



The Standards People

ETSI ISG ENI**

How do big data and artificial
intelligence help in QoE assurance

Chairman:	Dr. Raymond Forbes (Huawei Technologies)
Vice-Chairman:	Mrs. Haining Wang (China Telecom)
Vice-Chairman:	Mr. Fred Feisullin "Fred" (Verizon)
Presented by: Secretary:	Dr. Yue Wang (Samsung)
Technical Officer:	Mrs. Korycinska Sylwia (ETSI)
Technical Manager:	Dr. Shucheng Liu "Will" (Huawei Technologies)

Outline

ETSI ISG ENI progress - Chairman

- Vision & background
- Introduce the status of the ETSI ISG on Experiential Networked Intelligence (ENI)
- Discussion about the analytics of big data to detect anomalies: improve the service QoE
- Other related SDOs and industry consortia
- Network intelligence activities in 2016, 2017 & 2018

ENI Workplan

Experiential Networked Intelligence (ENI) Work Items and Rapporteurs:

- ENI 001 (WI RGS/ENI-008) Use Cases – Wang, Yue (Samsung)
- ENI 002 (WI RGS/ENI-007) Requirements – Wang, Haining (China Telecom)
- ENI 003 (WI DGR/ENI-003) Context Aware Policy Modelling – Strassner, John (Huawei)
- ENI 004 (WI RGR/ENI-010) Terminology – Zeng, Yu (China Telecom)
- ENI 005 (WI DGS/ENI-005) System Architecture – Strassner, John (Huawei)
- ENI 006 (WI DGS/ENI-006) PoC Framework – Pesando, Luca (TIM) / Mostafa, Essa (Vodafone)
- ENI 007 (WI RGR/ENI-011) Definition of Networked Intelligence Categorization – Pesando, Luca (TIM)
- New work item under discussion: analytics for big data to detect anomalies: improve the service QoE – China Telecom, etc..

Business Value

• Network : Traditional → SDN & NFV → Autonomic Network

Network technology evolution

- Rapidly changing network conditions
- More services, more users

Network intelligence

Network mgmt. and operation evolution

- Human decisions
- Complex manual configuration

Management and operation intelligence

ENI

- Network perception and analysis
- Data driven policy
- AI-based closed-loop control

