



GROUP REPORT

Experiential Networked Intelligence (ENI); ENI terminology

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Contents

Intellectual Property Rights	5
Foreword.....	5
Modal verbs terminology.....	5
1 Scope	6
2 References	6
2.1 Normative references	6
2.2 Informative references.....	6
3 Definition of terms, symbols and abbreviations.....	7
3.1 Terms.....	7
3.2 Symbols.....	7
3.3 Abbreviations	8
4 Terms used in ETSI ISG ENI.....	8
4.1 0 to 9.....	8
4.2 A.....	8
4.3 B.....	10
4.4 C.....	11
4.5 D.....	13
4.6 E.....	15
4.7 F.....	18
4.8 G.....	19
4.9 H.....	19
4.10 I.....	20
4.11 J.....	21
4.12 K.....	21
4.13 L.....	22
4.14 M.....	23
4.15 N.....	25
4.16 O.....	26
4.17 P.....	28
4.18 Q.....	30
4.19 R.....	31
4.20 S.....	32
4.21 T.....	34
4.22 U.....	35
4.23 V.....	35
4.24 W.....	35
4.25 X to Z	36
5 Abbreviations used in ETSI ISG ENI	36
5.1 0 to 9.....	36
5.2 A.....	36
5.3 B.....	37
5.4 C.....	37
5.5 D.....	38
5.6 E.....	38
5.7 F.....	39
5.8 G.....	39
5.9 H.....	39
5.10 I.....	40
5.11 J.....	40
5.12 K.....	41
5.13 L.....	41
5.14 M.....	41
5.15 N.....	42
5.16 O.....	43

5.17	P.....	43
5.18	Q.....	44
5.19	R.....	44
5.20	S.....	45
5.21	T.....	46
5.22	U.....	46
5.23	V.....	46
5.24	W.....	47
5.25	X.....	47
5.26	Y.....	47
5.27	Z.....	47
Annex A:	Bibliography.....	48
History		49

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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

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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.

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3 Definition of terms, symbols and abbreviations

3.1 Terms

Void.

3.2 Symbols

Void.

3.3 Abbreviations

Void.

4 Terms used in ETSI ISG ENI

4.1 0 to 9

5G System: 3GPP system consisting of 5G Access Network (AN), 5G Core Network and UE

NOTE: As defined in 3GPP TS 23.501 [i.26].

4.2 A

abductive reasoning: inferring the best explanation for a given set of observations

abstract class: class that cannot be directly instantiated

abstraction: hiding of unnecessary details to focus on data and information that is relevant for defining a particular concept or process

NOTE: ETSI GR ENI 003 [i.24] defined abstraction as the "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". The above definition is introduced to emphasize the importance of hiding (not deleting) unnecessary details, and more importantly, removing the constraint of use for a model. Abstraction is fundamentally a mental process that may take the form of model elements, but does not have to.

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].

active learning: learning algorithm that can query a user interactively to label data with the desired outputs

NOTE: The algorithm proactively selects the subset of examples to be labelled next from the pool of unlabelled data. The idea is that an ML algorithm could potentially reach a higher level of accuracy while using a smaller number of training labels if it were allowed to choose the data it wants to learn from.

active repository: repository that pre- and/or post-processes information that is stored or retrieved

NOTE: It may contain dedicated (typically internal) Reference Points that provide the loading, activation, deactivation, and unloading of specialized functions that change the pre- and/or post-processing functionality according to the needs of the application.

actor: role, played by an external entity (human or machine), which interacts with the subject of a use case

NOTE: An actor is always a type of stakeholder (but not vice versa). See stakeholder.

adaptive closed control loop: closed control loop whose controlling function adapts to the object or process being controlled using parameters that are either unknown and/or vary over time

administrative domain: domain that employs a set of common administrative processes to manage the behaviour of its constituent Entities

agent: computational process that implements the autonomous, communicating functionality of an application

agentGPT: domain-specific model trained with domain-specific knowledge that matches the responsibilities of the AI Agent that it resides in

Agent Repository Function (ARF): network function in mobile core network that is responsible for maintaining the information about each network AI agent

NOTE: In the context of agent-to-agent communication, it allows the AI agents to discover each other.

AI agent: automated intelligent entity capable of e.g. interacting with its environment, acquiring contextual information, reasoning, self-learning, decision-making, executing tasks (autonomously or in collaboration with other AI Agents) to achieve a specific goal

NOTE 1: As defined in 3GPP TR 22.870 [i.28].

NOTE 2: AI agent can be further classified into Network AI Agent and UE AI Agent.

AI capability: type of metadata that represents a set of features that are available to be used

AI model: models that are capable of processing the understanding and generation of natural language

AI native: integrates AI as an inherent capability within network architecture

NOTE: Through distributed intelligent agents, it enables autonomous perception, real-time decision-making and self-optimization, driving the evolution of networks from connectivity capabilities towards intelligent services.

alethic logic: representation, using mathematical formalisms, expressions involving necessity, possibility, and contingency

algorithmic bias: algorithm that possesses systematic and repeatable errors that create unfair outcomes

algorithm hyperparameter: hyperparameter that affects only the speed and/or quality of the learning process, and does not affect the mathematical or statistical model used in the learning process (e.g. learning rate)

anomaly: measurable consequences of an unexpected change in state of a datum, or set of data, which is outside of its local or global norm

API: set of communication protocols, code and tools that enable one set of software components to interact with either a human or a different set of software components

NOTE: This is also known as an Application Programming Interface.

API broker: software entity that mediates between two systems with different APIs, enabling the two different systems to communicate transparently with each other

architecture: set of rules and methods that describe the functionality, organization, and implementation of a system

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".

Artificial Intelligence model (AI model): mathematical framework or algorithm designed to perform tasks that typically require human intelligence

NOTE: These models aim to replicate or simulate human-like intelligence, often involving complex tasks like natural language processing, image recognition, and reasoning. They often leverage deep learning architectures, particularly deep neural networks, including LLMs.

artificial neural network: computing system that learns to perform functions by using artificial neurons that take the form of a directed, weighted graph

NOTE: An ANN learns to perform a function by analysing examples (i.e. training data) instead of being programmed to perform a task.

artificial neuron: node in an ANN that receives weighted input data, adds the data, and produces an output using a non-linear output function

NOTE: The output function is also called a transfer function or activation function, and represents what portion of the potential action is transmitted.

atomic formula: formula that does not have logical connectives

attribute extraction: extraction of detailed features describing entities/relationships/events from input data

asset: anything that has value to an organization

assisted system: system that the ENI system is providing recommendations and/or management commands to

attention: part of a neural architecture that dynamically computes a weighted distribution on input text, assigning higher values to more relevant elements

NOTE: Attention mimics cognitive attention as performed in the human brain. It selectively enhances some parts of the input data while diminishing other parts. Instead of encoding the input sequence into a single fixed context vector, the attention model develops a context vector that is filtered specifically for each output time step. The model then predicts next word based on context vectors associated with these source positions and all the previous generated target words.

autonomous network: set of self-governing programmable and explainable systems that seamlessly deliver secure, context-aware, business-driven services that are created and maintained using model-driven engineering and administered by using policies

Autonomous Network Responsibility Index (ANRI): level of responsibility delegated to the AN in all the Operational Procedures bind to the lifecycle management of each Autonomous Domain and E2E Service

authoritative data model: instance of an ENI data model that is authoritative and in use

authoritative info model: instance of an ENI info model that is authoritative and in use

authoritative model: instance of an ENI model that is authoritative and in use

NOTE: Only one authoritative info model may be in use at any single time.

availability: accessible to authorized users when needed

axiom: statement that is assumed to be true, in order to serve as a starting point for further reasoning

4.3 B

bag-of-words model: model which represents text data as a collection of words, regardless of the order of words

NOTE: The bag-of-words model can determine the important words in the text by counting the number of occurrences of each word in the text data.

batch learning: type of offline learning algorithm that is updated (i.e. retrained) periodically

behaviour: way in which a set of objects function

NOTE: This includes how the object reacts in a particular situation given one or more events.

bias: systematic difference in treatment of certain objects, ideas, or people in comparison to others

bidirectional encoder representations from transformers: unsupervised deep learning strategy that utilizes bidirectional models that considers all words of the input sentence simultaneously and then uses an attention mechanism to develop a contextual meaning of the words

binary classifier: classifier that decides whether or not an input belongs to one of two groups (i.e. classes) based on a classification function

blackboard: architecture that uses a shared workspace that a set of independent agents contribute to, which contains input data along with partial, alternative and completed solutions

black hole: abnormal network phenomenon where a data packet disappears at a certain hop during the forwarding process

boolean clause: expression that, when evaluated, produces a value of either true or false

BSS-like functionality: functionality supporting customer-facing activities for the operator

NOTE: Examples include customer service, rating, order management, billing and settlement.

business intent: abstract network intent input by the user

4.4 C

camelCase: naming convention in which the first letter of each word in a compound word is capitalized, except for the first word

NOTE: This is also called lowerCamelCase.

capability: type of metadata that represents a set of features that are available to be used from a managed entity

NOTE: These features may, but do not have to, be used. These features may represent all or a subset of the functionality provided by a managed entity. Since a Functional Block is a type of managed entity, Capabilities can be defined for Functional Blocks as well. A Capability provides information about the functionality of a managed entity that enables management entities to decide whether that managed entity is useful for a given task.

case-based reasoning: use of existing experiences and knowledge to understand and solve new problems

catastrophic forgetting: tendency of an artificial neural network to forget previously learned information when learning new information

chatbot: computer program that simulates human conversation through text or voice interactions

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

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

class: template for defining a specific type of object that exhibits a common set of characteristics and behaviour

class-based inheritance: definition of a subclass's characteristics and behavior based on those of a superclass

NOTE: Class-based inheritance defines a subclass of a superclass as a class that keeps all of the characteristics and behaviour of its superclass, and refines that definition in one or more of the following ways:

- 1) the subclass changes the class from abstract to concrete;
- 2) the subclass adds one or more attributes, methods, constraints, and/or relationships to its definition.

classifier: procedure that predicts which elements of a set belong to which (pre-defined) classes

NOTE: The classification is done using training data whose category membership is known, and can be thought of as a function that assigns a new observation a class label.

