ETSI NFV-MANO's future evolution will involve the adoption of select principles of cloud-native automation

March 2025

Joseph Attwood

In February 2025, ETSI released the report 'Report on architectural support for NFV evolution.' in which it outlines its ambitions for updating the NFV-MANO framework.[1] This report acknowledges many issues that Analysys Mason has previously identified with MANO and moves MANO more in-line with our proposed cloud-native automation (CNA) framework.

Telecoms operators have struggled to achieve operational efficiency benefits from MANO and so are turning to CNA solutions

Many telecoms operators say that MANO cannot effectively automate and orchestrate modern, cloud-native networks. MANO comes with many complexities due to its rigid and hierarchical architecture, the need to standardise across hardware vendors and dependencies on traditional NFV components (including the virtualised infrastructure manager (VIM), virtualised network function manager (VNFM) and network function virtualisation orchestrator (NFVO) components). Furthermore, its non-declarative nature limits its ability to support intent-driven automation, which is necessary for moving towards higher levels of autonomous networks.

Instead of MANO, operators are calling for CNA solutions that are intent-based, declarative and model-driven. These solutions should leverage the inherent automation capabilities of cloud environments and Kubernetes (K8s), such that automation is converged across all cloud components. Commonly, GitOps and configuration-as-data (CaD) approaches, as well as open-source components, are used as part of CNA.

Industry momentum behind CNA is growing and vendors are beginning to respond to industry demands for CNA products. For example, VMware has recently announced that it will be offering a CNA solution as an alternative to its legacy MANO-based automation solution, with Nokia planning to take a similar step. Additionally, work continues on Nephio.

---

[1] ETSI = European Telecommunications Standards Institute. NFV-MANO = network functions virtualisation management and orchestration. See the report here: ETSI GR NFV IFA 054.

Figure 1: Main features of CNA solutions compared with those of traditional automation solutions

	NFV MANO-based automation	Cloud-native automation
Automation approach	Imperative and script-based	Intent-based, declarative and model-driven
Architecture	Centralised and complex hierarchical architecture	Decentralised and streamlined architecture
Toolsets, data models and APIs	Vendor-proprietary, black-box automation components	Open-source, standardised and common cloud-native components
Operational models	Siloed network function and cloud infrastructure operations	Converged across all cloud components
CI/CD/CT	Fragmented, manual pipelines and technologies	Automated, pipelines through GitOps

Source: Analysys Mason

ETSI's aims include simplifying MANO, moving to a declarative approach and refocusing MANO on network cloud management

Perhaps in response to growing concerns about MANO's suitability, ETSI's latest report proposes a number of enhancements to MANO based on the network cloudification trends that it foresees.

In the report, ETSI acknowledges that the evolutionary path of MANO has left it too complex, with MANO having a high number of functional components and with complex interactions happening between these components. Consequently, it has identified architectural simplification as a key goal for MANO. To achieve this, ETSI plans to increasingly adopt modular design principles that will consolidate components into architectural blocks and move it away from a component-based design approach that has strong dependencies between components. Furthermore, it will aim to move towards a services-driven architecture to better align MANO with how operators view management and orchestration. The report also sets out plans to simplify integration with open-source components by specifying that ETSI will continue to take the approach of profiling (mapping) ETSI-specified management interfaces to open-source de facto APIs such as K8s and Helm.

In addition, ETSI plans to make MANO more declarative, shifting the complexity burden from operators using MANO to the developers of MANO. However, ETSI emphasises that it will not go "all in" on a declarative approach, instead opting for a balance between imperative and declarative mechanisms.

analysys mason

ETSI also aims to refocus MANO's scope so that its architectural views cover the entirety of telecoms cloud management more explicitly, which includes both telecoms cloud infrastructure and telecoms cloud applications. As such, ETSI is starting to adopt a taxonomy change, which it highlighted in its report: moving from 'NFV-MANO' to 'TC-MANO' (telecoms cloud MANO). This ambition bears a resemblance to one of the key principles of Analysys Mason's CNA framework: unifying the automation of xNFs, containers-as-a-service (CaaS) and cloud infrastructure.

ETSI also laid out its Telco Cloud and Orchestration Platform (TCOP) architectural framework in the report. This is a vision for a telecoms platform-as-a-service (PaaS) that will allow for many of MANO's existing capabilities to be reused and extended. At the OSS/BSS level, this architecture implements a component called 'Telco Cloud services (network-level),' which has the primary function of managing underlying infrastructure and applications to reconcile specified network/service intents. ETSI suggests that this architecture will facilitate declarative approaches, infrastructure as code and GitOps, as well as allowing K8s' Custom Resource Definitions (CRDs) to be used for telecoms cloud application orchestration.

ETSI's plans will be welcomed by current users of MANO and those that plan to use MANO alongside CNA in the future

Despite the benefits of CNA, many operators are likely to continue using MANO in the near future. Operators may be unwilling to migrate to CNA solutions due to the immaturity of these solutions, sunk costs with MANO and the cost of entirely replacing their legacy automation. There are also outstanding questions about the suitability of K8s-based automation for end-to-end service orchestration. In addition, it may be especially challenging to replace MANO with CNA in the transport domain because MANO is widely used for transport switching, routing, IP applications and WAN domains, which are difficult to move to fully cloud-native environments.

While MANO has previously evolved to support containers and K8s, it does not seem that MANO will fully embrace all of our CNA principles – mentions of critical CNA attributes such a K8s-based automation and GitOps are not prominent enough in the report for this to be the case. Therefore, rather than these changes positioning MANO as an alternative to CNA solutions, they may more critically enable MANO to be used more effectively alongside CNA within operators' environments. MANO and CNA together could support the orchestration of both virtual machine-based and container-based infrastructure and applications, potentially with MANO's NFV orchestrator component continuing to play a substantial role in co-ordinating orchestration across domains.

It should be noted that ETSI has not provided expected timescales for implementing its proposed changes. Consequently, this evolution may be too little, too late to reverse growing disillusionment with MANO among advanced operators that have the appetite to adopt alternative automation/orchestration solutions.