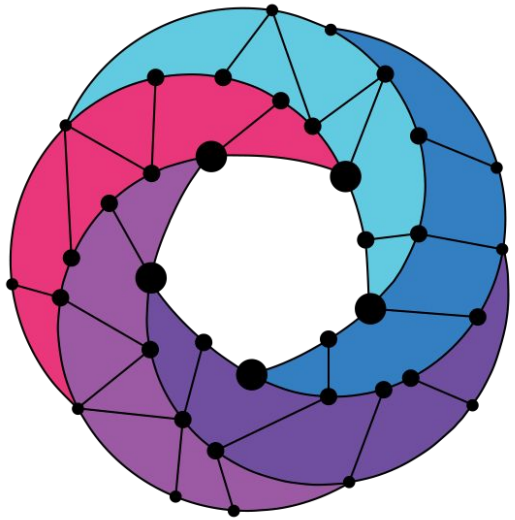
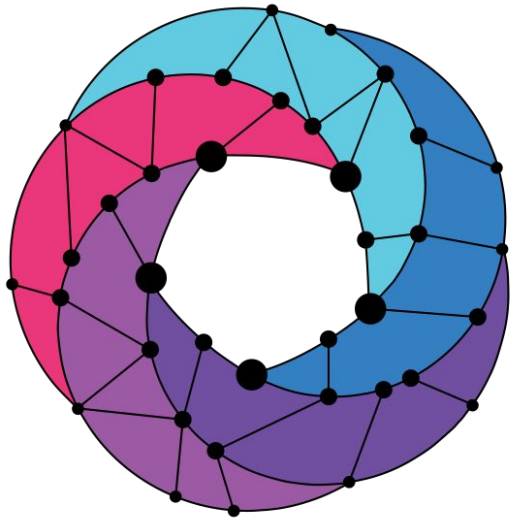


Open Source
MANO

OSM 7th Hackfest

ETSI



Open Source
MANO

OSM 7th Hackfest – **Welcome**

Spyros Denazis (University of Patras)
sdena@upatras.gr

ETSI

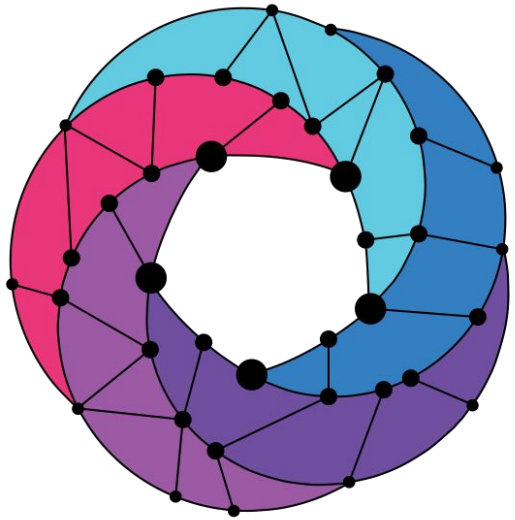
Hackfest program

OSM-MR#7 & Hackfest Patras	MONDAY 9 Sept	TUESDAY 10 Sept	WEDNESDAY 11 Sept	THURSDAY 12 Sept	FRIDAY 13 Sept
09:00..10:30 (1h30)	LG	TECH / S2 Basic Descriptors	TECH / S6 Day 1/2 Config	S11 Robot Framework	TECH / S10 How to Contribute; Q&A & Wrap-up
10:30 ..11:00 (0h30)	COFFEE BREAK				
11:00..13:00 (2h00)	EUAG	TECH / S3 Multi VDU; S4 Advanced Descriptors	TECH / S6 Day 1/2 Config	TECH / S8 Network Slicing	DEMO 3 - Canonical; DEMO 4 - Tata Elxsi; DEMO 5 - Whitestack
13:00..14:00 (1h00)	REGISTRATION	LUNCH BREAK			
14:00..16:00 (2h)	Welcome; TSC / S0 Intro; DEMO 0	TECH / S5 Day 0 Config	TECH / OSM & 5G Verticals	TECH / S7 Fault & Perf Mgmt	
16:00..16:30 (0h30)	COFFEE BREAK				
16:30..18:00 (1h30)	TSC & MDL / S1 OSM Install	DEMO 1 - DPB WIM; DEMO 2 - VNF Onboarding	TECH / OSM & 5G Verticals	TECH / Overflow and Q&A	

19:00 ...

Social Gathering

Slides



Open Source MANO

OSM 7th Hackfest – **Introduction**

José Miguel Guzmán (Whitestack)
jmguzman@whitestack.com

ETSI

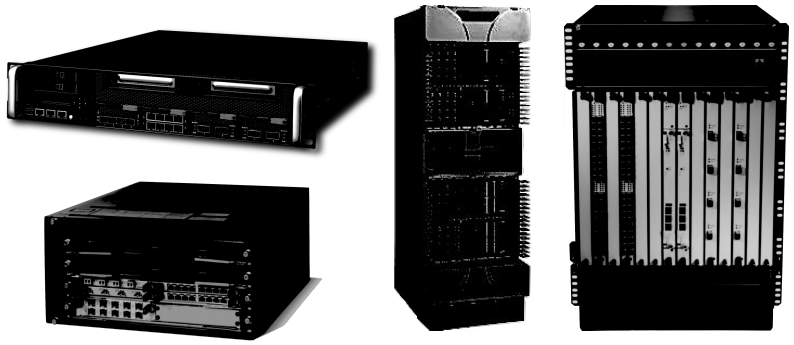
Agenda

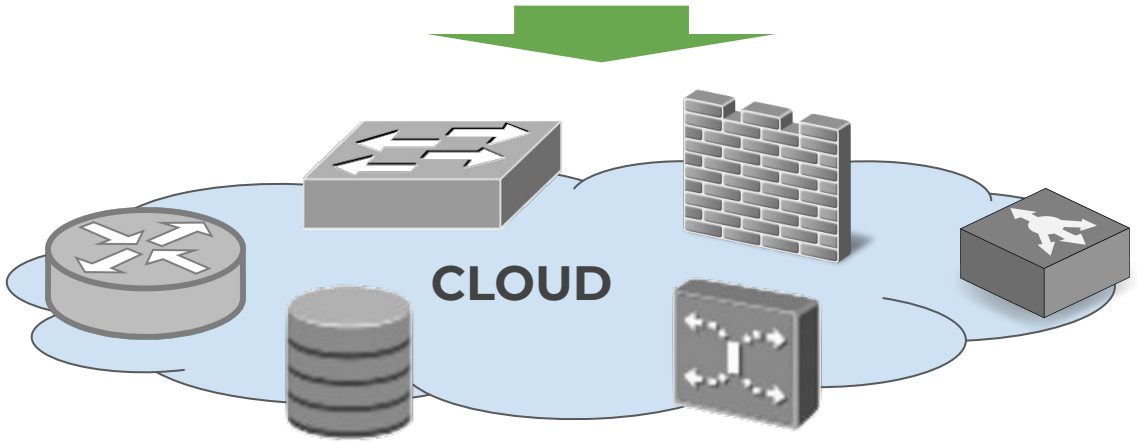
- Quick review of NFV
- Introduction to the latest OSM Release

Open Source MANO

Quick review of NFV

What is NFV trying to address?



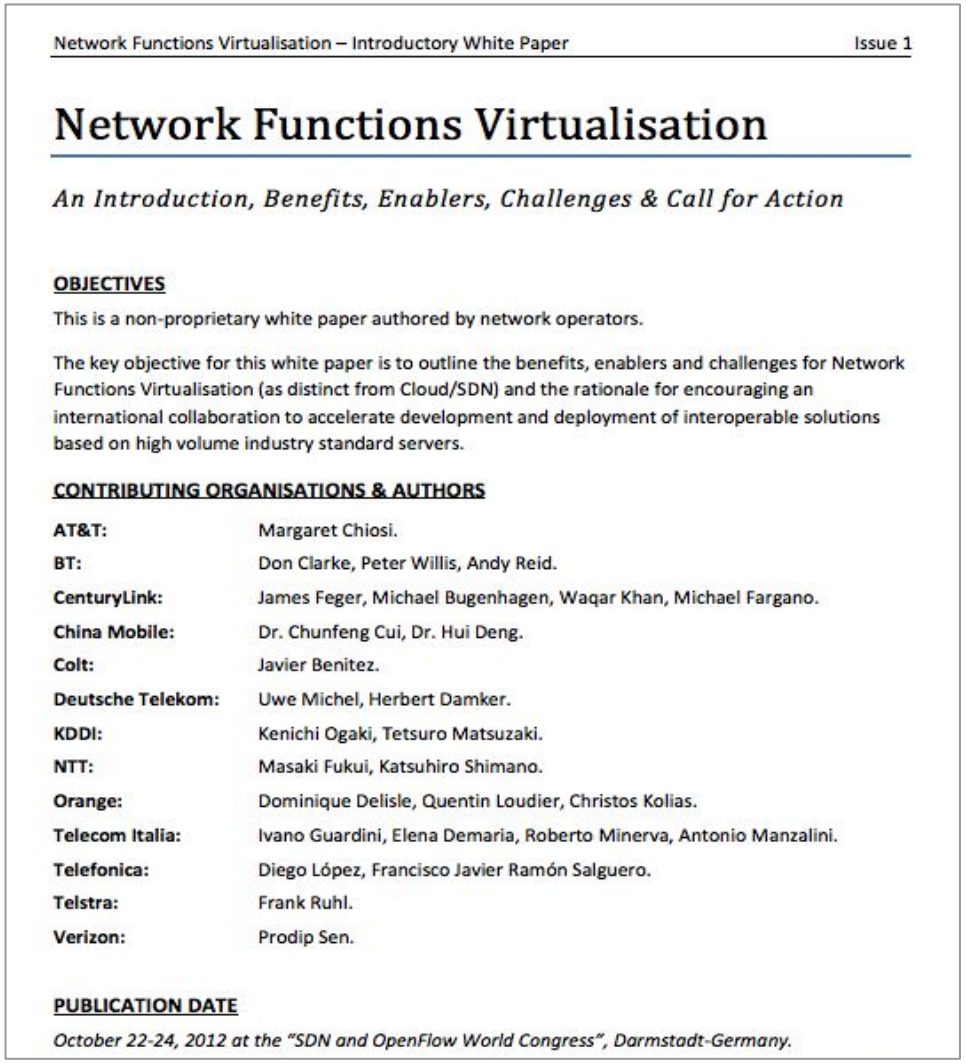


- Network Function Virtualization (NFV) proposes to **virtualize network functions that typically run in dedicated appliances**
- The main goal is to **support virtualized functions over COTS servers.**
- Virtual Network Functions (VNFs) acquire **all the advantages of Cloud** Applications!

The original idea…. triggered an industry movement

Open Source MANO

- Initial white paper was written in 2012 by the world's leading telecom network operators (Europe, América & Asia).
- This group evolved to the ETSI NFV ISG (Industry Specification Group), formed today by 300+ companies.
- Their main motivation had to do with reducing TCO of building a network by using open solutions.



Network Functions Virtualisation – Introductory White Paper Issue 1

Network Functions Virtualisation

An Introduction, Benefits, Enablers, Challenges & Call for Action

OBJECTIVES

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

The key objective for this white paper is to outline the benefits, enablers and challenges for Network Functions Virtualisation (as distinct from Cloud/SDN) and the rationale for encouraging an international collaboration to accelerate development and deployment of interoperable solutions based on high volume industry standard servers.

CONTRIBUTING ORGANISATIONS & AUTHORS

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Verizon:	Prodip Sen.

