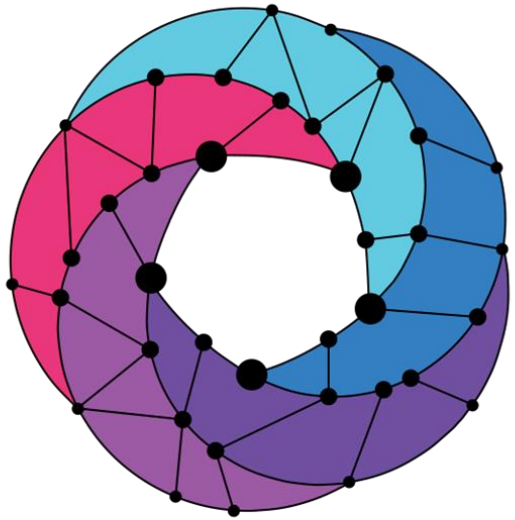


Open Source
MANO

OSM 6th Hackfest

ETSI

Hackfest program

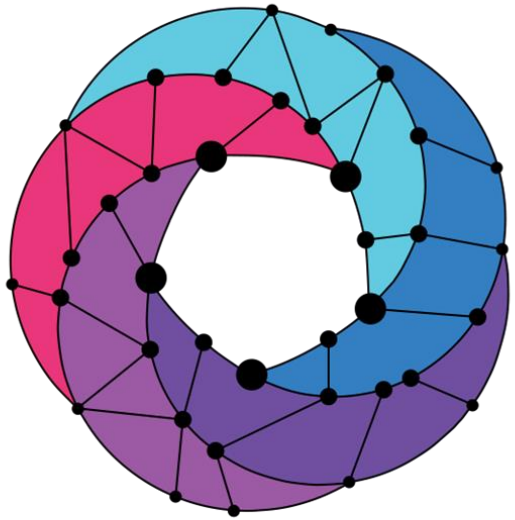
Session 0: Introduction to NFV and OSM
Lead by: Jose Miguel Guzman (Whitestack)
Session 1: OSM Installation and first use
Lead by: Guillermo Calvino, Adrian Candel (Altran)
Session 2: Creating a basic VNF and NS
Lead by: Guillermo Calvino, Adrian Candel (Altran)
Session 2.5: Guidelines for VNF providers to build their own packages
Lead by: Guillermo Calvino, Adrian Candel (Altran)
Session 3: Modeling multi-VDU VNFs
Lead by: Guillermo Calvino, Adrian Candel (Altran)
Session 3.5: Modeling PNFs and HNFs
Lead by: Guillermo Calvino, Adrian Candel (Altran)

Session 4: Adding day-0 configuration to your VNF
Lead by: Guillermo Calvino, Adrian Candel (Altran)
Session 5: Modeling EPA capabilities in your VNF descriptor
Lead by: Guillermo Calvino, Adrian Candel (Altran)
Session 6: Adding day-1/day-2 configuration to your VNF.
Lead by: Dominik Fleischmann, David Garcia (Canonical)
Session 7: OSM Fault & Performance Management
Lead by: Benjamin Diaz (Whitestack)
Session 8: 5G Network Slicing with OSM
Lead by: Guillermo Calvino, Adrian Candel (Altran)
Session 9: Service Function Chaining
Lead by: Guillermo Calvino, Adrian Candel (Altran)
Session 10: How to Contribute to OSM
Lead by: Benjamin Diaz (Whitestack)

OSM#7 & Hackfest Santa Clara : HL Week Plan

OSM#7 & Hackfest Santa Clara	MONDAY 13 May	TUESDAY 14 May		WEDNESDAY 15 May		THURSDAY 16 May		FRIDAY 17 May	
08:00..10:00 (2h00)	LG	OPENING PLENARY	OSM Hack S2 Basic VNF/NS OSM Hack S2.5	TECH	OSM Hack S5 - EPA	TECH	OSM Hack S8 - Network Slicing	CLOSING PLENARY	OSM Hack S10 - How to contribute
10:00..10:30 (0h30)	COFFEE BREAK								
10:30..12:00 (1h30)	EUAG	OPENING PLENARY	OSM Hack S3 - Multi VDU	TECH	OSM Hack S6 - Day1/2 Conf I - Charms	TECH	OSM Hack S7 - Fault&Perf Mgmt	OSM Hackfest WRAP UP	
12:00..13:00 (1h00)	LUNCH BREAK								
13:00..15:00 (2h00)	Welcome TSC / OSM Hack S0 - Intro	TECH	OSM Hack S3.5 - Modeling PNFs and HNFs	TECH	OSM Hack S6 - Day1/2 Conf II - Charms	VNF Day			
15:00..15:30 (0h30)	COFFEE BREAK								
15:30..17:00 (1h30)	TSC& MDL / OSM Hack S1 - Install	TECH	OSM Hack S4 - Day - 0	TECH	OSM Hack S9 - SFC	VNF Day			

6th OSM Hackfest Info



Open Source MANO

OSM 6th Hackfest – Introduction to NFV and OSM

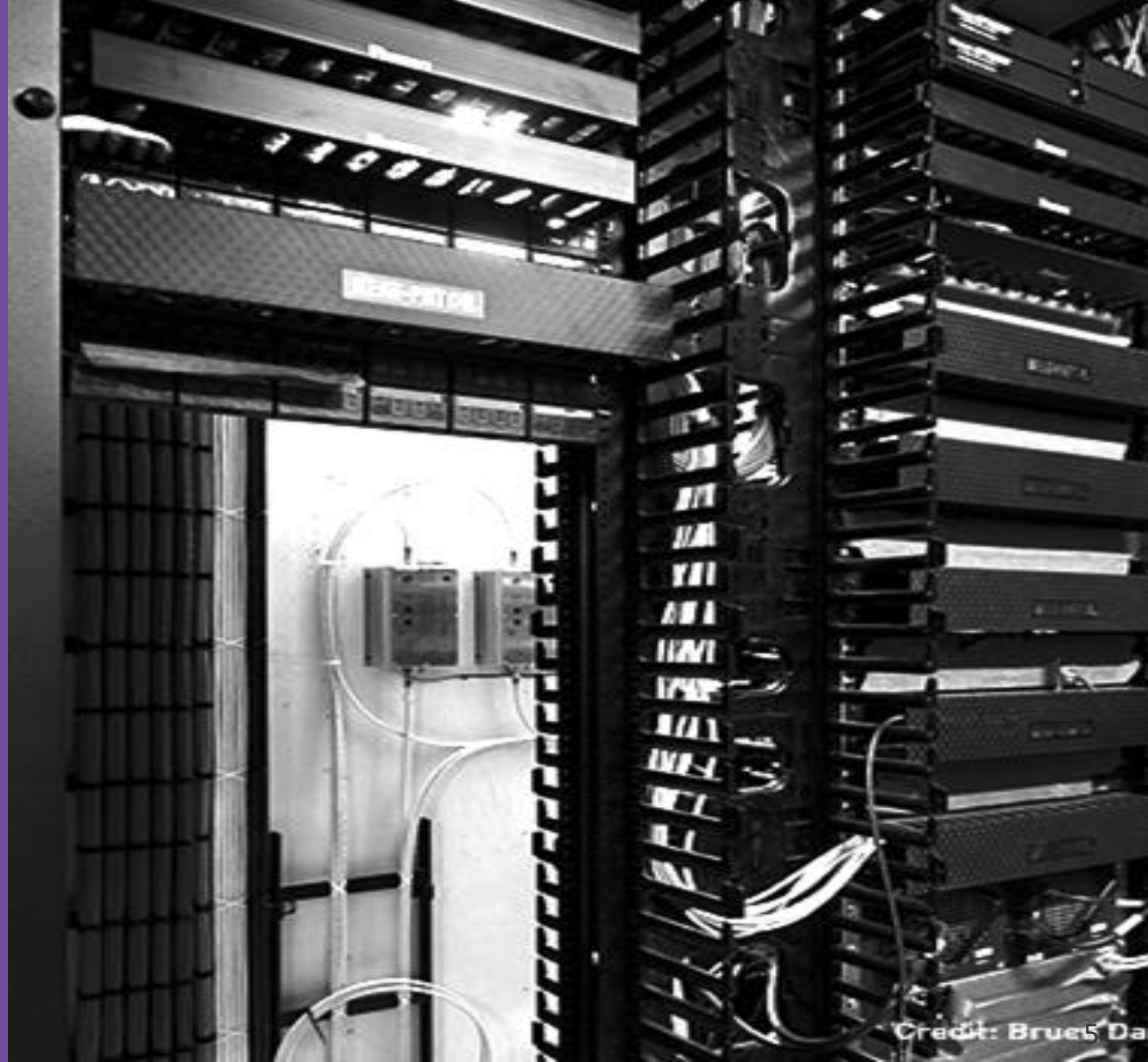
José Miguel Guzmán (Whitestack)

Agenda

- Background for moving to a NFV world
- Quick review of NFV
- Introduction to the latest OSM Release
- Contributing to the Community

Open Source MANO

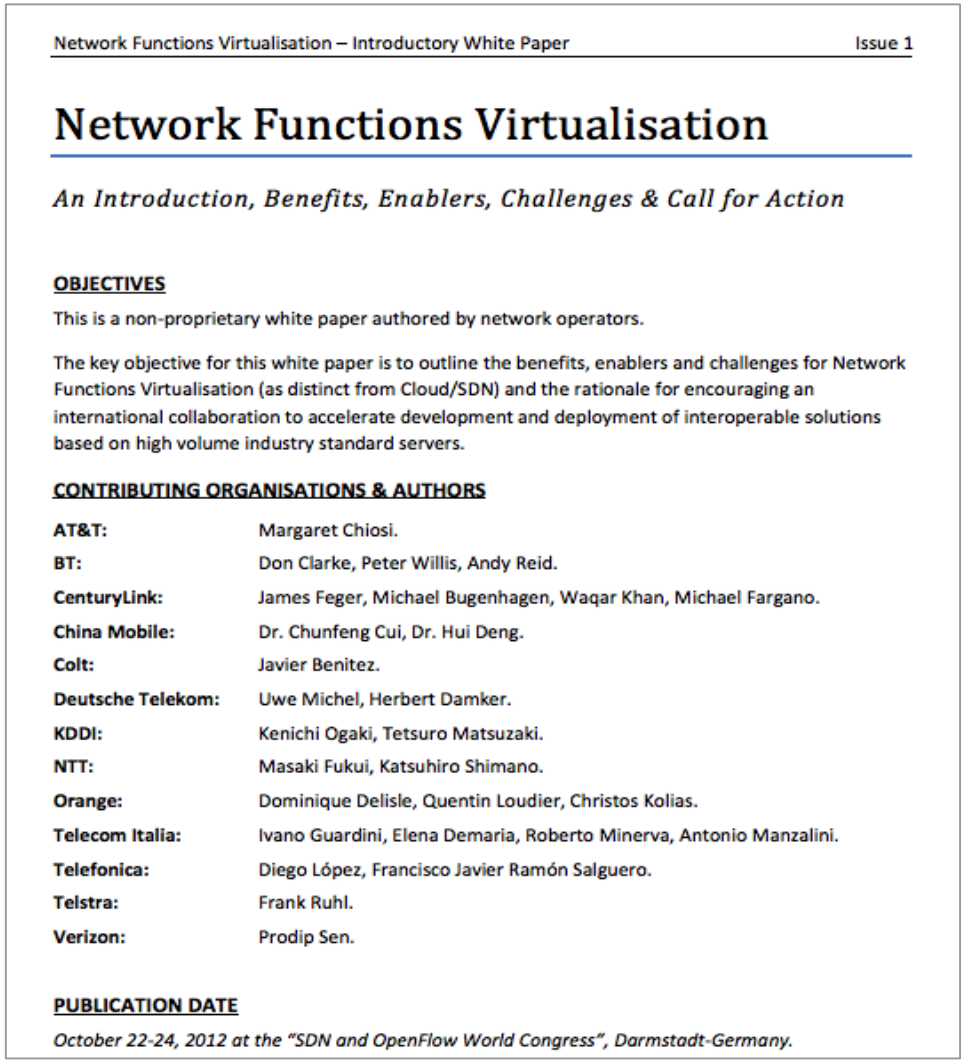
Background for moving to a NFV world



How was this originated?

A white paper was written in 2012 by the world's leading telecom network operators.

- Introduction
- Benefits
- Enablers
- Challenges
- Call for Action



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.

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PUBLICATION DATE

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

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

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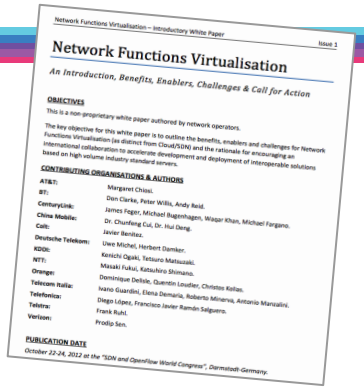
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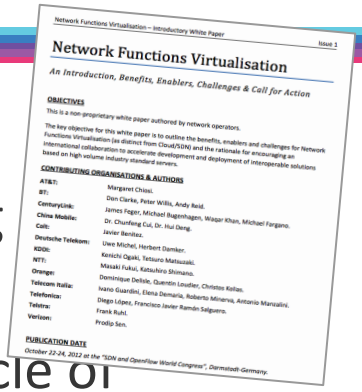
The issues

- Network Operators' networks are populated with a **large and increasing variety of proprietary hardware** appliances.
- To launch a new network service often requires **finding the space and power to accommodate these boxes,** what is becoming increasingly difficult;
- **Increasing costs** of energy, capital investment challenges and the **rarity of skills necessary** to design, integrate and operate increasingly complex hardware-based appliances.
- Moreover, hardware-based appliances rapidly reach end of life, **requiring much of the procure-design-integrate-deploy cycle to be repeated with little or no revenue** benefit.

