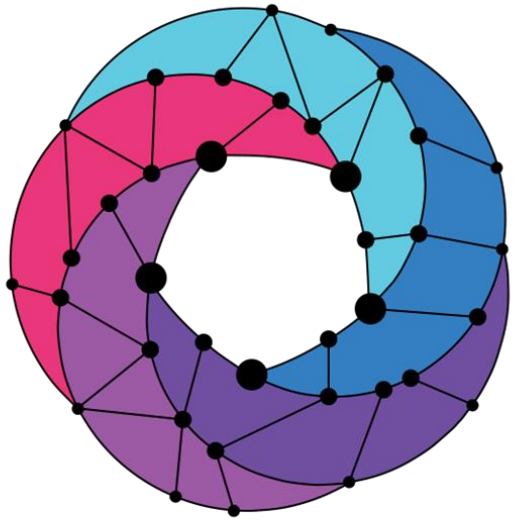

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What is OSM?

Gerardo García de Blas (TSC Chair, Telefónica)

ETSI

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Introduction to NFV

ETSI

Network Function Virtualization provides a mean to make the network more flexible by minimizing dependence on HW constraints…

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Network functionalities are fully defined by SW, minimising dependence on HW constraints

Traditional Network Model: APPLIANCE APPROACH


DPI


BRAS


GGSN/SGSN


PE Router


Firewall

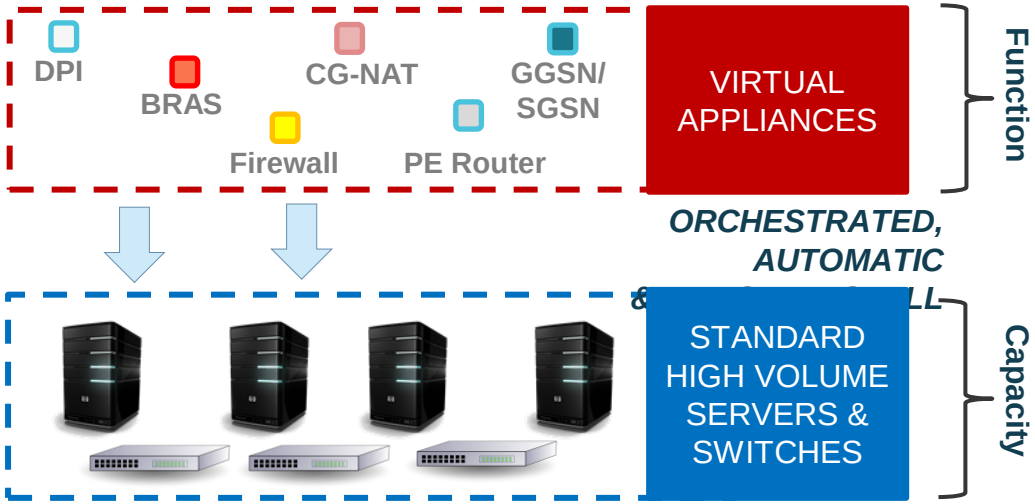

CG-NAT


Session Border Controller


Imagenio STB

- Network functionalities are **based on specific HW with specific SW linked to HW vendors**
- **One physical node per role**

Virtualised Network Model: VIRTUAL APPLIANCE APPROACH



- Network functionalities are **SW-based over COTS HW**
- **Multiple roles over same HW**

… helping to reduce network management complexity, as HW can be treated as a pool of resources

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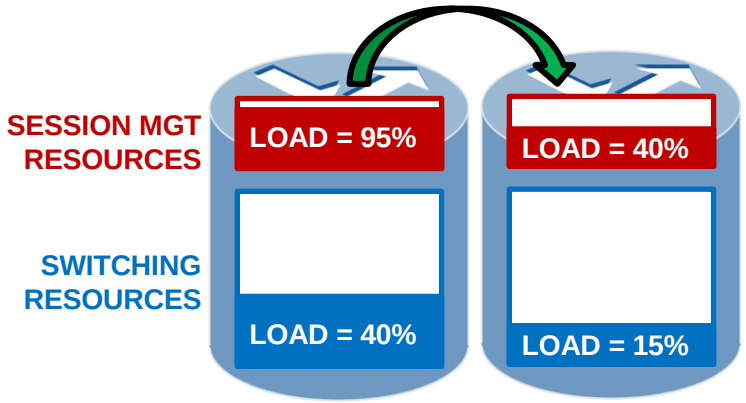
APPLIANCE APPROACH

- Node sizing is **determined by the bottleneck of its functionalities**
- Capacity growth **often leads to node growth** or silo HW purchase

SESSION MGT LIMITATIONS PER NODE LEADING TO 2nd NODE PURCHASE



Vs.

VIRTUAL APPLIANCE APPROACH

- HW becomes interchangeable and aggregatable (**pool**)
- Resource assignation becomes fully **flexible and dynamic**

PROCESSING CAPACITY BECOMES COMMODITY & MANAGED AS A CONTINUUM

NETWORK FUNCTIONS VIRTUALISATION (NFV) implies the separation of the **FUNCTION** from the **CAPACITY**

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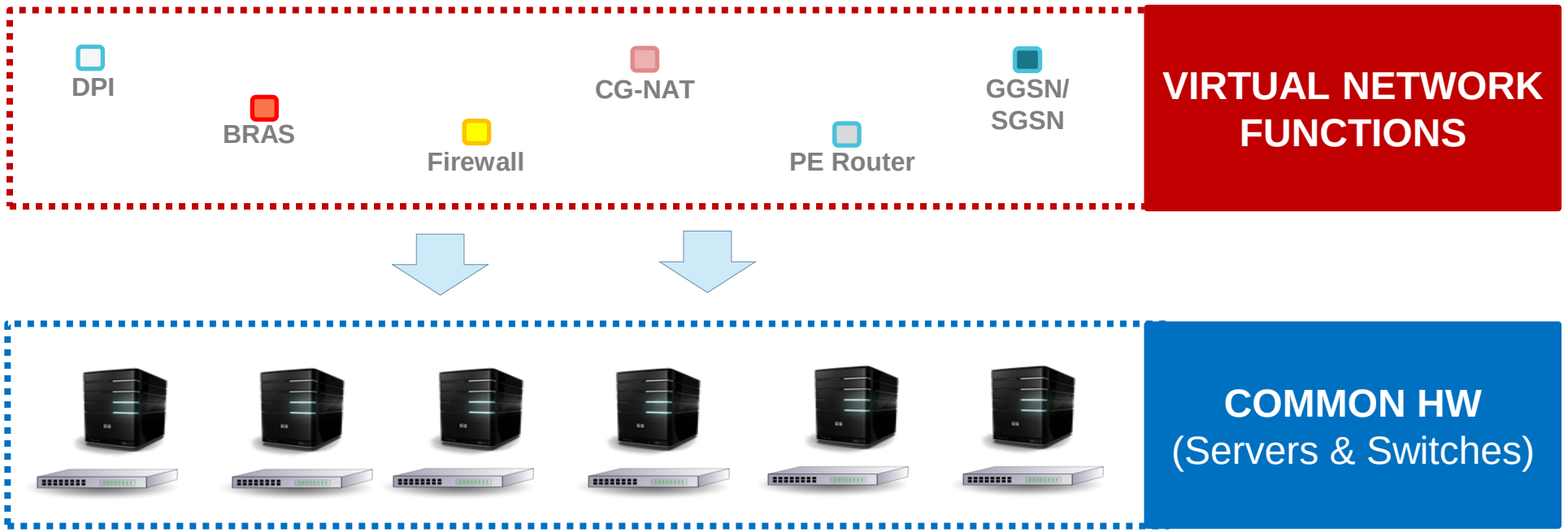
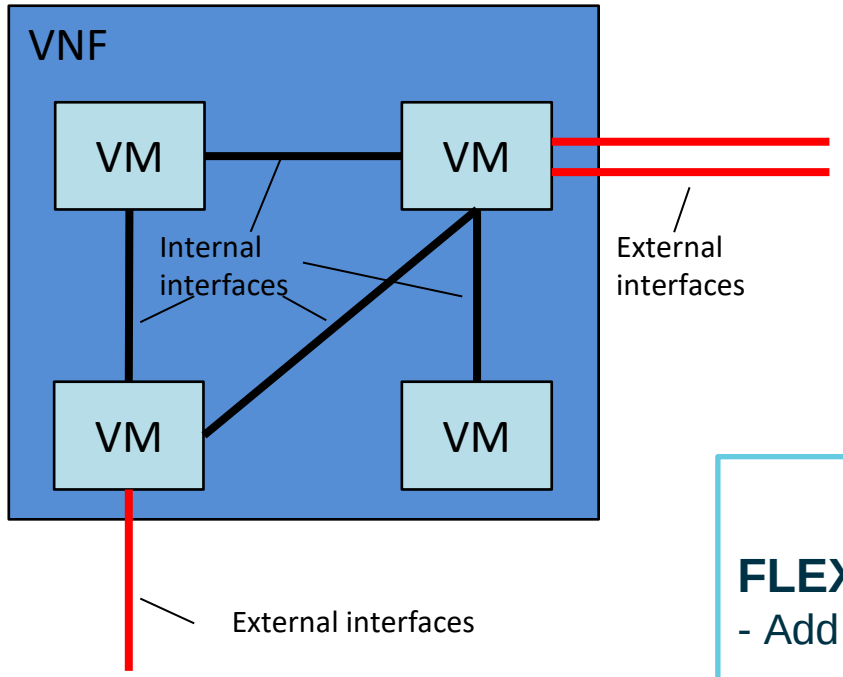


FUNCTION (semantics)

Decoupled

CAPACITY (resource mgmt)

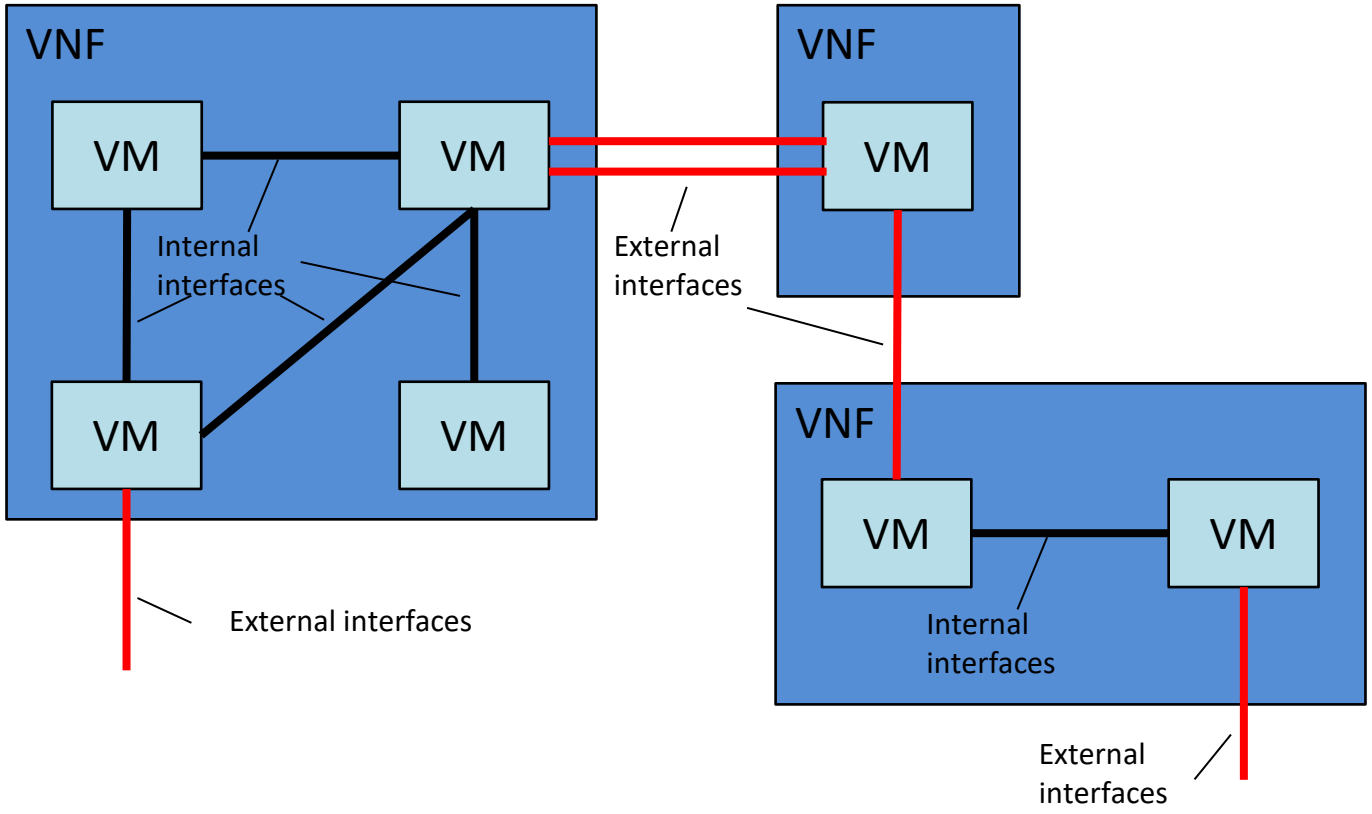
VIRTUALIZED NETWORK FUNCTIONS (VNFs) are composed of a set of interconnected VMs…