Enhanced network experience

Better customer experience

Improved QoE of service

Increased service value

Improved business efficiency

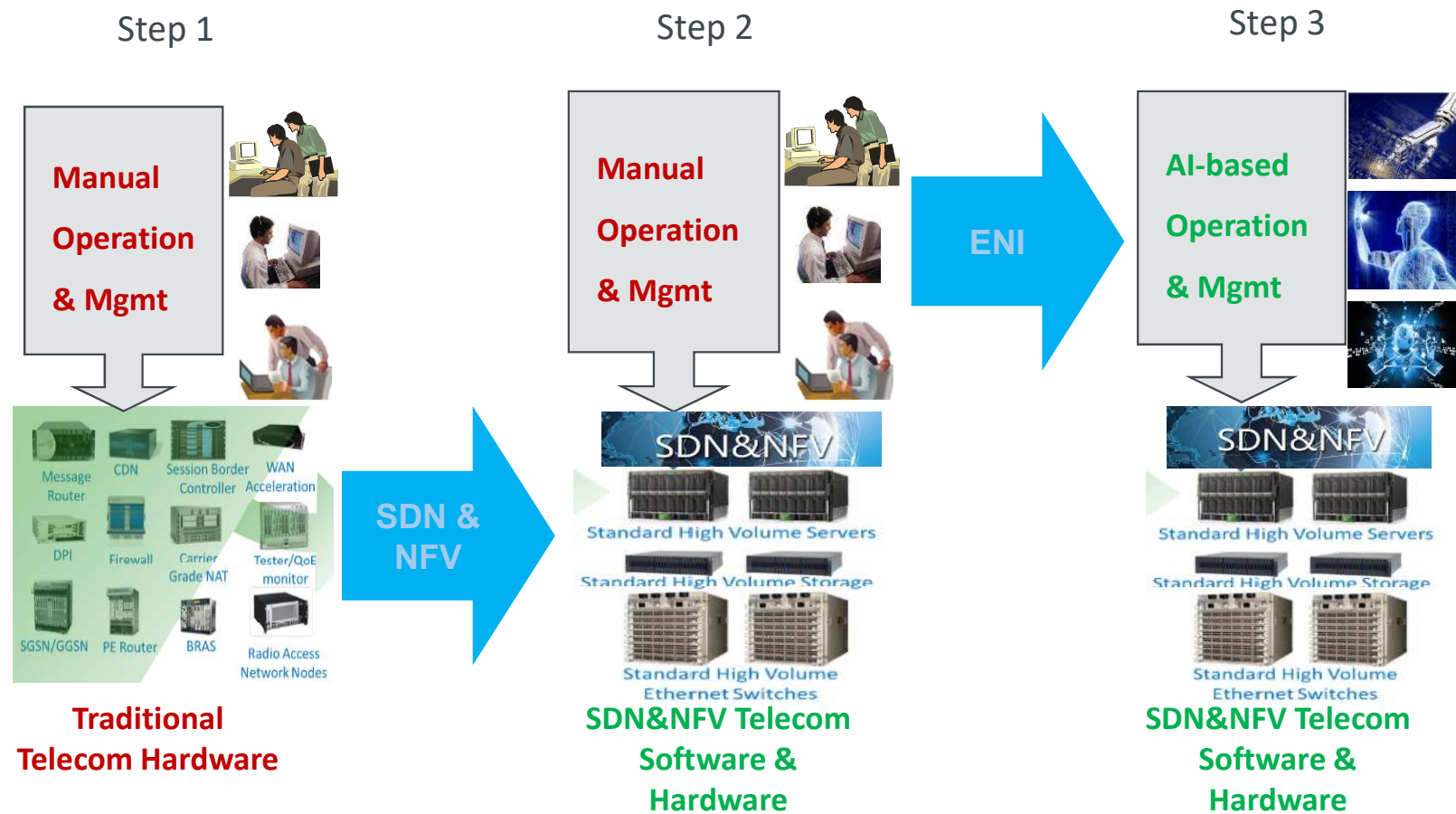
Reduced OPEX

QoE assurance in service delivery

Increased profit

5G/IoT automation

Vision



ENI Goals, Members and Participants

Core idea: Network perception analysis, data-driven policy, AI based closed-loop control

ETSI ISG ENI founded at 17Q1

- The ISG ENI focuses on improving the operator experience, adding closed-loop artificial intelligence mechanisms based on context-aware, metadata-driven policies to more quickly recognize and incorporate new and changed knowledge, and hence, make actionable decisions.
- In particular, ENI will specify a set of use cases, and the architecture, for a network supervisory assistant system based on the ‘observe-orient-decide-act’ control loop model.
- This model can assist decision-making systems, such as network control and management systems, to adjust services and resources offered based on changes in user needs, environmental conditions and business goals.

The ISG ENI Leadership team

Role	Company
Chairman	Huawei (Dr. Raymond Forbes)
Vice Chairman	China Telecom (Mrs. Haining Wang)
Second Vice Chairman	Verizon (Mr. Farid Feisullin “Fred”)
Technical Officer	ETSI (Mrs. Sylwia Korycinska)
Technical Manager	Huawei (Dr. Shucheng Liu “Will”)
Secretary	Samsung (Dr. Yue Wang)
ENI ISG PoC Review Team	Raymond Forbes (Huawei) ENI Chairman Sylwia Korycinska (ETSI Technical Officer) Michele Carignani (ETSI CTI) Haining Wang (China Telecom) & ENI Vice Chairman Luca Pesando (TIM) Mostafa Essa (Vodafone) Antonio Gamelas (Portugal Telecom)

ENI Members and Participants



- 41 operators, vendors and research institutes from across Europe, USA and Asia



Participants

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Source: <https://portal.etsi.org/TBSiteMap/ENI/ListOfENIMembers.aspx>
 Members signed the ENI Member agreement and are ETSI members
 Participants signed the ENI Member agreement but are not ETSI members

Objectives

Identify requirements to improve experience

Enable intelligent service assurance

Publish reference architecture

Develop the use of big data analytics to detect anomalies: improving the service QoE