PUBLICATION DATE

October 22-24, 2012 at the "SDN and OpenFlow World Congress", Darmstadt-Germany.

https://portal.etsi.org/nfv/nfv_white_paper.pdf

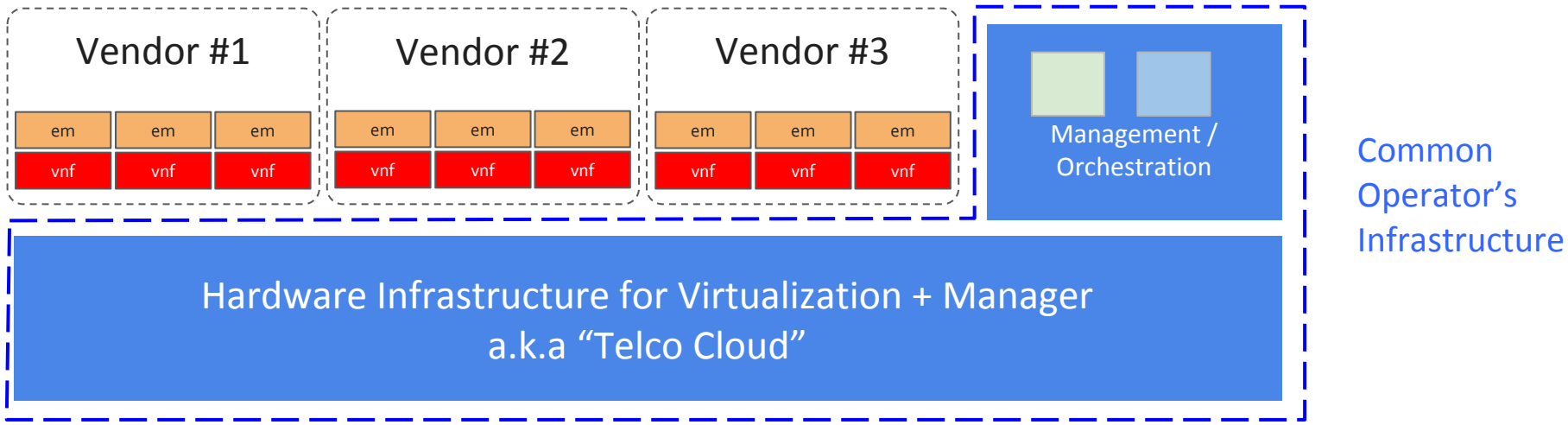
ETSI Publications

- Based on member's feedback, field experiences and proof of concepts, standard documents have evolved.
- 60+ publications exist today, including the following three main documents:
  - NFV Architectural Framework
    http://www.etsi.org/deliver/etsi_gs/NFV/001_099/002/01.02.01_60/gs_NFV002v010201p.pdf
  - NFV Infrastructure Overview
    http://www.etsi.org/deliver/etsi_gs/NFV-INF/001_099/001/01.01.01_60/gs_NFV-INF001v010101p.pdf
  - NFV Management and Orchestration
    http://www.etsi.org/deliver/etsi_gs/NFV/001_099/002/01.02.01_60/gs_NFV002v010201p.pdf

http://www.etsi.org/standards-search

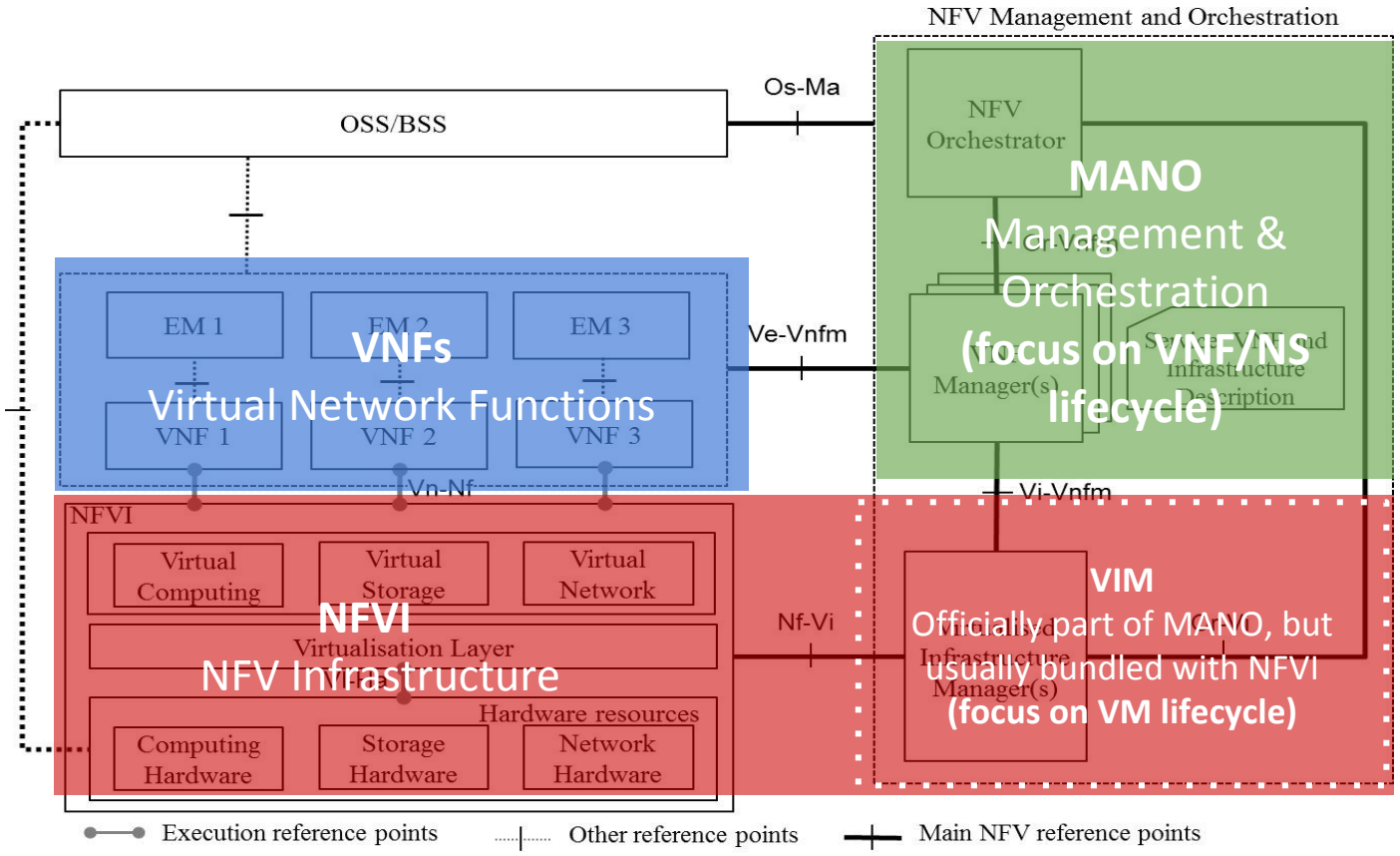
Benefits of a standard NFV architecture

We are looking for a **unified and generic virtualization infrastructure**, compatible with any vendor's Virtual Networking Function (VNF), **so standardization is a must**.



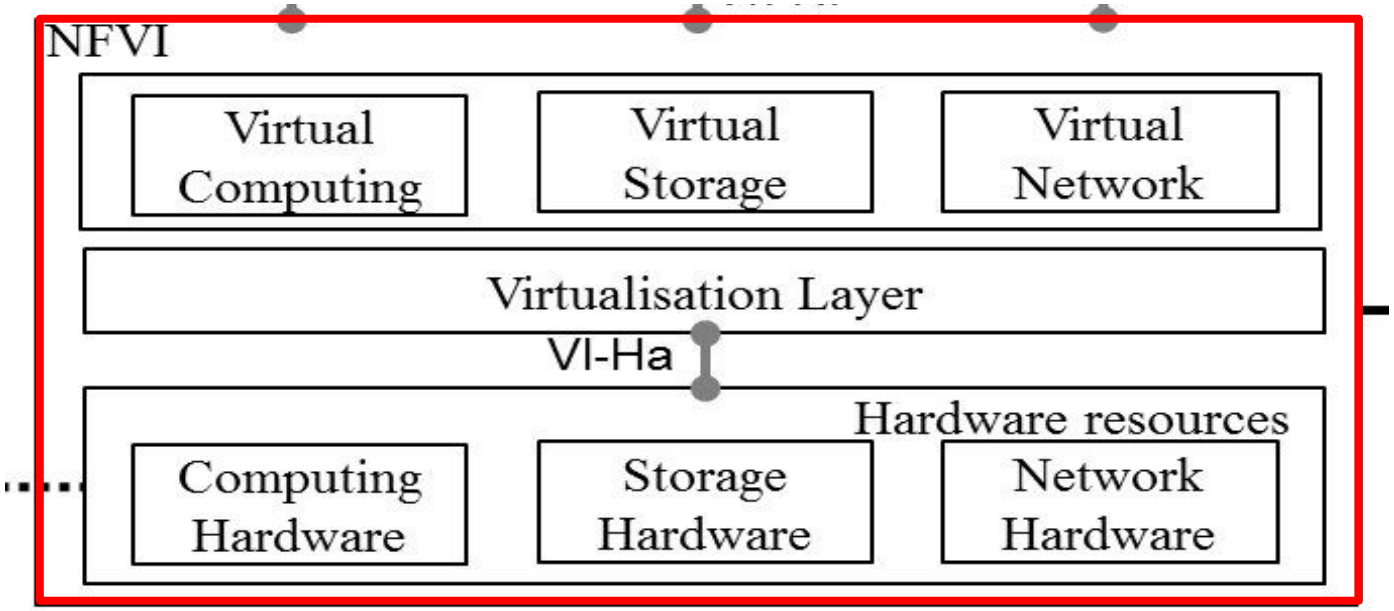
The ETSI NFV Architecture

The standard architecture can be better understood in three blocks:



NFVI:
NFV Infrastructure

NFVI goal is to provide a virtualization environment for VNFs, including virtual compute, storage and networking resources.



- But!

  Networking applications may have more strict performance requirements, we will discuss that later.

NFVI: NFV Infrastructure

VNF Special Requirements

VNFs, especially data-plane ones, usually have additional requirements than common cloud applications, including:

- **Minor latency** (disk I/O & network)
  → Faster hardware (More cores, SSD disks, faster buses)
  → Dataplane acceleration
- **Higher throughput or PPS**
  → Dataplane acceleration
  → EPA: Enhanced Platform Awareness
- **Geographical distribution**
  → multi-site cloud
- **Horizontal auto-scaling**
  → automated operations (orchestration)

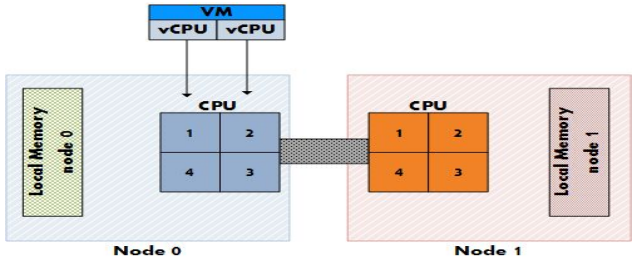
NFVI: NFV Infrastructure

VNF Special Requirements

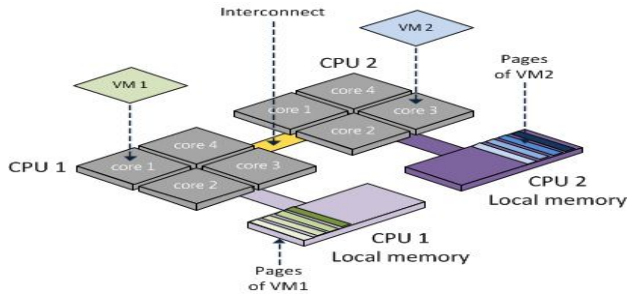
EPA covers the different approaches that can be taken at the NFVI layer to increase performance while maintaining a generic (COTS) infrastructure. VIM and MANO should be able to request them.

Huge Pages

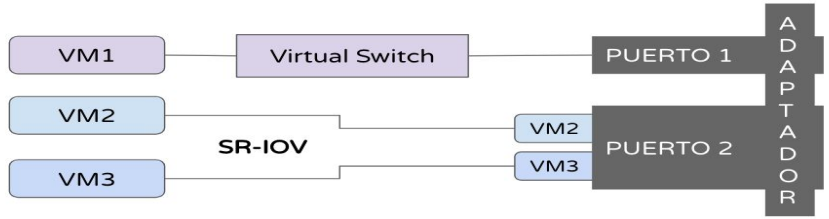
NUMA Topology Awareness



CPU Pinning

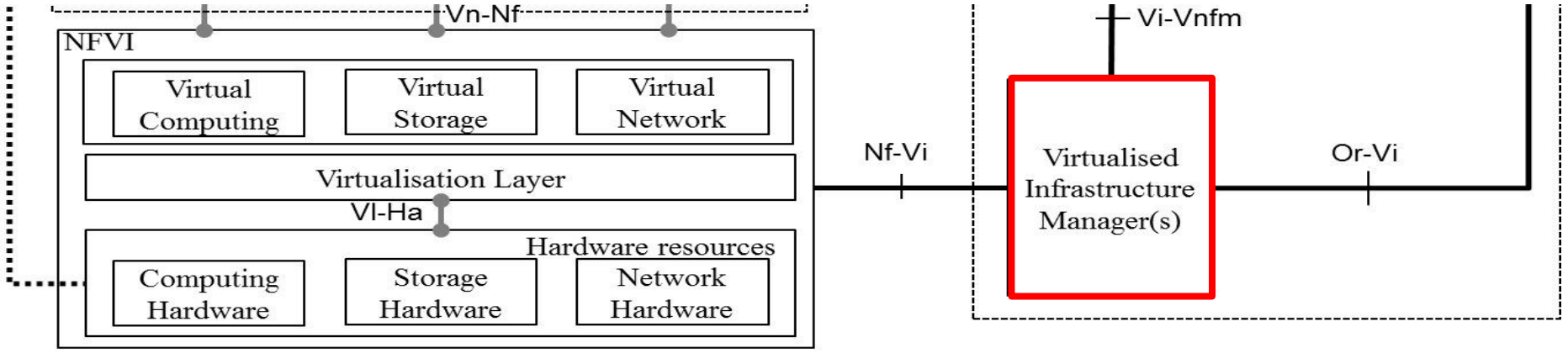


Data Plane assignment



VIM:
Virtualized Infrastructure Manager

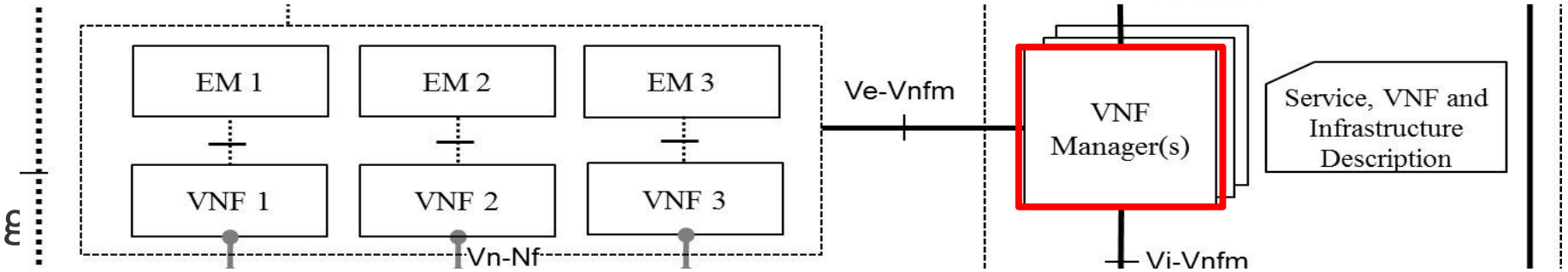
- The Virtualized Infrastructure Manager is part of the ‘MANO Stack’ and addresses provides lifecycle management for virtualized resources (VMs, volumes, networking paths and connectivity, etc.)