How was this originated?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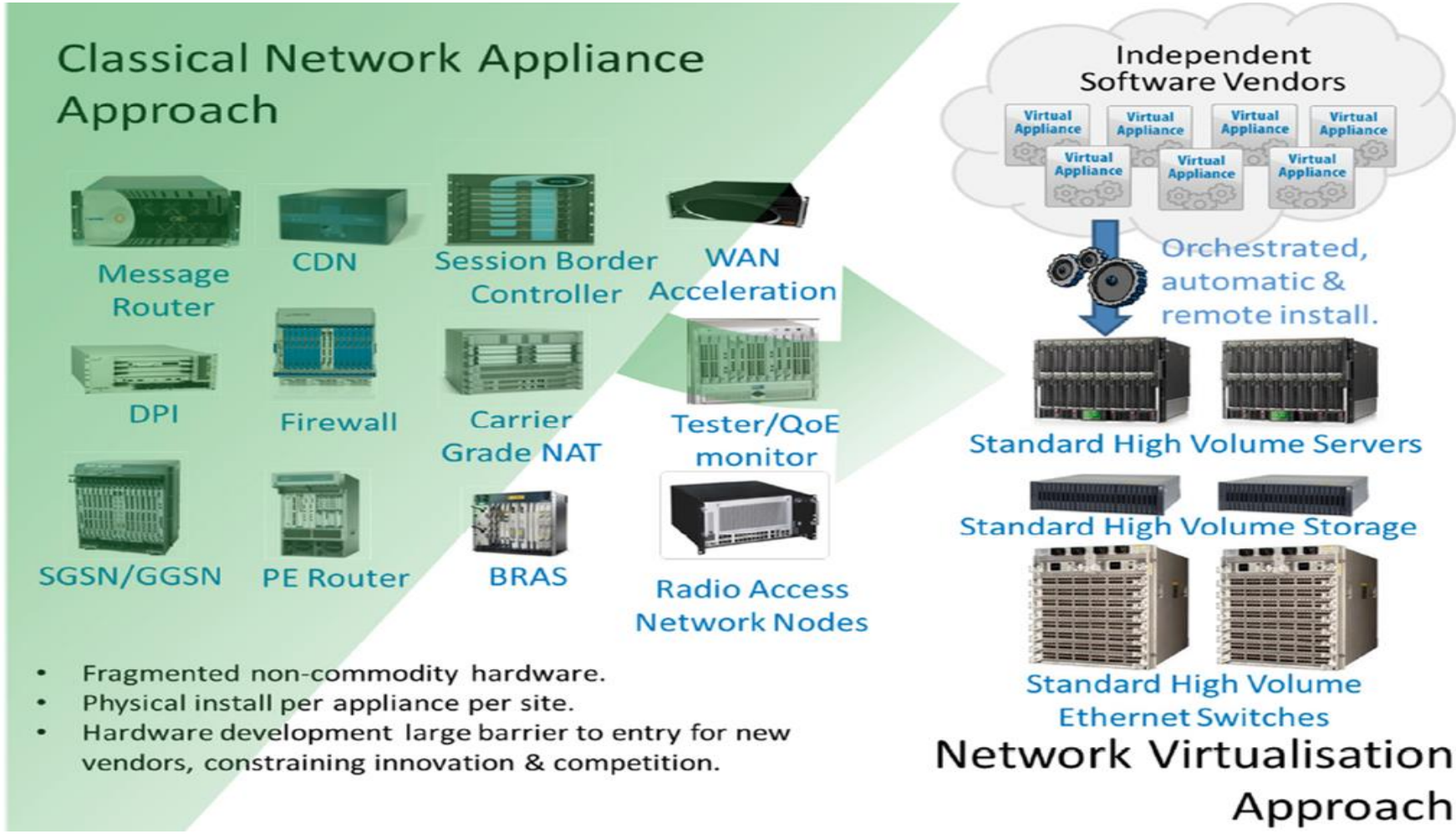
The Benefits

- **Reduced equipment costs** and reduced power consumption through consolidating equipment (scale of the IT industry)
- Increased speed of **Time to Market** by minimising the typical network operator cycle of innovation.
- Availability of network appliance multi-version and multi-tenancy, which allows use of a **single platform for different applications, users and tenants**.
- **Targeted service introduction** based on geography or customer sets is possible. **Services can be rapidly scaled up/down** as required.
- Enables a wide **variety of eco-systems and encourages openness**.

What is NFV trying to address?

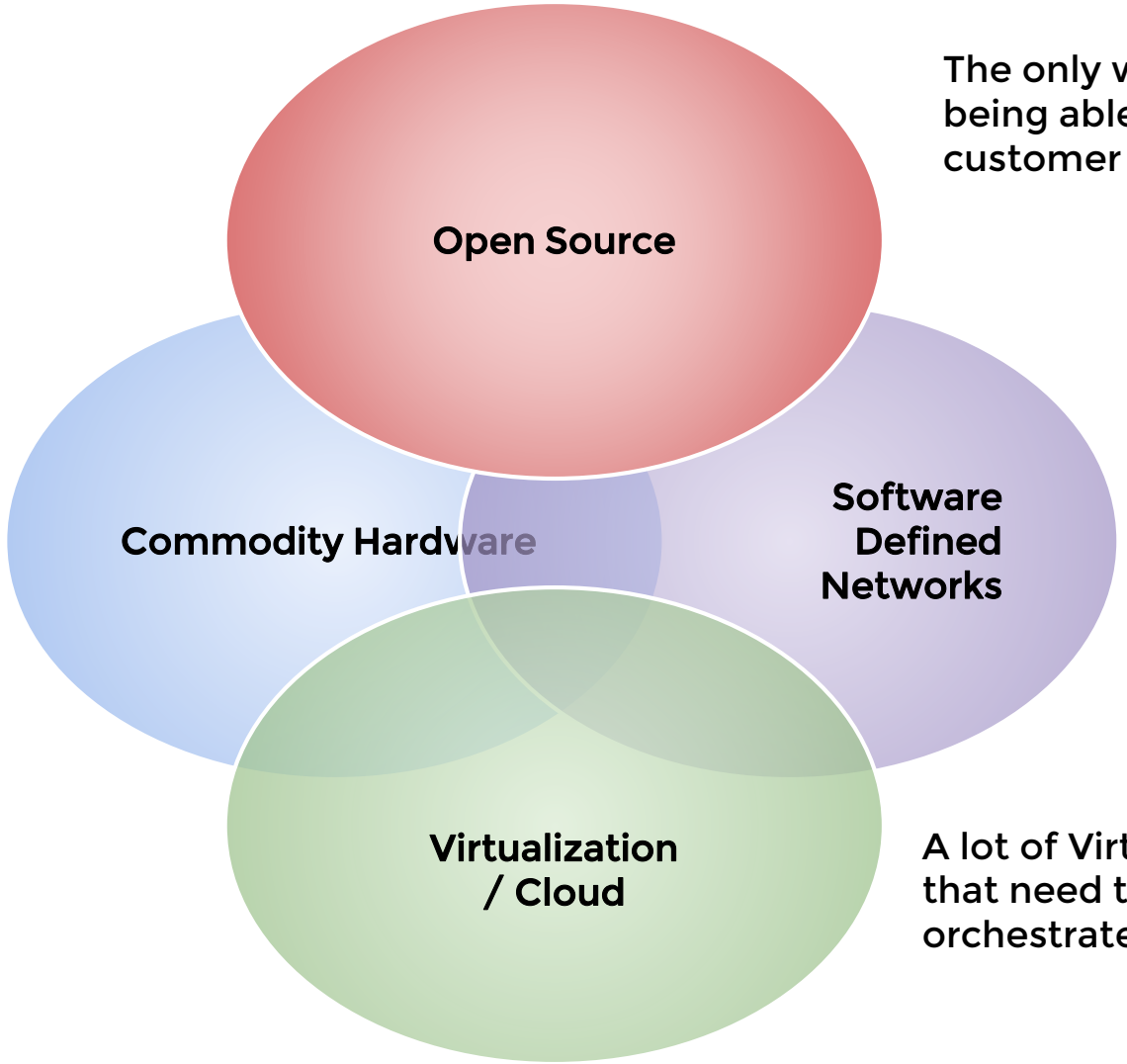
Open Source MANO

Bringing “cloud efficiencies” to the Telecom Industry



Conjunction of 4 mature technologies

Open Source MANO



The only way the industry is being able to catch up the customer needs.

A lot of compute power, at a reasonable cost.

Massive & Automated networking is required

A lot of Virtual Machines that need to be orchestrated

1) Commodity Hardware

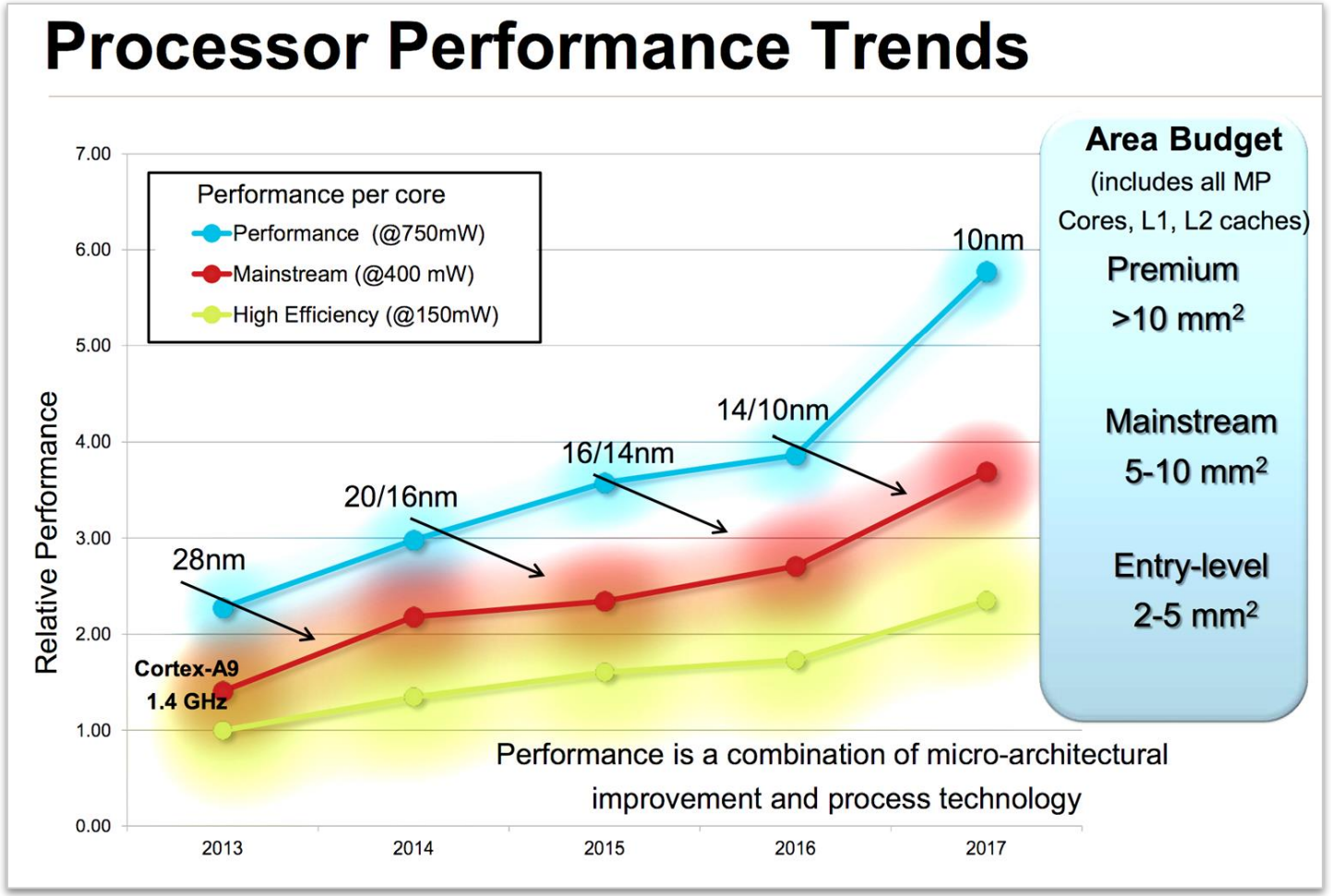
- The Telecom industry has transitioned from proprietary (tailor-made) hardware platforms, to commodity (COTS) x86 hardware

Arquitectura Hardware Advanced TCA

Arquitectura Hardware Commodity "off-the-shelf" con procesador x86

1) Commodity Hardware

- In recent years, the performance of Microprocessors has more than duplicated, specially in the servers segment



