



The Standards People



ETSI Zero touch network and Service Management (ZSM) Increasing Network and Service Automation with AI and ML

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Zero-touch network and service management

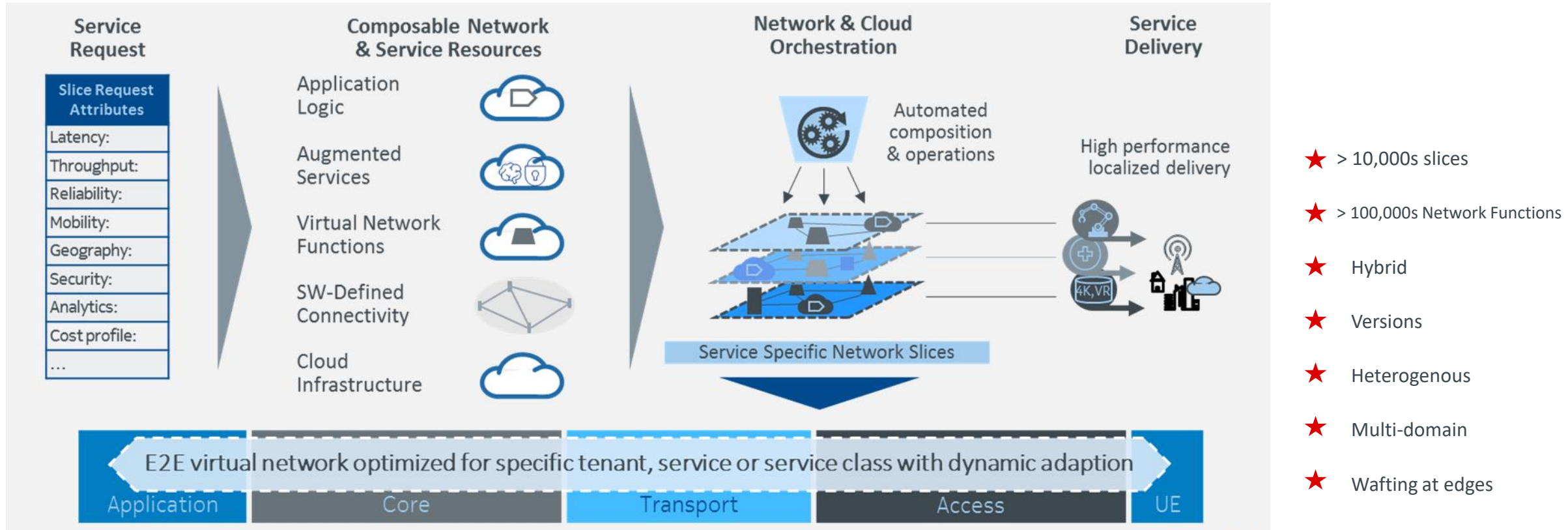
Trends and market drivers



- ✔ Rapid business digitization and automation of all major industries, supporting a similar level of business agility and flexibility
- ✔ Increase in overall complexity created by the transformation of the networks into programmable, software-driven and service-based architecture
- ✔ New business models and value creation opportunities enabled by technology breakthroughs such as Network Slicing, imposing unprecedented operational agility and higher cooperation across network domains

Network Slicing - the foundation for future value create

How do we want to manage this?



Source: Nokia

The disruptive deployment of 5G triggers the need for a radical change in the way networks and services are managed and orchestrated; full end-to-end automation of network and service management becomes an urgent necessity.

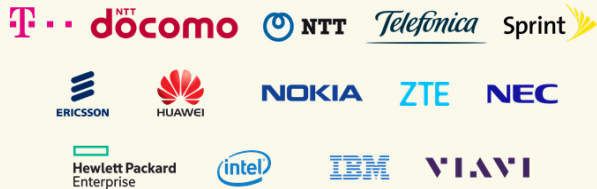
Current state of the industry

Currently there are multiple inconsistent management frameworks in the industry, many silos, a lack of alignment and a lack of interoperability.



It is essential to move to an environment that leverages synergies and achieves alignment through convergence on a single end-to-end network and service management architecture.