VNF-M:
VNF Manager

- The VNF Manager, also part of the ‘MANO Stack’, covers **lifecycle management for Virtual Network Functions** (VNFs), either directly or through their own Element Management System (EMS).

- VNF Manag

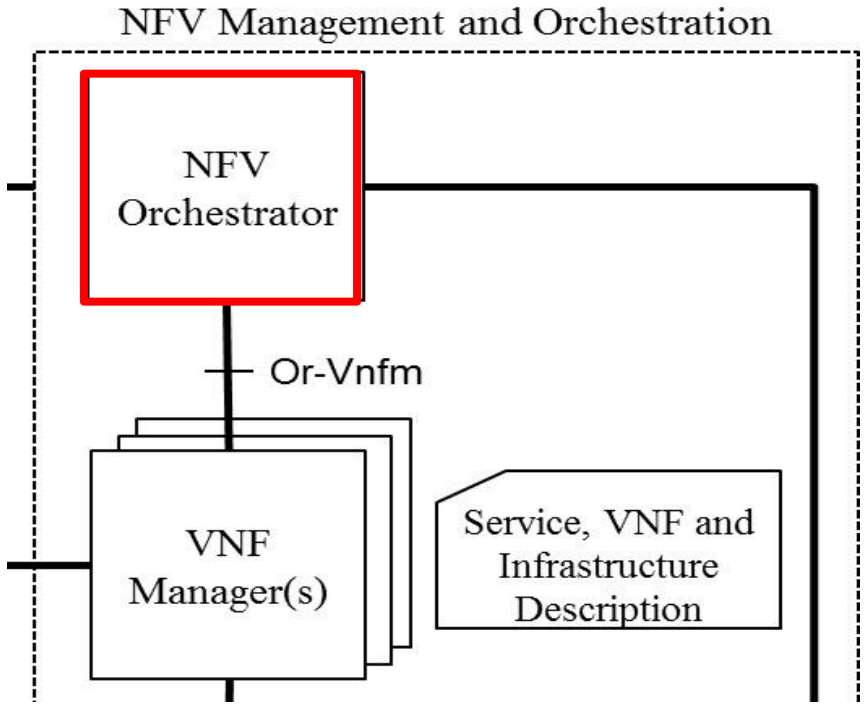


CANONICAL

Juju

MANO: NFV Orchestrator (NFV-O)

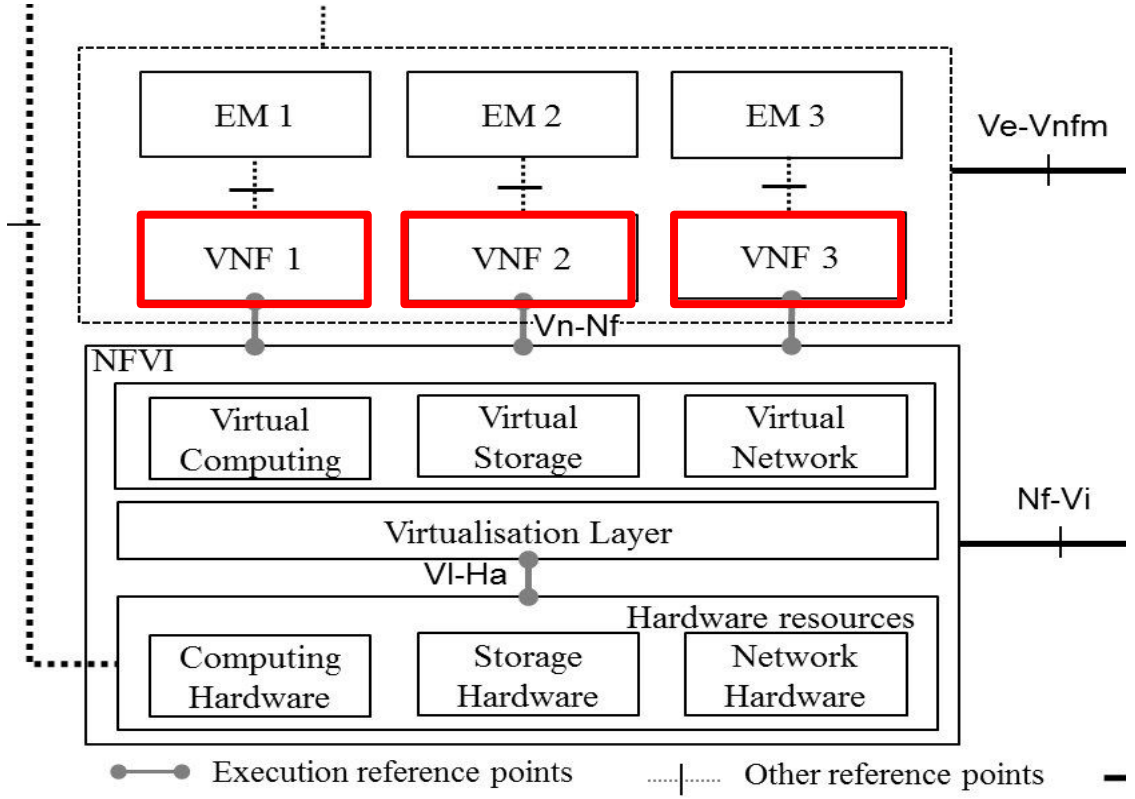
- The NFV Orchestrator, the higher entity in the ‘MANO Stack’, covers general resource orchestration and services lifecycle, which comprise multiple VNFs and define their roles (traffic paths, scaling decisions, and other service-related requirements)
- It can interact with a generic VNF Manager, or vendor-specific ones.



LCM & RO

Virtual Network Functions (VNF)

- Finally, the VNFs, which are supported by the underlying NFVI, and managed by their own EM (internal manager) and the VNF Manager (external, ‘context-aware’ manager)
- They should be able to provide any networking function and interact with other VNFs.



VNF Descriptor files (VNFD)

One of the most important aspects of achieving a unified VNF catalogue, is having a standard way of describing VNFs.

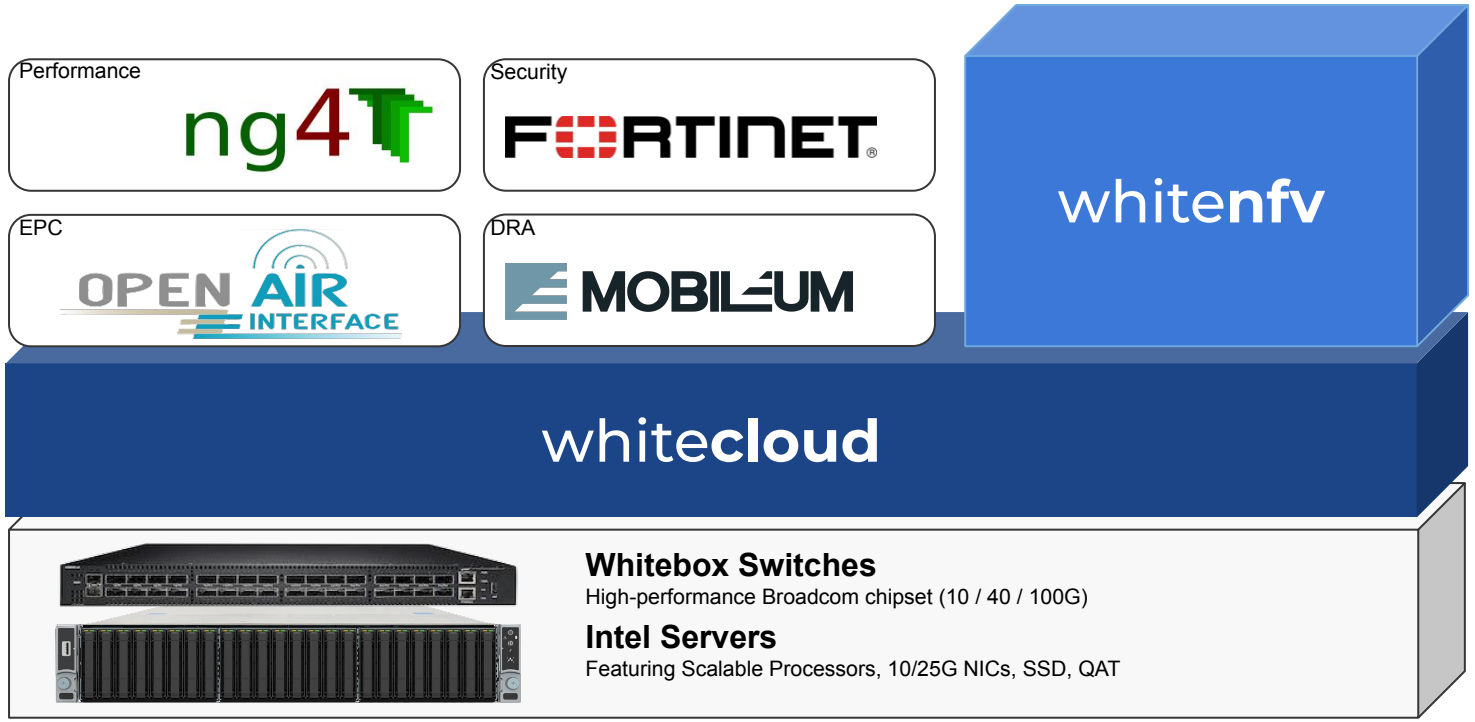
- MANO solutions should give the possibility to describe VNFs through ‘descriptor files’
- The industry’s goal is a unified and standard descriptor file format across different platforms.
- Both NS (comprised of VNFs) and VNFs should be described in a simple way.

```
vnfd:vnfd-catalog:
    vnfd:vnfd:
    -   vnfd:connection-point:
        -   vnfd:name: eth0
            vnfd:type: VPORT
        vnfd:description: Generated by OSM pacakage generator
        vnfd:id: ubuntuvnf_vnfd
        vnfd:mgmt-interface:
            vnfd:cp: eth0
        vnfd:name: ubuntuvnf_vnfd
        vnfd:service-function-chain: UNAWARE
        vnfd:short-name: ubuntuvnf_vnfd
        vnfd:vdu:
        -   vnfd:cloud-init-file: cloud_init
            vnfd:count: '1'
            vnfd:description: ubuntuvnf_vnfd-VM
            vnfd:guest-epa:
                vnfd:cpu-pinning-policy: ANY
            vnfd:id: ubuntuvnf_vnfd-VM
            vnfd:image: ubuntu_admin
            vnfd:interface:
            -   rw-vnfd:floating-ip-needed: 'false'
                vnfd:external-connection-point-ref: eth0
```

Multi-vendor NFV Showcase

with the support of **leading NFV-enablers,** putting together a number of leading VNF vendors, on top of commoditized x86 infrastructure, managed by OpenStack and Open Source MANO.

