Welcome to the World of Standards

ETSI

World Class Standards

EXPERIENTIAL NETWORKED INTELLIGENCE

Presented by Dr Raymond Forbes (ISG Chairman)

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ETSI ISG ENI

- State of the Art & Challenges
- Networked Intelligence Improving Experience
- Introduce new ETSI ISG ENI on network intelligence

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Inspired by the Development of Technology

AlphaGo

The game of Go is complex because of the huge number of possible states. So is the operator's network management: many types of devices/protocols, complex connection topology, different configuration options and languages from different vendors, etc. Manual management is costly and error-prone.

How can ALPHAGO's success inspires us to improve the operator's network management experience?

Inspired by the Development of Technology

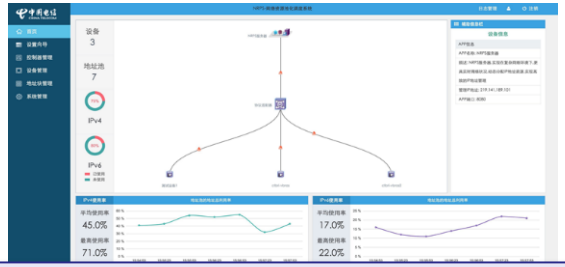
scientific and technological improvement

- Mobile： Feature phone → 1st Gen Smart Phone → Smart Phone
- Automobile： MT → AT → Self-driving
- Network： Traditional → SDN → NFV → AI based Autonomics

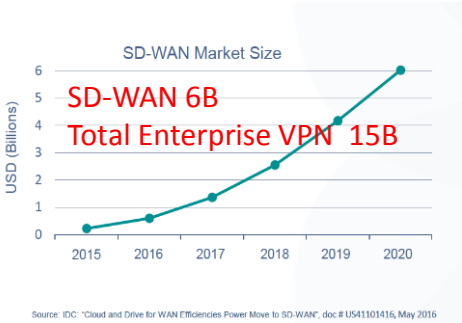
The goal of science and technology development is for human to use easily & friendly, improve machine close to human intelligence to simplify human-machine interaction: connecting digital and emotional

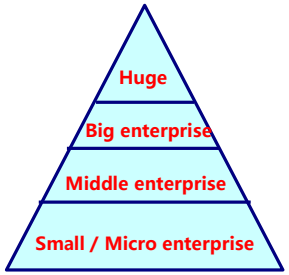
Ultimate UX with simplicity / intent NBI: in line with customer demand for new revenue from agile service and OPEX reductions

Use Cases Example:
Demand emerging from operators for operation and management



High OPEX and inefficient allocation of resources trigger operators expectations for the future network :
Intelligent, adaptive strategy provides context-aware services, efficient use of network resources, reduce manual work





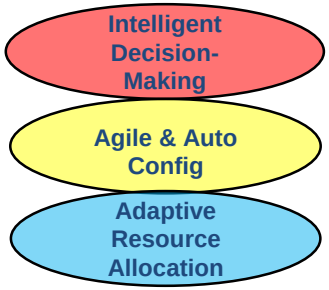
The outbreak of the SD-WAN market reflects the demands of operators and content providers:
Context-awareness and personalized services demand dynamic and efficient resource allocation; networks learn from experience, and reduce OPEX and CAPEX

Intelligence to Improve Operator Experience?

so popular in IT, what is OPX for CT?

- **User experience** (**UX**) refers to a person's emotions and attitudes about using a particular product, system or service,… includes a person's perceptions of system aspects such as utility, ease of use and efficiency. - from wikipedia
- *If* network = cell phone, *then* the experience of its owner(operator) is still barely satisfactory:
  - Human-dependent decision, complex manual config, low resource utilization
- OPX for SDN/NFV/Legacy operation depends on three concepts

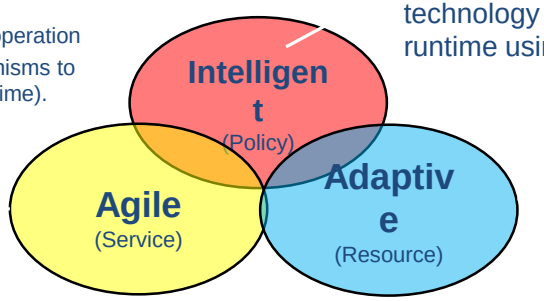
Ideal UX example



Challenges

- Automating human-dependent decision-making processes
- Determining services status
- Defining how best to visualize network services and improve network maintenance and operation
- Providing an experiential architecture (i.e., an architecture that uses AI and other mechanisms to improve its understanding of the environment, and hence the operator experience, over time).

