.aspx
- Approved various Recommendations including "Harmonization of frequency bands for Intelligent Transport Systems in the mobile service" (ITU-R M.2121); "Radio interface standards of vehicle-to-vehicle and vehicle-to-infrastructure two-way communications for ITS applications" (ITU-R M.2084); "Systems characteristics of automotive radars operating in the frequency band 76-81 GHz for ITS applications"(ITUR M.2057); "Operational radiocommunication objectives and requirements for advanced ITS" (ITU-R M.1890); "ITS - Dedicated short range communications at 5.8 GHz"(ITU-R M.1453); "Millimetre wave vehicular collision avoidance radars and radiocommunication systems for ITS applications" (ITUR M.1452)
- Also approved several Reports including "Advanced ITS Radiocommunications" (ITU-R M.2228), "Intelligent transport systems (ITS) usage" (ITU-R M.2445) and "Examples of arrangements for ITS deployments under the mobile service" (ITU-R M.2444).
- A new Question ITU-R 261/5 on "Radiocommunication requirements for connected automated vehicles (CAV)" was approved.
- Further work and studies on ITS and CAV are being carried out by ITU-R WP 5A.
- ITU-R WP 5D is in charge of the studies related to the International Mobile Telecommunication (IMT) systems. IMT-2020 systems provide various specific applications to facilitate development of the digital economy, e.g., e-manufacturing, eagriculture, e-health, intelligent transport systems, smart city and traffic control, etc., which could bring requirements beyond current capabilities of IMT systems. In this respect, ITU-R WP 5D has also carried out several studies that are of relevance for the improvement of Intelligent Transport Systems. This includes the revision of Recommendation ITU-R M.1036 on "Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations" and also of Recommendation ITU-R M.2150 "Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2020 (IMT-2020)".
- ITU-R WP 5D is currently undertaking studies towards a new ITU-R Report on the use of the use of the Terrestrial Component of IMT for Cellular-Vehicle-to-Everything Application. It is expected that this work will be completed at the end of 2021.

ITU-T SG16 approved Recommendations ITU-T F.749.2 "Service requirements for vehicle gateway platforms", ITU-T H.550 "Architecture and functional entities of Vehicle Gateway Platforms" ITU-T F.749.3 "Use cases and requirements for the vehicular multimedia networks" ITU-T H.560 "Communications interface between external applications and a Vehicle Gateway Platform", and ITU-T F.749.4 "Use cases and requirements for multimedia communication enabled vehicle systems using artificial intelligence". Studies on

taxonomy of automated driving (F.AUTO-TAX), gap analysis of vehicle gateways (HSTP-VG-Gap) and requirements for vehicle recognition application in visual surveillance system (F.VRVS) are continuing. https://www.itu.int/itu-t/workprog/wp_search.aspx?sg=16

The Focus Group on Vehicular Multimedia (FG-VM) analyzes and identifies the gaps in the vehicular multimedia standardisation landscape and studies vehicular multimedia use cases, requirements, applications, interfaces, protocols, architectures, and security issues. See the completed Technical Reports at: https://itu.int/go/fgvm

The ITU-T Focus Group on AI for Autonomous and Assisted Driving (FG-AI4AD) aims to develop a definition of minimal performance threshold for AI systems that are responsible for the driving tasks in vehicles, so that an automated vehicle always operates safely on the road, at least as a competent and careful human driver.

More info: https://itu.int/go/fgai4ad

The ITU is also actively involved in **"AI for road safety"**, in collaboration with the UN Secretary-General's Special Envoy for Road Safety and the UN Envoy on Technology, as well as other UN sister agencies The focus of **"AI for Road Safety"** will be to harness the value of AI in enhancing the safe system approach to road safety, especially in low- and middle- income countries, where most of the road fatalities and injuries occur. We will explore the role of AI in the following areas: road safety data and regulatory frameworks; safer vehicles; road infrastructure; and post-crash response

- See "AI4Road Safety - launch event":https://aiforgood.itu.int/event/ai-for-road-safety/
- See new initiative on "AI for Road Safety": https://aiforgood.itu.int/about/ai-ml-pre-standardisation/ai4roadsafety/

ITU-T SG13 approved Recommendation ITU-T Y.4407/Y.2281 "Framework of networked vehicle services and applications using NGN" and is working on QoS requirements for train communication network supported by IMT-2020 (Y.IMT2020-qos-req-tcn) as well as on deployment of data platform for ITS in developing countries (Supp-Y.TDP-Gen). https://www.itu.int/itu-t/workprog/wp_search.aspx?sg=13

ITU-T SG5 is working on effects of ICT enabled autonomy on vehicles longevity and waste creation (L.AUVE). https://www.itu.int/itu-t/workprog/wp_search.aspx?sg=05

ITU-T SG20 approved Recommendation ITU-T Y.4211 "Accessibility requirements for smart public transportation services". ITU-T SG20 is working on draft Recommendation ITU-T Y.4809 (Y.IoT-ITS-ID) "Unified IoT Identifiers for intelligent transport systems" and draft Recommendation ITU-T Y.dt-ITS "Requirements and capability framework of digital twin for intelligent transport system".

More info: https://itu.int/go/tsg20

ITU-T SG17 works on ITS security. It has approved Recommendations ITU-T X.1371 "Security threats to connected vehicles", ITU-T X.1372 "Security guidelines for Vehicle-to-Everything (V2X) communication", ITU-T X.1373 "Secure software update capability for intelligent transportation system communication devices", ITU-T X.1374 "Security requirements for external interfaces and devices with vehicle access capability", ITU-T X.1375 "Guidelines for intrusion detection system for in-vehicle networks", ITU-T X.1376 "Security-related misbehaviour detection mechanism using big data for connected vehicles" and is developing many more standards in this domain: (X.edrsec, X.eivnsec, X.evtol-sec, X.fstiscv, X.idse, X.ipscv, X.itssec-5, X.rsu-sec, X.srcd, etc). More info: http://itu.int/ITU-T/go/tsg17

The Collaboration on ITS Communication Standards provides a globally recognized forum for the coordination of an internationally accepted, globally harmonized set of Intelligent Transportation Systems (ITS) communication standards of the highest quality in the most expeditious manner possible to enable the rapid deployment of fully interoperable ITS communication-related products and services in the global marketplace.

The Collaboration meetings are typically held twice a year (March and September), and are usually organized back-to-back with other ITS events, including the Symposia on the Future Networked Car. During the CITS meetings, the representatives of relevant SDOs are invited to submit to the Collaboration meetings status reports on ITS standardisation ongoing in their respective organizations. Based on the pertinent inputs and presentations, CITS maintains the global ITS Communication Standards Database.

IEEE

IEEE has standards activities in support of the digital transformation of transportation addressing e.g. communication, sensors, safety, and electric charging of EVs.

IEEE 802 LAN/MAN Standards Committee:
• Intra-vehicle communication: WGs 802.3/802.1 evolve Ethernet standards to support high bitrates and Time Sensitive Networking (TSN) in a vehicle.
• V2X-wireless communication: WG: 802.11 (WLAN): the physical layer for mission critical communication and ad-hoc V2X networking has been optimized in the dedicated 5.9 GHz spectrum (IEEE 802.11p). The ongoing work on the next generation of IEEE 802.11p, i.e. 802.11bd will support many more use cases. ETSI ITS G5 relies on IEEE 802.11p and will benefit from 802.11bd.

The Dedicated Short Range Communication Working Group develops the IEEE WAVE family of standards (Wireless Access in Vehicular Environments). WAVE adds a whole protocol stack on top of IEEE 802.11p/bd. In particular, IEEE 1609.2 standardises a PKI based security architecture and security functions for V2X. ETSI ITS-G5 and IEEE WAVE coordinate to harmonize security features for V2xX.

The Automotive Image Quality Working Group (in particular IEEE P2020) standardises a suite of objective and subjective test methods for measuring automotive camera image quality attributes, and tools and test methods to facilitate decision making among OEM and Tier 1 system integrators and component vendors regarding automotive ADAS image quality.

The Lidar Working Group develops a Standard for the Performance of Lidar Used in Traffic Speed Measurements (P2452) and a Standard for Test Methods of Automotive Lidar Performance (P2936)

The Automated Vehicles Standards Committee develops a Standard for Automotive Radar Performance Metrics and Testing Methods for Advanced Driver Assistance Systems (ADAS) and Automated Driving System (ADS) Applications (IEEE P3116)

The Smart Transportation enabling Terminal Working Group (STTWG) of the Smart Devices Standards Committee SDSC develops a Standard for Edge Intelligent Terminal for Expressway Cooperative Transportation (IEEE P2979)

A WG of the ITS Standards Committee develops a standard for a Formal Model for Safety Considerations in Automated Vehicle Decision Making (in particular P2846). The WG 'Exchange/Interoperability format for functional safety analysis and safety verification of IP, SoC and mixed signal ICs' (in particular P2851) defines a data format with which results of safety

analyses (such as FMEA, FMEDA, FMECA, FTA) and related safety verification activities - such as fault injection - executed for IPs, SoCs and mixed signal ICs can be exchanged and made available to system integrators. The goal of the standard is to provide a common ground for EDA, SoC and IP vendors in needs of developing tools, SoC and IP for safety critical applications.

The Distributed Ledger Technology in Connected and Autonomous Vehicles WG (in particular P2418.4) provides a common framework for distributed ledger technology (DLT) usage, implementation, and interaction in connected and autonomous vehicles (CAVs).

The Software & Systems Engineering Standards Committee (C/S2ESC) has several WGs to develop a family of standards (P70xx series) for ethical considerations in a broad range of artificial intelligence/autonomous system uses, including vehicular contexts.

The 'Smart Grid Powerline Communication' WG develops IEEE 1901 to provide broadband over powerline communications to be used e.g. when charging electric vehicles (EVs). The Working Group 'Creating technical specifications of quick charger for electric Vehicles' develops IEEE 2030.1.1 for a DC quick and bi-directional Charger for Use with Electric Vehicles.

For a list of these and other IEEE standardisation activities on transportation, please visit: https://ieeesa.io/rp-its

IETF

The Emergency Context Resolution with Internet Technologies (ECRIT) Working Group has developed a general architecture for enabling IP applications to discover and connect to emergency services.

The [https://datatracker.ietf.org/wg/geopriv/about/ Geographic Location/Privacy? (GEOPRIV) Working Group) has developed protocols that allow IP networks to inform end devices about their geolocation, a critical pre-requisite for emergency calling.

The application-specific working groups in the IETF (for example, the [https://datatracker.ietf.org/wg/sipcore/about/ Session Initiation Protocol Core (SIPCORE) Working Group) have developed extensions to support emergency calling as required.

The IP Wireless Access in Vehicular Environments (ipwave) WG works on Vehicle-2-Vehicle (V2V) and Vehicle-2-Internet (V2I) use-cases where IP is well-suited as a networking technology and will develop an IPv6 based solution to establish direct and secure connectivity between a vehicle and other vehicles or stationary systems. These vehicular networks are characterized by dynamically changing network topologies and connectivity.

V2V and V2I communications may involve various kinds of link layers: 802.11-OCB (Outside the Context of a Basic Service Set), 802.15.4 with 6lowpan, 802.11ad, VLC (Visible Light Communications), IrDA, LTE-D, LP-WAN. One of the most used link layers for vehicular networks is IEEE 802.11-OCB, as a basis for Dedicated short-range communications (DSRC). Several of these link-layers already provide support for IPv6. However, IPv6 on 802.11-OCB is yet to be fully defined. Some aspects of the IPv6 over 802.11-OCB work have been already defined at IEEE 1609 and the specification produced by this working group is expected be compatible with these aspects.

This group's primary deliverable (and the only Standards track item) will be a document that will specify the mechanisms for transmission of IPv6 datagrams over IEEE 802.11-OCB mode.

https://trac.ietf.org/trac/iab/wiki/Multi-Stake-Holder-Platform#IntelligentTransport

OASIS

OASIS hosts the Open Mobility Foundation (OMF) OASIS Open Project, an open source project launched by a coalition of cities and mobility and software vendors to provide an end-to-end set of standardized data specifications and open source software for managing traffic, availability and route planning for micromobility devices (such as dockless e-scooters). Various standards and code modules for vehicle ID, monitoring, traffic, parking control, consumer/passenger privacy, and policy issues are under development.

ONEM2M

A distinguishing feature of oneM2M is its Basic Ontology specification, which enables semantic and syntactic interoperability across the IoT. This will become increasingly important as greater quantities of data are generated and shared across the IoT.

oneM2M has been designed for interworking: so it naturally lends itself to be used as a factory hub aggregating modern equipment (e.g. OPC-UA based), legacy controllers and the plethora of sensors that are being added to equipment to provide input for innovative applications and whose characteristics and usage do not match well with many of the controllers that are commonly used. It is used, e.g., in BaSys 4.0, the Industrie 4.0 open-source middleware that has been funded by the German Federal Ministry of Education and Research (BMBF) since 2016, whose implementation is available as Eclipse Project BaSyx.

Furthermore, the interconnection capabilities that facilitate interoperability among smart cities also enable oneM2M to be used to support the operations of distributed, coupled supply chains.

These characteristics have been outlined in a recent study by ETSI (ETSI TR 103 536 - Strategic / technical approach on how to achieve interoperability/interworking of existing standardized IoT Platforms)

International cooperation for the development of harmonised global standards is particularly important in these areas. The Commission has concluded agreements with the US Department of Transport and with the Japanese Ministry for Land Transport and Industry. Cross-regional harmonisation task groups (HTGs) have been established in this area.

ETSI has cooperation and liaison agreements with relevant standards organisations such as IEEE, SAE, ISO, IETF, and standardisation supporting industry groups like TISA. Additionally ETSI have liaisons and contacts with regional and national standards organisations such as ARIB (Japan), CCSA (China) and TTA (Korea) and the Asian Pacific Telecommunication organisation (APT).

ITU has launched the Collaboration on ITS Communication Standards (CITS) aims at providing a globally recognized forum for the creation of an internationally accepted, globally harmonised set of ITS communication standards of the highest quality in the most expeditious manner possible to enable the rapid deployment of fully interoperable ITS communication-related products and services in the global marketplace. See http://itu.int/en/ITU-T/extcoop/cits

ICT for traffic management *and* **infrastructure to infrastructure (I2I)** *related information exchange and architectures beyond short range communications.*

CEN

CEN/TC278/WG8: DATEX data exchange standards. DATEX II is a standardised e-language for traffic and travel data exchange between traffic control centres, traffic information centres and service providers. In 2020, DATEX II is expected to be the information model for road traffic and travel information in Europe. The aim is to get the real mature parts of DATEX II standardised as European standards.

ISO

Standardisation activities are taken up in this area by ISO TC 204, with strong cooperation with CEN/TC 278, but also by ISO TC 22. ISO/TS 15638-19:2013 ITS — Framework for collaborative telematics applications for regulated commercial freight vehicles (TARV Part 19). It is at an early stage of development but not mature enough to serve as standard for reservation at that stage.

IEEE

IEEE has standards on charging communication: IEEE 1901 provides broadband over powerline communications to be used in charging, and IEEE 2030.1.1 on DC quick charging.

For a list of these and other IEEE standardisation activities on transportation, please see: http://standards.ieee.org/develop/msp/its.pdf

ITU

Study groups 12 and 16 both have work items to transform the deliverables of ITU-T focus group on driver distraction (2011-13) into proper ITU-T Recommendations. The mandate of ITU-T study group 17 includes the study of security aspects of ITS communications.

W3C

W3C has several ongoing activities related to automotive/ITS.

The mission of the automotive working group (https://www.w3.org/auto/wg/) is to develop open web platform specifications for HTML5/JavaScript application developers enabling web connectivity through in-vehicle infotainment systems and vehicle data access protocols. The API is agnostic with regard to the connection used.

The mission of the automotive and web platform business group (http://www.w3.org/community/autowebplatform/) is to influence the open web platform on the unique needs of the automotive industry, and to help stakeholders within the automotive industry to build a good and practical understanding on the standardisation processes within the W3C. The initial scope of this business group will be to determine what vehicle data should be exposed through a web API(s).

Several community groups (pre-standardisation open fora) were also started to look at specific ITS issues, e.g. the traffic event ontology community group (https://www.w3.org/community/traffic/), and automotive ontology (https://www.w3.org/community/gao/).

(C.2.) OTHER ACTIVITIES RELATED TO STANDARDISATION

C-ITS PLATFORM (2014-2017)

Commission expert group (E03188) brought together representatives of all C-ITS stakeholders to cooperate on legal, organisational, administrative and governing aspects, but also on more technical issues such as standardisation, or security and certification of the system, in view to ensure the interoperability of systems across the Member States.

CCAM PLATFORM (2019-NOW)

Commission expert group (E03657) to provide advice and support to the Commission in the field of testing and pre-deployment activities for Cooperative, Connected, Automated and Autonomous Mobility (CCAM).

CAR-2-CAR COMMUNICATION CONSORTIUM (C2C-CC)

The industry organisation represents car manufacturers and actively participates and chairs ETSI TC ITS. It also contributes to CEN working groups.

C-ROADS

The C-Roads Platform is a joint initiative of 16 European Member States, 7 associated states and road operators for testing and implementing C-ITS services in light of cross-border harmonisation and interoperability https://www.c-roads.eu/platform.html

5G AUTOMOTIVE ASSOCIATION (5GAA)

Association to connect the telecom industry and vehicle manufacturers to develop end-to-end solutions for future mobility and transportation services http://www.5gaa.org.org

ERTICO — ITS EUROPE, GSM-A

Stakeholder organisations providing input to ETSI and CEN

"AMSTERDAM GROUP" (AG)

This is an umbrella organisation bringing together the C2C-CC, ASECAP, CEDR and POLIS for smooth alignment of deployment of Cooperative-ITS functionalities and technologies European wide. A strong support for standardisation activities, regulation and harmonisation is provided to the European community directly by the individual AG members as agreed within the AG.

UN/ECE WP29

The UNECE transport division provides secretariat services to the intergovernmental body World Forum for Harmonization of Vehicle Regulations (WP.29). The World Forum has set one of its priorities related to the establishment of a global applicable regulatory framework for automated/autonomous and connected vehicles.

http://www.unece.org/WP29.html

GENIVI

GENIVI® is a non-profit industry alliance committed to driving the broad adoption of specified, open source, in-vehicle infotainment (IVI) software.

The alliance develops an open standard for aligning automotive and consumer infotainment cycles.

http://www.genivi.org/

MIRRORLINK INITIATIVE

The MirrorLink initiative turns the car into a terminal; it has little computing power itself and relies instead on the phone as its processor.

http://www.mirrorlink.com/

EU AND NATIONAL FUNDED RTD PROJECTS AND PILOTS

The standardisation activities are supported by RTD projects, pilots and field operational tests in the area of CAM, in particular contributing to fine-tuning the standards, among others, DriveC2X, FOTSIS, PRESERVE, ITSSv6, ComeSafety2, COMPASS4D, iMobilitySupport, SIM-TD, SCORE@F, eCoMove, EasyWay, SPITS

WCO DATAMODEL

The WCO datamodel (world customs organisation data model) is an important standard for providing alignment for announcements to and from government about transport and trade. It makes communication throughout Europe between governmental parties and between government and commercial parties easier and cheaper.

EU FUNDED RTD PROJECTS AND PILOTS

Projects such as Mobinet, Mobincity, eCo-FEV; E-DASH, eDAS, SmartV2G, ODIN, COSIVU, SafeAdapt, Smart-LIC, VRUITS and the pilots ICT4EVEU, MOBI.Europe, MOLECULES, SmartCEM, CODECS, ENSEMBLE and green e-motion and the support action smart EV-VC will have outcomes possibly relevant for standardisation. Pilots from both IoT Large Scale Pilots and 5G Corridors initiatives also have potential to provide outcomes relevant to CAM/ITS standardisation.

ICT for traffic management and ***infrastructure to infrastructure (I2I)*** *related information exchange and architectures beyond short range communications.*

TN-ITS (TRANSPORT NETWORK ITS SPATIAL DATA DEPLOYMENT PLATFORM)

Based on the outcome of ROSATTE project (FP7), the TN-ITS association promotes the integration of accurate (public) road data in navigation-oriented maps, and their timely updating, including possible alignment with the technical framework for the INSPIRE project, including the identification of standardisation needs.

https://tn-its.eu/

A CEF-funded project (TN-ITS GO) started in 2018 to implement the exchange of data between 15 Member States and digital map providers.

https://tn-its.eu/tn-its-go

EU FUNDED PROJECTS (HORIZON 2020 WG 3.5 CALL)

Projects supporting local dynamic maps standardisation (e.g. HIGHTS)

SMART TICKETING ALLIANCE

The Smart Ticketing Alliance (STA) represents a platform for cooperation and a coordinated approach for establishing ticketing interoperability for the Public Transport sector. www.smart-ticketing.org

The ITxPT (Information Technology for Public Transport) Initiative aims to further cooperate on the implementation of standards for plug-and-play IT-systems applied to public transport. An integrated testbench offers services to specify, test, qualify and showcase IT solutions. www.itxpt.org

3.4.6 DIGITISATION OF EUROPEAN INDUSTRY

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

Industry is central to Europe's economy. It contributes to Europeans' prosperity through business in global and local value chains and provides jobs to 36 million people – one out of five jobs in Europe. In particular, the manufacturing sector is hugely important because of its major role in driving productivity and innovation. An hour of work in manufacturing generates nearly EUR 32 of added value. With a share of approximately 16% of the total value added, manufacturing is responsible for 64% of private sector R&D expenditure and 49% of innovation expenditure. Every new job in manufacturing creates between 0.5 and 2 jobs in other sectors. More than 80% of EU exports are generated by industry. Recent years have seen impressive growth rates in labour productivity, namely 2.7% per year growth on average since 2009.

