ETSI GS ENI 001 V3.2.1 (2023-05)

Experiential Networked Intelligence (ENI); ENI Use Cases

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Reference

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Contents

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Foreword

This Group Specification (GS) 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 specifies a collection of use cases from a variety of stakeholders, where the use of an Experiential Networked Intelligence (ENI) system can be applied to the fixed network, the mobile network, and cloud-based network, to enhance the operator experience through the use of network intelligence. The present document is a revision of ETSI GS ENI 001 [i.1]. It identifies and describes additional use cases and scenarios and gives the baseline on how the studies in ENI can be applied as solutions of some identified use cases in accordance with the ENI Reference Architecture and will substantially benefit the operators and other stakeholders.

In Release 3 the present document will add additional use cases, including cloud based use cases.

2 References

2.1 Normative 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.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

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Not applicable.

2.2 Informative references

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

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

[i.1] ETSI GS ENI 001 (V3.1.1): "Experiential Networked Intelligence (ENI); ENI use cases".

[i.2] NGMN Alliance: "Description of Network Slicing Concept", Version 1.0, January 13, 2016.

[i.3] 3GPP TR 23.799 (V14.0.0): "Study on Architecture for Next Generation System (Release 14)", December 2016.

[i.4] ETSI TS 132 101 (V11.4.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Telecommunication management; Principles and high level requirements (3GPP TS 32.101 version 11.4.0 Release 11)".

[i.5] ETSI TS 128 530 (V15.1.0): "5G; Management and orchestration; Concepts, use cases and requirements (3GPP TS 28.530 version 15.1.0 Release 15)".

[i.6] ETSI GR NFV-EVE 012 (V3.1.1): "Network Functions Virtualisation (NFV) Release 3; Evolution and Ecosystem; Report on Network Slicing Support with ETSI NFV Architecture Framework".

[i.7] ETSI GS ENI 002 (V3.2.1): "Experiential Networked Intelligence (ENI); ENI requirements".

[i.8] ETSI GS ENI 005 (V3.1.1): "Experiential Networked Intelligence (ENI); System Architecture".

[i.9] ETSI GR ENI 004 (V3.1.1): "Experiential Networked Intelligence (ENI); Terminology".

[i.10] IETF RFC 6645: "IP Flow Information Accounting and Export Benchmarking Methodology".

[i.11] Y. Hu, D. Li, P. Sun, P. Yi and J. Wu, "Polymorphic Smart Network: An Open, Flexible and Universal Architecture for Future Heterogeneous Networks," in IEEE Transactions on Network Science and Engineering, vol. 7, no. 4, pp. 2515-2525, 1 Oct.-Dec. 2020, doi: 10.1109/TNSE.2020.3006249.

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI GR ENI 004 [i.9] apply.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

2G	Second Generation GSM
3G	Third Generation
3GPP	Third Generation Partnership Group
4G	Forth Generation
5G	Fifth Generation
ACNO	Algorithmic Centre for Network Operation
AI	Artificial Intelligence
AI/ML	Artificial Intelligence/Machine Learning
AI-MC	AI-based Mobile Caching
AIML	AI Mark-up Language
AI-NTC	AI enabled Network Traffic Classifier
AN	Access Network
AP	Access Point
API	Application Programming Interface
APIB	API Broker
APP	Application
AT	Antenna
BBU	Baseband Unit
BRAS	Broadband Remote Access Server
BSS	Business Support System
CA	Context Awareness
CA-KM	Context Awareness-Knowledge Management
C-AM	Context-Aware Management (functional block)
CAPEX	Capital Expenditure
CCO	Capacity and Coverage Optimization
CFD	Computational Fluid Dynamics
CGN	Carrier Grade Network address translation
CMS	Cloud Management System
CN	Core Network
CogM	Cognitive Management
COVID	Coronavirus
CP	Cloud Provider
CPRI	Common Public Radio Interface