closed control loop: control loop whose controlling action is dependent on feedback from the object or process being controlled

NOTE 1: This type of control loop measures the difference between the actual and desired values of a set of variables to adjust a set of parameters to change the behaviour of the system to bring the actual value closer to that of the desired value.

control loop: mechanism that senses the performance of an object or process being controlled to achieve desired behaviour

cloud line services: services connect cloud service users to edge or cloud data centres, and edge or cloud data centres to each other, with deterministic connection performance

clustering: grouping of a set of objects such that objects in the same group are more similar to each other, by one or more measures, than to other objects in other groups

cognition: process of acquiring and understanding data and information and producing new data, information and knowledge

cognition model: computer model of how cognitive processes, such as comprehension, action and prediction are performed and influence decisions

cognitive architecture: system that learns, reasons, and makes decisions in a manner resembling that of a human mind

NOTE: Specifically, the learning, reasoning, and decision-making is performed using software that makes hypotheses and proves or disproves them using non-imperative mechanisms that typically involve constructing new knowledge dynamically during the decision-making process.

cognitive closed control loop: closed control loop that selects data and behaviours to monitor that can help assess the status of achieving a set of goals, and produce new data, information, and knowledge to facilitate the attainment of those goals

cognitive learning: active and immersive style of learning that emphasizes understanding and connecting information rather than mere memorization

cognitive reasoning: mental process of drawing logical conclusions and making inferences based on available information

collaborating: two or more managed entities cooperate to accomplish a given task

column-oriented database: database that organizes data by field

NOTE: This type of database keeps all of the data associated with a field next to each other in memory, and is optimized for online analytical processing. They are optimizing for reading and computing on columnar data.

compiler: computer program that translates the content of a source programming language into a different, or target, programming language

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

concept drift: statistical properties of the data an algorithm trained on change over time

NOTE 1: As defined in [i.12].

NOTE 2: Concept drift means that the LLM or transformer is not taking changing data and its meanings into account during inference time.

concrete class: class that can be directly instantiated

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

conditional random fields: probabilistic structural model, which is used for sequence labelling and word segmentation tasks, can be regarded as undirected graph model or Markov random field

conditional probability distribution: probability of an event occurring given that another event already occurred

confidentiality: information is not made available or disclosed to unauthorized individuals, entities, or processes

consequentialist ethics: ethical theory according to which an agent is ethical if and only if it considers the consequences of each decision and chooses the decision that has the most moral outcome is often contrasted with deontology

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

context: collection of measured and inferred knowledge that describe the environment in which an entity exists or has existed

contextual identity: digital identity of an object for a particular context

controlled language: restricted version of a single Natural Language that uses a subset of the grammar of the Natural Language

control loop: mechanism that senses the performance of an object or process being controlled to achieve desired behaviour

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.

coordination orchestration: orchestration method that simultaneously analyses multiple types of elements required based on service demands, adheres to one or more constrained service objectives, and provides the optimal element set solution

co-reference resolution: task of finding all expressions in a text that refer to the same real-world entity

coupling: amount of interdependence between two components, modules or systems

4.5 D

data: facts and statistics collected together for reference or analysis

database: structured set of data held in a computer, especially one that is accessible in various ways

data cleansing: process of detecting and correcting (or removing) incomplete, incorrect, inaccurate, or corrupt data from being further processed

data lake: centralized storage repository that stores raw data that are in the form of structured, semi-structured and unstructured format

data mart: subset of a data warehouse focused on a particular line of business, department or subject area

data mining: procedure that discovers patterns in, and extracts knowledge from, data sets

NOTE: For the purposes of ENI, these patterns are of two principal types:

- 1) patterns that cause the generation of data; and
- 2) patterns that relate data (typically in a semantic manner).

data model: representation of concepts of interest to an environment in a form that is dependent on data repository, data definition language, query language, implementation language, and/or protocol

NOTE: This definition is taken from MEF 78.1 [i.5].

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

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

data warehouse: repository used to connect, analyse, and report on historical and current data from heterogeneous sources

NOTE: A data warehouse is designed for query and analysis as opposed to transaction processing. It analyses and reports on data from operational systems as used in decision-support systems.

decidable: procedure that determines, by a mathematical formal means in a finite amount of time, whether a formula is valid

decision making: set of processes that result in the selection of a set of actions to take from among several alternative possible actions

declarative policy: type of policy that uses statements from a formal logic to describe a set of computations that need to be done without defining how to execute those computations

decomposed intent policy: intent policy obtained by dividing or processing the original intent policy, this includes partial requirements of the original intent policy

NOTE: If the original intent policy is John gets: "a Gold Service", each decomposed policy is listed as an intent: with assurance, latency, resources, etc.

deductive reasoning: drawing specific conclusions from general information

deep learning: use of hierarchical computational models, which are composed of multiple processing layers, to learn representations of data with multiple levels of abstraction

NOTE: deep learning replaces manually-intensive processes, and enables a machine to both learn features and use them to perform a task. Deep learning can be applied to almost any of the other algorithms defined here, as long as there are at least two hidden layers.

defeasible logic: representation, using mathematical formalisms, weak rules that are not necessarily justified by the fact, and could thus be proven incorrect

NOTE: Defeasible logic (and reasoning) uses three types of rules: strict rules that are TRUE, weak rules that may be true if no evidence can be found to contradict them, and "defeaters" that represent contradictory evidence to prove that a weak rule is incorrect.

deliberative architecture: symbolic world model that enables problem-solving components to be built using a sense-plan-act paradigm

denormalization: process of changing information from a canonical form to one specialized for a particular actor and/or domain (from Architecture)

deontic logic: representation, using mathematical formalisms, expressions involving obligation, permission, and the concept of being forbidden

deontological ethics: ethical theory according to which an agent is ethical if and only if it respects obligations, duties, and rights appropriate for a given situation

description logic: family of formal languages that are subsets of first-order logic to ensure decidability and efficiency

design pattern: general, reusable solution in a given context to a commonly occurring software problem

NOTE: This type of design pattern is not an architecture and not even a finished design; rather, it describes how to build the elements of a solution that commonly occurs. It may be thought of as a reusable template.

design pattern, architecture: general, reusable solution in a given context to a commonly occurring problem in the design of the software architecture of a system

design pattern, software: general, reusable solution in a given context to a commonly occurring problem in the design of a software system

designated entity: operator, nms, ems, controller or orchestrator acting on behalf of the assisted system

NOTE: The Designated Entity is a trusted entity.

dictionary learning: use of sparse matrices to represent input data using a linear combination of elements from a dictionary learned from training data

digital identity: set of data and information used by a computer system to represent an actor, such as a person, device, or application

digital twin: virtual representation of a physical object or system across its lifecycle, using real-time data to enable understanding, learning and reasoning

directed acyclic graph: directed graph with no directed cycles

NOTE: A directed acyclic graph consists of vertices and edges, with each edge directed from one vertex to another, such that following those directions will never form a closed loop.

directed graph: graph where each connection, or edge, has an associated direction

disjointness: logical assertion that two or more classes do not share any common instances

discriminative classifier: classifier that differentiates an object using class labels

NOTE: The classifier directly estimates the conditional probability of $P(Y|X)$. An example is logistic regression.

distributed closed control loop: closed control loop whose components are physically distributed among different locations

distributed data learning: sets of data that are used to train multiple instances of the same model on different subsets of the training data set in parallel

NOTE: The same model is available to all computational nodes, so that a single coherent output emerges naturally by combining each of the model updates.

distributed learning: distribution of machine learning applications to multiple computing nodes

distributed model learning: multiple exact copies of the same data sets are processed by working nodes that operate on different parts of the model; the resulting model is an aggregate of each of these operations

distributive negotiation: zero-sum game, in which each participant assumes that there is a fixed amount of value to be divided between the (winning) bidders

domain: collection of entities that share a common purpose

NOTE: Each constituent Entity in a Domain is both uniquely addressable and uniquely identifiable within that Domain. This is based on the definition of an MCMDomain in MEF 78.1 [i.5].

Domain Specific Language (DSL): small human-understandable language that uses a higher level of abstraction to communicate and configure software systems for a particular application domain

domain technical expert: technical expert that has authority within a domain

doxastic logic: representation, using mathematical formalisms, expressions involving the belief of a particular entity or set of entities

4.6 E

element: type of resource that supports the realization of information and communication technology services

NOTE: It includes information and communication infrastructure resources such as network, computing, storage, etc., data resources, and application resources for realizing the services.

embedding: vector that represents the meaning of a word or phrase to the LLM (from transformer)

emergent bias: reliance on an algorithm that has not been adjusted to evaluate new forms of data

ENI application programming interface: set of communication mechanisms applied between two or more software components

NOTE: It consists of tools, object methods, and other elements of a model and/or code. APIs simplify producing programs, since they abstract the underlying implementation and only expose objects and flow of information, and the characteristics and behaviour of those objects. This prevents the unnecessary exposure of objects.

ENI external reference point: reference point that is used to communicate between an ENI Functional Block and an external functional block (e.g. a functional block of the OSS, BSS or assisted system)

NOTE: Where an ENI External Reference Point crosses between two organizational entities is not specified in this release.

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

NOTE 1: 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 hardware interface: point across which electrical, mechanical, and/or optical signals are conveyed from a sender to one or more receivers using one or more protocols

NOTE: A hardware interface decouples the hardware from other functional blocks in a system.

ENI API interface: ENI interface set of communication mechanisms through which a developer constructs a computer program

ENI External Reference Point: ENI Reference Point that is used to communicate between an ENI Functional Block and an external Functional Block of an external system

ENI hardware interface: ENI interface across which electrical, mechanical, and/or optical signals are conveyed from a sender to one or more receivers using one or more protocols

ENI interface: point across which two or more components exchange information

ENI internal reference point: reference point that is used to communicate between two or more ENI Functional Blocks

NOTE: This relationship stays within the ENI framework, and cannot be addressed by systems that are external to the ENI framework.