Advanced manufacturing addresses the evolution of the manufacturing industry towards a new level of digitalisation, including intelligent production, process handling, and integration. This progression is driven by the application of ICT in manufacturing and includes any optimisation solution improving productivity, quality, and flexibility in the entire manufacturing lifecycle. To enhance sustainability, the manufacturing lifecycle must prolong the life of durable industrial products in compliance with circular economy objectives. To lower waste and pollution, and use energy in smarter ways, it should take into account operations such as testing and diagnosis, disassembly/repair/upgrade, and recycling.

Nowadays, work pieces and semi-finished products involved in the manufacturing lifecycle often possess information on themselves and suitable means of communication, i.e. they have cyber-physical characteristics. These products can control not only their logistical path, but rather the entire lifecycle workflow from operating to maintenance, dismantling and recycling. Decentralisation of the digitally stored information could logically be followed by decentralisation of control systems.

The European policy on advanced manufacturing focuses on fostering the development and speeding up of the uptake of innovative technologies by the European industry. This ambition unfolds in three objectives: accelerate the dissemination and commercialisation of advanced manufacturing technologies, boost the demand for advanced manufacturing technologies, and reduce skills shortages and competence deficits.

This follows the overall Digitising European Industry (DEI) objectives: to reinforce the EU's competitiveness in digital technologies and to ensure that every industry in Europe, in whichever sector, wherever situated, and no matter of what size can fully benefit from digital innovations. The DEI initiative does not focus on certain digital technologies, nor is it limited to one or a few industrial sectors. However, several DEI actions are specifically targeted at the manufacturing sector.

European manufacturers would benefit from more automated flexibility and data intelligence in supply chains. Agile manufacturing (e.g. reacting to changes in demand, in labour or in material resources available) would enable smarter logistics and lower production costs. Industrialising and digitising the complete manufacturing lifecycle including circular economy operations would enable a smarter use of energy and resources, while maintaining competitiveness in costs and quality. Simulations or rapid prototyping methods like 3D printing would enhance the design process. Big data analytics, turning the data stored in clouds to intelligence, would provide insights on achieving cost and carbon emission reductions. Eventually, an internet of manufacturing things (better known as the Industrial Internet of Things) would provide for smooth communication between the various machines of an intelligent supply chain, building on the increased presence of sensors and actuators.

There are a number of initiatives around advanced manufacturing in Europe, in the Member States and also outside Europe (see B.2). The objective at the European level is to strengthen the coordination among the various initiatives and to facilitate the deployment of advanced manufacturing at a pan-European level, thus improving the competitiveness of the European manufacturing industry both in the Single Market and on a global scale, and creating the conditions for the European technology providers to flourish.

Advanced manufacturing technologies are one of the key enabling technologies (KETs) identified by the Commission as key to competitiveness20. In 2015, the global market for KETs was estimated to be more than EUR 1 trillion. KETs have huge potential for growth and employment. According to the European Competitiveness Report 2013, depending on the KET, growth potentials of 10 — 20% per year can be expected over the coming years. For particular submarkets, the growth potential is even larger. Countries and regions that fully exploit KETs will be at the forefront of advanced and sustainable economies. KETs deployment will contribute to achieving reindustrialisation, energy, and climate change targets simultaneously, making them compatible and reinforcing their impact on growth and job creation.

The revision of the Machinery Directive 2006/42/EC was completed on 21st April 2021. The proposal for a new regulation on machinery products is subject to the ordinary legislative procedure. Subsequently, when the concerned legal act will be adopted by co-legislators, some standardisation work in the context of newly adopted regulation on machinery products will be necessary. To address new and changed essential health and safety requirements, new standardisation request will be issued to support the sectorial legislation on machinery products.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

Standards can play a key role in accelerating the effectiveness of supply chains in manufacturing systems. In some cases, standardisation can also play a stabilising role of research activities on which real market opportunities may then be built on. The opportunity is to ensure Europe's technological leadership through the massive integration of ICT into advanced manufacturing technologies, systems and processes.

20 See also https://ec.europa.eu/futurium/en/implementing-digitising-european-industry-actions/national-initiatives-digitising-industry

The amount of communication between machines, sensors and actuators is increasing and will continue so. Machines will become increasingly self-organised as well as their supply chains, from design to warehousing until delivery of a product. IoT technologies will play a major role to support this. Securing high-speed communications infrastructures (e.g. broadband infrastructures) is vital. The specific industrial needs and requirements concerning, for example, availability, security and functional safety have to be taken into account in order to make these technologies suitable for advanced manufacturing. Moreover, the supply chains increasingly need flexibility in design to answer to individual customer requirements (mass customisation). Easier and cost-effective product differentiation is a key for growth. Additive manufacturing (3D printing) may push differentiation to a further stage of individualisation, generating a market of cloud-based production and retailing.

There is a need to promote the development of interoperability standards and European reference architectures, as well as open digital manufacturing platforms, including experimentation, validation, interoperability testing facilities and trusted labels and certification schemes.

The take-up of advanced manufacturing solutions will dramatically accelerate if they are compatible with the installed manufacturing base, and the related standards and technical specifications are coherent with the existing ones, e.g. on machinery, tools, digitalisation. In this respect, standardisation is of central importance since the success of advanced manufacturing demands an unprecedented degree of system integration across domain borders, hierarchy borders, and life-cycle phases. Consensus-based standards and technical specifications, and the close cooperation among researchers, industry and SDOs are the pre-requisites to ensure fruitful results especially in this domain.

Several research-oriented activities were launched under H2020:

- I4MS (Innovation for Manufacturing SMEs) is an EU initiative dedicated to the manufacturing sector and in particular to its high-tech SMEs. I4MS is part of the public-private partnership "Factories of the Future" (PPP H2020 FoF).
- Funded projects on flexibility and adaptability in the production chain (CloudFlow, INTEFIX, APPOLO), simulation (Fortissimo, CloudSME), robotics (EUROC) and data intelligence (LASHARE).
- The EFFRA (European Factories of the Future Research Association) developed a roadmap for the development of Factories of the Future by 2020 in the framework of H2020.
- SPIRE (Sustainable Process Industry through Resource and Energy efficiency) is a public-private partnership that represents more than 90 industrial and research process industry stakeholders from over a dozen countries across Europe.
- OPEN DEI addresses **the Large-Scale Pilots (LSPs) and platform projects** under the Digitising European Industries (DEI) Focus Area, which work in different strategic sectors: one of them is the **healthcare** domain.

In addition lighthouse pilot projects in the framework of the Joint Undertaking on Electronic Components and Systems for European Leadership (ECSEL) will provide for validation of standards for future markets, including large-scale experimental test-beds.

(A.3) REFERENCES

- Final Report of the MSP/DEI WG
- COM(2016) 180 **final.** *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Digitising European Industry Reaping the full benefits of a Digital Single Market*
- **COM(2016)176** "ICT Standardisation priorities for the digital single market"
- **COM(2012)341** *A European strategy for key enabling technologies — A bridge to growth and jobs*
- COM(2012) 582 final *A stronger European Industry for Growth and Economic Recovery*
- **SWD(2014) 120** *Advancing Manufacturing — Advancing Europe, Report of the Task Force on Advanced manufacturing for Clean Production*
- COM(2009)512 *Preparing for our future: Developing a common strategy for key enabling technologies in the EU*

- The following list is a non-exhaustive overview of initiatives at a national level:
- French strategy for factories of the future http://proxy-pubminefi.diffusion.finances.gouv.fr/pub/document/18/17721.pdf#page=47
- The German initiative Plattform Industrie 4.0, including over 350 experts from politics, businesses, industry associations, science and labour unions. https://www.plattform-i40.de/I40/Navigation/EN/Home/home.html
- R&D initiatives like "PAiCE" (https://www.digitale-technologien.de/DT/Navigation/DE/Foerderprogramme/PAiCE/paice.html), "Autonomik für Industrie 4.0" (https://www.digitale-technologien.de/DT/Navigation/EN/Foerderprogramme/Autonomik_fuer_Industrie/autonomik_fuer_industrie.html), "it's OWL" (http://www.its-owl.com/home/

news/2-forum-produktion-im-mittelstaendischen-maschinenbau/) or SmartFactory KL (http://smartfactory.dfki.uni-kl.de/en)
- IT initiative "Piano nazionale Impresa 4.0" http://www.sviluppoeconomico.gov.it/index.php/it/industria40
- NL initiative "Smart Industry" http://www.smartindustry.nl/
- UK initiative "High Value Manufacturing Catapult" https://hvm.catapult.org.uk/
- UK Foresight Study "Future of manufacturing: a new era of opportunity and challenge for the UK" https://www.gov.uk/government/publications/future-of-manufacturing
- US Advanced Manufacturing National Program Office (AMNPO) http://manufacturing.gov/amnpo.html
- CN "Made in China 2025" strategic plan http://english.gov.cn/2016special/madeinchina2025/
- Diginova's "Roadmap to Digital Fabrication" http://www.diginova-eu.org/content/dam/diginova/en/documents/Digital_Fabrication_eBook.pdf
- The strategic research and innovation agenda of Sweden "Made in Sweden 2030" https://www.teknikforetagen.se/globalassets/i-debatten/publikationer/produktion/made-in-sweden-2030-engelsk.pdf
- A comprehensive list of ongoing national initiatives is published at https://ec.europa.eu/futurium/en/implementing-digitising-european-industry-actions/national-initiatives-digitising-industry and https://ec.europa.eu/digital-single-market/en/cordination-european-national-regional-initiatives.

(B.) REQUESTED ACTIONS

ACTION 1 Common communications standards and a reference architecture for connections between machines (M2M) and with sensors and actuators in a supply chain environment are a basic need and a priority. Specific industrial needs must be included, like standards which support communications on broadband infrastructures and data formats in order to allow for the quick transfer of large volumes of data over networked industries. This could ease the ability to switch between platforms. Analysis is required as to how to provide industries with a solution enabling wireless communications without interfering with other wireless networks. In particular, a check should be run on M2M standards against requirements like real-time capability and close to hardware runtime codes.

ACTION 2 As part of the new skills agenda for Europe, ESOs could check whether the e-skills standards sufficiently account for the manufacturing skills of KETs, including future manufacturers, M2M, rapid prototyping and others.

ACTION 3 Conduct a study to identify and analyse opportunities for revisions of existing standards (communications, M2M) or new standards with a particular view on new production technologies, manufacturing processes including lifecycle operations (circular economy), functional safety issues and skills-deficit reduction.

ACTION 4 SDOs to continue to improve interoperability and reduce overlap, redundancy and fragmentation. Standards bodies should continue and further strengthen their coordinated approach regarding different reference architectures and measures should be taken to reduce overlap, redundancy and fragmentation and integrate existing protocols. One example is to develop further parts of the standards series IEC 63278 on the asset administration shell to describe further properties of digital twins for industrial applications to improve interoperability. Besides others, this includes concepts for security, interaction, and discovery.

ACTION 5 Interoperable and integrated security - SDOs should work on interoperability standards for security and for linking communication protocols in order to provide end-to-end security for complex manufacturing systems including the span of virtual actors (from devices and sensors to enterprise systems). Standards should take into account risk management approaches as well as European regulation and regulatory requirements.

ACTION 6 Create a hierarchical catalogue of technical and social measures for assuring privacy protection and task all SDOs impacting the DEI domain in general and the advanced manufacturing domain in particular to comment on and prioritize the elements in the catalogue. Digitising industry implies processing of data which includes personal data within the definition of the GDPR. That means, in addition to technical measures to ensure the security of the data, additional technical and social measures are needed to protect the privacy of personal data. Such social or non-technical measures will include, e.g. Codes of Conduct, Charters and Certifications, best practice guidelines, collection of evidence of privacy protection assurance, etc.

ACTION 7 Standards should be developed to define the main characteristics for all levels of the interaction from mechanical to electrical to protocol to semantic levels between robot and tool to ensure the exchangeability and to enable the design of generic tooling (plug-and-play). There are 2 main types of End Effector. "Off-the-Shelf" and "bespoke". It is desirable that off-the-shelf end effectors operate on a single software protocol. There is a need for Industry 4.0 to standardise this. It would then become Plug-&-Play. For "Bespoke" end effectors (most commonly purchased) the system integrator specifies the software protocol for the Robot and End Effector.

ACTION 8 Start the discussion about the possible development of harmonised standards in the area of additive manufacturing. Currently, there are no harmonised standards under the Machinery Directive for Additive Manufacturing (AM) equipment. The availability of these standards could facilitate the manufacturer conformity assessment process. The European Commission should discuss together with SDOs and AM equipment manufacturers the possible need for harmonised standards in this area.

ACTION 9 SDOs to develop standards or expand available standardisation efforts for including topics of relevance to circular economy, in particular long-term traceability of material to enable re-use and recycling.

ACTION 10 To identify and analyse opportunities for revisions of existing standards or new standards on the methodology of risk assessment of (and test framework for) cyber-physical (machinery) products with a particular view on a functional safety levels of digital manufacturing processes and products exploiting real-time data flows, artificial intelligence, and different combinations of cloud-, edge-, and soft- computing.

ACTION 11 To identify and promote open source technologies and relevant communities that complement standardisation work. Communities should be invited to present relevant work in the context of DEI to the MSP and the DEI/MSP working group. SDOs and open source communities should collaborate and consider establishing liaisons.

ACTION 12 Activities for the standardisation of sub-models of the asset administration shell are to be initiated. A sub-model must be standardized in its basic features, which means that there must be both basic/obligatory properties and basic/obligatory functions that can be supplemented by an industrial partner along the value chain with individual properties and functions. This means that, for example for energy considerations, the same obligatory property and functions must be available for different assets, so that, for example, all components of a system or systems of a plant can be easily consolidated or controlled in the same way. Specific amendments remain possible. Characteristics and properties of conceptual assets should be included in standardized dictionaries such as IEC and ISO Common Data dictionary (CDD).

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

DIN/DKE/SCI4.0:

DIN and DKE founded the Standardisation Council Industrie 4.0 (SCI 4.0) in conjunction with the industry associations BITKOM, VDMA and ZVEI.

SCI 4.0 is responsible for orchestrating standardisation activities and, in this role, acts as a point of contact for all matters relating to standardisation in the context of Industrie 4.0 nationally and on international scale.

In collaboration with the Plattform Industrie 4.0, SCI 4.0 brings together the interested parties in Germany and represents their interests in international bodies and consortia. SCI 4.0 also supports the concept of practical testing in test centres by initiating and implementing new informal standardisation projects tailored to meet specific needs.

http://www.sci40.com

CEN

CEN/TC 438 'Additive Manufacturing' has been working since 2015 to standardize the process of AM, their process chains (hard and software), test procedures, environmental issues, quality parameters, supply agreements, fundamentals and vocabularies. CEN/TC 438 works closely with ISO/TC 461 in cooperation with ASTM F42. CEN/TC 438 will develop new projects that relate to aeronautic, medical, 3D manufacturing and data protection.

CEN/TC 310 "Advanced Automation Technologies and their applications" has been working since 1990 to ensure the availability of the standards the European industry needs for integrating and operating the various physical, electronic, software and human resources required for automated manufacturing. It works closely with ISO/TC 184 and other committees to achieve international standards wherever possible in order to meet the needs and opportunities of the global market, as well as establishing common European strategies wherever possible. A key tactic is to use the Vienna agreement process to initiate work in Europe to exploit the results of R&D projects and promote them to the ISO level at the earliest opportunity.

CENELEC

CENELEC/TC 65X "Industrial-process measurement, control and automation" works out methods for safe and secure communication protocols for wired and wireless industrial automation applications some of which are included in the 2,4 GHz industrial, scientific and medical radio band (ISM).

The EN 62264 series 'Enterprise-control system integration' relate to the overall design architecture in the context of Industry 4.0. The series provide requirements for information flow in a manufacturing environment, and address IoT and Cybersecurity. '

- EN 62264-3:2017 'Enterprise-control system integration - Part 3: Activity models of manufacturing operations management'
- EN 62264-4:2016 'Enterprise-control system integration - Part 4: Object model attributes for manufacturing operations management integration'
- EN 62264-5:2016 'Enterprise-control system integration - Part 5: Business to manufacturing transactions'

CEN-CENELEC

CEN/CLC/WS EFPFInterOp on European Connected Factory Platform for Agile Manufacturing Interoperability

ETSI

ETSI ERM TG 11 is currently working on methods to improve the politeness of existing adaptive and non-adaptive mechanisms and to consider the inclusion of alternative mechanisms taking into account the needs of the wireless industrial applications operating in the 2,4 GHz ISM band.

ETSI ERM TG 41 is currently working on harmonised standards for wireless industrial applications in the frequency range 5725 MHz to 5875 MHz.

ETSI DECT is working on the development of DECT-2020, a 5G radio interface operating on license exempt spectrum that will support Ultra Reliable and Low Latency use cases required by Industry Automation scenarios. https://www.etsi.org/technologies/dect

ETSI TC DECT has published the first release of the new DECT-2020 NR (New Radio) technology (ETSI TS 103 636 parts 1 to 4). The work on additional parts for the set of standards are ongoing with planned publication by end of 2021. The standardisation effort will continue in next years with further releases, additional functionality and Application Specific profiles addressing the needs of multiple vertical industries. Industry Automation is considered a fundamental vertical scenario for DECT-2020 NR and has been taken into account in the requirements of the technology.

DECT-2020 NR is a new radio interface supporting Ultra Reliable Low Latency Communications (URLLC) and massive Machine Type Communications (mMTC) as specified by ITU-R IMT-2020 and required by many Industry Automation scenarios. The technology supports multiple operating bands and radio channel bandwidths. DECT-2020 has been submitted to ITU-R as an IMT-2020 candidate technology.

ISG F5G is addressing the use of fibre for industrial application to connect with the highest bandwidth and most secure technology each equipment in industrial production.

ISO

ISO/TC 184 deals with industrial automation technologies, including automated manufacturing equipment, control systems and the supporting information systems, communications and physical interfaces required to integrate them in the world of e-business

http://www.iso.org/iso/iso_technical_committee%3Fcommid%3D54110

Projects include:

ISO 6983-1:2009 — Automation systems and integration -- Numerical control of machines -- Program format and definitions of address words -- Part 1: Data format for positioning, line motion and contouring control systems

ISO 14649 (series of standards): Industrial automation systems and integration -- Physical device control -- Data model for computerized numerical controllers

ISO 22093:2011 — Industrial automation systems and integration -- Physical device control -- Dimensional Measuring Interface Standard (DMIS)

ISO 23570 (series of standards): Industrial automation systems and integration -- Distributed installation in industrial applications

ISO 13584 (series of standards): Industrial automation systems and integration -- Parts library

ISO 10303 (series of standards): Industrial automation systems and integration -- Product data representation and exchange

ISO 16100 (series of standards): Industrial automation systems and integration -- Manufacturing software capability profiling for interoperability

IEC/TC 3/SC3D" Product properties and classes and their identification"

ISO Strategic Advisory Group Industry 4.0/Smart manufacturing (ISO /SAG)

ISO/TC 261 works on standardisation in the field of additive manufacturing concerning their processes, terms and definitions, process chains (hard- and software), test procedures, quality parameters, supply agreements and all kind of fundamentals.

IEC

IEC/TC 65 "Industrial process measurement, control and automation", with its sub-committees, provides an extensive set of standards for manufacturing, including standards addressing cyber security (IEC 62443 series), functional safety (e.g. IEC 61508, IEC 61511) or interoperability (e.g. IEC 62541 (OPC)), and others.

Several groups of IEC/TC 65 and its subcommittees are involved in the development of standards for advanced manufacturing, foundational/structuring groups like IEC TC65/ahG4 that created a requirement list for IEC CDD according to IEC 61360 (all parts) and got a reply by IEC SC3D and coordinating in TC65 the class and properties for IEC CDD, TC 65/WG 23 "Smart manufacturing framework and system architecture", TC 65/WG24 "Asset Administration Shell for industrial application", TC 65/JWG 21 "Smart Manufacturing reference models", SC 65E/JWG 5 "Enterprise-control system integration", SC 65E/WG 9 "AutomationML — Engineering Data Exchange Format", operational groups like TC 65/WG 16 "Digital Factory", TC 65/WG 19 "Life-cycle management for systems and products", SC 65E/WG 8 "OPC" and communication groups, including real-time communications work, SC 65C/WG 9 "Industrial networks — Fieldbusses", WG18 TSN profile for IA (IEC/IEEE 60802) and the associated conformance assessment project (IEC 61802), SC 65C/WG 16 "Wireless" and SC 65C/WG 17 "Wireless coexistence".

The wireless coexistence in the draft IEC 62657 (all parts) is also pushing the framework of metadata usage by proposing content to the IEC CDD (see CR 000042).

The SyC COMM aims at facilitating and advising in the domain of communication technologies and architectures to converge communication technology related activities in the IEC. It will closely collaborate with IEC Committees to support their ongoing work on communication technologies according to clause 2 in AC/17/2018.