14 founding members



Key objective

Enable future operational processes and tasks to be executed automatically, end-to-end

Goal

Accelerate the definition of the end-to-end service management architecture, spanning both legacy and virtualized network infrastructures

Formed under the auspices of the ETSI ISG

Industry convergence

Facilitate collaboration with the relevant open-source projects, standardization bodies and fora

Interoperability

Provide a common foundation to enable a diverse ecosystem of open source groups to produce interoperable solutions

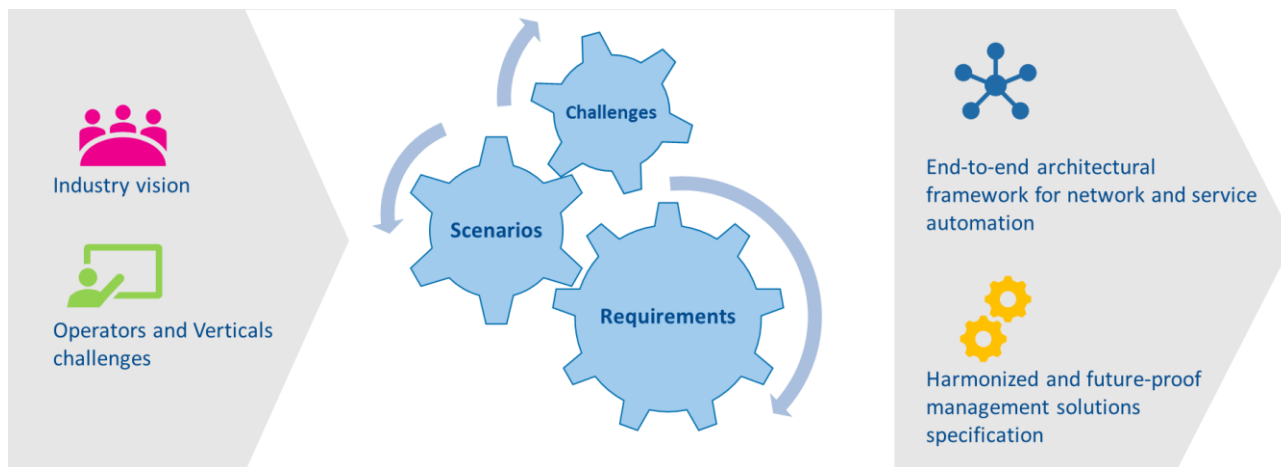
The ISG ZSM continues growing in a steady and healthy pace



65 members; 19 operators



ZSM work program



✓ The ISG ZSM work has started with the approval of the following Work Items (WIs):

- ✓ [ZSM 001](#): Requirements based on documented scenarios (specification) → **STABLE**
- ✓ [ZSM 002](#): Reference Architecture (specification)
- ✓ [ZSM 003](#): End to end management and orchestration of network slicing (specification)
- ✓ [ZSM 004](#): ZSM Landscape (report)
- ✓ [ZSM 005](#): Means for Automation (report)
- ✓ [ZSM 006](#): Proof of Concept Framework (specification) → **PUBLISHED**
- ✓ [ZSM 007](#): Terminology
- ✓ [ZSM 008](#): End-to-end cross-domain service orchestration and automation

* The ZSM DRAFT specifications are publicly available via the ZSM open area ([Link](#)). 7

ZSM Scenarios and Key Requirements (ZSM 001)

- ✔ 39 scenarios are used to identify business-oriented and automation-related challenges faced by operators and vertical industries.

The scenarios are categorized into the following groups:

- ✔ Automation of end-to-end network and service management
 - ✔ End-to-end automation of 5G network slice management
 - ✔ Analytics and Machine Learning
 - ✔ Automated Testing
 - ✔ NaaS lifecycle and exposure with slicing
 - ✔ Collaborative/Federated Service Management
 - ✔ Security
 - ✔ Integration/Interoperation
- ✔ Scenarios analysis derives architectural, functional and operational requirements

