



Experiential Networked Intelligence (ENI); Terminology for Main Concepts in ENI

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Contents

Intellectual Property Rights	4
Foreword.....	4
Modal verbs terminology.....	4
1 Scope	5
2 References	5
2.1 Normative references	5
2.2 Informative references.....	5
3 Definitions and abbreviations.....	6
3.1 Definitions.....	6
3.2 Abbreviations	12
Annex A: Authors & contributors.....	15
Annex B: Bibliography	16
Annex C: Change History	17
History	18

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Foreword

This Group Report (GR) has been produced by ETSI Industry Specification Group (ISG) Experiential Networked Intelligence (ENI).

Modal verbs terminology

In the present document "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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1 Scope

The present document provides terms and definitions used within the scope of the ETSI ISG ENI. The purpose is to define a common lexicon for use across all deliverables of ENI.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long-term validity.

The following referenced documents are not necessary for the application of the present document, but they assist the user with regard to a particular subject area.

- [i.1] ETSI GS NFV 003 (V1.3.1): "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".
- [i.2] MEF PDO CfC: "Policy-Driven Orchestration", v0.8, February 2018.
- [i.3] MEF 55.0.3: "Amendment to MEF 55: Service Orchestration Functionality", January 2018.
- [i.4] MEF 55: "Lifecycle Service Orchestration (LSO): Reference Architecture and Framework", March 2016.
- [i.5] MEF MCM CfC: "MEF Core Model", March 2018.
- [i.6] Gamma E., Helm R. Johnson R. and Vlissides J.: "Design Patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley, November 1994. ISBN 978-0201633610.
- [i.7] ISO/IEC 2382-28: "Information technology -- Vocabulary".
- [i.8] ISO/IEC/IEEE 42010: "Systems and software engineering -- Architecture description".

3 Definitions and abbreviations

3.1 Definitions

The purpose of the present document is to provide the terms and definitions to be used in ETSI ISG ENI deliverables.

0 to 9

Void.

A

abstraction: process of focusing on the important characteristics and behaviour of a concept and realizing this as a set of one or more elements in an information or data model

NOTE: When applied to modelling, it defines a generic set of characteristics and behaviours for a class that all of its subclasses inherit. This enables the definition of concepts to be separated from their implementation.

action: set of operations that may be performed on a set of managed entities, it represents a transformation or processing in the system being modelled

NOTE: An Action either maintains the state, or transitions to a new state, of the targeted managed entities. The execution of an Action may be influenced by applicable attributes and metadata. As defined in MEF PDO CfC [i.2].

Artificial Intelligence (AI): computerized system that uses cognition to understand information and solve problems

NOTE 1: ISO/IEC 2382-28 [i.7] defines AI as "an interdisciplinary field, usually regarded as a branch of computer science, dealing with models and systems for the performance of functions generally associated with human intelligence, such as reasoning and learning".

NOTE 2: In computer science AI research is defined as the study of "intelligent agents": any device that perceives its environment and takes actions to achieve its goals.

NOTE 3: This includes pattern recognition and the application of machine learning and related techniques.

NOTE 4: Artificial Intelligence is the whole idea and concepts of machines being able to carry out tasks in a way that mimics the human intelligence and would be considered "smart".

B

Void.

C

capability: set of features that is available from a Component

NOTE: These features may, but do not have to, be used. All Capabilities should be announced through a dedicated Reference Point. As defined in MEF PDO CfC [i.2].

choreography: set of processes that define how entities interact from a global point-of-view

NOTE: That is without a single point of control. Compare this definition to Orchestration.

closed loop control: self-regulating mechanism in which outputs of a system are provided to a system that compares the current state to a desired state (or set of states); the comparison is then used to adjust the behaviour of the system

NOTE 1: Positive feedback increases the correction value, while negative feedback reduces the correction value.

NOTE 2: Positive and negative feedback can be combined to achieve the needs of a system. In addition, more complex forms of closed loop control exist, such as proportional-integral-derivative (PID) control. See control theory.

component: part of a System that has operational and/or management significance

NOTE: A Software Component is an encapsulation of a set of related functions and/or data that perform a set of specific purposes and have a set of associated semantics and behaviour.

compute node: object that performs a set of calculations according to a set of algorithms

condition: set of attributes, features, and/or values that are to be compared with a set of known attributes, features, and/or values in order to determine what decision to make

container: object that stores collections of other objects in an organized manner

control plane: communication between entities that enables forwarding and routing of traffic to work

NOTE: Control plane packets are destined to, or locally originated, by entities themselves (e.g. they go to a network entity and direct how traffic flows). Compare to Data Plane.

control theory: application of mechanisms to regulate the behaviour of a target system

NOTE: Control theory includes linear and nonlinear control mechanisms.