A paramount element in the scope of the Syc COMM is the harmonization of communication systems by:

- Providing a mapping of existing drafts and publications specifying communication systems (including functional safety, security, resilience, etc.).
- Asking IEC TCs about their future use cases for communication systems to avoid duplications and advice on future communication system technologies suitable for the described use cases.
- Collecting requirements on radio spectrum to find commonalities, so that a broad market relevance will have a chance on dedicated spectrum or dedicated spectrum usage.

SyC SM provides coordination and advice in the domain of Smart Manufacturing to harmonize and advance Smart Manufacturing activities in the IEC, other SDOs and Consortia according to clause 2 in AC/22/2017 superseded by the AC/17/2018.

Among its tasks, SyC SMwill focus on:

- providing an inventory of existing standards and current standardisation projects under the management of IEC, ISO and other SDOs.
- expanding on the definition of common value chains within a smart manufacturing enterprise, as identified in SG 8, and identifying associated use-cases which will assist in determining the state of the art in the industry, and the identification of potential gaps where IEC standardisation is needed with respect to smart manufacturing.
- establishing an initial roadmap of smart manufacturing standardisation, architecture and prospective standardisation and conformity assessment projects to be conducted by the SyC member TCs and partners.
- delivering a dashboard to cross reference the project work items to documented use-cases within particular value chains to assist standards developers and industry stakeholders to navigate the domain

ISO/IEC JTC 1

ISO/IEC JTC 1/WG 12 3D Printing & Scanning: WG 12's focus is on the ICT foundational aspects of 3D printing standardisation. In the area of 3D printing and scanning, WG 12 develops standards and/or suggests work for other existing JTC 1 subgroups. WG 12 makes recommendations to JTC 1 to suggest delegation of work to other existing JTC 1 subgroups. It also leads or coordinates JTC 1 liaisons with ISO, IEC and external organizations working on projects in 3D printing and scanning.

Current projects: JTC 1/WG 12 has commended standardisation development in the area of additive manufacturing service platforms and medical image-based modelling

IEEE

IEEE has standards activities relevant to the digitisation of industry/ advanced manufacturing, including basic horizontal standards applicable to many industry domains, such as standards for networking and sensors, as well as specific standards addressing the needs of the manufacturing sector, like production process automation in a plant.

IEEE Working Groups evolve legacy standards and start new standardisation projects for smart manufacturing in support of:

- Industrial Services
- Intelligent Factories
- Intelligent Equipment
- These are complemented by standards for the
- Industrial Internet
- Industrial Software and Big Data

Some key enabling standards for Digitisation of European Industry include the following:

- The IEEE 802.1 Time-Sensitive Networking (TSN) family of standards provides deterministic connectivity to time and mission-critical industrial applications over IEEE 802.3 Ethernet networks. A joint Working Group with IEC SC 65C is developing IEC/IEEE 60802 TSN Profile for Industrial Automation to enable the logical configurations and re-configurations of communication systems supporting advanced manufacturing.
- The "Standard for Sensor Performance Parameter Definitions" Working Group develops IEEE 2700 "IEEE Standard for Sensor Performance Parameter Definitions", a common framework for sensor performance specification including terminology, units, conditions and limits.
- The "Quality of Data in the IoT Environment" Working Group is developing the IEEE P2510 "Standard for Establishing Quality of Data Sensor Parameters in the Internet of Things Environment" project to define quality metrics such as speed, location, and temperature for sensor data needed to improve the quality of the analytics decisions being made.
- The "Intelligent Process Automation" Working Group develops a family of standards for software-based intelligent process automation technologies. IEEE Std 2755-2017 specifies terms, capabilities and concepts and IEEE 2755.1-2019 classifies approximately 150 features and functions across five core technology areas, and IEEE P2755.2 "Recommended Practice for Implementation and Management Methodology for Software Based Intelligent Process Automation (SBIPA)" is under development.
- The "Online Detection" Working Group is developing IEEE P2671 "Standard for General Requirements of Online Detection Based on Machine Vision in Intelligent Manufacturing" project and the "Mass Customization" Working Group is developing the IEEE P2672 "Guide for General Requirements of Mass Customization".
- The "Digital Representation" Working Group is developing IEEE P2806 "System Architecture of Digital Representation for Physical Objects in Factory Environments".
- The "DevOps" Working Group is developing IEEE P2675 "Standard for DevOps: Building Reliable and Secure Systems Including Application Build, Package and Deployment" to specify technical principles and practices to build, package and deploy systems and applications reliably and securely. Its process outcomes and activities are aligned with the process model specified in ISO/IEC/ IEEE 12207:2017 "Systems and software engineering - Software life cycle processes", and in ISO/IEC/IEEE 15288:2015 "Systems and software engineering — System life cycle processes".

For a list of these and other standardisation activities on the Digitisation of European Industry, please visit: https://ieeesa.io/rp-digitization

ITU

ITU-T SG20 on "Internet of Things and smart cities and communities (SC&C)" provides a specialized IoT standardisation platform for the development of a cohesive set of international standards on IoT and smart manufacturing. SG20 has approved one Recommendation on "Overview of smart manufacturing in the context of the industrial Internet of things" (ITU-T Y.4003). It also has ongoing work on Framework and capabilities for smart livestock farming based on Internet of things (Y.IoT-SLF), on Requirements and framework of Industrial IoT (IIoT) infrastructure for smart manufacturing (Y.IIoT-infra-SM-fr), on Functional architecture enhancement with network capability exposure to support flexible QoS/QoE requirements from enterprise IoT services and applications (Y.NCE.arch.EIoT).

http://itu.int/go/tsg20

ITU-T SG13 approved Recommendations ITU-T Y.2238 on Overview of Smart Farming based on networks, Y.2623 with requirements and framework of industrial Internet networking based on future packet based network evolution and Y.2246 on an application of a u-learning environment to the smart farming. SG13 has a work in progress on Unmanned Smart Farm (Y.esm, Y.ous). Also under development is a Recommendations on requirements and architecture of Digital Twin Network (Y.DTN-ReqArch) and on QoS assurance use cases and requirements for the industrial internet supported by IMT-2020 (Y.IMT2020-QoS-II-req).

Supplement 67 to Y.3000-series of ITU-T Recommendations "Representative use cases and key network requirements for Network 2030" elaborates the use case description and key network requirements for digital twin.

http://itu.int/go/tsg13

OASIS

The OASIS Production Planning and Scheduling TC develops common object models and corresponding XML schemas for production planning and scheduling software, which can communicate with each other in order to establish collaborative planning and scheduling on intra and/or inter enterprises in manufacturing industries.

The OASIS Product Life Cycle Support (PLCS) TC established structured data exchange and sharing to support complex engineered assets throughout their total life cycle. It created Data Exchange Specifications (DEX's) based upon ISO 10303 (STEP) Application Protocol 239 (Product Life Cycle Support), in liaison with ISO TC 184/SC4.

ONEM2M

The oneM2M Basic Ontology specification enables semantic and syntactic interoperability across the IoT. This will become increasingly important as greater quantities of data are generated and shared across the IoT.

oneM2M has been designed for interworking: so it lends itself to be used as a factory hub aggregating modern equipment (e.g. OPC-UA based), legacy controllers and the plethora of sensors that are being added to equipment to provide input for innovative applications and whose characteristics and usage do not match well with many of the controllers that are commonly used. It is used, e.g., in BaSys 4.0, the Industrie 4.0 open-source middleware that has been funded by the German Federal Ministry of Education and Research (BMBF) since 2016, whose implementation is available as Eclipse Project BaSyx.

Furthermore, the interconnection capabilities that facilitate interoperability among smart cities also enable oneM2M to be used to support the operations of distributed, coupled supply chains.

These characteristics have been outlined in a recent study by ETSI (ETSI TR 103 536 - Strategic / technical approach on how to achieve interoperability/interworking of existing standardized IoT Platforms)

W3C

Web of Things

http://www.w3.org/WoT/

IIC

Developing test beds and contributing to reference architecture and use-case development

http://www.iiconsortium.org/test-beds.htm

(C.2) ADDITIONAL INFORMATION

There are three basic principles behind standardisation of advanced manufacturing technologies:

- accelerate the dissemination and commercialisation of advanced manufacturing technologies,
- boost the demand for advanced manufacturing technologies, and
- reduce skills shortages and competence deficits.

In industrial automation, it is essential for the vast variety of systems from various manufacturers to interact in a reliable and efficient manner. The users, operating globally, expect to be able to source their usual products and systems everywhere in the world. In order to ensure this global usability and consistency across different systems, international standardisation in industrial automation has always been regarded as especially important and pursued as a matter of a priority. Nowadays, standards are available or are at least being drafted to cover important issues in industrial automation. But again and again new technologies and new requirements create a new demand for standardisation. This requires the development of a host of new concepts and technologies. However, it will only be possible to implement these new concepts and technologies in industrial practice if they are backed by standards based on consensus. Only such standards are able to create the necessary security for investments and confidence among manufacturers and users.

Development of new technologies and intensifying the relationships between more and different actors in the value chain require not only new standards but also updating, maintenance and even re-design and integration of existing standards.

Additional communication capabilities and a (partial) autonomy to react to external influences and internally stored specifications are transforming mechatronic systems into cyber-physical systems. The objectives derived from that transformation are developments and adjustments in ICT for manufacturing applications: robustness, resilience, information security and real-time capability. In addition, increasing improvement is aimed for energy and resource efficiency, and in the adjustment of industry to accommodate the social demands arising from demographic change.

With regard to machine-to-machine communication, consideration should be given to the framework of metadata. There may be a role for standards in developing an accepted architecture building on existing agreed terminology.

3.4.7 ROBOTICS AND AUTONOMOUS SYSTEMS

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The importance of robotics and autonomous systems (RAS) lies in its strong economic contribution as an industrial and commercial activity in its own right and its broad and disruptive socioeconomic impact across diverse market sectors worldwide. Advanced robotics and autonomous (or near-autonomous) vehicles will have a potential annual economic impact by 2025 on a par with e.g. mobile internet, advanced materials or energy markets.

Industrial robotics has already become a cornerstone in several of Europe's high-value manufacturing industries, such as the automotive industry, keeping these industries in Europe. This trend must be maintained, strengthened and extended to all main industries in Europe. Robotics technology also has an impact on a broad range of end-user markets and applications. The robotics professional and consumer service sectors are expected to achieve double-digit growth in the next decade and SMEs will play a key role e.g. in opening new markets. In addition to manufacturing, important future application domains for robots, with a high impact on everyday life, will include healthcare, agriculture, civil, commercial or consumer sectors, logistics and transport.

The EU actively promotes research, job creation and innovation through better and safer robots, while safeguarding ethical aspects of the progress achieved. The importance of robotics lies in its wide-ranging impact on Europe's capacity to maintain and expand a competitive manufacturing sector with millions of related jobs at stake. Robotics also offers new solutions to societal challenges from ageing to health, smart transport, security, energy and environment. The European Commission's focus is on building on our continuous effort to develop a strong scientific base for pushing the limits of the technology, and exploiting such results in real world applications.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The robotics market is set to exceed 90 billion EUR by 2030, with almost 13% CAGR from 2019 (source: SMART Report 2018/0053). In 2021, robotics standardisation has continued its work on all fronts in both the International- and the European- Standardisation Organisations (ISOs, ESOs). R&D projects on robotics funded by the EU Framework for Research and Innovation set the scientific basis for new key technologies, interoperability between robots, and the use of robots to achieve societal challenges.

Since 2019 ISO has issued seven new documents on robotics:

- **ISO 8373:2021 Robotics — Vocabulary**
- **ISO 18646-2:2019 Robotics — Performance criteria and related test methods for service robots — Part 2: Navigation,**
- **ISO 18646-3:2021 Robotics — Performance criteria and related test methods for service robots — Part 3: Manipulation**
- **ISO 18646-4:2021 Robotics — Performance criteria and related test methods for service robots — Part 4: Lower-back support robots**
- **ISO 22166-1:2021 Robotics – Modularity for service robots – Part 1: General requirement,**
- **ISO/TR 23482-1:2020 Robotics — Application of ISO 13482 — Part 1: Safety-related test method**
- **ISO/TR 23482-2:2019 Robotics — Application of ISO 13482 — Part 2: Application guidelines**

Work is ongoing with other eleven ISO standards on robotics which will be published in the future.

This Rolling Plan calls for increased coordination in the standardisation work led by industry, notably through public-private partnerships.

Robotics and autonomous systems is a multidisciplinary scientific and technological domain for implementing complex systems with cognitive capabilities. These include mechatronics devices, power systems and drives, actuators, sensors, data communication systems, computer software, multi-agent technologies, signal processing techniques, artificial intelligence, semantic technologies and much more. Robots can be very small or very large and have many physical aspects; for instance, they can be similar to a crane, an arm, a snake or a human body, they can have wheels or legs, and they can be vehicles able to move on the ground, in the air or under the water. Robots can also be used for a large variety of applications including industrial manufacturing, logistics, maintenance, precision farming, autonomous driving, space exploration, surveillance, emergency and rescue, commercial services, health care, rehabilitation, assistive living, entertainment, education and social interaction.

Therefore, the number of standards that affect robotic engineering is very large. Some of the required standards address the robotics field exclusively, but robotics also inherits standards from related technological domains such as electromechanical engineering, electronics, information technologies, telecommunications, production management, geographical information and so forth.

At the worldwide level, the most active international organisation on standardisation on robotics is ISO. It has appointed a technical committee specifically devoted to robotics: ISO/TC299. This Committee is structured in six working groups.

- **WG 1 – Vocabulary and characteristics**
- **WG 2 – Service robot safety**
- **WG 3 – Industrial safety**
- **WG 4 – Service robot performance**
- **JWG 5 – Medical robot safety (joint with IEC/SC 62A and 62D)**
- **WG 6 – Modularity for Service Robots**
- **WG 7 – Management system for service robots**
- **WG 8 – Validation methods for collaborative applications**

The following link gives a catalogue of the standards developed by the technical committee ISO/TC299:

https://www.iso.org/committee/5915511/x/catalogue/

At European level, the most active organisations are the European Committee for Standardisation (CEN) and the European Committee for Electrotechnical Standardisation (CENELEC). CEN-CENELEC provides European standards on robotics by means of its Sector Forum on Machinery Safety. The following link gives a list of harmonised European standards on machinery including several standards specifically designed for robotic machines:

https://ec.europa.eu/growth/single-market/european-standards/harmonised-standards/machinery_en

In addition, associations such as IEEE and OCEANIS are also active in conducting technical studies and proposing standards, particularly in the area of ethics in autonomous and intelligent systems.

More generally, standardisation activities in robotics can be grouped in four main areas:

- Foundations: This set of standards covers vocabulary and characteristics that provide suitable definitions as a reference for other standards. It includes, among others, the following standards: ISO 89787 (Coordinate Systems), ISO 19649 (Vocabulary for Mobile Robots) and ISO 8373 (General terms and Definitions).
- Robotic safety: The bulk of robotic standards are connected with personal and functional safety and regulations for machinery such as EN/ISO 13849-1, IEC/EN 62061. However, the particularities of robotics and its applicability to industrial and non-industrial environments has made it necessary to develop more specific standards such as ISO/TS 15066 (Safety of collaborative robots) which builds further on EN/ISO 10218-1 and EN/ISO 10218-2 (Robots and robotic devices — Safety requirements for industrial robots) or EN/ISO 13482 (Robots and robotic devices — Safety requirements for personal care robots), ISO/TS 15066 (Safety of collaborative robots), The increased autonomy of robots due to the adoption of Artificial Intelligence, and the application of robotics in non-industrial environments such as healthcare, agriculture, autonomous driving and private homes, must be accompanied by the revision of existing standards and the development of new safety standards addressing specific issues. As an example, the robotics community has requested recently the development of new safety standards that prescribe testing procedures for wearable robots, such as exoskeletons for rehabilitation and worker support. The last thread suggests defining a relationship between the safety and the performance characteristics of concerned products.
- Robotics system integration and interoperability: Current robots can be made up of very different functional subsystems (dynamic control, perception, navigation, task planning, trajectory planning, human interaction, etc.) that must be integrated through complex interfaces. Also, robotic systems can cooperate with other systems by means of other interfaces. Many of the standards that define these interfaces are inherited from more general domains such as electromechanical engineering and ICT. But some standards are designed to fit robotics-specific requirements, for instance ISO 9409 (mechanical interfaces) and ongoing work in ISO/TC 299/WG6 (Modularity for service robots). At least three areas need further development:
- Robot programming languages and communication protocols for robot controllers. This area is mostly dominated by proprietary standards developed by robot manufacturers, such as the robot programming languages Rapid (ABB), PDL2 (Comau), KRL (Kuka), etc. The increasing level of integration of robots in complex systems creates a need to standardise programming languages and communication protocols.
- Robot operating systems. Robot operating systems are software platforms run in conventional computers that connect various robotic subsystems (perception, control, reasoning, planning, etc.) to perform complex tasks. Strictly speaking, they are not actual operating systems, but a middleware layer. They determine and manage the environment for the interoperability of all the software components of the robotic system, irrespective of where they run (on standard computers, robot controllers or embedded systems). In the last 10 years, a number of robot operating systems have come out: ROS, Player, YARP, OROCOS, CARMEN, ORCA, MOOS, to name a few. Most have been developed and maintained as open source software by universities and non-profit research centres. The most successful ones have the potential to set the interoperability standards of the future robotic systems.
- Knowledge modelling. Robot autonomy is based on having appropriate representations of the objects that robots manipulate, the physical environment, the robot missions and the work plans. These involve a great variety of techniques such as signal processing, sensor data fusion, localization and mapping, artificial intelligence, constraint solving, and optimisation. All these techniques have something in common: they manage enormous amounts of data that must be contextualised and processed semantically. Much of this information is captured through complex sensor systems (e.g. image processing or speech recognition) but also from the web. The way how this information can be generated, processed and distributed depends on the availability of appropriate standards. There are already many standards on knowledge modelling, most of them inherited from the ICT field (e.g. SQL, JSON, XML, OWL, and RDF)

and a few from other domains (e.g. ISO 10303 for product manufacturing information and ISO 11783 for precision farming), but knowledge modelling for robotics is still a research topic and lacks the stability needed to build a comprehensive set of accepted standards that cover the requirements of all potential applications.

- Ethics in Autonomous Intelligent Systems: Algorithms, sensors, big data, ubiquitous networking and technologies used in autonomous and intelligent systems are impacting our work and social environment today. The implications and consequences for our personal and social lives can lead to a loss of trust in technology from several issues. For example, there could be a loss of trust due to a perceived loss of agency over our digital identity and data, or due to ethical, transparency or accountability issues related to the operation of such systems. IEEE and others collaborating in OCEANIS have committed to identify and develop standards to address technical, societal and ethical implications of technology expansion.

(A.3) REFERENCES

- European Machinery Directive 2006/42/EC
- Directive 2001/95/EC of the European Parliament and of the Council of 3 December 2001 on general product safety
- **COM/2021/202 final** Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on machinery products

(B.) REQUESTED ACTIONS

ACTION 1 Foster coordination of standardisation efforts on robotics and autonomous systems in Europe, promoting interaction of all stakeholders taking into account their vision and real needs (i.e. through public-private partnership).

ACTION 2 Study to provide safety standardisation deliverables for autonomous robots driven by artificial intelligence.

ACTION 3 Standards for risk assessment for robot applications with interchangeable tools and applications should be developed; both for traditional robots and cobots.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

The most relevant standards on robotics are led by ISO. Robotic markets are global and it does not make much sense to develop standards at national or regional level. So far, most standardisation efforts have been primarily driven by manufacturers of industrial robots and robotic components. Their engineering teams are well integrated in the various ISO technical committees. European manufacturers are very active in this field. Also, many outstanding European manufacturers of robotic components are involved in standardisation groups in their areas of expertise.

However, new players such as start-ups and SMEs developing highly innovative solutions and products suited to the next generation of robotics have not been involved in standardisation so far. Engaging and supporting them in participating in standardisation efforts and activities will strengthen Europe's position in the robotics industry.

EU-funded R&D projects also contribute to standardisation activities but to a lesser extent because their activities tend not to last enough to match the usually long timetables of standardisation work. When European projects are involved in standardisation, it tends to be through recipients of funding that are robot or robot-component manufacturers. It is important to strengthen the ties between EU R&I projects and SDOs, bringing project results into standardisation activities.

Standards development

CEN

CEN/TC 310 'Advanced automation technologies and their applications' is responsible for standardisation in the field of automation systems and technologies and their application and integration, to ensure the availability of the standards required by industry for design, sourcing, manufacturing and delivery, support, maintenance and disposal of products and their associated services. Areas of standardisation may include enterprise modelling and system architecture, information and its supporting systems, robotics for fixed and mobile robots in industrial and specific non-industrial environments, automation and control equipment and software, human and mechanical aspects, integration technologies and system operational aspects. These standards may utilise other standards and technologies beyond the scope of CEN/TC 310, such as machines, equipment, information technologies, multi-media capabilities, and multi-modal communications networks.

EN ISO 13482:2014 'Robots and robotic devices - Safety requirements for personal care robots

Together with ISO, CEN/TC 310 is revising prEN ISO 10218-1 'Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots'; and prEN ISO 10218-2 'Robots and robotic devices - Safety requirements for industrial robots - Part 2: Robot systems and integration'.