ENI ISG PoC proposal: initial description of a PoC Project, submitted as a contribution for review and acceptance by the ENI ISG before the PoC Project starts

ENI ISG PoC report: detailed description of the results and findings of a PoC project, submitted once the PoC Project has finished

ENI Policy Rules: set of imperative, declarative, and/or intent policy rules

ENI Reference Point: logical point of interaction between specific Functional Blocks

ENI software interface: ENI interface point through which communication with a set of resources (e.g. memory or CPU) of a set of objects is performed

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.

ensemble learning: use of multiple learning algorithms to obtain better performance in predicting results than is possible from using any single learning algorithm

ensemble model: technique created by combining the predictions of multiple base models

entity: object in the environment being managed that has a set of unique characteristics and behaviour

NOTE: Objects are represented by classes in an information model.

entity disambiguation: process of finding references in a dataset that refer to the same entity

entity extraction: extraction of named entities from input data

ethical dilemma: situation in which any available decision leads to infringing on one or more ethical principles

ethics: set of principles that govern the moral behaviour of a person or machine

evaluation dimension: viewpoint that can be divided into five dimensions such as ManMachine Interface

NOTE: This can be subdivided into Decision Making Participation, Data Collection and Analysis, Degree of Intelligence and Environment Adaptability, as defined in ETSI GR ENI 007 [i.10].

evaluation object: AI application or a part of Network Lifecycle, defined from two dimensions: the subsystems and the network lifecycle

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.

existential quantifier: assertion that a property or relation holds for at least one member of a domain

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.

explanation-based learning: explanation-driven approach that enables a search procedure, constrained by general domain knowledge related to the context of the actual problem, to be used to provide more accurate and efficient learning in knowledge-intensive systems

extended backus-naur form: notation used to define the syntax of a formal language

external Domain Specific Language (DSL): DSL that has its own custom syntax

NOTE: External DSL is not dependent on another language.

extraction: activity of transforming valuable information into structured data from input data of different sources and structures

4.7 F

fact (clause): horn clause with no negative literals

feature: (traditionally), individually measurable property of an object under observation

feature: (for ENI), individually measurable characteristic or behaviour of an object being observed

NOTE: Traditionally, individually measurable characteristics were assigned numerical values. For ENI, these individually measurable characteristics or behaviours may be allowed to be numeric or other types of data.

feature construction: feature that creates higher-level features from lower-level features (see feature hierarchy)

feature engineering: process of transforming raw data into features that better represent the underlying problem to the predictive models, resulting in improved model accuracy on unseen data

NOTE: Feature engineering is concerned with determining the best representation of the sample data to learn a solution for a given problem.

feature hierarchy: tree-like structure of features, where a higher-level object represents the composition of its lower-level objects

feature learning: learning representations of data that make it easier to discover information from raw data when building different types of predictors (e.g. classifiers)

NOTE: Feature learning replaces manually-intensive processes, and enables a machine to both learn features and use them to perform a task.

federated closed control loop: set of semi-autonomous closed control loops that use formal agreements to govern their interaction and behaviour

federated learning: approach that trains an algorithm across multiple decentralized entities holding local data samples, without exchanging their data samples

NOTE: Each device trains the model on their own local data set, and then each client sends a model or model update to a centralized service, which aggregates each client's contribution into one global model. The centralized service then distributes the global model back to the clients.

feedforward neural network: ANN whose inter-nodal connections do not form a cycle

NOTE: Put another way, information always moves forward and never backwards. In general, any directed acyclic graph is a type of feedforward neural network.

first-order logic: extension of propositional logic to include predicates and quantification

first-order logic formula: well-formed formula that has a subject and a predicate that can have quantifiers

NOTE: First-order logic restricts the predicate to refer to a single subject. Both the universal and existential quantifiers may be used in constructing a first-order logic formula.

flow-oriented on-path telemetry: specific class of network forwarding-plane telemetry techniques, including In-situ OAM (IOAM), Enhanced Alternate Marking (EAM), Postcard-based Telemetry (PBT) and Hybrid Two Steps (HTS)

formal: study of (typically linguistic) meaning of an object by constructing formal mathematical models of that object and its attributes and relationships

formal grammar: set of structural rules that define how to form valid strings from a language's alphabet that obey the syntax of the language

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

formal semantics: set of tools that define grammatical meaning in a language

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

formula: finite sequence of symbols from an alphabet that is part of a formal language

foundation model: type of LLM trained on a vast quantity of data at scale (often by self-supervised learning or semi-supervised learning) such that it can be adapted to a wide range of downstream tasks

functional architecture: model of the architecture that defines the major functions of each module and how each module interacts with each other

functional block: abstraction that defines a black box structural representation of the capabilities and functionality of a component or module, and its relationships with other functional blocks

fuzzy logic: type of many-valued logic that allows a truth value to be any real number between 0 and 1 inclusive

4.8 G

general purpose language: programming language that can address a wide variety of problems and domains

generative artificial intelligence: type of artificial intelligence that can create new content (e.g. text, images or music) by learning the patterns and structures of existing data and then using those patterns to generate new data that is similar to the original data

generative classifier: classifier that learns a model of the joint probability of an input x and the label y , uses Bayes rules to calculate $p(Y|X)$, and then assigns the most likely label

NOTE: The classifier estimates $P(Y|X)$ by estimating $P(Y)$ and $P(X|Y)$. An example is Naïve Bayes classifier.

goal clause: horn clause without a positive literal

grammar: set of rules and principles that govern a language

NOTE: Grammar defines the structure, word formations, and sentence construction. It includes syntax and semantics, as well as verb conjugation, tense usage, and other aspects of language.

graph: collection of nodes, where some subset of the nodes is connected

NOTE: Visually, a node is a "point" and a connection is a "line", called an "edge". For the purposes of ENI, any graph may be directed, weighted or both.

graph database: database that uses graph structures to store and navigate relationships (i.e. edges) between entities (i.e. nodes) in a graph

graph loop: edge of a graph that joins a vertex to itself

NOTE: For ENI, graph loops are not applicable.

graph transformer: type of transformer that generalizes the transformer architecture to graphs

4.9 H

hadoop distributed file system: distributed fault-tolerant file system that stores data on commodity machines and provides high throughput access

hierarchical classifier: classifier that maps input data into a tree-like set of output categories by first, classifying at a low level, and then iterating each lower-level classification into a higher-level classification

hierarchical closed control loop: closed control loop that is organized in the form of a tree

horn clause: disjunction of literals that contains at most one positive literal

NOTE: This is also called a definite clause. This is used in some types of automated theorem proving.

hybrid architecture: system made up of reactive and deliberative components that are combined into a hierarchy of interacting layers, where each layer reasons at a different level of abstraction

hypergraph: graph in which generalized edges may connect more than two nodes

NOTE: A directed hypergraph is a pair $\{\{V, E\}\}$, where $\{V\}$ is a set of vertices and $\{E\}$ is a set of pairs of subsets of $\{V\}$. Each pair is called a hyperedge.

hyperparameter: learning parameter that is set before the learning process is started

hypothesis: set of statements for explaining an observation that is not yet known to be true

4.10 |

identity: set of data and information that allow an object to be disambiguated from all other objects in a system, including objects of the same type

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

NOTE: The canonical form of an imperative policy is a triple, consisting of a set of Event, Condition, and Action Boolean clauses. Conceptually, it is evaluated as: When the Event Clause occurs, IF the Condition Clause is TRUE, THEN a set of actions may be executed.

incremental learning: learning from a continuously changing source of data (e.g. streaming data) that arrives over time

NOTE: Incremental learning is a form of online learning.

inductive bias: set of assumptions that are used in a machine learning algorithm used to predict outputs for inputs that it has not encountered

inductive reasoning: making generalizations based on specific instances

inferred knowledge: knowledge that was created based on reasoning, using evidence provided

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/or protocol

NOTE: This definition is taken from ETSI GS ENI 019 [i.21].

inheritance: act of defining the characteristics and behaviour of one entity based on another entity

NOTE: The following definition of inheritance is from ETSI TR 102 748 [i.19]: "typical property related to the concept of classes: when building a new derived class it will inherit properties from one or more previously-defined base classes, while possibly allowing for redefining or adding new properties". The ENI Information Model does not allow redefinition of properties, as this breaks information encapsulation. See ETSI GR ENI 016 [i.20], clause 4.1.2.

In-situ Flow Information Telemetry (IFIT): network OAM data plane on-path telemetry techniques

NOTE: This includes In-situ OAM (IOAM), Direct Exporting (DEX) IOAM (IOAM-DEX), Postcard-based Telemetry (PBT) and Alternate Marking [i.11]. It can provide flow information on the entire forwarding path on a per-packet basis in real time. "In-situ" is Latin which can be translated as "in the original place".

instruction tuning: making a language model more generic by training the model on a large set of varied instructions

integrative negotiation: win-win (or non-zero-sum) game, in which all collaborating participants receive optimal value

integrity: information and systems are not altered in an unauthorized manner

intent knowledge: knowledge that is used in the process of Intent Translation

NOTE: It contains the relevant policyMetadata (e.g. a time period that this intent policy is valid, as well as version information, including a minimum version that can be used) and the generated new knowledge (e.g. rules for the specific domain, the corresponding actions to meet certain requirement). It is stored in the model repository and knowledge repository defined in MEF PDO CfC [i.2] within the Repository Management Functional Block.

intent-level templates: network intent with fixed format

intent policy: type of policy that uses statements from a restricted natural language (e.g. an external DSL) to express the goals of the policy, but not how to accomplish those goals

NOTE: In particular, formal logic syntax is not used. Therefore, 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.

intent translation functional block: new functional block that takes part in the process of Intent Translation

NOTE: It performs lexical analysis, syntactic analysis, semantic analysis and augmentation, compiling of the Intent Policy.

interface: common boundary between two associated systems

NOTE: As defined in ETSI TR 121 905 [i.27].

interpreter: computer program that directly executes code from a programming language without requiring the code to have been compiled into a machine language program

internal Domain Specific Language (DSL): DSL that defines a specific way to use a host language to give it a different feel

NOTE: Internal DSL does not require a custom compiler or interpreter, because it is embedded into its base language.

ISO 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].

4.11 J

Void.