E2E Services (independent of technology and vendor) adapted at runtime using policies



Modeling for network level service automation

Resource integrate control & sharing

Network should be provisioned based on improving OPX. This is done by using policy-driven orchestration and model-driven engineering to enable offered services to adapt to user, business, and environmental changes.

ENI Standards for Experiential Networked Intelligence Improving Experience

Intelligent Service Deployment

- Intent based service management
- Service mapping
- Service atom

Intelligent Policy Control

- Imperative policy
- Declarative policy
- Policy driven service/resource management

Intelligent Resource Management

- On-demand resource allocation
- 3rd party resource API
- Intent based resource management

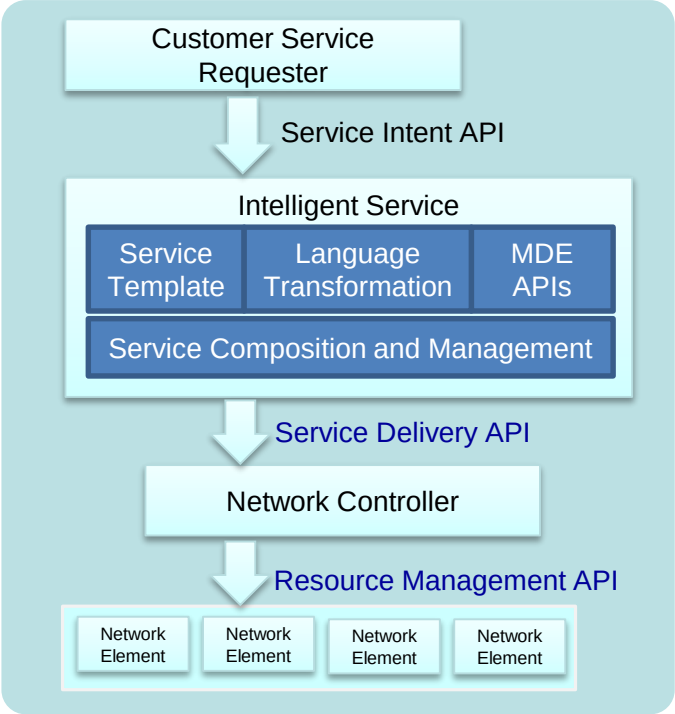
Intelligent Monitoring

- SDN Telemetry
- Network event & state collection
- Network performance collection

Intelligent Analyzing and Prediction

- Network analyzing
- Utilization/inventory Prediction
- Fault Prediction

Intelligent Service Management



Intent Service API:

- Independent of technology and vendor
- Specify what customer wants, but not how to implement it, using business-friendly concepts

Intelligent Service:

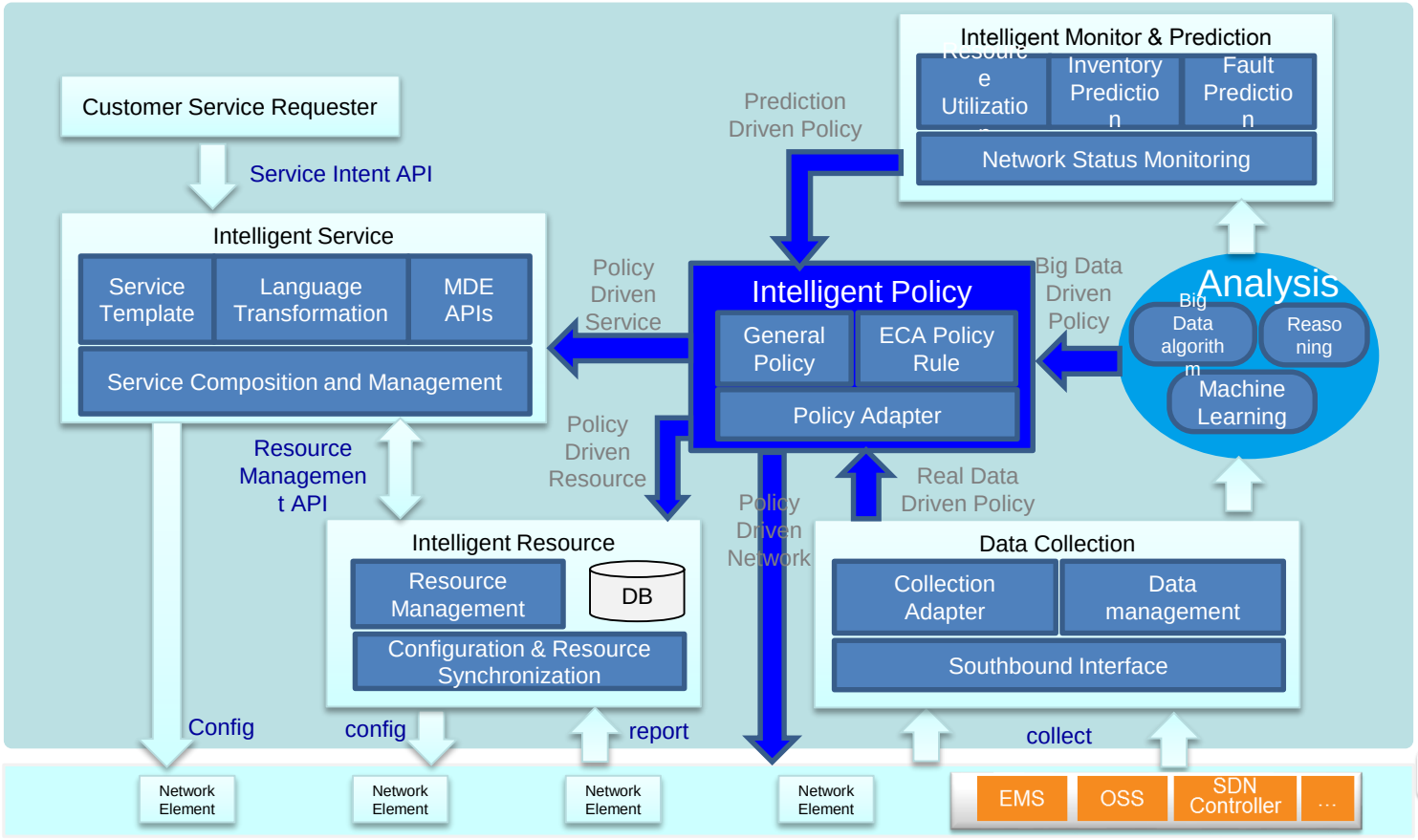
- Model-driven service API
- Service composition supports new services without having to recompile and redeploy
- Customized service template according to the scenario, based upon the model

Intelligent Resource Management:

- Model-driven translation to resource allocation, *transparent to the end-user* (see next slide)

The Service Intent API reduces the user's network knowledge requirements, and enhances the network operator's experience. L3SM & L2SM are good start of this trend.

Example of Possible Architecture of ENI engine



Intelligent Policy

IETF
SUPA WG

Generic Information Model (WG draft)

Imperative/ ECA (WG draft)

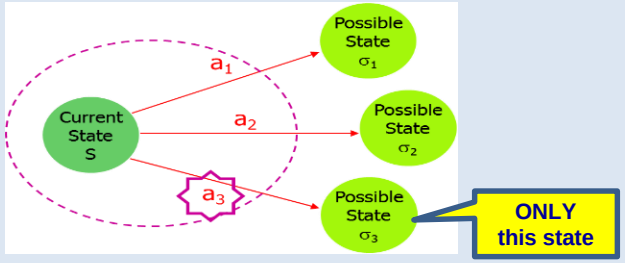
Declarative/ Intent (I-D)