CEN/TC 114 'Safety of Machinery' develops standards of general principles for safety of machinery incorporating terminology and methodology.

CENELEC

CLC/TC 44X 'Safety of machinery: electrotechnical aspects'

CLC/TC 63 'Electrical equipment in medical practice' is responsible for the EN IEC 80601 series, notably EN IEC 80601-2-77 'Particular requirements for the basic safety and essential performance of robotically assisted surgical equipment' and EN IEC 80601-2-78 'Particular requirements for basic safety and essential performance of medical robots for rehabilitation, assessment, compensation or alleviation'

ISO

ISO TC on Robotics: ISO/TC 299 — Robotics.

http://www.iso.org/iso/iso_technical_committee?commid=5915511

ISO/IEC JTC 1

The work ongoing in ISO/IEC JTC 1 SC 42 on Artificial Intelligence also has an impact on Robotics. (See chapter 3.4.6 on Artificial Intelligence).

IEEE

IEEE has standardisation and pre-standardisation activities in the field of robotics and automation,

- for functions like navigation as well as ethical considerations for autonomous robots, and
- for a diversity of applications in medicine, manufacturing, etc..

The Standing Committee for Standards Activities of the IEEE Robotics and Automation Society has been actively working with the research and industrial communities and other Standards Developing Organizations (SDOs) to identify areas for standardisation in robotics and automation.

- The 'Robot Task Representation' Working Group standardises ontologies for robotics and automation, e.g. IEEE 1872-2015. Ontologies include key terms as well as their definitions, attributes, types, structures, properties, constraints, and relationships. They allow reasoning and communication about tasks (P1872.1). There is ongoing work to extend IEEE 1872-2015 for Autonomous Robots (AuRs) by defining additional ontologies (P1872.2).
- The 'Robot Map Data Representation' Working Group has developed a standardised map data representation of environments for a mobile robot performing a navigation task (IEEE 1873-2015). It provides data models and data formats for two-dimensional (2D) metric and topological maps. The 'Robot 3D Map Data Representation' Working Group extends IEEE 1872-2015 to 3D (P2751).
- The 'Ontologies for Ethically Driven Robotics and Automation' Working Group develops a standard to establish a set of ontologies with different abstraction levels that contain definitions, axioms and concepts needed to establish methodologies for ethically driven Robots and Automation Systems (P7007).
- The Working Group 'Ethical Nudging for Robotic, Intelligent and Autonomous Systems' develops a standard for Ethically Driven Nudging for Robotic, Intelligent and Autonomous Systems (P7008). 'Nudges' are defined as overt or hidden suggestions or manipulations designed to influence the behavior or emotions. This standard establishes a delineation of typical nudges (currently in use or that could be created).
- IEEE through its Engineering Medicine and Biology Society (EMBS) Standards Committee also has focused standardisation activities on medical robots. The 'Medical Robots' Working Group specifies terms, definitions, and classification of medical electrical equipment/systems employing robotic technology (MEERT) (P2730).

The IEEE Robotics Automation Society Standards Committee have been focusing on new areas of standardisation work including work on Human-Robot interactions

- IEEE P3107 - Standard Terminology for Human-Robot Interaction
- IEEE P3108 - Recommended Practice for Human-Robot Interaction Design of Human Subject Studies
- IEEE P2940 - Standard for Measuring Robot Agility

For more information please visit https://ieeesa.io/rp-robotics.

ITU

ITU-T is active on a number of work items on Artificial Intelligence which have relevance to Robotics, as well. See the mentioning in chapter 3.1.11, section C1.

ITU-T SG16 has established the Focus Group on "AI for autonomous and assisted driving" (FG-AI4AD) to focus on AI performance evaluation in autonomous and assisted driving. The group aims to create an open framework for collaboration and sharing of expertise towards international harmonisation of a universal minimal performance threshold for AI-enabled driving functions (such as AI as a Driver), which is essential to building the global public trust required for widespread deployment of AI on our roads. FG-AI4AD is working on three Technical Reports related to "automated driving safety data protocol": 1) specification; 2) public safety benefits of continual monitoring; and 3) practical demonstrators". https://itu.int/en/ITU-T/focusgroups/ai4ad

ITU-T SG20 developed Recommendation ITU-T Y.4417 "Framework of self-organization network in the IoT environments" and is currently working on draft Recommendation on "Requirements and capability framework of IoT infrastructure to support network-assisted autonomous vehicles" (Y.IoT-AV-Reqts) and draft Recommendation ITU-T Y.4471 "Functional architecture of network-based driving assistance for autonomous vehicles" (ex Y.NDS-arch). https://www.itu.int/itu-t/recommendations/index.aspx?ser=Y

SG13 approved Recommendation ITU-T Y.3177 "Architectural framework for artificial intelligence-based network automation for resource and fault management in future networks including IMT-2020 and it has ongoing work item on functional requirements for Robotics as a Service (Y.RaaS-reqts). https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=16731

ITU-T SG13 established the Focus Group on Autonomous Networks (FG-AN) in December 2020. FG-AN leads exploratory 'pre-standardisation' studies to determine how ITU standards will support

the realization and evolution of autonomous networks.

The group is studying autonomous networks based on the key concepts of exploratory evolution, real-time responsive online experimentation, and dynamic adaptation.

https://www.itu.int/en/ITU-T/focusgroups/an/Pages/default.aspx

ITU-T SG20 approved Recommendation ITU-T Y.4471 "Functional architecture of network-based driving assistance for autonomous vehicles". ITU-T SG20 is also working on draft Recommendation ITU-T Y.4421 (Y.UAV.arch) and draft Recommendation ITU-T Y.RMDFS-arch "Functional architecture of roadside multi-sensor data fusion systems for autonomous vehicles".

More info: https://itu.int/go/tsg20

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

OCEANIS

The Open Community for Ethics in Autonomous and Intelligent Systems (OCEANIS) is a global forum for discussion, debate and collaboration for organizations interested in the development and use of standards to further the development of autonomous and intelligent systems.

https://ethicsstandards.org

SPARC

PPP for the collaboration between European robotic industry, academia and the European Commission to facilitate the growth and empowerment of the robotics industry and value chain. It includes a working group on standardisation.

http://www.sparc.eu/

H2020

R&D&I projects funded within topics ICT 24, ICT 25, ICT 26 and ICT 27 from Work Programme 2016-17 that may produce relevant input for standardisation.

(C.3) ADDITIONAL INFORMATION

Robotics PPP — EU Robotics: Strategic Research Agenda http://roboproject.h2214467.stratoserver.net/cms/upload/PPP/SRA2020_SPARC.pdf

Robotics PPP — EU Robotics: Multiannual Roadmap (rolling document) https://eu-robotics.net/sparc/about/roadmap/index.html

International Federation of Robotics: Standardisation http://www.ifr.org/standardisation/

US Occupational Safety and Health Administration: Robotics https://www.osha.gov/SLTC/robotics/index.html

3.4.8. CONSTRUCTION - BUILDING INFORMATION MODELLING

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The construction sector is one of the pillars of the EU economy, contributing to 9% of the EU GDP and to 18 million jobs (see the EC construction sector portal). Construction is also a horizontal sector, interconnected with many other industries – the sector is, for instance, a major consumer of intermediate products (raw materials, chemicals, and electric equipment, etc.) and services, including banking (ref. WEF 2016).

While the construction sector is a key driver of the overall economy, it faces numerous challenges relating to, inter alia, competitiveness, labor shortage, resource efficiency and especially productivity. In fact, over the past two decades, the labor productivity has grown at around a quarter of the rate in manufacturing (1.0% vs. 3.6% respectively) making the construction sector the poorest performer in terms of productivity (ref The Economist 2017).

Digitalisation in construction is increasingly recognised as a game changer (see BCG 2016), which could contribute significantly to sustainable development within the European Green Deal and the "Europe fit for digital age" priorities. According to the latest EC report on Digitalisation in the construction sector, market analysis showed that among data acquisition technologies, sensors are the technology with the highest level of market maturity and technological readiness; however, significant margins of improvement are present when it comes to their integration in existing buildings. 3D scanning is being increasingly used, while IoT is not yet widely adopted, although it is developing rapidly. Automating processes in the construction sector refer to the use of robots, 3D printing and drones to automate specific tasks in the construction sector. These technologies differ significantly in terms of development. Drones are being increasingly used, notably through the development and improvement of the sensors that they are equipped with, while robots and 3D printing are still at the development phase and utilised only for very specific and limited tasks. The low market readiness of automating technologies reflects also the fact that the construction and maintenance phases of the value chain have more limited traction when it comes to digitalisation. Last, the effective use of digital data represents the future of the digitalisation of the construction sector. In fact, data analysis is needed to give a meaning to all the data gathered and deliver tangible improvements and benefits. However, as the technologies and innovations in this category are deeply connected to the maturity of the data acquisition and automation technologies, their status varies significantly from one to the other. Building Information Management (BIM) is more and more utilised in the construction sector; however, it is often limited to the design phase of (large) projects. Virtual and Augmented reality and Artificial Intelligence are still at development stages and cannot yet be considered as market ready. Digital Twins are for the moment limited to a few pilot projects, but the majority of public and private stakeholders consulted agrees that they have high potential for the future.

The introduction of BIM is seen as the main solution to the management of information, especially during the following phases of the asset lifecycle: procurement, design, construction (including assembly), operation and maintenance. The development of BIM is advancing rapidly and requires the application of common standards to ensure interoperability and compatibility. The European BIM market was valued at EUR 1.8 billion in 2016, and is predicted to grow and reach EUR 2.1 billion in 2023, according to Business Wire 2017. In order to improve BIM adoption and allow public procurers to estimate monetary and non-monetary costs and benefits when introducing BIM in public tendering, the EC made available a methodology to conduct analysis and predictions, see EISMEA 2021.

Specifically when it comes to the management of the assets portfolios throughout their lifecycle, digital solutions can ensure that all actors (ex. clients and users) are better informed about the steps taken across the life cycle and take informed decisions, including when assets change owners. In this context, we observe the emergence of Digital Building's Logbooks and efforts on EU level to consolidate these (EU Framework for Buildings Digital Logbook, EASME 2019).

The European Commission has thus supported, promoted and developed several policies and initiatives aiming to foster the digitalisation in the construction sector. These include inter alia the Strategy for the sustainable competitiveness of the construction sector and its enterprises (COM(2012) 433), the EU BIM Task Group, the upcoming EU Digital Construction platform named as DigiPLACE and on demand support to MS through the EU Structural Reform Support Service. The digitalisation of the construction sector is also integrated in other policy areas such as the EU directive on Public Procurement (Directive 2014/24/EU), which promotes the use of BIM in construction project.

The introduction of common standards and operating methods using BIM would:

- reduce barriers to operation and trade across the European market area and beyond
- reduce both the capital and operating cost of construction assets
- reduce the time wasted because of inefficient breaks between productive construction processes
- improve the reliability of construction output, with better quality and fewer defects
- improve the resource efficiency of construction products and materials, improving both operating and embodied carbon performance

- support improvements in team working and collaboration
- improve the operations processes of construction assets

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

CEN Technical Committee 442 on Building Information Modelling was officially kicked off in 2015. The aim is to help the construction sector to be more (cost) efficient and sustainable by enabling smooth data exchange and sharing between partners in the value chain.

The objectives of CEN/TC 442 are:

- to deliver a structured set of standards, specifications and reports which specify methodologies to define, describe, exchange, monitor, record and securely handle asset data, semantics and processes with links to geospatial and other external data.
- to be the home for European BIM standardisation. CEN/TC 442 will be the central place to go for coordinating European BIM harmonisation.
- to coordinate the work with ISO under the Vienna Agreement, either adopting existing international standards at European level or developing new ones in parallel
- to receive and consider proposals for new deliverables and develop them within the TC structure of working groups for the different scopes

The Committee so far has adopted the most important ISO standards in the field of BIM as European standards: EN ISO 12006-2 - Framework for classification; EN ISO 12006-3 - Framework for object-oriented information; EN ISO 16739 – 1 Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries - Part 1: Data schema; EN ISO 29481-1 – Information Delivery manual – Methodology and format; EN ISO 29481- 2 - Information Delivery manual – Interaction framework

Through the CEN/ISO Vienna Agreement with ISO lead (together with ISO/TC 59/SC 13) the following standards have been developed: EN ISO 19650 Information Management using Building Information Modelling together with ISO/TC 59/SC 13. Part 1- Concept and Principles and part 2 – Delivery phase of an asset was published in December 2018. Part 3 Operation phase of an asset and Part 5 – Security Minded approach to information management are expected to be published in 2020. Part 4 – Information exchange is under development.

Through the CEN/ISO Vienna Agreement with CEN lead (together with ISO/TC 59/SC 13) the following standards have been developed: EN ISO 23386 – Methodology to describe, author and maintain properties in interconnected dictionaries; EN ISO 23387 - Data templates for construction objects used in the life cycle of any built asset-Part1 Concepts and Principles. The standards are expected published early in 2020; EN ISO 12006-3 revision - Framework for object-oriented information.

(A.3) REFERENCES

- **EC construction sector portal**: https://ec.europa.eu/growth/sectors/construction_en
- McKinsey (2017). Reinventing construction
- **European Construction Sector Observatory** - Analytical Report - Digitalisation in the construction sector – April 2021:
- EISMEA 2021: Calculating costs and benefits for the use of Building Information Modeling in public tenders - Methodology handbook
- EASME 2019: Study on the Development of an EU Framework for Buildings' Digital Logbook.
- COM(2012) 433 Communication from the Commission to the European Parliament and the Council on the Strategy for the sustainable competitiveness of the construction sector and its enterprises
- **SWD(2012) 236 final** Strategy for the sustainable competitiveness of the construction sector and its enterprises
- **The EU BIM Task Group**, http://www.eubim.eu/
- DigiPLACE, https://www.digiplaceproject.eu/
- EU Structural Reform Support Programme (SRSP).
- Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC, especially Art. 22.
- Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC.
- Handbook for the introduction of Building Information Modelling, by the European Public Sector (EU BIM Task Group).
- The European Construction Sector Observatory

(B.) REQUESTED ACTIONS

ACTION 1 CEN/TC442 collaborate with ISO/TC 59/SC 13 (ISO committee responsible for BIM standardisation) to align Business Plans and Work Programme as much as possible. The Business Plan will be updated regularly and based on an ongoing work with a Road Map for BIM. SDOs to develop European standards when necessary (i.e. if functional gaps are found or international standards are not available). Where development of European standards is necessary because European priorities are incompatible with ISO planning (EC market needs, new research trends, etc.), later alignment should be achieved leveraging on Vienna agreement.

ACTION 2 SDOs to work on information exchange — Enhance and harmonize open data formats, structures and classification systems for model based working in the construction industry. This work is coordinated in CEN/TC 442 in collaboration with ISO/TC 59/SC 13 and buildingSMART and focuses on activities such as:

The Industry Foundation Classes (IFC), EN ISO 16739 and its extension within the infrastructure sector. Important developments on a European and International Scale are ongoing for bridge, tunnel, road, rail and harbours with buildingSMART lead. A common neutral IFC based standard for infrastructure related asset management and construction activities supports a common European market and shall enable equal access to European IT companies

Work Items in CEN/TC 442 on providing a framework for common catalogues, templates and exchange structures for harmonized product data including those who following the CPR directive. The work Item for a common structure for Construction Product Data is developed in collaboration with ISO/TC 59/SC 13 with CEN lead

other national, domain specific, open data format for model based working with potential for European wide application. CEN/TC442/WG has a preliminary Work Item to develop a transport data format for Product based in IFC. (IFCxml)

ACTION 3 SDOs to develop common information requirements for project and information management as part of construction service procurement standards:

- EN 17412 Level of Information. Needs a common European framework to express the requested information to be delivered during the project execution and project hand over as Work Item within CEN/TC 442. To support this standard CEN/TC442 should realise the development of a "guide for application" and a standardised data schema.
- Work Item to develop Guidelines on how to understand and utilise EN ISO 29481 in a European context
- EN ISO 19650 require use of a Common Data Environment – CDE. CDE is the BIM synonym for Information platforms that enable and enforce collaborative Information Exchange across all stakeholders and participants in the value chain of operation, planning and construction of built assets. CEN TC/442 should develop guidance and standard to support implementation of CDE in the European marked:
- Guidance, Framework and Implementation of Common Data Environment (CDE) Workflow and Solution in accordance with EN ISO 19650
- Common Data Environments (CDE) for BIM projects – Open data exchange between platforms of different vendors via an open CDE API

ACTION 4 SDOs to support data dictionaries - Develop European standards for exchange of data on construction products, to ensure quality in data to support Regulation (EU) No 305/2011 CPR and trade of construction products in the European market. In specific, provide digital tools to support the collaborative development and European wide harmonization of terms and corresponding semantics for:

- written language in standards,
- names, classifications and properties of entities in object oriented data models,

Tools providing a mapping between national/European terms and their corresponding semantics are the basis for the development of a framework for harmonized European vocabulary for digital construction and its European and national implementation.

In the current dynamic development phase with many groups working in parallel there is a great risk that without such tools divergent definitions will be established permanently.

ACTION 5 SDOs to create NWI to develop a technical report needed for standards to support BIM for infrastructure in the European market.

ACTION 6 Develop a framework for how CEN/TC442 can support the use of BIM in other relevant TC's in CEN (e.g. construction products, energy analyses, acoustics)

Other national, domain specific, open data format for model based working with potential for an European wide application. CEN/TC442 has a preliminary Work Item to develop a transport data format for Product based in IFC (IFCxml).

ACTION 7 SDOs to consider the environmental aspects and, in particular, support circularity in development of BIM standards; see also the Circular Economy chapter in this document.

ACTION 8 SDOs to support and, when possible, undertake open source initiatives to support the adoption of BIM standards.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN

CEN/TC 442 "Building Information Modelling (BIM)" is about standardisation in the field of structured semantic life-cycle information for the built environment.

Publlished standards:

CEN/TR 17439 - Guidance on how to implement EN ISO 19650-1 and -2 in Europe (note: this is referenced as "prEN 17439 Guidance on how to implement EN ISO 19650-1 and -2 in Europe" in the RP 2020)

Ongoing work:
https://standards.cen.eu/dyn/www/f?p=204:22:0::::FSP_ORG_ID,FSP_LANG_ID:1991542,25&cs=1085D2CA41E34A1C2DA860E5234AA5A97

CENELEC

CLC/TC 205 'Home and Building Electronic Systems (HBES) is exploring the need for standardising BIM attributes within its scope and in coordination with CEN/TC 442 (which has a coordinating role for BIM), CEN/TC 247 'Building automation, controls and building management', and CEN/TC 169 'Light and Lighting'

ISO

ISO ISO/TC 59/SC 13 "Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)" is charged by TC 59 "Buildings and civil engineering works" to focus on international standardisation of information through the whole life cycle of buildings and infrastructure across the built environment to enable interoperability of information, to deliver a structured set of standards, specifications and reports to define, describe, exchange, monitor, record and securely handle information, semantics and processes, with links to geospatial and other related built environment information andto enable object-related digital information exchange. Published standards: https://www.iso.org/committee/49180/x/catalogue/p/1/u/0/w/0/d/0

ITU-T

ITU-T SG20 is currently working on "Requirements and functional architecture for smart construction site services" (Y.IoT-SCS).

More info: https://itu.int/go/tsg20

ONEM2M

The oneM2M standard supports a multi domains/solutions integration that supports the integration of the construction supporting systems and the building systems within the surrounding digital environment (e. g. the smart cities systems, infrastructure context, construction site, etc.). This includes both the construction of buildings and infrastructures (roads, dams, ports, industry plants, etc.) and the operational and management support of the built facilities). oneM2M Specifications are available at Specifications (onem2m.org).

Furthermore, the SAREF ontology makes use of oneM2M as communication framework and data collection for Building and Transport systems see ETSI TS 103 264 (Reference Ontology and oneM2M Mapping) and includes a specific extension for buildings ITS (ETSI TS 103 410-2). ETSI standards are available at https://www.etsi.org/standards-search.

(C.2) OTHER ACTIVITIES RELATED TO STANDARDISATION

H2020

DigiPLACE (Digital PLAtform for Construction in Europe). Call: H2020-DT-2018-2020 "Digitising and transforming European industry and services: digital innovation hubs and platform" - Topic: DT-ICT-13-2019 "Digital Platform/Pilots Horizontal Activities" Proposing future pilots in Standardisation::

- COMMON LANGUAGE: Semantic web and linked data. Definition of construction domains, ontology, class, lexicon, taxonomy, etc.
- DIGITAL CONTRUCTION STANDARD: Technical standard. Definition of digital common structure of technical standard and EU Standard DB
- DIGITAL LAW STANDARD: Law standard. Definition of digital common structure of construction laws and EU Law DB

BIM4EEB (BIM based fast toolkit for Efficient rEnovation of residential Building). Call: H2020-EU.2.1.5.2. "Technologies enabling energy-efficient systems and energy-efficient buildings with a low environmental impact" – Topic: "LC-EEB-02-2018 - Building information modelling adapted to efficient renovation (RIA)"

Focus on Semantic web and Linked Data in AECO domain, Renovation. Contribution in CEN standard: CT442 - (WI=00442021) Modelling and linking between semantic ontologies.