FLEXIBLE SCALING
- Add more VMs as you grow

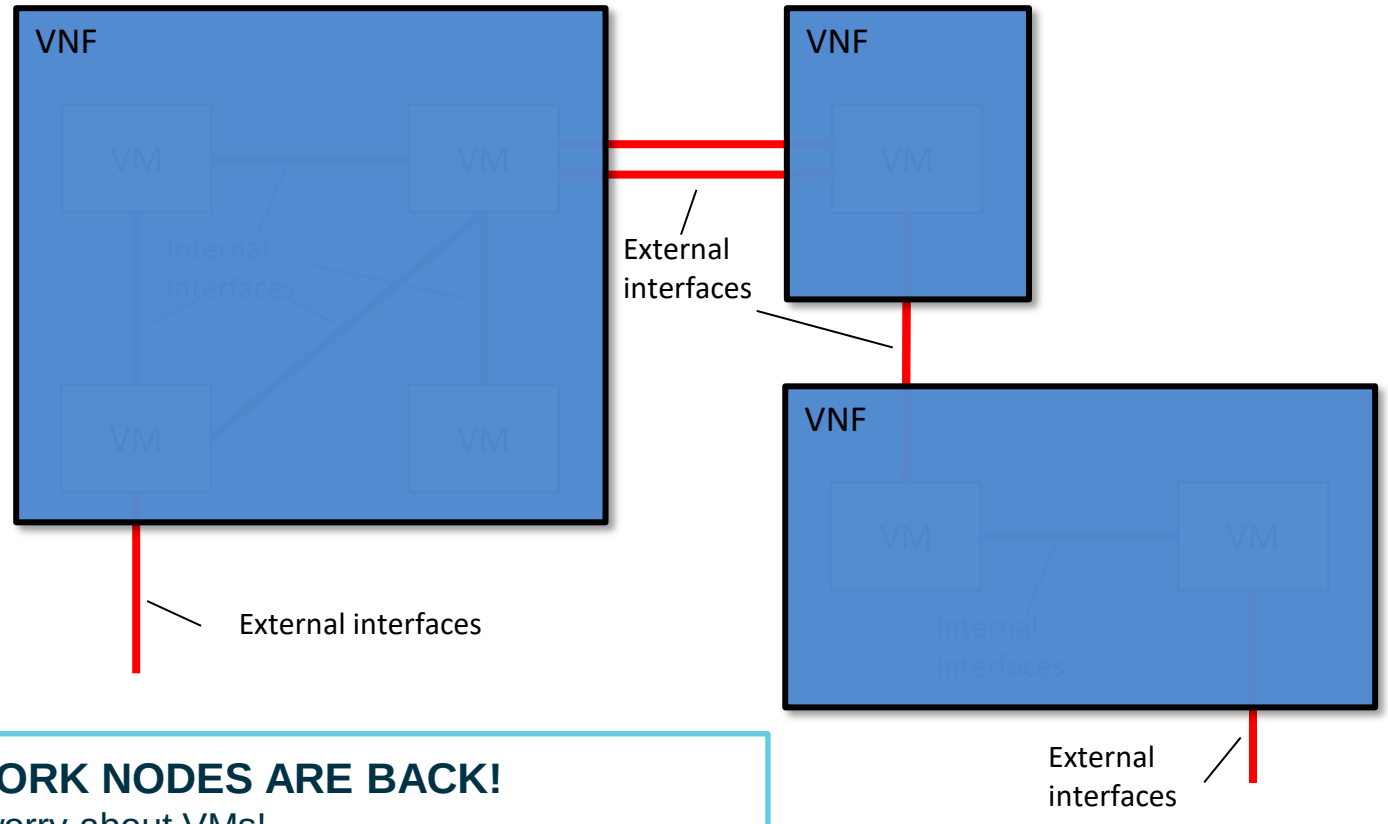
SIMPLER ADDITION OF NEW FEATURES
- Can be isolated in new VMs

… and VIRTUALIZED NETWORKS are built of a set of interconnected VNFs.



FULL NETWORK SCENARIOS/TOPOLOGIES CAN BE EASILY CLONED, MOVED, RESIZED, etc.

Fortunately, the **NFV ORCHESTRATION (NFV-O)** not only automates **network deployments**, but also hides that complexity



OUR NETWORK NODES ARE BACK!
- No need to worry about VMs!

SCENARIOS CAN BE ABSTRACTED
- Parameters for E2E management can be exposed

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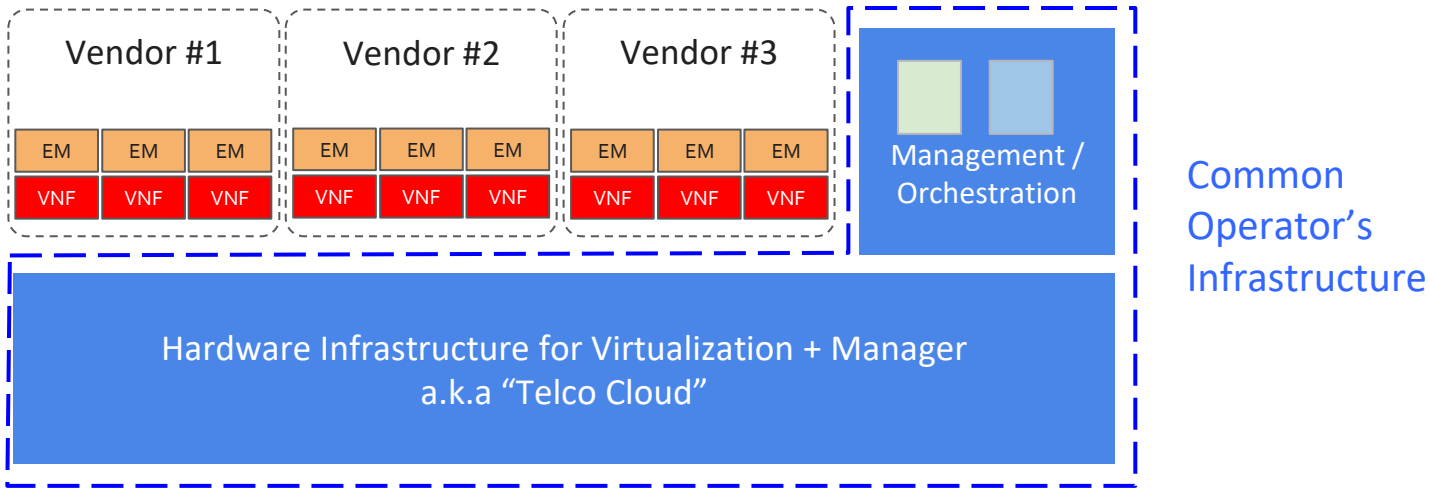
ETSI NFV ISG: NFV architecture under standardization

ETSI

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**.



How was this originated?

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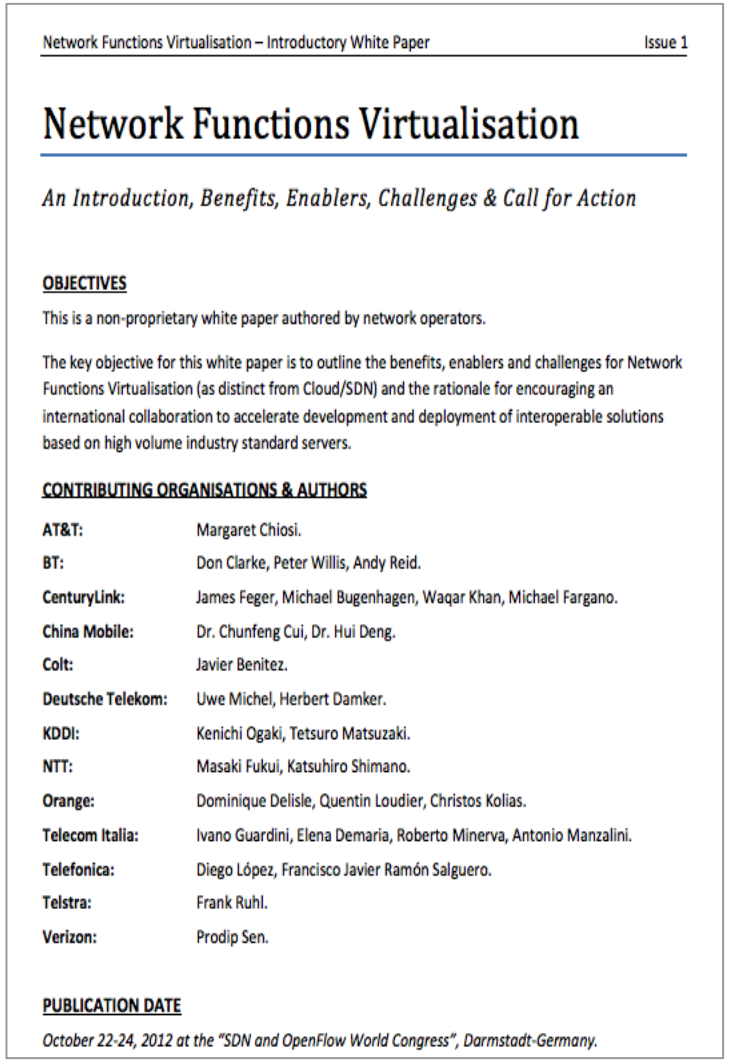
A white paper was written in 2012 by the world's leading telecom network operators.

This group evolved to the ETSI NFV ISG (Industry Specification Group), formed today by 300+ companies.

Their main motivation had to do with the increasing TCO of building a network with proprietary hardware appliances.



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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Telstra:	Frank Ruhl.
Verizon:	Prodip Sen.

PUBLICATION DATE

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

ETSI Working Groups

Release 1 (2013-2014): pre-standard studies

Relevant specs and recommendations:

- NFV Architectural Framework (NFV002)
- NFV Infrastructure Overview (INF001)
- NFV Management and Orchestration (MAN001)
- NFV Performance and Port. Best Practises (PER001)

Source: ETSI. Web: https://www.etsi.org/technologies/nfv

ETSI Working Groups

Release 2 and Release 3 (2015-2018):

Relevant WG:

IFA (stage 2 specifications): development of architecture, interfaces and information model aspects

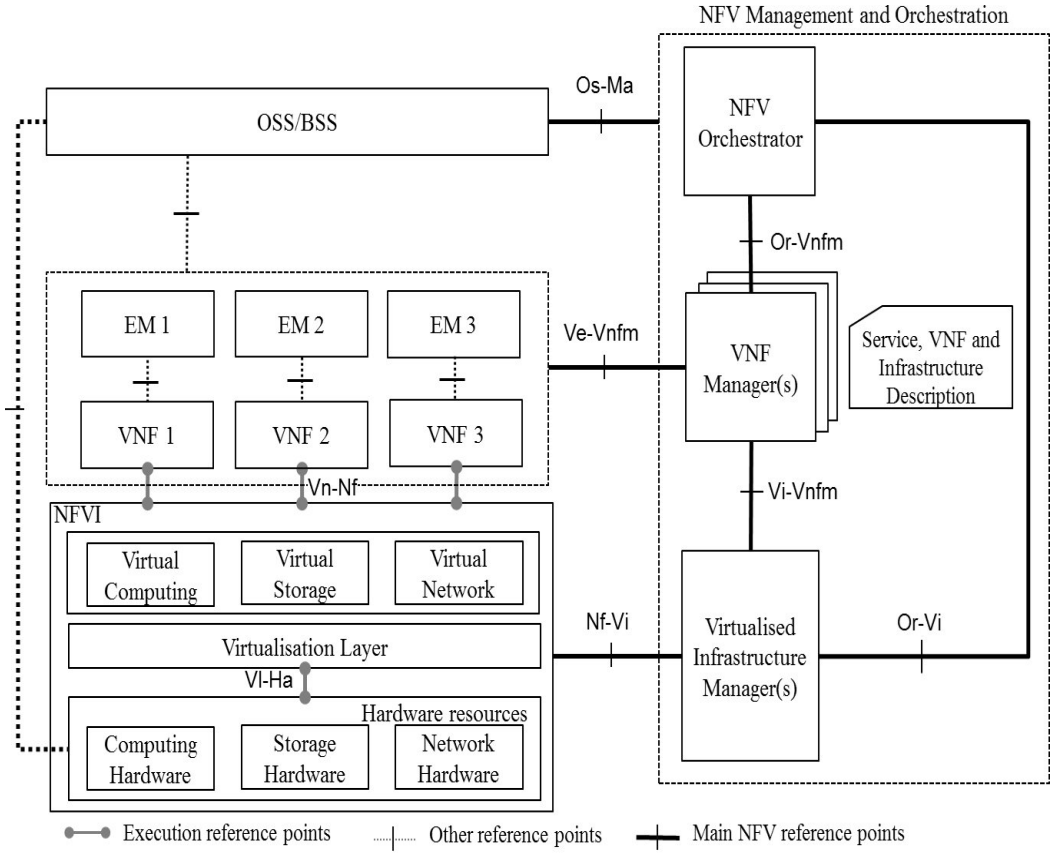
SOL (stage 3 specifications): specification of the implementable protocol and data model solutions