Goal: to demonstrate publicly that multi-vendor networks are possible



ETSI

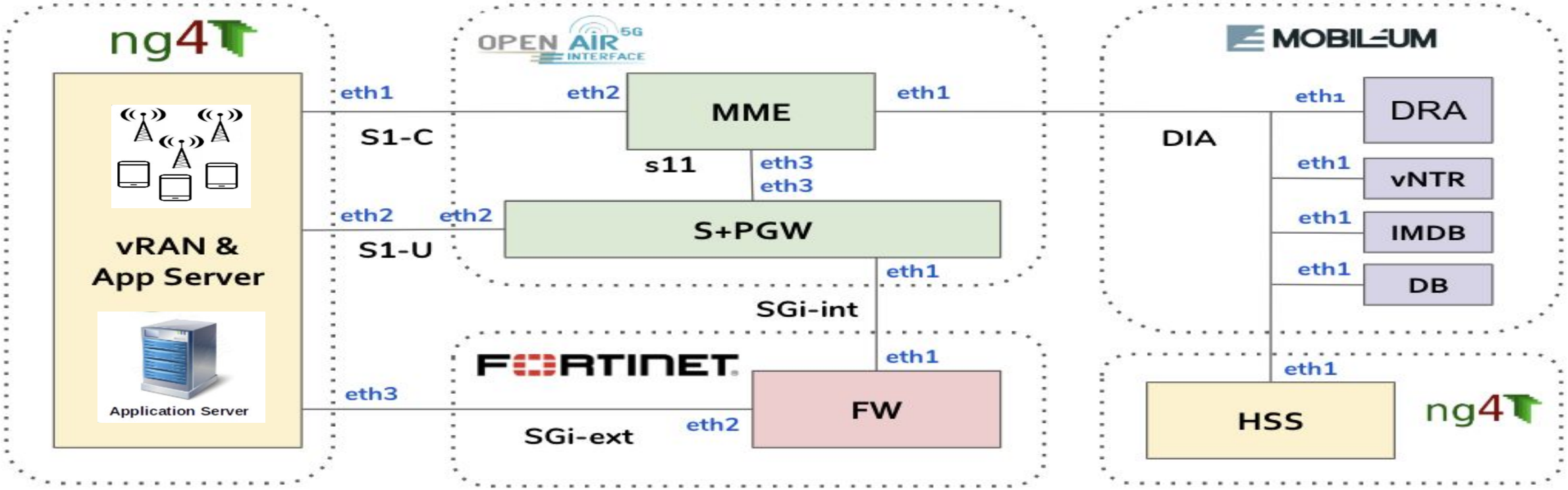
Open Source MANO

openstack.

intel

Multi-vendor NFV Showcase

- **ng4t** VRAN: Emulates the vRAN
- **OpenAir Interface**: Implement the vEPC (MME, SGW, PGW)
- **Fortinet**: implement security
- **Mobileum**: implement DRA and NTR (Roaming Steering)



Multi-vendor NFV Showcase

Open Source MANO

Day-0, Day-1 and Day-2

Open Source MANO

Day 0:
Instantiate

cloud-init

Isolated VNFs

FORTINET

OPEN AIR INTERFACE

MOBILEUM

ng4T

Open Source MANO

Day 1:
Build Service
(automated)

juju

Evolved Packet Core

FORTINET

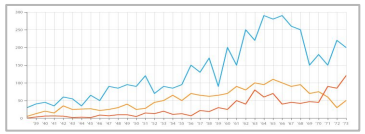
OPEN AIR INTERFACE

MOBILEUM

ng4T

Open Source MANO

Day 2:
Operate
(on demand)



juju

Evolved Packet Core

FORTINET

OPEN AIR INTERFACE

MOBILEUM

ng4T

Multi-vendor NFV Showcase

The final results, including configurations used for deploying this vEPC, are published, following the guidelines from **ETSI Plugtests Programme.**

https://www.whitestack.com/posts/results-multivendor-nfv-showcase/

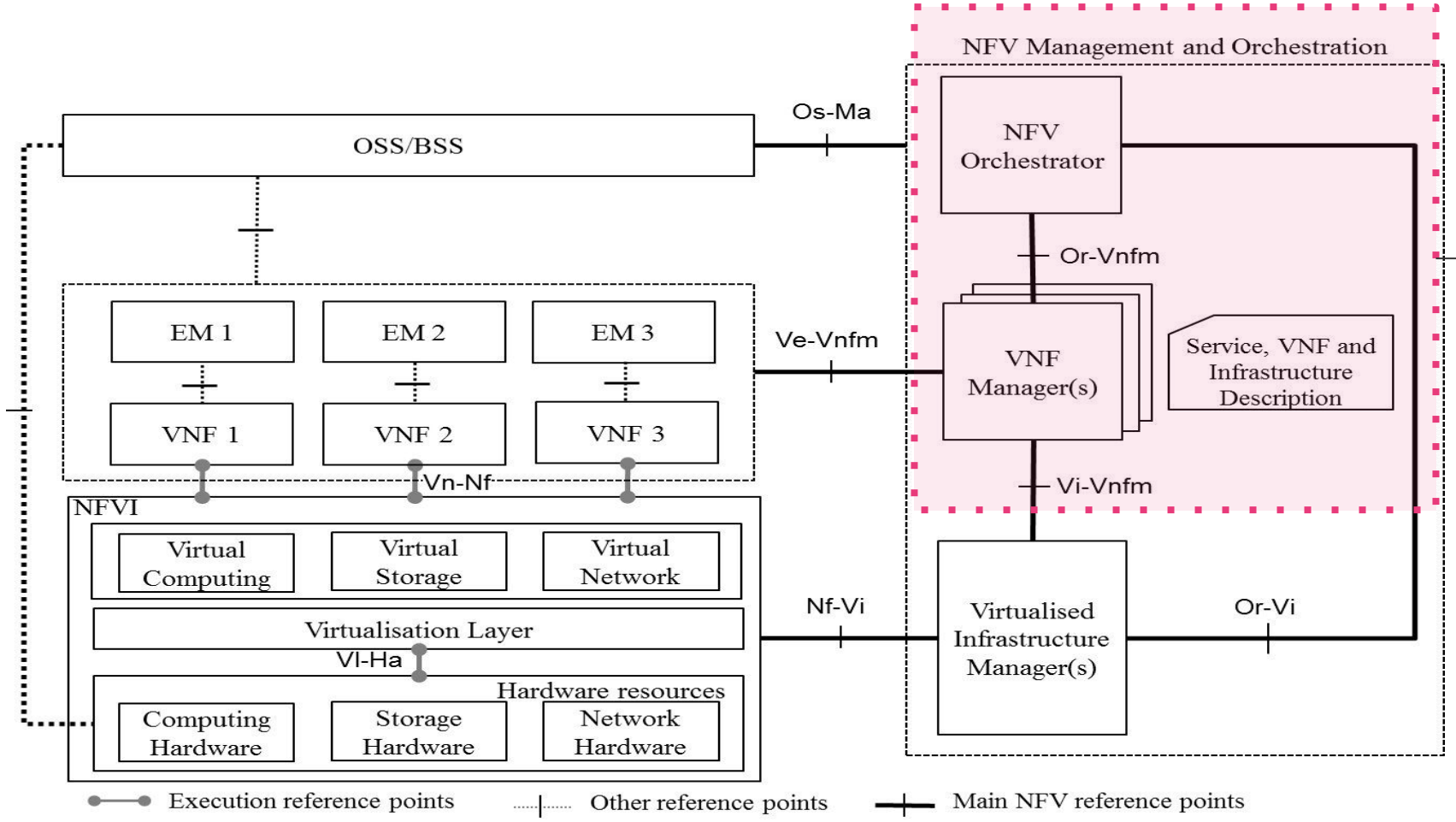
Open Source
MANO

Introduction to OSM Release Five

The NFV MANO Landscape

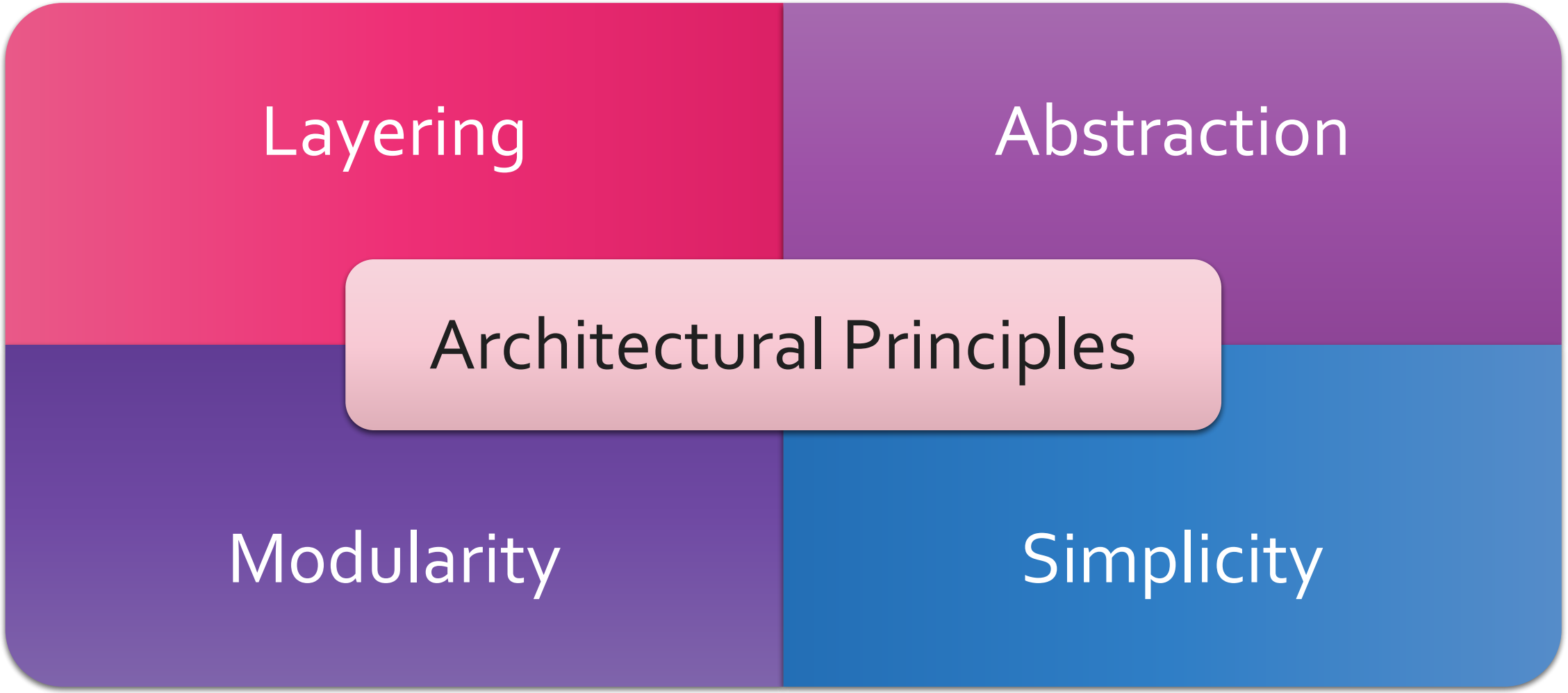
- Given that the VIM is already well covered by OpenStack distributions and proprietary solutions (e.g. vCD), in practice, **the "NFV MANO" part focuses on the VNF Manager and NFV Orchestrator.**
- Among the most popular open source platforms for NFV MANO, we have:

The Open Source MANO Project



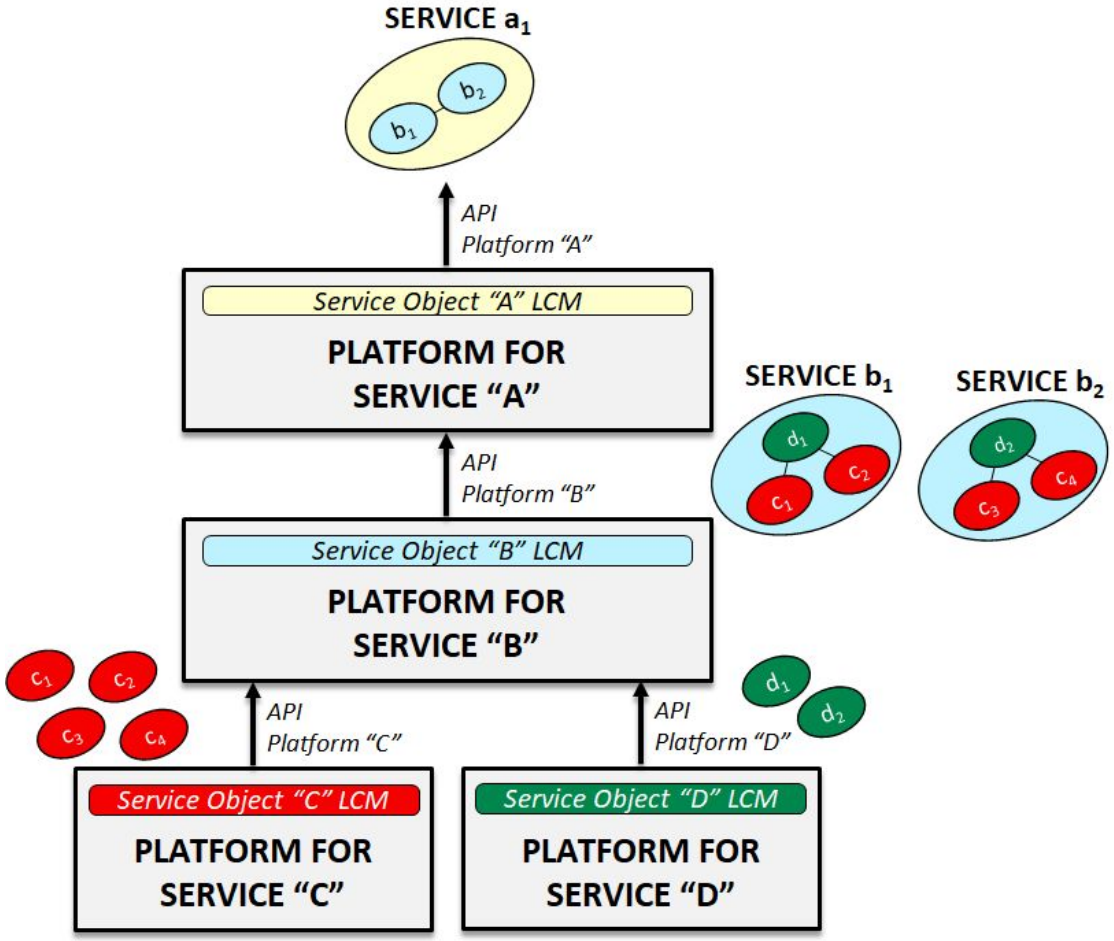
We are here!
Open Source MANO is an ETSI-hosted project to develop an Open Source NFV Management and Orchestration (MANO) software stack aligned with ETSI NFV.