3.4.9 COMMON INFORMATION SHARING ENVIRONMENT (CISE) FOR THE EU MARITIME DOMAIN

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The global action's objective is to establish a common information sharing environment (CISE) enabling enhanced awareness and knowledge of what is happening at sea as an important contribution to efficiency in maritime operations and performance in all sectors within the EU maritime domain. This in turn will ultimately ensure safer, cleaner and more secure seas.

In line with the EU digital single market, this translates into seamless, more structured and trusted cross-sector and cross-border information exchange between public administrations across seven distinct maritime domains (maritime safety and security, maritime pollution and marine environment, fisheries control, border control, general law enforcement, trade and economy and defence).

CISE seeks therefore to develop appropriate semantic, technical, organisational solutions and recommendations to enhance the interoperability between existing systems of around 300 maritime public authorities throughout the EU/EEA. As a result, the systems become compatible and the content, speed and reliability of information exchange optimal, enabling improved security and sustainable development of economic maritime activities.

Cross-sector and cross-border interoperability between maritime surveillance systems is the major innovative aspect of the CISE. The technical solution proposed is mainly based on the CISE data and service model. This solution has been tested by the major FP7 pre-operational validation project EUCISE 2020 and the solution is being consolidated in view of the operational phase. The interoperability specifications for CISE have been proposed for standardisation through an Industry Specification Group in ETSI. This development could also benefit the European industry: several industries participate to the ETSI group.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The objective is to reach firm agreement on the CISE data and service model with all the stakeholders involved in maritime surveillance in Europe. This interoperability agreement should encourage Member States to invest more resources in the exchange of maritime surveillance information across Europe with CISE, thus ensuring the long-term sustainability of the programme.

The present version of the CISE data and service model was developed in 2014 by a pilot project (the CISE cooperation project) involving 28 partners from 12 European countries and covering different sea basins and different sectors.

The EUCISE 2020 FP7 project (CISE pre-operational validation) has developed the CISE components using the CISE data and service model and validated them in a pilot environment. This project involved 39 authorities from 15 European countries and has been concluded on April 2019.

The EUCISE2020 project has established in April 2019 an Industry Specification Group (ISG) in ETSI to consolidate the CISE data and service model (interoperability specifications). This group includes Public Administrations and Industries. The JRC and EMSA support the activities of the ISG with the role of counsellor.

A Transitional Phase has been put in place, since May 2019, to prepare the ground for the deployment of CISE into operation by the end of 2023. This phase, managed by EMSA and benefiting from the technological and scientific support of JRC, is going to develop, deploy and configure the operational network of CISE on the grounds of the lessons learnt of EUCISE 2020 and the standardisation process of the CISE data and service model.

(A.3) REFERENCES

- Council of the European Union: Conclusions on maritime security, adopted on 22 June 2021.
- Council of the European Union: Conclusions on sustainable blue economy: health, knowledge, prosperity, social equity adopted on 26 May 2021
- The Commission Communication on a new approach for a sustainable blue economy of 17 May2021
- Council of the European Union: Conclusion on the revision of the European Union Maritime Security Strategy (EUMSS) – Action Plan adopted on 26 June 2018 - 10494/14
- Council of the European Union: Council conclusions on Global Maritime Security (19 June 2017 - 10238/17)
- Council of the European Union: European Union Maritime Security Strategy (EUMSS) – Action Plan adopted on 16 December 2014 - 17002/14
- (COM/2014/0451 final) Communication from the Commission to the European Parliament and the Council *Better situational awareness by enhanced cooperation across maritime surveillance authorities: next steps within the Common Information Sharing Environment for the EU maritime domain*
- Commission Staff Working Document: 'Impact Assessment accompanying the communication from the Commission to the European Parliament and the Council *Better situational awareness by enhanced cooperation across maritime surveillance authorities: next steps within the Common Information Sharing Environment for the EU maritime domain'* (SWD/2014/0225 final)
- Council conclusions *Towards the integration of maritime surveillance: A common information sharing environment for the EU maritime domain*, 3092nd General Affairs Council meeting, Brussels, 23 May 2011
- (COM/2010/0584 final) Communication from the Commission to the Council and the European Parliament *Draft roadmap towards establishing the Common Information Sharing Environment for the surveillance of the EU maritime domain*
- Council conclusions on integration of maritime surveillance, 2974th External Relations Council meeting, Brussels, 17 November 2009
- (COM/2009/0538 final) Communication from the Commission to the Council the European Parliament, the European Economic and Social Committee and the Committee of the Regions *Towards the integration of maritime surveillance: A common information sharing environment for the EU maritime domain* {SEC(2009) 1341}
- Commission Staff Working Document: *Review of the Common Information Sharing Environment (CISE) for the maritime domain: 2014 – 2019* (SWD/2019/322 final)

(B.) REQUESTED ACTIONS

ACTION 1 Based on the existing CISE data and service model, complete semantic and technical interoperability specifications to exchange surveillance information between competent authorities could be standardised.

ACTION 2 **The following complementary actions could be developed in addition to the standardisation action (these activities will have to take into account future developments to extend the CISE components to other domains such as Land Border Control):**

- Development of reference specifications (i.e. the CISE Data and Service model) to be used for the CISE software components to facilitate the adoption of CISE by interested authorities.
- Development of a testing platform to assess whether the CISE interface developed by the national authorities complies with the standardised specifications. These activities will have to take into account future developments to extend the CISE components to other domains such as Land Border Control.
- Development of template service level agreement or memorandum of understanding for the future agreements on sharing information between Member States, taking into account the one developed in the framework of the CISE transitional phase

C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

ISO

ISO/TC 8: Ships and marine technology

http://www.iso.org/iso/iso_technical_committee?commid=45776

ISO/TC8 new focus items include:

- Cyber safety
- Electronic certification for port entry; data harmonisation, e-Navigation, IHO

Ships' Energy Efficiency, EEOI, reductions in emissions from ships in freight transport

Projects include:

- ISO 19847, Ships and marine technology -- Shipboard data servers to share field data on the sea

- ISO 19848, Ships and marine technology -- Standard data for shipboard machinery and equipment

IEC

IEC/TC 80 Maritime navigation and radiocommunication equipment and systems has produced standards:

- IEC 62729 Long Range Identification and Tracking
- IEC 61993-2 Automatic Identification Systems for SOLAS ships
- IEC 62287 Automatic Identification Systems for non SOLAS ships
- IEC 62320 Automatic Identification Systems shore infrastructure

Current activities include the following projects:

- Satellite terminals to support new satellite service providers
- VHF Data Exchange System to support future e-navigation
- S-100 Common Maritime Data Structure to support future e-navigation

CENELEC

CLC/SR 80 Maritime navigation and radiocommunication equipment and systems. Standards and projects in CLC/SR 80 are those conducted at IEC level.

ONEM2M

As a multi domains/solutions platform oneM2M is a perfect choice for the retrieval and analysis of data in complex systems, such as the CISE ones. Collection and exposure of data form different sources, from weather stations to floating sensors (buoys) for tsunami, from predictive maintenance of naval machineries to boats digital twins, from ports logistics to port surveillance assistants. AlloneM2M Specifications are available at Specifications (onem2m.org).

ETSI

ETSI has set up the Industry Specification Group ETSI ISG 'European Common information sharing environment service and Data Model' (ISG CDM), whose main objective is to develop a consistent set of technical specifications to allow data exchange among different legacy systems in a cooperative network, European Common Information Sharing Environment (CISE). https://www.etsi.org/committee/1584-cdm

Common Information Sharing Environment provides a networked ecosystems that share an Nx1 (instead of an NxM) integration paradigm. The standardisation of common practices reduces computational resource consumption.

ITU-R

ITU-R Working Party (WP) 5B is responsible for studies related to the maritime mobile service including the Global Maritime Distress and Safety System (GMDSS); the aeronautical mobile service and the radiodetermination service, including both radiolocation and radionavigation services. It studies communication systems for the maritime mobile and aeronautical mobile services and radar and radiolocation systems for the radiodetermination service.

In close cooperation with the International Maritime Organization (IMO), ITU-R WP 5B also develops drafts of operational procedures for urgency, distress and safety communications and operation of systems belonging to the maritime mobile service, including the management of Maritime Mobile Service Identities (MMSI).

ITU-R WP 5B is currently working on the revision and update of some important deliverables, including:

- Recommendation ITU-R M.493 – Digital selective-calling system for use in the maritime mobile service
- Recommendation ITU-R M.541 – Operational procedures for the use of digital selective-calling equipment in the maritime mobile service
- Recommendation ITU-R M.585 – Assignment and use of identities in the maritime mobile service
- Recommendation ITU-R M.1371 – Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile frequency band
- Recommendation ITU-R M.2021 – Characteristics of a digital system, named Navigational Data for broadcasting maritime safety and security related information from shore-to-ship in the 500 kHz band
- Recommendation ITU-R M.2058 – Characteristics of a digital system, named navigational data for broadcasting maritime safety and security related information from shore-to-ship in the maritime HF frequency band
- Recommendation ITU-R M.2092 – Technical characteristics for a VHF data exchange system in the VHF maritime mobile band

Recommendation ITU-R M.2135 – Technical characteristics of autonomous maritime radio devices operating in the frequency band 156-162.05 MHz

3.4.10 WATER MANAGEMENT DIGITALISATION

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

Global water challenges are critical for our society, including alterations in water quality and availability, the frequency of floods and droughts due to climate and other environmental changes, pollution trends and increased competition in water uses. Currently, these cause serious problems in 11% of the EU territory and this is expected to increase to 30% by 203021. Moreover, **the usage of water is a key enabler for urban and rural industrial activities that is expected to increase by 55% in 2050**2223. It is fundamental to improve integrated water resource protection and management in the man-made or natural environments by addressing integrated water and wastewater management, water reuse, circular economy, water system monitoring and reporting, pollution reduction and prevention, smart irrigation, resilience in the field of floods and droughts, leakage reduction and prevention, water governance, and awareness raising of the true value of water by all stakeholders.

For these reasons, it is essential to **develop and implement robust, smart, cost-effective, efficient and tailored water management systems**, solutions and multi-sectoral governance models in Europe and globally. Advanced digital technologies comprise transversal common topics: big data-analytics, data sharing, privacy management, real-time and near-real-time monitoring, sensors, smart devices, decision support systems and water management tools, IoT, cloud and fog computing platforms, artificial intelligence and machine learning, algorithms, augmented reality and simulation tools, image and streaming data processing capabilities, reporting and consumer awareness tools and applications, cyber-security, system interoperability and standardisation solutions. These networked, intelligent systems help make better use of energy, avoid unnecessary water losses and minimize the consumption of resources.

Since 2007, the organisation, infrastructure and management of environmental data has been standardised through the **INSPIRE Directive (**Directive 2007/2/EC), but implementation is lagging behind, in particular many efforts in thematic domains, such as data related water management are ongoing to **improve standardisation for interoperability**.

The 2019 **European Green Deal (**COM(2019) 640) recognises the potential of digitalisation to achieve the environment and climate aims and the necessity to explore sustainable digital technologies as essential enablers of the changes needed for a just green transition. Reference is made to digital technologies such as Artificial Intelligence (AI), 5G, cloud and edge computing and the Internet of Things (IoT) as having the potential to accelerate and maximise the impact of policies to protect the environment and to address climate change (COM(2019) 640, p.)

Since 2007, the organisation, infrastructure and management of environmental data has been standardised through the **INSPIRE Directive (**Directive 2007/2/EC), but implementation is lagging behind, in particular many efforts in thematic domains, such as data related water management are ongoing to **improve standardisation for interoperability**.

The Zero Pollution (ZP) initiative and ZP Action Plan "Towards Zero Pollution for Air, Water and Soil" (COM(2021) 400) announces a number of flagship initiatives of the Commission which will encourage the sustainable deployment of digital solutions and start an exchange of good practices. It foster digitalisation of water sector to reach zero pollution ambition that for water. The vision and the key priorities in conjunction with the ICT4Water cluster - a community of 65 EU-funded research and innovation projects has been explicitly characterized in the Commission Staff Working Document '**On Digital solutions for zero pollution**' (SWD(2021) 140, see p.25-26).

21 https://www.riob.org/en/documents/communication-water-framework-directive-wfd-and-floods-directive-fd-actions-towards-good

22 https://www.oecd-ilibrary.org/development/aid-for-trade-at-a-glance-2017_aid_glance-2017-en

23 https://ec.europa.eu/environment/water/flood_risk/implem.htm

The **green and digital transitions** can offer new opportunities for achieving environmental objectives provided that the environmental risks stemming from digitalisation are managed. Many such cases already exist and 25 of them have been illustrated in the Staff Working Document "Digital Solutions for Zero Pollution". These examples represent only a small amount of all digital solutions for zero pollution. **However, green digital transition is not possible without standardisation.** The key elements needs standardisation are related to e.g. digital wins, data visualisation and dissemination, for smartening water management in creating smart resilient cities and communities, to manage eHealth and environmental pollution of water, use of smart sensors, IoT in water monitoring, optimisation of water sector operations by employing e.g. Machine Learning, use of Augmented Reality applications for water, etc.

The ICT4Water cluster is a hub for EU-funded research and innovation projects developing digital solutions for the water sector. Since January 2018 the cluster is led by EASME/REA. The cluster supports its members in exchanging information and best practices, disseminating and exploiting project outputs, contributing to define digital water strategies and to policy development in digital and water domain. The cluster has 65 member projects, financed by Horizon 2020, the LIFE programme, the European Maritime and Fisheries Fund and the Climate-KIC's Pathfinder Programme. In the context of the cluster, several studies and reports on digital water have been published in previous years. Of the EU-funded projects, three main digital solution types, data driven intelligence, smart sensors/drones and models/simulation account for the 67% of the ICT technologies used so far. While there is an increase of digital adoption in water, the sector still lags behind other industries in integrating new, smart technologies into the whole water cycle and ecosystem. The interoperability and the standardisation is the issue for digitalisation of water sector.. Currently, the cluster, with its seven action groups, among them Action group on *Smart water data interoperability and standardisation*, collaborates with ETSI, and working on SAREF extension for water.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The European Commission is working towards the definition of long-term regulatory strategy concerning the adoption of smart water technologies in coordination with relevant stakeholders and standard organisations, to ensure smooth digitalisation of water services over the next decade.

Data are the centrepiece of the digital agenda. Digitalisation has already helped generate, share, manage and re-use data more efficiently but latest technologies offer radically new solutions, which are not yet commonplace.

The water sector is living a revolution in their infrastructure towards the digitalization and the adoption of novel digital technologies (e.g. edge computing, Big Data, semantic interoperability, etc.). Indeed, water sector is moving to the Industry 4.0 paradigm to ensure the commitments of EU water directives in drinking water, water quality, bathing quality, and groundwater quality. Moreover, the application of novel digital technologies will also pave the way to the commitment of green deal directive in terms of efficiency of resources and finally, impacting on the adaptation and mitigation of climate change.

Under this paradigm shift, standardisation has also produced a change in the water industry minds. The water sector immersed in the adoption of private standards for water management and monitoring have evolved to the adoption of open standards. In this regards, newer semantic interoperable standards as SAREF4WATR have permitted the common representation of water data across systems. Complementary, the generation of context-brokers based on the ETSI GS CIM 009 specification opens the innovation towards the adoption of common reference digital architectures.

However, there are still some gaps and challenges to cover towards making **water sector open and transparent**. Indeed, interoperability and data standardisation requires for their **large-scale adoption** and the **generation of open and linked curated water data sets to sustain newer digital innovations**. This aspect will remove the generated barriers in information exchange caused by the lived fragmentation and heterogeneity of digital water infrastructures. Considering water data exchange, there is a real evidence on the interrelation of water domain with their interrelated domains (e.g. energy, climate, land-use, etc.). This will permit to **establish balanced policy and decision-making actions**. Moreover, it also will permit to **transfer and replicable decision-making tools and strategies between domains**. The proliferation of AI driven tools have put on evidence the need to create trustworthy and transparent models. These aspects are currently available in the recently published EU Data Strategy and Artificial Intelligence Act. Subsequently, there is a **need to establish the basis to adopt those directives**. For that, main gap is the **lack of data sovereignty and non-discriminator algorithms to support these change**. All of these aspects highlights the **lack of newer digital business models** able to make the transition from traditional models towards data centered models.

EU needs to move towards the generation of common data places to enable not only free-flow of information but also the **elaboration of digital data spaces** to share datasets and knowledge at cross-domain. Under this vision, EU needs to **reduce the legislative and policy-making gaps that exist on data sharing across different countries** (Data Governance Act, COM(2020) 767). This aspect will facilitate a more cohesive EU in terms of **data transparency and data democracy**. These aspects applied into the water sector will permit to **unlock organizations and people potential to generate AI driven innovations from water sector**. Therefore, it will permit to introduce social innovations in water management, water quality management, etc.

Another key aspect in the Water Framework Directive towards the incorporation of Earth Observation and data-driven models as a part of the water technologies to monitor water resources and quality. A strategy and standardisation in this regards will permit to **open up the proliferation of standardized data-driven tools capable of improving existing monitoring methods protected under a standardized umbrella**.

Finally, and in terms of ICT standardisation in the EU, there exist some standardisation landscape that covers EU and worldwide standardisation in water-related sector. These open-standards covers all horizontal (e.g. water reuse and recycling across sectors) and also, vertical sectorial aspects (from monitoring to data visualization). In the view of this standards however, there is a gap in standardisation of **water data manipulation and knowledge generation** and **lack of standardisation in the SMART Water Market is seen as one of the biggest obstacles** in realising the full potential that the adoption of this technology has in making SMART Water Networks standard practice. This is an aspect that should be reinforced in the following years.

(A.3) REFERENCES

- Zero Pollution Action Plan COM(2021) 400
- SWD on Digital solutions for zero pollution SWD(2021) 140
- SAREF extension for water https://saref.etsi.org/saref4watr/v1.1.1/
- ETSI GS CIM 009: Context Information Management (CIM), NGSI-LD API [2]. https://www.etsi.org/deliver/etsi_gs/CIM/001_099/009/01.01.01_60/gs_cim009v010101p.pdf
- A Europe fit for the digital age: Priorities for 2019-2024
- Shaping Europe's digital future – A European Strategy data
- European Data Governance Act COM92020) 767 final
- EU Water Framework Directive 2000/60/EC
- Naiades project Standardisation Web page.
- ICT4Water cluster (https://ict4water.eu/)
- ICT4WATER cluster - Vision and showcases (2021)
- "The need for digital water in a green Europe - EU H2020 projects' contribution to the implementation and strengthening of EU environmental policy"(2021)
- The study "Business models for digital water solutions - A study on the development of business models of digital solutions related to ICT4Water cluster projects"(2021)
- ICT4Water report on Recommendations for standards and standardisation in the European Smart Water Market (2015)
- 'Green Data for All' initiative'24

24 This initiative was announced in the European Data Strategy and it consists in evaluating and possibly reviewing the Directive establishing an Infrastructure for Spatial Information in the EU (INSPIRE), together with the Access to Environment Information Directive. It will modernise the regime in line with technological and innovation opportunities, making it easier for EU public authorities, businesses and citizens to support the transition to a greener and carbon-neutral economy, and reducing administrative burden.

OTHER RELEVANT REFERENCES:

- General Union Environment Action Programme to 2030 COM(2020) 652
- The European Green Deal COM(2019) 640
- Commission Communication - Shaping Europe's digital future COM(2020) 67
- A European strategy for data COM(2020) 66
- WHITE PAPER On Artificial Intelligence - A European approach to excellence and trust COM(2020) 65
- A New Industrial Strategy for Europe COM(2020) 102

(B.) REQUESTED ACTIONS

The requested actions towards digitalisation of the water sector and implementation of ICT were defined in the scope of the ICT4Water Cluster:

ACTION 1 Guidelines for the definition of Smart Water Grids, powered by IoT technologies and standards, which contributes to decentralised, circular water and information flow. The concept of the Smart Water Grid was expected to be developed in the framework of ICT4Water Cluster running projects. Many standards organisations such as ETSI, CEN/CENELEC, AIOTI, OGC, OpenFog, BVDA are expected to contribute in coordination with the EC.

ACTION 2 Guidelines and collaborative work among key actors (associations, alliances, SDOs, etc.) for the definition of Water Big Data standardisation frameworks, which contributes to implementing smart water best practices and an interoperability framework for smart water services. Special emphasis is made on key aspects of a big data platform such as integration, analytics, visualisation, development, workload optimisation, security and governance. ICT4Water Cluster used the testbeds established in the scope of the running projects to prove working concepts. There is a need of coordination with other sector programmes supported by EC like environment, communication and content management, humanitarian operations, space etc.

ACTION 3 Selection and integration of the widely accepted technologies in each class among all the range of suitable standards and ontologies ensuring the interoperability at data and communication level as SAREF for example. SDOs have to define the framework that allows the producers, providers, stakeholders and end-users to develop the smart water services next decade. The process needs to be in conformance to the policy set by the European Commission.

ACTION 4 Definition of open models and open data through interoperable platforms. The first steps as a policy decision are made by the EC. Then SDOs have to define the architectures, data models, ontologies, standard interfaces and protocols to allow data sharing, platforms integration and interoperability.