1) Commodity Hardware

- New form factors, might achieve the highest compute & storage density levels

8x  = 224 physical Cores

96x  = 6 TB of RAM

24x  = 96 TB of SSD

4x  = 16 x 10G Ports

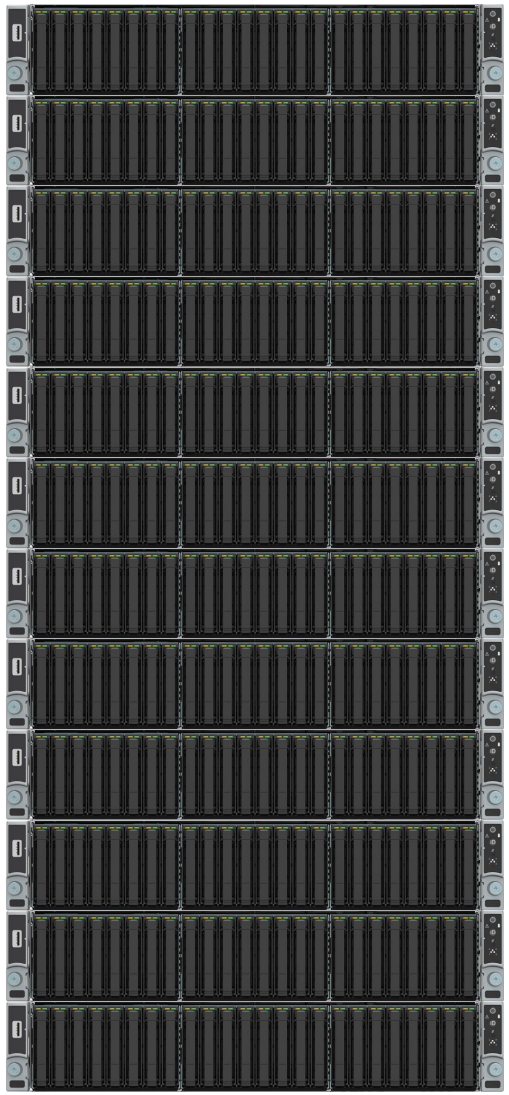
1) Commodity Hardware

- A super computer.. in a rack

5K Physical Cores
60 TB of RAM
3840 TB of Solid State Storage
320 x 10G Ports

/Rack

@ ~ 20K Watts



2) HW Assisted Virtualization

- Two leading solutions for virtualization

Commercial

vmware

Microsoft Hyper-V

VirtualBox

CITRIX XenServer

Open Source

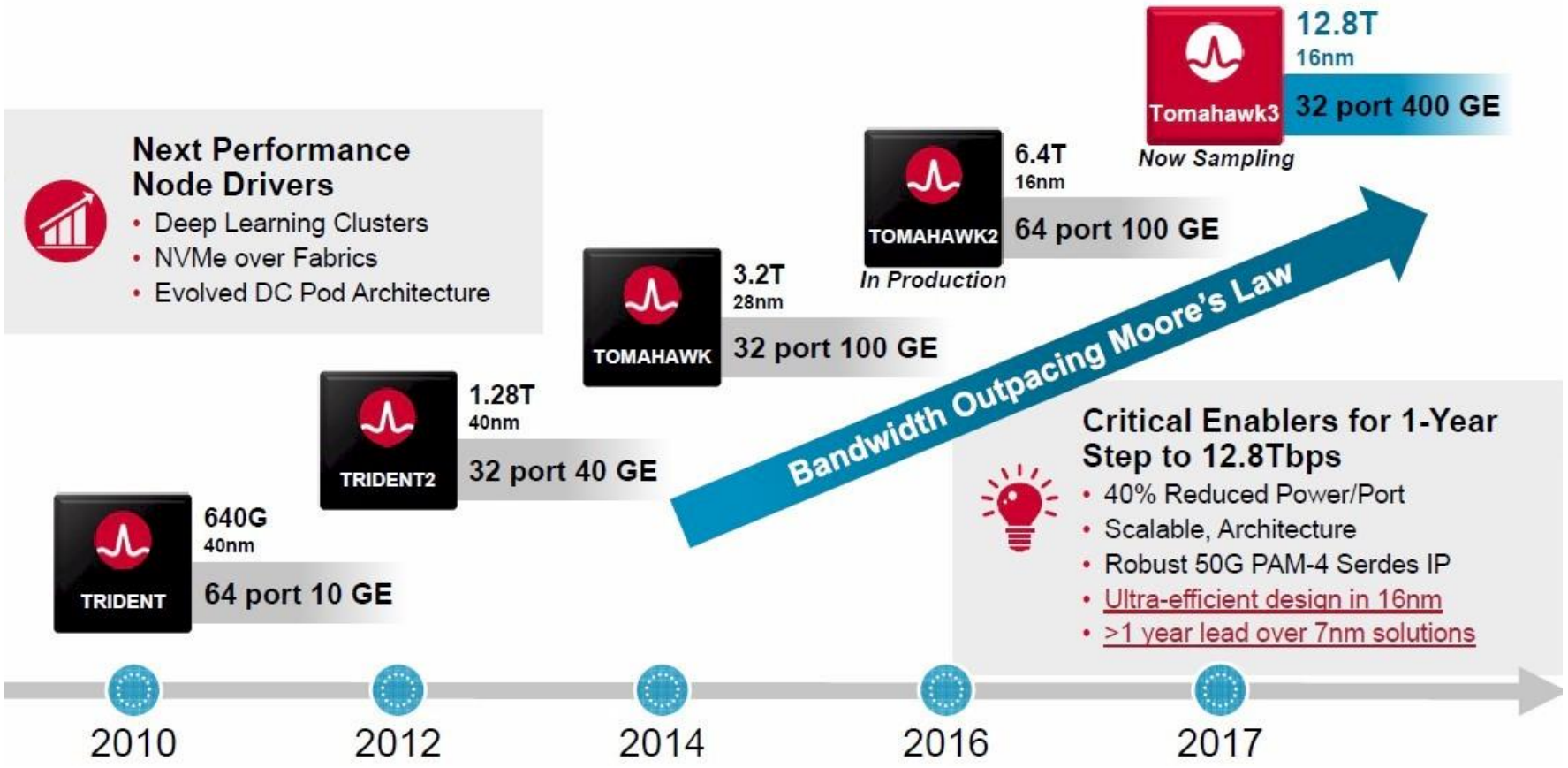
KVM

XenServer™

Fuente: 2017 Openstack Survey

3) SDN / Open Networking

High Capacity switching chipsets



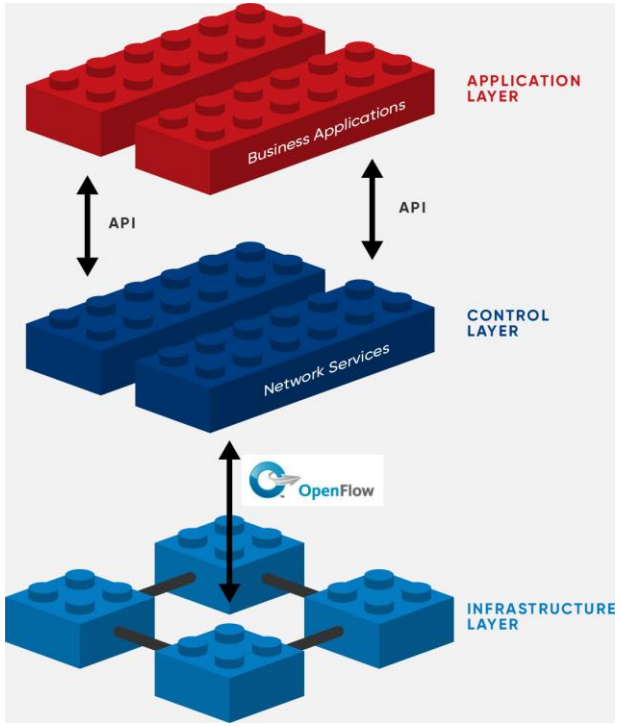
3) SDN / Open Networking

Open Source MANO

Most vendors adopting “Merchant Silicon”

3) SDN / Open Networking

SDN is not a requirement, but increases the potential of NFV



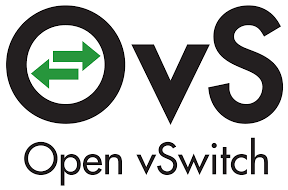
Easily portable to general purpose **CPUs**, therefore *highly virtualizable*

Achievable by using **ASICs** or **CPUs**
(dataplane acceleration)

- NFV and SDN aligns closely with the objectives to use commodity servers and switches.
- Control plane can be easily ported to NFV
  But, dataplane too (lots of improvements here)

4) Open Source initiatives

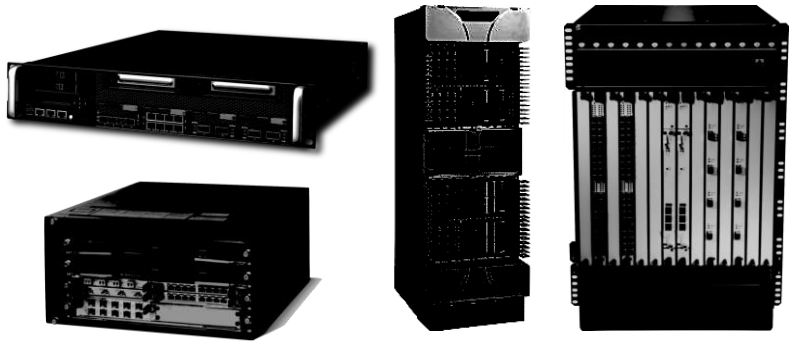
Current landscape provides several open source initiatives, that cover most of the industry challenges:

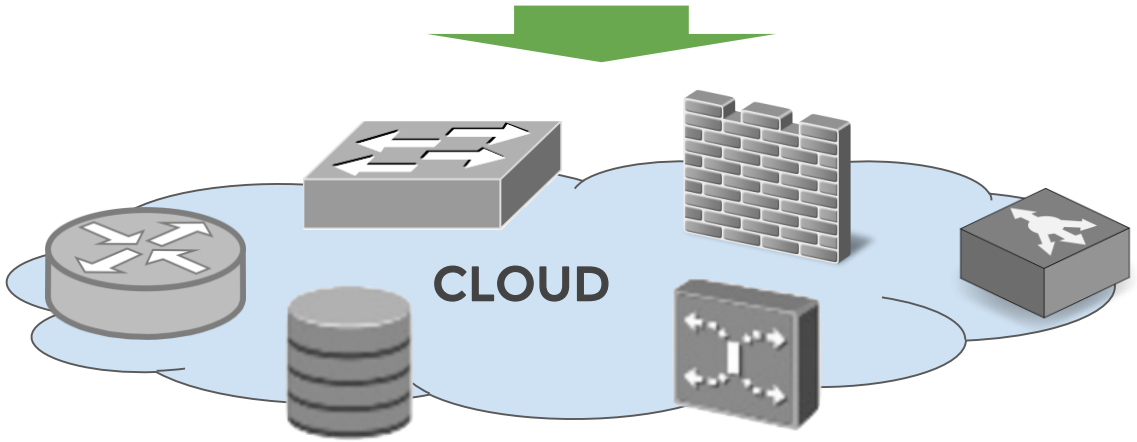


Open Source MANO

Quick review of NFV

What is NFV trying to address?



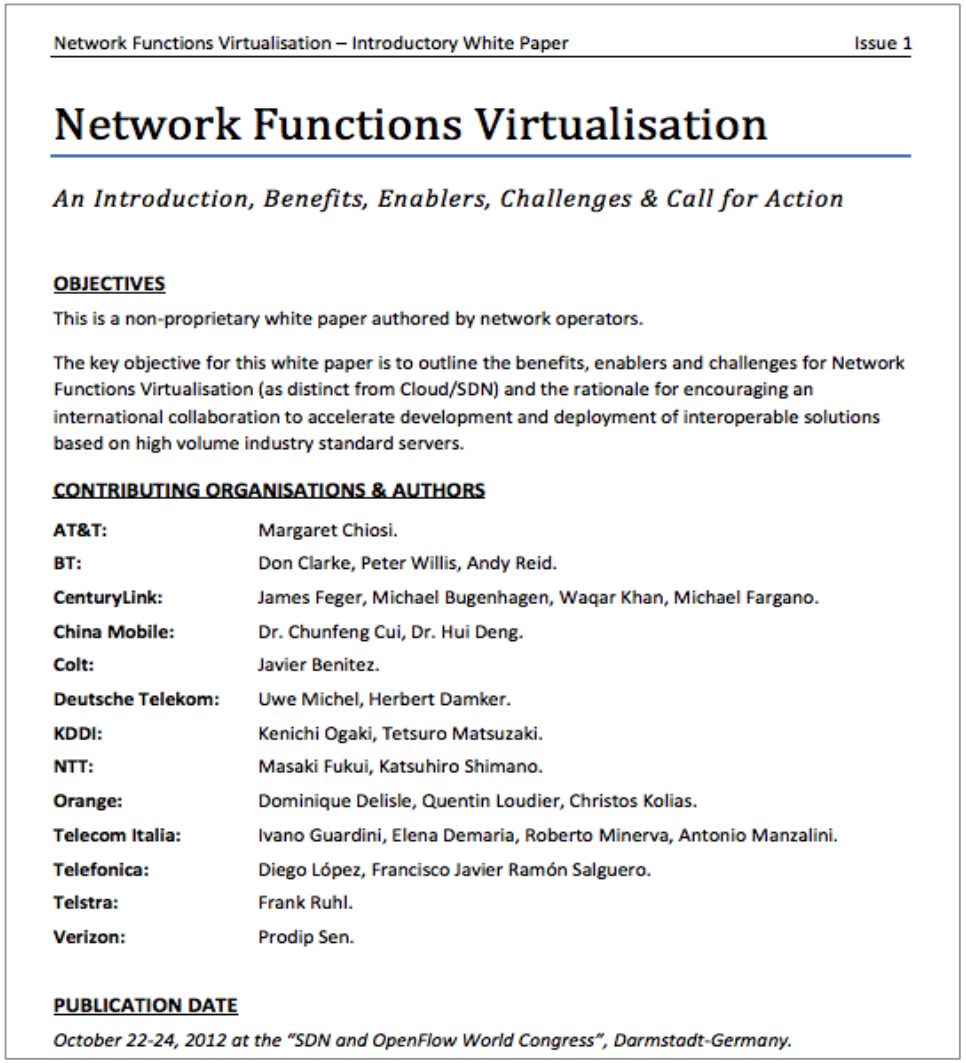


- Network Function Virtualization (NFV) proposes to **virtualize network functions that typically run in dedicated appliances**
- The main goal is to **support virtualized functions over COTS servers.**
- Virtual Network Functions (VNFs) acquire **all the advantages of Cloud** Applications!

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.



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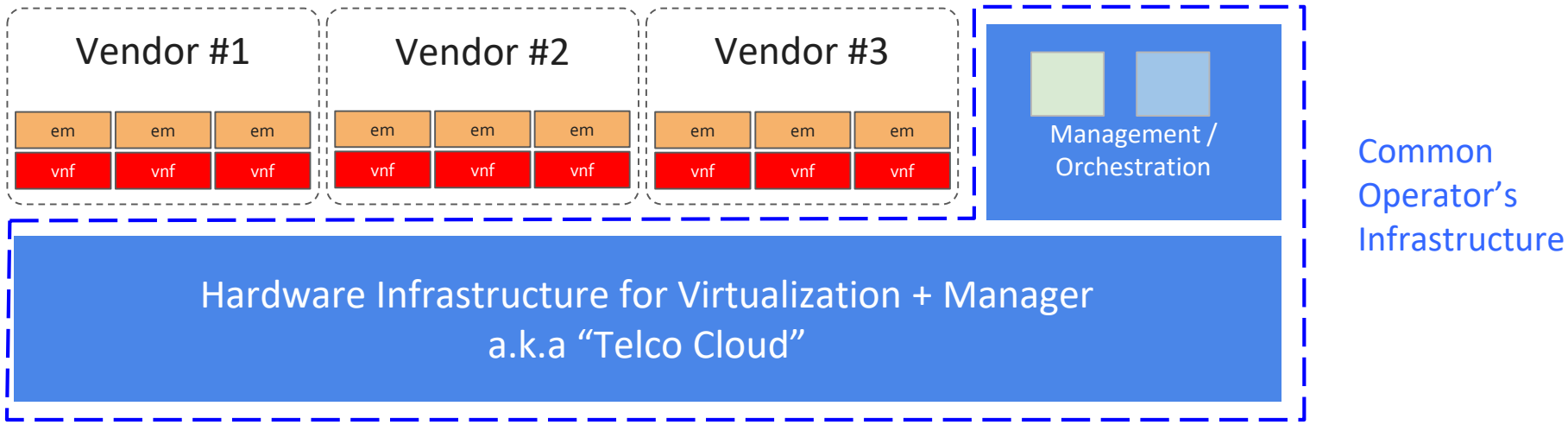
ETSI Publications

- 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

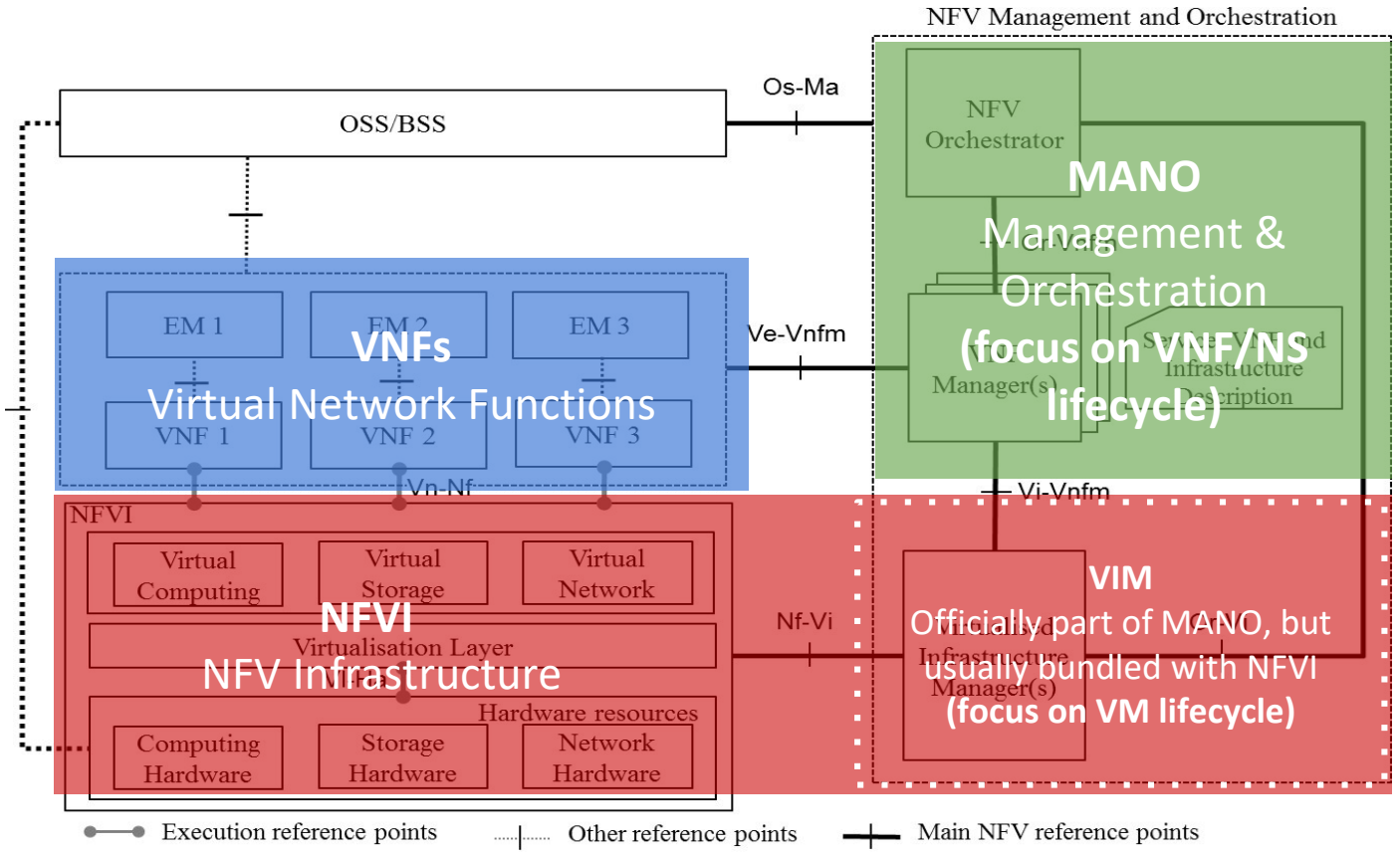
Benefits of a standard NFV architecture

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



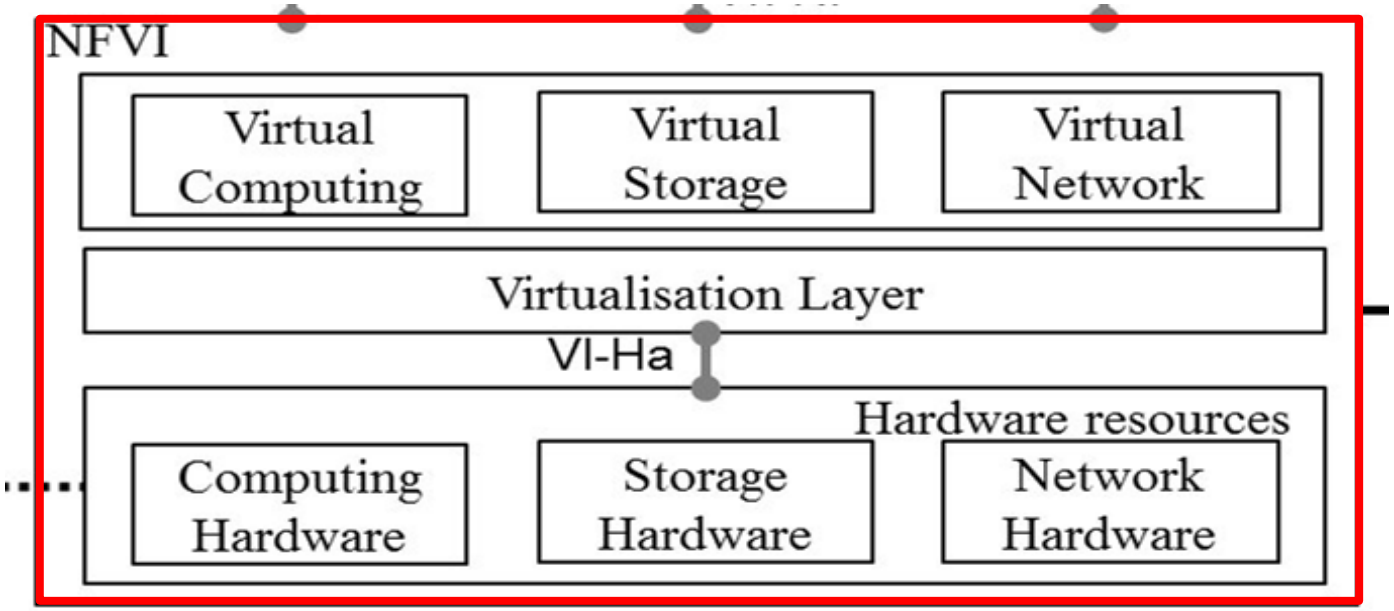
The ETSI NFV Architecture

The standard architecture can be better understood in three blocks:



NFVI:
NFV Infrastructure

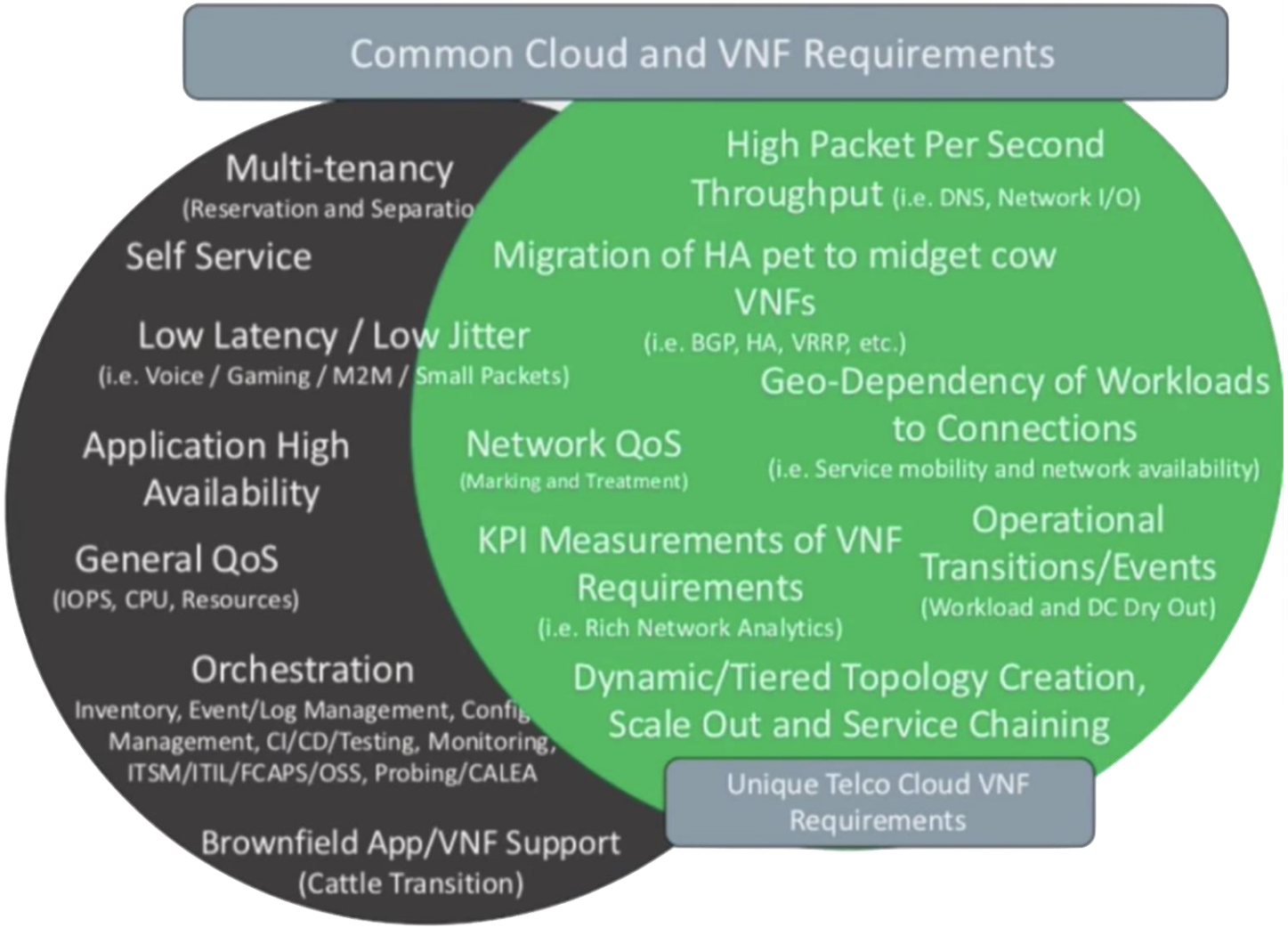
NFVI goal is to provide a virtualization environment for VNFs, including virtual compute, storage and networking resources.



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

NFVI: NFV Infrastructure

VNF Special Requirements



OpenStack Austin 2016: Telco Cloud Requirements: What VNF's Are Asking For

NFVI: NFV Infrastructure

VNF Special Requirements

Open Source MANO

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)

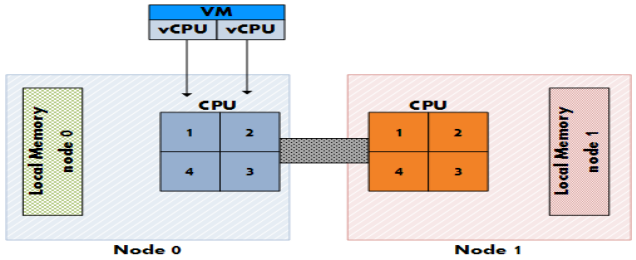
NFVI: NFV Infrastructure

VNF Special Requirements

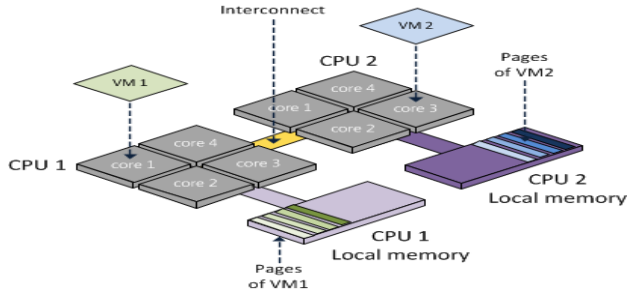
EPA covers the different approaches that can be taken at the NFVI layer to increase performance while maintaining a generic (COTS) infrastructure. VIM and MANO should be able to request them.

Huge Pages

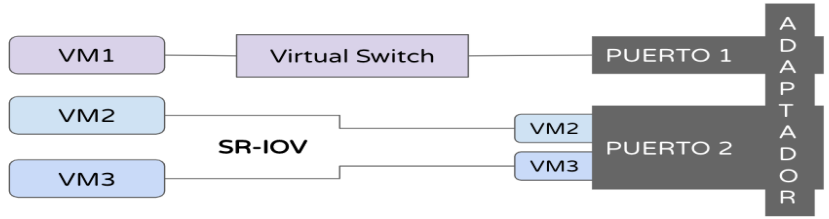
NUMA Topology Awareness



CPU Pinning

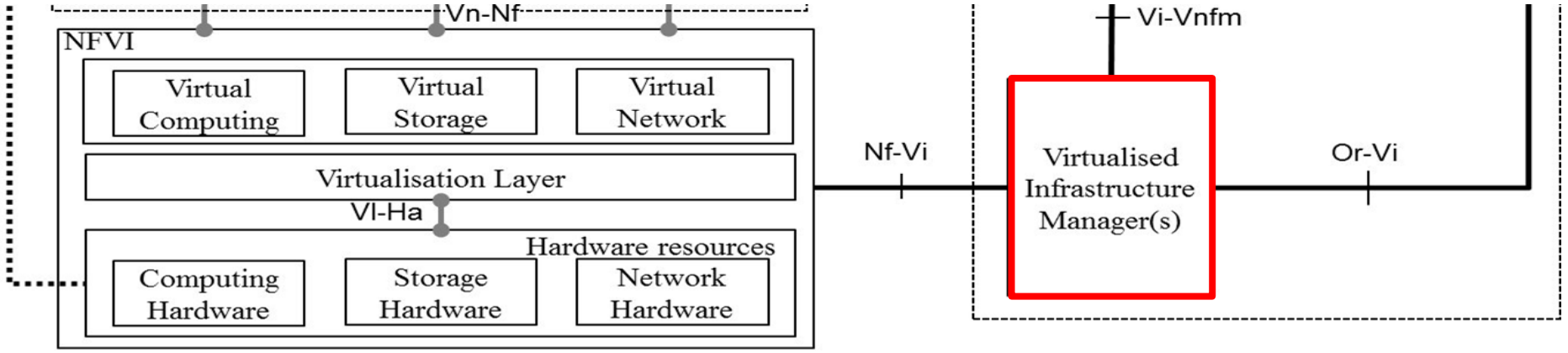


Data Plane assignment



VIM:
Virtualized Infrastructure Manager

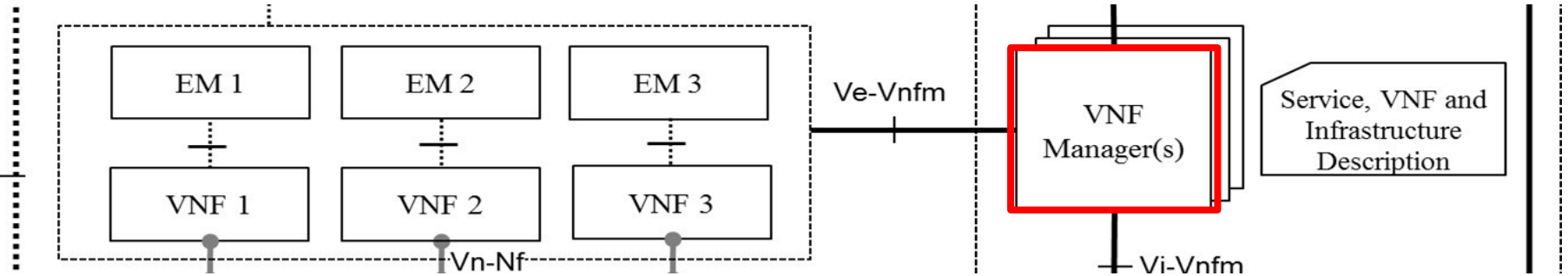
- The Virtualized Infrastructure Manager is part of the ‘MANO Stack’ and addresses provides lifecycle management for virtualized resources (VMs, volumes, networking paths and connectivity, etc.)



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).

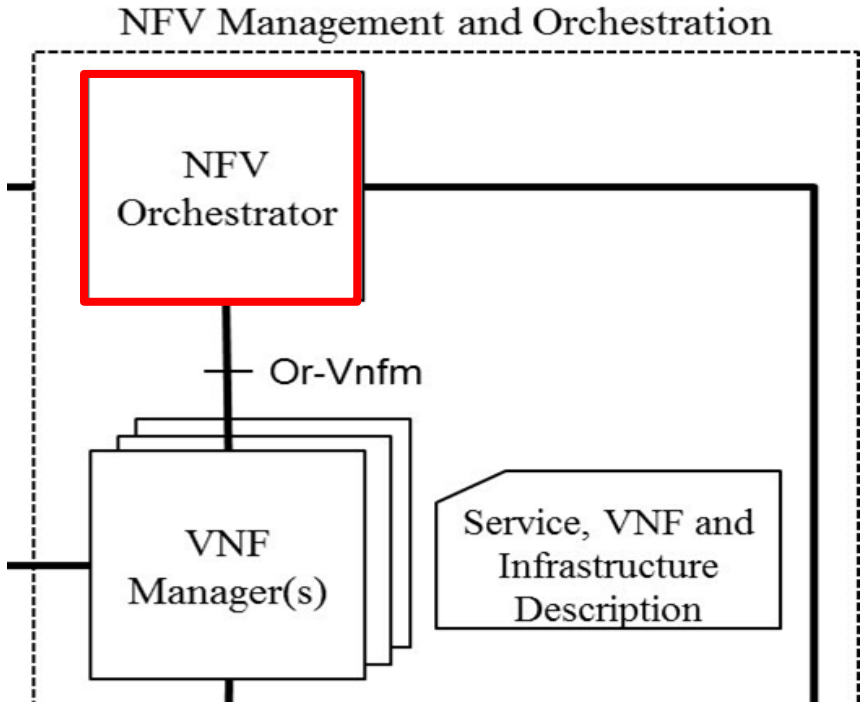
- VNF Manag



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.



ONAP

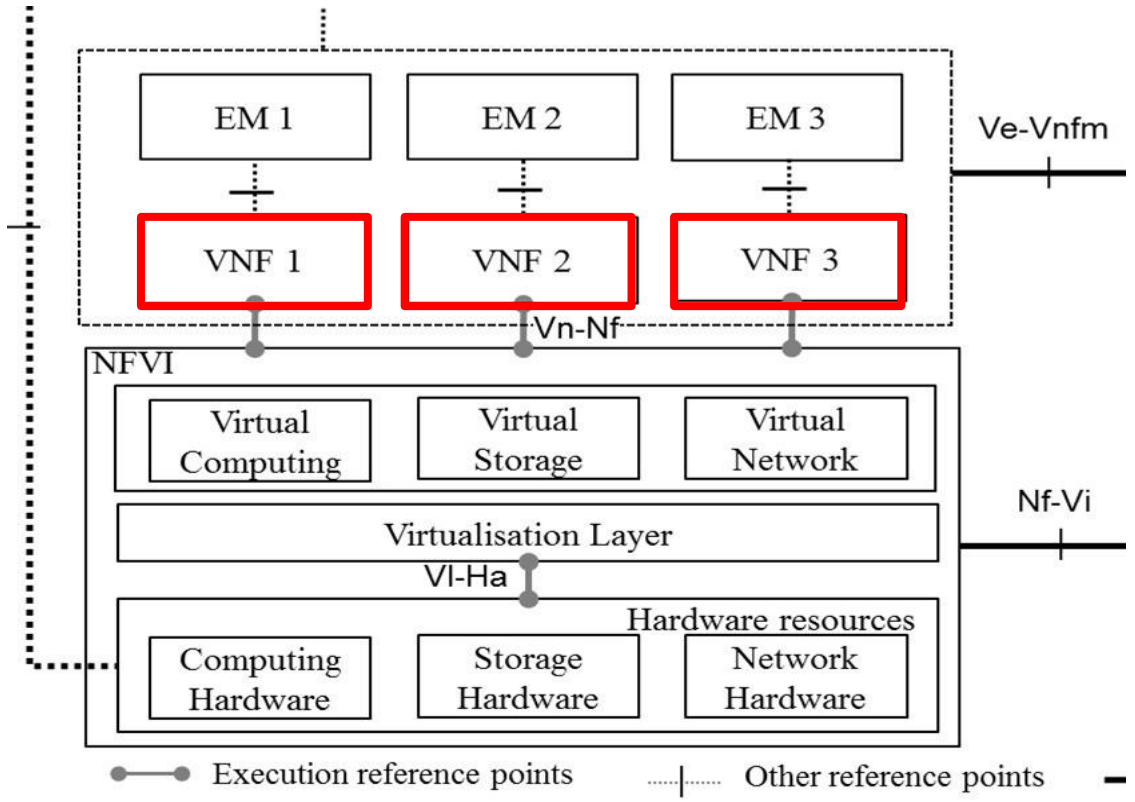
VF-C *(Virtual Functions Controller)*

Open Source MANO

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.