Framework (WG draft)

Applicability (I-D)

Imperative: Event-Condition-Action (ECA)

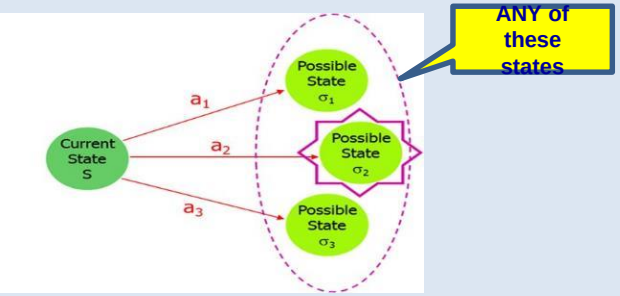
IF the Event clause evaluates to TRUE
IF the Condition clause evaluates to TRUE
THEN Execute Actions in Action Clause
ENDIF
ENDIF



Rationality is defined by the developer

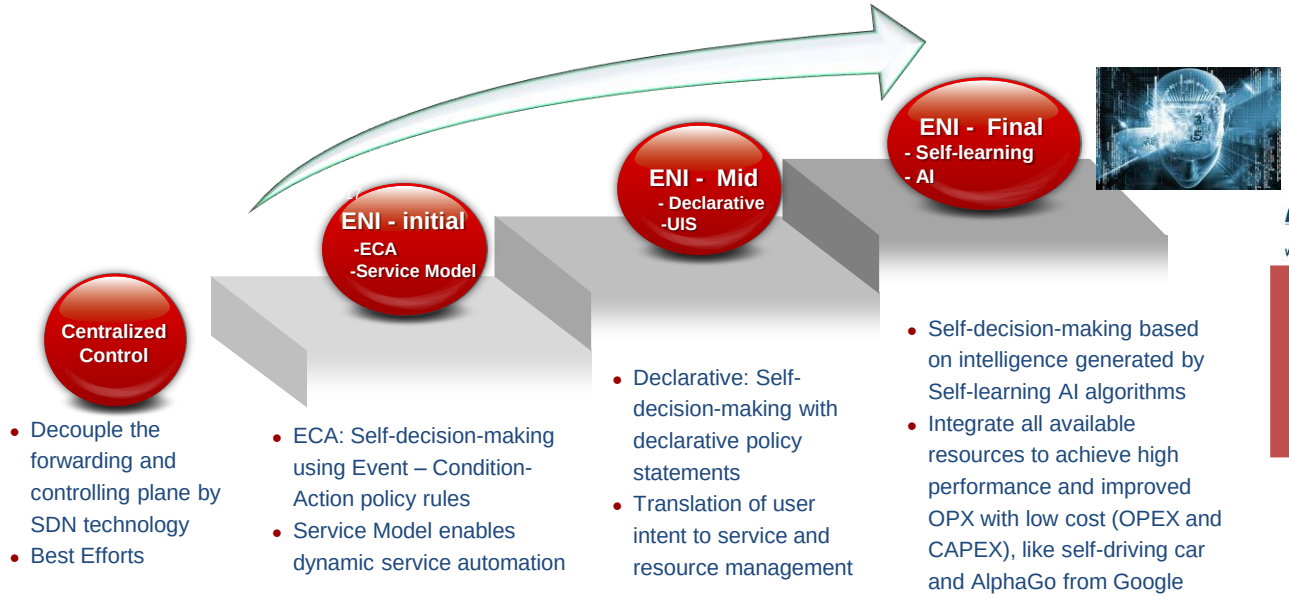
Declarative: Goal- or Intent-based

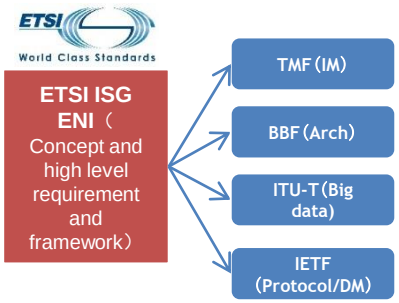
Express **What** should be done.
not **How** to do it
Specifies criteria for choosing acceptable states, each of which has a binary value



