Questions and Answers

(received from ETSI ISG ENI proponents on ENI scope and concepts)

Georgios Karagiannis

Huawei Technologies Co. Limited

Questions received from ETSI ISG ENI proponents

- Question Q1:
  - Define whether all stakeholders can provide requirements on the KPIs (used to improve operator experience) or only network operators. Can others such as manufacturers and network administrators contribute? Are such requirements taken from network operational real life scenarios?
  - **Answer to Q1: All Stakeholders can bring Use cases and requirements**
- Question Q1.1: How to quantify? Can we have a common KPI/KQI?
  - **Answer to Q1.1**:
    - Focus on: Network centric automation and policy management;
    - Network Operators have propriety and closely guarded KPIs
- Question Q1.2: Can we abstract the indicators to a set of standard measures?
  - **Answer to Q1.2:**
    - If we have a model that relates SLAs and SLSs to KPIs and KQIs, then for any given Role (or Actor), we can relate business requirements to the network state. This uses context to select the set of policies that are currently applicable, and then the policies tell the engine how to behave.
    - Focus on Use cases and requirements – and how to show abstracted information

Questions received from ETSI ISG ENI proponents

- Question Q2: Are these KPIs only on network service level, or do they also cover resource management level?
- **Answer to Q2:**
  - KPIs are performance measures on the network, service and fulfilment, assurance, billing,
  - Assume measures need to be transferred and used to analyse
  - KPIs may be the resultant measures
  - Big data *analytics may be used* to verify meeting the KPIs and KQIs:
    - Big Data analytics are used to determine if the KPIs/KQIs are being met or not.

The following 4 principles are controlled by Policy. Big Data Analytics are used to feed data into the policy-based control loop, and the decisions are made by policy:

1. Control which data from which devices are used to calculate KQIs and KPIs,
2. Control what type of data is used (e.g., should the data be delivered raw, or filtered, or correlated, or transformed somehow),
3. Control which apps and processes are used in the transformation process,
4. Control which actions to take in response to information pertaining to KPIs and KQIs.

Not the opposite way round: hence the control loop of machine learning.

Questions received from ETSI ISG ENI proponents

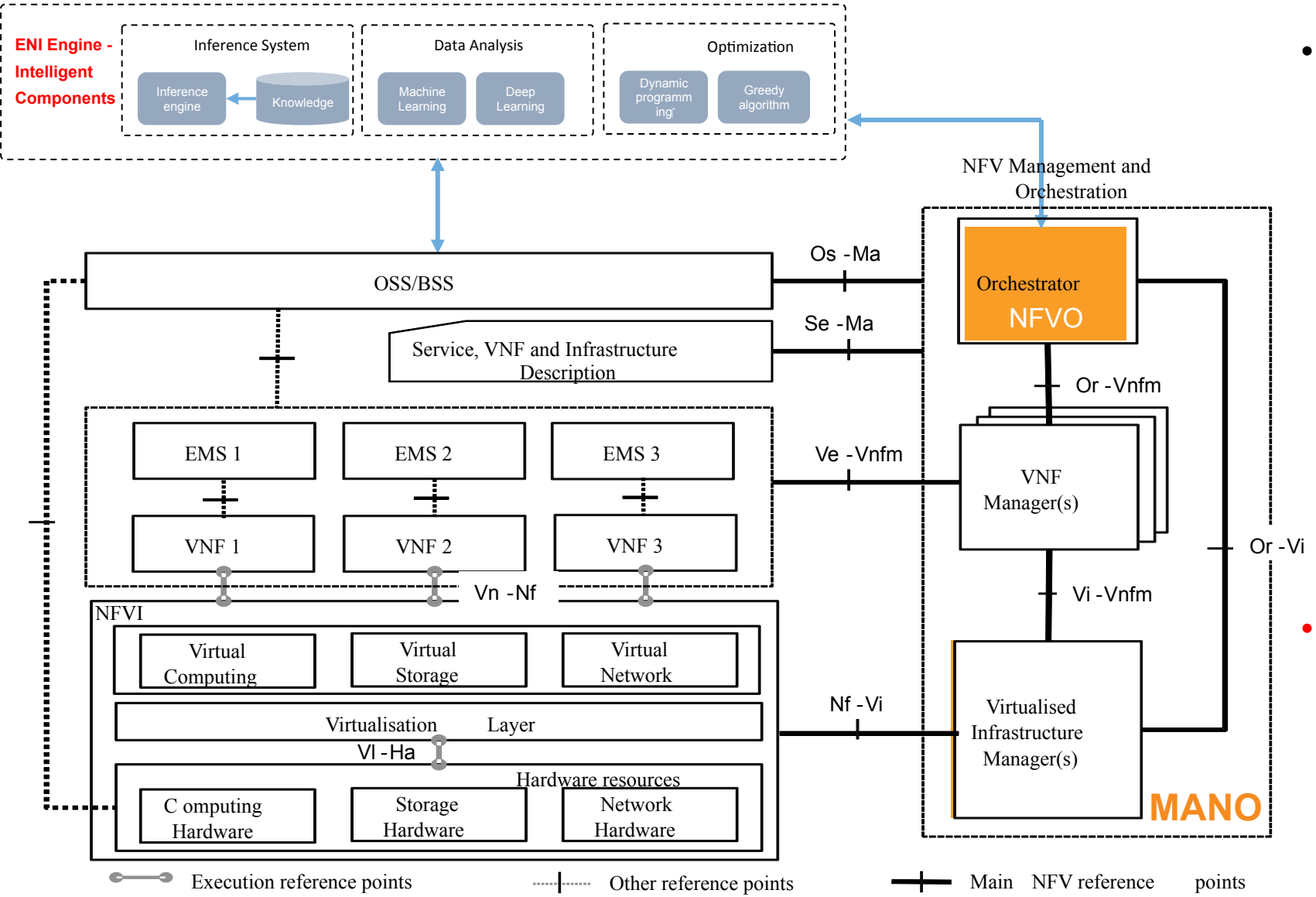
- Question Q3: Show the relation of the ISG ENI (and in particular the Intelligent engine) with work that is being done by other SDOs and other initiatives (relation to MANO, ONF SDN controller, MEC Orchestrator, etc.)?
- **Answer to Q3:** There are several ways to show the relation of ETSI ISG ENI with other SDOs:
  - Analysis has been done to identify the relations of ETSI ISG ENI with the following SDOS:
    - ETSI NTECH/AFI, ETSI NFV, ETSI MEC, ETSI NGP, TM Forum, IETF SUPA, IRTF NFVRG, ONF, MEF
  - Use the NFV, SDN, MANO, MEF & MEC architectures to show how the ENI Intelligent Engine interacts with these evolving ecosystems (NFV, SDN, MANO, MEF & MEC)
-

Q3: Some findings based on analysis done to identify relations of ETSI ISG ENI with other SDOS

- Regarding Operator Experience:
  - NO SDO is doing anything on operator experience,
  - The MEF LSO is a great starting place, but the place where operator experience would be addressed is in the SOF,
    - The work in MEF LSO is currently under development. Huawei (John) is the editor of the SOF,
    - Currently, there are no plans or proposals to address operator experience in it
  - IETF SUPA obviously has nothing to do with operator experience
- Regarding Policy:
  - Most SDOs do not have a policy info or data model; The only three that are known of that do are the IETF, TMF, and the MEF
  - Of these, the TMF model is focused on traditional NMF manual networks
  - The IETF SUPA model is a great model. However, it ONLY models imperative policies. Everyone wants "intent", but intent is the exact opposite of imperative (i.e., intent is declarative); The IETF SUPA model is not related to any architecture
  - The MEF PDO (Policy-driven Orchestration) project we lead will start with the latest version of SUPA, and then add in declarative (and possibly other types of) policies. However, there is a second important difference: the MEF PDO will relate policies explicitly to its orchestration architecture
  - In addition, most SDOs do not have an orchestration architecture specified at this level of detail, and of those that do (NFV, ONF), neither has a policy model

Q3: Use NFV, SDN, MANO, MEF & MEC architectures to show how ENI Intelligent Engine interacts with these evolving ecosystems