Standardize how the network experience is measured

Engage with SDOs and consortia

Quote the ETSI ENI white paper: “The ENI architecture will show how these functional entities, including: APIs, and DSLs can be integrated. In particular, the ISG ENI focuses on intelligent service operation and management based on emerging technologies, such as **big data analysis, analytics, and artificial intelligence tools**, and on automating complex human-dependent decision-making processes.” [It is expected that QoE will be improved.](#)

Use Cases

Network Operations

Policy-driven IP managed networks

Radio coverage and capacity optimization

Intelligent software rollouts

Policy-based network slicing for IoT security

Intelligent fronthaul management and orchestration

Elastic Resource Management and Orchestration

Application Characteristic based Network Operation

Network Assurance

Network fault identification and prediction

Assurance of service requirements

Infrastructure Management

Policy-driven IDC traffic steering

Handling of peak planned occurrences

Energy optimization using AI

Service Orchestration and Management

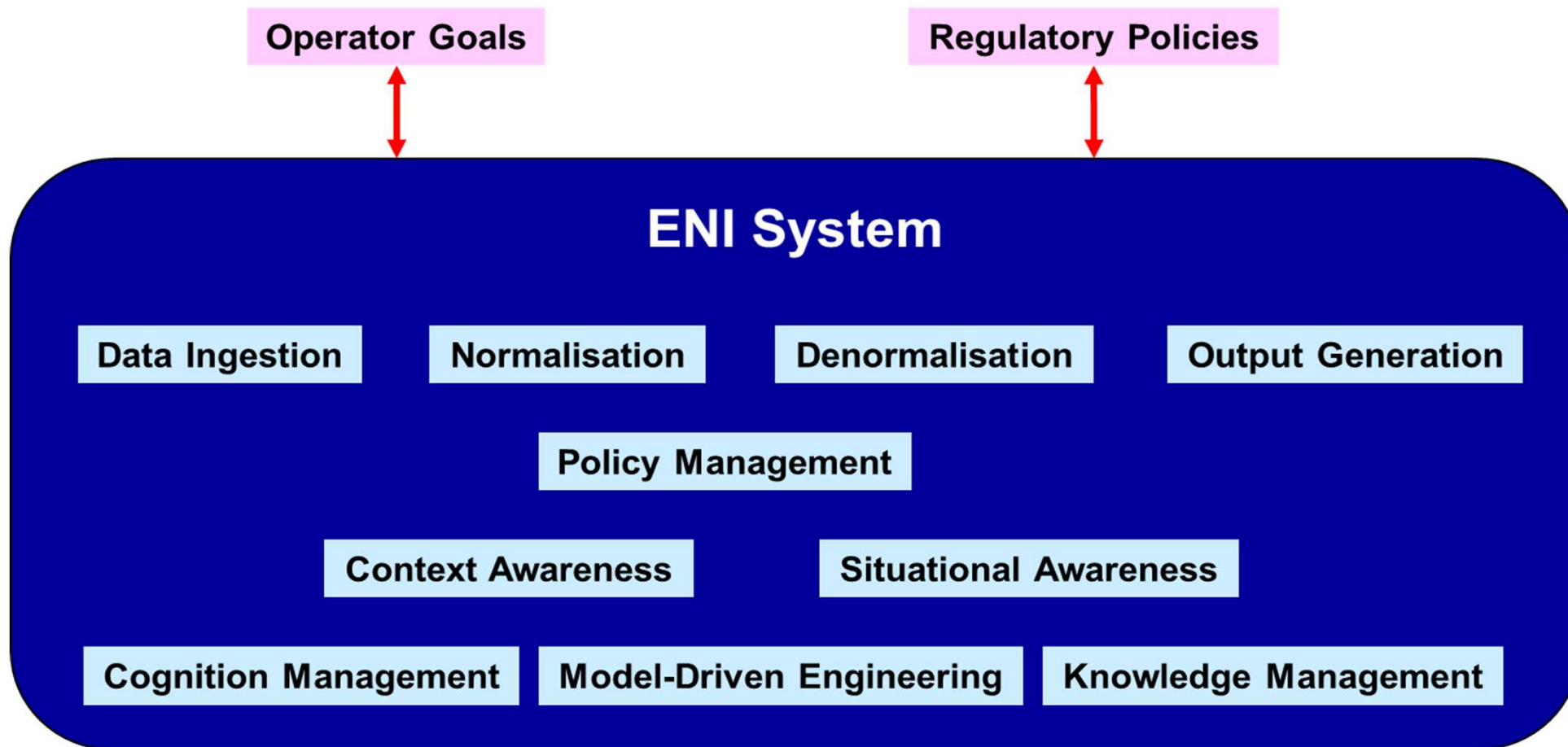
Context aware VoLTE service experience optimization

