The Standards People

Updated 30-July-2018
for presentation to
ITU-T FG-ML5G
workshop, 7-Aug-2018

ETSI ISG ENI**

Defining closed-loop AI mechanisms

for network management

Presented by:

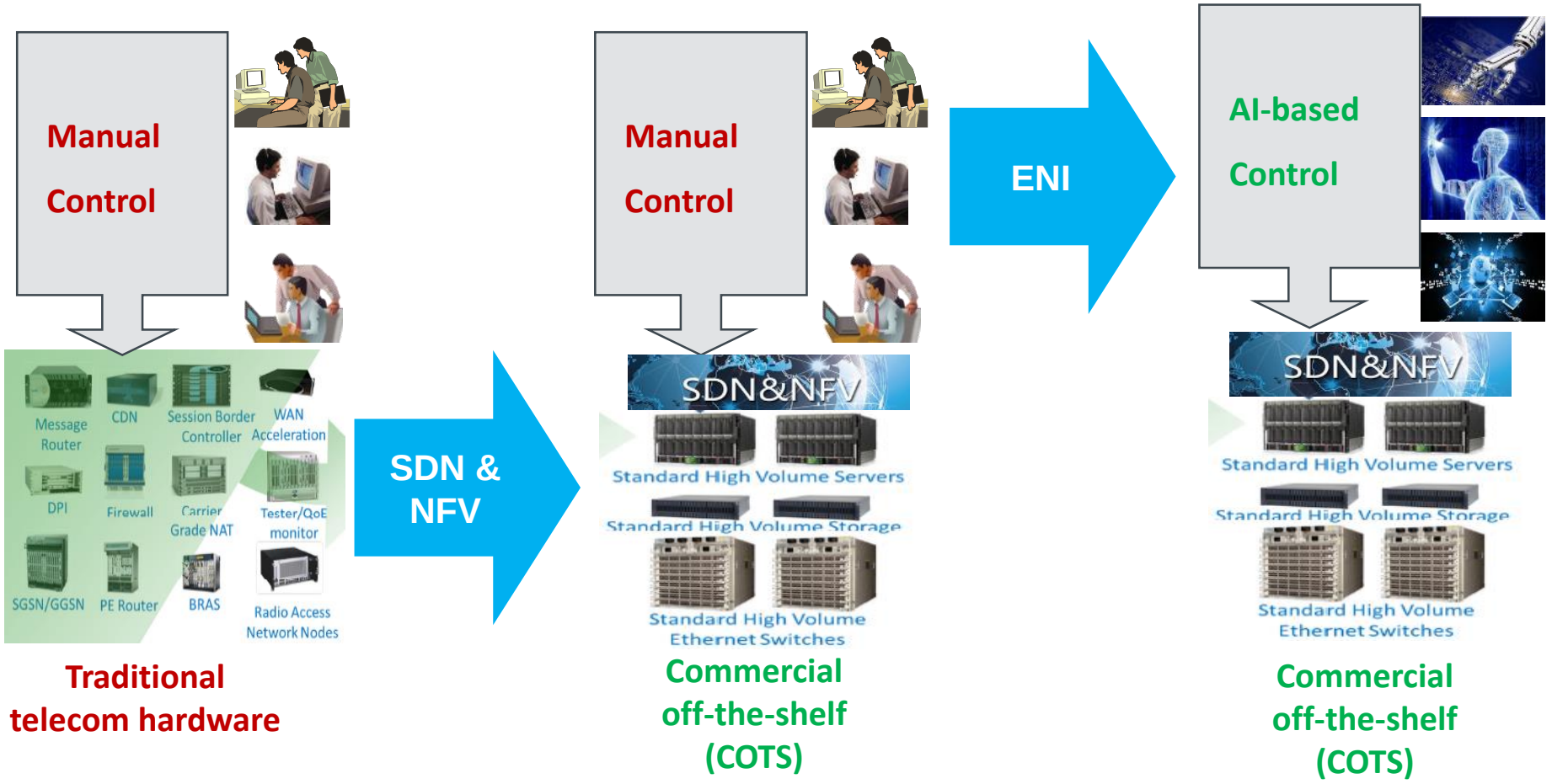
Chairman:	Dr. Raymond Forbes (Huawei Technologies)
Vice-Chairman:	Mrs. Haining Wang (China Telecom)
Vice-Chairman:	Mr. Fred Feisullin (Verizon)
Secretary:	Dr. Yue Wang (Samsung)
Technical Officer:	Mrs. Korycinska Sylwia (ETSI)
Technical Manager:	Dr. Shucheng Liu “Will” (Huawei Technologies)

***European Telecom Standards Institute Industry Standards Group on Experiential Networked Intelligence*

Outline

- Vision & background
- Introducing ETSI's ISG on Experiential Networked Intelligence (ENI)
- Proof-of-Concept (PoC) framework
- Network intelligence activities in 2016, 2017 & 2018
- Other related SDOs and industry consortia

Vision



ENI Work Items and Rapporteurs

Work Item	Deliverable	Topic	Rapporteur(s)
ENI 001	(WI RGS/ENI-008)	Use Cases	Wang, Yue (Samsung)
ENI 002	(WI RGS/ENI-007)	Requirements	Wang, Haining (China Telecom)
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	Feisullin, Fred (Verizon) Strassner, John (Huawei)
ENI 006		PoC Framework	Pesando, Luca (TIM) Mostafa, Essa (Vodafone)

Business Value

Traditional Network → SDN & NFV → Autonomic Network

Evolution of network technology

- Dynamic network conditions
- More services, more users
- Better network telemetry
- Cost-effective AI, ML, DL

→ Network intelligence

Evolution of network management

- Human decisions
- Complex policy definitions
- 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

Increased service value

Smarter situational awareness

Improved business efficiency

Reduced OPEX

Increased profit

5G/IoT automation

Source: ETSI ENI White Paper, http://www.etsi.org/images/files/ETSIWhitePapers/etsi_wp22_ENI_FINAL.pdf

ENI Goals, Members and Participants

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

Founded Q1 2017

- Improve operator experience via **closed-loop artificial intelligence (AI)** mechanisms using **context-aware policies** enabling **timely, actionable decisions**.
- Adopt the '**observe-orient-decide-act**' (OODA) control loop model.
- Enable assisting or directing network management systems based on **changing needs, environmental conditions** and **business goals**.

34 leading network operators, hardware/software vendors and research institutes from around the world**

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)
Other ENI Members	**ADVA Optical Networking, Amdocs, Aria Networks, Cadzow, CATR, CEA-LETI, Chunghwa Telecom, Convida Wireless, ETRI, Intel, MeadowCom, NCIT, Portugal Telecom, Rogers, Sandvine, Telefonica, TIM, University of Luxembourg, University of Surrey, Vodafone, WINGS, Xilinx, ZTE**
ENI Participants	**SK Telecom, China Unicom, HKUST, UC3M, Layer123, Ruijie Network, MC5G**

Source: https://portal.etsi.org/TBSiteMap/ENI/ListOfENIMembers.aspx

**As of June 2018

ENI Members and Participants – 34** and growing

**As of June 2018

Members

Participants

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

Standardize how the network experience is measured

Enable intelligent service assurance

Engage and collaborate with other SDOs and consortia

Publish reference architecture

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

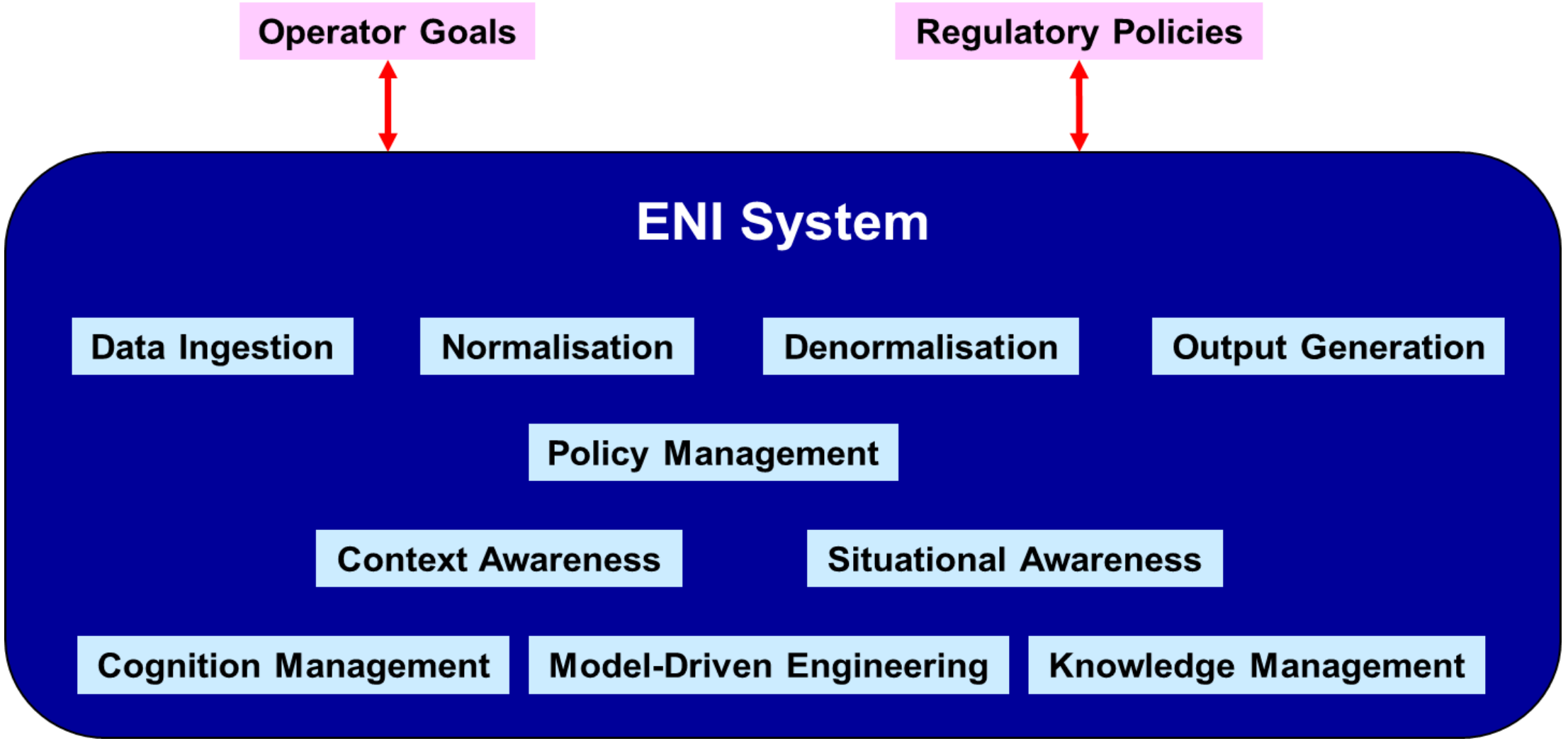
Network Assurance
Network fault identification and prediction
Assurance of service requirements