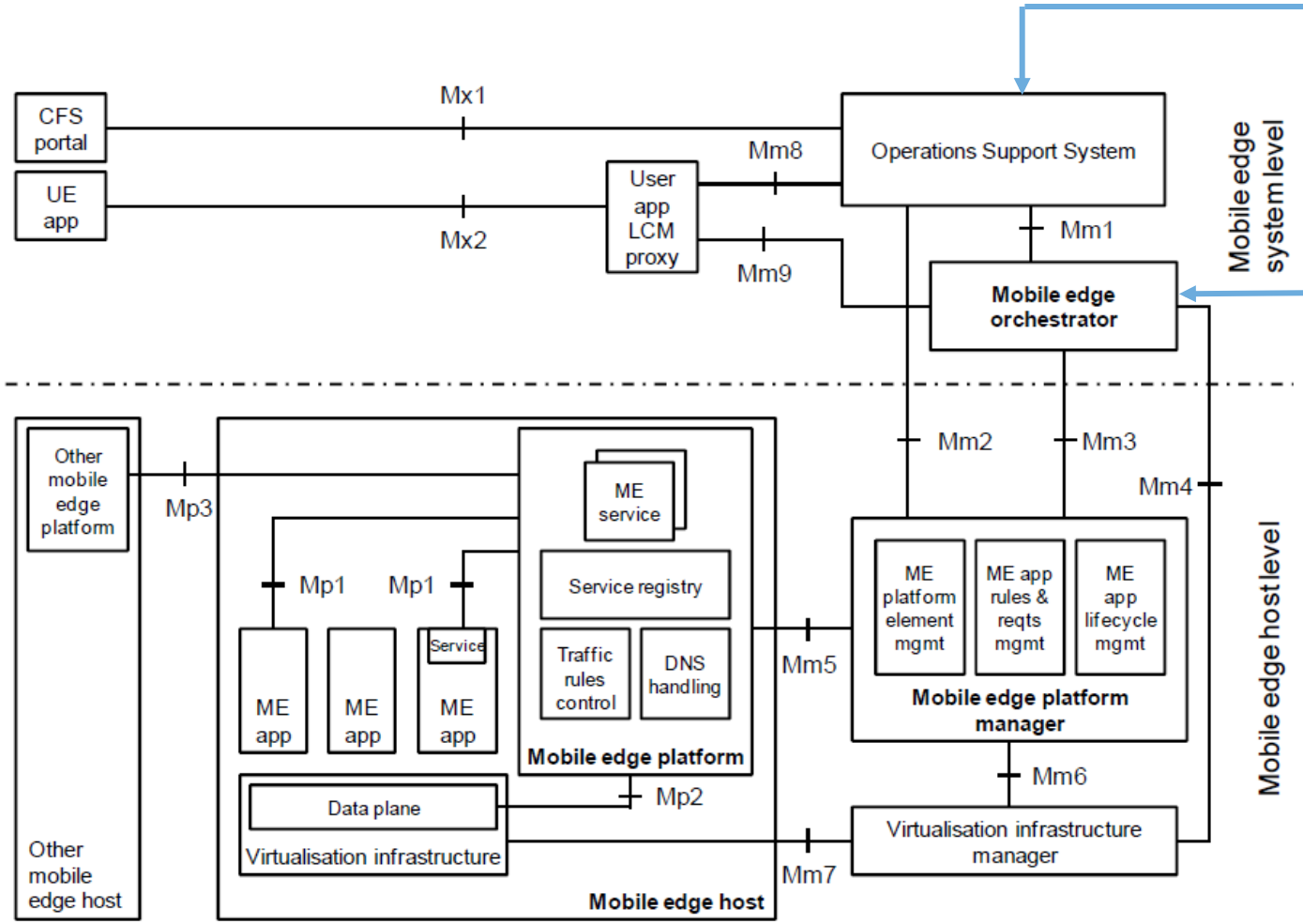
Q3: How an ENI Engine is placed within the ecosystem of the evolving NFV & MANO

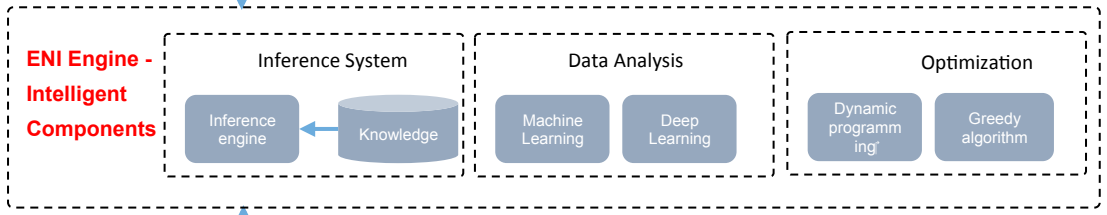


- The Network Big Data Analysis module of ENI Engine collects the information of MANO's resource description and dynamic resource to include complete meta-data and data for lifecycle management of the virtual environment. The output of Network Big Data Analysis can be used to act on service / policy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

- *there is no closed control loop in MANO. However, important to note that the ENI Engine is OUTSIDE of the MANO elements and of the MANO architecture; This addresses compatibility and avoids rebuilding MANO components!*

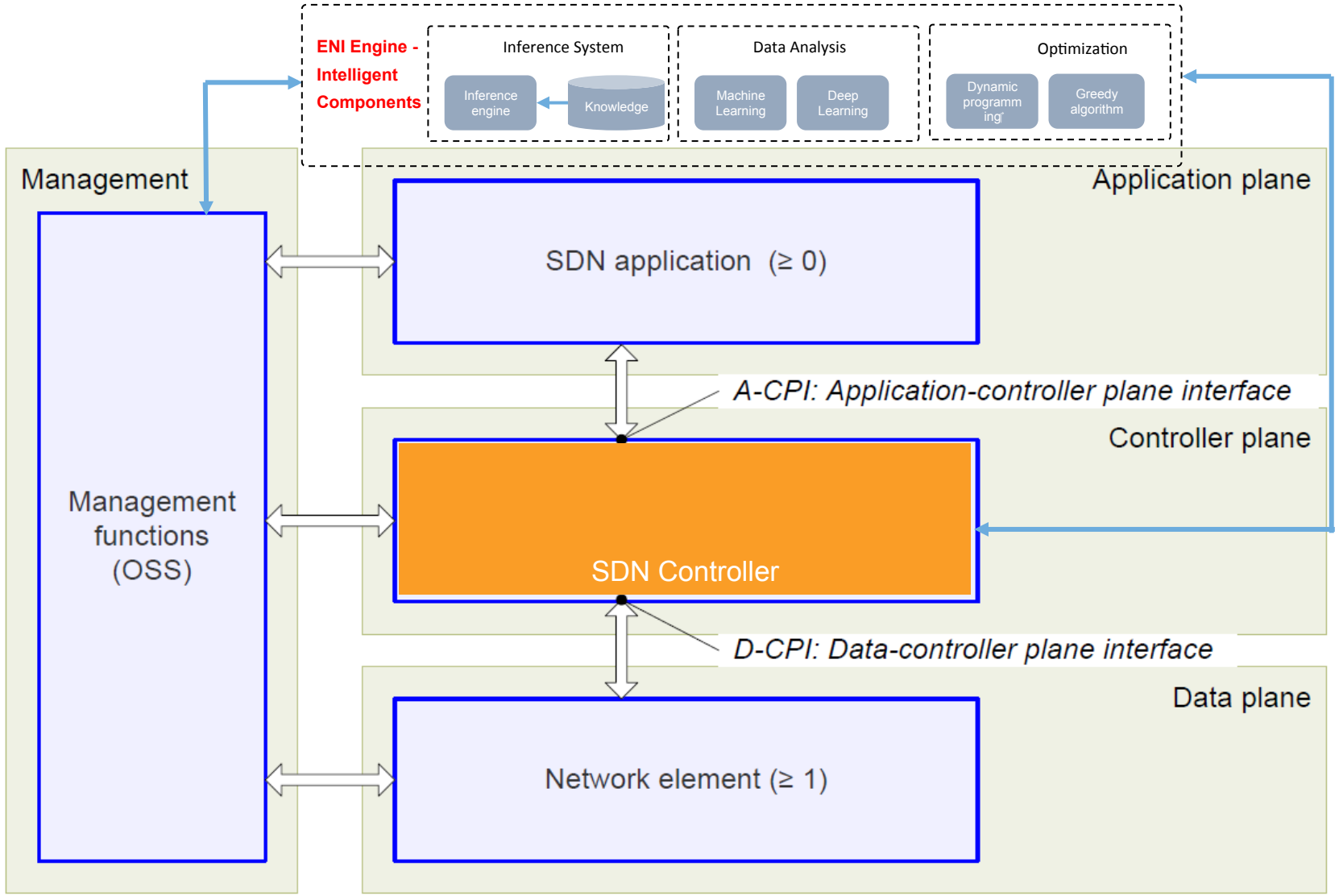
Q3: How an ENI Engine is placed within the ecosystem of the evolving MEC