D

data model: representation of concepts of interest to an environment that is dependent on data repository, data definition language, query language, implementation language, and/or protocol (typically, but not necessarily, all five)

NOTE: As defined in MEF PDO CfC [i.2].

data plane: path that the end-user traffic takes through a network

NOTE It is made up of traffic that goes through network entities, not to a network entity. Compare to Control Plane.

declarative policy: type of policy that uses statements to express the goals of the policy, but not how to accomplish those goals

NOTE 1: State is not explicitly manipulated, and the order of statements that make up the policy is irrelevant.

NOTE 2: In the present document, Declarative Policy will refer to policies that execute as theories of a formal logic.

NOTE 3: As defined in MEF PDO CfC [i.2].

domain: collection of entities that share a common purpose, and which are governed in a common way

NOTE: As defined in MEF MCM CfC [i.5].

E

ENI framework: set of abstractions that provide reusable and extensible mechanisms to provide generic functionality

NOTE 1: The ISO/IEC/IEEE 42010 [i.8] defines the term **architecture framework** as: "An architecture framework establishes a common practice for creating, interpreting, analysing, and using architecture descriptions within a particular domain of application or stakeholder community".

NOTE 2: The ENI Framework also uses its abstractions to enable the ENI System to dynamically adapt to changing business goals, user needs, and environmental conditions. The ENI Framework hence provides a standard way to build and deploy applications and application components.

ENI system: set of entities, based on the "observe-orient-decide-act" control loop model, that produces commands, recommendations, and knowledge to assist or direct the management of another system

NOTE: The ENI system is an innovative, policy-based, model-driven entity that uses artificial intelligence and other mechanisms to provide intelligent service operation and management. It is the enabler of intelligent Infrastructure management, Network Operations Service Operation and Management, and Assurance. It automates complex human-dependent decision-making processes. It also provides the ability to ensure that automated decisions taken by the system are correct and are made to increase the reliability, security and maintenance of the network and the applications that it supports. It also includes hardware and software components, programs, and system and user documentation.

Event-Condition-Action (ECA): type of imperative policy in which actions can only execute if the event and condition clauses are true

NOTE: An ECA policy rule is activated when its event clause is true; the condition clause is then evaluated and, if true, enables the execution of one or more actions in the action clause. This type of policy explicitly defines the current and desired states of the system being managed.

Experiential Networked Intelligence (ENI): processes associated with assimilating and understanding knowledge and learning through experience

NOTE: Adding closed-loop artificial intelligence mechanisms based on context-aware, metadata-driven policies enables the network to more quickly recognize and incorporate new and changed knowledge, and hence, make actionable decisions. This enables the network functionality to evolve and become better able to meet the demands of its operators with continued usage.

F

formal logic: use of inference applied to the form, or content, of a set of statements

NOTE: The logic system is defined by a grammar that can represent the content of its sentences, so that mathematical rules may be applied to prove whether the set of statements is true or false. Refer to MEF PDO CfC [i.2].

formal methods: set of mathematical theories, such as logic, automata, graph or set theory, that provide associated notations for describing and analysing systems

NOTE: As used in MEF PDO CfC [i.2].

functional block: modular unit that defines the properties, behaviour, and relationships of a part of a system

NOTE: With respect to ENI, functional blocks may be categorized as external (meaning that other systems external to ENI can see them) and internal (meaning that the functional block is only visible to other ENI functional blocks). External functional blocks use Reference Points to provide access to their functionality. Internal functional blocks use private interfaces to provide access to their functionality. As used in MEF 55.0.3 [i.3].

G to H

Void.

I

imperative policy: type of policy that uses statements to explicitly change the state of a set of targeted objects

NOTE 1: The order of statements that make up the policy is explicitly defined.

NOTE 2: In the present document, Imperative Policy will refer to policies that are made up of Events, Conditions, and Actions. As defined in MEF PDO CfC [i.2].

information model: representation of concepts of interest to an environment in a form that is independent of data repository, data definition language, query language, implementation language, and protocol

NOTE: As defined in MEF PDO CfC [i.2].

intent policy: type of policy that uses statements to express the goals of the policy, but not how to accomplish those goals

NOTE 1: Each statement in an Intent Policy may require the translation of one or more of its terms to a form that another managed functional entity can understand. As defined in MEF PDO CfC [i.2].

NOTE 2: In the present document, Intent Policy will refer to policies that do not execute as theories of a formal logic. They typically are expressed in a restricted natural language and require a mapping to a form understandable by other managed functional entities.

J

Void.

K

knowledge reasoning: field of artificial intelligence that uses a set of knowledge bases and a given knowledge representation to reason about the information available

NOTE: Typically, this is used to validate data as well as predict or infer new information from existing information.

knowledge representation: field of artificial intelligence that represents data and information in a form that a computerized system can use

L

Lifecycle Service Orchestration (LSO): open and interoperable automation of management operations over the entire lifecycle of Layer 2 and Layer 3 Connectivity Services

NOTE: This includes fulfilment, control, performance, assurance, usage, security, analytics and policy capabilities, over all the network domains that require coordinated management and control, in order to deliver the offered Service. As defined in MEF 55 [i.4].