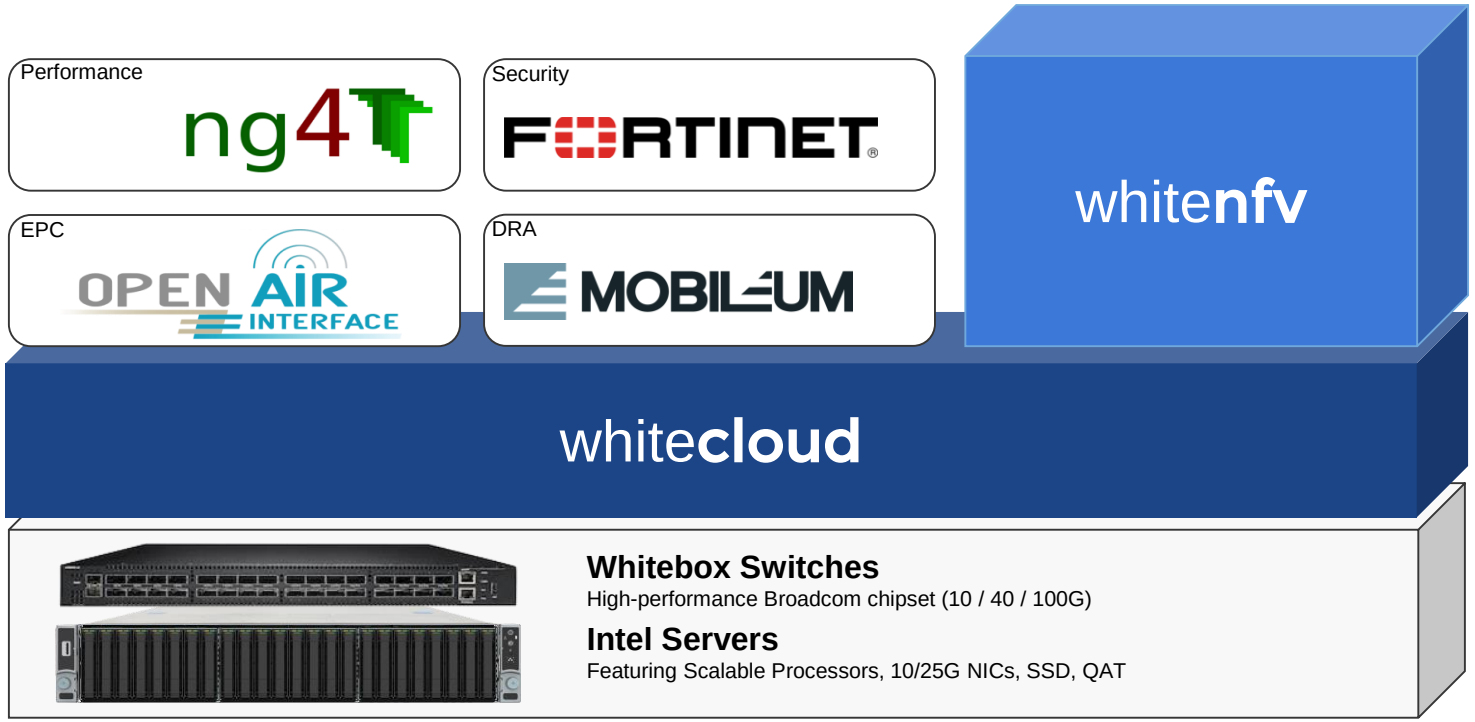
- MANO solutions should give the possibility to describe VNFs through ‘descriptor files’
- The industry’s goal is a unified and standard descriptor file format across different platforms.
- Both NS (comprised of VNFs) and VNFs should be described in a simple way.

```
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

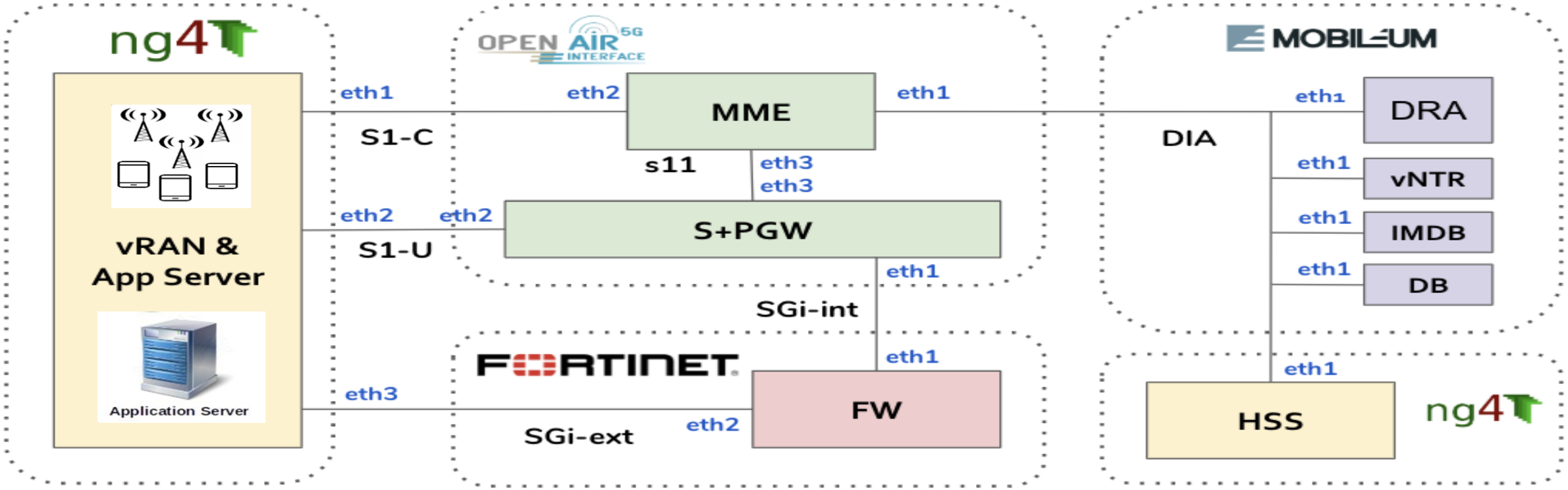
with the support of **leading NFV-enablers,** putting together a number of leading VNF vendors, on top of commoditized x86 infrastructure, managed by OpenStack and Open Source MANO.

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



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

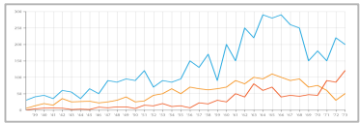
FORTINET

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

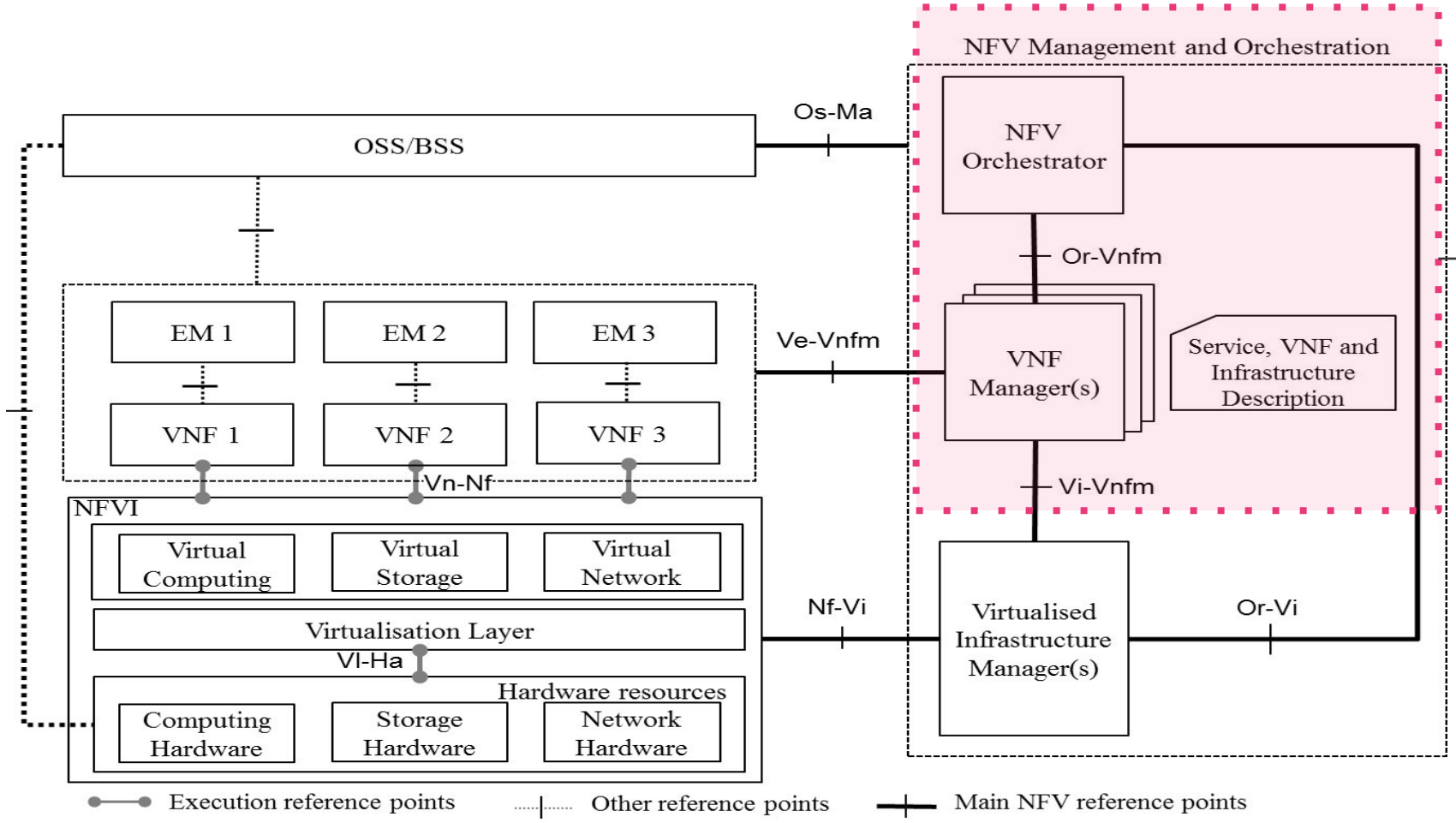
The final results, including configurations used for deploying this vEPC, are published, following the guidelines from **ETSI Plugtests Programme.**

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

Open Source
MANO