CPU	Computing Processing Unit
CS	Control System
CSMF	Communication Service Management Function
CSP	Cloud Service Provider
CT	Client/Tenant
DaaS	Desktop as a Service
DC	Data Centre
DDoS	Distributed Denial of Service
DevOps	Development and Operations
DHCP	Dynamic Host Configuration Protocol
DIN	Data Ingestion and Normalization
DL	Downlink
DNS	Domain Name System
DOG	Denormalization and Output Generation
DPI	Deep Packet Inspection
D-RAN	Distributed RAN
E2E	End-to-End
eCPRI	electronic Common Public Radio Interface
eMBB	electronic Mobile Broad Band
EMS	Element Management System
ENI	Experiential Networked Intelligence
ETL	Extract-Transform-Load
FB	Functional Block
FCAPS	Fault, Configuration, Accounting, Performance and Security
FPS	Frames Per Second
FTP	File Transfer Protocol
GUI	Graphic User Interface
HTTP	Hypertext Transfer Protocol
I/O	Input and Output
IANA	Internet Assign Number Authority
IBCM	Intent-Based Cloud Management
ID	Identity
IDC	Internet Data Centre
IDS	Intrusion Detection Systems
INFP	Intelligent Network Failure Prevention
IoT	Internet of Things
IP	Internet Protocol
ISP	Internet Service Provider
IT	Information Technology
KM	Knowledge Management (functional block)
KPI	Key Performance Indicator
KVM	Kernel-based Virtual Machine
LTE	Long Term Architecture
MAN	Metro Area Network
MANO	Management and Orchestration
MC	Mobile Caching
MCP	Multi-vendor Command Platform
MDE	Model Driven Engineering (functional block)
MEC	Multi-access Edge Computing
MIMO	Multiple Input Multiple Output
ML	Machine Learning
MOP	Mode Of Operations
MOS	Mean Opinion Score
MPLS	Multi-Protocol Label Switching
MS	Monitoring System
N/A	Non Applicable
NF	Network Function
NFV	Network Functions Virtualisation
NFVI	NFV Infrastructure
NFVO	NFV Orchestrator
NGFI	Next Generation Fronthaul Interface
NGMN	Next Generation Mobile Networks

NPO	Network Planning and Optimization
NRM	Network Resource Management
NSI	Network Slice Instances
NSMF	Network Service Management Function
NSSMF	Network Sub-Slicing Management Function
O&M	Operation and Maintenance
OMC	Operation and Maintenance Centre
OPEX	OPerational EXpenditure
OPN	Operations/Parameters in the Network
OS	Operating Systems
OSS	Operations Support System
OTN	Optical Transport Network
P2P	Point to Point
PHY	PHYsical layer
PINet	PolymorphIc Network
PM	Policy Management (functional block)
PoC	Proof of Concept
PoP	Point of Presance
PTN	Packet Transport Network
PTP	Precision Time Protocol
PUE	Power Usage Effectiveness
QCI	Quality of service Class Identifiers
QoE	Quality of Experience
QoS	Quality of Service
RAM	Random Access Memory
C-RAN	Centralized RAN
RAN	Radio Access Network
RAU	Remote Aggregation Unit
RCA	Root Cause Analysis
RCC	Radio Cloud Centre
RF	Radio Frequency
RP	Reference Point
RRU	Remote Radio Units
RSRP	Reference Signal Received Power
SA	Service Assurance
SDN	Software Defined Networking
SD-WAN	Software Defined - Wide Area Network
SIA	Service Impact Analysis
SINR	Signal to Interference plus Noise Ratio
SIP	Session Initiation Protocol
SLA	Service-Level Agreement
SM	Session Management
SON	Self-Organizing Network
SP	Service Provider
TCP	Transmission Control Protocol
TLS	Transport Layer Security
TN	Transport Network
TT	Trouble Ticket
UC	Use Case
UE	User Equipment
UL	UpLink
UPF	User Plane Function in 5G
V2I	Vehicle to Infrastructure
V2N	Vehicle to Network
V2P	Vehicle to People
V2V	Vehicle to Vehicle
vBRAS	virtual Broadband Remote Access Server
vCPU	virtual CPU
VDI	Virtual Desktop Interface
VM	Virtual Machines
VNF	Virtualised Network Functions
VoIP	Voice over IP (Internet Protocol)

VoLTE Voice over LTE in 4G
WAN Wireless Access Network
WLAN Wireless Local Area Network
XDR eXternal Data Representation
XML eXtensible Markup Language
YAML YAML Ain't Markup Language

4 Overview

4.1 Background

Operators see human-machine interaction as slow, error-prone, expensive, and cumbersome. For example, operators are worried about the increasing complexity of integration of different standardization platforms in their network and operational environment; this is due to the vast differences inherent in programming different devices as well as the difficulty in building agile, personalized services that can be easily created and torn down. These human-machine interaction challenges are considered by operators as barriers to reducing the time to market of innovative and advanced services. Moreover, there is no efficient and extensible standards-based mechanism to provide contextually-aware services (e.g. services that adapt to changes in user needs, business goals, or environmental conditions).

