

# Management and Orchestration Challenges in Network Functions Virtualization

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## Abstract

This paper gives an overview of ETSI NFV MANO framework. And then present projects and vendor products related to MANO, and discuss their features and relationship with the framework. Finally describes challenges of open MANO and opportunities for future research.

## 1 Introduction

Network providers provide network functions(NFs) to their customers. Traditionally NFs are deployed at customers place but this is costly so NFV came into picture. NFV decouples NFs from dedicated hardware and moves the function into virtual servers. NFV aims to reduce OpEx by automation and scalability. Increased flexibility can also lead to more efficient utilization of resources and hence reductions in CAPEX.

Management of NFV is done by MANO. MANO is a working group of ETSI. It is the ETSI defined framework for management and orchestration of all resources in cloud data centre. In this paper, MANO projects and products are classified in two ways. Firstly their functionality is mapped to the functional blocks of the ETSI MANO framework, and then their features are studied[5].

## 2 Model Description

ETSI MANO framework has 3 main entities.

- NFV architectural layers - Includes NFVI and VNFs
- Network management systems - Includes element management (EM), operation system support (OSS), and business system support (BSS).
- NFV management and orchestration - Includes VIM, VNFM, NFVO, Data Repositories.

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NFV MANO is broken up into three functional blocks. Together, these blocks are responsible for deploying and connecting functions and services when they are needed throughout the network. Brief explanation of each block is as follows:

1. **The Virtual Infrastructure Manager(VIM) : Model description**

As we know, the NFV architectural layers include the NFVI and VNFs. VIM Controls and manages the NFVI compute, storage, and network resources. It can directly manipulate NFVI resources and also forwards performance measurements and events information to NFVO and VNFM. NFV architecture may contain more than one VIM[6].

2. **Virtual Network Function Manager(VNFM):**

Oversees lifecycle management of VNF instances. The VNFM and the Element Management System (EMS) are closely aligned in providing overall management support for the VNF. VNFM can be generic when VNFM and VNF can be from different providers. VNFM can still execute VNF specific standardized scripts[6].

3. **NFV Orchestrator:**

It directs both VNFM and VIM and is Responsible for on-boarding, Instantiating, Scaling up or scaling down, Updating of network services (NS) and virtual network function (VNF) packages[6].

### 3 Related Work

Below are the projects and products related to NFV MANO.

1. **CloudNFV:** The goal was to add more management and orchestrations capabilities. The main difference between the ETSI NFV MANO and CloudNFV is that CloudNFV considers both management and orchestration as applications.

“Active Virtualization” model consisting of Active Contracts and Active Resources, elements that could be built to help service providers deploy VNFs. Active Contracts would consist of standardized service templates for particular VNFs, while Active Resources uses policy rules to designate the best hardware and infrastructure to be used to deliver these VNFs[2].

2. **EXPERIASPHERE:**

Approach was to outline a service as a group of functional objects that were vertically integrated from the service level to resources. The objects were created by writing a Java application[3].

3. **OPENMANO:**

It develops and tests an Integrated open source platform and includes service providers and end users as well to validate that OPNFV meets the needs of user community. Main focus is to integrate what already exists[8].

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#### 4. **ZOOM:**

It regularly conducts demos called catalyst projects which brings together companies to create innovative solutions to common challenges[10].

#### 5. **CloudBand**

It has two elements: a node and a management system. Node is to host cloud services where as management system is to aggregate cloud resources and also it automates, and optimizes VNFs[7].

#### 6. **Ensemble Service Orchestrator**

It supports both centralized and distributed data centre for VNF placement. ESO uses OpenStack cloud controller bundled with the system to manage the virtual compute environment, including virtual machines, Open vSwitches and top-of-rack data center switches[5].

#### 7. **OpenNFV**

Main agenda is to provide end to end NFV and SDN infrastructure. NFV director acts as NFVO which makes sure each VNF run efficiently on hardware platforms. Helion Openstack is responsible for providing a platform to run VNFs[4].

#### 8. **Open Network Strategy**

Cisco's Open Network Strategy (OPN) provides SDN controller which connects virtualized services both to the service provider VPNs and the Internet. VNFM can take a responsibility of life cycle management of third party VNFs also[1].

#### 9. **Planet Orchestrate**

It has multi-vendor management capabilities. TOSCA formats and data models are used to characterize components and their connections[5].

## 4 Challenges And Research Opportunities

Few of the challenges and Research opportunities are given below:

1. **Resource Management:** Multiple functions would be hosted in a single VM which requires scheduling approaches for allocating the VM resources. Scalability can be achieved by this. Automation and self allocation to dynamically manage resources instead of manual trigger by the user
2. **Management of SDN:** "SDN and NFV gives information technology professionals better control of network performance, cost, and security parameters. The centralized, software-based nature of these technologies allows them to more closely align these parameters with the needs of the application", says Shawn Hakl, vice president of networking and managed services at Verizon. Key research area here

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is the management of both SDN and NFV together efficiently This section is from the Reference [9].

**3. Security in the cloud:**

In case of multi vendor environment, one TSP challenger might have an access to different TSP's data. So isolation between the two is very Important. The MANO products which provides security are cloud band,Planet Orchestrate and ZOOM.

**4. Management across the board:**

For multi vendors, management of all FCAPS is very challenging.

**5. Interfacing And Interoperability:**

Proposed projects and products have customised models for service. So it would be difficult to combine functions of different operators into a single service. Interoperability is the main key here.

In this regard the Alliance for Telecommunications Industry Solutions (ATIS) has proposed seven use cases which are generic that Is they do not provide any technical requirements that could be used to enable use cases.

## **5 Conclusion**

NFV MANO architecture proposed by ETSI as well as other projects and products related to MANO framework are presented in this article. These projects are compared with NFV MANO and their future research opportunities are discussed

We look at that MANO nonetheless lacks some requirements when implementing interfaces. Most of the functionalities in these tasks are customized which leads to interoperability problems. Security is also the main concern. Another factor for the success of NFV can rely on the mechanisms that are ready to autonomously manage network and performance resources.

## **References**

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