Grouping scenarios: analytics & machine learning

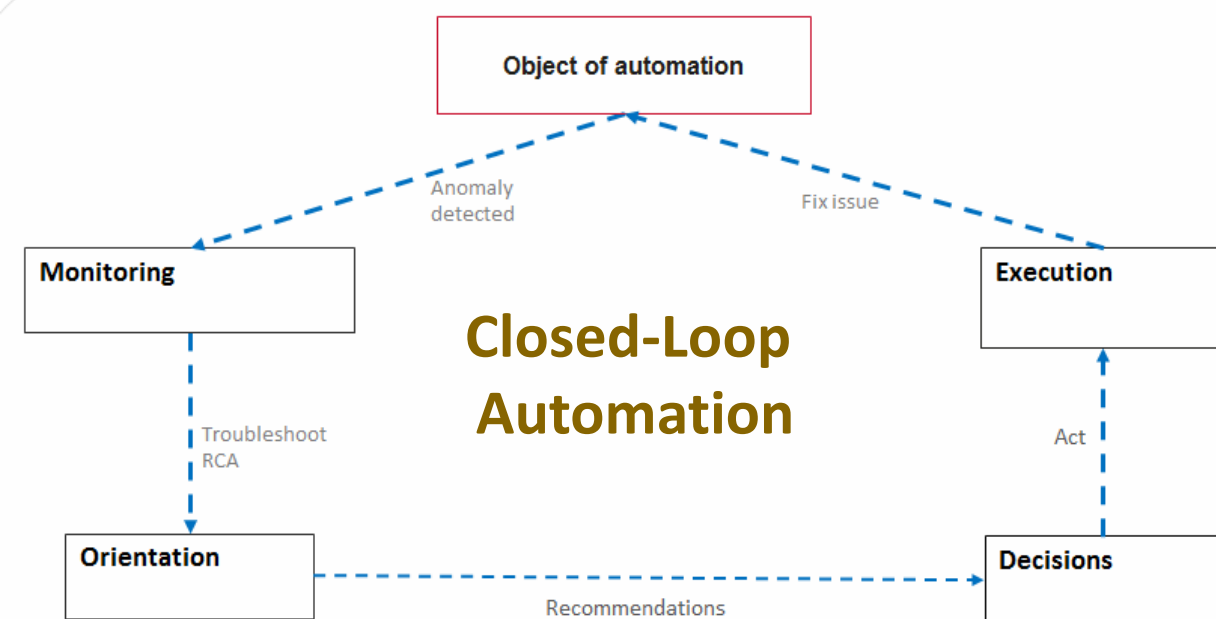
The analytics & machine learning scenario includes:

- ✔ Real-time monitoring analysis
- ✔ Access to accurate telemetry data
- ✔ Machine learning (ML) and Artificial Intelligence (AI) for network and service automation
- ✔ Predictive analytics
- ✔ Closed-loop automation
- ✔ CI/CD for ZSM framework functional components

Analytics & machine learning scenarios – key requirements

Key requirements:

- ZSM framework shall have the capability to support common access to the collected up-to-date telemetry data, both inside a domain and cross-domain.
- ZSM framework shall have the capability to store historical data that is needed for the prediction and make it accessible to the analytics.
- ZSM framework shall have the capability of enforcing a data governance scheme for the common access to telemetry data.
- ZSM framework shall support loosely coupled composite services, e.g. Machine-Learning-as-a-Service, Analytics-as-a-Service.
- ZSM framework shall provide interfaces that facilitate the integration of Machine Learning-as-a-Service frameworks into a zero-touch automation environment.
- ZSM framework shall support the use of automated decision loops, with different characteristics and scope, as a means to perform network and service Management.
- ZSM framework shall provide an interface for the purpose of bringing decision criteria to the decision loops, i.e. triggers, policies.



Means for automation

- ✓ Means for automating measurement
 - by using streaming telemetry and analytics to generate meaningful insights

- ✓ Means for automating learning
 - by using mathematical models and machine learning to support predictive and prescriptive operations

- ✓ Means for automating decision
 - by using artificial intelligence as well as cognitive and adaptive closed-control loops to produce effective (re)action plans