Intelligent network slicing management

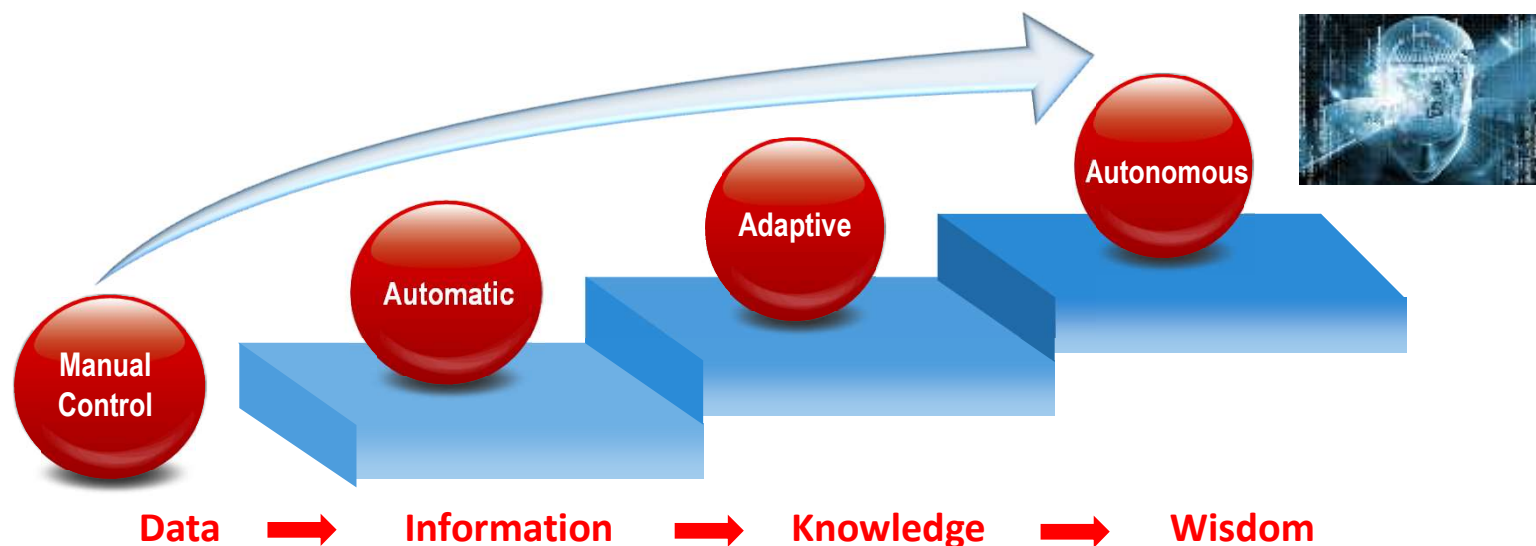
Intelligent carrier-managed SD-WAN

Source: ETSI RGS/ENI-008 , Experiential Networked Intelligence (ENI); ENI use cases; – Wang, Yue (Samsung)