4.12 K

knowledge: analysis of data and information, resulting in an understanding of what the data and information mean

NOTE: Knowledge represents a set of patterns that are used to explain, as well as predict, what has happened, is happening, or is possible to happen in the future; it is based on acquisition of data, information, and skills through experience and education.

knowledge discovery: finding new knowledge from existing knowledge

knowledge-enhanced Large Language Model (LLM): LLM that is systematically augmented with structured external knowledge sources to improve factual accuracy, reasoning depth, and interpretability

knowledge entity: concept of reflecting specific things in the knowledge graph

knowledge extraction: extraction of entities, relationships, and new knowledge from patterns or inference from data

knowledge fusion: process of combining knowledge from multiple sources to create a more comprehensive and accurate representation of the system

knowledge graph: structured representation of knowledge that uses a graph data structure and formal logic to represent entities and their relationships

knowledge integration: combination of knowledge from different sources in a manner that preserves its semantics

knowledge reasoning: process of using structured knowledge to validate existing information and infer new conclusions based on a defined knowledge representation

knowledge representation: definition of data and information, applied in a particular context, that enables a machine to understand and use in computations

NOTE: This is available at <http://groups.csail.mit.edu/medg/ftp/psz/k-rep.html>.

4.13 L

label: identification of an output value for a given input

NOTE: Supervised learning uses labelled data; semi-supervised learning uses labels for a portion of the training data (the remaining training data are not labelled); unsupervised learning is based on training data that are not labelled.

language: structured and well-defined system of communication

language model: use of probabilistic and/or statistical mechanisms to determine the probability of a given sequence of words occurring in a sentence

large language model: type of self-supervised language model whose number of parameters in the model can change autonomously as it learns

Large Language Model Meta AI (LLaMA): family of autoregressive large language models released by Meta AI® starting on February 24, 2023

NOTE: As defined in <https://github.com/meta-llama/llama>.

learning: process that acquires new knowledge and/or updates existing knowledge to optimize a function using sample observations

NOTE 1: The learning process adjusts parameters to minimize observed errors; if the error rate becomes too high, then the ANN needs to be redesigned.

NOTE 2: The learning agent is not told which actions to take, but can instead discover which actions yield the highest reward.

least privilege: security concept that ensures users, applications, and systems are granted only the minimum level of access necessary to perform their tasks, and nothing more

lexeme: linguistic unit of meaning, consisting of a word or group of words

NOTE: A lexeme is an abstract unit that can have many different forms. For example, in inflectional languages, a lexeme will have many forms (e.g. present and past). Idioms, as well as expressions, are also lexemes.

lexicon: collection of all words, phrases and symbols used in a language, along with their definition(s) and meaning(s)

NOTE: More formally, a lexicon is the complete set of morphemes in a language, along with their definitions and grammatical rules, that enables a complete vocabulary to be defined.

lifecycle: evolution of a system, product, service, project or other human-made entity, from conception through retirement

NOTE 1: As defined in ETSI GS ENI 050 [i.29].

NOTE 2: Derived from ISO/IEC/IEEE 12207:2017 [i.33].

NOTE 3: ISO/IEC/IEEE 42020:2019 [i.34] defined life cycle with respect to aspects of entity and architecture. For entity, the life cycle is defined as "<entity> set of distinguishable phases or phases that an entity goes through from its conceptualization until it ceases to exist". For the architecture, the life cycle is defined as "<architecture> set of distinguishable phases or phases that an architecture goes through" with a note to this entry that indicates "the architecture life cycle starts with the identification of a need for the architecture and ends when it is no longer needed". These definitions of life cycle could be also referred for NetOAM LM and its LCM functional block architecture.

lifecycle management of intent policy: management of basic Create Read Update Delete (CRUD) operations and other operations of state management on intent policies, which comes from ENI system or intent policy creator

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].

linear classifier: classifier that assigns a label based on a linear combination of its features

location: physical geographic location (e.g. a geocode or a bounding polygon) of an entity (e.g. a server)

NOTE: Contrast this with Placement.

logic: formal or informal language that evaluates a conclusion based on a set of premises

NOTE: Fuzzy logic is most often used to reason about the degree of truth, or probability, in a system.

logic clause: expression made up of a finite set of literals (i.e. literals), including the negation of literals

NOTE: In propositional logic, a literal is a variable. In predicate logic, a literal is an atomic formula.

4.14 M

machine learning: process by which a system improves its performance on a task through experience, using data to adjust or create models without explicit programming for each outcome

NOTE: A commonly used formal definition is: "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".

machine learning model: representation of a deterministic system using mathematical and/or logical formalisms

NOTE: A deterministic system is a system in which successive states of a system are determined by its preceding state; this means that an algorithm, given a particular input, will always produce the same output.

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 domain: domain that uses a set of common Policies to govern its constituent Entities

NOTE: A Management Domain refines the notion of a Domain by adding three important behavioural features:

- 1) it defines a set of administrators that govern the set of Entities that it contains;
- 2) it defines a set of applications that are responsible for different governance operations, such as monitoring, configuration, and so forth;
- 3) it defines a common set of management mechanisms, such as policy rules, that are used to govern the behaviour of MCMMangedEntities contained in the MCMMManagementDomain.

This is based on the definition of an MCMDomain in MEF 78.1 [i.5].

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.

manufacturer: company having a substantial capacity to develop and/or produce and/or install and/or maintain products to be used in, or directly or indirectly connected to, an electronics communications network

NOTE: An association or organization of such manufacturers also falls within this category. (Member categories from Rules of procedure in ETSI Directives [i.13]).

massively parallel processing: use of a large number of processing nodes that perform a set of coordinated tasks in parallel using a high-speed network

NOTE: The processing nodes typically are independent, and do not share memory, and typically each node runs its own instance of an operating system.

measured knowledge: knowledge that has resulted from the analysis of data and information that was measured or reported

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 GR NFV 003 [i.1].

message system: system that transfers data between components

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

mixture of experts model: technique where multiple expert models are used to divide a problem space into homogeneous regions, where only one or a few expert models will be run

modal logic: representation, using mathematical formalisms, expressions involving necessity and possibility

model: representation of the entities of a system, including their relationships and dependencies, using an established set of rules and concepts

Model-Driven Behaviour (MDB): approach in which the behaviour of components, modules of systems are managed using MDE

NOTE: For ENI, this applies to Functional Blocks, not components within a Functional Block.

Model-Driven Engineering (MDE): approach in which models are central to all phases of the development and implementation processes

model element: classes, attributes, methods, constraints, relationships, and stereotypes used in constructing a model

model hyperparameter: hyperparameter that selects the mathematical or statistical model used in the learning process (e.g. size and topology of the ANN)

model parser: processing user intent using large language models or NLP methods

morpheme: smallest unit of meaning in a language

multigraph: graph in which multiple edges between nodes are permitted

NOTE: A multigraph is a graph that is permitted to have multiple edges (also called parallel edges) between the same pair of vertices. This means two vertices may be connected by more than one edge.

multi-layer perceptron: type of feedforward ANN that consists of an input layer, an output layer, and one or more hidden layers

NOTE: Since a non-linear function is used, a multi-layer perceptron can distinguish data that is not linearly separable (compare to perceptron).

multiple inheritance: capability for an object or class to inherit characteristics and/or behavior from more than one superclass

NOTE: This style of inheritance is not used in ENI.

4.15 N

named entity: word or phrase that refers to an item or process of interest

named entity recognition: task that identifies and classifies mentions of real-world entities (such as persons, organizations, or locations) in unstructured text

NOTE 1: Typical entity categories include persons, organizations, locations, dates, and other domain-specific types.

NOTE 2: In NLP, named entity recognition does not identify the entity itself. Rather, it identifies *text spans* that refer to an entity.

natural language: human-understandable language that is used to interact with a computer program

Natural Language ToolKit (NLTK): suite of libraries and programs for working with natural language data in the Python® programming language

negotiation: set of communications that is intended to reach a beneficial outcome for a set of conflicting issues:

NetGPT: domain-specific model trained with data from core network domain

network AI agent: AI agent that resides in the mobile network to support providing network services

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 Digital Twin (NDT): Virtual Digital Twin of telecom network, including its own network lifecycle

network entities: entities representing partial network information, such as time, bandwidth, etc.

network function: 3GPP adopted or 3GPP defined processing function in a network, which has defined functional behaviour and 3GPP defined interfaces

NOTE: As defined in 3GPP TS 23.501 [i.26].

network intelligence categories: network classification, in terms of the advantages that intelligence and automation bring into the management and operation processes, by using capabilities of adaptation and optimization

network invariant: objective attribute or inviolable rule that ensures the normal operation of the network

network lifecycle: work-flow of activities including network planning, network deployment, network service provisioning, network changes, network maintenance, network optimization in real-time

Network Model (NM): network mode which can run on a multimodel network environment through standardized software and hardware implementations in layers of the protocol stack

NOTE: This encompasses the treatment of compatibility of data coming from different sources located at different technical areas of the network e.g. IP based networks, identity-based networks, content based networks and location based networks all in Polymorphic Networks (PINet).

network OAMP Large Language Model (OAMP-LLM): large language model fine-tuned on network operation, administration, maintenance, and performance (OAMP) data to support OAMP-specific tasks

NOTE: An OAMP-LLM is a domain-adapted version of a general LLM.

network OAMP Large Language Model system (OAMP-LLM system): system that integrates and invokes an OAMP-LLM to provide intelligent OAMP functions

NOTE: Examples include automated troubleshooting, performance analysis, and configuration assistance.

network operator (also known as network carrier): operator of an electronics communications network or part thereof

NOTE: An association or organization of such network operators also falls within this category. (Member categories from Rules of procedure in ETSI Directives [i.13]).

network policy: specific type of policy that affects network behaviour and can be directly understood and executed by network devices within the Assisted System

network slice: technology of cutting a physical network into multiple virtual networks to meet the needs of different services

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.

neural network: network of nodes that communicate with other nodes via specialized connections

NOTE: The above technically refers to the biological concept, where a node is a neuron (i.e. nerve cell). ENI will use the term artificial neural network, or ANN, to refer to the artificial intelligence concept.

neural-symbolic logic: integration of neural and symbolic AI systems to enhance reasoning and learning capabilities

NLTK: suite of libraries and programs for working with natural language data in Python®

normalization: process of changing ingested information to a canonical form

np-complete: class of computational problems for which no efficient solution algorithm has been found

4.16 O

object: instance of a concrete class

offline learning: data set being worked on does not change

NOTE: This means that parameters defined during the training depend on the entire training data set (e.g. are global).

offline training: phase in machine learning that is used to create a model when the algorithm is not currently being executed

on-demand service: service that can be provisioned and used as needed

one-cold vector: $1 \times N$ matrix (vector) used to distinguish each word in a vocabulary from every other word in the vocabulary, where the vector consists of 1 s in all cells with the exception of a single 0 in a cell used uniquely to identify the word

one-hot vector: $1 \times N$ matrix (vector) used to distinguish each word in a vocabulary from every other word in the vocabulary, where the vector consists of 0 s in all cells with the exception of a single 1 in a cell used uniquely to identify the word

online learning: learning when data is not previously available

NOTE: In this approach, data arrives over time, and a model is first inferred, and then refined after each subsequent time step. It is similar to incremental learning, except that it is bounded in time (and possibly other factors, such as model complexity and resources).

online training: phase in machine learning that is used to perform inferences in real-time (i.e. when the model is actively being used)

ontology (traditionally): explicit specification of a conceptualization

NOTE 1: As defined in [i.14].