Rationality generated by compiler

New ETSI ISG ENI to describe and specify the future evolution of network intelligence on enhancing experiences





Background	Strategy
• **IETF** – already done some successful work in policy(SUPA), service (L3SM, L2SM), resource (on-going), will extend the existing work to support network intelligence • **ETSI** – There is no specific WG focusing on the future evolution of intelligent and enhanced network experience	new ISG in ETSI – **ENI (Experiential Network Intelligence), as the home of network intelligence discussion** • Guide the industry to focus on the future evolution of network intelligence, to make the next hot spot after the NFV ISG • Leading the industry trend, provide concept and high level design to other SDOs

About ETSI ISG ENI

(Experiential Networked Intelligence)

Challenges

- Automating complex human-dependent decision-making processes,
- Determining which services should be offered, and which services are in danger of not meeting their SLAs, as a function of changing context
- Defining how best to visualize and how network services are provided and managed in order to improve network maintenance and operation
- Providing an experiential architecture (i.e., an architecture that uses AI and other mechanisms to improve its understanding of the environment, and hence the operator experience, over time)

About ETSI ISG ENI

(Experiential Networked Intelligence)

Standardization Goals

- Describe answers to the aforementioned challenges to improve the experience of operators and network administrators focusing on improved policy and automation
- Specify a policy-based, model-driven architecture that defines functionalities to assist orchestration on adapting offered services to changing user needs, business goals, and environmental conditions at scale
- Propose an approach that enables the networked experience to be measured and presented to operators and other stakeholders
- Engage with other SDOs on the impacts of ENI and it's architectural realization

About ETSI ISG ENI

(Experiential Networked Intelligence)

Objectives

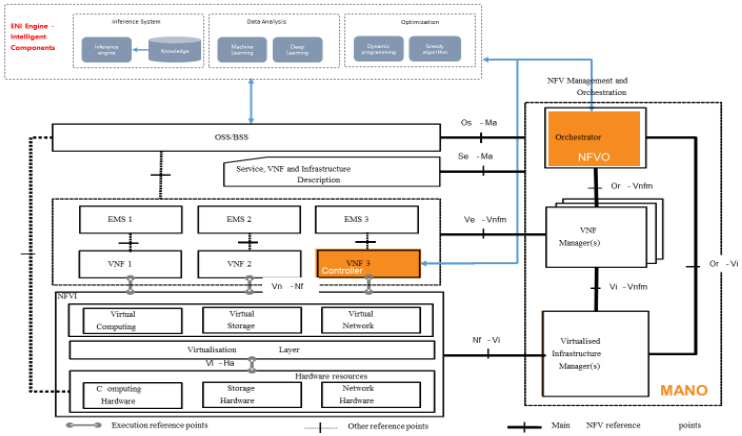
- Identify the requirements (e.g., from operators and network administrators) to improve operator experience
- Specify an architecture that is used to apply adaptive and intelligent service operation and management, which uses dynamic policy management to assist the orchestration of service management and resource management at scale,
- Propose a standard definition on how the networked experience is measured and projected/presented to operators and other stakeholders
- Engage with other SDOs on the impacts of ENI and it's architectural realization

ETSI ISG ENI Phases

- Phase 1 (informative):
  - Lasting approx. 12 months from launch, will describe use cases and requirements, definition of features, capabilities and policies, with following tasks:
    - Identify and describe appropriate use cases
    - Identify and describe the requirements for the improved Operator Experience
    - Carry out a gap analysis of work on context-aware and policy based standards
    - When gaps are found on existing interfaces that have been developed by other SDOs and ISG ENI needs to re-use, then the recommendation on how these gaps should be filled will be discussed in co-operation with the SDO that defined these interfaces within Phase 1 and beyond
  - Output:
    - initially publish informative best practice documents (Group Reports (GRs)) that show how cross-SDO functional architecture, interfaces/APIs, and specific models or protocols address stated objectives/requirements; Additional Informative Group Reports will also describe how policies can be managed and also illustrate service and resource management