ACTION 5 Incentives for the adoption of Open Data standards, in order to be able to provide information in a transparent and up to date manner. This action is related to the policy of the EC but needs to be developed taking into account the security. Citizen's awareness is an important issue and is related to the developed open data models by standards organisations in Action 4.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN/CENELEC/ETSI

A European Technical Report comprising a software and hardware open architecture for utility meters that supports secure bidirectional communication upstream and downstream through standardised interfaces and data exchange formats and allows advanced information and management and control systems for consumers and service suppliers. The Report identifies a **functional reference architecture for communications in smart metering systems**. and the standards relevant to meeting the technical / data communications requirements of Mandate M/441, in particular to assist the active participation of consumers. The architecture has been developed drawing on existing and planned implementations, but its generic nature should enable it to support future different implementations.

The previous CEN_CENELEC-ETSI Smart Meters Co-ordination Group has been merged into the similar structure dealing with smart energy grids co-ordination (see the relevant section of the Rolling Plan).

OGC®

HY_FEATURES: reference model defining real-world water-objects and the way they relate to each other according to hydro-science domain defined by semantics and network topology.

http://www.opengeospatial.org/projects/groups/hydrofeatswg

WaterML2.0. Standard information model for the representation of water observations data, with the intent of allowing the exchange of such data sets across information systems, using existing OGC standards.

http://www.opengeospatial.org/projects/groups/waterml2.0swg

ETSI

SAREF Investigation for Water (DTR/SmartM2M-103547): determining the requirements for an initial semantic model for the Water domain based on a set of use cases and from available

existing data models.

https://goo.gl/324EyW

Industry Specification Group "City Digital Profile" (ISG CDP) was doing work relevant to city standards for water management, but the ISG was closed September 2019.

https://portal.etsi.org/Portals/0/TBpages/CDP/Docs/ISG_CDP_ToR_DG_Approved_20171011.pdf

CEN

See CEN/CENELEC/ETSI entry above

INSPIRE

INSPIRE Directive. reference EU architecture for data sets sharing between EU countries.

http://inspire.ec.europa.eu

ISO/IEC

Generic Sensor networks Application Interfaces (ISO/IEC 30128). International Standard that depicts operational requirements for generic sensor network applications, description of sensor network capabilities, and mandatory and optional interfaces between the applications.

https://webstore.iec.ch/preview/info_isoiec30128%7Bed1.0%7Den.pdf

https://www.iso.org/standard/53248.html

ITU-T

The ITU-T Focus Group on Smart Water Management (FG-SWM) issued a series of deliverables including the following:

- The Role of ICT in Water Resource Management
- Smart Water Management Stakeholders Map
- Smart water management project classification
- Smart water management stakeholder challenges and mitigation report on the KPI to assess the impact of the use of ICT in SWM

https://www.itu.int/en/ITU-T/focusgroups/swm/Pages/default.aspx

The ITU-T Focus Group on Environmental Efficiency for Artificial Intelligence and other Emerging Technologies (FG-AI4EEE) will develop technical reports and technical specifications to address issues related to environmental efficiency, water and energy consumption. More information on ITU FG-AI4EE is available at: https://www.itu.int/en/ITU-T/focusgroups/ai4ee/Pages/default.aspx.

Recommendation ITU-T F.747.6 elaborates on the "Requirements for water quality assessment services using ubiquitous sensor networks (USNs)" https://www.itu.int/rec/T-REC-F.747.6-201410-I/en

ITU-T SG20 is currently working on draft Recommendation on "Framework of monitoring of water system for smart fire protection" (Y.water-SFP). https://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=16399

ISO

ISO/TC 282: standardisation of water re-use of any kind and for any purpose. It covers both centralised and decentralised or on-site water re-uses, direct and indirect ones as well as intentional and unintentional ones. It includes technical, economic, environmental, and societal aspects of water re-use. Water re-use comprises a sequence of the stages and operations involved in uptaking, conveyance, processing, storage, distribution, consumption, drainage, and other actions related to the handling of wastewater, including the water re-use in repeated, cascaded, and recycled ways.

https://www.iso.org/committee/4856734.html

PSA

WITS Standard Protocol: standard method dedicated to water industry telemetry control and monitoring. This standard protocol makes interoperable equipment from different manufacturers by using features of the DNP3 protocol to satisfy water industry specific functional requirements.

http://www.witsprotocol.org

ONEM2M

oneM2M was launched in 2012 as a global initiative to ensure the most efficient deployment of Machine-to-Machine (M2M) communications systems and the Internet of Things (IoT) and it includes several SDOs and representatives of different industry sectors. The latest technical specifications can be found on their website http://www.onem2m.org/technical

The oneM2M standards supports a multi domains/solutions integration that supports Water Management digitalisation requirements, and in particular the integration with the other services and systems that are building the Digital Single Market (e.g. the integration with Smart Cities and with Smart Agriculture solutions). The SAREF ontology makes use of oneM2M as a communication framework (ETSI TS 103 264 (Reference Ontology and oneM2M Mapping) and a specific Smart Watering extension (ETSI TS 103 410-10) is available at https://www.etsi.org/standards-search

AIOTI

High Level Reference Architecture: reference ICT architecture and semantic data model based on the ISO/IEC/IEEE 42010 standard for representing IoT entities and services. This reference architecture is transversal to several domains including water. https://aioti.eu/wp-content/uploads/2017/06/AIOTI-HLA-R3-June-2017.pdf

W3C

Web of Things Working Group: RDF and Linked Data vocabularies to reduce the fragmentation generated in the IoT devices. Moreover, this group is also focused on providing best practices and corresponding APIs to enable semantic interoperability within the Smart City.

Iot-Schema.org. Extension of schema.org data model towards modelling IoT entities with focus on energy, transport, and water infrastructures.

https://www.w3.org/

(7) ICT4Water cluster: www.ict4water.eu/ , Action Plan for a DSM for Water Services on the discussion platform Futurium: https://ec.europa.eu/futurium/en/content/ict4water-roadmaps-action-plan

3.4.11 SINGLE EUROPEAN SKY

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

The EU's Single European Sky (SES) initiative has at its heart the reform of the Air Traffic Management (ATM) in Europe in order to cope both with sustained air traffic growth over the last decade and with significant unforeseen traffic variations such as the one caused by the COVID-19 pandemic. This requires changes in operations under the safest, most cost- and flight-efficient and environmentally friendly conditions. It implies de-fragmenting the European airspace, reducing delays, increasing safety standards and flight efficiency to reduce the aviation environmental footprint, and regulating costs related to monopolistic service provision. A new legislative package (SES2+) is currently under discussion.

As a key pillar of the Single European Sky (SES) Regulation (EC) No 552/2004 on the interoperability of the European ATM has set out requirements for developing standards and for testing of ground-based ATM systems and constituents. With the adoption of the New Basic Regulation, Regulation (EC) 552/2004 was repealed and the essential requirements for ATM systems have been transferred to it. During a transition period, ending on 12 September 2023, the requirements on developing standards and assessing conformity remain valid. In line with the European Plan for Aviation Safety (EPAS) 2020-2024, the European Aviation Safety Agency (EASA) will develop a new framework for conformity assessment of ground systems and constituents used in the provision of ATM/ANS (Rule Making Task RMT.0161). These future rules for demonstrating compliance with relevant requirements for safety, performance and interoperability aim to ensure the proper functioning of European ATM operations. During the transition period until September 2023, grandfathering of existing standards (i.e. Community Specifications) and of EC Declarations is provided.

The SESAR programme, as the technological pillar to modernise the SES is instrumental in pursuing the Digital European Sky as a vision which has the potential to drive research and innovation. The deployment of the SESAR solutions by ANSPs, airports and airlines require in many cases the use of standards to ensure safety and interoperability of the systems deployed. In this context, standards remain a fundamental part of the SESAR life cycle to ensure the seamless and timely transition from the R&D phase to deployment.

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

Implementing Regulation (EU) No 116/2021 on the establishment of a first common project to support the implementation of the ATM Master Plan ("CP1 Regulation") has mandated the deployment of a group of ATM functionalities that requires standardisation. The CP1 regulation has replaced the previous Pilot Common Project,, but the functionalities are not expected to be changed. These functionalities are as follows:

- (a) Extended Arrival Management *and integrated arrival management ('AMAN')/ departure management ('DMAN')* in the High Density Terminal Manoeuvring Areas;
- (b) Airport Integration and Throughput;
- (c) Flexible Airspace Management and Free Route Airspace;
- (d) Network Collaborative Management;
- (e) System Wide Information Management;
- (f) Initial Trajectory Information Sharing.

The standardisation and regulatory related activities in support of SES are coordinated by the European ATM Standards Coordination Group (EASCG). The EASCG work to develop, monitor and maintain an overarching European ATM standardisation rolling development plan (RDP), based on the standardisation roadmap from the SESAR framework, and inputs from its members. The group facilitates the sharing of work among the European Standardisation Organisations (CEN, CENELEC, ETSI) thus avoiding overlapping developments and identifying gaps. It identifies the technical input from other sources (such as ICAO GANP and ASBUs or RTCA) Other two groups have been set up to develop, coordinate and maintain similar Standardisation Rolling Development Plans in the areas of drones and cybersecurity. These groups are European Unmanned Standard Coordination Group (EUSCG) and European Cybersecurity Standard Coordination Group (ECSCG).

(A.3) REFERENCES

- Single European Sky initiative
- Commission Regulation (EC) No. 2018/1139
- Implementing Regulation (EU) No 116/2021 on the establishment of a first common project to support the implementation of the ATM Master Plan ("CP1 Regulation")
- Single European Sky Interoperability Regulation EC 552/2004 -
- Commission Regulation (EC) No 29/2009
- Commission Implementing Regulation (EU) 2015/310
- Enhanced Large Scale ATN deployment (ELSA)
- Implementing Regulations for interoperability: Regulations (EC) No 1033/2006, (EC) No 1032/2006, (EC) No 633/2007, (EC) No 262/2009, (EC) No 29/2009, (EU) No 73/2010, (EU) No 1206/2011, (EU) No 1207/2011, and (EU) No 1079/2012.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

EUROCAE

The Commission decided to award a grant to Eurocae in support of the development of standards and technical specifications for SESAR technologies and standards using EGNOS and Galileo in aviation. The action ran from 1January 2019 until 31 December 2020.

This grant was in support in the development of the required standards or revision of existing ones in support of the Single European Sky with a view to accelerating the transition from development to deployment of SESAR solutions, and supporting end-to-end product/system standardisation.

EASCG / EUSCG / ECSCG

European ATM Standards Coordination Group (EASCG) coordination of ATM standardisation activities in support of SES and SESAR deployment maintains a Rolling Development Plan (A-SDP) that can be found in the link: https://www.eascg.eu/rdp/

European Unmanned Standard Coordination Group (EUSCG) coordination of drone standardisation activities and their integration with UTM and ATM maintains a Rolling Development Plan (U-SDP) that can be found in the link: https://www.euscg.eu/rdp/

European Cybersecurity Standard Coordination Group (ECSCG) coordination of cybersecurity standardisation activities maintains a Rolling Development Plan (C-SDP) that can be found in the link: https://eurocae.net/about-us/ecscg/ (note that this Group is confined to ATM cybersecurity issues)

The three above mentioned SDPs are regularly updated to reflect the current situation of standardisation developments.

CEN-CENELEC-ETSI

The Commission has mandated European standards, consistent with the ATM Master Plan in support of the SES, based on EUROCAE documents.

3.4.12 U-SPACE

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

Drones are a promising source of innovative services for the society, from safer infrastructure inspections to more efficient transport and mobility solutions. Drones also offer an opportunity to green aviation and optimise deliveries. The aim of the Commission is to promote a transport system that is accessible, affordable, efficient, safe, secure and environmentally friendly and to create the conditions for a competitive industry generating growth and jobs. This is why, in perspective of the foreseen increase in drone traffic in Europe, the Commission's Directorate-General for Mobility and Transport is addressing the safe operations and management of drone traffic in the wider context of aviation safety.

U-space is a set of new services relying on a high level of digitalisation and automation of functions and specific procedures, supported by AI, designed to provide safe, efficient and secure access to airspace for large numbers of unmanned aircraft, operating automatically and beyond visual line of sight. This initiative confirms the EU's ambition to develop sustainable and digital mobility solutions..

(A.2) EC PERSPECTIVE AND PROGRESS REPORT

The impact of the digitalisation cannot be underestimated. Aviation moves from a human-centric system - where safety ultimately depends on pilots and air traffic controllers – towards an information-centric system, where highly automated aircraft can fly safely based on information flowing on mobile telecommunication networks.

As the aviation and mobile telecommunication worlds converge, the need for ICT standard will increase in aviation. This is particularly observable in the field of drones and unmanned aircraft traffic management solution, which are a laboratory for digital aviation solutions.

U-Space is such an unmanned aircraft traffic management solution which will allow the scaling up of the volume of drone operations that are complex, in environments that are challenging. This would include transport and mobility applications in urban environments, or close to airports.

On the basis of the Opinion 01/2020 published by EASA on a high-level regulatory framework for the U-space, the Commission has adopted three Implementing Regulations on a regulatory framework for the U-space. They cover the roles and responsibilities of the organisations involved in the definition of U-space airspace, the provision of U-space airspace services, including common information, and the minimum necessary services that need to be provided for unmanned aircraft in order to operate in the U-space airspace, the roles and responsibilities of Air Traffic Service Providers for the dynamic reconfiguration of airspace and the electronic conspicuity of manned aviation when entering a U-space airspace in non-controlled airspace.

For what standardisation concerns, the European Commission established the European UAS Standardisation Coordination Group (EUSCG), a joint coordination and advisory group coordinating the drone-related, including U-space, standardisation activities across Europe, and essentially stemming from the EU regulations and EASA rulemaking initiatives. The EUSCG is supported by the work of the AW-Drones Horizon 2020 project, which is developing an open repository of unmanned aircraft standards and validating the suitability of technical standards to comply with existing regulation for drone operations.

(A.3) REFERENCES

- Commission Implementing Regulation (EU) 2021/664 of 22 April 2021 on a regulatory framework for the U-space
- U-space Blueprint, SESAR Joint Undertaking, SESAR Joint Undertaking, 2017, ISBN: 978-92-9216-087-6.
- DRONES AMSTERDAM DECLARATION, Amsterdam - 28 November 2018.
- EASA Opinion 01/2020 on a High-level regulatory framework for the U-space, 13 March 2020.
- EUSCG Rolling Development Plan – continuously maintained (www.euscg.eu).
- AW-Drones – ongoing (www.aw-drones.eu).

(B.) REQUESTED ACTIONS

ACTION 1 Based on the U-space regulatory framework, and in coordination with the European UAS Standardisation Coordination Group (EUSCG), standardise semantic and technical interoperability specifications to exchange U-space information and operational data:

- between air navigation service providers, common information service providers and U-space service providers; and
- between U-space service providers and UAS operators.

ACTION 2 The following complementary actions could be developed in addition to the standardisation action:

- Development of a reference implementation of U-space software components to facilitate the adoption of U-space.
- Development of a testing platform to assess whether the U-space interfaces developed by service providers comply with the standardised specifications.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN

CEN/TC 377 'Air Traffic Management' has concentrated in the past on the introduction and update of EN 16495 "Air Traffic Management - Information security for organisations supporting civil aviation operations". The standard represents a variant of the transversal ISO 27002 security standard. It adds a concept of evidence-based trust in the implementation of the security measures of the different stakeholders involved in air traffic management.

While U-Space represents a new discipline of airspace user management adding new "players" and thus new complexities, from a security point of view the fundamental approach of EN 16495 can be applied also with u-space regarding the integration of conventional ATM and U-Space management.

IEEE

IEEE has many efforts underway to develop standards for drones and UASs (Unmanned Aerial Systems):

The Standards Committee: PE/T&D – 'Power and Energy/Transmission and Distribution' published a Guide for 'Unmanned Aerial Vehicle-Based Patrol Inspection System for Transmission Lines' (IEEE 2821-2020: https://standards.ieee.org/standard/2821-2020.html)

The 'COM/AccessCore – Communication/Access and Core Networks' Standards Committee published a Standard for 'Interface Requirements and Performance Characteristics of Payload Devices in Drones' (IEEE 1937.1-2020, https://standards.ieee.org/standard/1937_1-2020.html)

More standardisation projects are in the drafting stage and several proposals have been approved:

Standards Committee: COM/AccessCore-SC - Access and Core Networks:

IEEE P1936.1TM, Draft Standard for Drone Applications Framework

IEEE P1936.2 - Photogrammetric Technical Standard of Civil Light and Small Unmanned Aircraft Systems for Overhead Transmission Line Engineering

IEEE P1937.3TM, Draft Protocol for the Flight Data Transmission of Civil Unmanned Aerial Vehicle Based on BeiDou Short Message

StandardsCommittee:COM/AccessCore-SC-AccessandCoreNetworks, Co-Standards Committee: AES/UAS/UAV/SC, SASB/SCC42:

IEEE P1939.1TM, Draft Standard for a Framework for Structuring

Low Altitude Airspace for Unmanned Aerial Vehicle (UAV) Operations

Standards Committee: COM/MobiNet-SC - Mobile Communication Networks Standards Committee:

EEE P1920.1 - Aerial Communications and Networking Standards

IEEE P1920.2 - Standard for Vehicle to Vehicle Communications for Unmanned Aircraft Systems

Standards Committee: IM/RNIS - TC45 - Radiation and Nuclear Instrumentation and Systems:

IEEE PN42.63 - Recommended Practice for Unmanned Aerial Radiation Measurement Systems (UARaMS)

Standards Committee: Communications Society/Access and Core Networks:

IEEE P1937.6 Standard for Unmanned Aerial Vehicle (UAV) Light Detection and Ranging (LiDAR) Remote Sensing Operation

IEEE P1937.7 Standard for the Unmanned Aerial Vehicle (UAV) Polarimetric Remote Sensing Method for Earth Observation Applications

IEEE P1937.8 Standard for Functional and Interface Requirements for Unmanned Aerial Vehicle (UAV) Cellular Communication Terminals

IEEE P1937.9 Requirements for External Power and Power Management Interfaces for Unmanned Aerial Vehicle

Standards Committee: Communications Society/Mobile Communication Networks:

IEEE P1954 Standard for Self-Organizing Spectrum-Agile Unmanned Aerial Vehicles Communications

Other activities include e.g. the 2022 IEEE Autonomous Unmanned Aerial Vehicles (UAV) Competition https://www.computer.org/publications/tech-news/events/uav-2022

ISO

ISO/TC 020/SC 016, Unmanned aircraft systems, includes work on UAS Traffic Management (WG4).

WG4 published:

ISO/TR 23629-1:2020, UAS traffic management (UTM) — Part 1: Survey results on UTM

WG4 is working on:

ISO/WD 23629-5, UAS traffic management (UTM) — Part 5: UTM functional structure

ISO/CD 23629-7, UAS traffic management (UTM) — Part 7: Data model for spatial data

ISO/WD 23629-12, UAS traffic management (UTM) — Part 12: Requirements for UTM services and service providers

EUROCAE

EUROCAE WG-105, Unmanned aircraft systems, includes work on UAS Traffic Management (SG3)

WG-105 WG3 published:

ED-269 - Minimum Operational Performance Standard for UAS Geo-Fencing

ASTM INTERNATIONAL

ASTM committee FC38, Unmanned aircraft systems, includes work on UAS Traffic Management (in subcommittee FC38.02, Flight Operations).

FC38.02 published:

ASTM F3411 – 19, Standard Specification for Remote ID and Tracking

FC38.02 is working on:

WK63418, New Specification for Service provided under UAS Traffic Management (UTM)

3.4.13 CIRCULAR ECONOMY

(A.) POLICY AND LEGISLATION

(A.1) POLICY OBJECTIVES

Circular Economy (CE) is a top priority of the European Green Deal, which is one of the pillars of the twin transitions. As the term "twin transitions" implies, achieving the objectives of a Circular Economy will go hand-in-hand with the further progressing of the digital transformation. Circular Economy is described as a systematic approach to the design of processes, products (including services) and business models, enabling sustainable economic growth by managing resources effectively as a result of making the flow of materials more circular and reducing and ultimately eliminating waste. It requires a systemic approach that includes all levels from the collection of raw material to the full circle of use and re-use. The entire productive system must be totally "redesigned" with this new paradigm. The most evident and profound transformations are and will be represented by the great re-conversions in the Energy, Industrial (Automotive, Engineering, Iron and Steel), Construction, and Agricultural sectors and in the processes with greater consumption and impact on resources and raw materials (e.g. Supply Chains).

As part of the twin transitions, circular economy is a key aspect of the renewal of industry by driving green innovation and increasing competitiveness. Effective ways of handling scarcity of resources will help decrease dependencies. It has the potential of putting industrial development on fundamentally new grounds.

Digital technologies have revolutionised the possibilities for generating, storing, accessing, and using product-related information. The possibility to tag and identify products means that such useful information – both static and dynamic - can be linked to individual products, down to the level of the individual components and materials. Therefore, both the European Green Deal and the New Circular Economy Action Plan (CEAP) identify *inter alia* product passports as a way to contribute to an effective product policy and empower professional users and consumers to make more sustainable choices. The European Green Deal notes that "Digitalisation can also help improve the availability of information on the characteristics of products sold in the EU. For instance, an electronic product passport could provide information on a product's origin, composition, repair and dismantling possibilities, and end of life handling".