OSM Architectural Principles



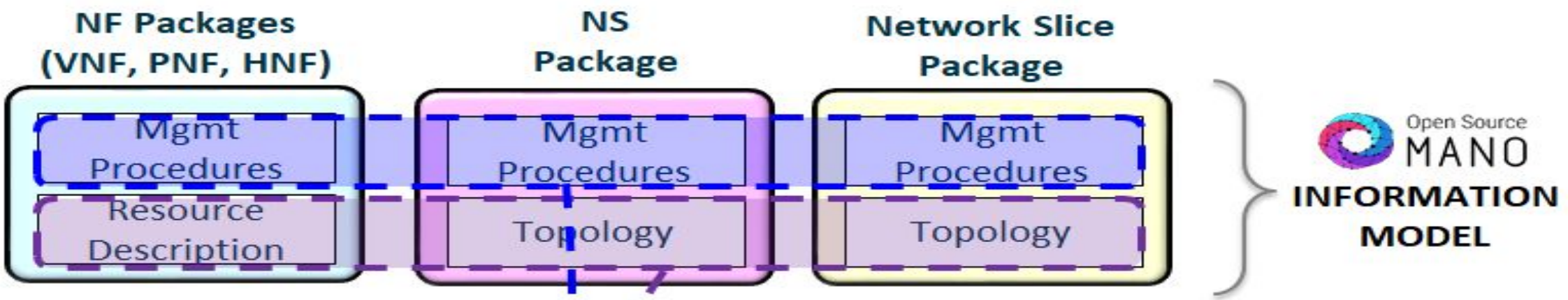
Layered Model

A multilayered model, where each layer provides a “service object”, composed by service objects provided by lower layers.



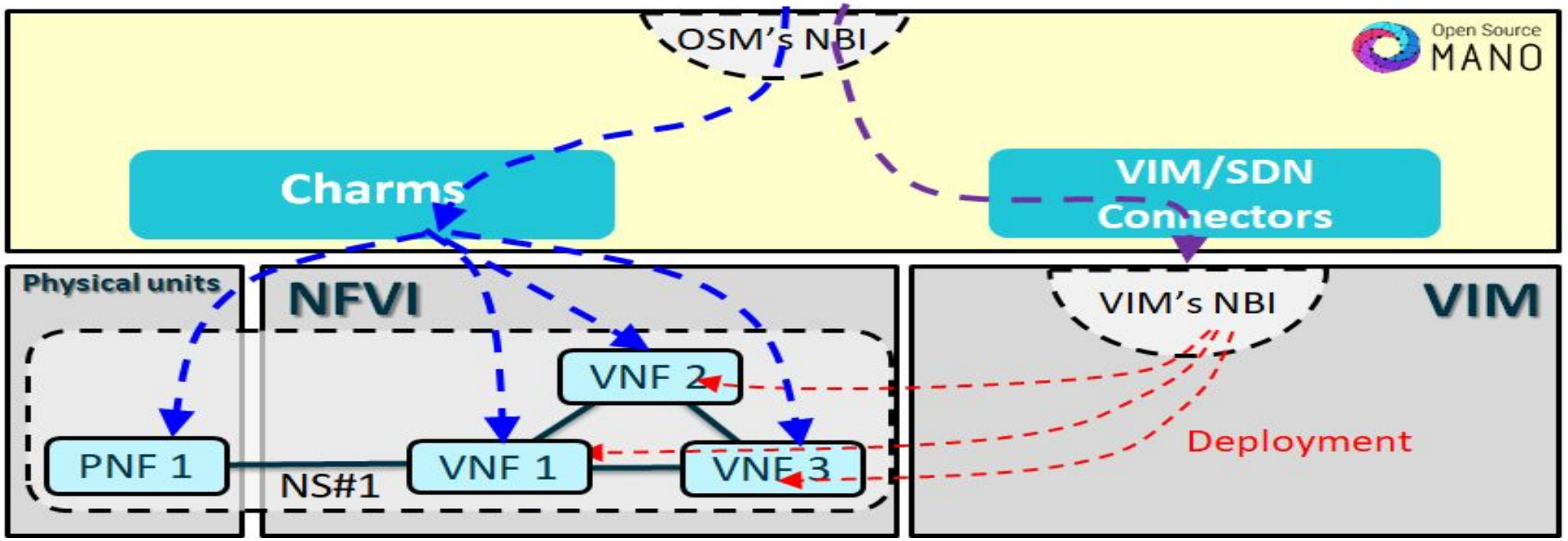
OSM's approach aims to minimize integration efforts

1. **A well-known Information Model (IM)**, aligned with ETSI NFV, that is capable of modelling and automating the full lifecycle of Network Functions:
   - VNFD (VNF Descriptor),
     VNFR (VNF Record),
   - NSD (Network Service Descriptor),
     NSR (Network Service Record),
   -



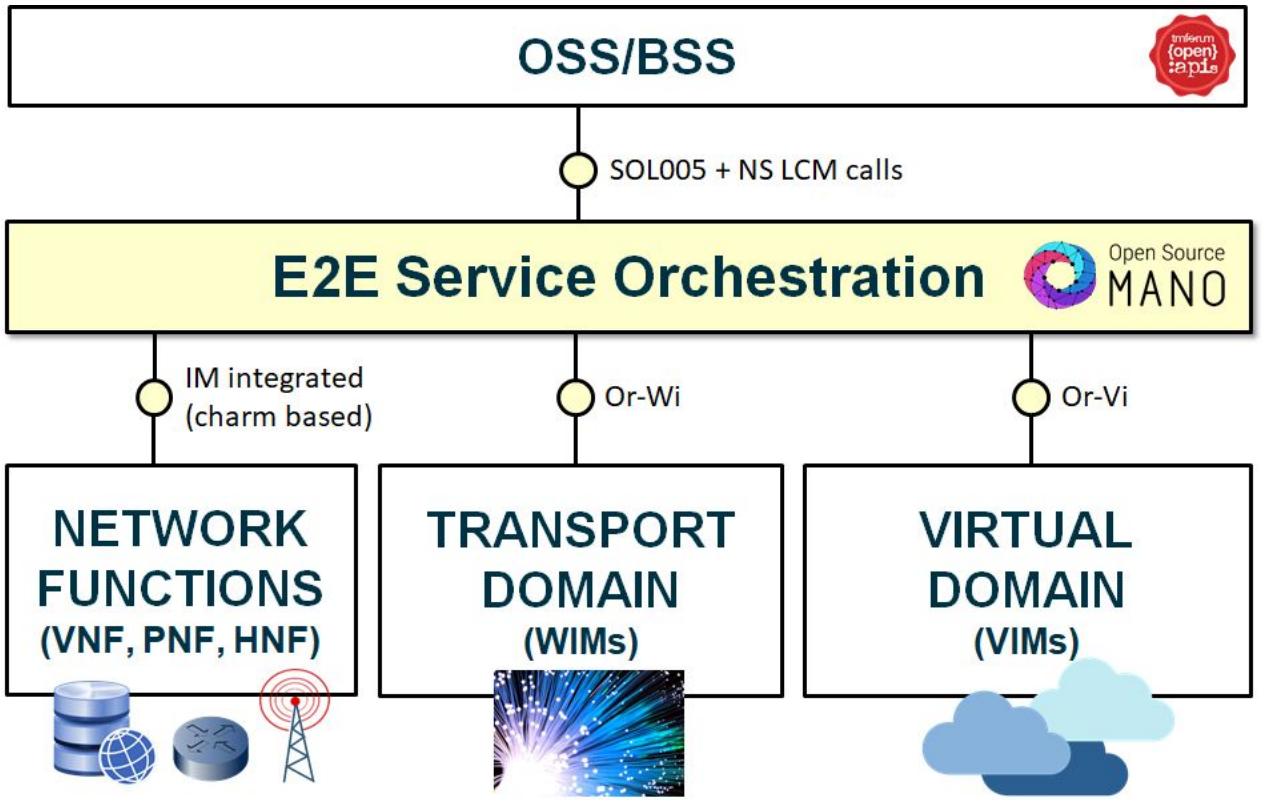
OSM's approach aims to minimize integration efforts

2. A **unified northbound interface** (NBI), based on NFV SOL005



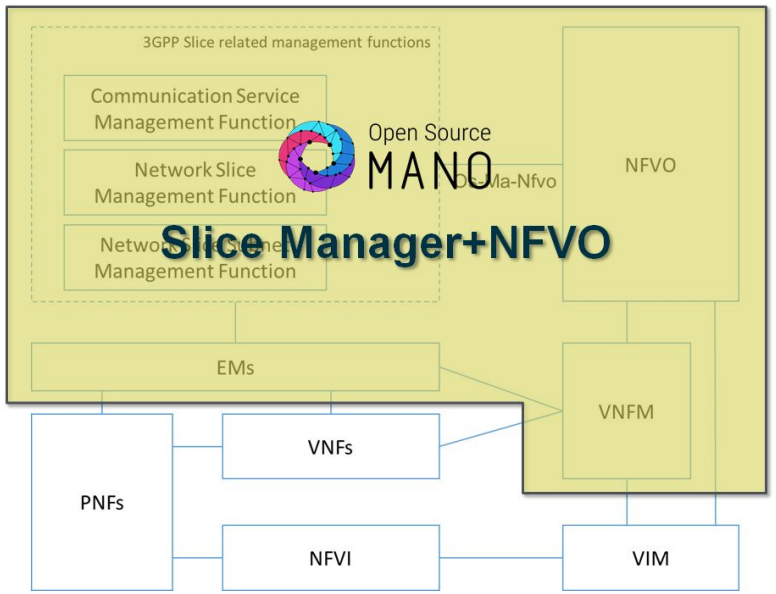
OSM's approach aims to minimize integration efforts

3. The extended concept of "**Network Service**" in OSM, so that an NS can span across the different domains identified and therefore control the full lifecycle of an NS interacting with VNFs, PNFs and HNFs.

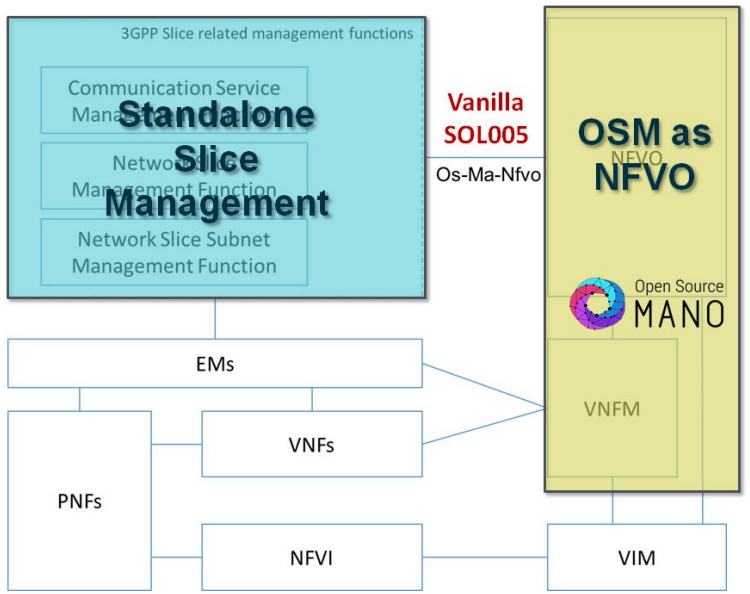


OSM's approach aims to minimize integration efforts

4. In addition, OSM can also manage the lifecycle of **Network Slices**, assuming if required the role of Slice Manager, or integrating with an external Slice Manager