TST: API conformance testing, interoperability testing guidelines

Source: ETSI. Web: https://www.etsi.org/technologies/nfv

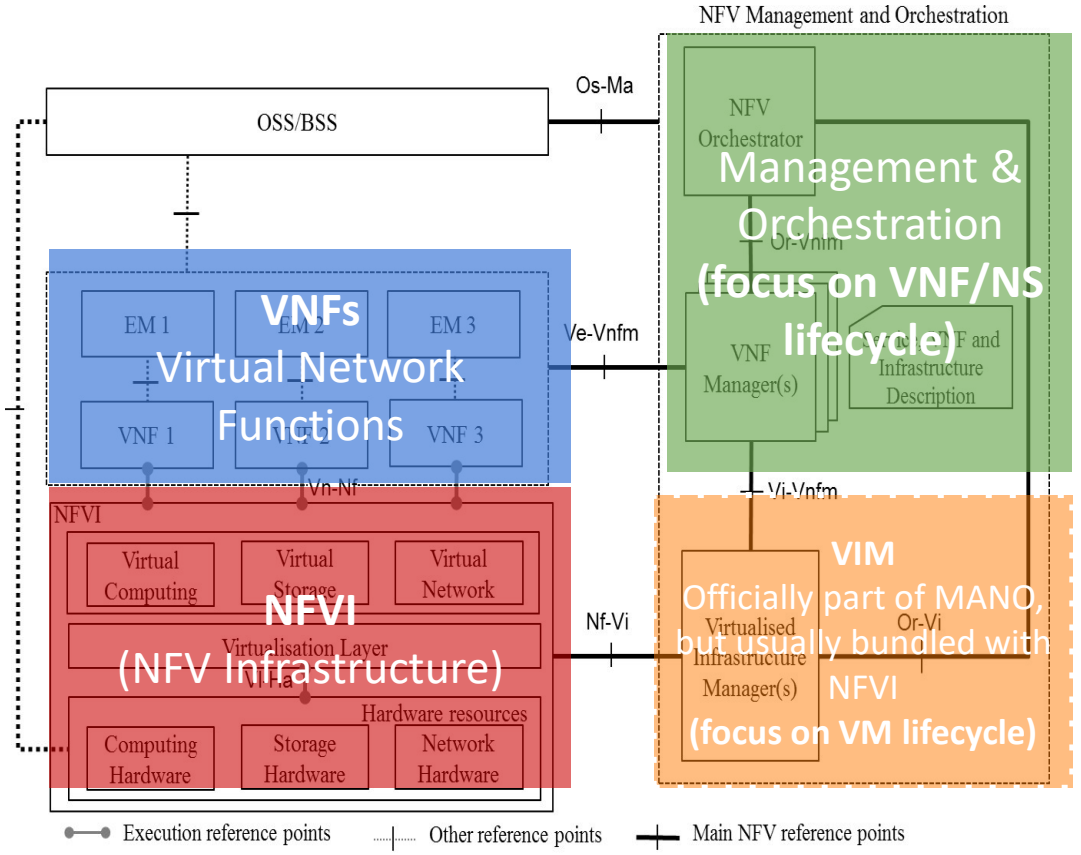
The ETSI NFV Architecture

The NFV architecture is described in the [NFV Architectural Framework GS (NFV002)]



The ETSI NFV Architecture

The NFV architecture is described in the [NFV Architectural Framework GS (NFV002)]



ETSI NFV architecture and specifications

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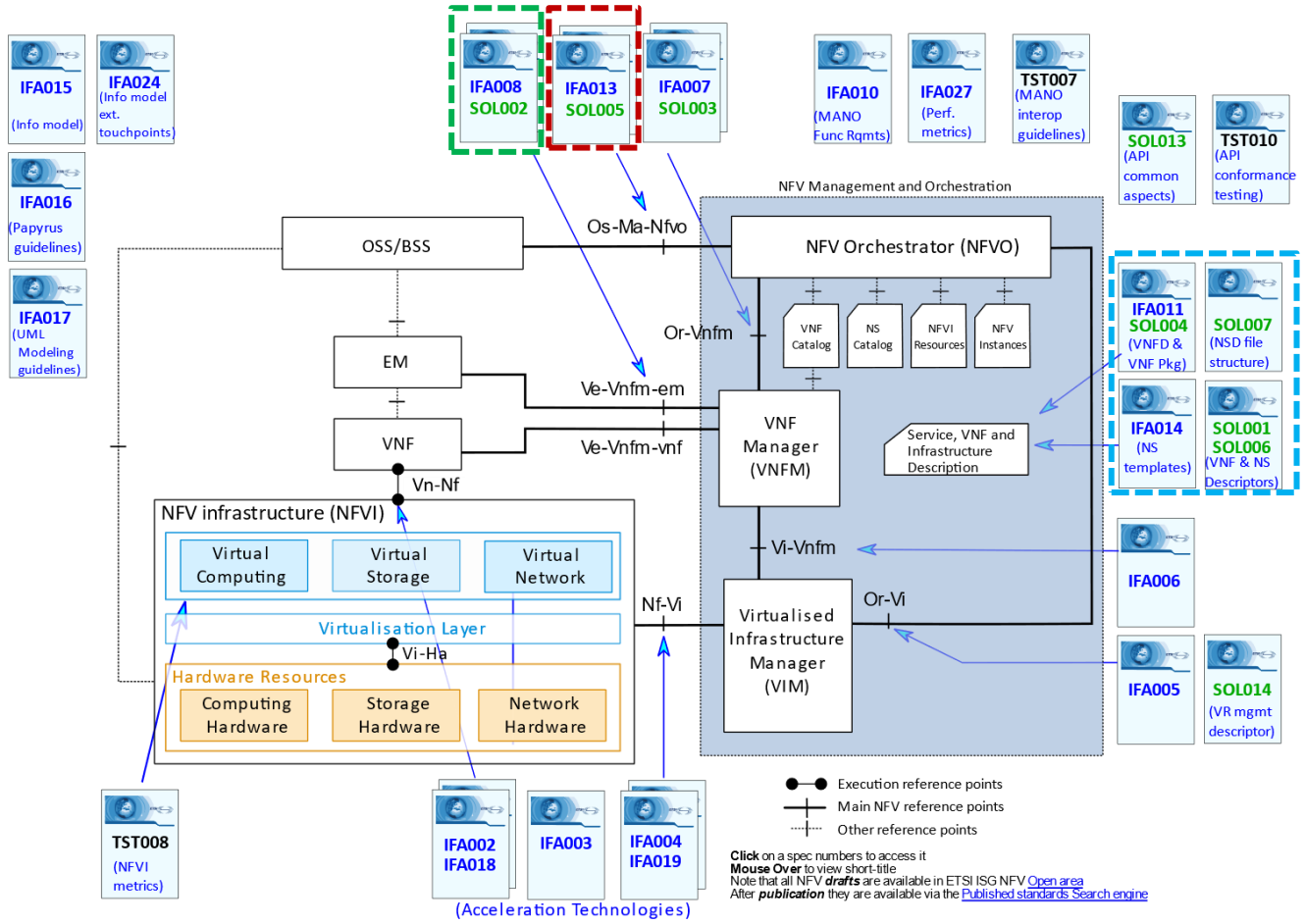
All you need is a map



Os-Ma-Nfvo reference point (interface between OSS/BSS and NFVO)

Ve-Vnfm-em/vnf reference points (interface between VNFM and EM/VNF)

VNF and NS descriptors and packages

Source: ETSI. Web: https://www.etsi.org/images/articles/NFV%20Architecture.svg

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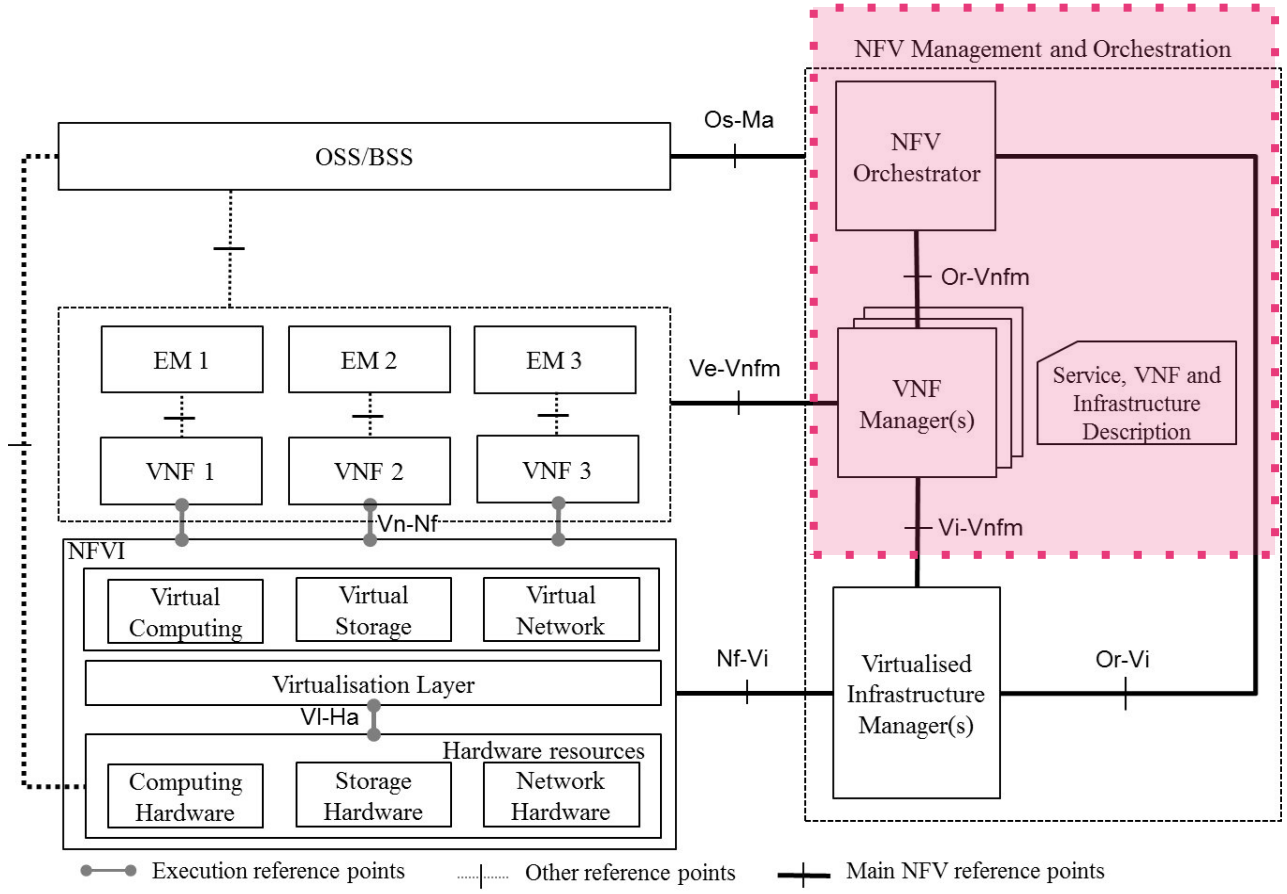
ETSI OSM: the orchestration layer

ETSI

The Open Source MANO Project

Where does OSM fit in the NFV architecture?



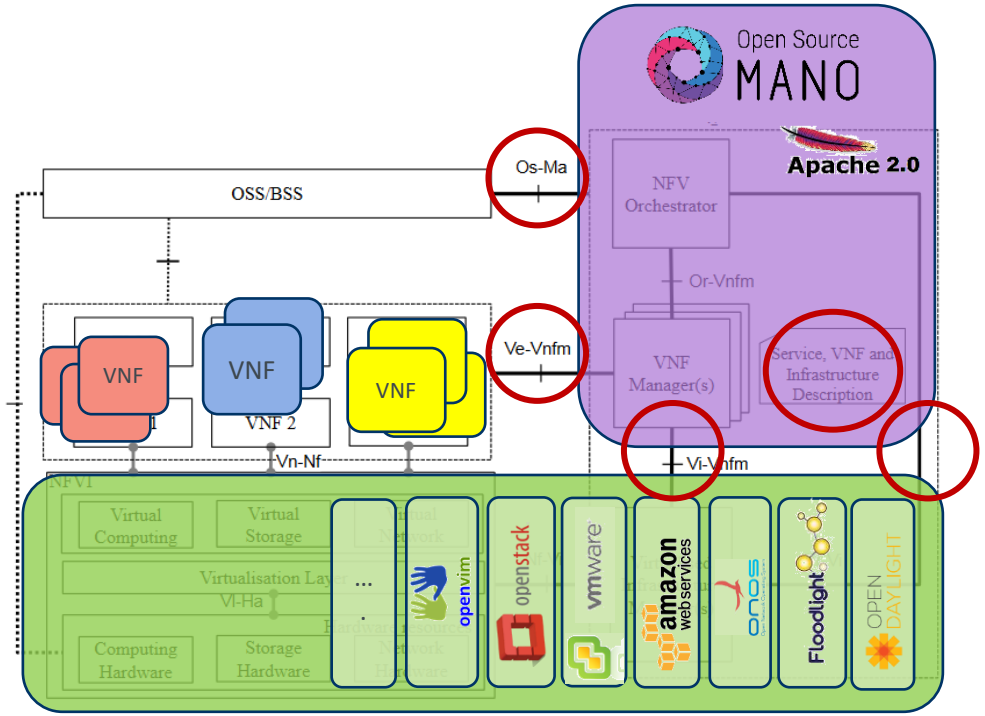
We are here!
Open Source MANO is an ETSI-hosted project to develop an Open Source NFV Management and Orchestration (MANO) software stack aligned with ETSI NFV.