Infrastructure Management
Policy-driven IDC traffic steering
Handling of peak planned occurrences
Energy optimization using AI

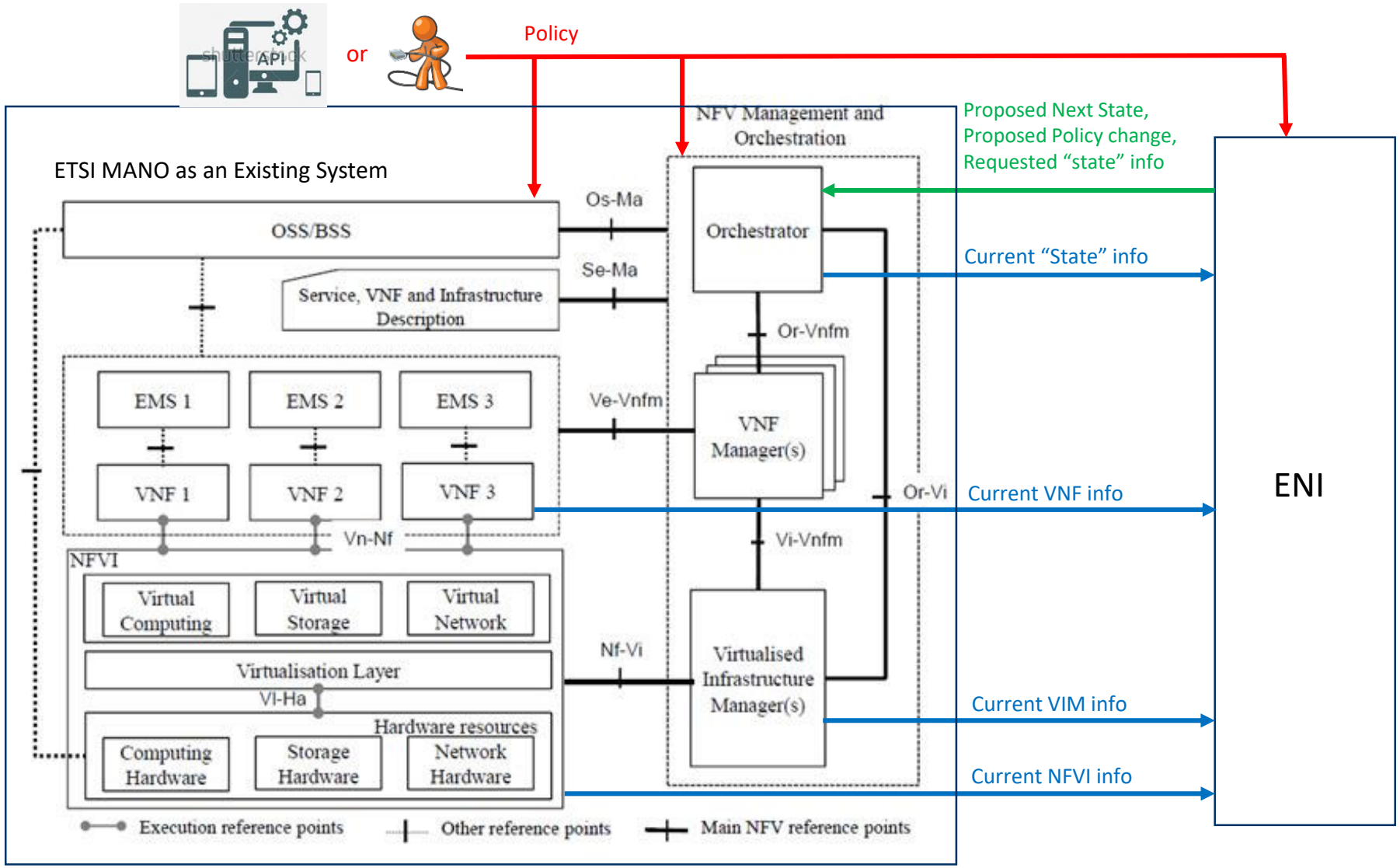
Service Orchestration and Management
Context aware VoLTE service experience optimization
Intelligent network slicing management
Intelligent carrier-managed SD-WAN

Source: ETSI GR ENI 001 V1.1.1 (2018-04), Experiential Networked Intelligence (ENI); ENI use cases

Conceptual ENI Architecture



ENI Assisting MANO



For MANO to take full advantage of ENI, existing interfaces extension or in some cases, new interfaces may be required

Physical Network interaction, e.g. with SDN Controller explicitly depicted through NFVI interaction (OOB possible too)