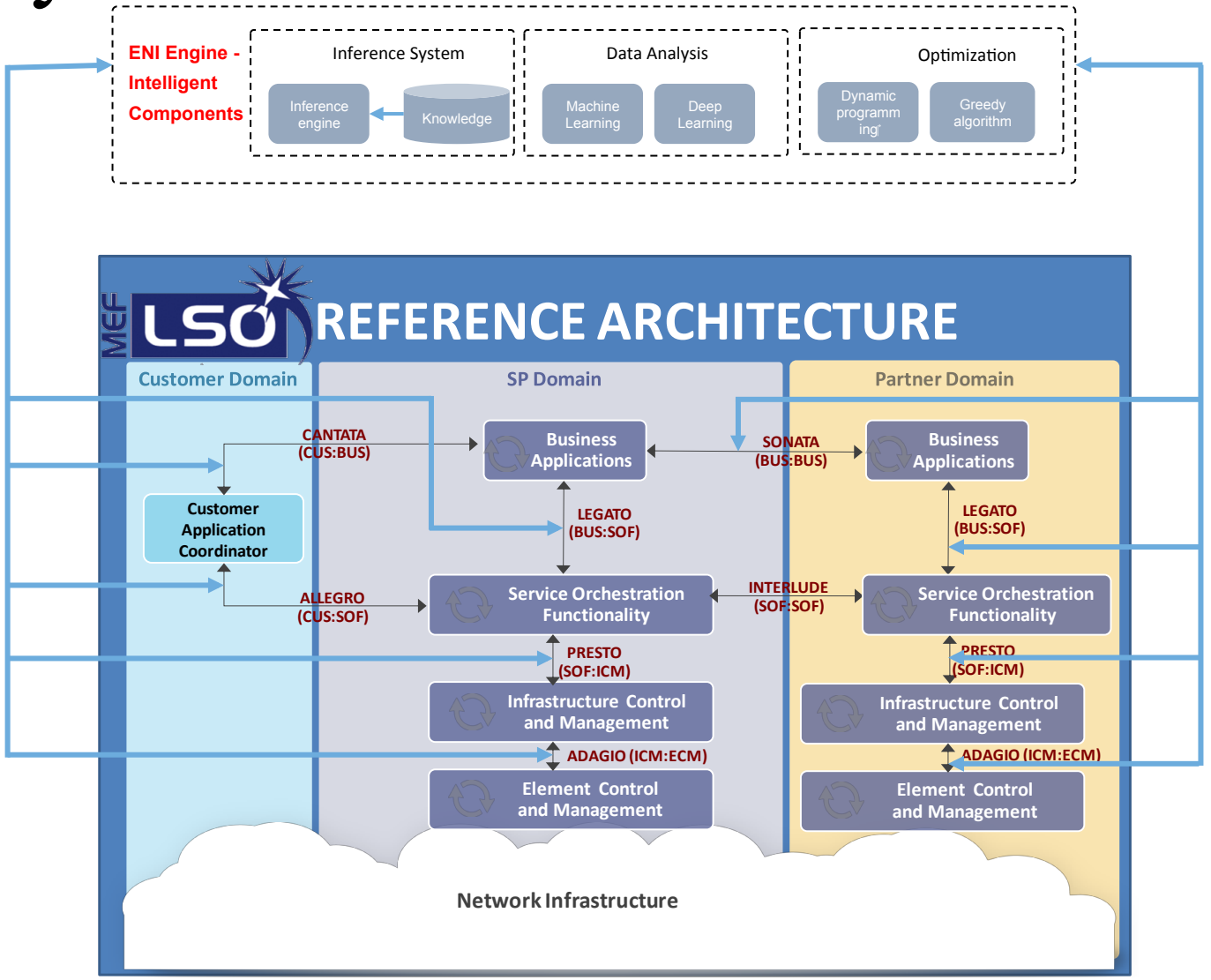
- *Important to note that the ENI Engine is OUTSIDE of the MEC elements and MEC architecture; This addresses compatibility and avoids rebuilding MEC components!*

Q3: How an ENI Engine is placed within the ecosystem of the evolving SDN



- In SDN, the 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.
- *Important to note that the ENI Engine is OUTSIDE of the SDN Controller. This addresses compatibility and avoids rebuilding SDN components!*

Q3: How an ENI Engine is placed within the ecosystem of the MEF LSO RA

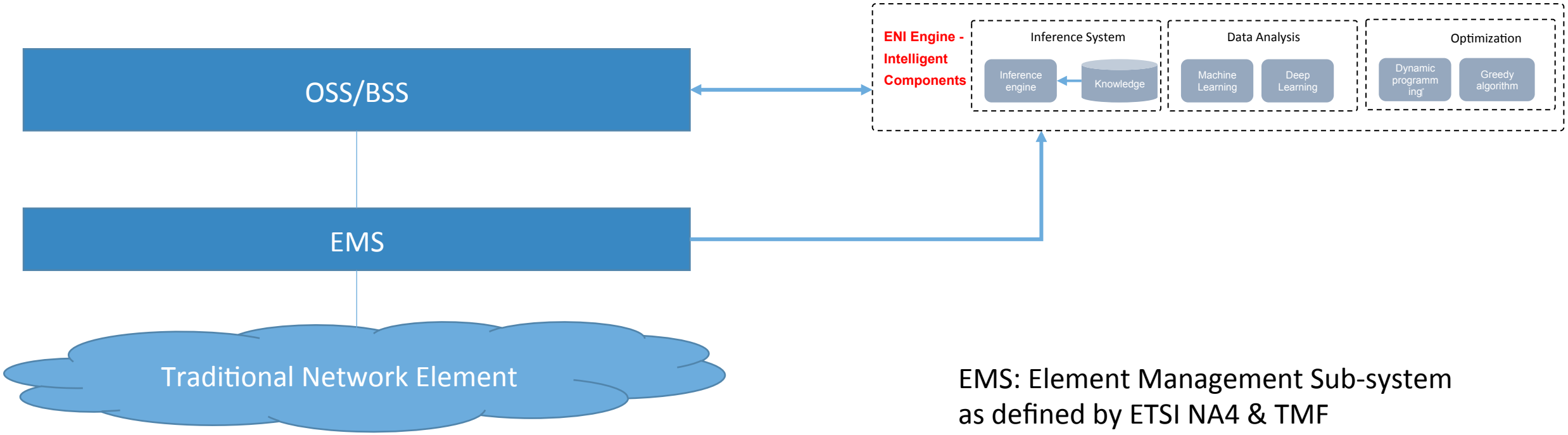


- The LSO RA defines a set of Management Interface Reference Points that specify the logical points of interaction between different functional management entities. Each Management IRP is defined by an Interface Profile, supported by an information model and a set of data models, and implemented by APIs.
- The ENI Engine sits outside the MEF LSO RA functional elements, and augments their behavior.
- The ENI Engine interacts with the functional blocks of the LSO RA via the existing APIs defined by the LSO RA; this avoids altering the architecture