ETSI NFV & ETSI OSM

OSM and NFV are not the same, but they complement each other

ETSI NFV: Industry Specification Group that elaborates specifications on Network Functions Virtualization

ETSI OSM: Open Source Group developing a Management and Orchestration (MANO) stack aligned with ETSI NFV Architectural Framework and Information Models



OSM provides a platform to create **Networks as a Service** and to manage them conveniently later

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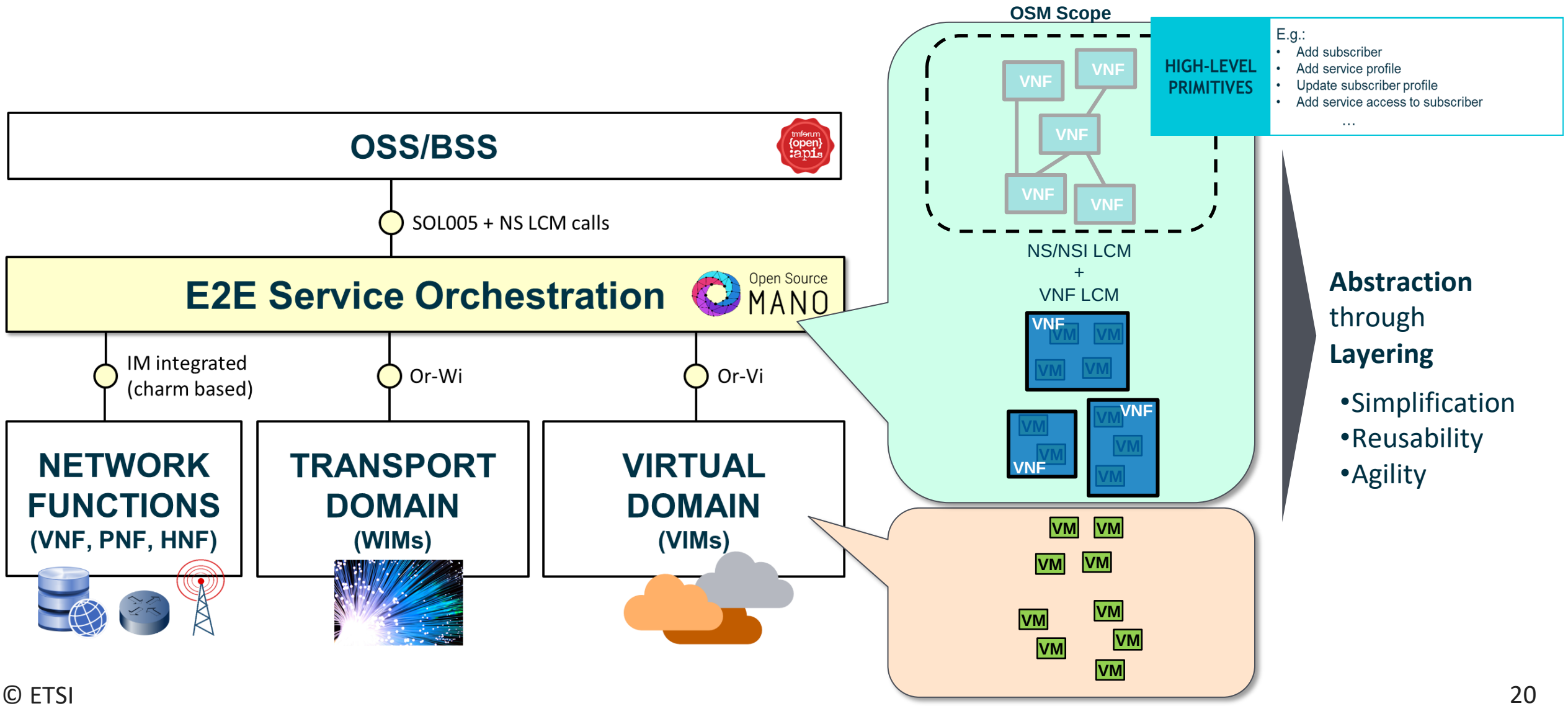
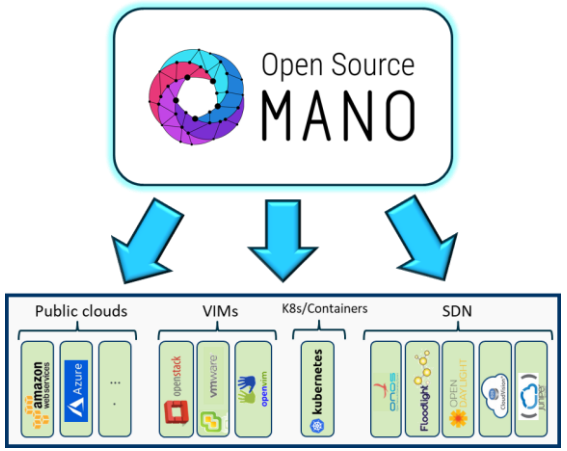
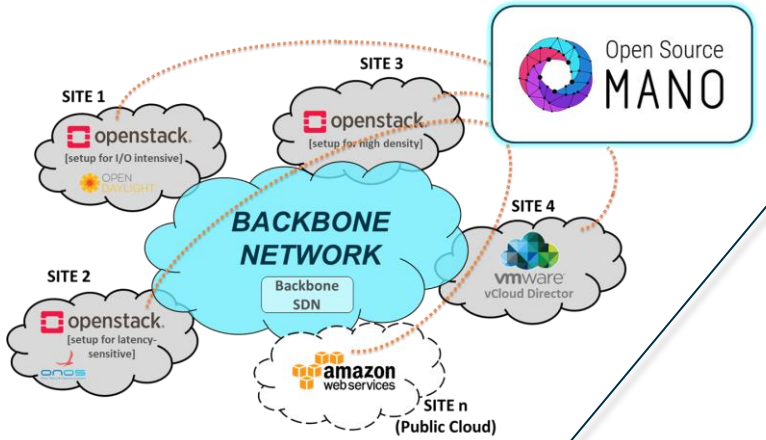


… on different types of infrastructure and across different locations…

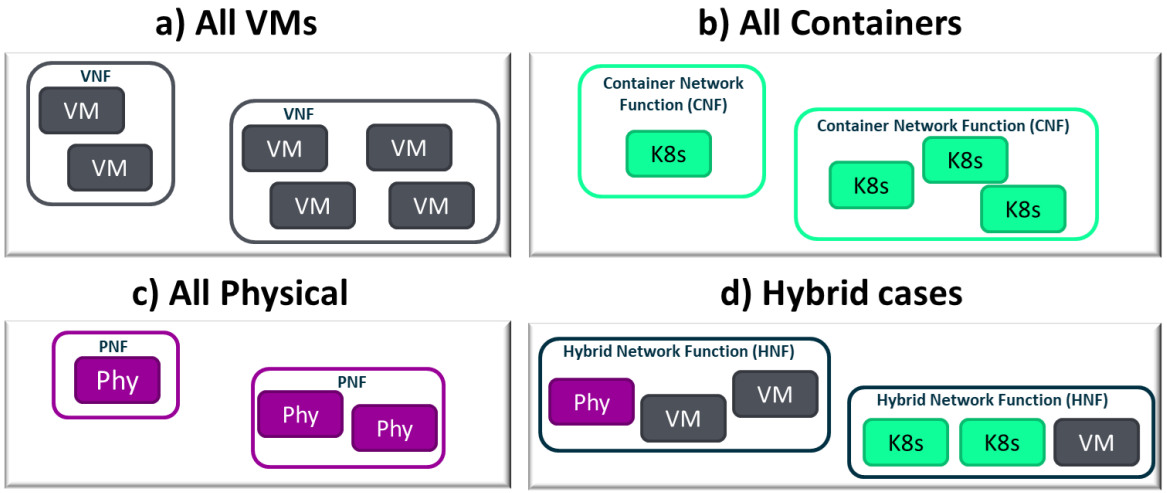
MULTI-VIM & MULTI-SDN



MULTI-SITE



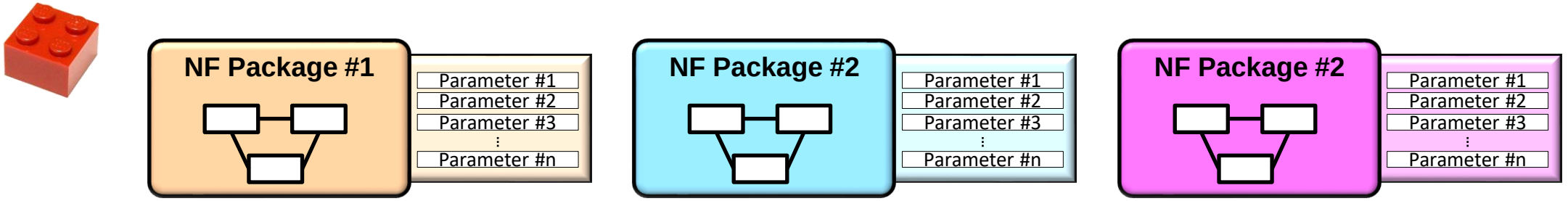
… with VNFs composed of **VMs, containers** and/or **physical elements**…



All in OSM is model-driven to make VNFs and scenarios as portable and reusable as possible

Open Source MANO

(V)NF PACKAGES:

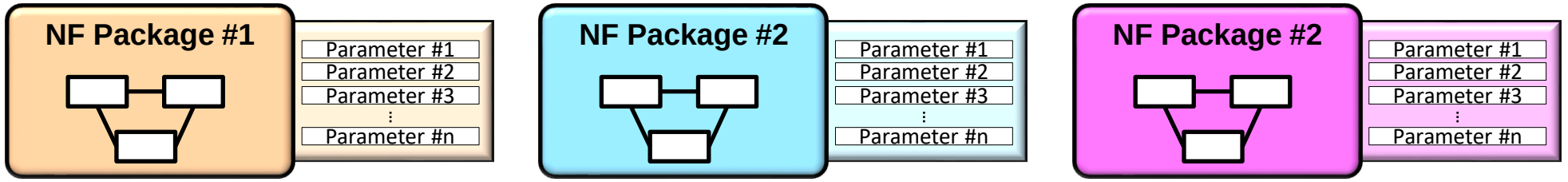


- **Provided by the vendor**, fully describe their own product:
  - Topology
  - Parametrized
  - Actions for Day-0, Day-1, and Day-2
- **Doesn't** need to know any detail about :
  - The target infrastructure
  - Other components that will be part of the scenario

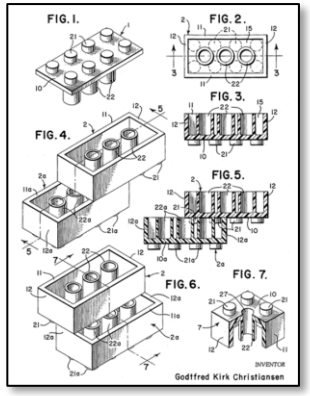
All in OSM is model-driven to make VNFs and scenarios as portable and reusable as possible

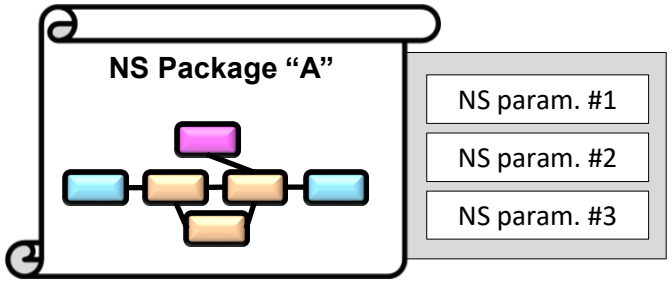
Open Source MANO

(V)NF PACKAGES:



NS PACKAGES / SLICE PACKAGES:





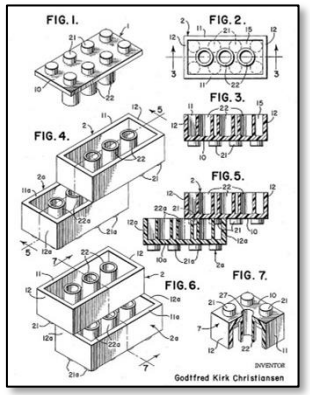
- Describes how to combine a set of NF packages to create a specific scenario.
- Parametrized.
- Have actions for Day-0, Day-1, and Day-2.

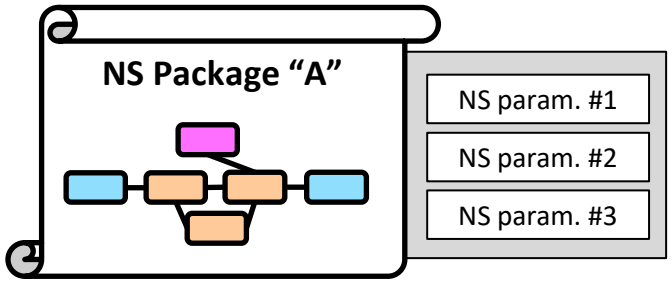
Slice Packages work similarly, but using NS as building blocks(*)

(*) NS instances play the role of Slice Subnets of a given slice. Some of them may be shared by more than one slice instance. This is taken into account by OSM, so a slice is more sophisticated than just a "NS of NS".