LSO reference architecture: layered abstraction architecture that characterizes the management and control domains and entities, and the interfaces among them, to enable cooperative orchestration of Connectivity Services

NOTE: As defined in MEF 55 [i.4].

M

machine learning: set of processes that enables computers to understand data and enhance its knowledge; said knowledge is used to learn new information without being explicitly programmed

NOTE 1: ISO/IEC 2382-28 [i.7] defines machine learning as "a process by which a functional unit improves its performance by acquiring new knowledge or skills, or by reorganizing existing knowledge or skills".

NOTE 2: Mitchell's book (Machine Learning) defines this as: "A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P if its performance at tasks in T, as measured by P, improves with experience E".

NOTE 3: Machine Learning is a subsidiary ongoing application of AI based around the idea that it should give machines access to data and let them learn for themselves.

management: set of procedures that are responsible for describing, organizing, controlling access to, and managing the lifecycle needs of information and entities of an organization

NOTE As defined in MEF PDO CfC [i.2].

management abstraction: abstraction used for management purposes

NOTE: As defined in MEF PDO CfC [i.2].

management plane: collection of services that enable authorized roles to change entity settings in a domain

NOTE: Traditionally, the Management Plane configures, monitors, and provides management of the network stack and associated logic. In contrast, the Control Plane is concerned with the configuration and monitoring of routing and forwarding information.

measurement: set of operations having the object of determining a Measured Value or Measurement Result

NOTE 1: The actual instance or execution of operations leading to a Measured Value

NOTE 2: See ETSI GS NFV 003 [i.1].

meta-policy: policy that governs that operation, administration, and/or management of another set of policies

NOTE: As defined in MEF PDO CfC [i.2].

metadata: set of objects that contains prescriptive and/or descriptive information about the object(s) to which it is attached

NOTE: As defined in MEF MCM CfC [i.5].

metric: standard definition of a quantity, produced in an assessment of performance and/or reliability of the entity being measured, which has an intended utility and is specified to convey a measured value or set of values

N

network controller: functional block that provides configuration, monitoring, and management functionality for entities in its domain

NOTE: It may provide an abstract view of its domain to other functional blocks via Reference Points.

network operator (aka network carrier): operator of an electronics communications network or part thereof

network supervisory controller/network supervisory assistant: roles played by an ENI System

NOTE: The former sends commands and information, while the latter sends recommendations and information. A single ENI System may play both roles, reflecting the confidence in different sets of operations by the Network Operator.

O

optimization: set of mechanisms that select a best solution (with respect to a set of criteria) from a set of available alternatives

NOTE: Optimization may be implemented by a centralized and/or distributed architecture.

orchestration: set of processes that coordinates the interaction among, and behaviour of, a set of entities, from the point of view of a set of entities that perform the orchestration function

NOTE: That is the "Orchestrator". Compare this definition to Choreography.

P

pattern: named, generic, reusable solution to a problem that applies to a particular context

NOTE 1: A pattern is not a finished design, but rather, is a reusable template that defines a set of objects, and their interactions, that can be adapted to meet the context-specific needs required to solve a problem.

NOTE 2: As defined in MEF MCM CfC [i.5] and [i.6].

policy: set of rules that are used to manage and control the changing and/or maintaining of the state of one or more managed objects

NOTE: As defined in MEF PDO CfC [i.2].

policy-driven orchestration: use of different types of policies, in conjunction with an object-oriented information model, to guide orchestration and choreography

NOTE: As defined in MEF PDO CfC [i.2].

policy enforcement: set of processes that ensure that a set of policies was successfully executed on a set of target entities

Q

Void.

R

Reference Point (RP): logical point of interaction between specific functional blocks

NOTE: Each Reference Point defines a set of related interfaces that define how the functional blocks communicate.

resiliency: ability of the ENI System to limit disruption and return to normal or at a minimum acceptable service delivery level in the face of a fault, failure, or an event that disrupts the normal operation of the system being managed or assisted by the ENI System

resource allocation: process of assigning and managing assets in a manner that supports an agreed process or commitment

resource reservation: action to reserve resources across a network for a service according to an agreed commitment

resource sharing: different customers to sharing the same resource within the same time window

S

service continuity: continuous delivery of service in conformance with a Service's functional and behavioural specification and SLA requirements, both in the control and data planes, for any initiated transaction or session till its full completion even in the events of intervening exceptions or anomalies, whether scheduled or unscheduled, malicious, intentional or unintentional

NOTE 1: From an end-user perspective, service continuity implies continuation of ongoing communication sessions with multiple media traversing different network domains (access, aggregation and core network) or different user equipment.