Questions received from ETSI ISG ENI proponents

- Question Q4: Show the relation of the ISG ENI (and the Intelligent engine) with existing legacy systems (NMS, etc.)?
- **Answer to Q4:**
  - Use legacy TMF systems to show how ENI Intelligent engine relates to this ecosystem

How an ENI Engine is placed within the ecosystem of the traditional OSS/BSS managed network



EMS: Element Management Sub-system
as defined by ETSI NA4 & TMF
The EMS to ENI Engine interface is unidirectional
only Receiving sensing information

Questions received from ETSI ISG ENI proponents

- Question Q5: Explain how NBI interfaces that are defined elsewhere are being used here?
- **Answer to Q5:**
  - See next slide

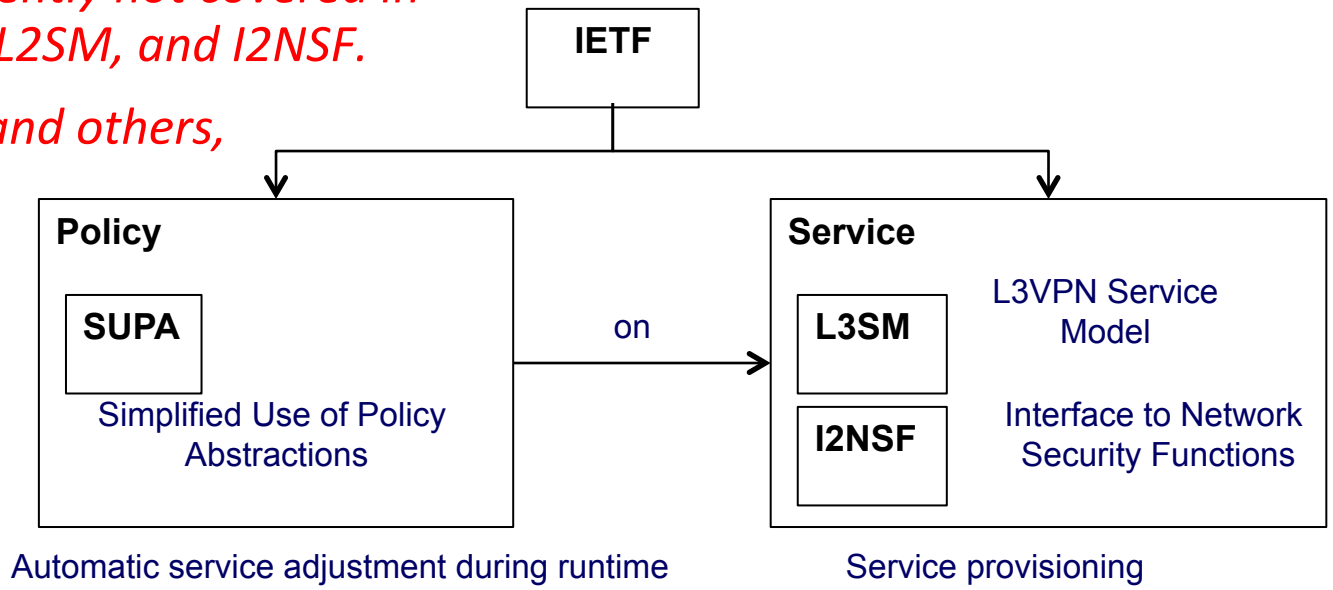
Q5: Explain how NBI interfaces that are defined elsewhere are being used here?

- If they need to be modified, they will be modified in the body that owns them
- Explain the reuse of the NBI work from IETF SUPA and L3SM
  - The SUPA work is underway is a draft RFC. Identified revisions will cause input to the RFC process.
  - The L3SM work is in Published RFC phase. Identified issues will cause new and informational RCFs to be worked on to complement the work.

IETF SUPA does not (yet) define interfaces. It defines an information model and a YANG data model. While one could build interfaces, that is currently not covered in the current SUPA charter. Same with L3SM, L2SM, and I2NSF.

ENI can use the output of all of these WGs (and others, such as I2RS), but as input to its models.

*The important part of ENI is that it is **model-driven**. Hence, it can incorporate any model (IETF, MEF, ONF, etc.). The function of the ENI logic is to interpret the models and incorporate them into its framework as knowledge.*

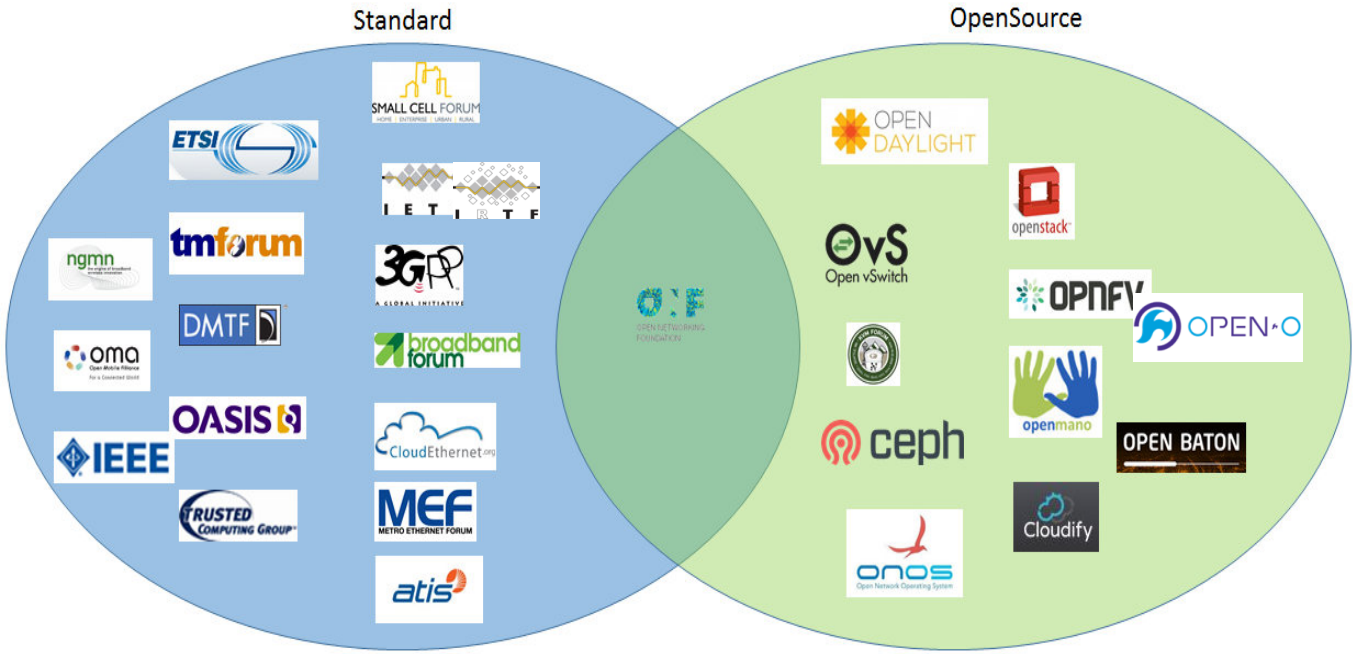


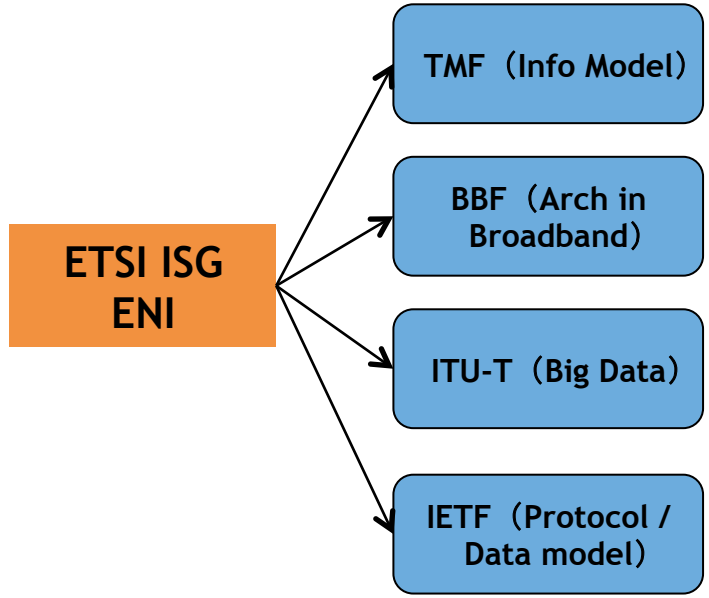
Questions received from ETSI ISG ENI proponents