Conceptual ENI Architecture



Evolution

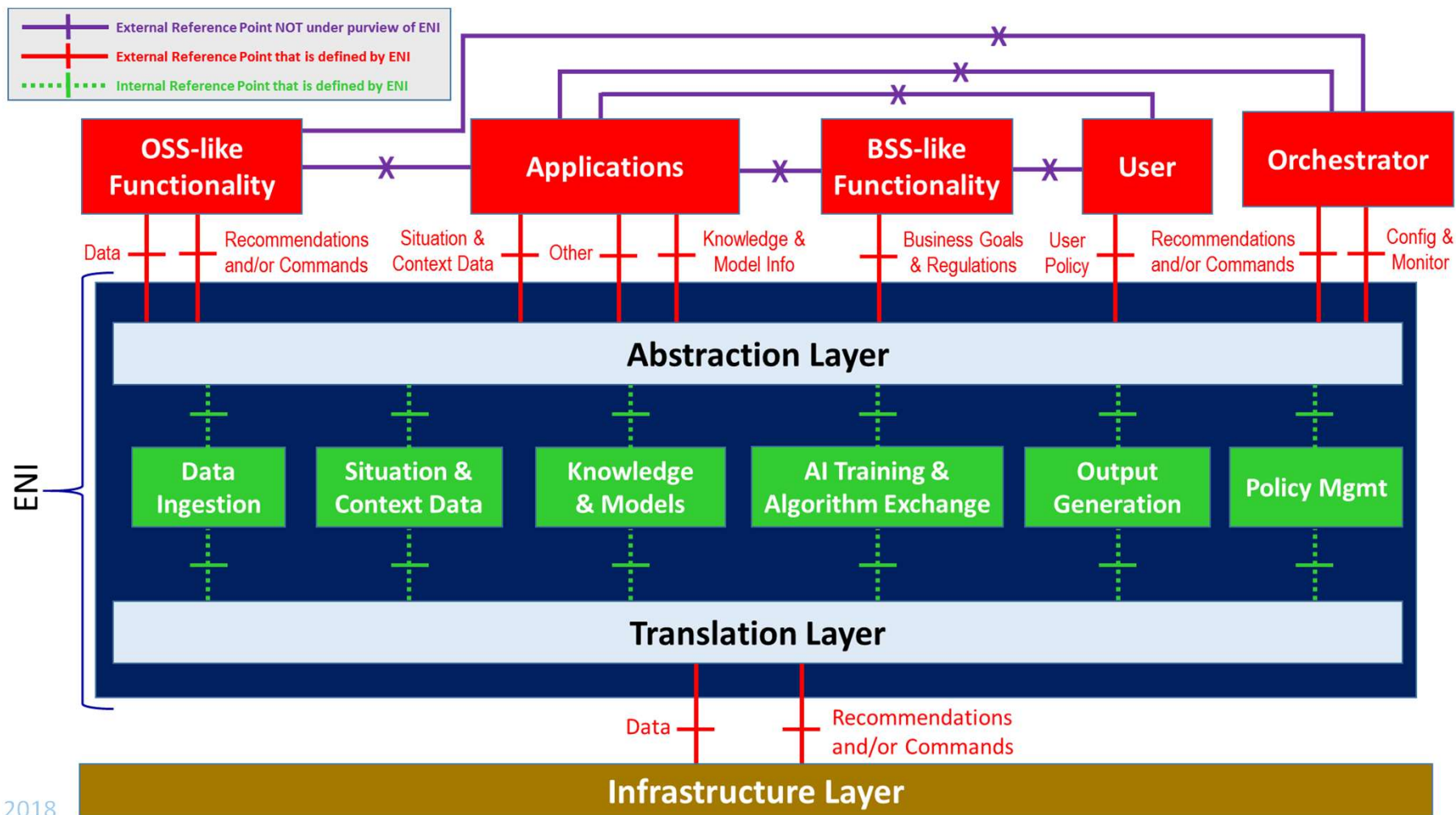


Automatic: automation of service distribution, network deployment and maintenance, through the integration of network management and control. Human controlled.

Adaptive: intelligent analysis, real-time acquisition of network data, perception of network status, generate optimization strategies to enable closed-loop operation.

Autonomous: Introduction of artificial intelligence to realize self-* features, based on a robust knowledge representation. Includes context-aware situation awareness as part of a comprehensive cognition framework, and uses policy-based management to enable adaptive and extensible service offerings that respond to changing business goals, user needs, and environmental constraints.