NOTE 2: This definition is the basis for definitions in OneM2M and SmartM2M.

ontology (for ENI): language, consisting of a vocabulary and a set of primitives, that enable the semantic characteristics of a domain to be modelled

ontology alignment: finding mappings between overlapping concepts in two or more ontologies to align them

open control loop: control loop whose controlling action is independent of the output of the object or process being controlled

NOTE: This type of control loop does not link the control action to the object or process being controlled (it simply continues to apply the control action).

Operation, Administration, Maintenance, Performance (OAMP): framework for managing telecommunication and computer networks, focusing on service delivery, system reliability, and operational efficiency

operational system: physical and virtual system that is used by operators to maintain and manage the network/resources or provide the network service

NOTE: ENI System can be deployed independently to assist the operational system or as an integrated part of the operational system, by mapping some or all of its functionalities to the corresponding components of the operational system.

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: The set of entities that perform the orchestration function is the "Orchestrator". Compare this definition to Choreography.

OSS-like functionality: functionality used to support back-office activities that configures and operates a network for the operator

NOTE: Examples include inventory, configuration management, service assurance and service activation.

override: changing of an attribute or operation implementation by a subclass that is already provided by its superclasses

NOTE: The ENI information model does not use overriding, because this alters the semantics of the class.

4.17 P

parser: computer program that creates one or more data structures from an input programming language using an associated formal grammar confirmed

part-of-speech tagging: natural language processing technique used to determine the grammatical category of each word in a sentence, such as nouns, verbs, adjectives, etc.

pascalCase: naming convention in which the first letter of all words in a compound word is capitalized

NOTE: pascalCase is also called UpperCamelCase.

passive repository: repository that stores or retrieves information without pre- or post-processing

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].

peer closed control loop: two or more closed control loops that may interact, but are independent of each other

perceptron: supervised learning algorithm for binary classifiers, where the classification function is based on a linear function that combines the weighted sum of inputs with the feature vector

NOTE: Since a linear function is used, a perceptron can only distinguish data that is linearly separable (compare to multi-layer perceptron).

phase: period in the life cycle during which activities are performed that enable achievement of objectives for that phase

NOTE: Derived from ISO/IEC/IEEE 42020:2019 [i.34].

pipeline: end-to-end construct that orchestrates a flow of events and data in response to a trigger

placement: logical placement of an entity (e.g. a virtual machine) on or in another entity (e.g. a server)

NOTE: Contrast this with location.

planning: finding a procedural course of action for a declaratively described system to reach its goals while optimizing overall performance measures

PoC demo objective: detailed description of one particular aspect that the PoC Team intends to demonstrate and how it will be achieved

PoC project: activity oriented to perform a PoC

NOTE: According to the framework described in ETSI GS ENI 006 [i.25].

PoC review team: entity in charge of administering the PoC activity process

PoC scenario report: collection of PoC demo objectives

PoC team: organizations participating in the PoC project

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

NOTE: This is defined in MEF 55 [i.4], but also see MEF PDO CfC [i.2] and [i.15].

policy conflict: two policies that, when executed, cause contradictory and otherwise incompatible results within a given execution time window

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

policy Metadata: data that provides information about policy

NOTE: It helps ENI System find relevant information and discover resources Examples of policy Metadata include a time period that this intent policy is valid, as well as version information, including a minimum version that can be used.

Polymorphic Network (PINet): network composed of multiple or more network models running on standardized software and hardware interfaces and intelligent operation and maintenance management systems

NOTE: It supports the full-dimensional definitions of routing mode, switching mode, interconnection mode, network element form, transmission protocol, service attributes, etc.

Principal Component Analysis (PCA): data dimensionality reduction algorithm

NOTE: The central idea of principal PCA is to reduce the dimensionality of a data set consisting of a large number of interrelated variables, while retaining as much as possible of the variation present in the data set.

predicate: statement that can be true or false depending on the value of its variables

Principal Component Analysis (PCA): data dimensionality reduction algorithm

NOTE: The central idea of principal PCA is to reduce the dimensionality of a data set consisting of a large number of interrelated variables, while retaining as much as possible of the variation present in the data set.

private networks: closed-domain network deployed for vertical industry scenarios (e.g. manufacturing, ports), with customized RAN, core network, and transmission components

probabilistic classifier: classifier that assigns a label to an object based on a (conditional) probability distribution

probability: numerical value defining the likelihood of an event occurring

probability distribution: mathematical function that defines the probability of occurrence of all possible outcomes of the random phenomenon being observed

process: set of interrelated or interacting activities that use inputs to deliver an intended result

NOTE 1: Whether the "intended result" of a process is called output, product or service depends on the context of the reference.

NOTE 2: Inputs to a process are generally the outputs of other processes and outputs of a process are generally the inputs to other processes.

NOTE 3: Two or more interrelated and interacting processes in series can also be referred to as a process

NOTE 4: Processes in an organization are generally planned and carried out under controlled conditions to add value.

prompt: input that a Large Language Model (LLM) responds to

prompt drift: degradation of a model's performance due to changes in the prompts that it is given

prompt engineering: process of designing a set of prompts to generate a specific output

prompt injection: attack against applications that have been built on top of AI models

prompt injection attack: attack against applications built on top of AI models that aims to misalign a large language model (LLM) [i.3] by inserting malicious text into prompts [i.4]

prompt pipeline: pipeline that takes a user request and translates into a prompt or set of prompts

prompt template: pre-defined structure that can be used to generate text

prompt tuning: efficient, low-cost method of adapting an AI foundation model to new downstream tasks without retraining the model and updating its weights

prompt pipeline: pipeline that takes a user request and translates into a prompt or set of prompts

NOTE: A prompt pipeline typically uses one or more prompt templates and may also use external knowledge.

prompting, chain-of-thought: concatenating a series of prompts that serve as intermediate steps to achieve desired behaviour

prompting, few-shot: prompting an LLM with a small number of examples of expected behaviour

prompting, skills-in-context: technique that instructs a Large Language Model (LLM) how to compose basic skills in order to resolve more complex problems

prompt template: pre-defined structure that can be used to generate text

prompting, tree-of-thought: prompting an LLM with a starting point and then asking it to explore different possible outcomes or conclusions that serve as intermediate steps toward problem solving

prompting, zero-shot: prompting an LLM without any examples of expected behaviour

proposition: statement that can be true or false

propositional knowledge: knowledge of a proposition, along with a set of conditions that are individually necessary and jointly sufficient to prove (or disprove) the proposition

propositional formula: well-formed formula that has a unique truth value

propositional logic: manipulation of a set of propositions, possibly with logical connectives, to prove or disprove a conclusion

NOTE: Propositional logic does not deal with logical relationships and properties that involve the parts of a statement smaller than the statement itself. It is also called sentential logic, zeroth-order logic, and propositional (or sentential) calculus.

protocol buffers (Protobuf): language-neutral, platform-neutral, extensible mechanism for serializing structured data

4.18 Q

Quality of Experience (QoE): performance of users when using what is presented by a communication service or application user interface

Quality of Service (QoS): collective effect of service performances which determine the degree of satisfaction of a user of a service

NOTE: As defined in ETSI TR 121 905 [i.27].

quantifier: specification of the number of objects in a given domain that satisfy a formula containing at least one variable

quantitative evaluation criteria: score given to specific network intelligent application(s) or system(s) considering multiple dimensions

4.19 R

radon: line integration of a two-dimensional function along any line

NOTE: Convert the two-dimensional function $f(x, y)$ into an integral transformation of its projection at various angles θ .

RAG pipeline: end-to-end workflow collaboratively constructed by retrieval and generation modules, dynamically enhancing language model outputs through external knowledge bases.

reactive architecture: system that is aware of changes that affect its computations and adjusts accordingly

NOTE: The adjustment is made by reacting to an event in real-time without centralized control. The availability of new information drives program logic execution.

reactive telemetry: telemetry operation in a dynamic and interactive fashion

reasoning: process of drawing logical inferences, making deductions, and uncovering implicit information within a structured representation of knowledge

recurrent neural network: ANN that is connected between nodes form a directed graph across a temporal sequence

NOTE: RNNs contain cyclic connections that make them effective in storing history and state. This is done by using feedback loops in the processing of an output.

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.

refine: addition of attributes, methods, constraints, and/or relationships to an inherited class

NOTE: Refinement is required to only add to the semantics of the class. Refinement is required to be not delete or override attributes, methods, constraints, and/or relationships that it inherits.

reinforcement learning: use of software agents to take actions in an environment in order to maximize a cumulative reward

NOTE: The learning agent is not told which actions to take, but instead needs to discover which actions yield the highest reward.

reinforcement learning with human feedback: training of a reward model in reinforcement learning using human feedback

relationship extraction: extraction of various semantic associations between different entities from input data

repository: centralized location of a set of storage devices that enable different Functional Blocks to store and retrieve information

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

retrieval augmented generation: framework for improving the performance of LLMs by providing them with access to external knowledge sources

row-oriented database: database that organize data by record

NOTE: This type of database keeps all of the data associated with a record next to each other in memory, and is optimized for online transaction processing. An example is MySQL.

rule-based learning: use of rules to represent the knowledge of a system

NOTE: This type of system learns rules to make decisions, instead of using a model. These rules are different than other types of rule-based systems because this set of rules are learned, while rules in other types of systems are defined.