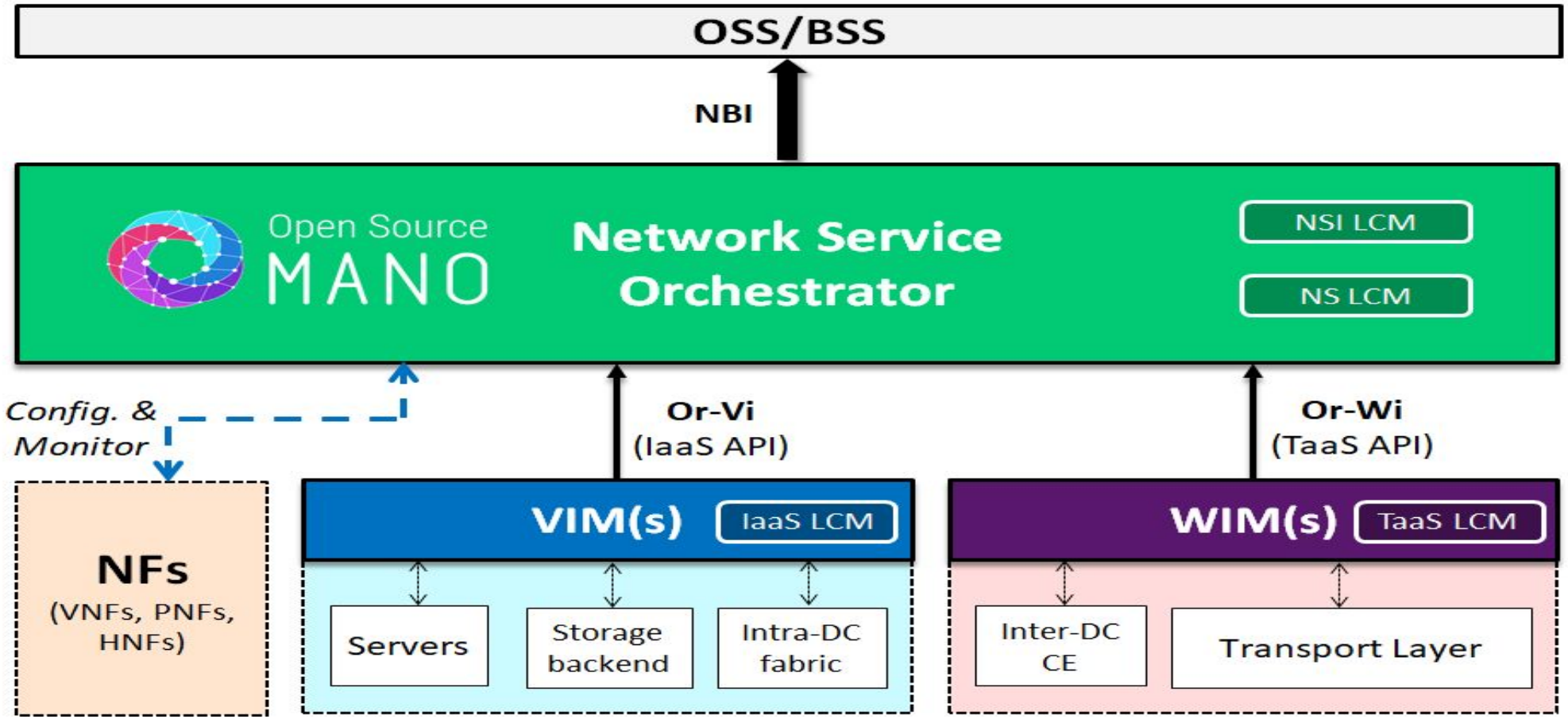
Full E2E Management
(Integrated Modelling)



Standalone Management
(Vanilla NFV/3GPP)

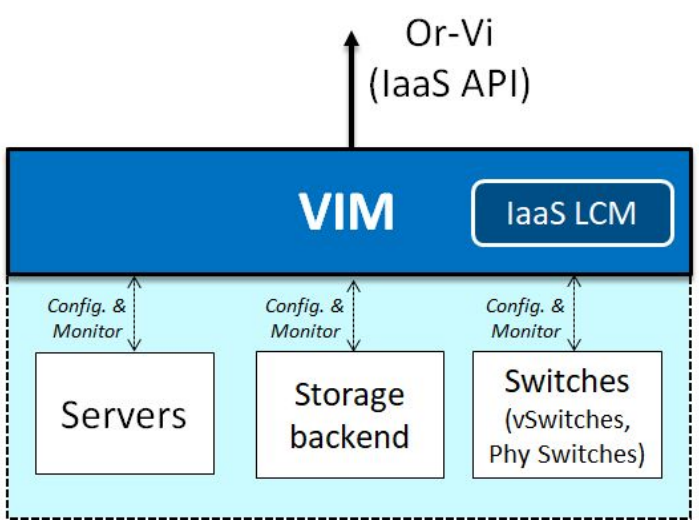
Service Platform view

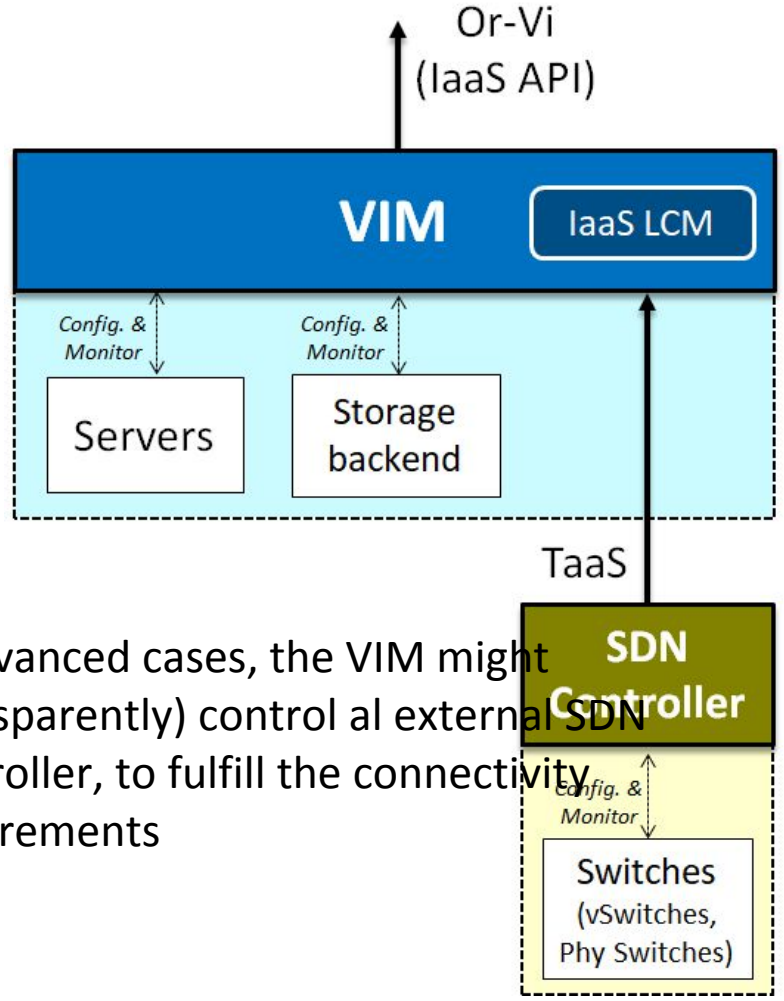
OSM as a Network Service Orchestrator (NSO)



Service Platform view

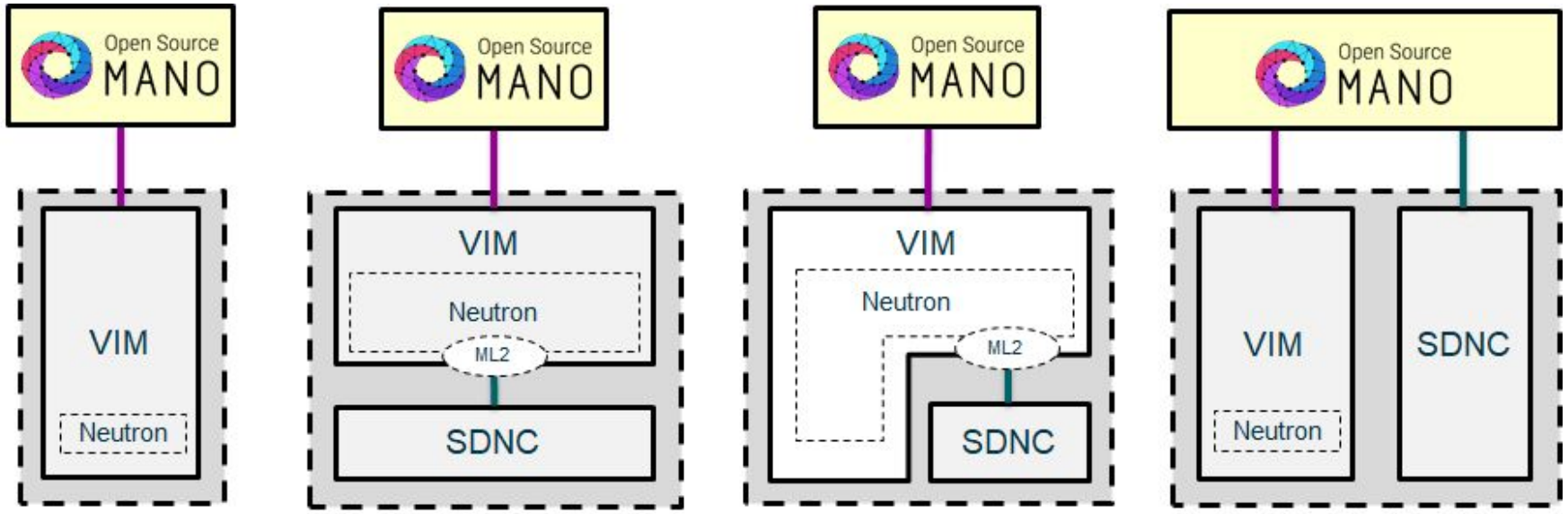
VIM manages the virtual network to support VNF's connectivity





In advanced cases, the VIM might (transparently) control al external SDN Controller, to fulfill the connectivity requirements

Integration with SDN Controller



CASE #1: Vanilla
- Overlay: Native
- No underlay

CASE #2: VIM + all SDN
- Overlay: SDNC
- Underlay: if available, via SDNC

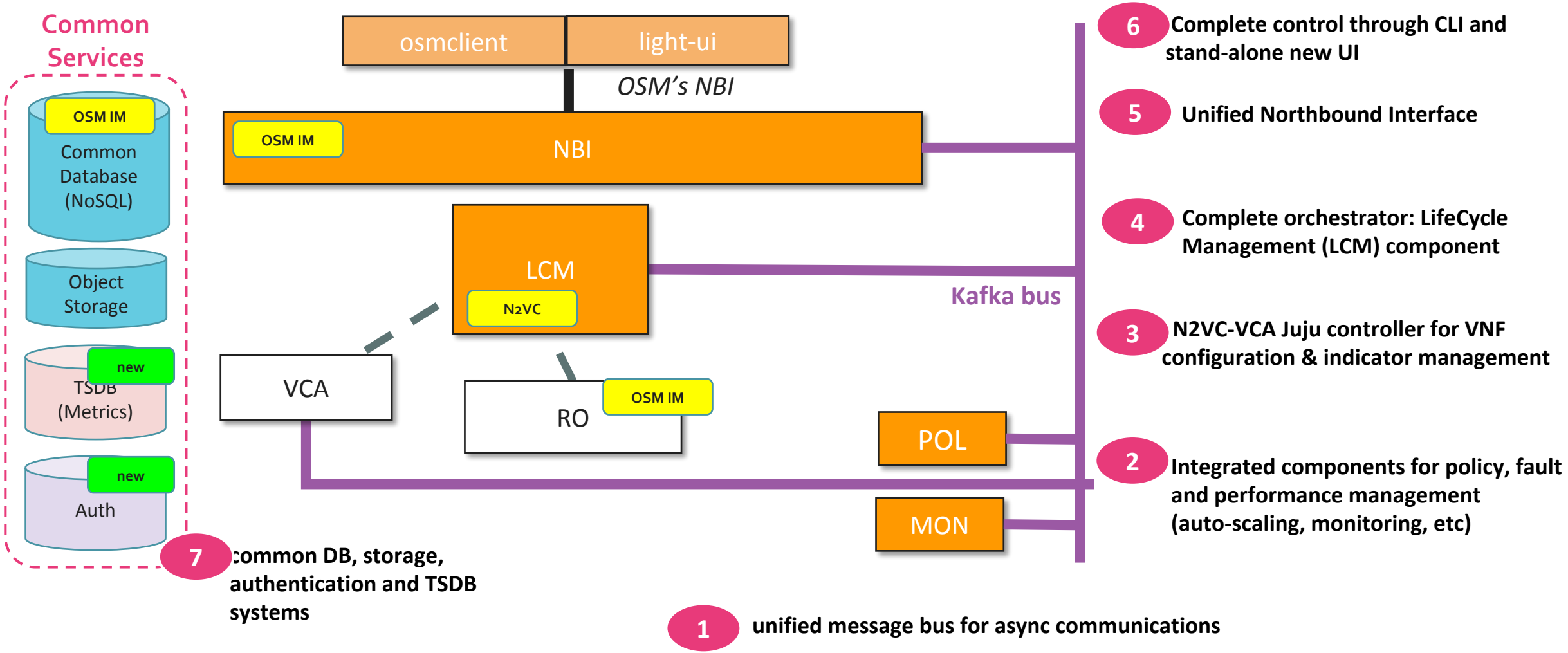
CASE #3: VIM with partial SDN
- Overlay: Native
- Underlay: SDNC

CASE #4: SDN Assist
- Overlay: VIM native
- Underlay: SDNC, via OSM

SDN Assist

Allows OSM to control SDN connectivity, even when not possible by the VIM (eg: PCI Passthrough, SR-IOV)

