Zero-touch Network and Service Management

Operators' view on the necessity of automation in end-to-end network and service management, and operation

RATIONALE

This is a non-proprietary white paper authored by network operators.

The key objective of this whitepaper is to outline the necessity and benefit of automating network and service operation in next generation networks, and the usefulness of standardisation works in this area.

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1. Introduction and Problem Statement

The challenges introduced by the deployment of new network foundations such as NFV and new architectures such as 5G trigger the need to accelerate network transformation and radically change the way networks and services are managed and orchestrated. These new network architectures come with an extreme range of requirements, including massive capacity (perceived as infinite in practice), imperceptible latency, ultra-high reliability, personalised services with dramatic improvements in customer-experience, global web-scale reach and support for massive machine-to-machine communication. Networks are being transformed into programmable, software-driven, service-based and holistically-managed infrastructures, utilising enablers and catalysts, such as NFV, SDN and Edge Computing. New business models, including those enabled by technology breakthroughs such as Network Slicing, are being considered to support new markets, imposing unprecedented operational agility and higher cooperation across network and service domains. The resulting extended reach of network and service delivery, and the exponential increase in overall complexity of end-to-end management and operation makes automation a dire and urgent necessity.

2. Industry Direction

A new network & service management paradigm is required to manage such challenging environments, one that takes human intervention out of the loop in order to abstract and cope with increasing operation complexity while eliminating operational errors. Solutions must aim at enabling full end-to-end automation of network and service management including infrastructure orchestration.

In this regard, we see the necessity for a new cross-industry initiative responsible for introducing and harmonising new (future-proof) horizontal and vertical end-to-end solutions which enable agile, efficient and qualitative management and operational automation of emerging and future networks and services. In this context, horizontal end-to-end refers to cross-domain, cross-technology aspects, while vertical end-to-end refers to cross-layer aspects, from the resource-oriented layers up to the customer-oriented service layers. The goal is to have all operational processes and tasks (e.g., planning and design, delivery, deployment, provisioning, monitoring and optimisation) executed automatically, ideally with 100% automation and without human intervention.

An exemplar use case, automation of the end-to-end management aspects of 5G networks and services, is one of the key and urgent challenges for network operators and service providers. Success will only be assured if network and service automation becomes an integral part of future Operation and Support Systems (OSS). The network and service management functionality set(s) shall encompass and support MANO and EM capabilities.

3. Necessity for Harmonisation and Coordination

In pursuing the goal of full Automation of Network & Service Management and Operation (ANSMO), we see the necessity for coordination and cooperation among relevant standardisation organisations and open source projects. Mechanisms and means to ensure efficient and fruitful collaboration need to be identified, evaluated and leveraged. In order to take advantage of relevant previous results and current industry endeavours, a new industry collaboration initiative should be created and tasked with driving a cross-industry effort on ANSMO. Such an initiative would contribute to the coordination of work on the use cases, requirements, architecture, management interfaces design, and other specifications and recommendations necessary for a fully automated, multi-vendor ANSMO ecosystem (see Figure 1). Such an initiative should reach out to existing organisations in the automated management and operation ecosystem to avoid duplication and conflict, and to leverage existing specifications and solutions created by such organisations. Along with utilising existing specifications and solutions, the new initiative should also seek to address any gaps discovered while considering the end-to-end aspects of ANSMO.