ICT standards play a critical role in this context. They are of relevance at very different levels. For example standards are relevant for identifying, capturing, collecting, sharing, classifying, analysing and transferring data, providing data formats and defining IT/network infrastructure. Standards also support tools to work with data as well as tools for design. Standards define methods as well as metrics, e.g for testing and benchmarking. Standards also lay down rules for data governance. And many more areas.

The ICT sector, therefore, plays a key role in supporting interoperability and innovation of production processes related to industrial transformation and standardisation can make a significant contribution in supporting industry, in particular SMEs, in successfully undertaking the green transformation towards a circular economy. This is not just about "digitalisation" of processes: a real digital transformation is needed, processes have to be redesigned "thinking digital" and starting from digital since their (re) conception. The "digital by design" principle must be applied systematically and consistently in many sectors, including policy measures and legislation. There will be an unprecedented need of collaboration between traditional sectors and ICT, especially in standardisation activities.

(A.2) EC perspective and progress report

The European Commission Communication "A new Circular Economy Action Plan for a cleaner and more competitive Europe" (COM(2020) 98 final) identifies a number of areas where digital transformation plays a key role in enabling the circular economy - in particular:

- Designing sustainable products and business models: mobilising the potential of digitalisation of product information, including solutions such as Digital Product Passports, tagging and watermarks (Chapter 2.1) as well as enabling circular business models such as product-as-a-service;
- Circularity in production processes: promoting the use of digital technologies for tracking, tracing and mapping of resources (Chapter 2.3);
- Construction and buildings: promoting measures to improve the durability and adaptability of built assets in line with the circular economy principles for buildings design and developing digital logbooks for buildings (Chapter 3.6);
- Driving the transition through research, innovation and the digital transformation: Digital technologies can track the journeys of products, components, and materials and make the resulting data securely accessible. The European data space for smart circular applications will provide the architecture and governance system to drive applications and services such as product passports, resource mapping and consumer information (Chapter 6.3).

The Commission is working on the Sustainable Product Initiativel(SPI) which involves the widening of the scope of the Ecodesign Directive to the broadest possible range of products and the development of the digital product passport (DPP). The DPP will include requirements on data infrastructure, cross sectoral interoperability and data governance that need to be underpinned by standards.

The Digital Europe Programme is planning to support a Coordination and Support Action to define Digital Product Passports in the areas of batteries, electronics, and other priority sectors indicated in the CEAP. Pilots related to dataspaces for manufacturing will also be supported in 2022.

The MSP study group on Circular Economy (SGCE) has made a thorough analysis of the information and actions proposed via the Rolling Plan 2020. In general, a large number of topic areas covered in the Rolling Plan and specific proposed actions relate to digital transformation. This ranges from topic areas with high attention like Cloud or Internet of Things (IoT), addresses issues around security and privacy, but is also true for many topic areas where the digital transformation can help to reduce waste and - even better - to identify potentials for re-use. The analysis has shown that there are many actions that are relevant to circular economy, yet not are all are immediately recognisable as such, so some context setting and sharpening of this relation would be important.

In May 2021, 26 Member States and Norway and Iceland have signed a declaration to accelerate the use of green digital technologies for the benefit of the environment. They will deploy and invest more green digital technologies to achieve climate neutrality and accelerate the green and digital transition. At the same time, the European Green Digital Coalition (EGDC) of companies was formed with the purpose to develop consistent and science-based approach to assess the net environmental impact of ICT. The work of the companies will be complemented by **European Parliament Pilot project** (call for tender) that will support the work of the EGDC by bringing together experts in assessing the environmental impact of ICT including standardisation experts (mostly ITU and ETSI). The work of this pilot project and coalition should ideally built on the existing standards, in particular the joint standard of ITU L.1410 and ETSI ES 203 199, and feed the work on the future standards.

(A.3) REFERENCES

- **COM/2019/640 final** Commission Communication *The European Green New Deal*
- Circular Economy Action Plan For a cleaner and more competitive Europe
- Report of the MSP Circular Economy Study Group

(B.) REQUESTED ACTIONS

ACTION 1 SDOs to do a detailed landscaping of the standards that are available or under way to support circular economy objectives. The MSP may facilitate cooperation in this respect including on the work of respective standardisation roadmaps.

ACTION 2 SDOs to cooperate and start work in the areas of data carriers, identifiers, vocabularies, semantics, taxonomies, ontologies for circularity and sustainability of products along the life cycle. SDOs to describe further the approaches for a Digital Nameplate based on the concept of the Asset Administration Shell and semantic properties of IEC and ISO Common Data Dictionary (CDD).

ACTION 3 SDOs to start activities that support the sustainable product initiative objectives like ecodesign and its applications based on wider sustainability criteria to priority product groups and key value chains.

ACTION 4 SDOs to build on existing work and progress towards adding standardisation activities for circular economy objectives around the Digital Product Passport.

ACTION 5 Existing product identifier systems used in industry should be identified and the potential for interworking should be explored. The conversion from existing "island" solutions into a mesh of interworking data elements and finally into a (few) major product identifier catalogues is a long process best handled within the ESO and international standardisation systems. The Digital Product Passport concept – allowing identification of products and components throughout a full product lifecycle from manufacture to recycling – could have beneficial economic and environmental aspects.

ACTION 6 SDOs to standardize the interfaces and sub-models of Asset Administration Shell based on IEC 63278 series (for plants and products) for the input of current maintenance information (repairs, maintenance, conversions) into the systems of condition monitoring and predictive maintenance.

ACTION 7 SDOs to cooperate on developing an Open Architecture Framework for Digital Product Passport and circular economy.

ACTION 8 CEN/CENELEC and ETSI to progress their work on energy-related products towards further addressing needs and supporting objectives of circular economy.

ACTION 9 SDOs to cooperate on developing use cases for new and emerging technologies like AI and Blockchain in the context of circular economy and to start respective standardisation activities in order to support making these technologies available fast for supporting circular economy.

ACTION 10 SDOs to work on metrics and setting criteria for the assessment of the environmental impact of equipment in the context of green financing.

ACTION 11 The European Commission, with the support of the MSP and relevant stakeholders, to facilitate the production of a landscape overview of ongoing open source projects in the area of circular economy that complement standardisation activities.

ACTION 12 SDOs to build on existing work and progress towards development of standards applicable for the Digital Product Passport in the area of access rights management, end-to-end communication, data transfer, data authentication, data reliability, data integrity, and data security and privacy.

(C.) ACTIVITIES AND ADDITIONAL INFORMATION

(C.1) RELATED STANDARDISATION ACTIVITIES

CEN / CENELEC

The CEN-CENELEC Strategic Advisory Body on Environment (SABE) launched a new Joint Group on Circular Economy (JG-CE). The purpose of this Group is to provide advice and coordinate CEN and CENELEC's standardisation activities related to the Circular Economy. More than 20 CEN and CENELEC Technical Committees are developing standards in support of various Ecodesign and Ecolabelling product regulations (through standardisation requests/mandates). Approximately 150 ENs were published (covering products such as: computer and computer servers, televisions, external power supplies, etc.). standardisation work related to energy efficiency mainly focused on the energy efficiency of products during their use phase. Moreover, as part of the Circular Economy Action Plan published in 2015, the European Commission requested to develop standards on material efficiency that would establish future ecodesign requirements on, amongst others, durability, reparability and recyclability of products. CEN/CLC/JTC10: Energy-related products - Material Efficiency Aspects for Ecodesign

A full list of new standards - EN 4555X - was recently released addressing specific aspects of circular economy:

EN 45552:2020 'General method for the assessment of the durability of energy-related products';
EN 45553:2020 'General method for the assessment of the ability to remanufacture energy related products';
EN 45556:2019 'General method for assessing the proportion of reused components in energy related products';

EN 45557:2020 'General method for assessing the proportion of recycled material content in energy-related products';

EN 45558:2019 'General method to declare the use of critical raw materials in energy-related products';

EN 45559:2019 'Methods for providing information relating to material efficiency aspects of energy-related products'. https://www.cenelec.eu/dyn/www/f?p=104:7:2648015834401701::::FSP_LANG_ID,FSP_ORG_ID:25,2240017#1

Further on battery and circular economy: https://www.cencenelec.eu/news/publications/Publications/

CEN-CENELEC ‹Standardisation in a Circular Economy – Closing the loop›

CEN/TC 319 ‹Maintenance›: various working groups, etc. are currently working on standards for "Maintenance Management" and "Maintenance Engineering". These standards are intended to concretise and standardise basic tasks, role definitions and methods in the maintenance process of Industry 4.0 installations

ECMA INTERNATIONAL

Standard ECMA-328 - Determination of Chemical Emission Rates from Electronic Equipment - Part 1 (using-consumables) and Part 2 (not using-consumables). This Standard (all parts) specifies methods to determine chemical emission rates of analyte from ICT & CE equipment during intended operation in an Emission Test Chamber (ETC). This Standard (all parts) includes specific methods for equipment using consumables, such as printers, and equipment not using consumables, such as monitors and PC's. http://www.ecma-international.org/publications/standards/Ecma-328.htm

ETSI

ETSI TC ATTM (Access, Terminals, Transmission and Multiplexing) issued EN 305 174-8, supported by European Commission and based on EU WEEE (Waste Electrical and Electronic Equipment) and RoHS (Restriction of Hazardous Substance) Directives. This EN and the TS 105 174-8 Series are some fundamental steps to improve the collection and treatment of ICT WEEE, promoting the circular economy regarding the amount of e-waste generated each year. The content of WEEE needs to be processed carefully due to the presence of both hazardous and precious substances. ETSI TC EE (Environmental Engineering) has produced TR 103 476 "Circular Economy (CE) in Information and Communication Technology (ICT); Definition of approaches, concepts and metrics" and is producing an EN on "Assessment of material efficiency of ICT network infrastructure goods (circular economy)" in the scope of Mandate M/543 on Material Efficiency on which the work is done in coordination with CEN/CLC/JTC10. Furthermore, EN deliverables are in preparation for the circular economy requirements specific to servers.

GREEN ELECTRONICS COUNCIL

EPEAT is an IT sector ecolabel for purchasers, manufacturers, resellers and others wanting to find or promote environmentally preferable products. The EPEAT program provides independent verification of manufacturers' claims through Conformity Assurance Bodies evaluating products against EPEAT criteria. The EPEAT criteria are developed through a balanced voluntary consensus process. Standards that the EPEAT Program has historically adopted were created by Standards Development Organisations (SDOs) employing balanced voluntary consensus processes but are now developed through the Green Electronics Council Dynamic Standards Development Process (DSDP). The EPEAT online Registry lists sustainable products from a broader range of manufacturers than any comparable ecolabel. National governments and thousands of private and public institutional purchasers around the world use EPEAT as part of their sustainable procurement decisions. See https://greenelectronicscouncil.org/epeat/epeat-overview/

GS1

GS1 global and open standards provide a common language to identify, capture, and share supply chain data about products, locations, assets, and more. Companies usually combine different GS1 standards to ensure compliance and to streamline processes. https://www.gs1.org/standards The Global Trade Identification Number - GTIN is the most used product identifier by companies globally and Data attributes included in the GTIN (e.g., serial number, regulatory requirements,...) support regulatory and business needs. https://www.gs1.org/standards/id-keys/gtin The GS1 Digital Link standard extends GS1 identifiers by making them part of the web and by enabling connections to all types of business-to-business and business-to-consumer information. This could support the circular economy model in making data available in a smarter way directly from trusted sources and through open standards. https://www.gs1.org/standards/gs1-digital-link The GS1 Global Traceability Standard defines a minimum set of traceability requirements within business processes to achieve full chain traceability, independent of any technology. It outlines a common framework to build a traceability system using GS1 standards – such as barcodes, data carriers and EPCIS. This standard allows an end-to-end traceability system, linking the flow of information to physical products. https://www.gs1.org/standards/traceability/how-traceability-standards-work GS1 is working with other stakeholders in Europe to develop a circular data model allowing interoperability across sectors and data spaces. https://www.gs1.eu/news/circular-data-for-a-circulareconomy

IEC

The following horizontal standards are available or being developed:

EN IEC 60086-6:2020 'Primary batteries - Part 6: guidance on environmental aspects'

EN IEC 63115-1 'Secondary cells and batteries - Sealed nickel-metal hybrid cells and batteries for use in industrial applications - part 1: Performance'

prEN IEC 63218 'Secondary cells and batteries - Secondary lithium ion, nickel cadmium and nickel metal hybrid cells and batteries for portable applications - guidance on environmental aspects'

IEC TS 61851-3-7 'Electric vehicles conductive power supply systems - particular requirements for EV supply equipment - battery system communication'

prEN IEC 62933-4-4 'Electrical energy storage systems - environmental requirements for BESS using reused batteries in various installations and aspects of life cycles'

Predictive maintenance is another current standardisation with focus on maintainability. Ongoing activities are IEC 63270 ED1 "Industrial automation equipment and systems – Predictive maintenance" within IEC/SC 65E.

ISO

ISO/TC 323, Circular economy, was formed in 2018 to address standardisation in the field of Circular Economy to develop frameworks, guidance, supporting tools, and requirements for the implementation of activities of all involved organisations to maximise the contribution to Sustainable Development. The following working groups are active:

WG1: Framework, principles, terminology, and management system standard. WG2: Guidance for implementation and sectoral applications. WG3: Measuring circularity. WG4: Specific issues of circular economy type of business models (PSS,....). https://www.iso.org/committee/7203984.html WG5: Product circularity data sheet - ISO/AWI 59040 "Circular Economy — Product Circularity Data Sheet" is a new standard under development to provide a methodology and format for reporting and exchanging information about the circular economy aspects of products. More information available at https://pcds.lu/"

ISO/TC 324, Sharing economy, was formed in 2019 to address standardisation in the field of sharing economy. The following working group is active: WG1: Terminology and principles. https://www.iso.org/committee/7314327.html ISO 13374 on condition monitoring and diagnostics of machines during the processing, exchange and presentation of data. https://www.iso.org/standard/37611.html ISO 13381 describes the principles for prognosis in the context of condition monitoring and diagnostics of machines. https://www.iso.org/standard/51436.html

ITU

The ITU has developed a series of international standards that support the transition to circular economy at city level and encourage re-use, recycling and circular design, and more in the ICT industry, including:

- Recommendation ITU-T L.1020 "Circular economy: Guide for operators and suppliers on approaches to migrate towards circular ICT goods and networks"
- Recommendation ITU-T L.1022 "Circular economy: Definitions and concepts for material efficiency for information and communication technology"
- Recommendation ITU-T L.1023 "Assessment method for Circular Scoring"
- Recommendation ITU-T L.1024 "Effect for global ICT of the potential of selling Services instead of Equipment on the waste creation and environmental impacts»
- Recommendation ITU-T L.1100 "Procedure for recycling rare metals in information and communication technology goods"
- Recommendation ITU-T L.1050 "Methodology to identify the key equipment in order to assess the environmental impact and e-waste generation of different network architectures".
- Recommendation ITU-T L.1032 "Guidelines and certification schemes for e-waste recyclers"
- Recommendation ITU-T L.1021 "Extended producer responsibility - Guidelines for sustainable e-waste management"
- Recommendation ITU-T L.1031 "Guideline on implementing the e-waste reduction target of the Connect 2020 Agenda"
- Draft Recommendation ITU-T L.1033 "Guide for the institutions of higher learning to contribute in the effective life cycle management of e-equipment and e-waste" (under approval process)
- Additionally, ITU is working on the following international standards:
- Draft Recommendation ITU-T L.GDSPP "Requirements for a global digital sustainable product passport to achieve a circular economy"
- Draft Recommendation ITU-T L.E-waste-collection "Guidelines on the collection, pretreatment, dismantling, valorisation and final disposal of WEEE"
- Draft Recommendation ITU-T L.ICT_CE "ICT response to circular economy"
- Draft Recommendation ITU-T L.TWS "Method for Evaluation of the Environmental and Safety Performance of True Wireless Stereo Products"

The following work item are being developed in collaboration with ETSI TC EE:

- Draft Recommendation ITU-T L.Mat_frame "Assessment of material efficiency of ICT network goods (circular economy). Part 1: General for server and data storage equipment"

- Draft Recommendation ITU-T L.ME_AF "Assessment of material efficiency of ICT network infrastructure goods (circular economy). Part 3: Server and data storage product availability of firmware and of security updates to firmware"
- Draft Recommendation ITU-T L.ME_DD "Assessment of material efficiency of ICT network infrastructure goods (circular economy). Part 2: server and data storage product secure data deletion functionality"
- Draft Recommendation ITU-T L.ME_DIS "Assessment of material efficiency of ICT network infrastructure goods (circular economy). Part 5: Server and data storage product disassembly and disassembly instruction"
- Draft Recommendation ITU-T L.ME_RM "Assessment of material efficiency of ICT network infrastructure goods (circular economy). Part 4: Server and data storage product critical raw materials". Information on the ongoing work items is available here.

The ITU worked with the Basel Convention, Climate KIC, and other partners to include ITU's green ICT standards in the world's first Massive Open Online Course (MOOC) on e-waste management, which includes lessons on the role of ICT standardisation in the circular economy. ITU also recently organised webinars on e-waste management and circular economy - E-waste Challenge MOOC live events. Additionally, the United for Smart Sustainable Cities (U4SSC) initiative, which is led by the ITU together with UNECE and UN-Habitat with the support of 14 other UN Agencies and Programmes, published "A Guide to Circular Cities".

More info: https://www.itu.int/en/ITU-T/studygroups/2017-2020/05/Pages/default.aspx

OASIS OPEN

The eDelivery Building Block of the Connecting Europe Facility uses implementation guidelines for various OASIS technical specifications, in particular a profile of the OASIS AS4 standard (also ISO 15000-2). It is widely used in the public and private sector, not just to replace paper, but also to support innovative business processes and services. As a relevant example, eDelivery is used by suppliers of electrical products to register products in the European Product Database for Energy Labelling (EPREL) and for the Poison Centres Notifications of the European Chemicals Agency. While these are central systems, eDelivery also supports distributed, peer-to-peer exchanges, so market participants could also use it more widely for exchange of product or other circular economy related data.

OASIS UBL v 2.1 (ISO/IEC 19845) enables public sector procurement, including product reuse and sustainability analysis and has granular item description information structures to represent and exchange parts and materials data exchange. OASIS Product Life Cycle Support from the PLCS Technical Committee, which developed and issued data exchange templates ("DEX") to augment the product management works of ISO TC 184/SC4 on industrial data (particularly ISO 10303 "STEP"). Use of these now-well-established open methods like UBL and STEP enhances the ability of suppliers and procuring agencies to comparably track and coordinate re-use over product lifecycles.

OASIS OriginBX will produce data standards encapsulating product attributes and the determination and auditability of tax and trade attestations. In addition to country of origin attestations for qualifying a good for tariff savings, its work covers forced labor, sustainability, HTS classification, export controls, customs value, and other admissibility attestations. It also addresses tax residency/origin certifications for withholding tax relief at source and will enable counterparties within trade to quickly obtain information on the raw materials and components of manufactured goods within complex multi-tier supply chains.

TEKOM IIRDS CONSORTIUM

The iiRDS standard (intelligent information Request and Delivery Standard) enables the provision of intelligent maintenance-relevant information independent of industries and manufacturers. One goal of the iiRDS consortium, founded in 2018, is the specification of standardised mechanisms and a standardised vocabulary, which, in the context of Industry 4.0, make it possible to generate situation-specific and context-specific information for the cases occurring throughout the product life cycle.

The following functions, among others, are to be fulfilled:

- dynamically adapt to the user and application context
- provide targeted information for all life cycle phases, from specification to maintenance
- match the delivered system, even after configuration changes and updates
- dynamically integrate assistance and sensor information and operating parameters
- support various search and filter functions

The metadata of the iiRDS thus represent a standardised vocabulary for technical documentation. The iiRDS consortium is currently cooperating with the committee responsible for VDI 2770 to ensure the compatibility of that guideline.

UN ECE

Circular economy is one of the key themes of the work of the United Nations Economic Commission for Europe; it will be the main discussion theme of the commission session in April 2021. As input to discussions a Briefing Note on the United Nations Economic Commission for Europe – United Nations Centre for Trade Facilitation and Electronic Business Contribution to Advance Circular Economy Actions has been developed outlining policy positions as well as activities in standardisation with relevance to the circular economy: http://www.unece.org/fileadmin/DAM/cefact/cf_plenary/2020_Plenary/ECE_TRADE_C_CEFACT_2020_24E-UNCEFACTdeliverablesCE.pdf

UNECE & UN CEFACT, in a project co-funded by the European Union, aim at developing the recommendations and tools for transparency and traceability in the apparel & footwear industry.

https://www.unece.org/info/media/news/trade/2019/transparency-in-fashion-unece-mobilizing-industry-and-experts-to-develop-blockchain-traceability-tool-and-policy-framework-under-eu-funded-project/doc.html

This exercise involves the development under the aegis of UN CEFACT of a standard for communicating along value chains relevant information allowing to substantiate claims.