ENI Assisting MEF LSO RA

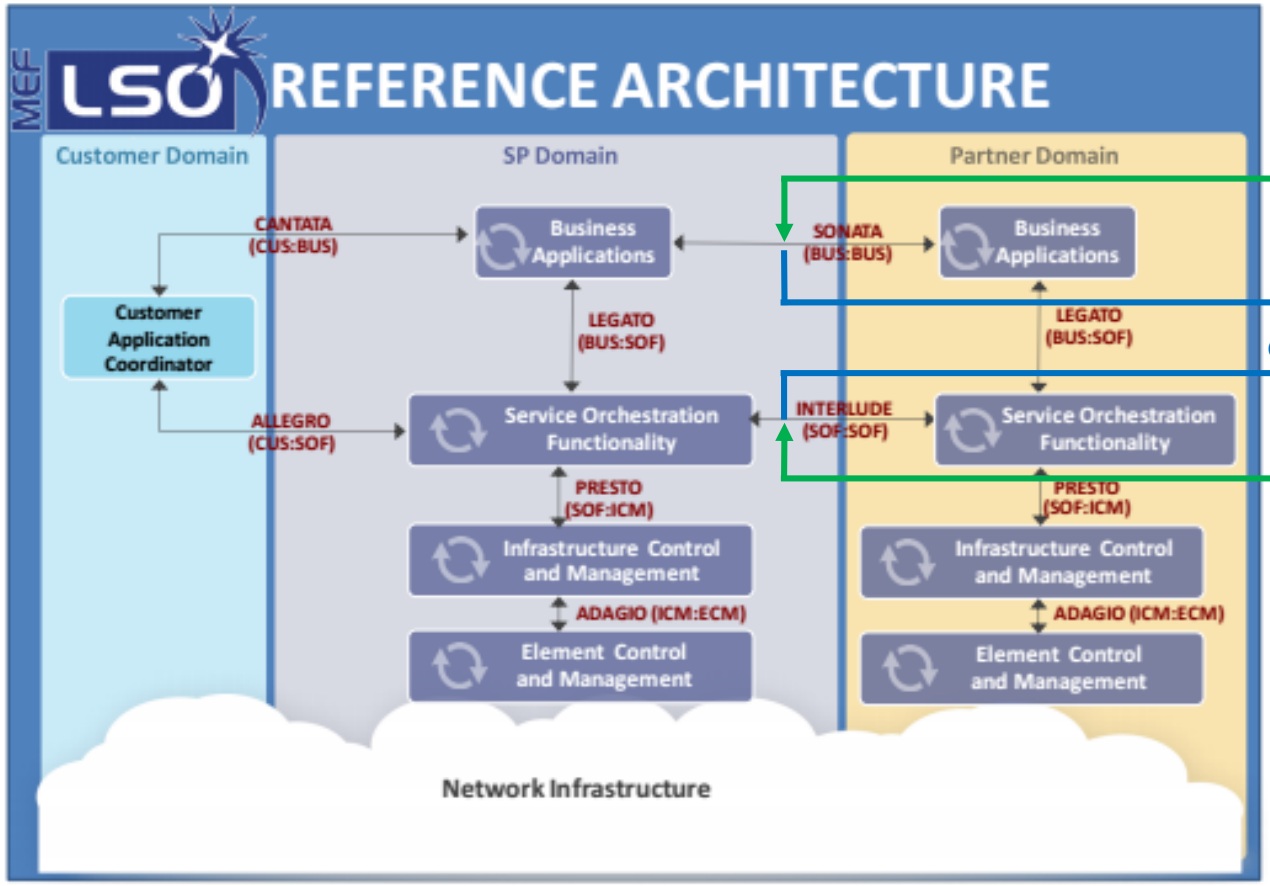
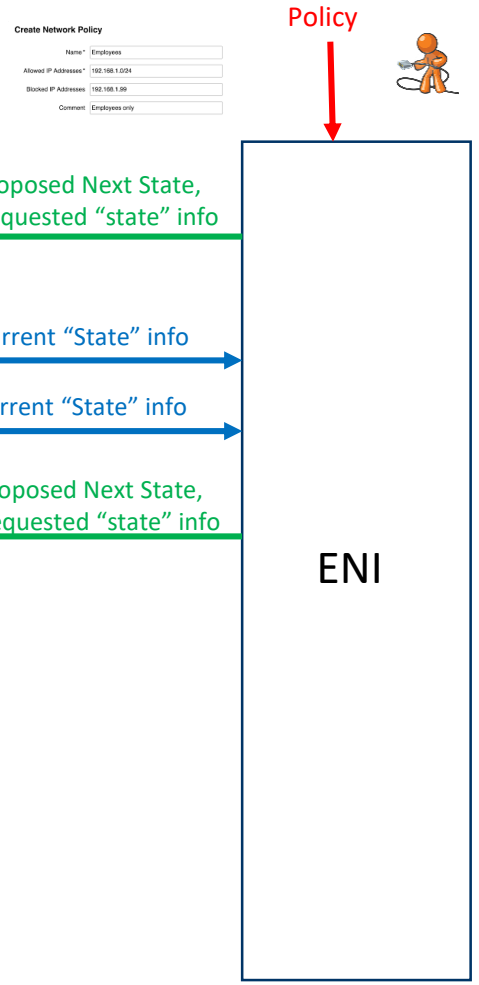
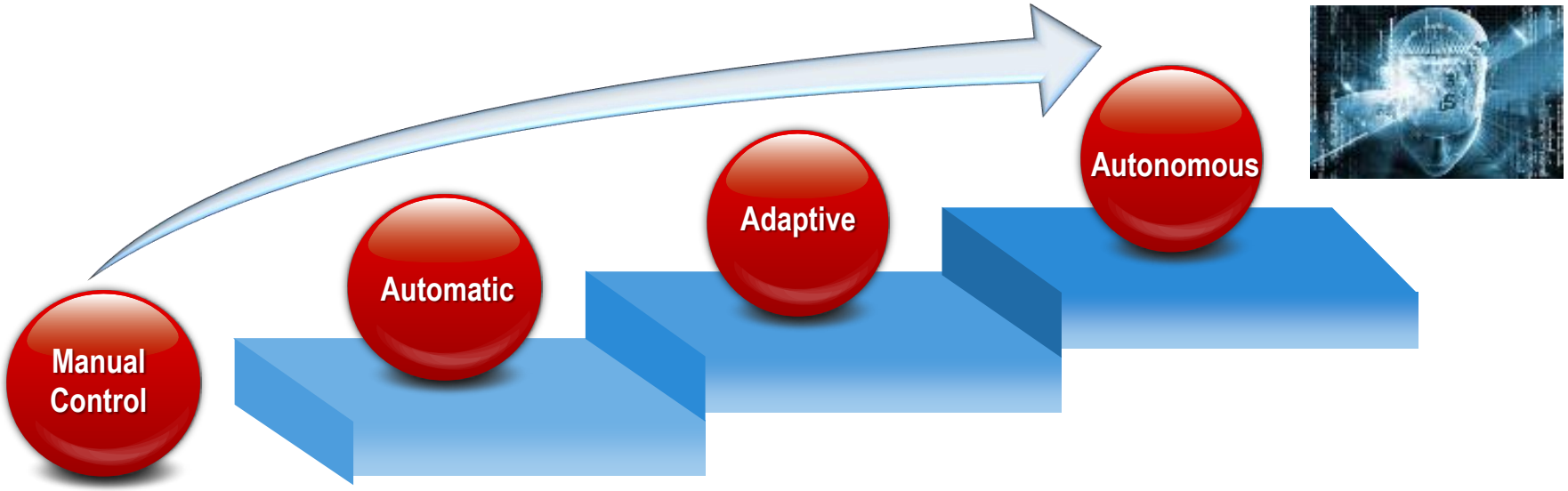


Figure 2 LSO Reference Architecture



- ENI ISG collaborates with MEF on liaison basis
- ENI insights can improve the consumer experience by improving the inter-operator interaction
- Of potential interest can also be LSO extensions to include ENI ⇔ ENI interaction and collaboration

Evolution



Data → Information → Knowledge → Wisdom

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.

Timetable & Deliverables

ENI Activities

Dec'16	Feb'17	Apr'17	May'17	Sep'17	Dec'17	Mar'18	Jun'18	Aug'18
Brainstorm event	ETSI ENI launched	1st meeting. Officers elected.	2nd meeting	3rd meeting + SNDIA[1] joint workshop	4th meeting + SliceNet[2] joint workshop	5th meeting	6th meeting + 5G MoNArch[3] joint workshop	Presentation in ITU-T FG-ML5G[4] workshop

ENI Deliverables

Name	Number	Rapporteur	Company	Early Draft	Stable Draft	Draft for Approval	Current Status (5-Jun-2018)
Use Cases	GS ENI 001	Yue Wang	Samsung	May'17	Dec'17	Mar'18	Rel.1 **Published** & Rel.2 begun
Requirements	GS ENI 002	Haining Wang	China Telecom	May'17	Dec'17	Mar'18	Rel.1 **Published** & Rel.2 begun
Context Aware Policy Modeling	GR ENI 003	John Strassner	Huawei	Sept'17	Dec'17	Mar'18	Rel.1 **Published**
Terminology	GR ENI 004	Yu Zeng	China Telecom	Sept'17	Dec'17	Mar'18	Rel.1 **Published** & Rel.2 begun
Architecture	GS ENI 005	Fred Feisullin, John Strassner	Verizon, Huawei	Feb'18	Feb'19	Mar'19	Early draft
PoC Framework	GS ENI 006	Luca Pesando, Mostafa Essa	TIM, Vodafone	Feb'18	Mar'18	Mar'18	**Published**

[1]SDNIA: SDN Industry Alliance

[2]SliceNet: H2020 & 5G-PPP Project

[3]5G MoNArch

[4]ITU-T FG-ML5G

Deliverables Published at ETSI Shop Window

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

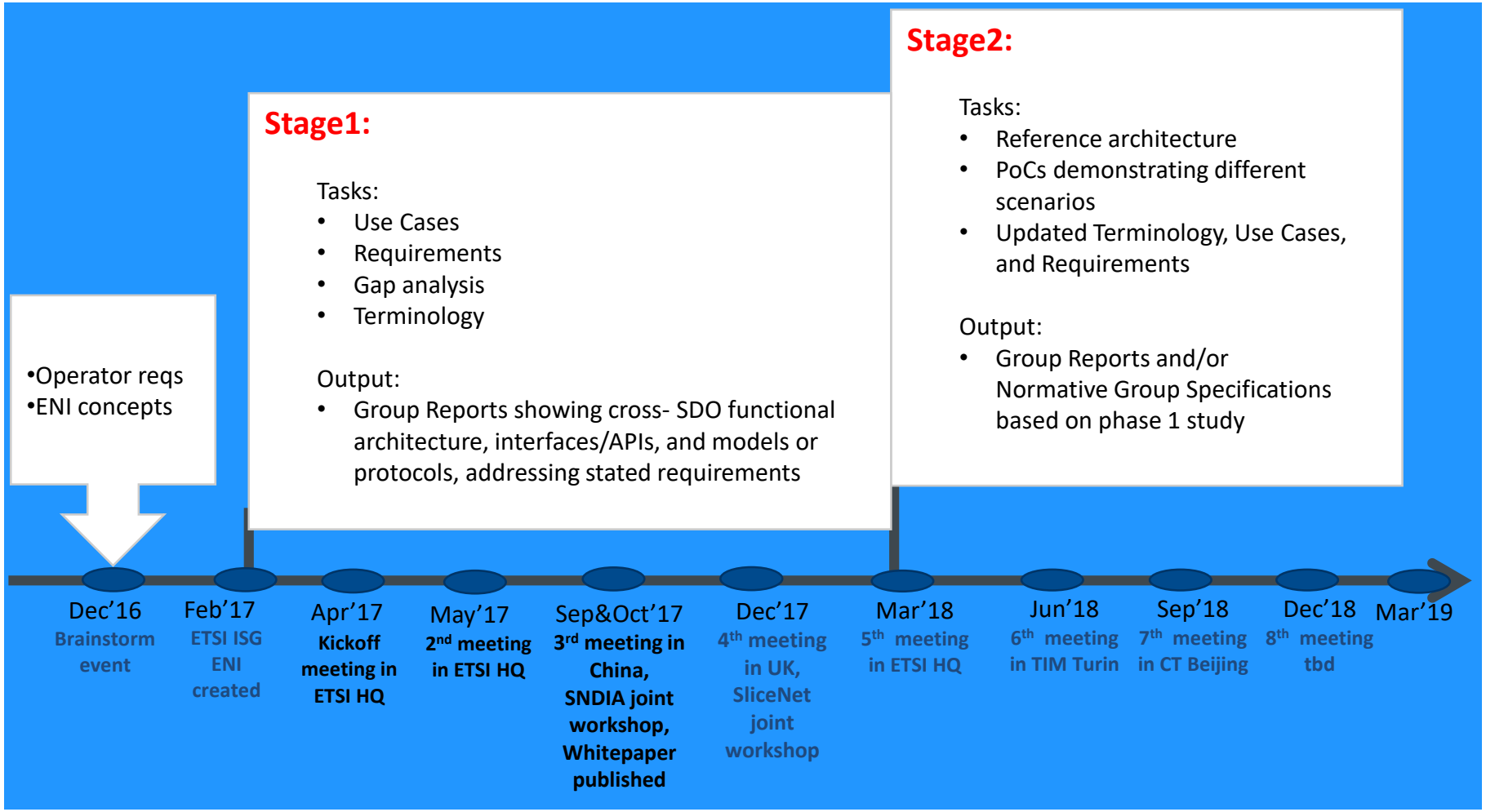
2. ETSI GS ENI 002 V1.1.1 (2018-04) Published
   Experiential Networked Intelligence (ENI); ENI requirements