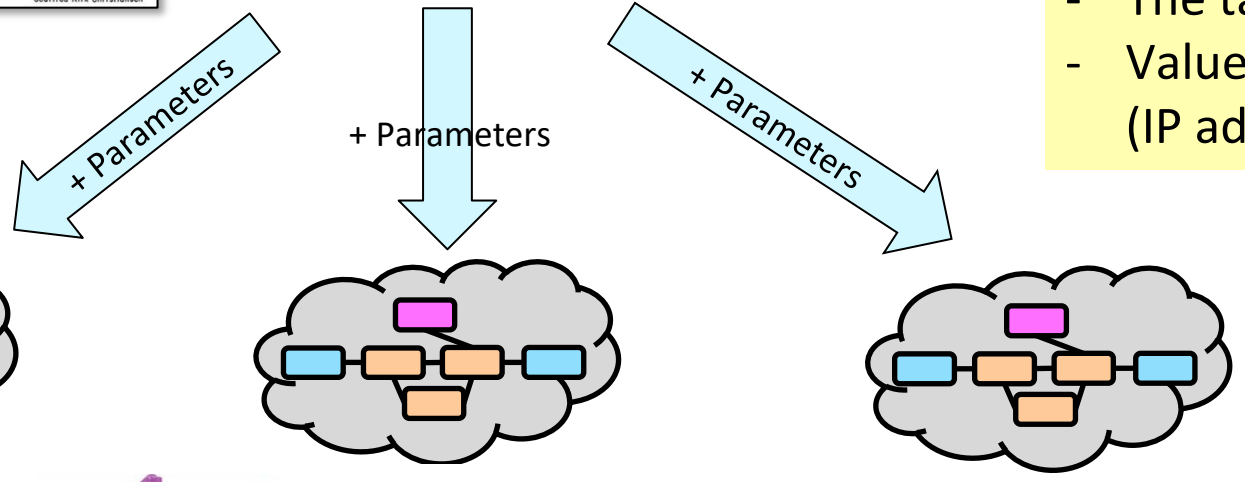
All in OSM is model-driven to make VNFs and scenarios as portable and reusable as possible

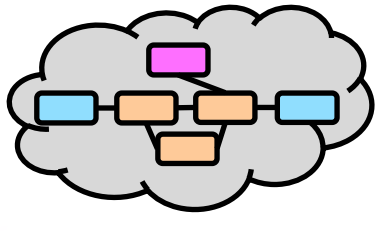
NS PACKAGES / SLICE PACKAGES:



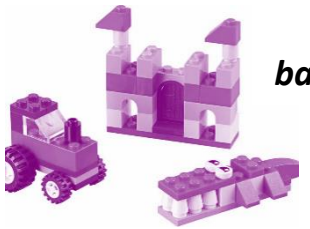


DEPLOYED INSTANCES:

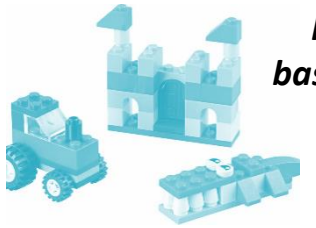




Instance #1 based on NS "A"



Instance #2 based on NS "A"

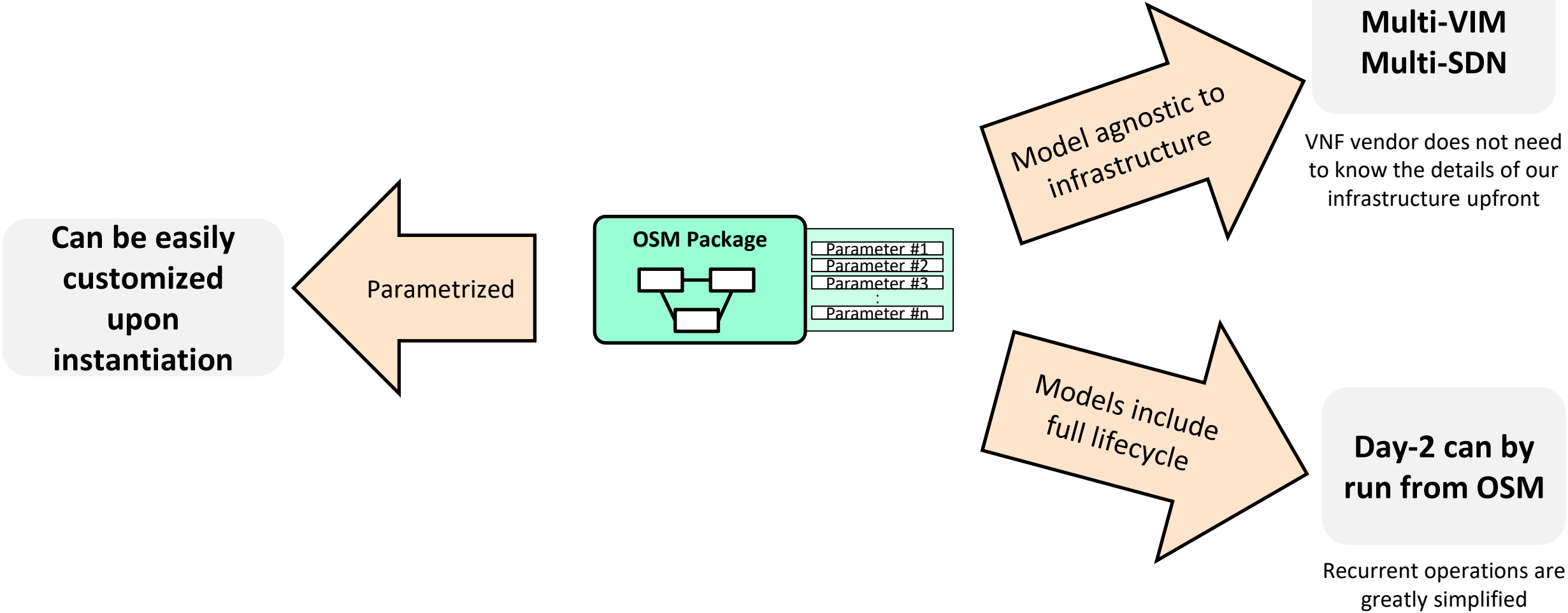


Instance #3 based on NS "A"

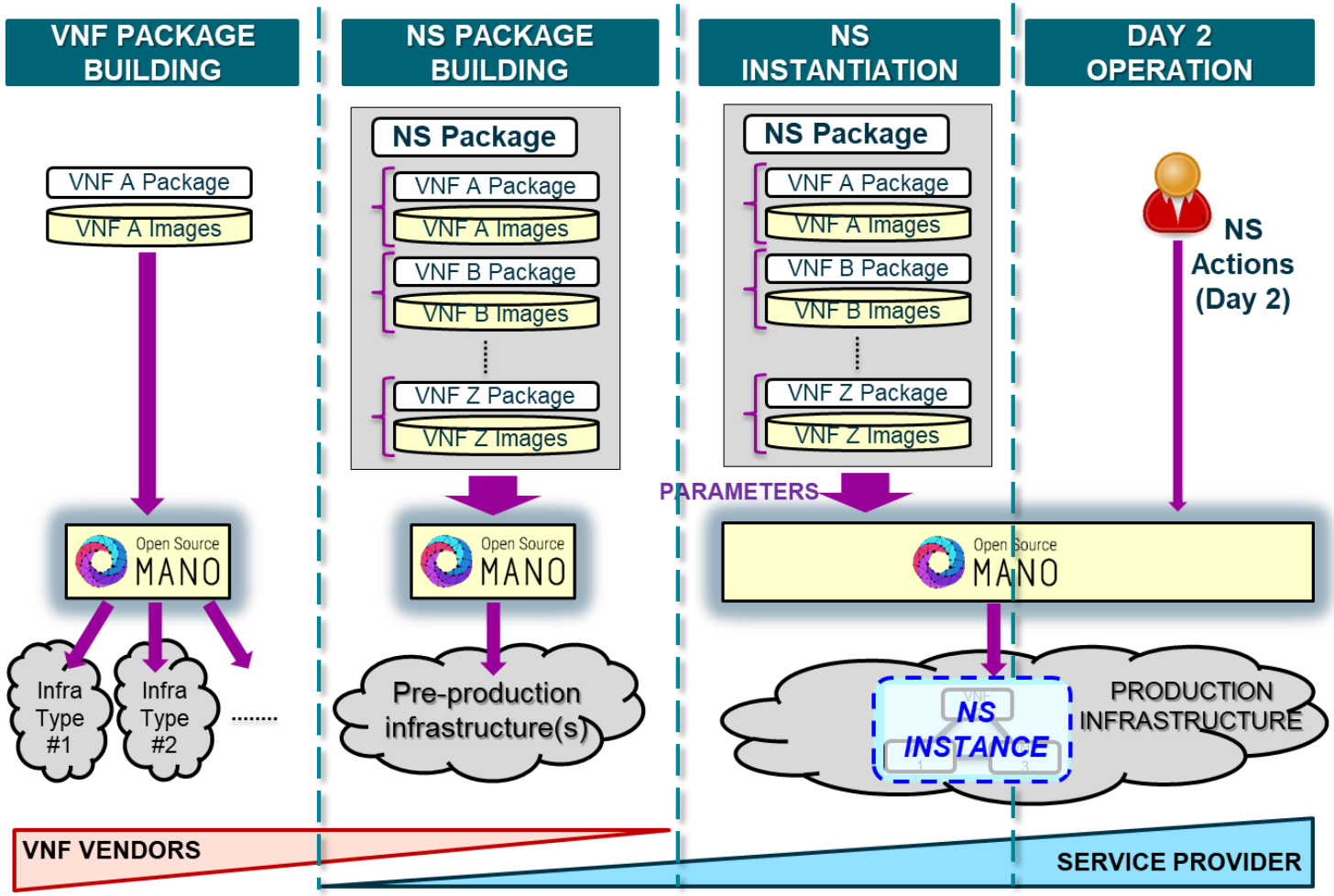
Upon instantiation, you just need to decide:

- The target VIM (or VIMs)
- Values for the parameters (IP addresses, keys, etc.)

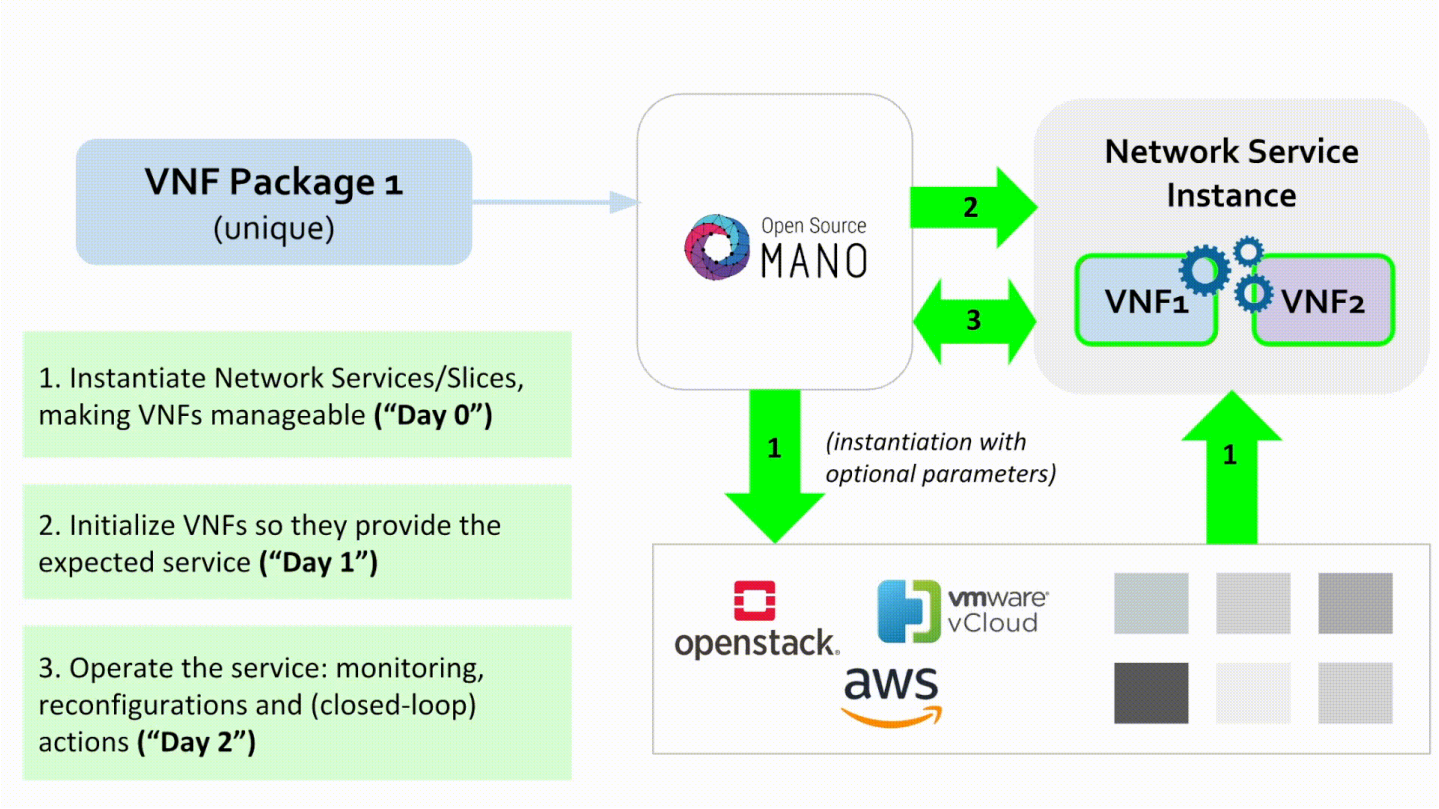
All these OSM packages are oriented to maximize reusability for multiple scenarios