4.20 S

sample: set of objects selected or collected from a statistical population using a procedure

network OAM LLM application system: system which can invoke the LM and other systems according to user needs, enabling the creation of scenario-based intelligent applications capable of handling complex tasks and completing intelligent operation management services

SDO system: part of an assisted system that is defined by another SDO

NOTE: Examples include NFV MANO and MEF LSO.

semantic bus: type of message bus used to orchestrate and filter communications between ENI Functional Blocks based on the meaning, attributes and metadata of a message using a shared set of interfaces

semantics: study of the meaning of something (e.g. a sentence or a relationship in a model)

semantic closeness: measure of how similar the semantics of two different sets of concepts are

NOTE: The types of semantic relationships may be changed to achieve a closer amount of semantic closeness. This is one important mechanism in the knowledge discovery and alignment processes.

semantic learning: acquisition and organization of conceptual knowledge and meaning

semantic network: knowledge representation technique used to model and organize information as a directed graph

semantic reasoner: software tool designed to infer logical consequences from a set of asserted facts or axioms

NOTE: It is recommended that ENI members use the term "reasoning engine" instead of "semantic reasoner" to avoid confusion.

semantic reasoning: process of drawing logical conclusions and making inferences based on semantic knowledge

semi-structured data: information that does not conform to a formal data model, but does have some organizational properties that define key data (e.g. tags) that enable data to be self-describing

semi-supervised learning: hybridization of supervised and unsupervised learning, where the training data consists of both labelled and unlabelled data

service continuity: continuous delivery of service in conformance with a Service's functional and behavioural specification and SLA requirements

NOTE 1: This is 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 2: 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 3: 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): contract between a service provider and a customer that defines the service(s) to be provided and the level of performance to be expected

NOTE: This covers 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-level templates: template incorporating Quality of Service, Access Control List, Service-Level Agreements, and Network Function Virtualisation, etc.

Service Orchestration Functionality (SOF): set of service management layer functionality supporting an agile framework to streamline and automate the service lifecycle

NOTE 1: This is carried out in a sustainable fashion for coordinated management supporting design, fulfilment, 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 2: 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: An association or organization of such service providers also falls within this category. (Member categories from Rules of procedure in ETSI Directives [i.13]).

single inheritance: requirement that an object or class inherit characteristics and/or behavior from only one superclass

situation: set of circumstances and conditions at a given time that may influence decision-making

situation awareness: perception of data and behaviour that pertain to the relevant circumstances and/or conditions of a system or process, the comprehension of the meaning and significance of these data and behaviours, and how processes, actions, and new situations inferred from these data and processes are likely to evolve in the near future

NOTE: This definition is based on the material in [i.17] and MEF 55 [i.4].

software agent: software that acts on behalf of a user or another program

software architecture: high-level structure and organization of a software-based system

NOTE: This includes the objects, their properties and methods and relationships between objects.

software autonomous agent: software agent that acts on behalf of the entity that owns it without any communication from the owning entity

software intelligent agent: software agent that reasons about its environment and take the best set of actions to satisfy a set of goals

NOTE: This has the connotation of containing AI mechanisms to provide the reasoning and decision-making capabilities.

software multi-agent: set of software agents that are physically separate that work together to satisfy a set of goals

E2E Slice: logical network that provides a combination of specific network and application capabilities

E2E Slice Instance: set of Network Function, and Application Function instances and the required computing and communication resources that form a deployed E2E Slice

software defined hardware: software programmable hardware that is able to be reconfigured at runtime to enable near ASIC performance without sacrificing programmability for data-intensive algorithms

stage: period within the life cycle of an entity that relates to the state of its description or realization

NOTE: From ETSI GS ENI 050 [i.29], life cycle management for large language model.

stakeholder: set of individuals and/or organizations that may affect, be affected by, or perceive themselves to be affected by a decision, activity, or outcome of a process

statistical model: representation of a non-deterministic system using a set of statistical assumptions that describe how system data are generated

NOTE: In this model, randomness is introduced via defining some variables as stochastic (i.e. their values depend on the outcome of a random phenomenon). This is typically represented using probability distributions.

structured data: information organized in a predetermined way (a fixed format, data model or schema) within a record or a file

NOTE 1: As defined in [i.9].

NOTE 2: Structured data enables all elements to be individually addressable and conform to a data model.

subsystem: network element, management system, network platform

symbolic logic: manipulation of symbols and explicit rules to represent and reason about knowledge

sub-symbolic logic: operates on patterns and associations rather than explicit symbols

supervised learning: learning a function that maps an input to an output based on example pairs of labelled inputs and outputs

syntax: set of rules that govern how elements of a statement are structured, including what element goes where in a statement

4.21 T

technical expert: person in charge of defining or supporting Operational Procedures within a CSP Network (e.g. in charge of Capacity Planning, Engineering and Designing, Troubleshooting)

telemetry: automated process of recording and transmitting data to receiving equipment for monitoring purposes

NOTE: The process is typically automated, and the data transfer may include wireless, cellular, optical and other mechanisms.

temporal logic: representation, using mathematical formalisms, expressions involving time (e.g. it will be, it will always be, it was, and it has always been)

theorem: set of statements that has been mathematically proven to be true, based on a set of axioms and/or (previously proven) theorems

topic model: model which is used to identify topics or keywords in text data, such as Latent Semantic Analysis (LSA) based on probabilistic topic model

traditional ML model: model based on conventional machine learning algorithms and neural networks

NOTE: This is typically used without large-scale parameters and complex data structures. It is mainly applied to relatively simple tasks, such as single-task prediction, classification, and regression. These models primarily focus on learning patterns from structured or semi-structured data to perform specific tasks, such as classification, regression, or clustering.

training: process of teaching an entity a set of knowledge, skills, processes and/or behaviours

transfer learning: mechanism where knowledge learned from one task is reused to improve performance on a related task

transformer: deep learning transduction model that utilizes attention, weighing the influence of different parts of the input data

transpiler: software that converts the source code of a program written in one language to the source code of another language

4.22 U

UE AI agent: AI agent that runs on a User Equipment (UE) and initiates connections with a mobile network. It supports intelligent and multimodal communication between the user and the mobile network

universal quantifier: assertion that a property or relation holds for all members of a domain

unstructured data: information that does not have a pre-defined data model, and does not contain properties that provide any organization or structure to its elements

NOTE: Unstructured data needs to be processed in order to find information by domain-specific applications.

unsupervised learning: learning a function that maps an input to an output without the benefit of the data being classified or labelled

use case: description of a specific configuration/deployment scenario of a system from the user point of view

NOTE: As defined in ETSI TR 103 240 [i.16].

use case (for ENI): list of actions defining the interactions between a set of actors and the system in order to achieve a goal that has an observable result beneficial to a set of stakeholders

NOTE: The above definition of use case is more applicable for ENI modelling activities. In addition, the list of actions may consist of different sets of actions to accomplish a goal.

user-defined policy: user-defined conflict detection rule to fulfil distinguished requirements

user-level templates: service-level template that incorporates user preferences, device information, etc.

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

4.23 V

vector database: type of database that stores data as vectors

video stalling: process during the video playback, the video is paused and waits for the buffer due to dragging or other reasons

virtue ethics: ethical theory according to which an agent is ethical if and only if it acts according to a set of moral values

4.24 W

weighted graph: graph where each connection, or edge, has an associated weight

well-formed formula: formula used in logic that obeys the grammatical rules of its formal language

NOTE: Feature engineering is concerned with determining the best representation of the sample data to learn a solution for a given problem.

working data model: instance of an ENI data model that is not authoritative

working info model: instance of an ENI info model that is not authoritative

working model: instance of an ENI model that is not authoritative

NOTE: Zero or more working models may be resident in the ENI System at any given time.

workflow: network management logical entity used to describe a series of activities that constitute a task, with clearly defined start and end points

NOTE: Source: Recommendation ITU-T Y.3061 [i.30], modified.

4.25 X to Z

Void.

5 Abbreviations used in ETSI ISG ENI

5.1 0 to 9

2B	To Business
2C	To Consumer
2G	Second Generation GSM
2H	To Home
3G	Third Generation
3GPP	Third Generation Partnership Group
4G	Forth Generation
5G	Fifth Generation
6G	Sixth Generation

5.2 A

A2A	Agent2Agent
AAA	Authentication, Authorization, and Accounting
ABAC	Attribute-Based Access Control
ABI	Agent Based Interface
ACL	Access Control List
ACNO	Application Characteristic based Network Operation
ACP	Agent Communication Proxy
ACT-R	Adaptive Control of Thought-Rational
ADRF	Analytics Data Repository Function
AES	Advanced Encryption Standard
AF	Application Function
AgentGPT	Agent Generative Pre-Trained Transformer
AGV	Automated Guided Vehicle
AI	Artificial Intelligence
AI model	Artificial Intelligence model
AI/ML	Artificial Intelligence/Machine Learning
AI4N	AI for Network
AIIMS	All India Institutes of Medical Sciences
AI-MC	AI-based Mobile Caching
AIML	AI Mark-up Language
AI-NTC	AI enabled Network Traffic classifier
AIOp	Artificial Intelligence for IT Operations
ALPN	Application-Layer Protocol Negotiation
AMF	Access and Mobility Management Function
AMM	enhanced Alternate Marking Method
AMQP	Advanced Message Queuing Protocol
AN	Access Network
ANN	Artificial Neural Network
AP	Access Point
API	Application Programming Interface
APIB	API Broker
APN	APplication-aware Network
APP	Application
AR	Augmented Reality
ARF	Agent Repository Function
ARIMA	Auto Regressive Integrated Moving Average
AS	Autonomous System

ASCII	American Standard Code for Information Interchange
ASG	Aggregation Site Gateway
ASIC	Application Specific Integrated Circuit
AT	Antenna

5.3 B

BBF	BroadBand Forum
BBU	BaseBand Unit
BER	Bit Error Rate
BERT	Bidirectional Encoder Representations from Transformers
BFD	Bidirectional Forwarding Detection
BGP	Border Gateway Protocol
BIO	Beginning-Inside-Outside
BLER	Block Error Rate
BMES	Beginning-Middle-End-Singleton
BMP	BGP Monitoring Protocol
BOSS	Business Operations Support System
BoW	Bag of Words
BP	Back Propagation
BRAS	Broadband Remote Access Server
BS	Base Station
BSS	Business Support System
BUM	Broadcast, Unknown-Unicast and Multicast