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 General Terminology

5. ETSI GR ENI 006 V1.1.1 (2018-05) Published
   Experiential Networked Intelligence (ENI); ENI Proof of Concept (PoC) Framework

Work Plan



Stage 1 focus on use case & requirements, Stage 2 design architecture and start PoCs.
4 F2F meetings per year: 18Q1 – ETSI HQ, Q2 – Italy (hosted by TIM), Q3 – China (hosted by CT)
Online meeting every week https://portal.etsi.org/tb.aspx?tbid=857&SubTB=857#5069-meetings

Proof-of-Concept (PoC) Team and ENI Work-Flow Proposal

using the process under definition in ETSI

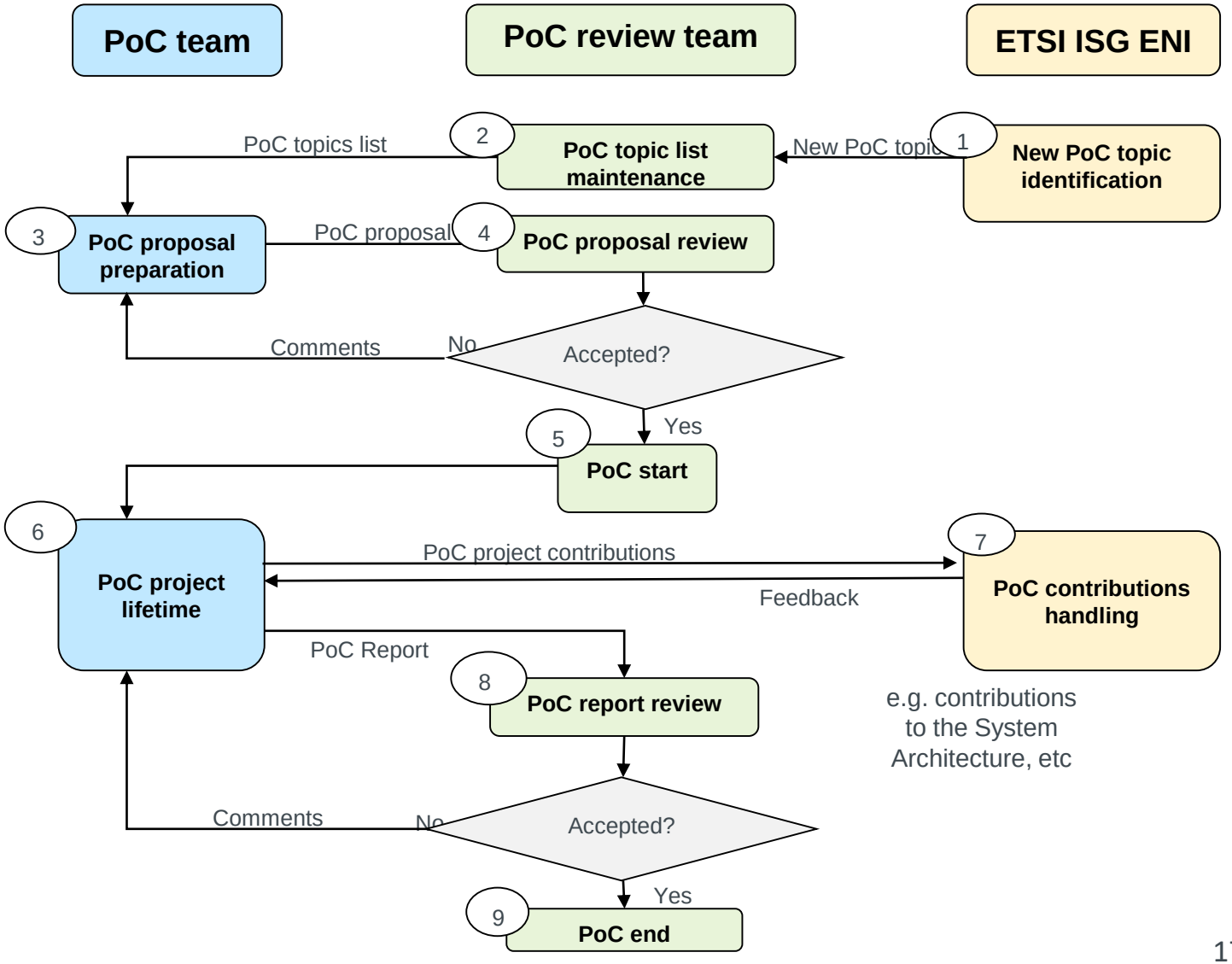
Procedures:

ETSI ISG ENI drafted, approved and published a PoC framework, including a wiki

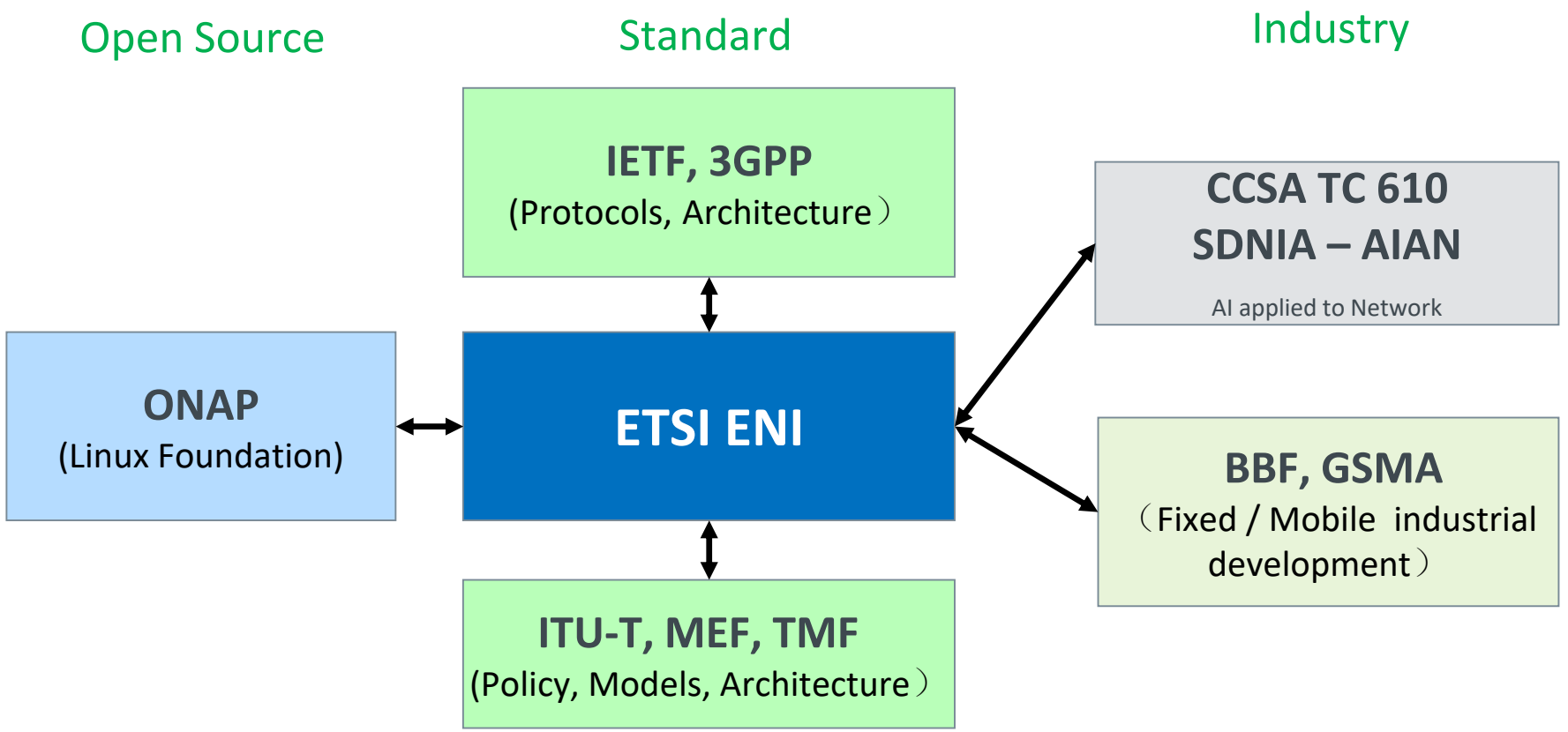
ENI established a PoC Review Group to receive and review PoC proposals

PoC team(s)

- May include non-members of ENI
- Operates independent of ENI
- Shall choose a POC Team Leader
- Shall use the process and template of ENI to present an initial proposal and a final report for review by ENI



Ecosystem



- Cooperate with mainstream operators, vendors and research institutes in Europe, Americas 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

Network Intelligence Activities in 2016, 2017, 2018

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

- Orange, NTT, CableLabs, China Telecom, China Unicom, China Mobile, NEC, HPE, HKUST etc (40+ participants)
- 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

Forum on Network Intelligence, Dec'16

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)
- 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
- SDNIA created new industry group AIAN (AI Applied to Network) … now CCSA TC610

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

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 program, contributing one or more PoC proposals

ENI & 5G-PPP 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 & SliceNet workshop, Dec'17

Other related SDOs, Industry Consortia and EU Projects

Organization	Activity
ITU-T	ITU-T FG-ML5G (Focus Group on Machine Learning for Future Networks including 5G)
IETF	IETF WG “SUPA” (Simplified Use of Policy Abstractions) IETF WG “anima” (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” (5G Mobile Network Architecture for diverse services, use cases, and applications in 5G and beyond)
TMF	5G Intelligent Service Operations
Linux Foundation	ONAP (Open Networking Automation Platform) Acumos
ETSI *(see next slide)*	
Bodies with no active interaction or liaison at this time	
Telecom Infra Project (TIP)	Artificial Intelligence (AI) and Applied Machine Learning (ML) Project Group
IEEE	ComSoc Network Intelligence Emerging Technology Initiative (ETI)

Other ETSI internal Technical Bodies (TCs/ISGs)

Technical Body	Activity
ETSI ISG NFV	ETSI Industry Standardization Group on **Network Functions Virtualization**
ETSI ISG MEC	ETSI Industry Standardization Group on **Mobile-access Edge Computing**
ETSI OSG OSM	ETSI Open Source Group on **Open Source MANO**
ETSI ISG ZSM	ETSI Industry Standardization Group on **Zero touch network and Service Management**
3GPP SA2 **3GPP SA5**	**Mobile standardization specification global partnership project**

ENI#7 meeting will be hosted by
China Telecommunications
Beijing, China,
17-19 September, 2018.
You are welcome to join us!