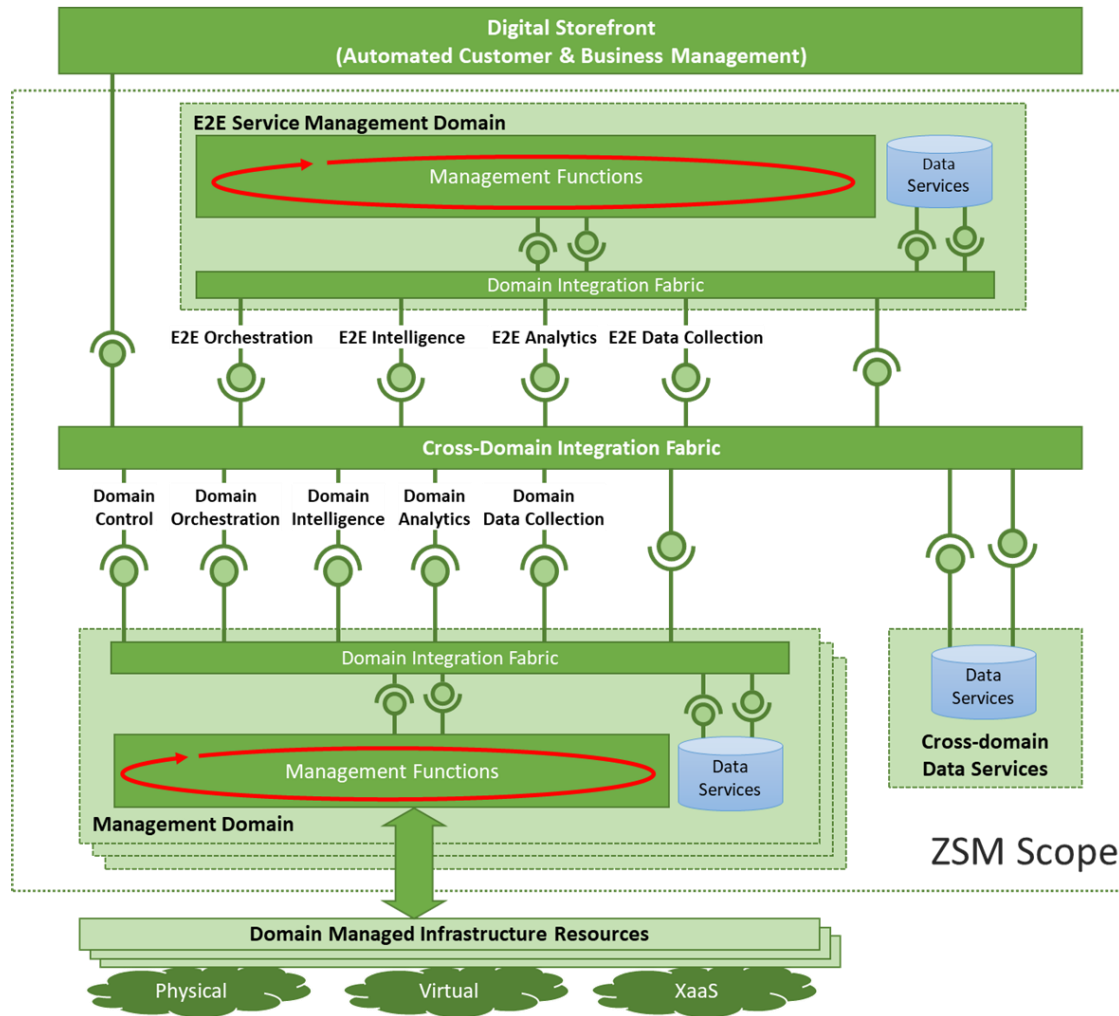
- ✓ Means for automating management
 - by using powerful, declarative abstractions (e.g. intents)

Comprehensive automation

A comprehensive automation solution consists of chained automated functions, with the following properties:

- ✔ Vertically end-to-end, i.e. across the protocol stack or from the business-layer through the service-layer to the resource-layer
- ✔ Horizontally end-to-end, i.e. across different technologies and/or administrative domains
- ✔ Repeatable and reusable in different contexts
- ✔ Coordinated closed-control loops
- ✔ Provision dynamically, customizable “control or touch points” in the end-to-end automation – closed loop – allows for human supervision

ZSM architecture framework (ZSM 002)



Architectural principles:

- Modular, flexible, scalable and extensible service-based architecture
- Separation of concerns: network domain management and end-to-end cross-domain service management, where each domain addresses its own sphere of expertise
- Support of model-driven, open interfaces
- Support of intent-based interfaces
- Enablement of adaptive closed-loop management automation, where the automated decision-making mechanisms can be bounded by rules and policies
- Support of stateless management functions
- Design for resilience
- Functional abstraction

ZSM architecture framework (ZSM 002)

Data services



Efficient access to data is **key** for analytics and machine intelligence!