- Phase 2 (informative/normative), lasting approx. 12 months from completion of Phase 1:
  - Document the ENI architecture in informative Group Report(s), and demonstrate how the different scenarios defined in Phase 1, are addressed using a dynamic policy-driven management approach
    - Architecture may be in one document or logically split between documents as required
    - Architecture should support the functionality to be able to learn from inputs and decisions, along with information relating to the context of the decisions
  - Output is expected to be a number of informative Group Reports and/or normative Group Specifications

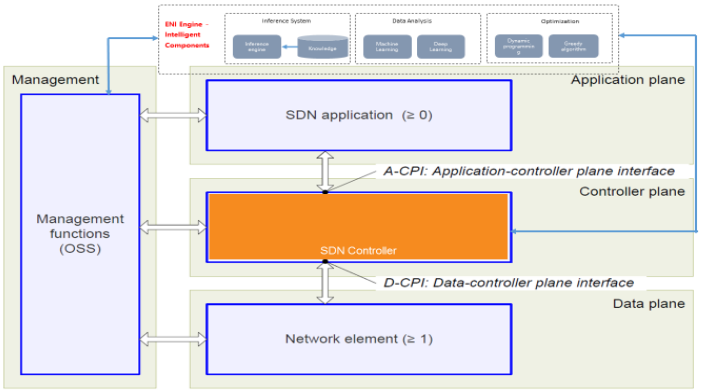
Relationship with NFV / SDN



NFV

Network Big Data Analysis module of ENI Engine collects the information of MANO's resource description and dynamic resource to include complete meta-data and data for lifecycle management of the virtual environment. The output of Network Big Data Analysis can be used to act on service / policy / resource (consistent with MANO) as well as engineering rules, recipes for various actions, policies and processes.

There is no closed control loop in MANO. The ENI Engine is OUTSIDE of the MANO elements. This addresses compatibility and avoids rebuilding MANO components.



SDN

Network Big Data Analysis module of ENI Engine collects the information both from SDN data plane and SDN control plane. The result analysis of Network Big Data Analysis helps service/policy resolver adjust the network / infrastructure.

The ENI Engine is OUTSIDE of the SDN controller and may interact with it via the SDN app, providing context based policy modelling capabilities.

Official release of ETSI ENI

New ETSI group on improving operator experience using Artificial Intelligence

Sophia Antipolis, 21 February 2017

ETSI is pleased to announce the creation of the Industry Specification Group 'Experiential Network Intelligence' (ISG ENI).

The purpose of the group is to define a Cognitive Network Management architecture that is based on the "observe-orient-decide-act" control model. It uses AI (Artificial Intelligence) techniques and context-aware policies to adjust offered services based on changes in user needs, environmental conditions and business goals. The system is experiential, in that it learns from its operation and from decisions given to it by operators to improve its knowledge of how to act in the future. This will help operators automate their network configuration and monitoring processes, thereby reducing their operational expenditure and improving the use and maintenance of their networks.

Operators see human-machine interaction as slow, error-prone, expensive, and cumbersome. Programming different devices and building agile, personalized services makes it increasingly complex to integrate different standardized platforms in their network and operational environment. These human-machine interaction challenges are considered by operators as barriers to reducing the time to market of innovative and advanced services. They also lack an 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).

"*The unique added value of the ETSI ISG ENI approach is to define new metrics to quantify the operator's experience; this enables the optimization and adjustment of the operator's experience over time, taking advantage of machine learning and reasoning.*" says Ray Forbes, convenor of ETSI ISG ENI.

The group's work will include the requirements of the operator's experience in and across legacy and virtualized networks including 5G networks, and a model-driven architecture that supports adaptive and intelligent service operation through Cognitive Network Management. Different types of policies will be

The group's work will include the requirements of the operator's experience in and across legacy and virtualized networks including 5G networks, and a model-driven architecture that supports adaptive and intelligent service operation through Cognitive Network Management. Different types of policies will be reviewed to drive adaptive behavioral changes using various AI mechanisms. Existing mechanisms will be augmented and improved by using the networked intelligence defined by the ENI system.