- Question Q5: Show that ENI is not reinventing the wheel and that we are reusing work that is being done in other SDOs and reusing legacy systems?
- **Answer to Q6:**
  - See next slide

Q6: Show that ENI is not reinventing the wheel and that we are reusing work that is being done in other SDOs and reusing legacy systems

- Working to analyse the automation needs
- Liaise and improve interfaces in the interface specification SDOs





Examples of ENI Re-use or send requirement to related SDOs

Questions received from ETSI ISG ENI proponents

- Question Q7:
  - Assuming that MEF will define the Policy related topics that are similar to ENI:
    - Will MEF work on the Same Policy topics?
    - Who will define the Lexicon of terms?
    - Why start a new ISG if MEF is going to do the work? Show that ENI is not reinventing the wheel and that we are reusing work that is being done in other SDOs and reusing legacy systems?
- **Answer to Q7:**
  - See next slide

Q7: Relation to MEF

- Regarding Operator Experience:
  - NO SDO is doing anything on operator experience,
  - The MEF LSO is a great starting place, but the place where operator experience would be addressed is in the SOF,
    - The work in MEF LSO is currently under development. Huawei (John) is the editor of the SOF,
    - Currently, there are no plans or proposals to address operator experience in it
  - IETF SUPA obviously has nothing to do with operator experience
- Regarding Policy:
  - Most SDOs do not have a policy info or data model; The only three that are known of that do are the IETF, TMF, and the MEF
  - Of these, the TMF model is focused on traditional NMF manual networks
  - The IETF SUPA model is a great model. However, it ONLY models imperative policies. Everyone wants "intent", but intent is the exact opposite of imperative (i.e., intent is declarative); The IETF SUPA model is not related to any architecture
  - The MEF PDO (Policy-driven Orchestration) project we lead will start with the latest version of SUPA, and then add in declarative (and possibly other types of) policies. However, there is a second important difference: the MEF PDO will relate policies explicitly to its orchestration architecture
  - In addition, most SDOs do not have an orchestration architecture specified at this level of detail, and of those that do (NFV, ONF), neither has a policy model

Questions received from ETSI ISG ENI proponents

- Question 8:
  - Will the Interfaces from/to the network intelligent engine be specified: to be generic, and used in any deployment scenario (MEC/NFV/MEF/SDN Controller), or
  - Will the Interfaces from/to the network intelligent engine be specified: to be specific for each deployment scenario?
- **Answer to Q8: The interfaces need to be specified in a Generic way**
- Question 9:
  - Which SDO will standardise this interface; will it be generic or specific?
    - If generic; which SDO will standardise the generic interface?
    - If specific; which SDOs will standardise the specific interfaces, and the interworking?
- **Answer to Q9:**
  - This needs to be worked out: as multiple expertise will be needed
  - Generic specification using a self learning AI approach and liaison to individual areas of expertise is expected.

Questions received from ETSI ISG ENI proponents

- Question 10: What is the role for ISG ENI: on the specification - generic or specific interface:
- **Answer to Q10**:
  - This needs to be worked out: as multiple expertise will be needed: Generic specification using a self learning AI approach and liaison to individual areas of expertise is expected
- Question 11:
  - A Generic interface is more efficient, in terms of usability. However, who has the knowledge to fit all the deployment scenarios?
- **Answer to Q11**: Liaison and cooperation with other SDOs are the preferred ways to proceed.

Do you have more questions?

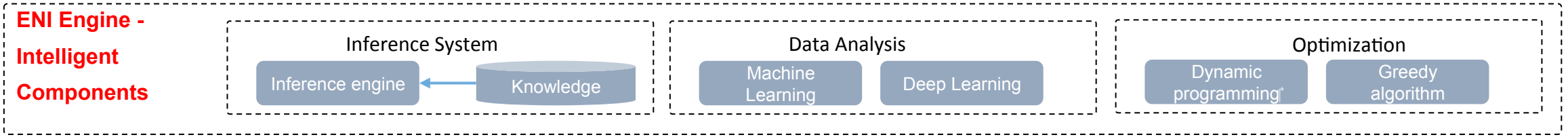
Some Questions for you

- Is the problem scope of ETSI ISG ENI clear to you?
- Are the objectives of the ETSI ISG ENI clear to you?
- Are the three ETSI ISG ENI phases clear to you?
- Who is willing to support this ETSI ISG activity?
- Who will be contributing to this ETSI ISG activity?

Thank you!

More background

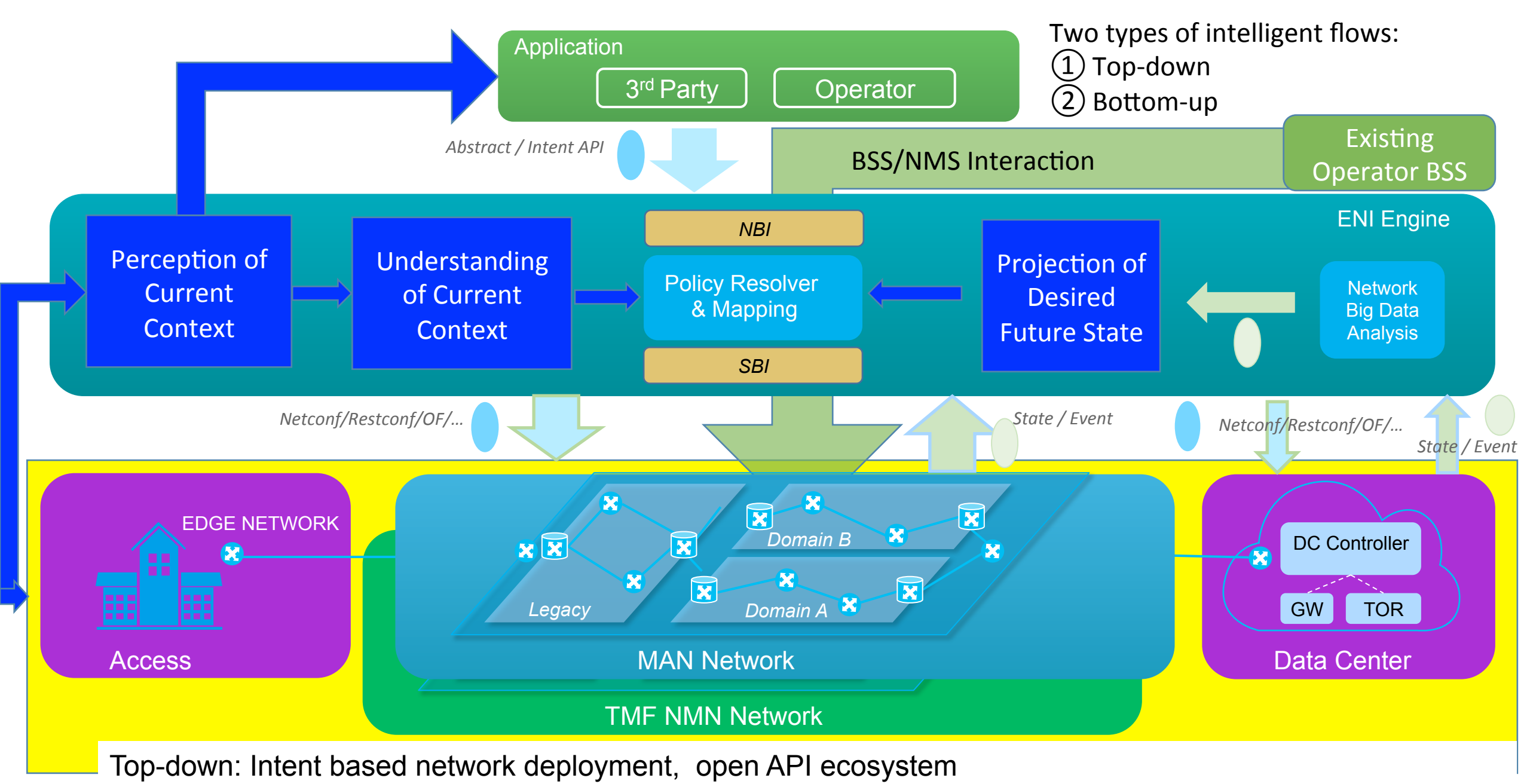
Functional entities within the ENI Engine (for illustration)
– not to standardize the internal structure