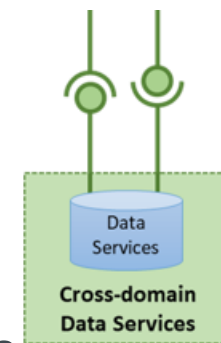
- ✔ Data services allow data to be stored separately from the application.

Data may include: performance monitoring data, assurance data, trace data, configuration data, miscellaneous log data, topology data, inventory data

- ✔ Data services support big data analysis

- ✔ Data services provide rapid access to support closed-loop automation.

- ✔ Data governance is supported to enforce access restrictions to data



ZSM architecture framework (ZSM 002)

Enabling closed-loop automation

- Data collection services

Monitor the managed entities and provide live performance and fault data to support closed loop network automation, which requires verification of how the network reacts to changes (such as optimization)

- Analytics services

Provide domain-specific insights based on data collected by domain data collection services and from other data (e.g. topology)

- Domain intelligence services

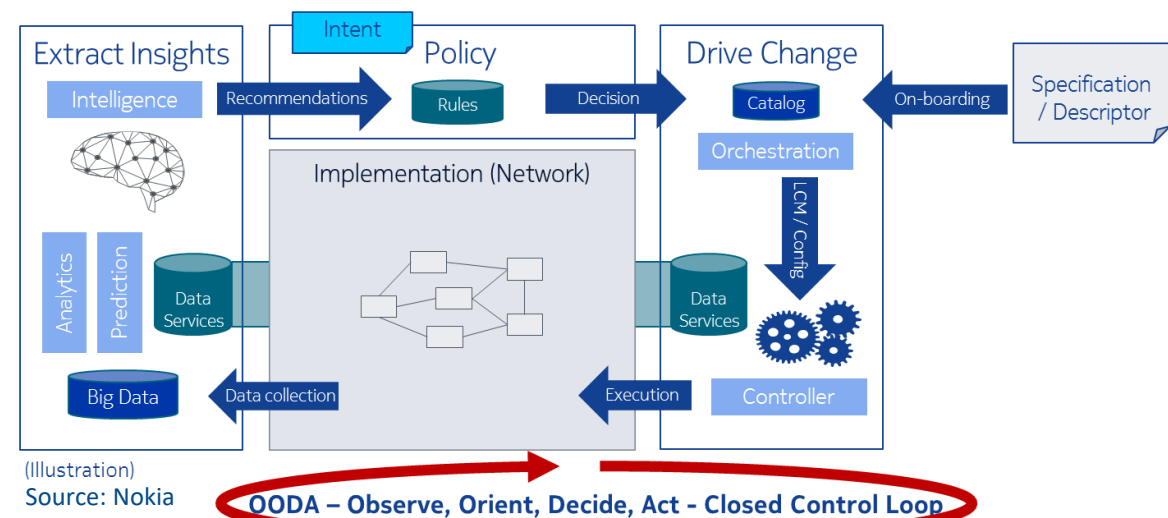
- Generate domain-specific predictions and recommendations
- Makes decisions and drive the closed-loop automation with the management domain (e.g. to optimize resource utilization, automate service assurance, etc.)

- Domain orchestration services

Automate the workflows and processes to handle the instantiation and lifecycle management of the services provided by the domain

- Domain control services

Allow to steer the state of each managed entity (resource, consumed service)



Automation challenges

Business-level intent language. How to define **business-level abstractions augmented with cognitive capabilities** that can be automatically translated into (adaptive) actions

Diversity. How to **design automation patterns** applicable to the heterogeneity of components; how to understand the semantic of the data to create meaningful insight

Reliability. How to avoid **massive error propagation** when extreme automation is deployed

Uncertainty. How to automate when faced with **lack of knowledge or variability** of the environment or conditions

Trust building. How to **explain** mathematically and/or intuitively the decisions taken by ML algorithms; how to **mitigate** security risks; how to **monitor** the performance and quality of the algorithms; how to **keep** the complexity under control

New skills. How to **inject/tune policy** during the automation process

ZSM Proofs of Concept (PoCs)

- ✔ ETSI ISG ZSM encourages PoCs to demonstrate the viability of ZSM implementations
- ✔ ZSM PoCs are multi-party projects: network/service providers, suppliers, universities, research centers, open source projects, integrators, etc.
 - ✔ The main PoC point of contact shall be an ISG ZSM member/participant
- ✔ ZSM PoCs address at least one of the PoC Topics listed on the ETSI ZSM WIKI page: [Link](#).
- ✔ The results and lessons learned from the ZSM PoCs will be channeled to the ISG ZSM specification work.