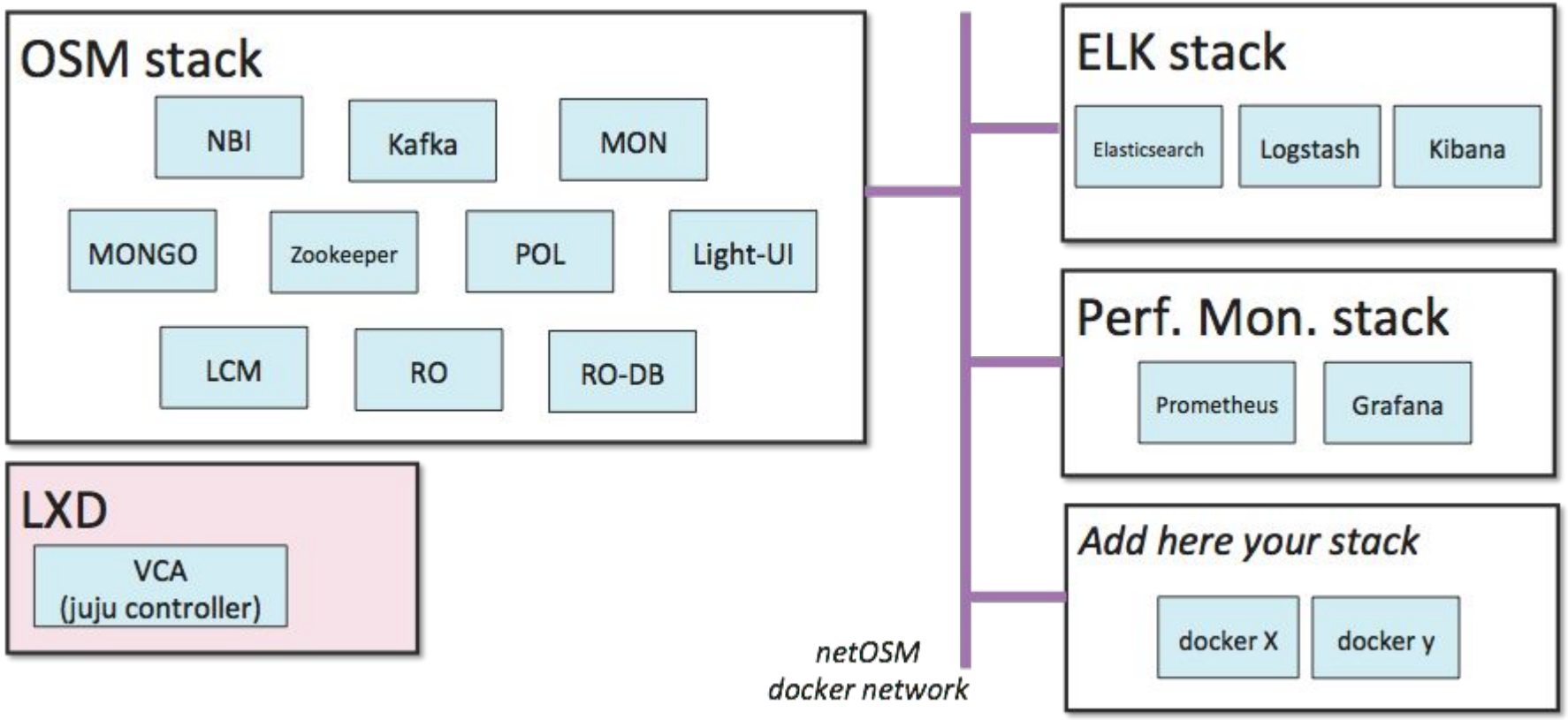
Release FOUR+ architectural view



Release FOUR+ architecture

Open Source MANO

Microservice architecture to enable extensibility

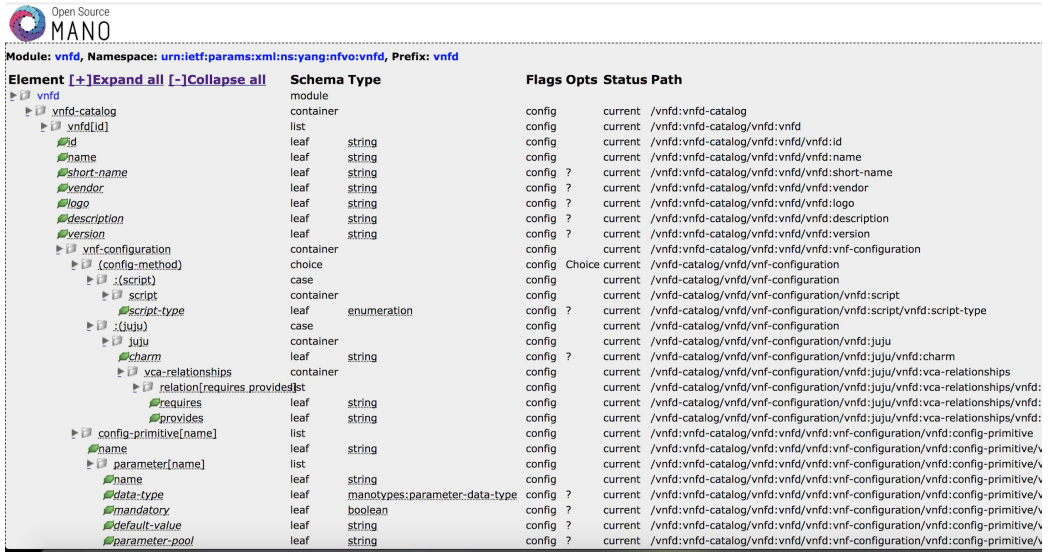


Why is OSM Awesome?

It has a rich and open information model

- Agnostic to VIM, SDN platform, VNF and OSS connectors/specifics.
- It allows for a uniform NFV orchestration, abstracted from the environment
- Aligned with ETSI-NFV Information Model

Visit:
https://osm.etsi.org/wikipub/index.php/OSM_Information_Model



Open Source MANO

Module: vnfd, **Namespace:** urn:ietf:params:xml:ns:yang:nfvo:vnfd, **Prefix:** vnfd

Element [+]Expand all [-]Collapse all	Schema Type		Flags	Opts	Status	Path
vnfd	module					
vnfd-catalog	container		config		current	/vnfd:vnfd-catalog
vnfd[id]	list		config		current	/vnfd:vnfd-catalog/vnfd:vnfd
id	leaf	string	config		current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:id
name	leaf	string	config		current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:name
short-name	leaf	string	config	?	current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:short-name
vendor	leaf	string	config	?	current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:vendor
logo	leaf	string	config	?	current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:logo
description	leaf	string	config	?	current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:description
version	leaf	string	config	?	current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:version
vnf-configuration	container		config		current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:vnf-configuration
(config-method)	choice		config	Choice	current	/vnfd-catalog/vnfd/vnf-configuration
:(script)	case		config		current	/vnfd-catalog/vnfd/vnf-configuration
script	container		config		current	/vnfd-catalog/vnfd/vnf-configuration/vnfd:script
script-type	leaf	enumeration	config	?	current	/vnfd-catalog/vnfd/vnf-configuration/vnfd:script/vnfd:script-type
:(juju)	case		config		current	/vnfd-catalog/vnfd/vnf-configuration
juju	container		config		current	/vnfd-catalog/vnfd/vnf-configuration/vnfd:juju
charm	leaf	string	config	?	current	/vnfd-catalog/vnfd/vnf-configuration/vnfd:juju/vnfd:charm
vca-relationships	container		config		current	/vnfd-catalog/vnfd/vnf-configuration/vnfd:juju/vnfd:vca-relationships
relation[requires provides]	list		config		current	/vnfd-catalog/vnfd/vnf-configuration/vnfd:juju/vnfd:vca-relationships/vnfd:
requires	leaf	string	config		current	/vnfd-catalog/vnfd/vnf-configuration/vnfd:juju/vnfd:vca-relationships/vnfd:
provides	leaf	string	config		current	/vnfd-catalog/vnfd/vnf-configuration/vnfd:juju/vnfd:vca-relationships/vnfd:
config-primitive[name]	list		config		current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:vnf-configuration/vnfd:config-primitive
name	leaf	string	config		current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:vnf-configuration/vnfd:config-primitive/v
parameter[name]	list		config		current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:vnf-configuration/vnfd:config-primitive/v
name	leaf	string	config		current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:vnf-configuration/vnfd:config-primitive/v
data-type	leaf	manotypes:parameter-data-type	config	?	current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:vnf-configuration/vnfd:config-primitive/v
mandatory	leaf	boolean	config	?	current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:vnf-configuration/vnfd:config-primitive/v
default-value	leaf	string	config	?	current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:vnf-configuration/vnfd:config-primitive/v
parameter-pool	leaf	string	config	?	current	/vnfd:vnfd-catalog/vnfd:vnfd/vnfd:vnf-configuration/vnfd:config-primitive/v

Why is OSM Awesome?

Open Source MANO

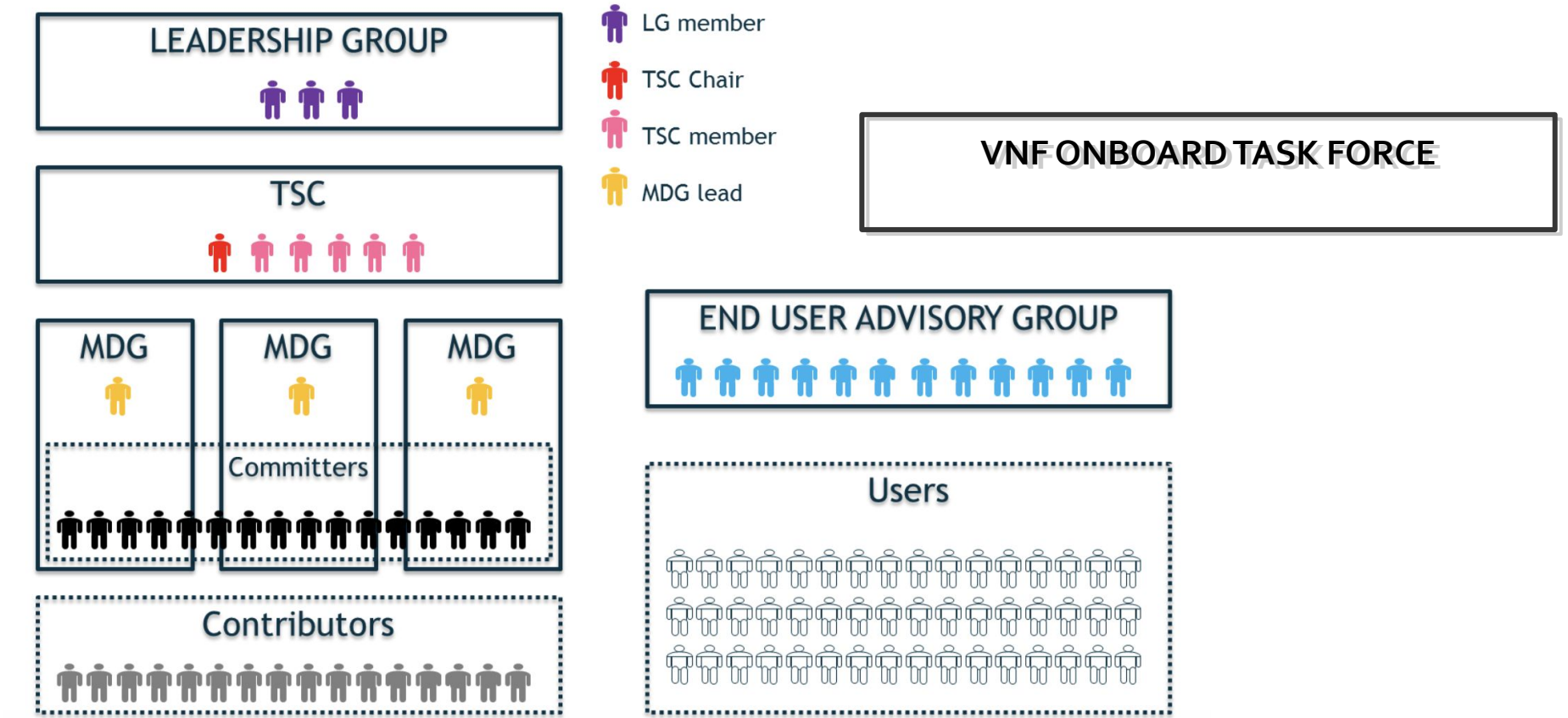
It has a large and diverse community! More than members! **131**

- **12 Global Service Providers**
- **Leading IT/Cloud players**
- **VNF providers**

Why is OSM Awesome?

Open Source MANO

It is well organized for producing production-ready upstream code



Why is OSM Awesome?