Initial Thoughts on Reference Architecture



Initial Published Deliverables

The ETSI www.etsi.org shop window shows recently published ENI deliverables:

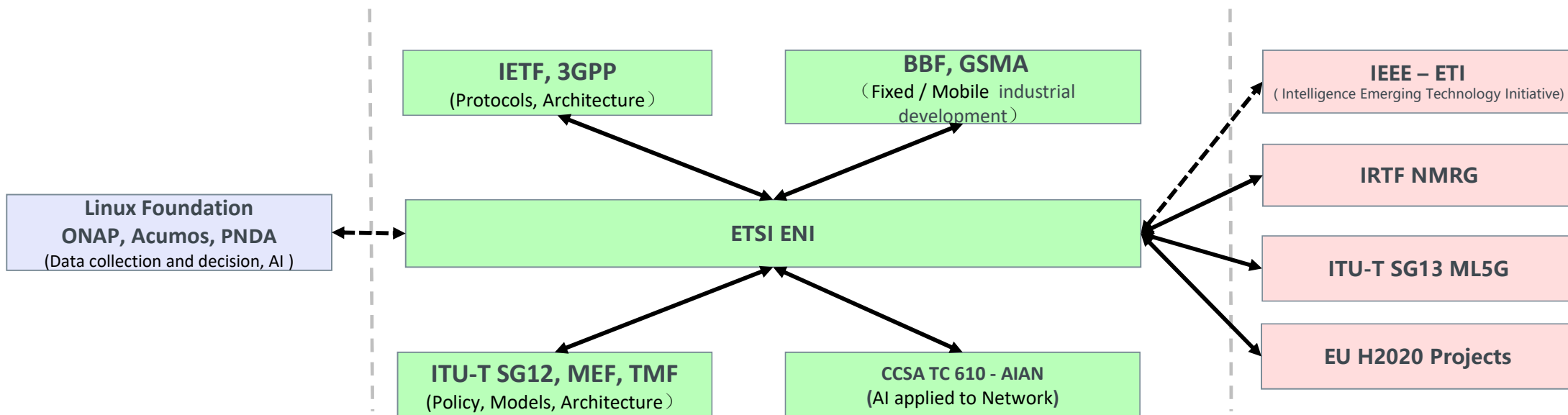
1. [ETSI GR ENI 001 V1.1.1 \(2018-04\)](#) **Published**
Experiential Networked Intelligence (ENI); ENI use cases
2. [ETSI GS ENI 002 V1.1.1 \(2018-04\)](#) **Published**
Experiential Networked Intelligence (ENI); ENI requirements
3. [ETSI GR ENI 003 V1.1.1 \(2018-05\)](#) **Published**
Experiential Networked Intelligence (ENI); Context-Aware Policy Management Gap Analysis
4. [ETSI GR ENI 004 V1.1.1 \(2018-05\)](#) **Published**
Experiential Networked Intelligence (ENI); ENI Terminology
5. [ETSI GS ENI 006 V1.1.1 \(2018-05\)](#) **Published**
Experiential Networked Intelligence (ENI); ENI Proof of Concept (PoC) Framework

Ecosystem

Open Source

Standard & Industry

Research



- Cooperate with mainstream operators, vendors and research institutes in Europe, USA and Asia
- Collaborate with other SDOs and industry ad-hocs
 - Liaisons exchanged with IETF, BBF, MEF, ITU-T
 - Liaisons with other ETSI groups: NFV, NGP, MEC, NTECH, OSM, ZSM
- Position ETSI ENI as the home of network intelligence standards
- Guide the industry with consensus on evolution of network intelligence
- Boarder between different categories are becoming vague.

Other related SDOs, Industry Consortia and EU Projects

Organization	Activity
ITU-T	Focus Group on Machine Learning for Future Networks including 5G
IETF ANIMA	IETF Research group on Autonomic Networking Integrated Model and Approach
CCSA TC610 (was SDNIA)	AIAN (Artificial Intelligence Applied in Network) industry group
H2020 & 5G-PPP	SliceNet, SelfNet, 5G-MoNArch
TMF	5G Intelligent Service Operations
Oasis	Advanced systems interworking – Open intelligent protocols
Linux Foundation	ONAP, Acumos
Bodies with no active interaction or liaison	
Telecom Infra Project (TIP)	Artificial Intelligence (AI) and Applied Machine Learning (ML) Project Group
IEEE	ComSoc Network Intelligence Emerging Technology Initiative (ETI)

Liaison with ITU-T SG12

Expected Liaison with SG12:

ETSI ISG ENI is focusing on developing the requirements, architectures, and maybe functions of an intelligent network.