Co-located with CCSA TC610 AIAN Forum,
20 September, 2018

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Acknowledging the assistance of:

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Chris Cavigioli Chris.Cavigioli@intel.com

Thank you!

ENI
Use Cases

Dr. Yue Wang (Samsung), Rapporteur, Use Cases

Overview of the Use Case Work Item

Identify and describe appropriate use cases

First phase (April 2017 – April 2018)

- Scope - use cases and scenarios that are enabled with enhanced experience, through the use of network intelligence.
- Group report (GR) produced: **ETSI GR ENI 001 V1.1.1**
  - Details where intelligence can be applied in the fixed and/or mobile network
  - Gives the baseline on how the studies in ENI will substantially benefit the operators and other stakeholders.

Second phase (started April 2018)

- Gives baseline on how the studies in ENI can be applied as solutions of the identified use cases in accordance with the ENI Reference Architecture, and will substantially benefit the operators and other stakeholders.
- Group Specification to be produced

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

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

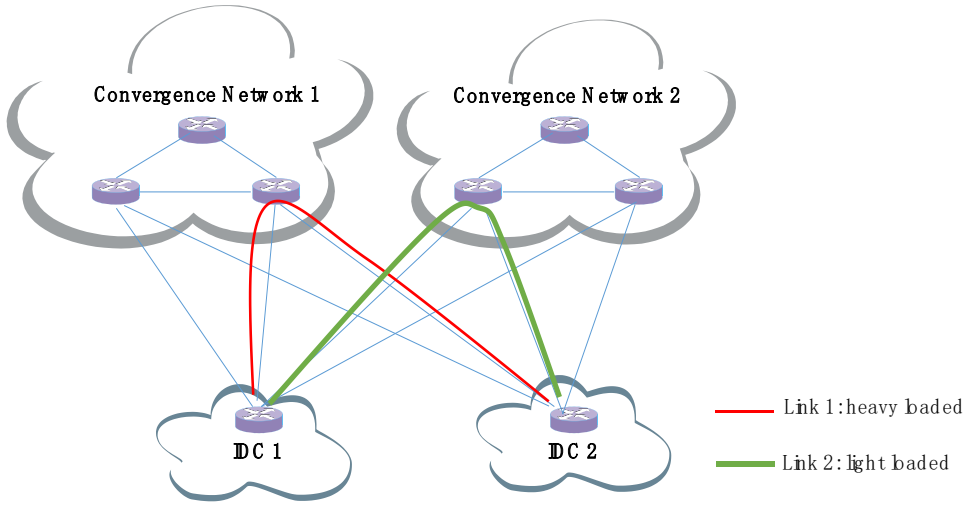
Service Orchestration and Management
Context aware VoLTE service experience optimization
★ Intelligent network slicing management
Intelligent carrier-managed SD-WAN

Source: ETSI GR ENI 001 V1.1.1 (2018-04), Experiential Networked Intelligence (ENI); ENI use cases

★ = examples shown in the next slides

ENI Use Case:

Policy-driven IDC traffic steering



The challenges:

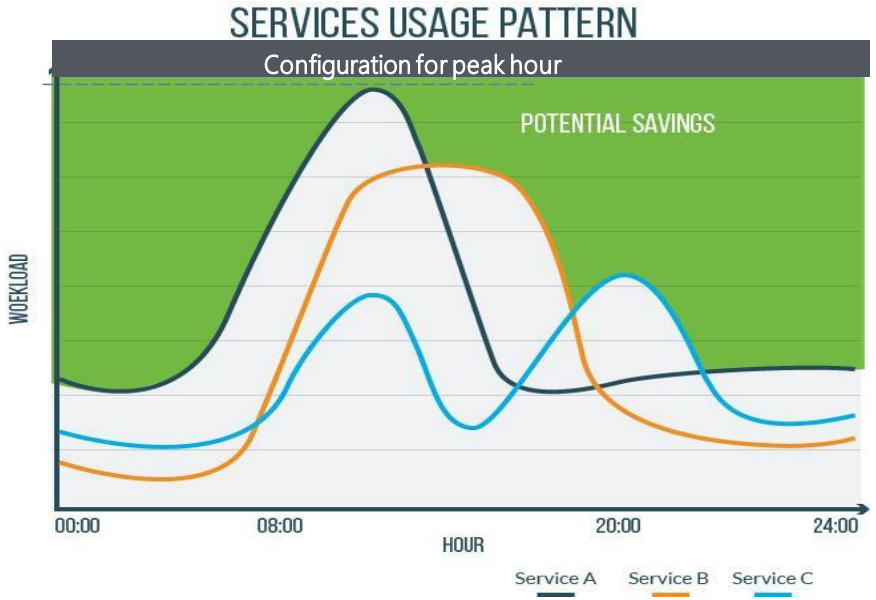
- Multiple links between IDCs, allocated by network administrator, e.g., shortest path strategy
- Link load not sufficiently considered when calculating the traffic path
- Bandwidth allocated to a tenant is not always fully used all time

The role of AI and ENI:

- Autonomous service volume monitoring
- Network resource optimization through historical data and prediction in real-time
- Network traffic via different links is balanced
- Network resource, such as bandwidth, will be used more efficiently

ENI Use Case:

Energy optimization using AI



The challenges:

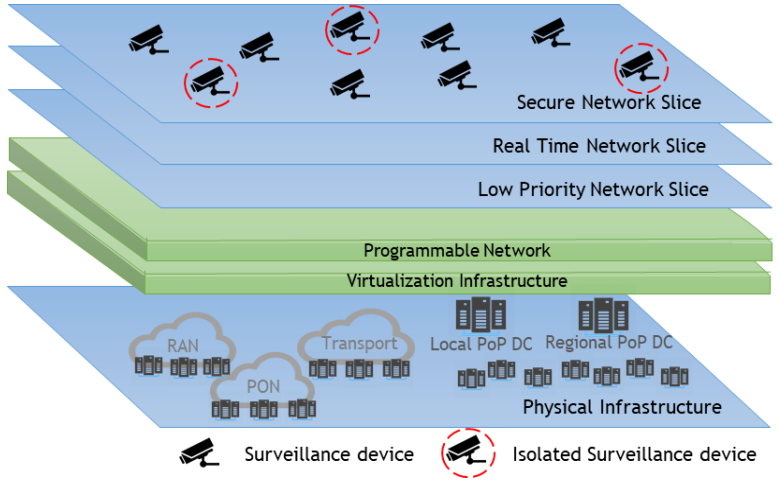
- The servers in a DC take 70% of the total power consumption
- Servers are deployed and running to meet the requirement of peak hour service – 100% powered-up full time.

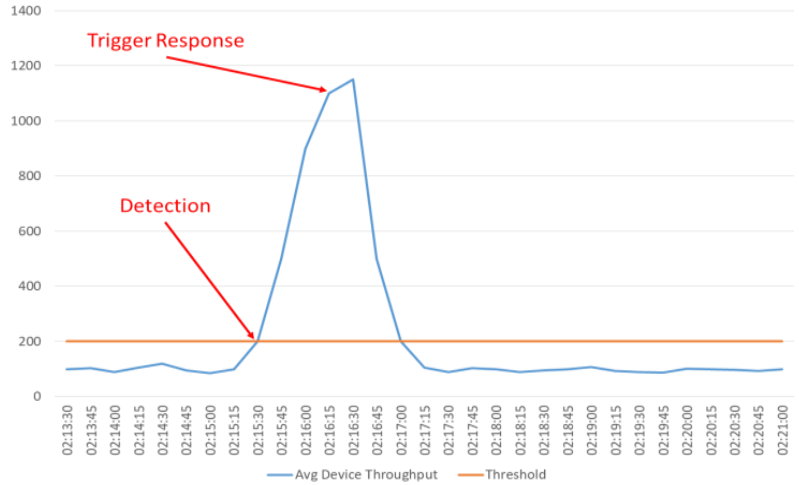
The role of AI and ENI:

- Learn and update the usage pattern of the services
- Autonomously turn the spare servers to idle state
- Predict the peak hours and wake up the necessary number of servers

ENI Use Case:

Policy-based network slicing for IoT security





The challenges:

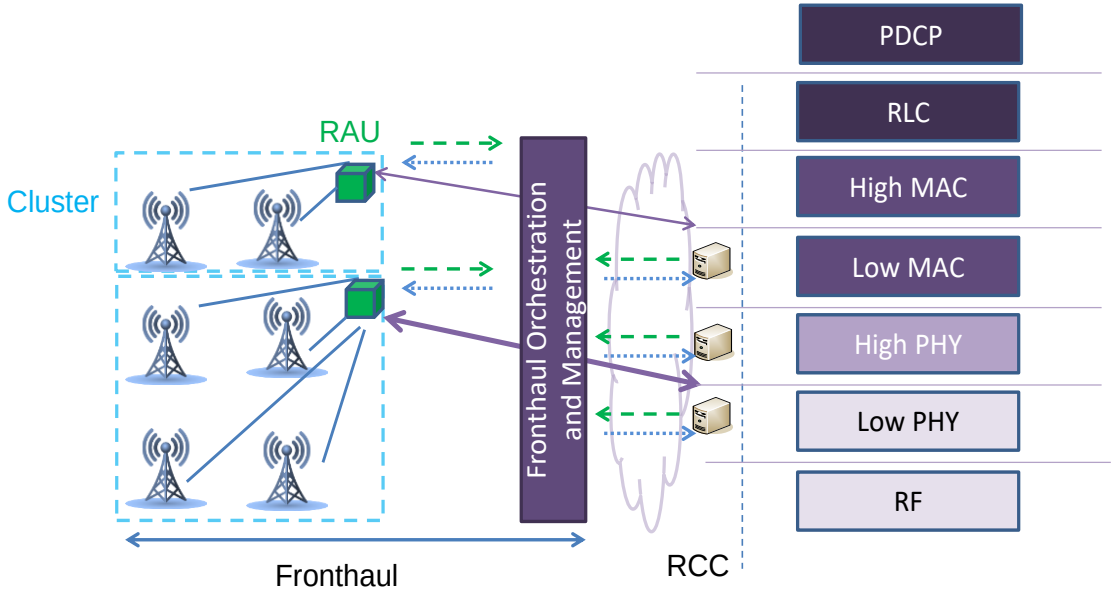
- Massive deployment of devices
- Slices may be dynamically expansible and adaptable in a changing context
- Methods and technologies of attacks are widely changing

The role of AI and ENI:

- Signal specific traffic patterns indicating Distributed Denial of Service (DDOS) attack or other type of attacks
- Automatically isolate the attacked devices

ENI Use Case:

Intelligent Fronthaul Management and Orchestration



The challenges:

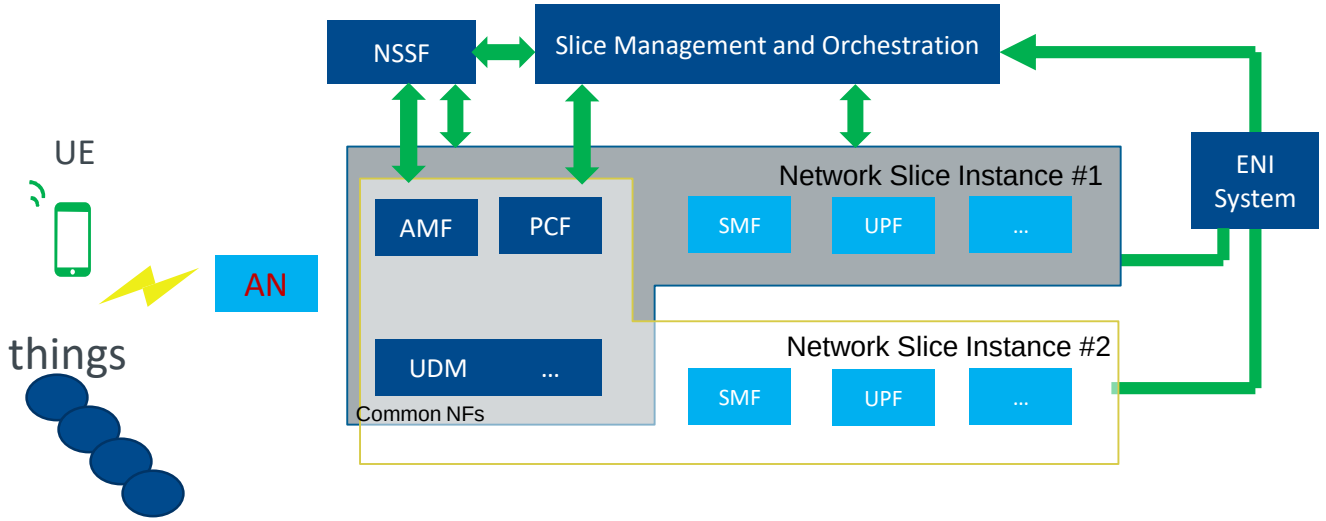
- Multiple factors and changing contexts
- Dimensionality of solution space on network resources (power, processing capability, radio resources, buffering memory, route to be selected across multiple fronthaul nodes)

The role of AI and ENI:

- An optimisation framework at the fronthaul
- Enables flexible and dynamic resource slicing and functional split
- Real-time optimisation according to, e.g., the changing traffic demand and requirements

ENI Use Case:

Intelligent Network Slicing Management



3GPP Functions

NSSF – Network Slice Selection Function
AMF – Access Management Function
AN – Access Network
SMF – Session management Function
UE – User Equipment
PCF – Policy Control Function
UDM – User Data Management
UPF – User Plane Function
NF – Network Function

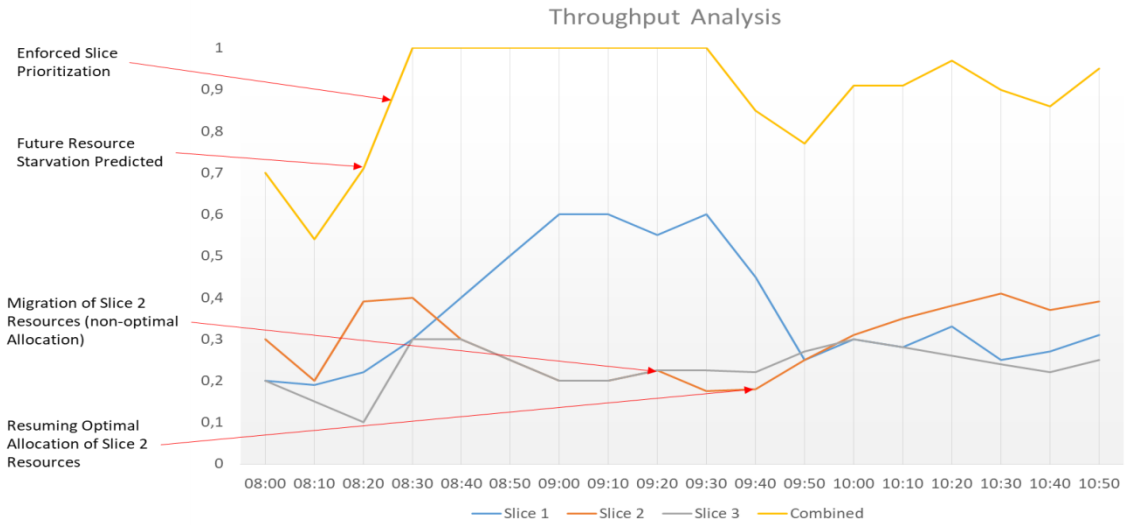
The challenges:

- Dynamic traffic
- Allocation of network resources intra/inter slices (VNF scale in/out, up/down)

The role of AI and ENI:

- Analyze collected data associated to e.g., traffic load, service characteristic, VNF type and constraints, infrastructure capability and resource usage, etc.
- Produce a proper context aware policy to indicate to the network slice management entity when, where and how to place or adjust the network slice instance (e.g., reconfiguration, scale-in, scale-out, change the template of the network slice instance)
- Dynamically change a given slice resource reservation

ENI Use Case:
Assurance of Service Requirements



The challenges:

- Dedicated slice (e.g., banking, energy provider company)
- Vital applications of the network to operate core business
- Very strict requirements (e.g., a personalized SLA)

The role of AI and ENI:

- Predict situations where multiple slices are competing for the same physical resources and employ preventive measures
- Predict or detect requirements change and make decisions (e.g., increasing the priority of a given network slice over neighbouring slices) at run time

Benefits

- Optimized energy and network resource usage
- Enhanced security
- Simplified operations
- Guaranteed services

The role of AI and ENI:

- Adaptive to changing context
- Enabling autonomous and policy driven operation
- Dynamic
- Real-time

Contact

Questions or interest in other use cases:

Contact: Yue Wang (Samsung UK)
yue2.wang@samsung.com

Thank you!

ENI Use Cases

ENI Requirements and Terminology

Haining Wang (China Telecom), Rapporteur, Requirements

Yu Zeng (China Telecom), Rapporteur, Terminology

Overview of ENI requirements Work Item

General information:

Creation Date:	2018-04-20	**Type:**	Group Specification
Work Item Reference:	RGS/ENI-007	**Latest version:**	2.0.0
Rapporteur:	Haining Wang	**Technical Officer:**	Sylwia Korycinska

Scope:

This document specifies the requirements related to ENI. This includes the common requirements for both fixed and mobile, fixed specific requirements and mobile specific requirements. The ENI requirements are based on the ENI use case document and identified requirements from other SDOs. These requirements will form the base for the architecture design work. This revision will update the existing requirements where needed and add new functional and non-functional, security and architectural requirements.