These and other factors contribute to a very high OPerational EXpenditure (OPEX) for network management. Operators need the ability to automate their network configuration and monitoring processes to reduce OPEX. More importantly, operators need to improve the use and maintenance of their networks. In particular, this requires the ability to visualize services and their underlying operations so that the proper changes can be applied to protect offered services and resources (e.g. ensure that their Quality of Service (QoS) and Quality of Experience (QoE) requirements are not violated). If such visualization could be provided, then operators would be better able to maintain their networks.

The associated challenges may be stated as:

a) automating complex human-dependent decision-making processes;

b) determining which services should be offered, and which services are in danger of not meeting their Service-Level Agreement (SLA), as a function of changing context;

c) defining how best to visualize how network services are provided and managed to improve network maintenance and operation; and

d) providing an experiential architecture (i.e. an architecture that uses various mechanisms to observe and learn from the experience an operator has in managing the network) to improve its understanding of the operator experience, over time.

The aforementioned challenges will require advances in network telemetry, big data mechanisms to gather appropriate data at speed and scale, machine learning for intelligent analysis and decision making, and applying innovative, policy-based, model-driven functionality to simplify and scale complex device configuration and monitoring.

4.2 Overview of the ENI System

4.2.1 Brief Description

The purpose of the ISG ENI is to define a Cognitive Network Management architecture that improves on the operator experience. The operator experience is improved by adding closed-loop mechanisms (including AI functions) based on context-aware, metadata-driven policies to recognize and incorporate new and changed knowledge, and hence, make actionable decisions more quickly.

The ENI System is an innovative, policy-based, model-driven functional architecture that improves operator experience. In addition to network automation, the ENI System assists decision-making of humans as well as machines, to enable a more maintainable and reliable system that provides context-aware services that more efficiently meet the needs of the business. For example, the ENI System enables the network to change its behaviour (e.g. the set of services offered) in accordance with changes in context, including business goals, environmental conditions, and the varying needs of end-users.

Examples of the possible functionalities of an ENI system are given in Figure 4-1.

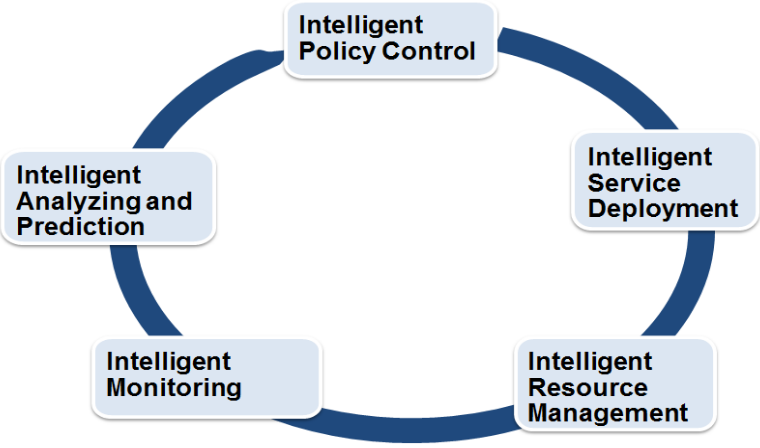

Figure 4-1: Example of functionalities of ENI system

4.2.2 Expected Benefits

The ENI System provides the following important benefits:

1) to measure and quantify the operation and performance of the resources and services of an operator;

2) to enable personalized services to be provided to customers;

3) to learn from the operation of the network, and decisions made by the operator;

4) to automate the operator's complex human-dependent decision-making processes by translating changing user needs, business goals, and environmental conditions into closed-loop configuration and monitoring;

5) to enable the optimization and adjustment of resources and services managed by the operator, as well as associated tools and applications needed by the operator to conduct business.

ENI system delivers enhanced customer experience by allowing operators to understand the operating status of their network and networked applications in near-real-time, and reconfigure their network. The ENI system automatically collects network status and associated metrics, faults, and errors, and then uses artificial intelligence to ensure network performance and quality of service are met at the highest possible efficiency (e.g. with the minimum required resources). An ENI system can also be used to find bottlenecks of service and/or failure of network. Both of these benefits are done on-demand, in response to changing contextual information.

The ENI system helps to increase the value of services provided by an operator to its customers by rapidly on-boarding new services, enabling the creation of a new ecosystem of cloud consumer and enterprise services, reducing Capital and Operational Expenditures, and providing efficient operations.