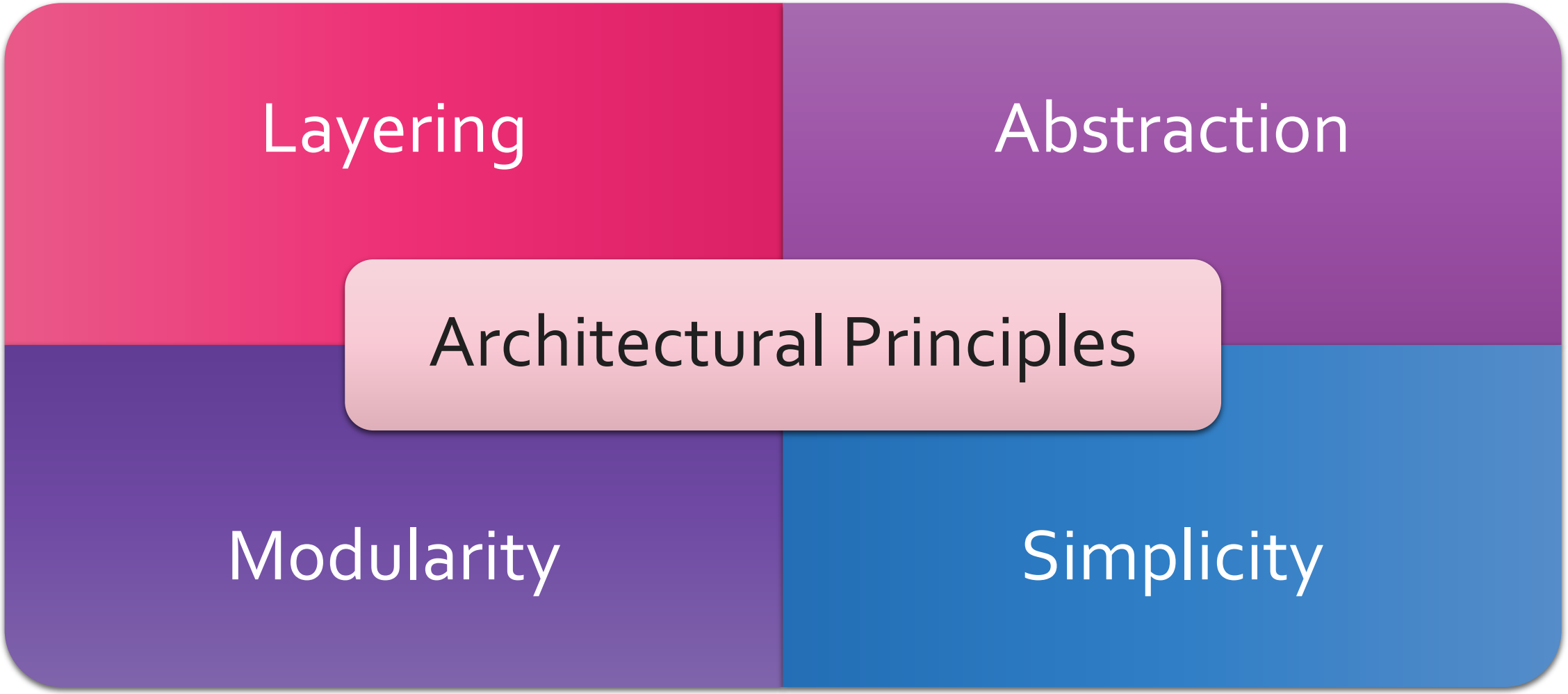
Introduction to OSM Release Five

The Open Source MANO Project



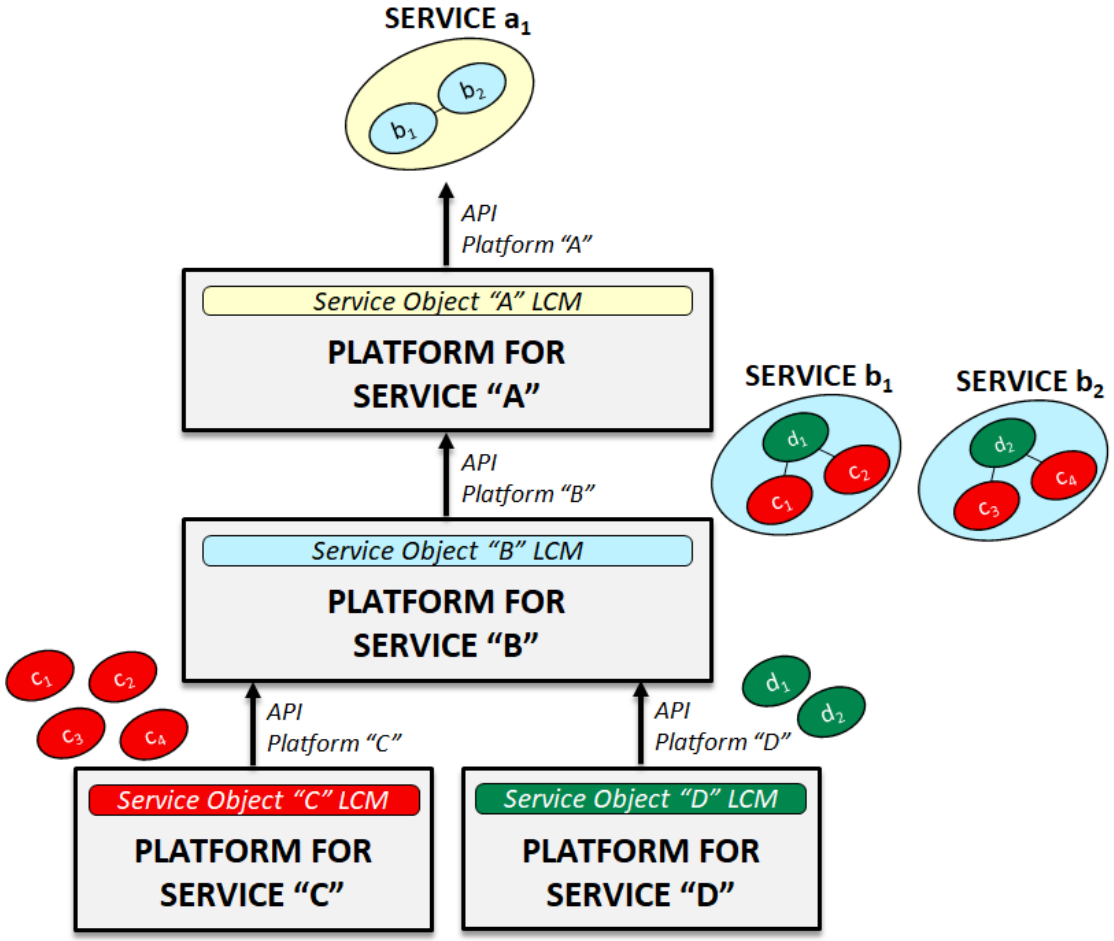
We are here!
Open Source MANO is an ETSI-hosted project to develop an Open Source NFV Management and Orchestration (MANO) software stack aligned with ETSI NFV.

OSM Architectural Principles



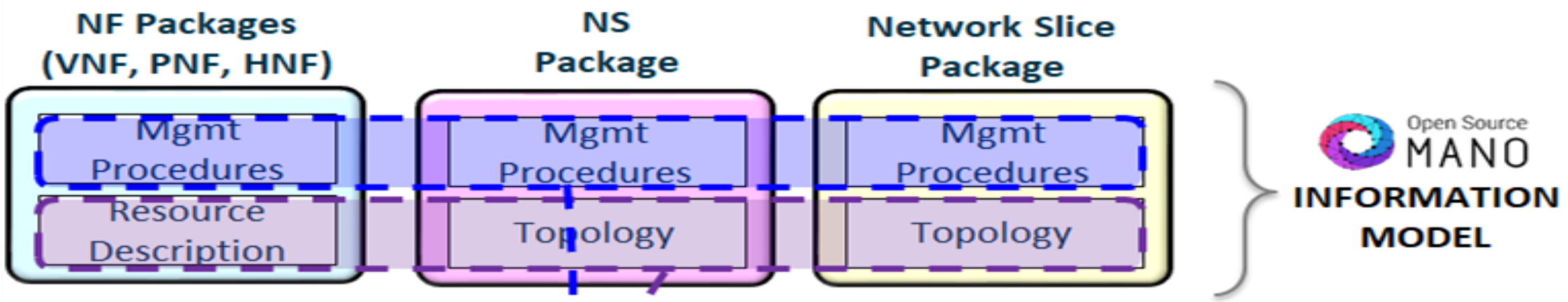
Layered Model

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



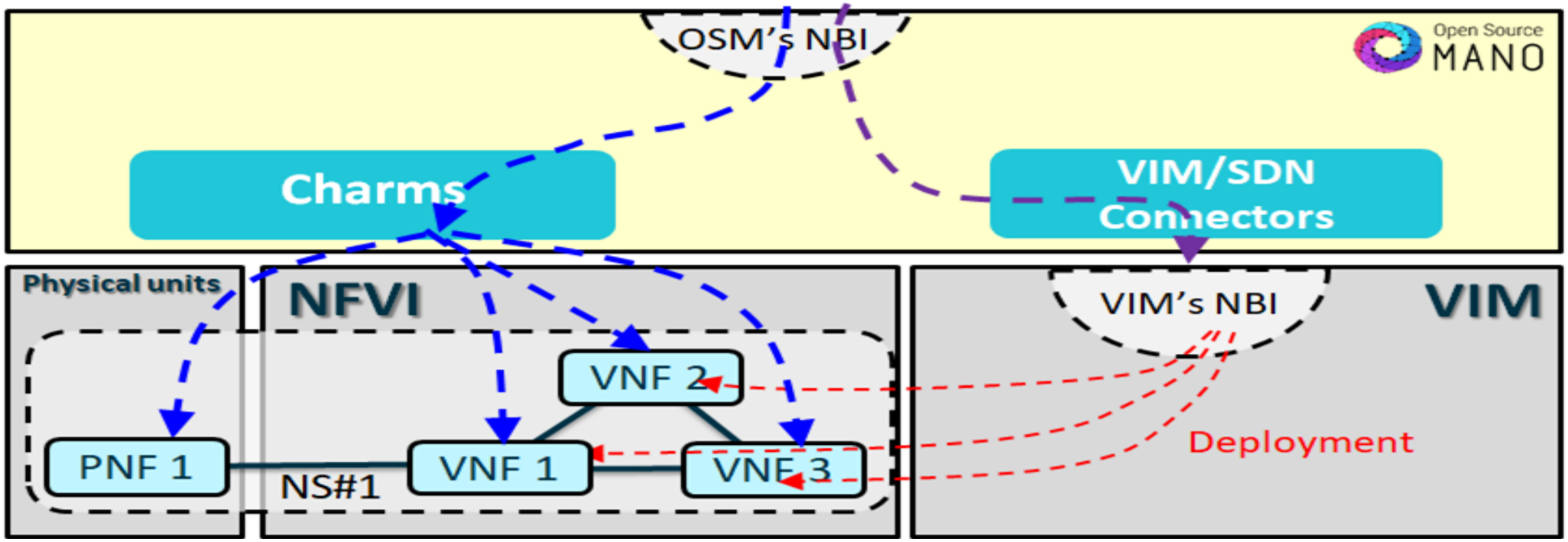
OSM's approach aims to minimize integration efforts

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),
   -



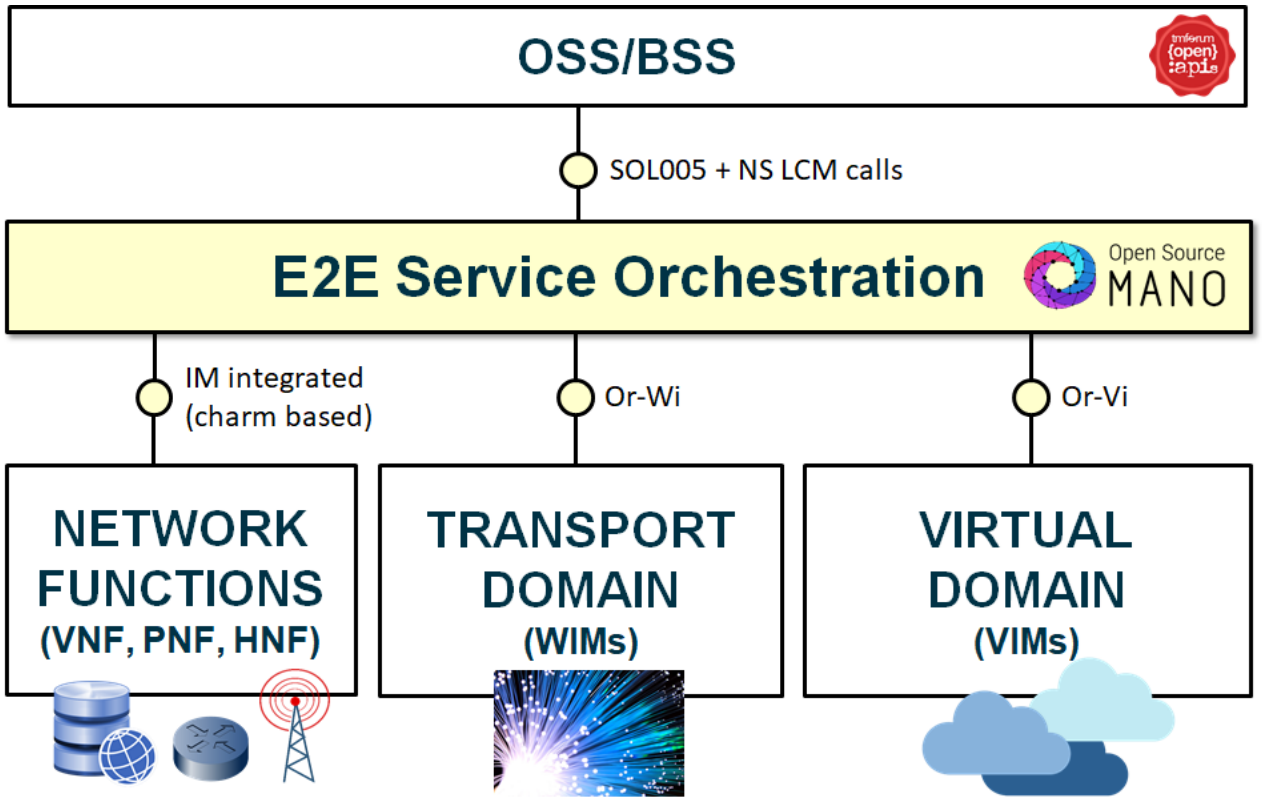
OSM's approach aims to minimize integration efforts

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



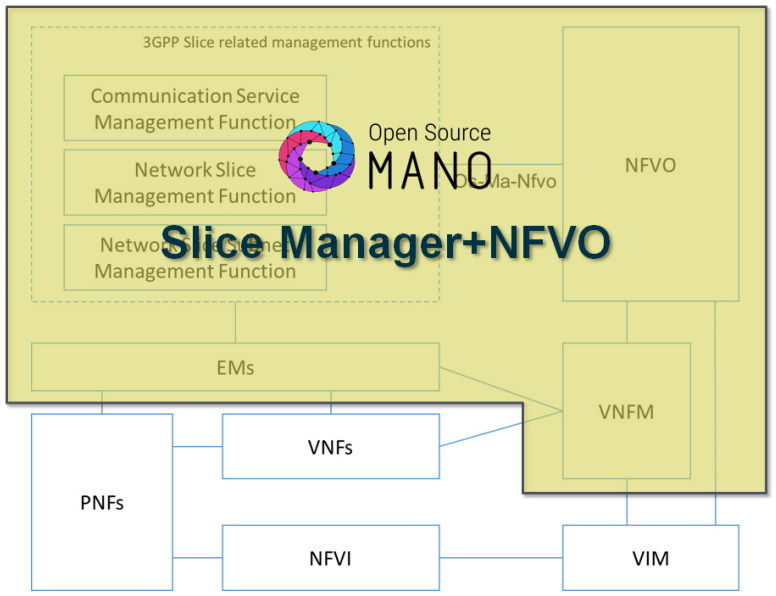
OSM's approach aims to minimize integration efforts

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.

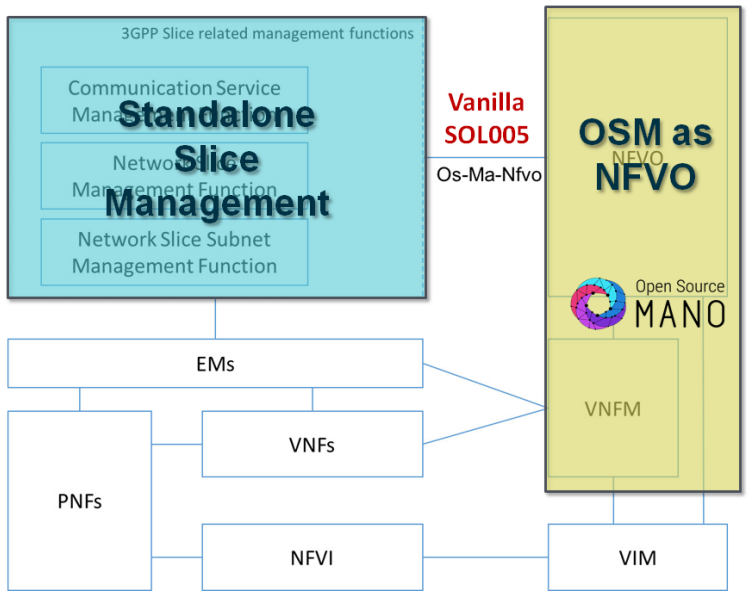


OSM's approach aims to minimize integration efforts

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



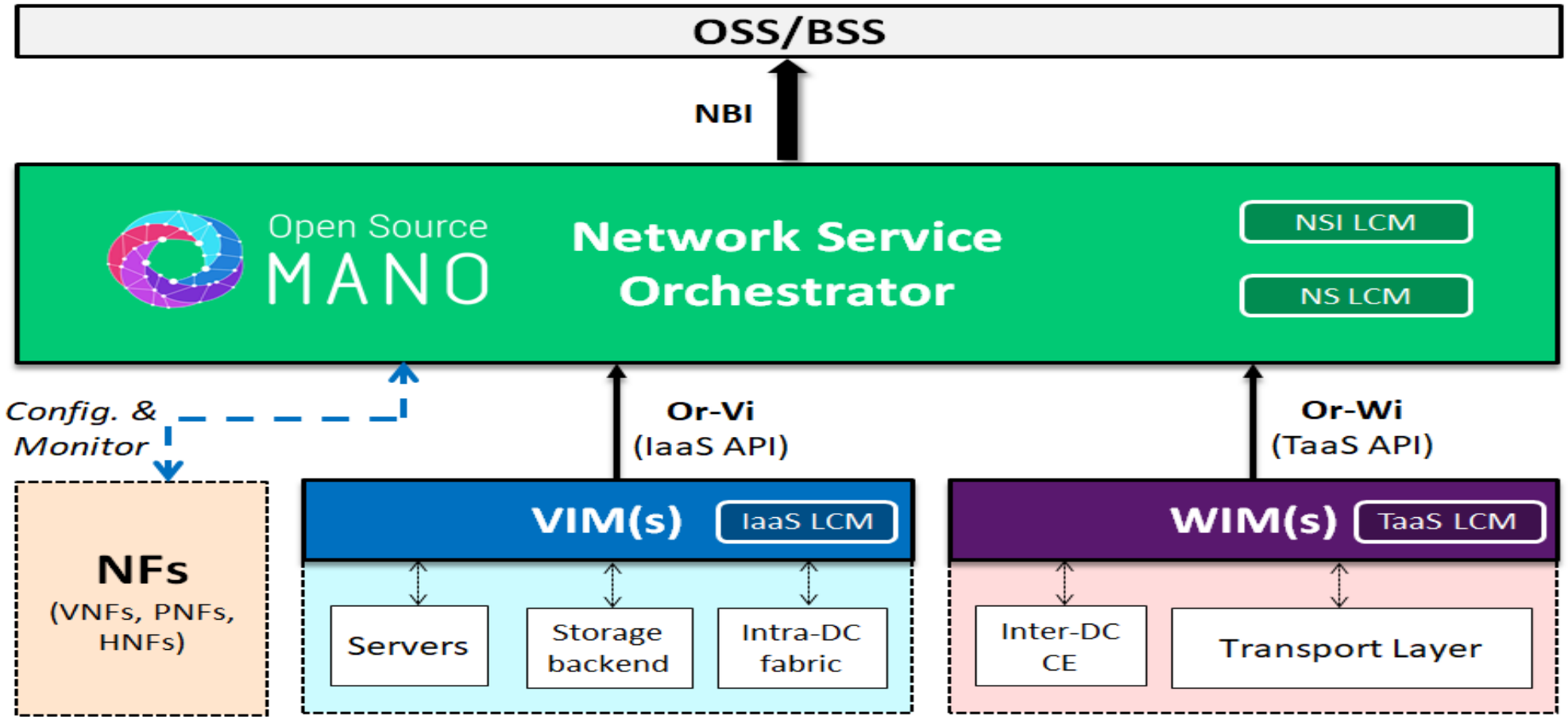