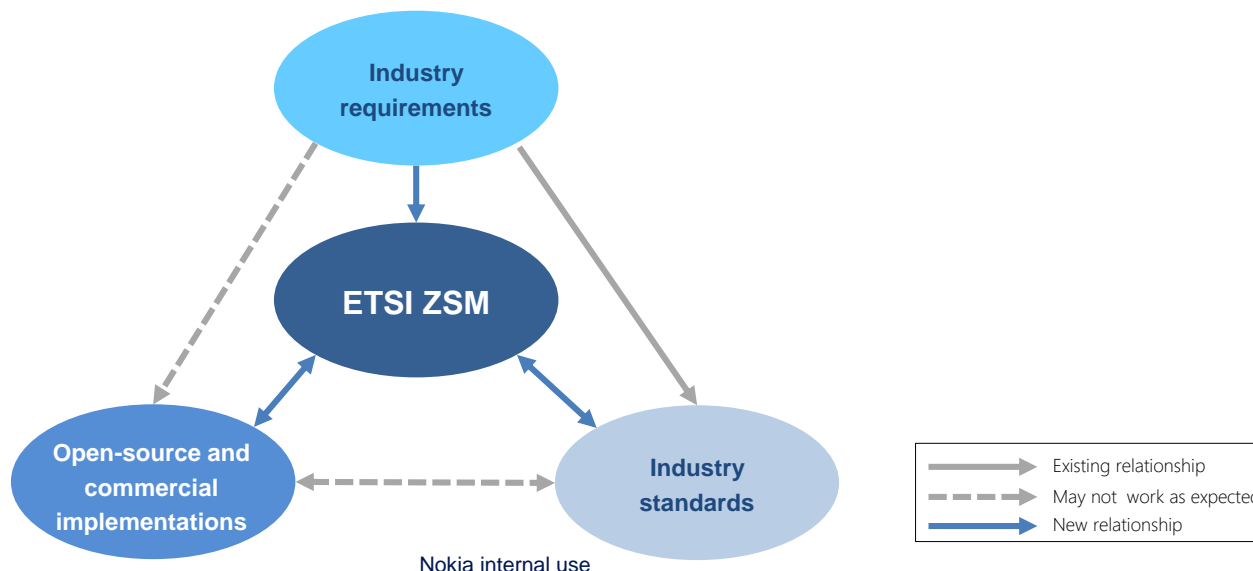
What next?

- ✔ The ISG will start working on solution for end-to-end cross-domain service orchestration and automation
 - ✔ A gap analysis will be conducted to ensure that existing activities are not duplicated and that the barriers to end-to-end automation are addressed
 - ✔ If a gap can be addressed by an existing body, that body will be encouraged to do the work to avoid duplication. The ISG will work to fill the remaining gaps.



Harmonization and collaboration across the industry

- ✔ Cooperation and alignment with other SDOs (including ETSI groups), forums and Open Source projects is essential to:
 - ✔ promote adoption of and alignment with the ZSM architecture and solutions;
 - ✔ achieve automated end-to-end network and service management
- ✔ The ISG ZSM intends to have an open dialogue with the related organizations and open source projects to encourage mutual convergence



Additional information

- ✔ ZSM Terms of Reference ([Link](#))
- ✔ ZSM technology page ([Link](#))
- ✔ ZSM blogs ([Link](#))
- ✔ ZSM Wiki, pointing to information related to ZSM PoCs ([Link](#))
- ✔ ZSM FAQ ([Link](#))
- ✔ List of members ([Link](#))
- ✔ Operators' white paper ([Link](#)) on the necessity of automation in end-to-end network and service management

Epilogue

- ✔ We have just embarked on an exciting journey towards the automation transformation that will help operators to meet user expectations for service agility and create new business opportunities.
- ✔ The ISG drives a highly focused and agile industry effort involving key players spanning the breadth of the ecosystem.
- ✔ The ISG is open for both ETSI members and non-ETSI members. The different players in the value chain are welcome to join the ISG effort, contribute to the development of the specifications and demonstrate Proofs of Concepts (PoCs).

Thank you



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Thank you!