VNF Packages are a key asset to enable the delivery chain



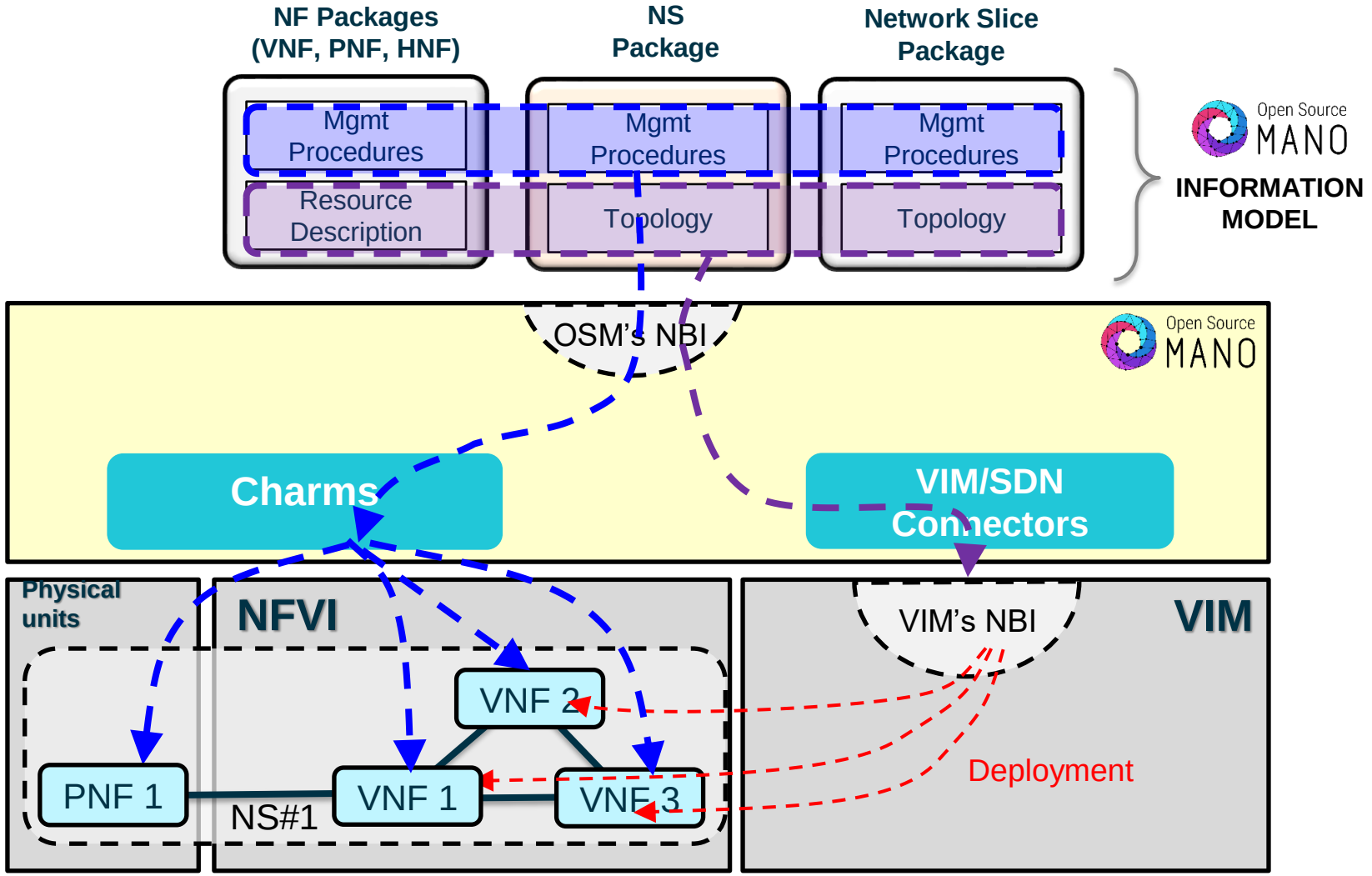
VNF Onboarding: best practices and main techniques have been consolidated in "**VNF Onboarding Guidelines**"



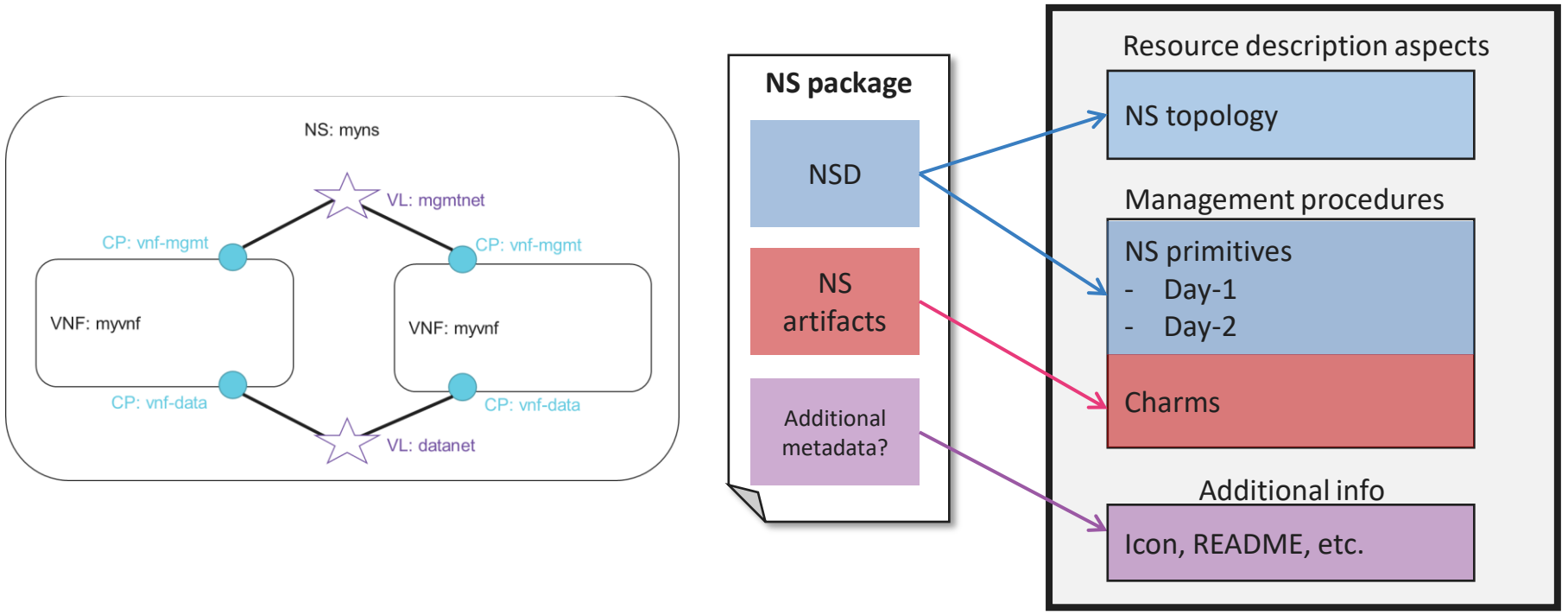
… the document is in continuous evolution, keeping & increasing its relevance

https://osm.etsi.org/docs/vnf-onboarding-guidelines/

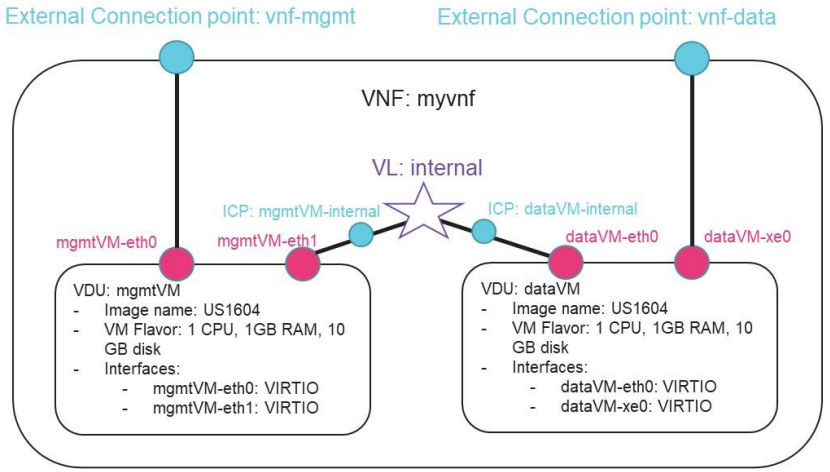
The **Information Model** embeds resource description and operational procedures

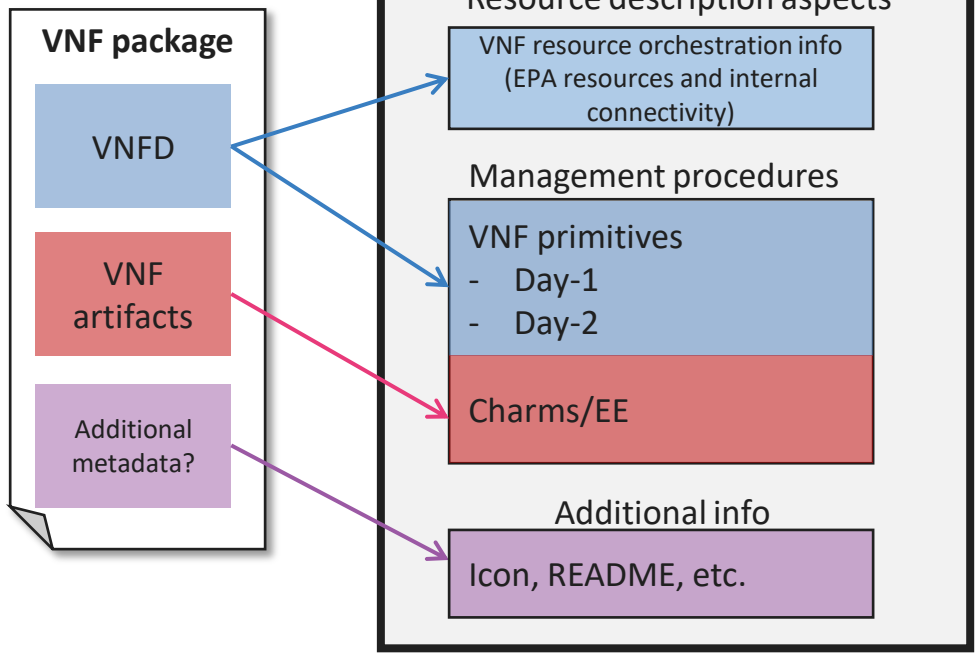


A glimpse to the VNF package



A glimpse to the NS package





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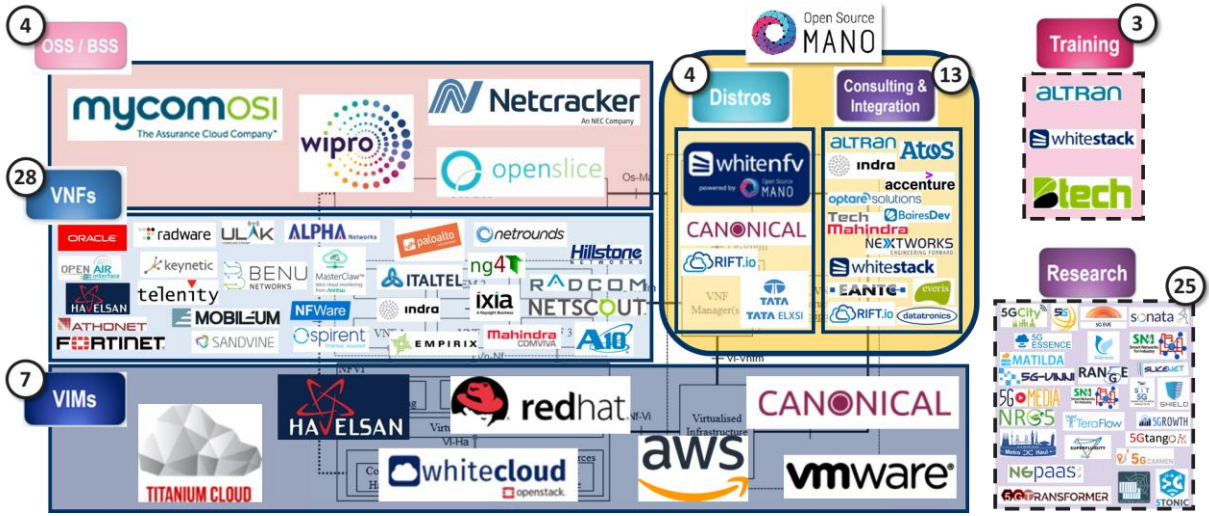
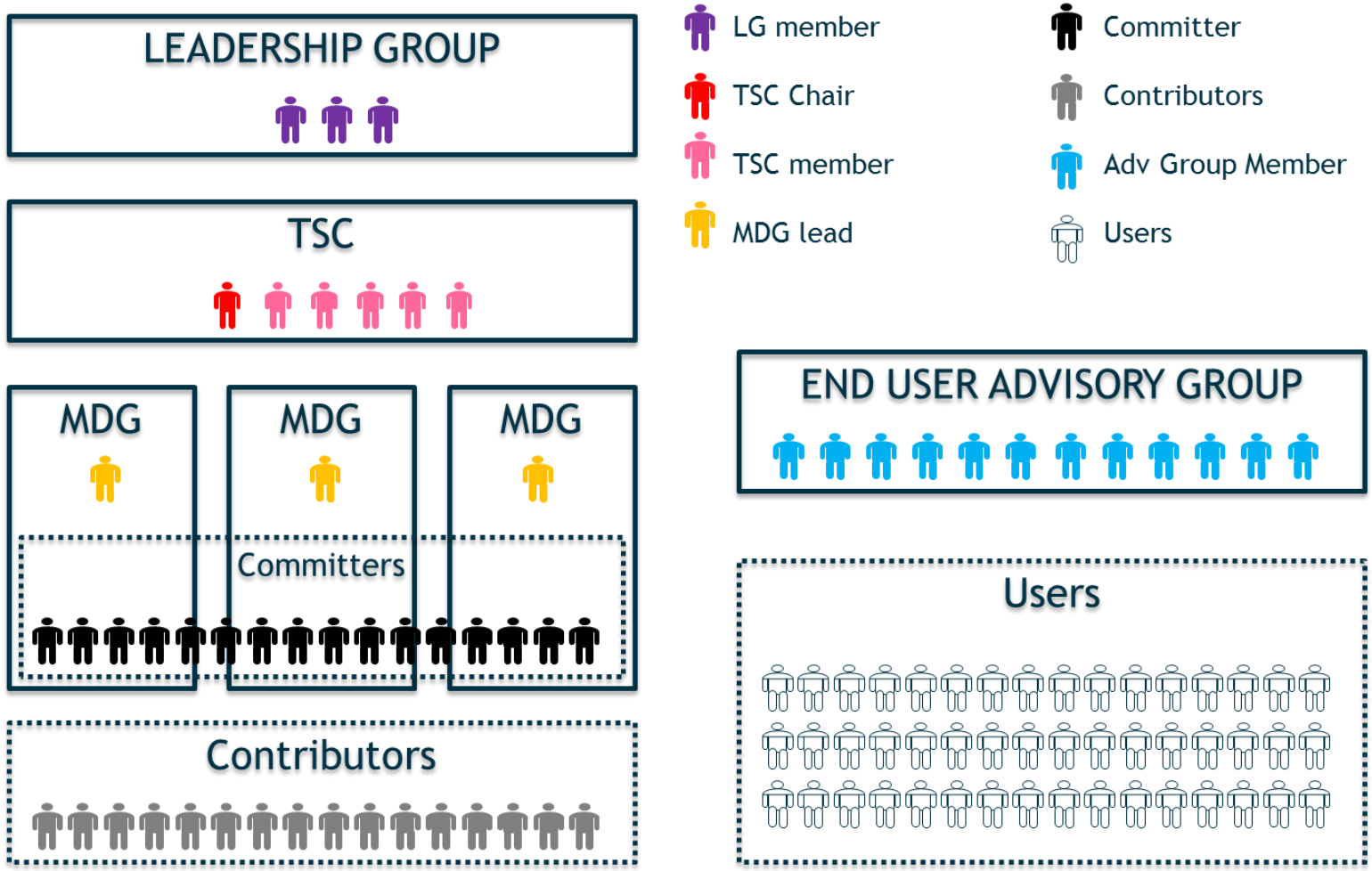
A vibrant and thriving community