Open Source MANO

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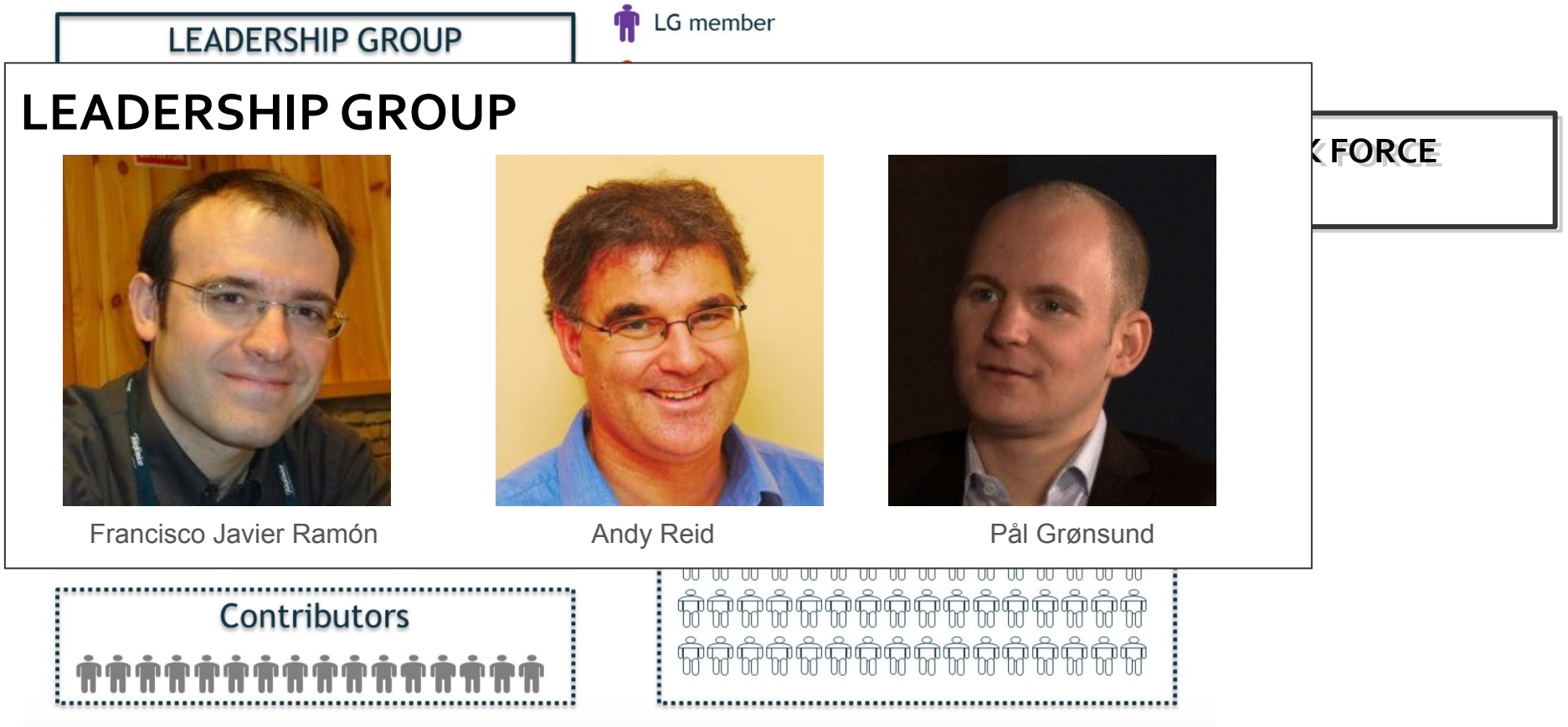


Why is OSM Awesome?

Open Source MANO

It is well organized for producing production-ready upstream code

LEADERSHIP GROUP

LG member

TECHNICAL STEERING COMMITTEE

Vanessa Little

Gerardo García

Mark Shuttleworth

José Miguel Guzmán

Felipe Vicens

Contributors

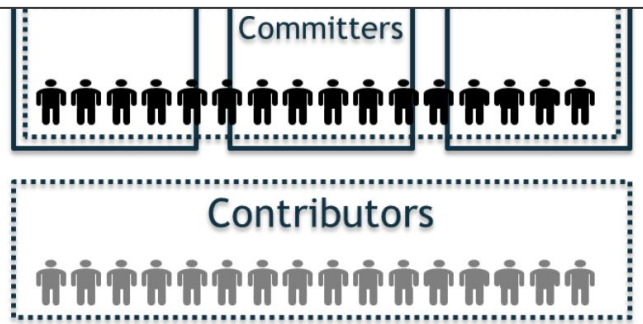
Why is OSM Awesome?

Open Source MANO

It is well organized for producing production-ready upstream code

END USER ADVISORY GROUP

Andy Reid



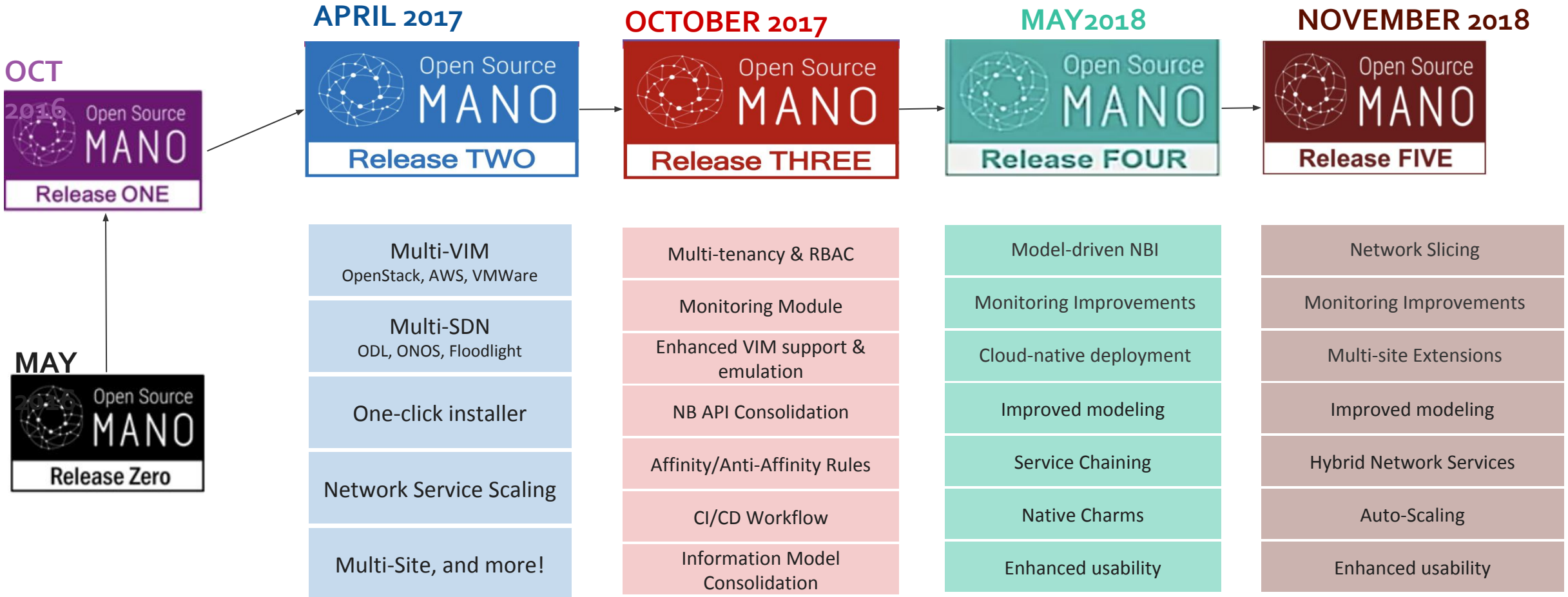
VNF ONBOARD TASK FORCE

VNF ONBOARDING TASKFORCE

Gianpietro Lavado

Why is OSM Awesome?

It prioritizes features for production readiness...



Why is OSM Awesome?

...and launched Release SIX in May 2019, with more key features for 5G and production environments!

- Role-based authentication control (RBAC)
- Support for full/native charms for enhanced VNF management
- Network Slicing extensions
- Network-Service-level primitives
- Improved monitoring of infrastructure components and VNFs
- Enhanced support for instantiation parameters

Why is OSM Awesome?

Open Source MANO

And because other people say that OSM Rocks!

Table III: OSM vs ONAP resource footprint comparison.

Resource	OSM-4	ONAP-B
vCPU	2	88
Memory(GB)	8	176
Storage(GB)	40	1760
IP Addresses	1 static	20 Floating 3 static

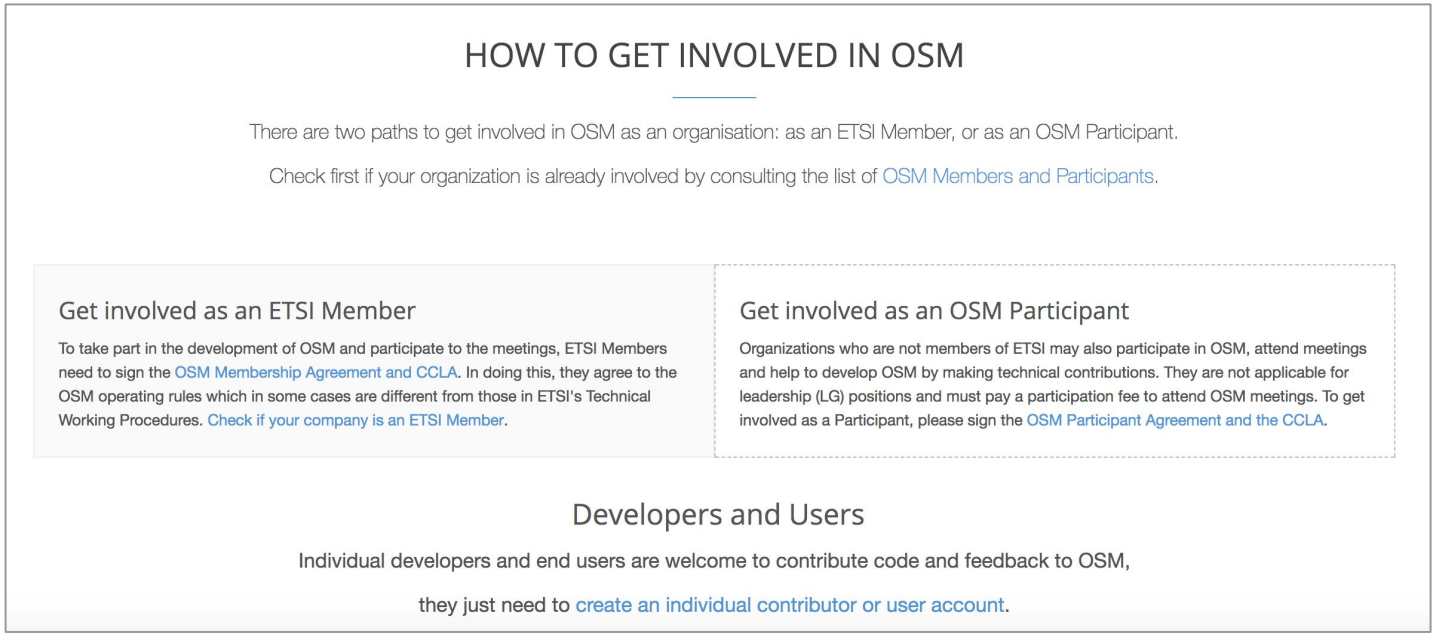
Scan & Download

Open Source MANO

Contributing to the Community

Joining the OSM Community

- Join here as a company or individual contributor!
  https://osm.etsi.org/about/how-to-join



HOW TO GET INVOLVED IN OSM

There are two paths to get involved in OSM as an organisation: as an ETSI Member, or as an OSM Participant.

Check first if your organization is already involved by consulting the list of OSM Members and Participants.

Get involved as an ETSI Member

To take part in the development of OSM and participate to the meetings, ETSI Members need to sign the OSM Membership Agreement and CCLA. In doing this, they agree to the OSM operating rules which in some cases are different from those in ETSI's Technical Working Procedures. Check if your company is an ETSI Member.

Get involved as an OSM Participant

Organizations who are not members of ETSI may also participate in OSM, attend meetings and help to develop OSM by making technical contributions. They are not applicable for leadership (LG) positions and must pay a participation fee to attend OSM meetings. To get involved as a Participant, please sign the OSM Participant Agreement and the CCLA.

Developers and Users

Individual developers and end users are welcome to contribute code and feedback to OSM,

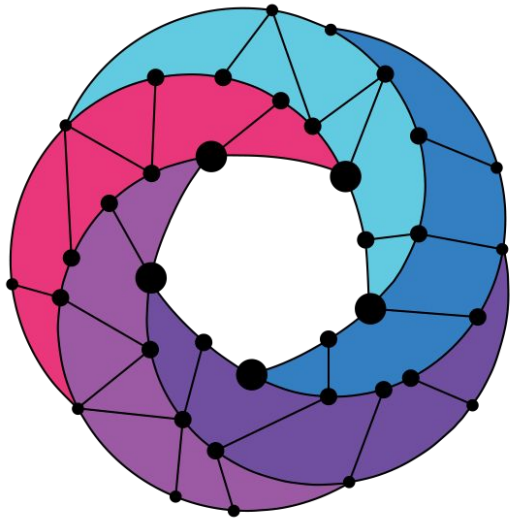
they just need to create an individual contributor or user account.

OSM Community Activities

- **Weekly Conference Calls**
  - Technical, leadership, DevOps, and more!
- **Face to Face Meetings**
  - Plenaries and Mid-Release meetings (every 3 months)
  - Next location: Santa Clara, US (May 2019)
- **OSM Hackfest**
  - Sixth edition taking place on May 2019 at Santa Clara, expecting to keep **co-locating** with OSM Face-to-Face meetings.

Ways to contribute to OSM

- **Try OSM** and give feedback to the community.
- Join as a developer to **make contributions to the code**.
- Join the community to **contribute to design discussions**.
- **Start building your own distribution** of OSM as an integrator.
- **Host an OSM meeting** to contribute to the community's growth and diversity.



Open Source
MANO

Thanks

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ETSI