5.4 C

CA	Certificate Authority
CA	Context Awareness
CAFB	Context Awareness Functional Block
CAGR	Compound Annual Growth Rate
CA-KM	Context Awareness-Knowledge Management
C-AM	Context-Aware Management (functional block)
CAP	Content Aware related Policy
CAPEX	CAPital EXpenditure
CCO	Capacity and Coverage Optimization
CCTV	Closed Circuit TeleVision
CCVPN	Cross domain and Cross layer Virtual Private Network
CFD	Computational Fluid Dynamics
CGN	Carrier Grade Network address translation
ChatGPT	chatbot made by OpenAI
CLI	Command Line Interface
CMD	Command
CMS	Cloud Management System
CN	Core Network
CNN	Convolutional Neural Network
CogM	Cognitive Management
COM	Control, Orchestration, and Management
COMPA	Control, Orchestration, Management, Policy and Analytics
CoordOME	Coordination Orchestration of Multiple Elements
CoT	Chain-of-Thought
CoT-SC	Self Consistency with Chain of Thought
COVID	Coronavirus
CP	Cloud Provider
CPRI	Common Public Radio Interface
CPT	Continual Pre-Training
CPU	Central Processing Unit
CQI	Channel Quality Indicator
C-RAN	Centralized RAN
CRC	Cyclic Redundancy Check

CRL	Certificate Revocation List
CRM	Customer Relationship Management
CRUD	Create Read Update and Delete
CS	Control System
CSAFB	Context and Situation Awareness Functional Block
CSC	Communication Service Customer
CSF	Cybersecurity Framework
CSI	Channel State Information
CSMF	Communication Service Management Function
CSP	Communication Service Provider
CSV	Comma Separated Values
CT	Client/Tenant

5.5 D

DaaS	Desktop as a Service
DAG	Directed Acyclic Graph
DAPT	Domain Adaptive Pretraining
DB	Data Base
DC	Data Centre
DC	Data Collection
DCA	Data Collection and Analysis
DDoS	Distributed Denial of Service
DE	Decision Element
DEN-ng	Directory Enabled Networks-next generation
DevOps	Development and Operations
DEX	Direct Exporting
DHCP	Dynamic Host Configuration Protocol
DIKW	Data Information Knowledge Wisdom
DIN	Data Ingestion and Normalization
DL	Description Logic
DL	Downlink
DLT	Distributed Ledger Technology
DNN	Deep Neural Network
DNP	Dynamic Network Probes
DNS	Domain Name System
DOG	Denormalization and Output Generation
DPI	Deep Packet inspection
DPR	Dense Passage Retrieval
D-RAN	Distributed RAN
D-RAN	Distributed RAN
DSL	Domain Specific Language
DSSM	Deep Structured Semantic Model
DTFB	Design Time Functional Block
DTLS	Datagram Transport Layer Security
DTN	Digital Twin Networks

5.6 E

E2E	End-to-End
EAM	Enhanced Alternate Marking
EBNF	Extended Backus-Naur Form
ECA	Event Condition Action
ECMP	Equal-Cost MultiPath
eCPRI	electronic Common Public Radio Interface
EDP	Event monitor Data Processing
EG	Expert Group
eMBB	enhanced Mobile BroadBand
EMS	Element Management System
ENI	Experiential Networked Intelligence

EO	Executive Order
ERP	External Reference Point
ESB	Enterprise Service Bus
ESFB	Evaluation and Simulation Functional Block
ETL	Extract-Transform-Load

5.7 F

FAISS	Facebook AI Similarity Search
FB	Functional Block
FCAPS	Fault, Configuration, Accounting, Performance and Security
FIB	Forwarding Information Base
FLAN	Finetuned LAnguage Net
FLOPS	FLoating-point Operations Per Second
FOCALE	Foundation Observe Compare Act Learn rEason
FOL	First Order Logic
FPGA	Field Programmable Gate Array
FPS	Frames Per Second
FSM	Finite State Machine
FTP	File Transfer Protocol

5.8 G

GAN	Generative Adversarial Network
GANA	Generic Autonomic Networking Architecture
GATs	Graph Attention Networks
GB	GigaByte
GCNs	Graph Convolutional Networks
GDPR	General Data Protection Regulation
Gen-AI	Generative Artificial Intelligence
GIS	Geographic Information System
GLoVe	Global Vectors
gNMI	gRPC® Network Management Interface
GNN	Graph Neural Network
GoT	Graph-of-Thought
GPB	Google Protocol Buffer
GPL	Graphics Processing Unit
GPL	Graphics Purpose Language
GPM	General Policy Management
GPRS	General Packet Radio Service
GPS	Global Positioning System
GPT	Generative Pre-trained Transformer
GPU	Graphics Processing Unit
GR	Group Report
gRPC®	gRPC® Remote Procedure Call

NOTE: Originally, gRPC® was a recursive acronym (the 'g' stood for gRPC). Now, the 'g' stands for various words that start with the letter g.

GRU	Gated Recurrent Unit
GS ENI	Group Specification of the Experiential Networked Intelligence ISG
GS	Group Specification
GTP	GPRS Tunnelling Protocol
GUI	Graphic User Interface

5.9 H

HATEOAS	Hypermedia As The Engine Of Application State
HD	High Definition

HDFS	Hadoop Distributed File System
HITL	Human-In-The-Loop
HTML	HyperText Markup Language
HTS	Hybrid Two Steps
HTTP	HyperText Transfer Protocol
HTTPS	HyperText Transfer Protocol Secure

5.10 I

I/O	Input and Output
IANA	Internet Assign Number Authority
IBCM	Intent-Based Cloud Management
IBM	International Business Machines
ICL	In-Context Learning
ICM	Infrastructure Control and Management
ICT	Information and Communication Technology
ID	IDentification
IDA	Intent Driven Action
IDC	Internet Data Centre
IDF	Inverse Document Frequency
IDL	Interface Definition Language
IDMS	Intent Driven Management Service
IDO	Intent Driven Object
IDS	Intrusion Detection Systems
IETF	Internet Engineering Task Force
IFIT	In-situ Flow Information Telemetry
IM	Intent Management
IMS	Integrated Management System
IMU	Inertial Measurement Unit
INFP	Intelligent Network Failure Prevention
IOAM	In-situ OAM
IOPS	Input/Output Operations Per Second
IoT	Internet of Things
IP	Internet Protocol
IPFIX	IP Flow Information eXport
IPFPM	IP Flow Performance Measurement
IPPM	IP Performance Metrics
IPPP	Intent Policy Pre-Processing
IPv4	Internet Protocol version 4
IRCOT	Interleaved Retrieval with Chain-of-Thought
IRI	Internationalized Resource Identifiers
IRP	Internal Reference Point
ISAC	Integrated Sensing and Communication
ISG	Industry Specification Group
ISMS	Information Security Management Systems
ISP	Internet Service Provider
IT	Information Technology
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication standardization sector
IVR	Interactive Voice Response

5.11 J

JPG	Joint Photographic Experts Group
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NOTE: JPG is the working group of ISO/IEC JTC 1/SC 29/WG 1. JPG is also a three-letter filename extension used for images encoded in the JPEG standard. The format itself is called JPEG (Joint Photographic Experts Group), and both .jpg and .jpeg files are included.

JSON	JavaScript Object Notation
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5.12 K

KELLM	Knowledge Enhanced LLM
KG	Knowledge Graph
KGC	Knowledge Graph Completion
KGMFB	Knowledge Graph Management Functional Block
KGO	Knowledge Graph Orchestrator
KGOFB	Knowledge Graph Orchestrator Functional Block
KGPFB	Knowledge Generation and Processing Functional Block
KGQA	Knowledge Graph Question Answering
KGRFB	Knowledge Graph Reasoning and Processing Functional Block
KM	Knowledge Management (functional block)
KMFB	Knowledge Management Functional Block
KNN	K-Nearest Neighbour
KP	Knowledge Plane
KPI	Key Performance Indicator
KQI	Key Quality Indicator
KVM	Kernel-based Virtual Machine

5.13 L

LAN Local Area Network

NOTE: From ETSI GR ENI 031 [i.31].

LCM	Life cycle management
LDAP	Lightweight Directory Access Protocol
LI	Lawful Interception
LiDAR	Light Detection and Ranging
LLaMA	Large Language Model Meta AI
LLC	Last Level Cache
LLM	Large Language Model
LM	Language Model
LM	Large Model
LSO RA	Lifecycle Service Orchestration - Reference Architecture
LSO	Lifecycle Service Orchestration
LSTM	Long Short-Term Memory
LTE	Long Term Evolution
LTFB	Linguistics Tools Functional Block

5.14 M

M&O	Management and Orchestration
MAC	Media Access Control
MAN	Metropolitan Area Network
MANO	MANagement and Orchestration
MAPE	Model-Analyse-Plan-Execute
MAPE-K	Model-Analyse-Plan-Execute-Knowledge
MAS	Multi-Agent System
MB	MegaByte
MBM	MEF Business Model
MBT	Model-Based Translation
MC	Mobile Caching
MCM	MEF Core Model
MCP	Model Context Protocol
MCP	Multi-vendor Command Platform
MDB	Model-Driven Behaviour
MDE	Model-Driven Engineering
MDFB	Model-Driven Functional Block
MDT	Model Driven Telemetry
ME	Managed Element

MEC	Multi-access Edge Computing
MedQA	Medical Question Answering
MEF	Metro Ethernet Forum

NOTE: An industry association.

MIME	Multipurpose Internet Mail Extension
MIMO	Multiple Input Multiple Output
ML model	Machine Learning model
ML	Machine Learning
MLM	Masked Language Modelling
MMKG	Multi-Modal Knowledge Graph
mMTC	massive Machine Type Communications
MNO	Mobile Network Operator
MnS	Management Service
MoE	Mixture of Experts
MOP	Mode Of Operation
MOS	Mean Opinion Score
MP3	MPEG-1 Audio Layer III

NOTE: ETSI GS ENI 005 [i.22].