ETSI OSM community is really LARGE AND DIVERSE, with 150 members today

… with a significant number of commercial offers related to OSM ("OSM Ecosystem")

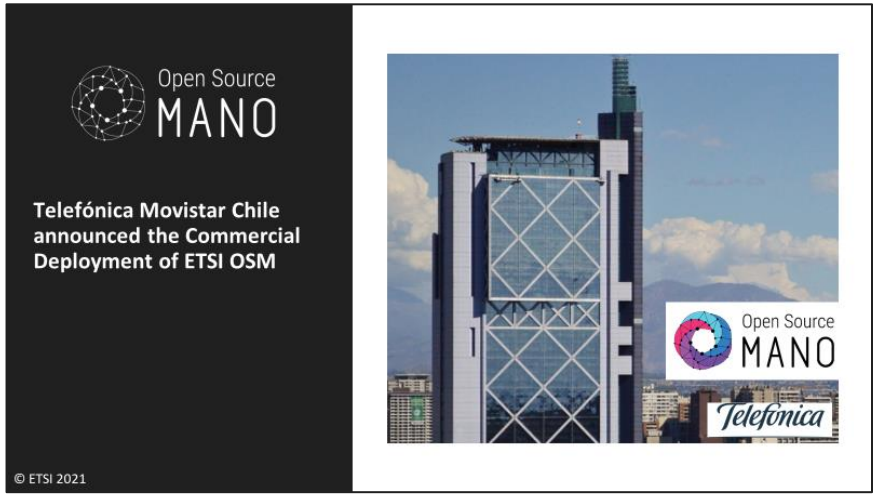


OSM organization



While production deployments keep growing

02/12/2020



2021

+ 4 new deployments

+ 2 deployments planned for 2022

… and growing

Release TEN brought new features to foster current and new deployments…

Open Source MANO

Open Source MANO

Release TEN

Available at: osm.etsi.org

Brand-new support for Azure clouds

- Support of latest IaaS developments
- Improved networking
- Better coherence with OpenStack's behaviour

Better access to OSM's subscription API

- OSM client extension

Support of distributed VCA

- VCA can run in multiple remote locations
- Useful to secure special clouds and edge deployments

Monitoring of availability of VIM resources

- OSM's portal now provides visibility on available resources

… and other improvements in usability and stability derived from the learnings of latest OSM production deployments

And **Release ELEVEN** brings some new features

Open Source MANO

Open Source MANO

Release ELEVEN

Available at:
osm.etsi.org

SOL004 and SOL007 package formats

ETSI

Brand-new support for Google Cloud

- Completing the infrastructure support for 3 largest public clouds

Google Cloud

Fine-grained operations in CNFs

- Start and stop services
- Run one-shot commands
- Files API

kubernetes

Better coordination across PNFs, VNFs, and CNFs

- Enhanced data exchange between NFs in the NS.

CNF monitoring from Kubernetes metrics

- Metrics collection from K8s clusters in centralized Grafana dashboard.

Enhanced installation process

- Support of Ubuntu 20.04 and better tracking of the installation process.

… and other improvements in usability and stability derived from the learnings of latest OSM production deployments

… to be added on top of an already long set of features…

Open Source MANO

Release ZERO

- Simplified on-boarding process
- Human-readab
- Multi-VIM supp
- EPA Support, a
- Underlay confi
- Web interface
- Comprehensive
  - Installation gu
  - How-to guide
  - Data Model c
  - Minimal infra
  - Videos
  - …

Open Source

© ETSI 2019

Release ONE

Multi-VIM

vmware

Mul

Releases TWO & THREE

Plug

Multi-VIM

Multi-SDN

Mul

Network Serv
scaling

Monitoring
Plugin Model, N
App metrics, no

Ope

Full Day 0 & D
operations

… ar

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Releases TWO & THREE

Multi-VIM

Multi-SDN

Network Serv
scaling

Monitoring
Plugin Model, N
App metrics, no

Full Day 0 & D
operations

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Release FOUR

MODEL-DRIVEN NORTHBOUND INTERFACE

- SOL005 aligned
- OpenAPI model

MONITORING IM

- On-demand conf
- Push notification
- Policy support

IMPROVED MOD

- Full support of I
- Consistency che
- MAC address se
- Support of alter

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Release FIVE

NETWORK SLICING FOR 5G

- Integrated Slice Manager
- IM extended to support NST and NSI

MULTI-SITE EXTENSIONS

- Dynamic inter-DC connections
- WIM plugin model
- Multi-VIM Enhancements

MONITORING IMPROVEMENTS

- Extended interop capabilities
- Policy support
- VNF + VIM Metrics Collection

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Release SIX

Open Source MANO

NBI and operation

- RBAC improvem
- Re-enable NS pr

Monitoring

EPA and physical

- Support of multi
- Support for addi

New enablers fo

- Allow instantiati
  non cloud-native
- Adding relations
- Ansible proxy Ch

User interfaces (

- Users and proje
- Support of WIM
- Ability to provid

Open Source

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Release SEVEN

Open Source MANO

Improved lifecycle and feedback

- Improved VNF configur
- Real-time feedback upc

Kubernetes and

Open Source

Fault Management &
Management

- Fault and performance
  of OSM modules
- Automated dashboards

VNF Onboarding

- Improved validation of

100% Python 3

- RO migration to Python
- OSM client migration to

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Release EIGHT

Open Source MANO

Open Source MANO

Catalogue of VNF/NS Packages

- VNF repositories

Improved lifecycle and

Improved usab

- New angular-ba

Improved onbo

- Simplified packa
  over Git.
- On the fly transl

Readiness for H

- VCA readiness f
- HA proxy charm

IMPROVED MODEL

- Service Function
- Physical Deploym
- Multi-VDU relations in VNF

USER EXPERIENCE & OPTIMIZATION

- GUI based NS composer
- Faster startup and responsiveness
- Better event and log visualization
- Docker, Vagrant and VM image install

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Release NINE

Open Source MANO

Open Source MANO

Modelling ex

- SOL006 align
- Full integrati
  declarative R
- Simple strate
  address pairs

VNF lifecycle

- Distributed P
- Support of H
- Kubernetes V
- Centralized V

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Release TEN

Open Source MANO

Open Source MANO

Release TEN

Soon available at:
osm.etsi.org

Brand-new support for Azure clouds

- Support of latest IaaS developments
- Improved networking
- Better coherence with OpenStack's behaviour

Better access to OSM's subscription API

- OSM client extension

Support of distributed VCA

- VCA can run in multiple remote locations
- Useful to secure special clouds and edge deployments

Monitoring of availability of VIM resources

- OSM's portal now provides visibility on available resources

… and other improvements in usability and stability derived from the learnings of latest OSM production deployments

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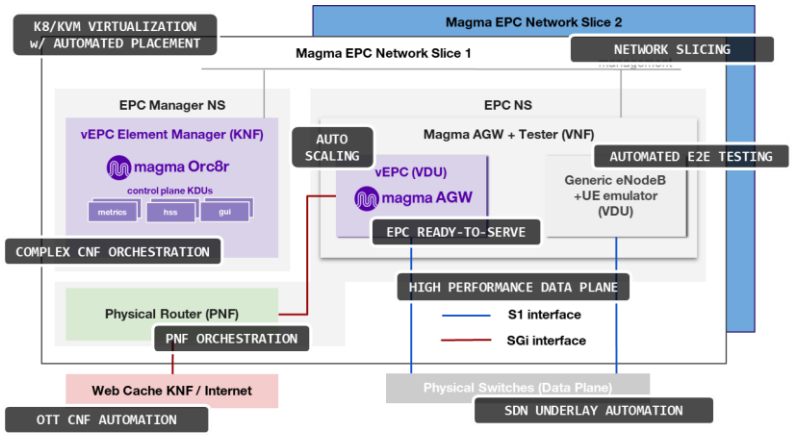
6

At this point, it is becoming easier explaining OSM features in practice

Open Source MANO

MAGMA EPC DEMO (2020)



https://osm.etsi.org/gitlab/vnf-onboarding/osm-packages/tree/master/magma

OSM#11 Hackfest

11 teams onboarding 8 NFs in just one week!

Asterisk

freeRADIUS

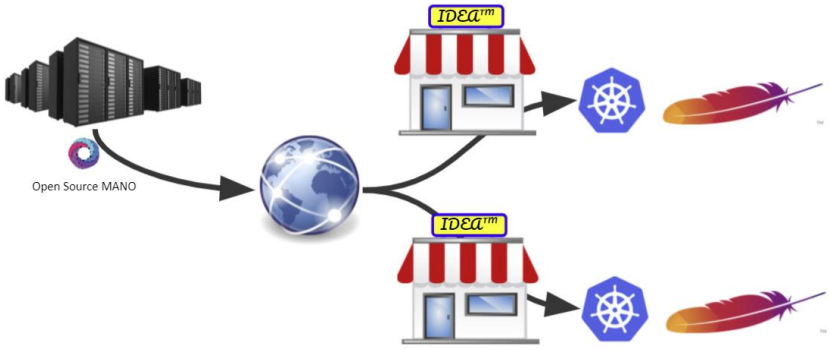
PowerDNS

OPC UA

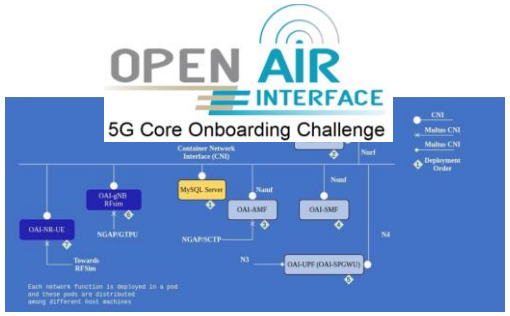
NetNumber

Release TEN Webinar

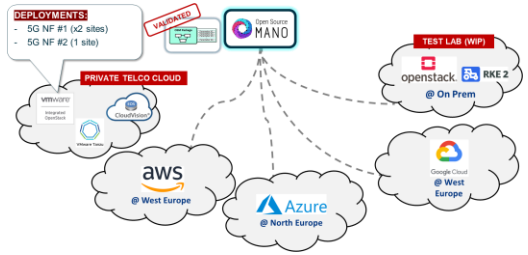
Edge orchestration with OSM



OSM-MR#11 Hackfest



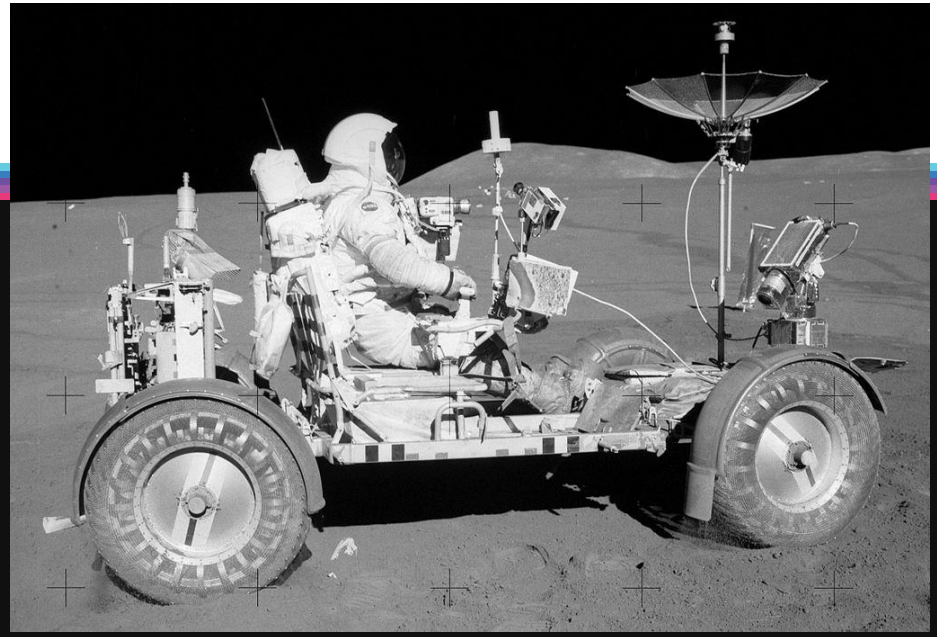
Multi-Cloud Deployments



More info on ETSI OSM
Further reading

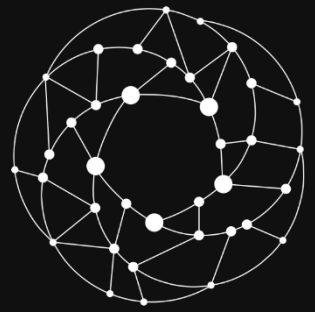
- Main page: https://osm.etsi.org
- User guide: https://osm.etsi.org/docs/user-guide/
- Developer guide: https://osm.etsi.org/docs/developer-guide/
- VNF Onboarding guide: https://osm.etsi.org/docs/vnf-onboarding-guidelines/
- Code:
  - https://osm.etsi.org/gerrit
  - https://osm.etsi.org/gitlab
- OSM Slack: https://join.slack.com/t/opensourcemano/shared_invite/zt-4fkraa92-7VGPbFtOQn6pJSWzVV8Bxw