Full E2E Management
(Integrated Modelling)



Standalone Management
(Vanilla NFV/3GPP)

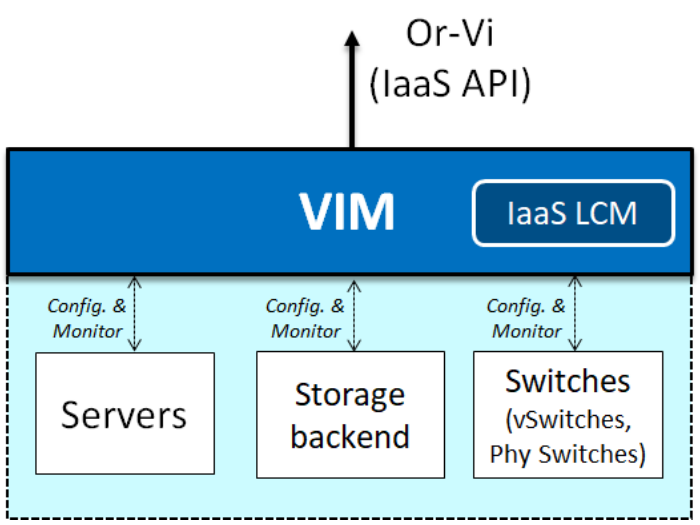
Service Platform view

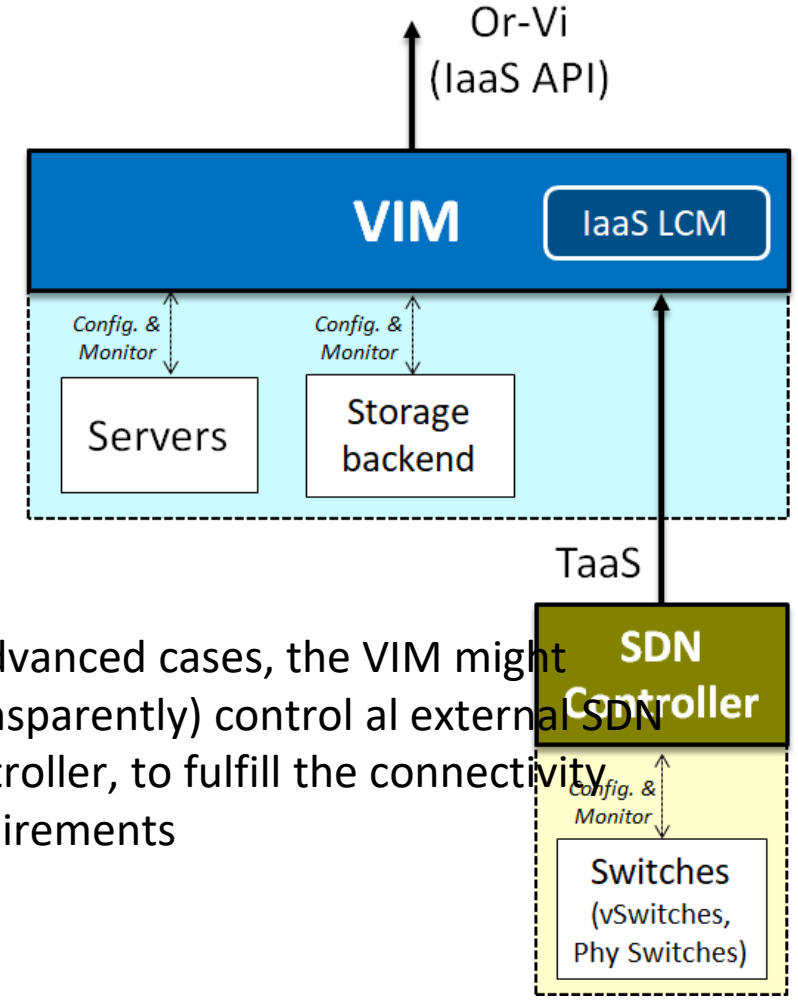
OSM as a Network Service Orchestrator (NSO)



Service Platform view

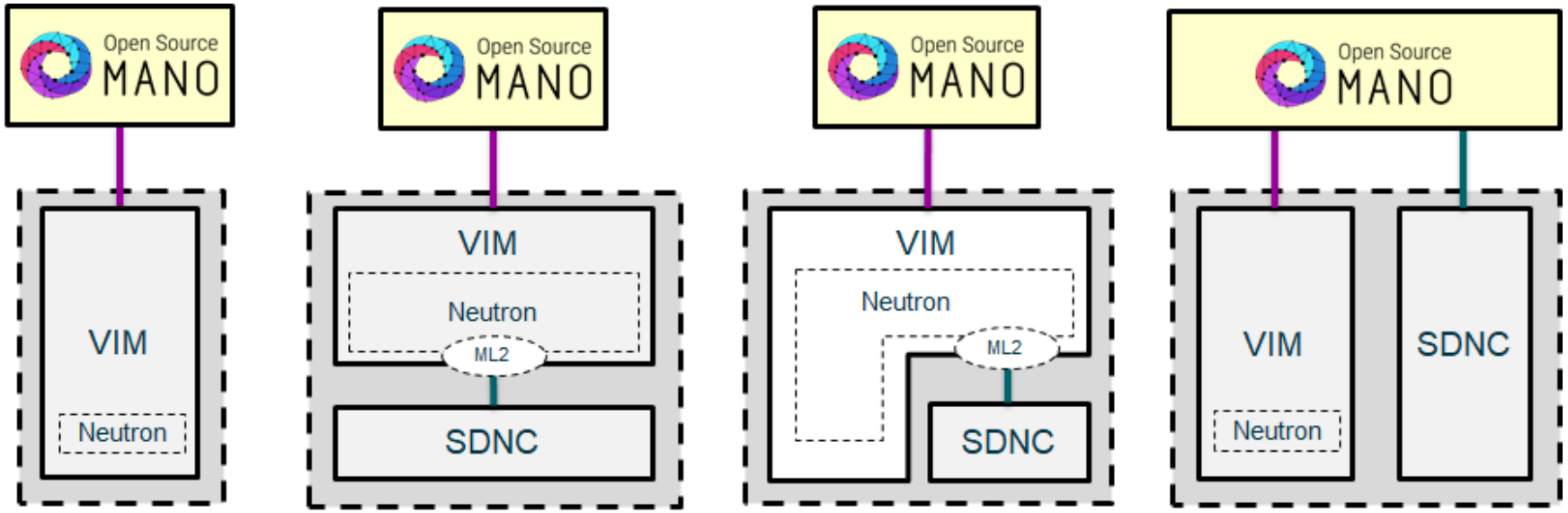
VIM manages the virtual network to support VNF's connectivity





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

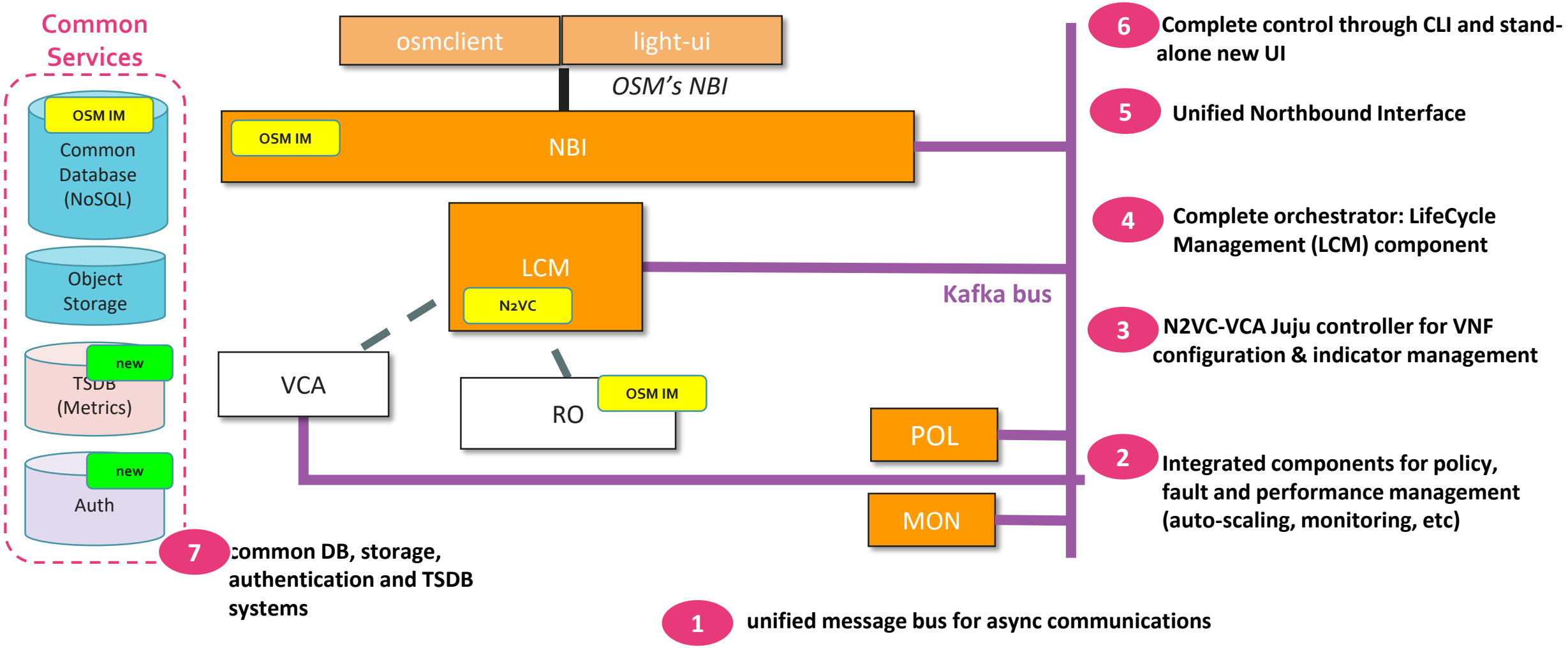
CASE #3: VIM with partial SDN
- Overlay: Native
- Underlay: SDNC

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)

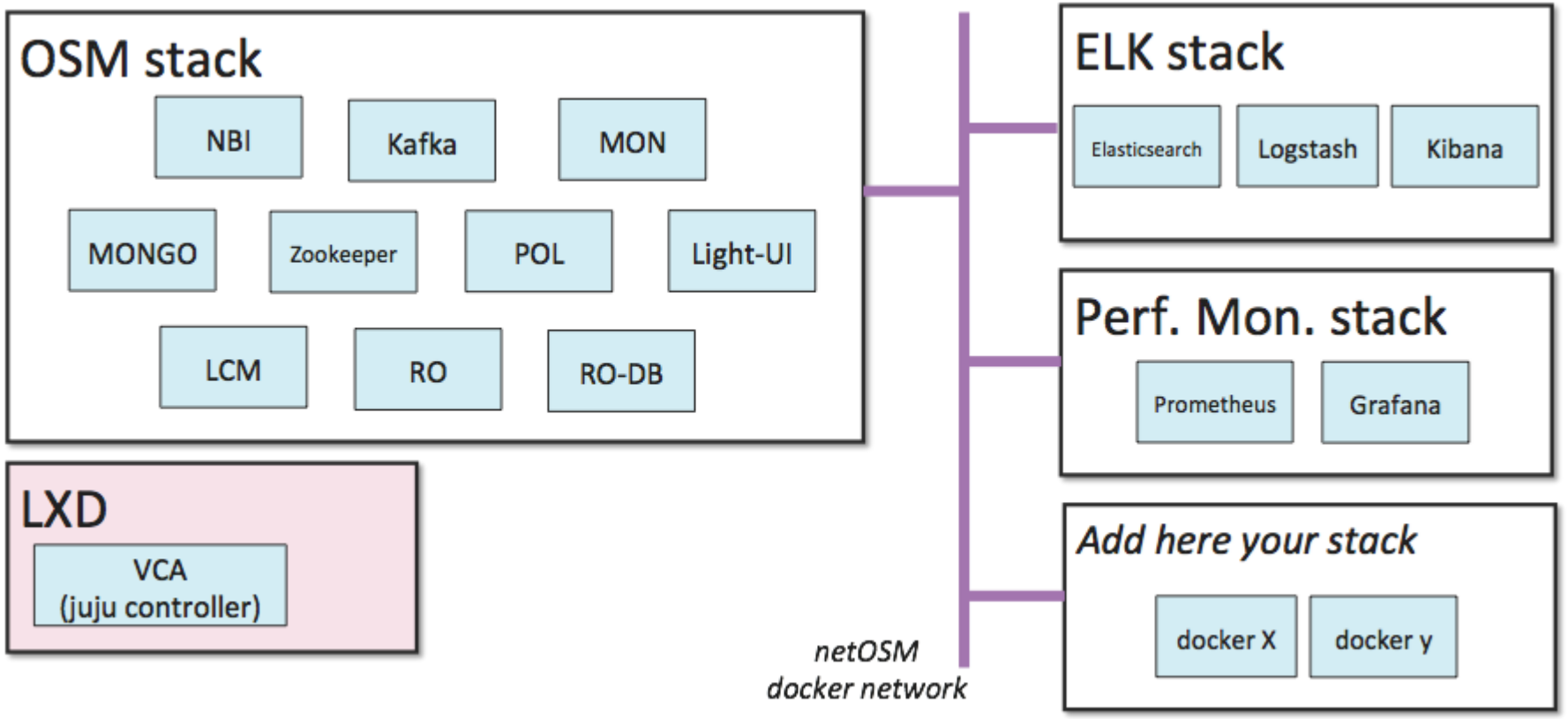
Release FOUR+ architectural view



Release FOUR+ architecture

Open Source MANO

Microservice architecture to enable extensibility

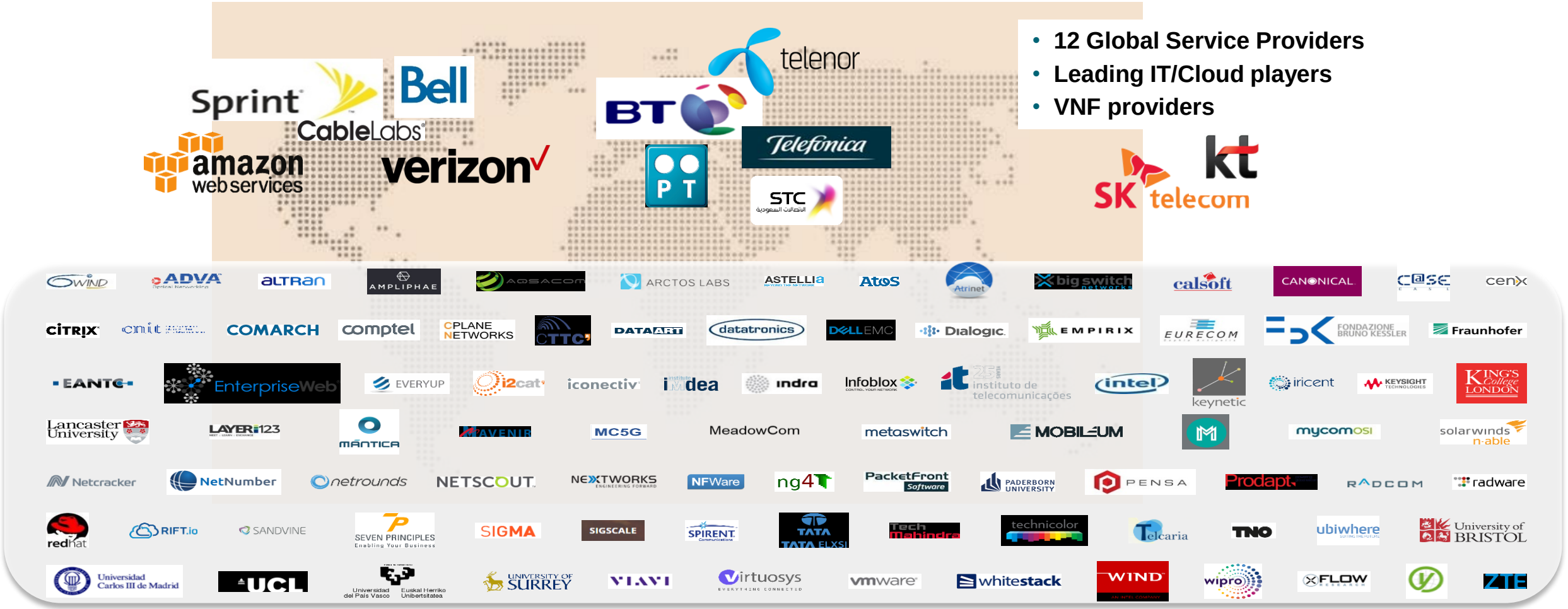


Why is OSM Awesome?

Open Source MANO

It has a large and diverse community! More than 120 members!

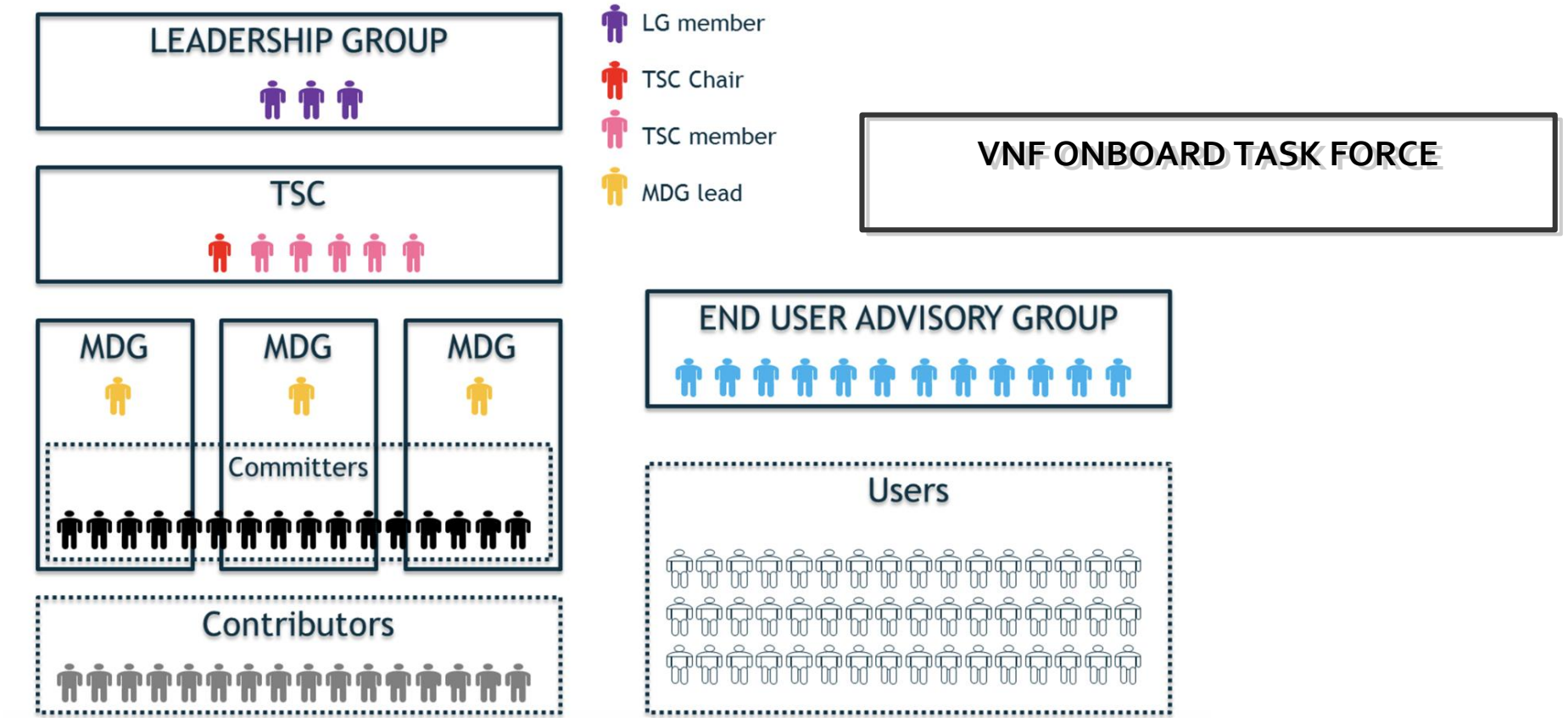
- **12 Global Service Providers**
- **Leading IT/Cloud players**
- **VNF providers**



Why is OSM Awesome?

Open Source MANO