Enlightenment brought by the development of technology

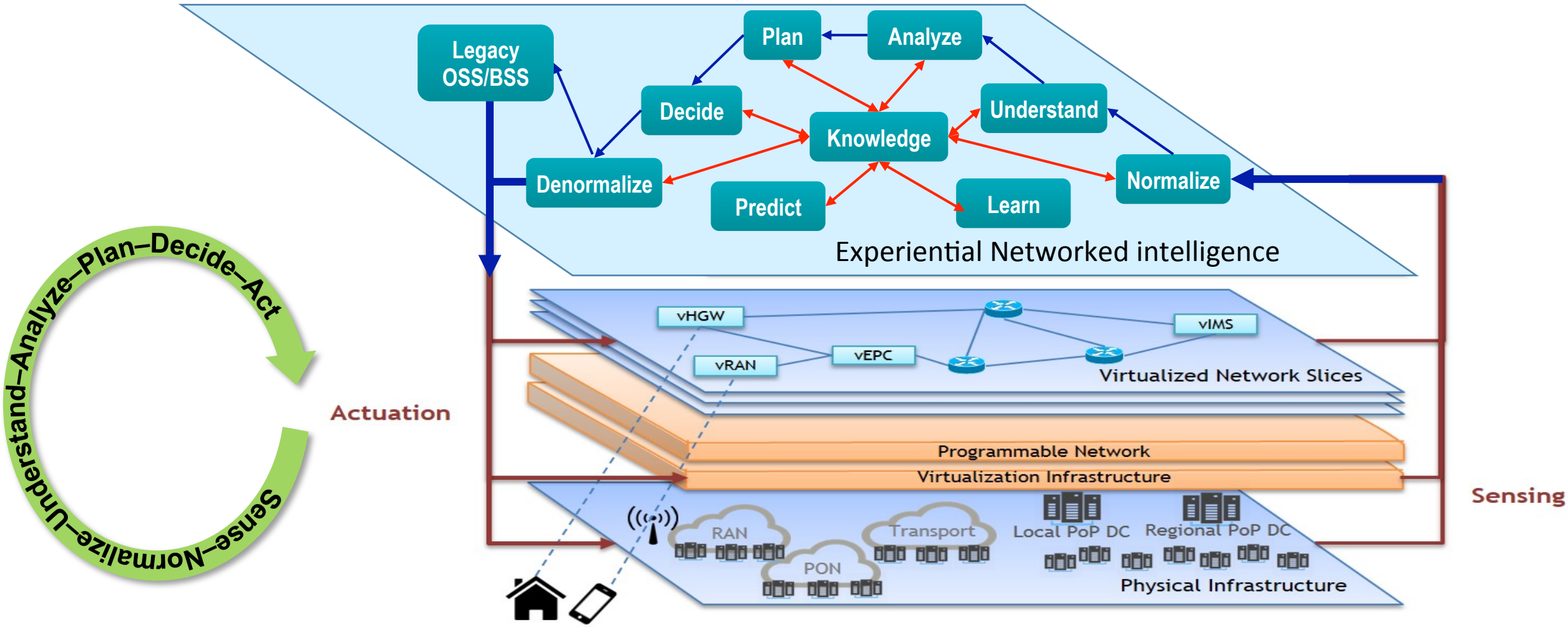
- Mobile： Feature phone → 1st Gen Smart Phone → Smart Phone
- Automobile： MT → AT → Self-driving
- Network： Traditional → SDN → NFV → ?

The ultimate goal of development of science and technology, is to improve the human experience, more suitable for human to use, simplify the human-machine interaction by improving the AI of machine

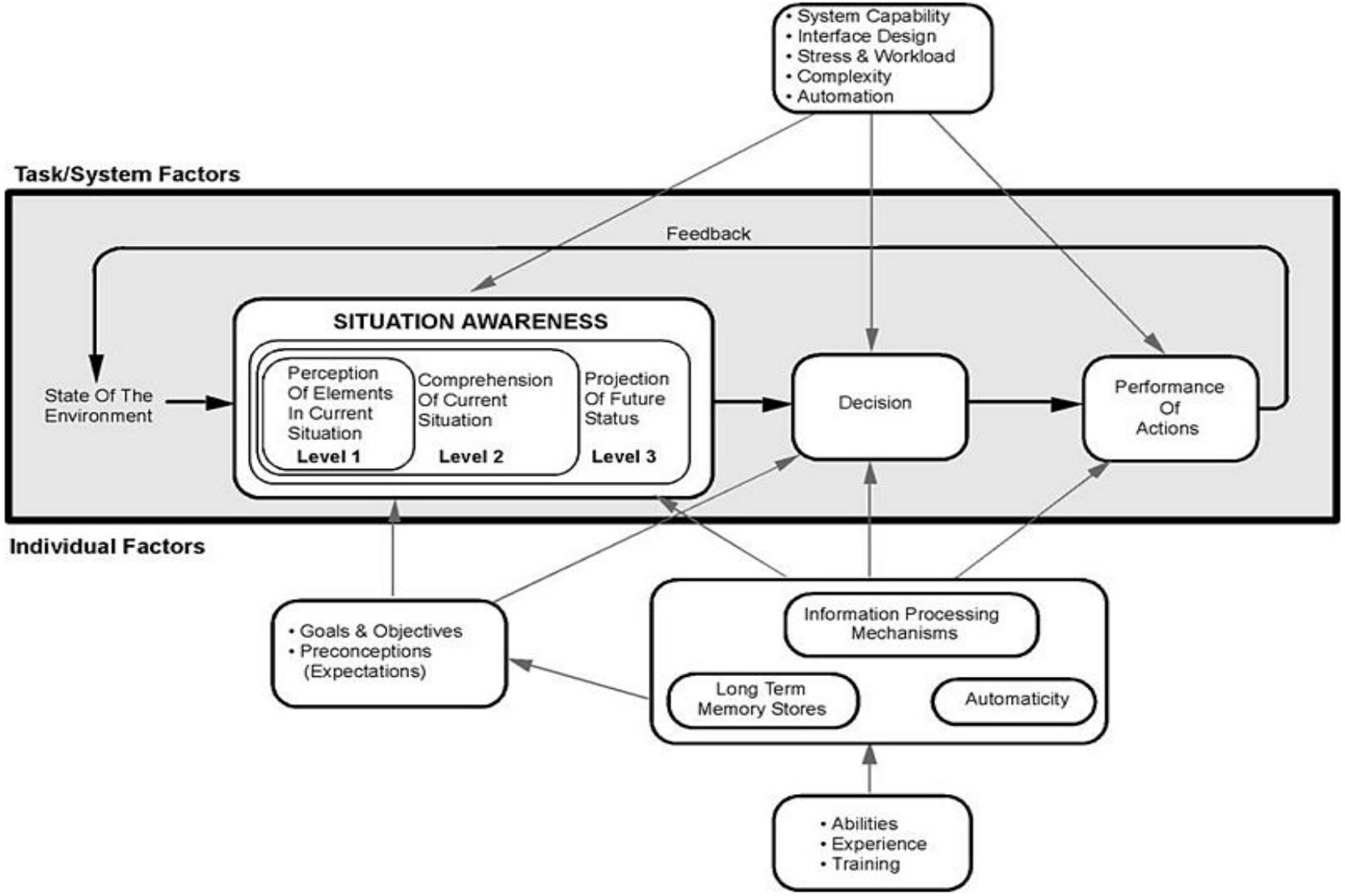


Top-down: Intent based network deployment, open API ecosystem
Bottom-up: Self-adaptive network, control plane adjusts network automatically based on network status