MPLS	Multi-Protocol Label Switching
MPM	MEF Policy Model
MR	Measurement Report
MS	Monitoring System
MSE	Mean Square Error
MSISDN	Mobile Subscriber Integrated Services Digital Network Number
mTLS	mutual TLS

5.15 N

N/A	Non Applicable
N4AI	Network for AI
NAS	Network Attached Storage
NAT	Network Address Translation
NBI	North Bound Interface
NE	Network Element
NEET	National Eligibility come Entrance Test
NER	Named Entity Recognition
NetGPT	Network Generative Pre-trained Transformer
NetOAM LM	Network OAM Large Model
NF	Network Function
NFS	Network File System
NFV	Network Functions Virtualisation
NFVI	NFV Infrastructure
NFV-MANO	Network Functions Virtualisation MANagement and Orchestration
NFVO	Network Functions Virtualisation Orchestrater
NGFI	Next Generation Fronthaul Interface
NGMN	Next Generation Mobile Networks
NIC	Network Interface Controller
NKELLM	Network Knowledge Enhanced Large Language Model
NLI	Natural Language Inference
NLP	Natural Language Processing
NLTK	Natural Language ToolKit
NM	Network Model
NMI	Network Management Interface
NMS	Network Management System
NOC	Network Operation Centres
NOP	Network OPerator
NP	Network Processor
NPD	Network Planning & Deployment

NPN	Non-Public Network
NPO	Network Planning and Optimization
N-PoP	Network Point of Presence
NRF	Network Repository Function
NRM	Network Resource Management
NS	Network Service
NSAI	Neuro-Symbolic AI
NSD	Network Service Descriptor
NSI	Network Slice Instance
NSMF	Network Service Management Function
NSP	Next Sentence Prediction

NOTE: From ETSI GR ENI 043 [i.32].

NSSF	Network Slice Selection Function
NSSMF	Network Sub-Slicing Management Function
NWDAF	Network Data Analytics Function

5.16 O

O&M	Operation and Maintenance
OAM	Operation, Administration and Maintenance
OAMP	Operation, Administration, Management, and Performance
OAuth	Open Authentication
OCL	Object Constraint Language
OCSP	Online Certificate Status Protocol
OGFB	Output Generation Functional Block
OM	Operation and Maintenance
OMC	Operations and Maintenance Centre
OMFB	Operation and Monitoring Functional Block
ONF	Open Networking Foundation
ONF	Open Networking Foundation
ONIX	Overlay Network for Information eXchange
OOD	Out-of-Distribution
OODA	Observe Orient Decide Act
OPEX	Operational Expenditure
OPN	Operations/Parameters in the Network
OR	Operational Requirements
O-RAN	Open-Radio Access Network
OS	Operating System
OSS	Operations Supporting System
OTN	Optical Transport Network
OTT	Over The Top
OWAMP	One-Way Active Measurement Protocol
OWL	Web Ontology Language

5.17 P

P2P	Point-to-Point
PBAC	Policy-Based Access Control
PBM	Policy-Based Management
PBT	Postcard-Based Telemetry
PC	Personal Computer
PCA	Principal Component Analysis
PCEP	Path Computation Element communication Protocol
PCF	Policy Control Function
PDF	Portable Document Format
PDO	Policy-Driven Orchestration
PFFB	Prompting Framework Functional Block
PHP	Hypertext Preprocessor

PHY	PHYSical layer
PII	Personally Identifiable Information
PINet	Polymorphic Network
PKI	Public Key Infrastructure
PM	Performance Management
PM	Policy Management
PMF	Policy Management Federation
PMFB	Policy Management Functional Block
PMO	Policy Management Orchestrator
PNF	Physical Network Function
PnP	Plug-and-Play
PoC	Proof of Concept
POO	Policy Operations Orchestrator
PoP	Point of Presence
PORFB	Policy Management Orchestrator Functional Block
PoS	Part-of-Speech
PPO	Proximal Policy Optimization
PR	Performance Requirements
PSK	Pre-Shared Keys
PTN	Packet Transport Network
PTP	Precision Time Protocol
PUE	Power Usage Effectiveness

5.18 Q

QCI	Quality of service Class Identifiers
QoE	Quality of Experience
QoS	Quality of Service

5.19 R

RA	Reference Architecture
RAFT	Retrieval-Augmented Fine-Tuning
RAG	Retrieval Augmented Generation
RAM	Random Access Memory
RAML	RESTful API Modelling Language
RAN	Radio Access Network
RAT	Radio Access Technology
RAT	Radio Access Type
RAU	Remote Aggregation Unit
RBAC	Role-Based Access Control
RCA	Root Cause Analysis
RCC	Radio Cloud Centre
RCS	Rich Communication Service
RD	Research and Development
RDBMS	Relational DataBase Management System
RDF	Resource Description Framework
ReAct	Response and Action
ReLU	Rectified Linear Unit
REST	Representational State Transfer
RF	Radio Frequency
RFFB	RAG Framework Functional Block
RLHF	Reinforcement Learning from Human Feedback
RMI	Remote Method Invocation
RMM	Remote Monitoring and Management
RNN	Recurrent Neural Network
ROA	Resource Orientated Architecture
RP	Reference Point
RPC	Remote Procedure Call
RR	Resilience and Reliability

RRU	Remote Radio Units
RSG	Radio Service Gateway
RSRP	Reference Signal Received Power
RSRQ	Reference Signal Received Quality
RSSI	Received Signal Strength Indicator
RTFB	Run Time Functional Block
RTP	Real-time Transport Protocol

5.20 S

S3	Simple Storage Service
SA	Service Assurance
SAFB	Situational Awareness Functional Block
SAML	Security Assertion Markup Language
SAN	Storage Area Network
SBA	Service Based Architecture
SBERT	Sentence-BERT
SBI	Service-Based Interface
SBI	South Bound Interface
SBVR	Semantics of Business Vocabulary and business Rules
SCP	Service Communication Proxy
SCTP	Stream Control Transmission Protocol
SDK	Software Development Kit
SDN	Software Defined Networking
SDO	Standards Defining Organization
SD-WAN	Software-Defined Wide Area Network
SFT	Supervised Fine-tuning
SHA	Secure Hash Algorithm
SIA	Service Impact Analysis
SiC	Skills-in-Context
SINR	Signal to Interference plus Noise Ratio
SIP	Session Initiation Protocol
SLA	Service Level Agreement
SLM	Small Language Model
SLO	Service Level Objective
SM	Session Management
SMF	Session Management Function
SMS	Service Management System

NOTE: From ETSI GS ENI 050 [i.29].

SMS	Short Message Service
SNLI	Stanford Natural Language Inference Corpus
SNMP	Simple Network Management Protocol
SOC	Security Operations Centre
SOF	Service Orchestration Functionality
SOM	Service Orchestration and Management
SON	Self-Organizing Network
SOP	Sentence-Order Prediction
SP	Security and Privacy
SP.2A	Security and Privacy 2A
SP.2B	Security and Privacy 2B
SPN	Slicing Packet Network
SQL	Structured Query Language
SR	Segment Routing
SR-IOV	Single Root I/O Virtualisation
SSD	Solid State Drive
SSE	Server-Sent Events
SSH	Secure Shell
SSL	Secure Socket Layer
STS	Semantic Textual Similarity

SVM Support Vector Machine

5.21 T

TCO Total Cost of Ownership
 TCP Transmission Control Protocol
 TF Term Frequency
 TF-IDF Term Frequency-Inverse Document Frequency
 TICS Telecommunication Intelligent Customer Service
 TLS Transport Level Security
 TM Traffic Manager
 TMF Telecom Management Forum
 TMFB Transformer Management Functional Block
 TN Transport Network
 ToT Tree-of-Thought
 TPFB Transformer Processing Functional Block
 TPU Tensor Processing Unit
 TR Technical Report
 TRPO Trust Region Policy Optimization
 TSFT Task-Specific Fine-Tuning
 TSN Time Sensitive Network
 TT Trouble Ticket
 TTL Time-To-Live
 TVRA Threat, Vulnerability and Risk Analysis
 TWAMP Two-Way Active Measurement Protocol

5.22 U

UC Use Case
 UDM Unified Data Management
 UDP User Datagram Protocol
 UE User Equipment
 UL UpLink
 UMFB User Management Functional Block

NOTE: From ETSI GS ENI 050 [i.29].

UML Unified Modelling Language
 UPF User Plane Function
 URI Uniform Resource Identifier
 URL Universal Resource Location
 URLLC Ultra-Reliable Low-Latency Communication
 USD United States Dollar
 USMLE United States Medical Licensing Examination
 UTF Unicode Transformation Format

5.23 V

V&V Verification and Validation
 V2I Vehicle to Infrastructure
 V2N Vehicle to Network
 V2P Vehicle to People
 V2V Vehicle to Vehicle
 VA Virtual Application
 VAE Variational Auto Encoder
 vBRAS virtual Broadband Remote Access Server
 vCPU virtualised CPU
 VDI Virtual Desktop Interface
 VES VNF Event Stream

VIM	Virtualised Infrastructure Manager
VLM	Visual Language Model
VM	Virtual Machine
VNF FG	VNF Forwarding Graph
VNF	Virtualised Network Function
VNFC	Virtualised Network Function Component
VNFD	Virtualised Network Function Descriptor
VNFM	Virtualised Network Function Manager
vNIC	virtualised NIC
VoIP	Voice over IP
VoLTE	Voice over LTE
VPN	Virtual Private Network
VR	Virtual Reality
vStorage	virtualised Storage
vSwitch	virtualised Switch

5.24 W

WADL	Web Application Description Language
WAN	Wide Area Network
WG	Working Group
WI	Work Item
WIP	Work In Progress
WLAN	Wireless Local Area Network
WOFB	Workflow Orchestration Functional Block
Word2Vec	Word to Vector
WQMKG	Wireless Quality Maintenance Knowledge Graph
WSDL	Web Service Description Language

5.25 X

XDR	eXternal Data Representation
XML	eXtensible Markup Language
XR	eXtended Reality

5.26 Y

YAML	YAML Ain't Markup Language
YANG	Yet Another Next Generation

5.27 Z

Void.

Annex A: Bibliography

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