NOTE 2: End to end service continuity requires that the service is delivered with service quality defined by an SLA. This is true regardless if the service is delivered via a non-virtual network, virtual network or a combination.

Service Level Agreement (SLA): negotiated agreement between two or more parties, recording a common understanding about the service and/or service behaviour (e.g. availability, performance, service continuity, responsiveness to anomalies, security, serviceability, operation) offered by one party to another, and the measurable target values characterizing the level of services

Service Orchestration Functionality (SOF): set of service management layer functionality supporting an agile framework to streamline and automate the service lifecycle in a sustainable fashion for coordinated management supporting design, fulfillment, control, testing, problem management, quality management, usage measurements, security management, analytics, and policy-based management capabilities providing coordinated end-to-end management and control of Layer 2 and Layer 3 Connectivity Services

NOTE: As defined in MEF 55 [i.4].

service provider: company or organization, making use of an electronics communications network or part thereof to provide a service or services on a commercial basis to third parties

NOTE: See ETSI GS NFV 003 [i.1].

T

Void.

U

user service: component of the portfolio of choices offered by Service Providers to the End-Users/Customers/Subscribers

V to Z

Void.

3.2 Abbreviations

The purpose of the present document is to provide the abbreviations to be used in ETSI ISG ENI deliverables.

0 to 9

Void.

A

AI	Artificial Intelligence
AP	Access Point
API	Application Programming Interface

B

BBU	BaseBand Unit
BRAS	Broadband Remote Access Server
BSS	Business Support System

C

C-RAN	Centralized RAN
CAPEX	CAPital EXpenditure
CCO	Capacity and Coverage Optimization
CGN	Carrier Grade Network address translation
CPRI	Common Public Radio Interface
CPU	Central Processing Unit

D

D-RAN	Distributed RAN
DC	Data Centre
DDoS	Distributed Denial of Service
DevOps	Development and Operations
DHCP	Dynamic Host Configuration Protocol
DSL	Domain Specific Language

E

E2E	End-to-End
ECA	Event Condition Action
ENI	Experiential Networked Intelligence

F

FOL	First Order Logic
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G

GDPR General Data Protection Regulation

H

Void.

I

ICM Infrastructure Control and Management
 IDC Internet Data Centre
 INFP Intelligent Network Failure Prevention
 IoT Internet of Things
 IP Internet Protocol
 IT Information Technology

J to K

Void.

L

LSO Lifecycle Service Orchestration
 LSO RA LSO Reference Architecture
 LTE Long Term Evolution

M

MAN Metropolitan Area Network
 MANO MANagement and Orchestration
 MEC Multi-access Edge Computing
 MEF Metro Ethernet Forum

NOTE: An industry association.

MPLS Multi-Protocol Label Switching

N

N-PoP Network Point of Presence
 NAT Network Address Translation
 NF Network Function
 NFV Network Functions Virtualisation
 NFVI NFV Infrastructure
 NGFI Next Generation Fronthaul Interface
 NIC Network Interface Controller
 NS Network Service
 NSI Network Slice Instance

O

OPEX OPERational EXpenditure
 OS Operating System
 OSS Operations Supporting System

P

PBM Policy-Based Management
 PDO Policy-Driven Orchestration
 PHY PHYSical layer
 PM Policy Management

PNF	Physical Network Function
PoP	Point of Presence
Q	
QoE	Quality of Experience
QoS	Quality of Service
R	
RAN	Radio Access Network
RF	Radio Frequency
RP	Reference Point
RSRP	Reference Signal Received Power
S	
SD-WAN	Software-Defined Wide Area Network
SDN	Software Defined Networking
SLA	Service Level Agreement
SOF	Service Orchestration Functionality
SVM	Support Vector Machine
T	
TCO	Total Cost of Ownership
TCP	Transmission Control Protocol
TVRA	Threat, Vulnerability and Risk Analysis
U	
UE	User Equipment
V	
VA	Virtual Application
vCPU	virtualised CPU
VIM	Virtualised Infrastructure Manager
VM	Virtual Machine
VNF	Virtualised Network Function
VNFC	Virtualised Network Function Component
VNFD	Virtualised Network Function Descriptor
VNF FG	VNF Forwarding Graph
VNFM	Virtualised Network Function Manager
vNIC	virtualised NIC
VoIP	Voice over IP
VoLTE	Voice over LTE
vStorage	virtualised Storage
vSwitch	virtualised Switch
W	
WAN	Wide Area Network
WLAN	Wireless Local Area Network
X to Z	
Void.	

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Annex B: Bibliography

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Annex C: Change History

Date	Version	Information about changes

History

Document history		
V1.1.1	June 2018	Publication