It is well organized for producing production-ready upstream code



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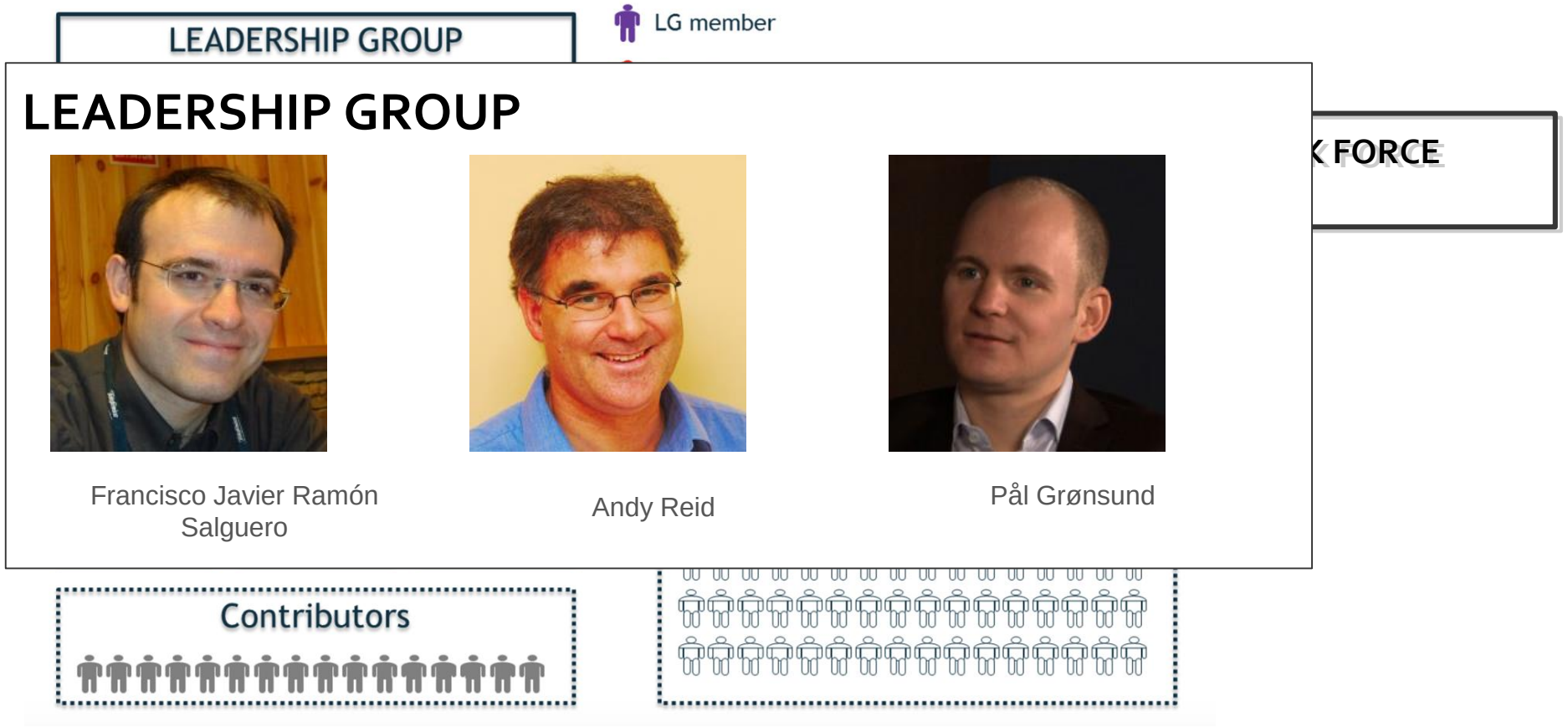


Why is OSM Awesome?

Open Source MANO

It is well organized for producing production-ready upstream code

LEADERSHIP GROUP

LG member

TECHNICAL STEERING COMMITTEE

Vanessa Little

Matt Harper

Gerardo García

Mark Shuttleworth

Jatinder Pancar

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

Committers

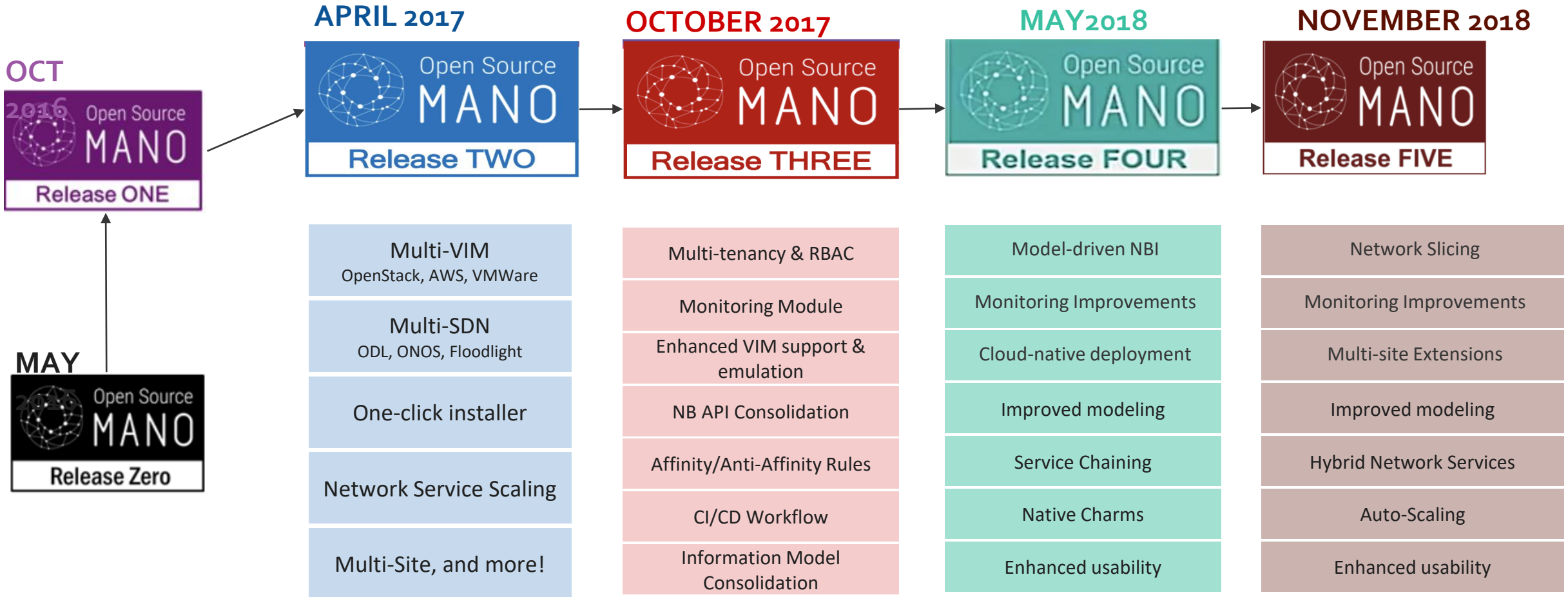
Contributors

VNF ONBOARDING TASKFORCE

Gianpietro Lavado

Why is OSM Awesome?

It prioritizes features for production readiness…



Why is OSM Awesome?

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

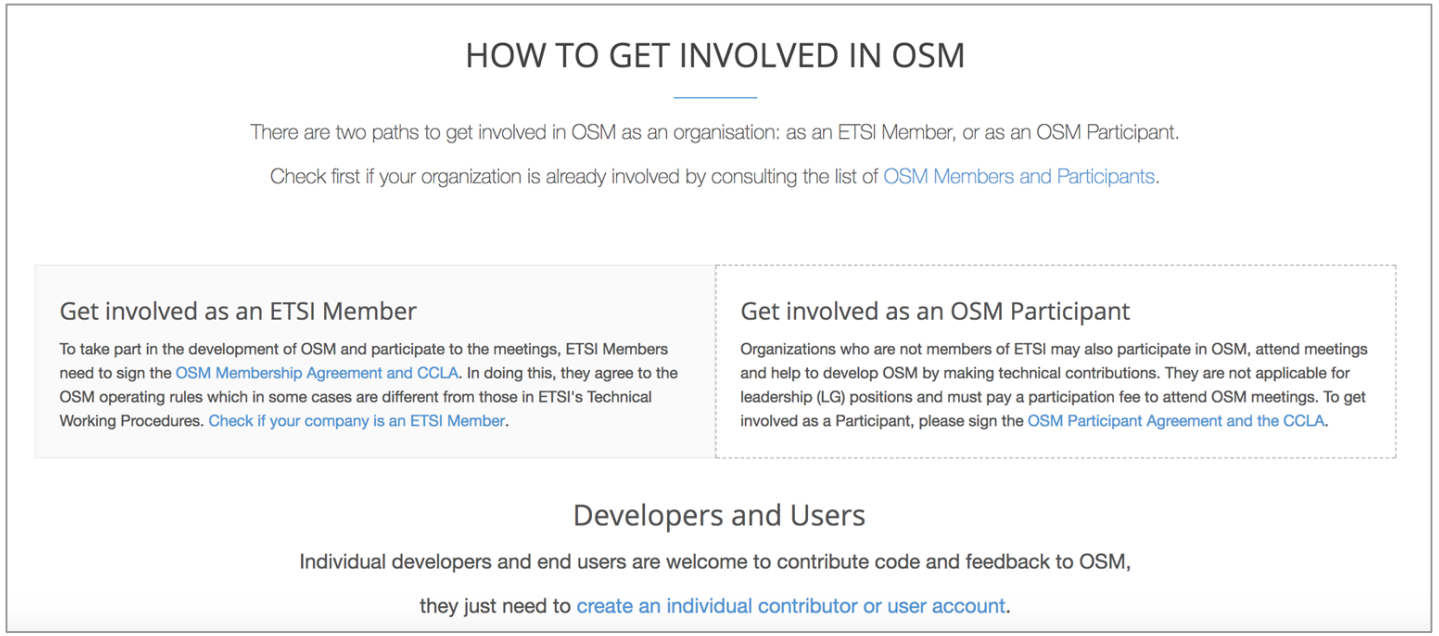
- Role-based authentication control
- Support for full/native charms for enhanced VNF management
- Network Slicing extensions
- Network-Service-level primitives
- Improved monitoring of infrastructure components and VNFs
- Enhanced support for instantiation parameters

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.