Open Source MANO



For more information:

osm.etsi.org
osm.etsi.org/wikipub
osm.etsi.org/docs/user-guide



Open Source
MANO

Openstack: the reference VIM

With subtitle

ETSI

Openstack: Open source IaaS for public and private clouds

- Openstack is a **cloud computing project** aimed at providing **Infrastructure as a Service (IaaS)**
- Cloud computing, also known as on-demand computing: shared resources, data and information are provided to computers and other devices on-demand
- It's **Open Source!**
- Oriented both for **public and private clouds**
- Massively scalable

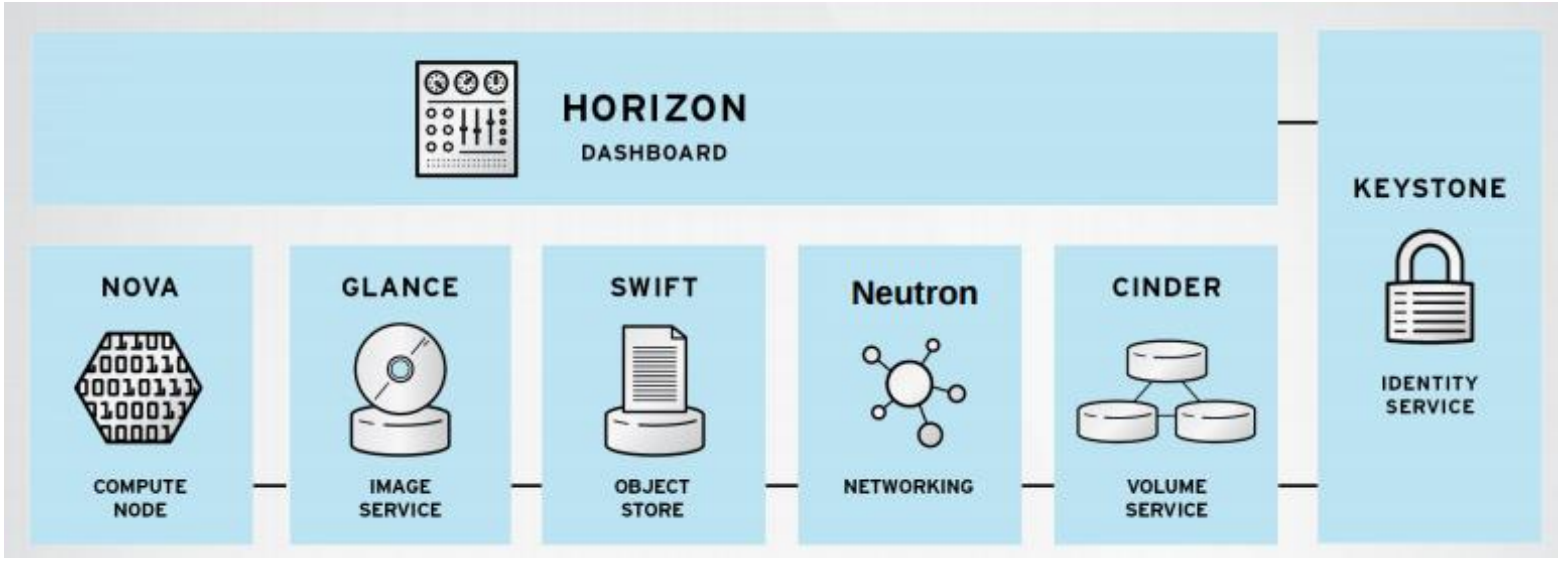
Terminology

- **Instance**: virtual machine running in Nova node
- **Image**: an attribute of a virtual machine which represents an ephemeral disk
- **Flavor**: virtual HW templates which defines the hardware characteristics of a virtual machine (tiny, small, medium, large)
- **Volume**: virtual disk attached to a VM instance (mostly refers to block device)
- **Tenant/project**: logical entity that represents the base unit of “ownership” for resources (instances, images, flavors, volumes and virtual networks). All resources in OpenStack should be owned by a specific project. Resources available for a project are controlled through quotas

Source: Haim Ateya. An introduction to Openstack (nov 2017). Web: https://es.slideshare.net/HaimAteya/an-intrudction-to-openstack-2017

Openstack architecture

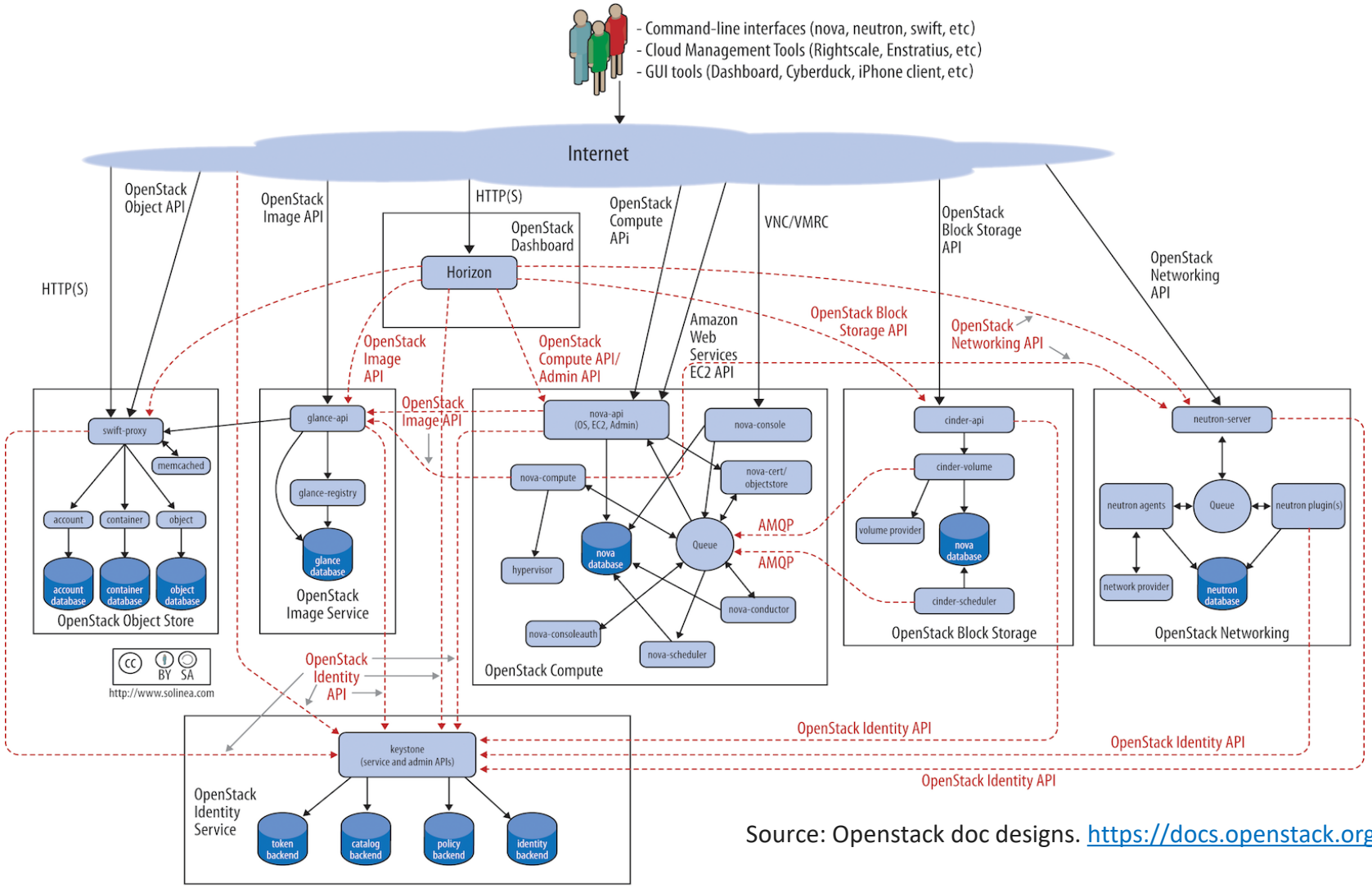
Core services



- Modular architecture
- Designed to easily scale out
- Based on (growing) set of core services

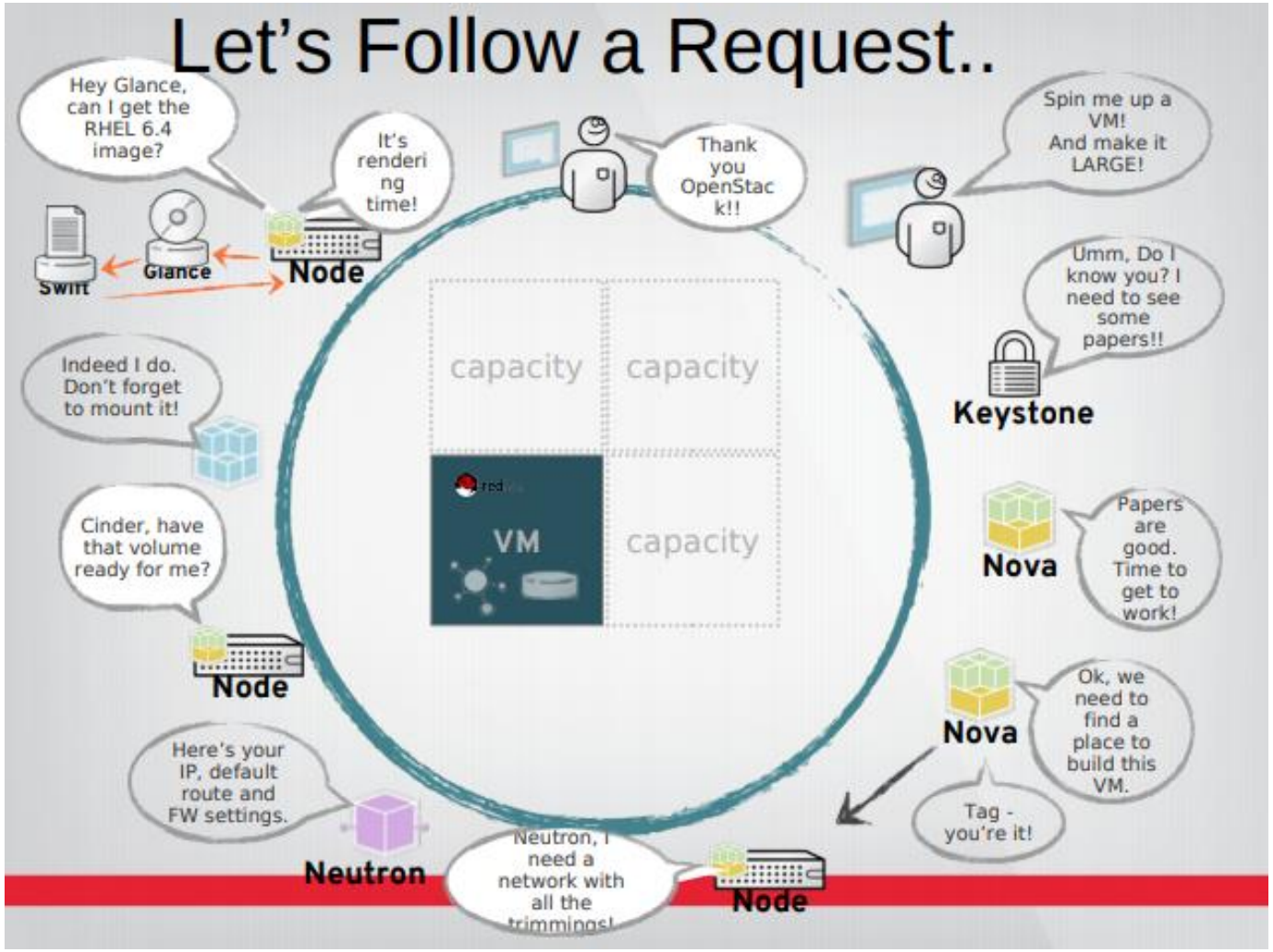
Source: Michael Lessard, Red Hat. Introduction to Openstack (oct 2013). Web: http://people.redhat.com/mlessard/mtl/presentations/oct2013/OpenstackOverview.pdf

Openstack architecture (advanced)



Source: Openstack doc designs. https://docs.openstack.org/arch-design/design.html

Openstack example: creating a VM



Source: Michael Lessard, Red Hat. Introduction to Openstack (oct 2013). Web: http://people.redhat.com/mlessard/mtl/presentations/oct2013/OpenstackOverview.pdf