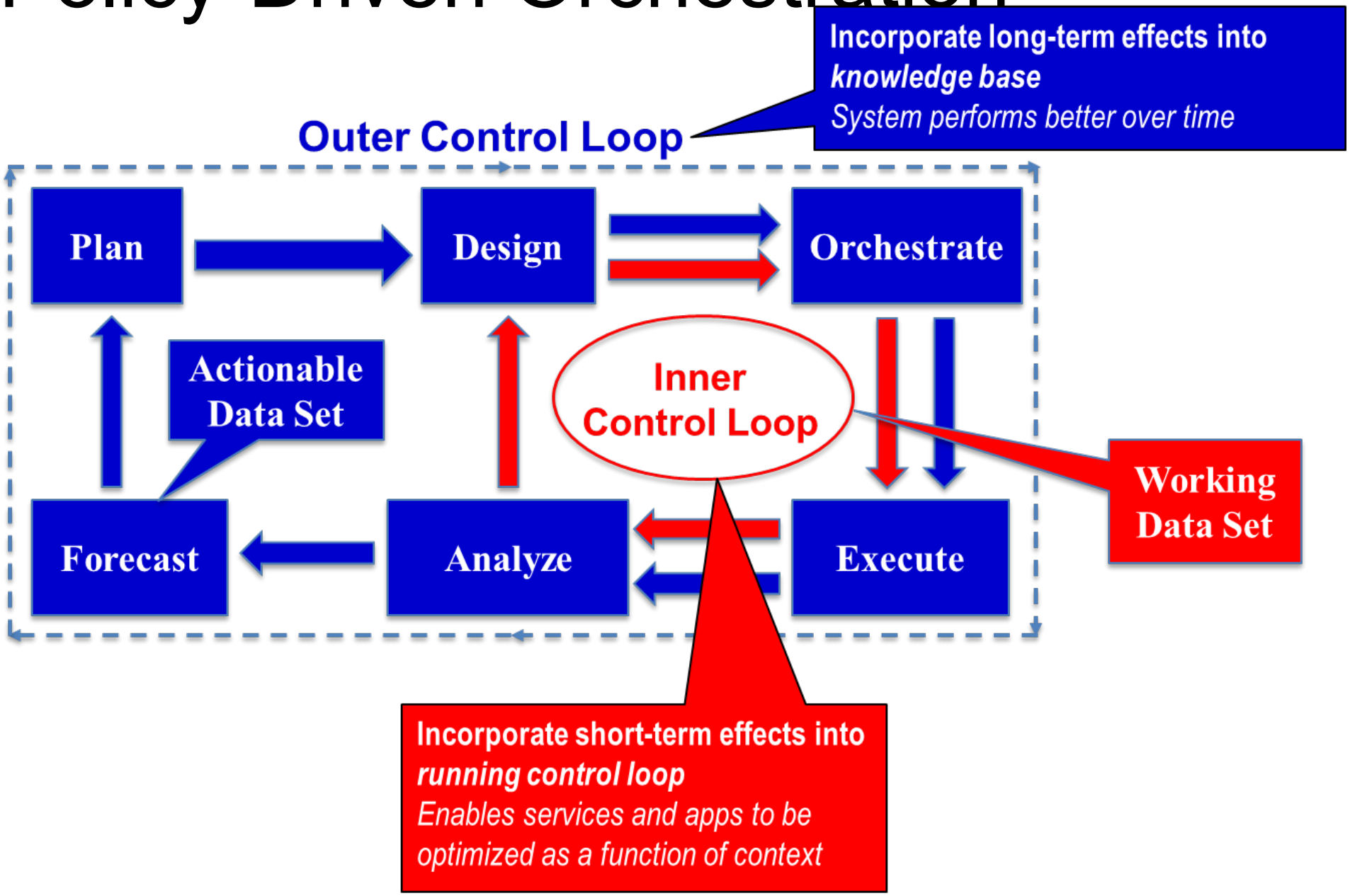
Future Vision (Detailed View)



Situational Awareness (Common AI Illustration)



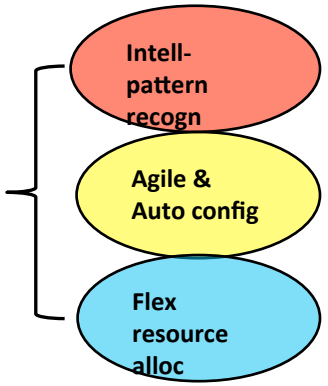
MEF Policy-Driven Orchestration

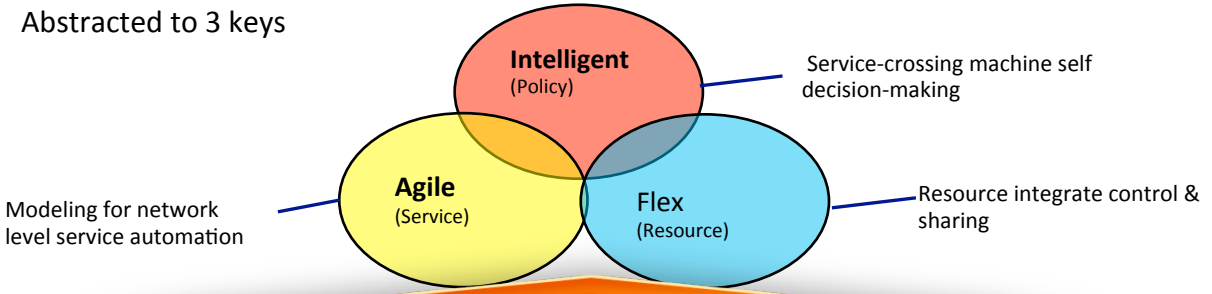


Operator Experience?

- UX is 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 wiki
  - *If* SDN = cell phone, *then* the experience of its owner (operator) is barely satisfactory:
    - Human-dependent decision, complex manual config, poor resource utilization
    - Ideal OPX for SDN/NFV operation:
      - Abstracted to 3 keys

Ideal UX example





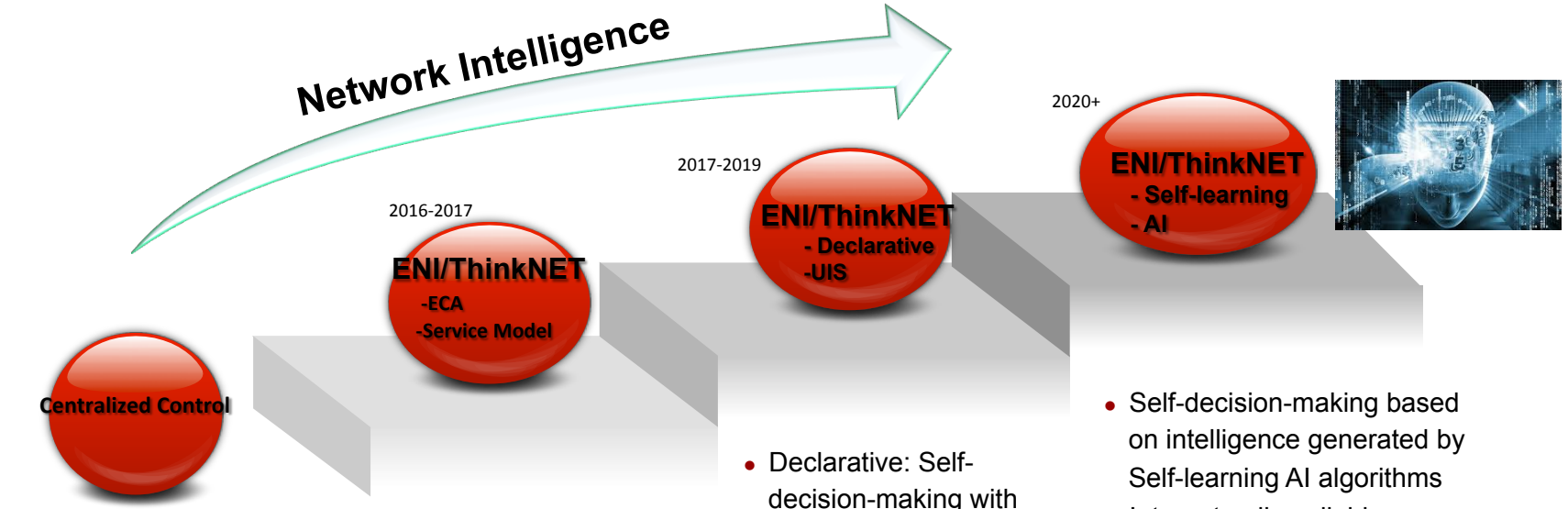
Policy → **SUPA WG** ✓ **IETF WG formed in 2015**
✓Policy based network management
✓Controller/network level policy modeling with YANG