This new group will drive innovative technologies in network telemetry, big data mechanisms to gather appropriate data at the right speed and scale, and machine learning for intelligent analysis. Innovative policy-based, model-driven functionality will also be needed to simplify and scale complex device configuration and monitoring.

Participation in the Experiential Network Intelligence Industry Specification Group is open to all ETSI members as well as organizations who are not members, subject to signing ISG Agreements. For information on how to participate please contact ISGsupport@etsi.org

The first meeting of the ISG ENI will take place at the ETSI premises in Sophia Antipolis, France, on 10-11 April 2017. The full list of members and participants in ISG ENI is available at: https://portal.etsi.org/TBSiteMap/ENI/ListOfENIMembers.aspx

About ETSI

ETSI produces globally-applicable standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, aeronautical, broadcast and internet technologies and is officially recognized by the European Union as a European Standards Organization. ETSI is an independent, not-for-profit association whose over 800 member companies and organizations, drawn from 67 countries, determine its work programme and participate directly in its work.

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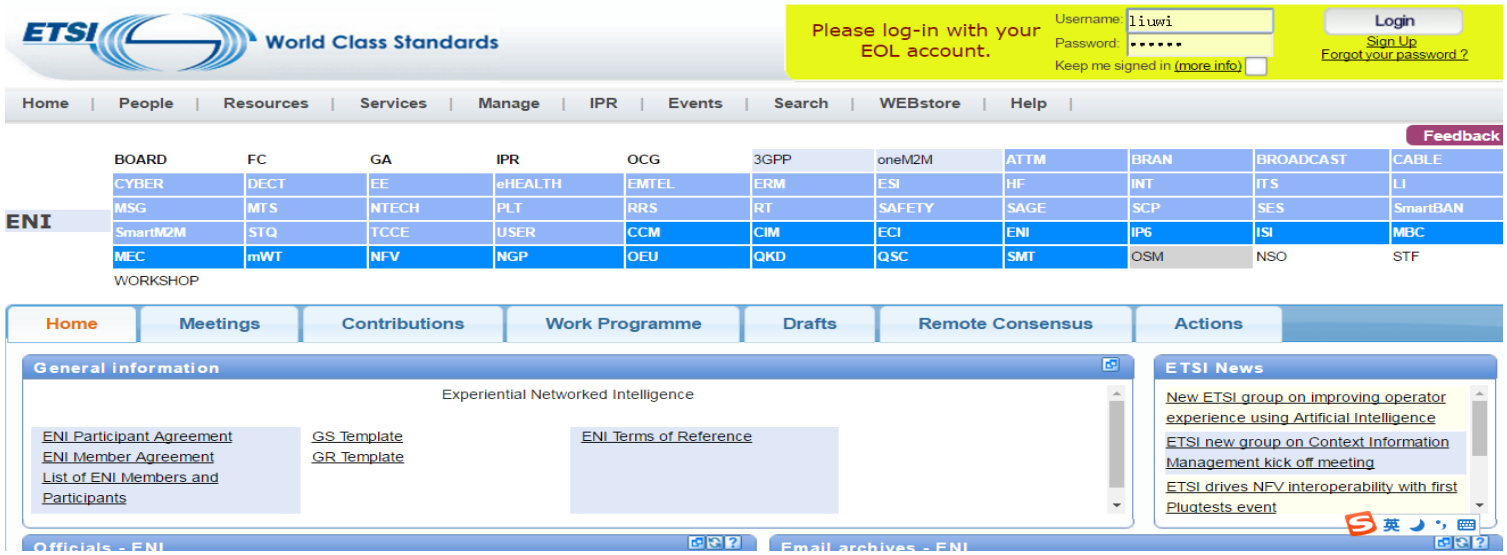
http://www.etsi.org/news-events/news/1171-2017-02-new-etsi-group-on-improving-operator-experience-using-artificial-intelligence

ENI progress and next step

- https://portal.etsi.org/tb.aspx?tbid=857&SubTB=857



Portal of ETSI ENI

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Thank you!

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