W3C

By building a web of data, W3C's strategy of data interoperability is directly and crucially relevant to the circular economy. The initiative is based on the Linked Data stack already specified that allow for re-use of existing tools like the specification on provenance of data. Relevant ongoing is work on is taking place especially in the Web of Things WG and in the Data Privacy Vocabulary CG.45

(C.2) ADDITIONAL INFORMATION

Zero defects in manufacturing Horizon 2020 project https://www.zdmp.eu/

4 - HORIZONTAL BUILDING BLOCKS (RP2022)

Original text published in the 2017 Rolling Plan is available here.

4.1. ICT DRIVES INNOVATION IN ALL ECONOMIC SECTORS

The disruptive potential of ICT results from its nature as a general purpose technology. It is all about communicating and processing of digital data. Digital data may represent all kinds of information, including numbers, symbols, voice, audio, pictures, video, etc. Digital data are therefore exchanged and processed for many different purposes. Major applications include making phone calls, watching films, calculating and simulating physical world phenomena and publishing knowledge and news, to name a few.

In the 1990s, the first wave of ICT based convergence of industries has blurred the boundaries of the telecommunication, the computer and the broadcasting sectors. Today, consumers take this convergence as a given and expect to watch news on their smartphone, to make voice calls using a notebook or tablet, and to surf the Internet with their television set.

Distributed processing of digitized voice, moving pictures and other information on networked computers has driven the first wave of convergence and disrupted prior separate vertical consumer markets. However, these previously separated vertical markets for telephony, computing and television have not converged into a single much larger market. The opposite holds true, ICT-based technology convergence resulted in accelerated market segmentation. Today, many alternative products and services coexist for telephony and TV, not mentioning the many new services never anticipated like social networks or e-commerce.

The processing power has continued to grow exponentially according to Moore's Law. The amount of data is exploding at unprecedented speed since whatever can be digitized has been and is digitized. Moreover, connecting what can be connected further boosts the exponential, self-amplifying, combined potential of ICT at large to embrace new application areas.

The combinatorial effect of more powerful general purpose computing platforms, an unprecedented abundance of digital data, including sensor data, and connectivity of all kinds of devices and objects are redefining other industries by transforming businesses and society. Thus, ICT drives innovation in all sectors, from the smart home to the smart city, from the smart grid to smart transportation, from smart healthcare to smart manufacturing in all kinds of industry sectors.

4.2. NEW WAVE OF CONVERGENCE

A second wave of convergence is under way and building speed. It is based on the integration of distributed processing of information and operation of equipment.

While the first wave of ICT based convergence revolutionized mainly consumer markets, the second wave of convergence will heavily impact critical infrastructure, industry, and business-to-business markets. The activities of economic actors in all sectors, whether manufacturers, service providers, administrations and their customers will be dramatically altered. Some examples are:

- interfaces between product and service suppliers and their customers, whether these are other businesses, governments or end-consumers will change profoundly. In this process, particularly close attention must be paid to the over-arching issues such as security, data protection and privacy and sometimes accessibility in order to make these changes fully acceptable and manageable for those outside the ICT industries themselves.
- in the case of industrial companies, many must rely on time-sensitive local area networks operated as private networks in order to ensure highly available and reliable closed loop control operating side-by-side with less critical information services. Operation of all kinds of systems, including utilities, will be increasingly automated and will be more and more autonomous - mainly by adding Artificial Intelligence (AI);
- regarding data value chains, common, semantically enriched data formats as well as common semantics are critical to enable the free flow of data both vertically and horizontally within industry domains and across industry sectors. This is needed as an accelerator for digitisation, e.g. in the context of the Internet of Things (IoT), for digitising industry, for smart cities and for digitisation in public services;
- many of these more conventional economic sectors such as transportation, utilities, manufacturing, agriculture, or healthcare are more regulated than various segments of ICT markets. Software, appliances, machines, and robots increasingly make decisions and act accordingly in an unsupervised manner, being more and more autonomous in their operation. They need to smoothly integrate into societies and interact with humans in alignment, not only with laws, but also with ethical principles. Trust is inevitable for the adoption of smart infrastructure. Regulatory requirements may change or have to be adapted.

Enhanced ICT enables a smarter world and is an inevitable means to reach crucial European policy goals. ICT is the basis of the European Digital Single Market and the key enabler for digitizing European industry and indeed society as a whole.

4.3. INTEGRATED SOLUTIONS FOR DIFFERENT INDUSTRY DOMAINS

The power and disruptive potential of ICT results from being a general purpose technology advancing exponentially in a combinatorial manner. More and more powerful ICT products and services are available for

- digitizing analog information
- data management
- symbolic computing and machine learning

These may be integrated into domain-specific platforms or be used as part of a solution for various different industry domains. Generic standardized solutions to exchange data, to analyze data, to decide and act upon knowledge extracted from data are applicable in many sectors, from transportation to manufacturing to agriculture. In this respect, ICT may be regarded as a common horizontal technology. The process of applying more and more such horizontal ICT technologies as an integral part of by now tightly vertically integrated industry domain specific infrastructures is known as 'Digital Transformation'.

Business drivers for the digital transformation include the following:

- cost reduction (OPEX mainly)
- new services (easy deployment)
- productivity gains
- less vendor lock-in
- economies of scale
- mass production of personalized products

It is, however, not straight forward how to benefit from digital transformation. There will not be a single end-to-end standardized system solution, but many instances tailored to company needs will coexist. The digital transformation is an innovation race to gain competitive advantages.

It is not obvious how to apply standardized ICT platforms or parts thereof to solve specific problems in manufacturing, transportation, agriculture, health care, or in other domains.

- From an ICT industry viewpoint the challenge is to enable novel solutions for various vertical industries based on common solution elements.
- From a vertical industry sector viewpoint the challenge is to reuse standardized ICT as enablers for innovations.

Common horizontal ICT building blocks will not be introduced in one go, but used and integrated step-by-step according to the needs of a particular industry. It is all about a process of adoption of off-the-shelf ICT solution elements depending on industry domain specific requirements. It is an evolution with revolutionary results rather than a revolution from the start.

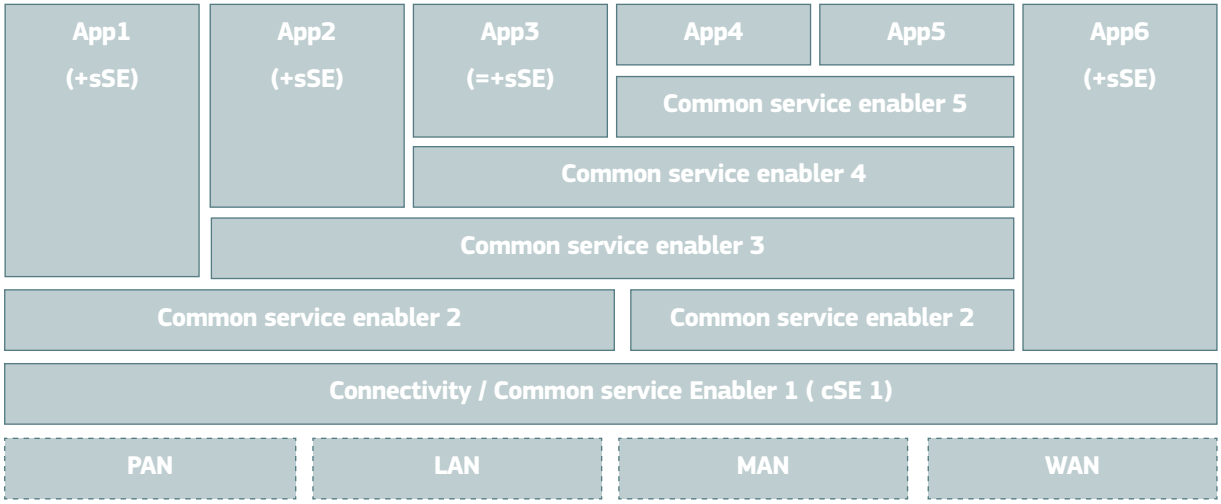

Figure 1: Examples for horizontally versus vertically integrated solutions for different industry domains (cSE=common Service Enabler, sSE=specific Service Enabler)

Various combinations of integrated horizontal and vertical building blocks for diverse industries will coexist, as is illustrated in Figure 1. The challenge, however, persists how to combine as many common horizontal building blocks as possible with as many vertical building blocks as necessary to maximize benefits.

Provided the digital transformation of industries works out as a smooth transition process, economy and society at large will benefit from achieving policy goals like

- customer choice
- protection of consumers and SME users of ICT solutions, both to ensure (physical and electronic) security and data protection and in the sense of ensuring citizens' rights, service quality etc.
- vibrant innovative eco-system
- business opportunities for new entrants
- economic growth

In these processes, the standardisation system will be challenged.

- ICT standardisation is characterised by its fragmentation, with the involvement of multiple organisations, both formal and informal.
- On the other hand, in the other sectors that will be more and more influenced by ICT, standardisation is typically a slow and formal process.
- Ways need to be found to ensure collaboration between the involved SDOs, and that participants in standardisation committees have the necessary competences.

ANNEX I - LIST OF MEMBER STATES' WORK PLANS AND STRATEGIES

This Annex provides a list of links to strategy documents, policies and work plans on ICT standardisation that are available in the Member States, sometimes comprising several links depending on the respective document structuring in Member States. This list is for reference only. It does not claim completeness and only represents a current snap shot.

FRANCE

French webportal for digital economy policy :
▸ https://www.entreprises.gouv.fr/numerique

Framework for interoperability and security:
▸ http://references.modernisation.gouv.fr/interoperabilite

GERMANY

German digital strategy:
http://www.digital-made-in.de

ITALY

Ministry of economic development - Directorate-General for Communications Technology and Information Security:

▸ https://www.mise.gov.it/index.php/it/direzioni-generali?view=structure&id=17:

Minister for Technological innovation and digital transition:

▸ https://innovazione.gov.it

eGovernment plan 2020-2022:

▸ https://www.agid.gov.it/agenda-digitale

NETHERLANDS:

Dutch Digitization Strategy (June 2018):
▸ https://www.government.nl/documents/reports/2018/06/01/dutch-digitalisation-strategy

Digital Government Agenda, NL DIGIbeter (2019):
▸ https://www.nldigitalgovernment.nl/digital-government-agenda/

Dutch National Interoperability Framework:
▸ https://www.noraonline.nl/wiki/NORA_online

Netherlands Standardisation Forum / open standards policy:
▸ https://www.forumstandaardisatie.nl/netherlands-standardisation-forum

Testing website and email compliance with modern and reliable Internet Standards:
▸ https://en.internet.nl/

SLOVENIA

- Slovenian digital strategy (https://www.gov.si/assets/ministrstva/MJU/DID/Strategija-razvoja-informacijske-druzbe-2020.pdf)
- Frequency management strategy 2022 (https://www.akos-rs.si/files/Javna_posvetovanja/2019/8_5/Strategija-upravljanja-z-radiofrekvencnim-spektrom-08052019.pdf)
- National broadband strategy 2020 (https://www.gov.si/assets/ministrstva/MJU/DID/NGO-2020)
- Cyber security strategy (https://www.gov.si/assets/ministrstva/MJU/DID/08af71a0e6/Strategija-kibernetske-varnosti.pdf)
- The Slovenian Digital Coalition (http://digitalna.si/en)
- Digital Innovation Hub Slovenia (https://dihslovenia.si/en/home-english/)
- The Blockchain Think Tank Slovenia (https://blockchainthinktank.si/)
- National interoperability framework (https://nio.gov.si/nio/vstopna.nio?lang=en)

SPAIN:

Digital Agenda for Spain:
▸ http://www.agendadigital.gob.es/digital-agenda/Paginas/digital-agenda-spain.aspx

Spanish National Cybersecurity Strategy:
▸http://www.lamoncloa.gob.es/documents/20131332estrategiadeciberseguridadx.pdf

Spanish National Interoperability Framework, English version:
▸ http://administracionelectronica.gob.es/pae_Home/dms/pae_Home/documentos/Estrategias/pae_Interoperabilidad_Inicio/pae_Esquema_Nacional_de_Interoperabilidad/ENI_INTEROPERABILITY_ENGLISH_3.pdf

Original Spanish version:
▸ https://www.boe.es/boe/dias/2010/01/29/pdfs/BOE-A-2010-1331.pdf

Strategy on Technical Interoperability Standards:
▸ http://administracionelectronica.gob.es/pae_Home/pae_Estrategias/pae_Interoperabilidad_Inicio/pae_Normas_tecnicas_de_interoperabilidad.html#.UnI2QlPFnzs

Technical Interoperability Standard for the Catalogue of Standards, English version:
▸ http://administracionelectronica.gob.es/pae_Home/dms/pae_Home/documentos/Estrategias/pae_Interoperabilidad_Inicio/LEGISLACION_2012_BOE-A-2012-13501_Catalogue_of_standards_ENI_publicacion_oficial_2012/Catalogue%20of%20Standards%20NIF%20Spain.pdf

Official Spanish version:
▸ https://www.boe.es/diario_boe/txt.php?id=BOE-A-2012-13501 plus

▸ https://www.boe.es/diario_boe/txt.php?id=BOE-A-2013-455

SWEDEN:

Digitalisation Strategy:
▸ https://www.regeringen.se/regeringens-politik/digitaliseringsstrategin/

eGovernment Strategy:
▸https://www.regeringen.se/informationsmaterial/2015/04/med-medborgaren-i-centrum/

ANNEX II – LIST OF LINKS TO STANDARDS BODIES' WEB SITES WITH UP-TO-DATE INFORMATION ON ONGOING WORK

This Annex provides a list of links to repositories of standards development organisations where information on projects and ongoing work relevant to the EU policy priorities can be found. The list does not claim completeness and may incrementally be increased.

CEN

http://www.cen.eu/cen/Sectors/Sectors/ISSS/Pages/default.aspx

CENELEC

http://www.cenelec.eu/aboutcenelec/whatwedo/technologysectors/Informationandcommunicationtechnology.html

ECMA INTERNATIONAL

https://www.ecma-international.org/

ETSI

ETSI work programme: http://www.etsi.org/about/etsi-work-programme

GS1

https://www.gs1.org/standards

IEEE:

IEEE entry to standardisation activities relevant to the Rolling Plan: http://standards.ieee.org/develop/msp/index.html

IETF:

IETF entry to standardisation activities relevant to the Rolling Plan: http://trac.tools.ietf.org/group/iab/trac/wiki/Multi-Stake-Holder-Platform

ISO/IEC JTC1:

https://www.iso.org/isoiec-jtc-1.html

ITU-T:

ITU Telecommunication Standardisation Sector: https://www.itu.int/en/ITU-T/Pages/default.aspx

OASIS

Current standards projects:

https://www.oasis-open.org/projects-committees/?filter-committee-status=active

UNECE-UN/CEFACT

http://www.unece.org/cefact

Main standards page:

https://www.unece.org/uncefact/mainstandards.html

Recommendations page:

http://www.unece.org/cefact/recommendations/rec_index.html

Trade Facilitation Implementation Guide:

http://tfig.unece.org/

W3C:

Current list of W3C active Groups:
https://www.w3.org/Consortium/activities

ANNEX III - TERM DEFINITIONS AND MAIN ABBREVIATIONS

TERM DEFINITIONS

EUROPEAN STANDARDS ORGANISATIONS (ESO)

The three European standards organisations are listed in Annex I to Regulation 1025/2012/EU, i.e. CEN, CENELEC and ETSI. Among other activities, they adopt European standards.

EUROPEAN MULTI-STAKEHOLDER PLATFORM ON ICT STANDARDISATION (MSP)

The MSP is an advisory group to the Commission on matters relating to the implementation of standardisation policy for information and communications technology (ICT), including its work programme, priority-setting in support of legislation and policies, and identification of specifications developed by global ICT standard development organisations. It is composed of members of the national authorities of Member States and EFTA countries, industry associations, societal stakeholders and organisations representing ICT standardisation stakeholders. http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetail&groupID=2758

ANNUAL UNION WORK PROGRAMME ON EUROPEAN STANDARDISATION (AUWP)

The AUWP is a formal document adopted by the Commission identifying the strategic priorities for European standardisation, taking into account Union long-term strategies for growth.
http://ec.europa.eu/growth/single-market/european-standards/policy/index_en.htm

MAIN ABBREVIATIONS

AAL	Active assisted living
ADMS	Asset Description Metadata Schema
AG	Amsterdam Group
AIOTI	Alliance for Internet of Things Innovation
AM	Additive manufacturing
AMNPO	Advanced Manufacturing National Program Office
AMQP	Advanced message queuing protocol
APT	Asian Pacific Telecommunication
BDVA	Big Data Value Association
BIM	Building information modelling
BSI	British Standards Institution
CAM	Connected and Automated Mobility
CBOR	Concise Binary Object Representation
CCEV	Core Criteria/Evidence Vocabulary
CEF	Connecting Europe Facility
CERIF	Common European research information format
CII	Cross-Industry Invoice
CIP	Competitiveness and innovation framework programme
CIS	Consent & information sharing
CISE	Common Information Sharing Environment
C-ITS	Cooperative ITS Communication Standards
CMS	Content management systems
COAP	Constrained Application Protocol
COC	Code of conduct
CORE	Constrained Restful Environments
CPS	Cyber-physical systems
CSA	Coordination and support action
CSC	Cloud Standards Coordination
CSCC	Cloud Standards Customer Council
CSI	Cities Standards Institute
DECT	Digital enhanced cordless telecommunications
DOA	Digital object architecture
DSM	Digital single market
DSRC	Dedicated short-range communications
ECC	Electronic Communications Committee
ECEP	European common enforcement priorities
EEAP	European electronic access point
EETS	European Electronic Toll Service
EFC	Electronic fee collection
EFFRA	European Factories of the Future Research Association
EMSFEI	European Multi-Stakeholder Forum on e-Invoicing
EPC	European Payment Council
EPS	Electric Power System
ERN	European Reference Networks
ERPB	Euro retail payments board
ESEF	European single electronic reporting format
ESMA	European securities and market authority
ESO	European standardisation organisation
ESoP	European Statement of Principles
ESPD	European single procurement document
EUPP	Energy using and producing products

EV Electric vehicles
EXEP Expert group on e-Procurement
FIBO Financial industry business ontology
GDC Green Digital Charter
GICTF Global Inter-Cloud Technology Forum
HAN Home automation networks
HMI Human-Machine-Interaction
HON Health On the Net
HRM Human resources management
HTG Harmonisation Task Groups
IAB Internet architecture board
IBOPS Identity-based attestation and open exchange protocol specification
ICT Information and communication technologies
IDM Information delivery manual
IDMP Identification of medicinal products
IFC Industry foundation classes
IFM Interoperable fare management
IFRS International financial reporting standards
IMF Interoperable master format
INSPIRE Infrastructure for Spatial Information in the European Community
IoT Internet of Things
ISA Interoperability solutions for public administrations
ISMS Information security management systems
ITLET Information Technology for Learning, Education and Training
ITS Intelligent Transport Systems
JISC Japanese Industrial Standards Committee
KET Key enabling technologies
KMIP Key management interoperability protocol
KPI Key performance indicators
KTN Knowledge Transfer Network
LOD Linked open data
LSP Large scale pilot
MOOC Massive open online course
MoU Memorandums of understanding
MQTT Message Queuing Telemetry Transport
NFC Near field communication
NSF Network security function
OAM Officially appointed mechanisms
OASC Open & Agile Smart Cities
OCC Open Cloud Consortium
OGC Open Geospatial Consortium
OGF Open Grid Forum
OMG Object Management Group
PACS Picture archive and communication systems
PCHA Personal Connected Health Alliance
PII Personally identifiable information
PLC Power line communication
PMRM Privacy management reference model
PO Publications Office
PoS Point of sale
PPP Public-Private Partnership
PPS Production planning & scheduling
PSA Programme Support Action
PSAP Public safety answering point
PSI Public sector information
QKD Quantum key distribution
QoE Quality of experience
QoS Quality of service
QSC Quantum safe cryptography
RED Radio Equipment Directive
RAN Radio access networks
RAS Robotics and autonomous systems
RDA Research Data Alliance
RE Renewable Energy
REEIF Refined eHealth European Interoperability Framework
RES Renewable energy sources
RTS Regulatory technical standards
SAGA Strategic Advisory Group on Accessibility
SAML Security assertion markup language
SBR Standard business reporting
SCIM System for Cross-domain Identity Management
SDO Standards Development Organisation
SEIF Semantic energy information framework
SEPA Single euro payments area
SGCC State Grid Corporation of China
SIP Strategic Implementation Plan
SLA Service level agreement
SME Small and medium-sized enterprises
SMPTE Society of Motion Picture and Television Engineers
SNIA Storage Networking Industry Association
SSP Smart Secure Platform
STA Smart Ticketing Alliance
STIR Secure Telephone Identity Revisited
TARV Telematics applications for regulated commercial freight vehicles
TC Technical committee
TGF Transformational Government Framework
TOSCA Topology and Orchestration Specification for Cloud Applications
TR Technical Report
TS Technical specification
TSP Trust service providers
UAAG User Agent Accessibility Guidelines
ULE Ultra-low energy
UPS Uninterruptible power sources
VIN Vehicle Identification Number
VOT Vectors of Trust
VRU Vulnerable Road Users
WAVE Wireless Access in Vehicular Environments
WCAG Web Content Accessibility Guidelines
WCPS Web coverage processing service
XDI XRI data interchange

European Commission
DG Internal Market, Industry, Entrepreneurship and SMEs
Standards for Growth