Categorization of the Requirements

Level 1	Level 2
Service and network requirements	General requirements
	Service orchestration and management
	Network planning and deployment
	Network optimization
	Resilience and reliability
	Security and privacy
Functional requirements	Data Collection and Analysis
	Policy Management
	Data Learning
	Interworking with Other Systems
Non-functional requirements	Performance requirements
	Operational requirements
	Regulatory requirements
	Non-functional policy requirements

Overview of ENI Work Item - Terminology

General information:

Creation Date:	2018-06-29	**Type:**	Group Report
Work Item Reference:	RGR/ENI-010	**Latest version:**	2.0.0
Rapporteur:	Yu Zeng	**Technical Officer:**	Sylwia Korycinska

Scope:

The WI will provide terms and definitions used within the scope of the ISG ENI, in order to achieve a "common language" across all the ISG ENI documentation. This work item will be updated with the general terminology required as the ENI specifications develop.

Work Plan and Next Steps

ENI Requirements

- Early draft: June 2018
- Stable draft: November 2018
- Draft for approval: March 2019

Contact Details:
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ENI Terminology

- Early draft: July 2018
- Stable draft: September 2018
- Draft for approval: December 2018

Contact Details:
Yu Zeng
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Thank you!

ENI Intelligent Policy Management

Dr. John Strassner, (Huawei), Rapporteur, Context-Aware Policy Management

Overview of ENI Work Item – Context Aware Gap-Analysis

General information:

Creation Date:	2017-04-10	**Type:**	Group Report
Work Item Reference:	DGR/ENI-003	**Latest version:**	1.1.1
Rapporteur:	John Strassner	**Technical Officer:**	Sylwia Korycinska

Scope:

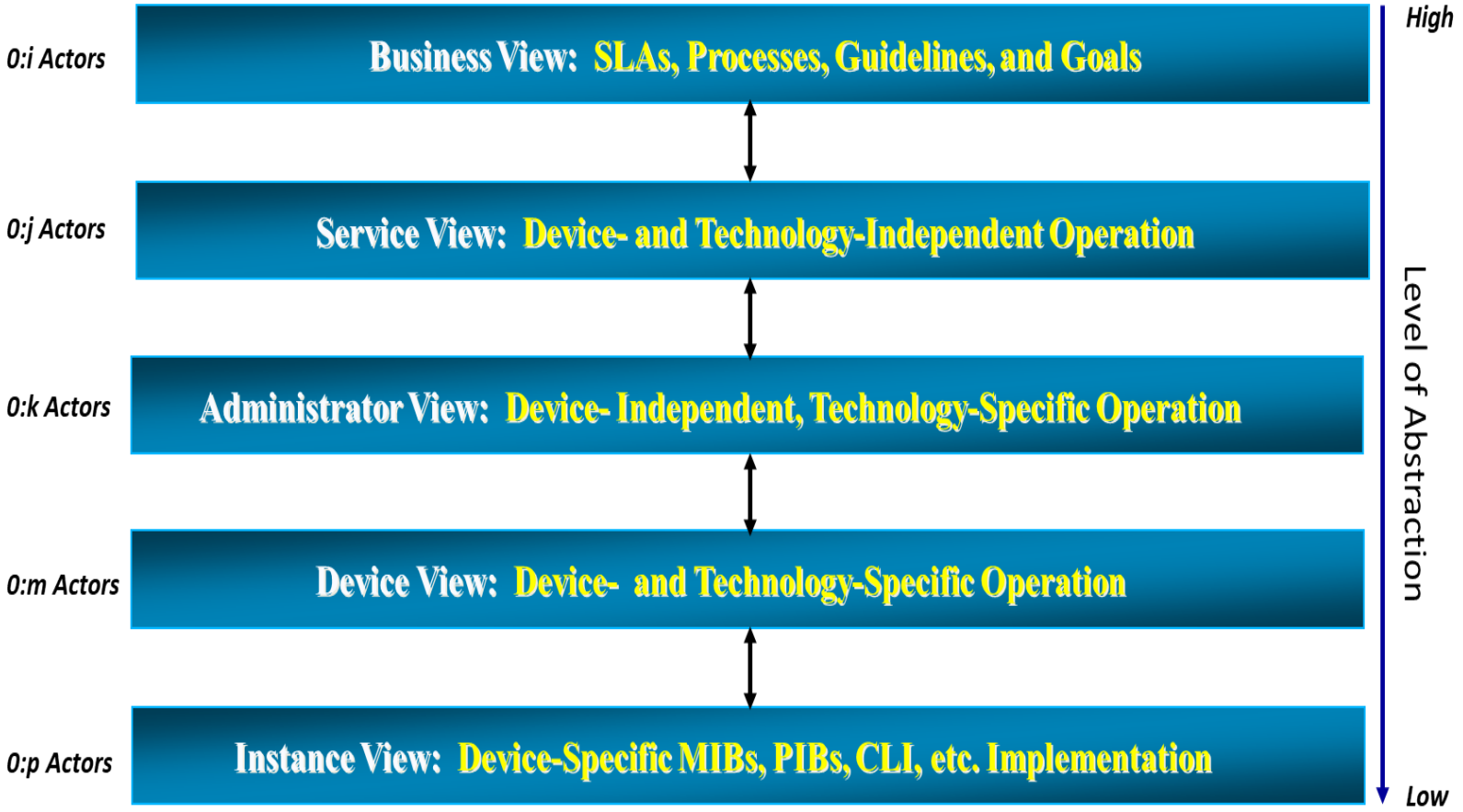
A critical foundation of experiential networked intelligence is context- and situation-awareness. This WI will analyze work done in various SDOs on network policy management in general, and context-aware network policy management specifically, to determine what can be reused and what needs to be developed. The requirements documented in this report will be considered during the architecture design work.

Main Contents of the Context-Aware Policy Management WI

Content

- Introduction and Approach
  - Including Introduction to Policy Management, The Policy Continuum, Types of Policy Paradigms, etc.
- Analysis of the MEF PDO Model
  - Including Characteristics, Supported Policy Paradigms, Imperative/Declarative/Intent Policy, etc.
- Analysis of the IETF SUPA policy Model
  - Characteristics, Supported Policy Paradigms, etc.
- Analysis of the TM Forum SID Policy Model
  - Characteristics, Supported Policy Paradigms, etc.

The Policy Continuum



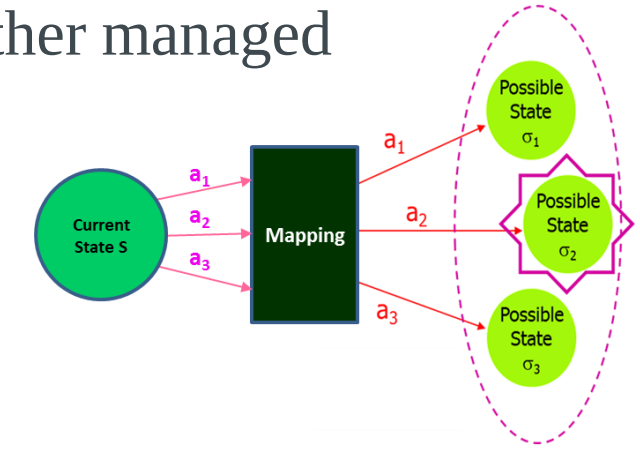
The number of continua in the Policy Continuum should be determined by the applications using it. There is no fixed number of continua.

Policy Examples: Intent

Intent policies describe the set of computations that need to be done without describing how to execute them

- Policies are written in a *restricted natural language*
- The flow of control is *not* specified
- *The order in which operations occur are irrelevant*
- 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.

Express **What** should be done, not **How** to do it.



Intent policy is an ongoing work in MEF, ENI may reuse some of the output

Work Plan and Next Steps

Early draft: Sep 2017
Stable draft: Dec 2017
Draft for approval: Mar 2018

Contact: Dr. John Strassner (Huawei)
strazpdj@gmail.com

Thank you!

Experiential Networked Intelligence *System Architecture*

Mr. Fred Feisullin (Verizon, Rapporteur)

Dr. John Strassner (Huawei, Co-Rapporteur)

Overview of ENI Work Item – System Architecture

General information:

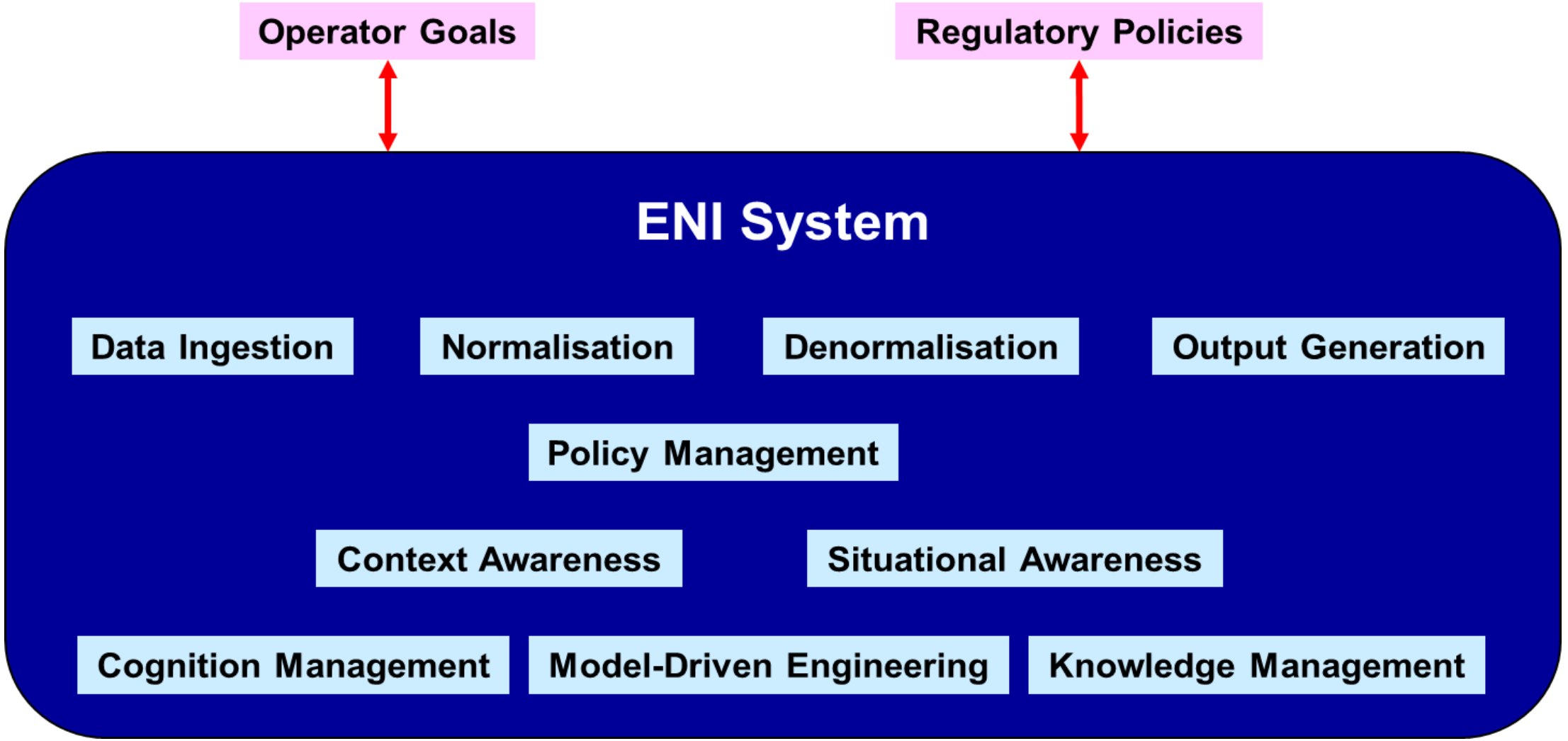
Creation Date:	2017-12-12	**Type:**	Group Specification
Work Item Reference:	DGS/ENI-005	**Latest version:**	0.0.10
Rapporteur:	Fred Feisullin John Strassner	**Technical Officer:**	Sylwia Korycinska

Scope:

The purpose of this work item is to define the software functional architecture of ENI. This includes:

- defining the functions and interactions that satisfy the ENI Requirements
- defining an architecture, in terms of functional blocks, that can meet the needs specified by the ENI Use Cases
- defining Reference Points that the above functional blocks use for all communication with systems and entities

High-Level Functional System Architecture



Knowledge Representation and Management

Functional Block

The purpose of the Knowledge Representation and Management Functional Block is to represent information about both the ENI System as well as the system being managed. Knowledge representation is fundamental to all disciplines of modelling and AI. It also enables machine learning and reasoning – without a formal and consensual representation of knowledge, algorithms cannot be defined that reason (e.g., perform inferencing, correct errors, and derive new knowledge) about the knowledge. Knowledge representation is a substitute for the characteristics and behaviour of the set of entities being modelled; this enables the computer system to plan actions and determine consequences by reasoning using the knowledge representation, as opposed to taking direct action on the set of entities.

There are many examples of knowledge representation formalisms, ranging in complexity from models and ontologies to semantic nets and automated reasoning engines.

Context-Aware Management

Functional Block

The purpose of the Context-Aware Management Functional Block is to describe the state and environment in which an entity exists or has existed. Context consists of measured and inferred knowledge, and may change over time. For example, a company may have a business rule that prevents any user from accessing the code server unless that user is connected using the company intranet. This business rule is context-dependent, and the system is required to detect the type of connection of a user, and adjust access privileges of that user dynamically.

Situation-Awareness Management

Functional Block

The purpose of the Situation Awareness Functional Block is for the ENI system to be aware of events and behaviour that are relevant to the environment of the system that it is managing or assisting. This includes the ability to understand how information, events, and recommended commands given by the ENI system will impact the management and operational goals and behavior, both immediately and in the near future. Situation awareness is especially important in environments where the information flow is high, and poor decisions may lead to serious consequences (e.g., violation of SLAs).
The working definition of situation awareness for ENI is:

The perception of data and behaviour that pertain to the relevant circumstances and/or conditions of a system or process ("the situation"), 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 to enable more accurate and fruitful decision-making.

Policy-based Management

Functional Block

The purpose of the Policy Management Functional Block is to provide decisions to ensure that the system goals and objectives are met. Formally, the definition of policy is:

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

There are three different types of policies that are defined for an ENI system:

- **Imperative policy:** a type of policy that uses statements to explicitly change the state of a set of targeted objects. Hence, the order of statements that make up the policy is explicitly defined.
  In this document, Imperative Policy will refer to policies that are made up of Events, Conditions, and Actions.
- **Declarative policy:** a type of policy that uses statements to express the goals of the policy, but not how to accomplish those goals. Hence, state is not explicitly manipulated, and the order of statements that make up the policy is irrelevant.
  In this document, Declarative Policy will refer to policies that execute as theories of a formal logic.
- **Intent policy:** a type of policy that uses statements to express the goals of the policy, but not how to accomplish those goals. 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.
  In this document, Intent Policy will refer to policies that do not execute as theories of a formal logic. They typically are expressed in a restricted natural language, and require a mapping to a form understandable by other managed functional entities.

An ENI system MAY use any combination of imperative, declarative, and intent policy to express recommendations and commands to be issued to the system that it is assisting.

Cognition Management

Functional Block

Cognition, as defined in the Oxford English Dictionary, is “the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses”.
The purpose of the Cognition Framework Functional Block is to enable the ENI system to understand ingested data and information, as well as the context that defines how those data were produced; once that understanding is achieved, the cognition framework functional block then provides the following functions:

- change existing knowledge and/or add new knowledge corresponding to those data and information
- perform inferences about the ingested information and data to generate new knowledge
- use raw data, inferences, and/or historical data to understand what is happening in a particular context, why the data were generated, and which entities could be affected
- determine if any new actions should be taken to ensure that the goals and objectives of the system will be met.

A cognition framework uses existing knowledge and generates new knowledge.

A cognition framework uses multiple diverse processes and technologies, including linguistics, computer science, AI, formal logic, neuroscience, psychology, and philosophy, along with others, to analyse existing knowledge and synthesise new knowledge

ENI PoC Framework

Luca Pesando (TIM), Rapporteur

Mostafa Essa (Vodafone), Co-Rapporteur

PoC Team and ENI Work-Flow proposal

using the process under definition in ETSI

ENI is setting up a PoC review team

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

Procedures:

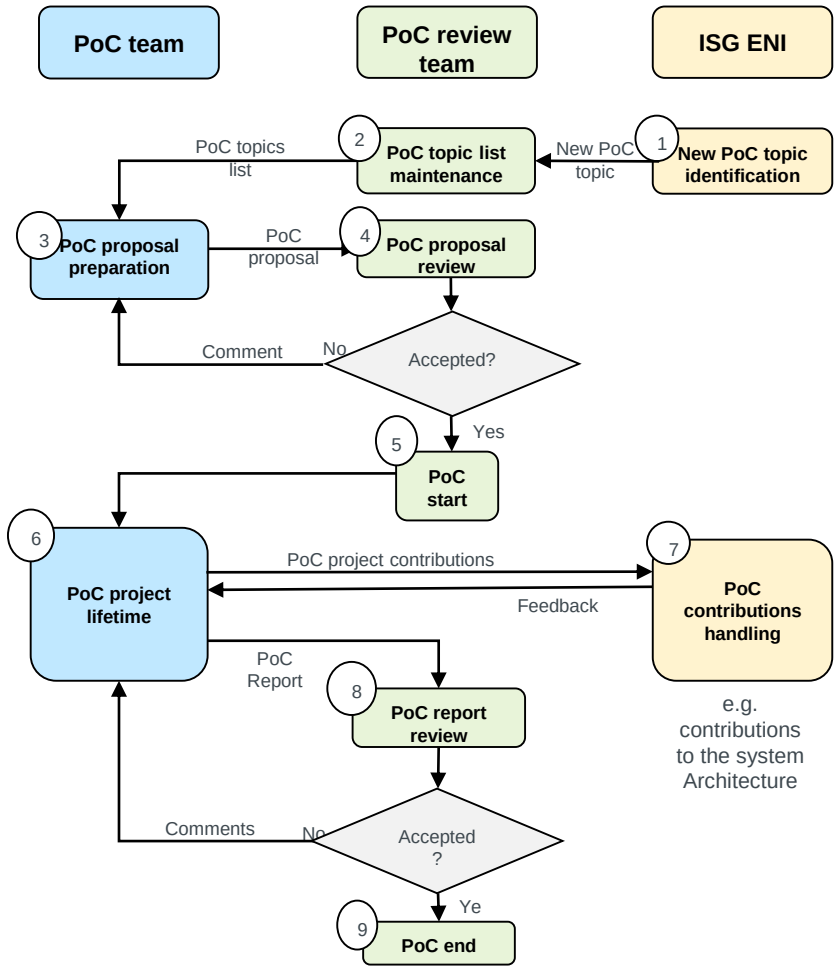
ISG ENI should draft and approve a PoC framework

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

Publish the framework (e.g. we can 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



Please Contribute

ENI#7 meeting will be held in China Telecommunications
Beijing, China, on 17-19 September, 2018.
You are welcome to join us!

CCSA TC610 AIAN Forum, 20 September, 2018 in the same location

Contact Details:
Chair: Dr. Raymond Forbes rayforbes@mail01.huawei.com

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Future expected issues:

- Version 2 on the Use cases & requirements (updates on Version 1)
- Development of the system architecture
  - Possible re-use of existing APIs
  - Intent policies – AI tools
- 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!