SG12 is providing QoS/QoE parameters definitions, measurements, models and methodologies, which could be input to ENI and referenced by ENI.

The two groups can usefully and productively cooperate and share synergy.

- there is a need to establish liaison
- there is a need to be aware of each others activities
- there is common membership and the basis for good cooperation
- Liaison works best where there is the intention to work together and the ability to use and contribute to each others recommendations/specifications

Please Contribute

ETSI ENI#8 meeting will be held in Telefonica/5tonic in Madrid, Spain,
on 3-5 December, 2018.
You are welcome to join us!

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Future expected issues:

Version 2 on the Use cases & requirements (updates on Version 1)

- New Use Cases
- Priority Use Cases demonstrated in PoCs

Development of the system architecture

- Possible re-use of existing APIs
- Intent policies – AI tools

Discussion about the analytics of big data to detect anomalies

- improve the service QoE

Establishment of ENI PoC, Contribution to PoC, assurance of PoC &
Validation of the ENI System Architecture

Standardize how the network experience is measured

Welcome new members: especially to be active in discussions

Thank you!

Backup material

Table 1: Classification of Network Intelligence , Example of categorization report

Categorization - level	Name	Definition	Man-machine interface	Decision-making participation	Data collection and analysis	Degree of intelligence	Environment adaptability	Supported Scenario
Level0	Traditional manual network	O&M personnel manually control the network and obtain network alarms and logs.	How (command)	All-manual	Single and shallow awareness (SNMP events and alarms)	Lack of understanding (manual understanding)	Fixed	Single scenario
Level 1:	Partially automated network automated diagnostics	Automated scripts are used in service provisioning, network deployment, and maintenance. Shallow perception of network status and decision making suggestions of machine;	How (command)	Provide suggestions for machines or humans and help decision making.	Local awareness (SNMP events, alarms, KPIs, and logs)	A small amount of analysis	Little change	Few scenarios
Level 2:	Automated network	Automation of most service provisioning, network deployment, and maintenance Comprehensive perception of network status and local machine decision making;	How (declarative)	The machine provides multiple opinions, and the machine makes a small decision.	Comprehensive awareness (Telemetry basic data)	Powerful analysis	Little change	Few scenarios
Level 3:	Self-optimization network	Deep awareness of network status and automatic network control, meeting users' network intentions	How (declarative)	Most of the machines make decisions	Comprehensive and adaptive sensing (such as data compression and optimization technologies)	Comprehensive knowledge Forecast	Changeable	Multiple scenarios and combinations
Level4	Partial autonomous network	In a limited environment, people do not need to participate in decision-making and adjust themselves.	WHAT (intent)	Optional decision-making response (decision comments of the challenger)	Adaptive posture awareness (edge collection + judgment)	Comprehensive knowledge Forward forecast	Changeable	Multiple scenarios and combinations
Level5	Autonomous network	In different network environments and network conditions, the network can automatically adapt to and adjust to meet people's intentions.	WHAT (intent)	Machine self-decision	Adaptive deterioration optimization (edge closed-loop, including collection, judgment, and optimization)	Self-evolution and knowledge reasoning	Any change	Any scenario&combination

Autonomous capability Continuous improvement

PoC Team and ENI Work-Flow proposal



using the process under definition in ETSI

ENI has set up a PoC review team

Draft of the GS on Process PoC Framework and empty template.

Procedures:

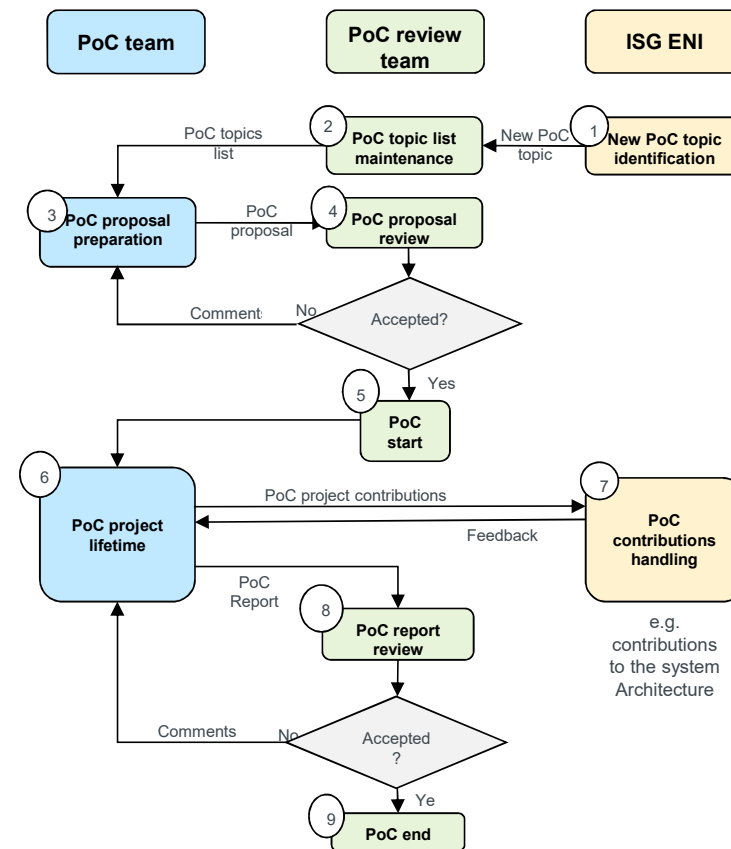
ISG ENI should draft and approve a PoC framework

Form a PoC review group to receive and review PoC proposals with formal delegation from ISG

Publish the framework (e.g. ENI has set up a wiki)

PoC teams (the proposers – which may include non-members) shall present an initial proposal and a final report, according to the templates given by ISG for review

PoC Team(s) are independent of the ISG – use the process and template of the ISG – Choose a POC Team Leader and draft the proposal



Other ETSI internal Technical Bodies (TCs/ISGs)

Technical Body	Activity
ETSI ISG NFV	Industry Standardization Group on Network Functions Virtualization
ETSI ISG MEC	Industry Standardization Group on Mobile-access Edge Computing
ETSI OSG OSM	Industry Standardization Group on Open Source MANO
ETSI ISG ZSM	Industry Standardization Group on Zero touch network and Service Management
ETSI TC INT - AFI	Technical Committee Core Network and Interoperability Testing - Evolution of Management towards Autonomic Future Internet
3GPP SA2 3GPP SA5	Mobile standardization specification global partnership project

Network Intelligence Activities in 2016 - 2018

Forum on Network Intelligence, Dec'16, Shenzhen, China

- Orange, NTT, CableLabs, China Telecom, China Unicom, China Mobile, NEC, HPE, HKUST etc, 40+ participants joined
- Study of the scope of network intelligence and related technologies, collected ideas of operators and academics
- Participants discussed and get rough consensus on the ENI ISG Proposal

ENI & SDNIA Joint Forum on Network Intelligence, Sep'17, Beijing, China

- China Telecom, China Unicom, China Mobile, Huawei, Nokia, Intel, Samsung, ZTE, H3C, Lenovo, HPE, etc , 140+ participants joined
- ENI main players presented the progress of ENI
- Operators shared use cases and practices
- Manufacturers shared solution ideas
- Demo prototype that embodies the ENI concept
- Deep cooperation between SDNIA and ENI was discussed, after that SDNIA created new industry group AIAN(AI Applied to Network)

ENI & H2020-SliceNet Workshop, Dec'17, London, UK

- Collaboration on PoC and Common partners identified between ENI and SliceNet
- ENI plan to set up a PoC team
- SliceNet then could take PoCs as an opportunity to feed requirements, use cases and input for ENI Work Programme, contributing one or more PoC proposals

ENI & 5GPPP MoNArch Workshop, June'18, Turin Italy

- Collaboration on PoC and Common partners identified between ENI and 5G=MoNArch
- Need to Formally submit the PoC Proposal

ENI & CCSA TC 610 ANIA Joint Forum on Network Intelligence, Sep'18, Beijing, China

- ENI main players presented the progress of ENI
- Operators shared PoC experience and demos with support of Manufacturers
- Demo prototype that embodies the ENI concept



Forum on Network Intelligence, Dec'16



ENI & SDNIA Joint Forum on Network Intelligence, Sep'17



ENI & SliceNet workshop, Dec'17