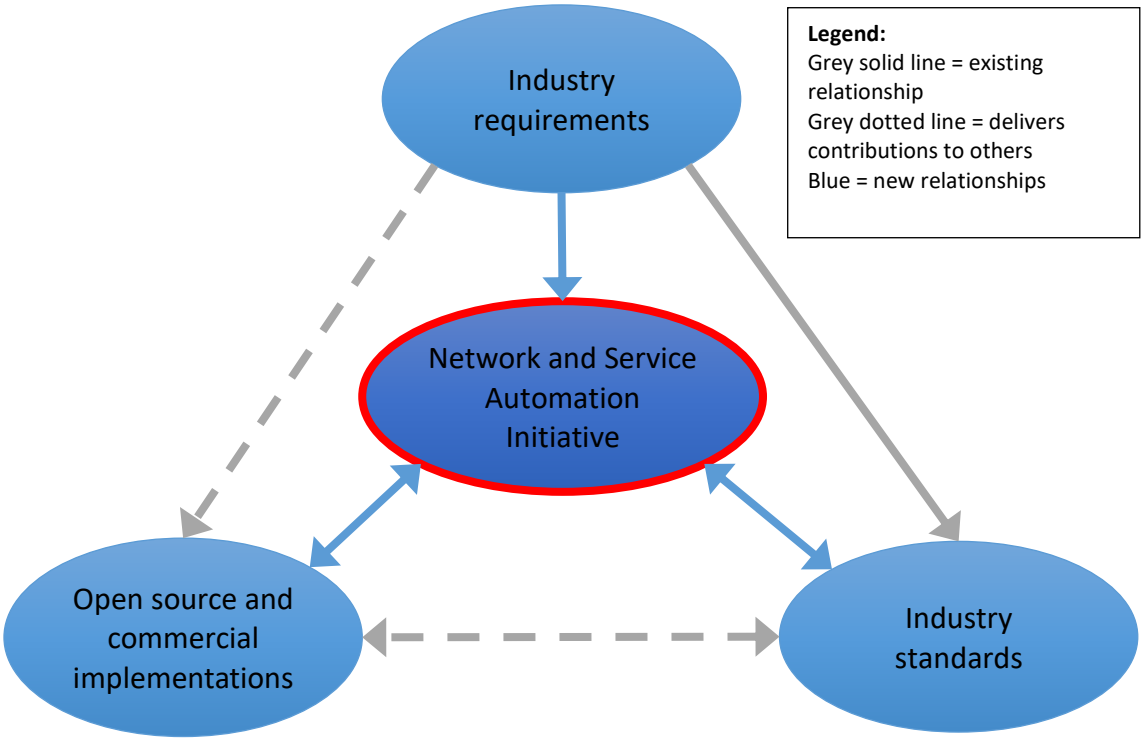

Figure 1: Network & service management automation initiative and its role in the end-to-end operation ecosystem.

We consider cooperation with other standardisation organisations and open source projects to be vitally important to ensure adoption of the architecture and solutions for ANSMO. Collaborative activities are expected to include: interoperability testing specifications, test platforms, acceptance testing and test results dissemination (to be considered in the specification activities) in the context of ANSMO.

This new initiative should maximise efforts to bring all relevant industry activities and outputs together through cooperation with related organisations including, but not limited to:

- Broadband Forum
- ETSI ISG ENI
- ETSI ISG MEC
- ETSI ISG NFV
- ETSI OSG OSM
- ETSI IPP 3GPP
- GSMA
- ITU-T
- IETF
- MEF
- NGMN
- OASIS TOSCA
- ONAP
- ONF
- TMF
- xRAN

Other organizations will be identified during the progression of the work.

4. Priorities for Network Operators

We consider the following items to be of highest priority to achieving our goal of full ANSMO:

- Enabling hybrid networks with end-to-end automated management of new virtualised network elements while supporting legacy OSS/BSS and legacy network and element management
- Enabling network and service management of end-to-end vertical resource
- Supporting a realistic evolution path starting with end-to-end automation of critical aspects and adding automation of additional aspects over time to permit real world deployments
- Defining an end-to-end network and service management concept including features and capabilities in the context of automation, based on a 5G use case (e.g. Network Slicing)
- Defining an end-to-end network and service management functional architecture and solutions (within the context of a cloud native architecture), including interfaces, APIs, protocols and information data models
- Enabling network and service management of inter-domain/service provider network

It is essential for the management of future networks that the end-to-end architecture is well understood and standardised in sufficient detail to enable harmonisation of standards and open source based solutions. Without a standardised/harmonised architecture, the key objectives will not be achievable. The architecture should consider cloud native solutions (e.g. based on micro-services architecture) and use a defined modelling language (e.g. YANG/TOSCA). The heterogeneity of YANG models should be limited and based on support for a common information model (CIM).

The architecture should be free of Element Management Systems (EMS) and VNF-specific VNF Managers (VNFM).

To achieve the target of full automation, tools and methods based on Artificial Intelligence (AI), Machine Learning (ML) and Big Data analytics should be considered.

Standardisation work to enable full automation of end-to-end ANSMO should address the above priorities and address industry barriers inhibiting delivery of a complete set of zero-touch network and service management (ZSM) solutions.

5. Call to Action

We recommend formation of a new industry collaboration initiative tasked with producing the following deliverables:

- Study and report market availability of VNFs which do not require EMS or VNF-specific VNFMs including estimation of transformation efforts towards generic VNFM capability
- Study and report on how Big Data analytics, Machine Learning and Artificial Intelligence can foster automation of network and service management
- Specification(s) for modelling artefacts (services, resources, policies, etc.) within a model-based design framework
- Propose a micro-services based architecture for network and service management considering existing open source and standards frameworks
- Study and report how hybrid networks spanning 2G-5G can be operated in a zero-touch manner including application of Network Slicing

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