Service → **L3SM WG** ✓ **IETF WG formed in 2015**
✓Controller/network level L3VPN service modeling with YANG

Resource → **On-going**
✓ **Still on-going**
✓ Controller/network level resource management modeling with YANG

Need to define how to assist the SDN network based in the perspective of improving OPX of using & maintaining of SDN network, by using policy - service - resource as the three basic dimensions, to promote SDN large-scale deployment

Growth Path of Networked Intelligence



- Decouple the forwarding and controlling plane by SDN technology

- ECA: Self-decision-making using Event – Condition-Action policy rules
- Service Model enables dynamic service automation

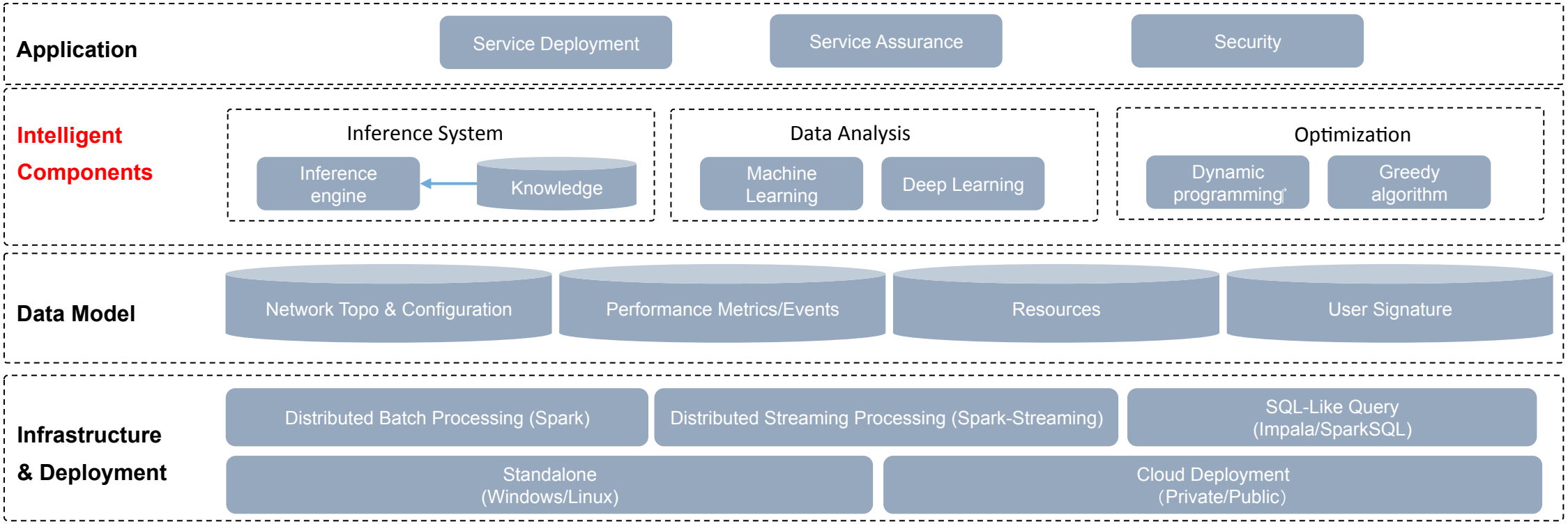
- Declarative: Self-decision-making with declarative policy statements
- Translation of user intent to service and resource management

- Self-decision-making based on intelligence generated by Self-learning AI algorithms
- Integrate all available resources to achieve high performance and improved OPX with low cost (OPEX), like self-driving car and AlphaGo from Google

Data → **Information** → **Knowledge** → **Wisdom**

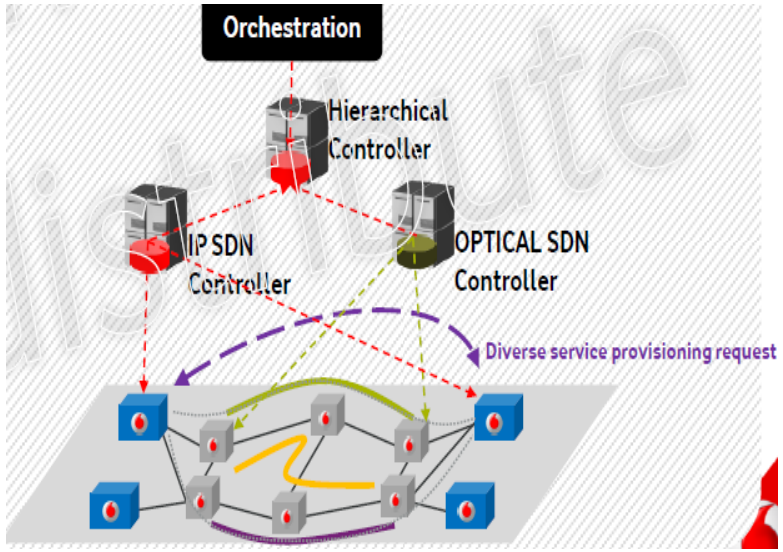
The future network grow path will be just like the mobile phone or automobile: from processing data, to learning to recognize information, to processing knowledge, to developing wisdom

Functional entities within the ENI Engine (for illustration) – not to standardize the internal structure



IP + Optical use case

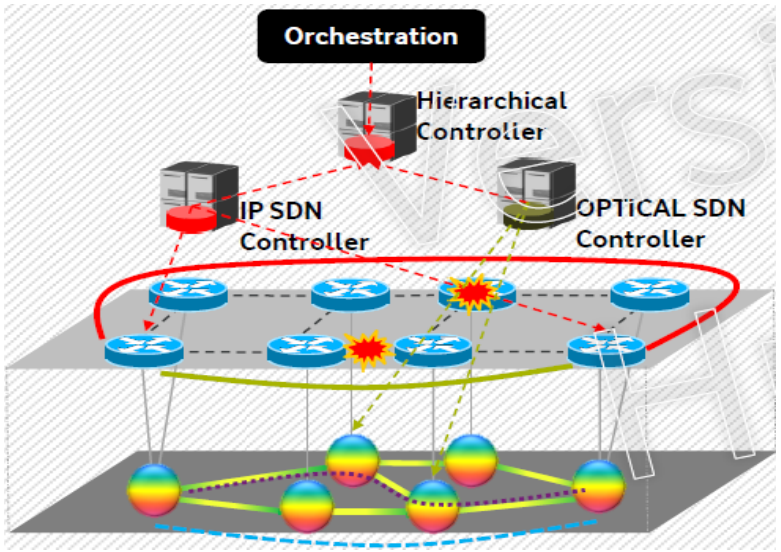
Case1： multi-layer service creation



Service creation based on the full visibility of the different network layer.

Multi-layer service creation, satisfy client requirement of automatic and fast routing.
Need to consider multi-layer constraints such as delay, etc.

Case2： multi-layer convergence protection



Better network resiliency and E2E service protection can be achieved with the coordination between both layers.
Resiliency against catastrophic failures in the network.

Convergence recovery, compare with IP layer/ optical layer/UNI protect independently, we can save network resource in order to save CAPEX according to multi-layer convergence protection