What is OSM?
Gerardo García de Blas (TSC Chair, Telefónica)
Introduction to NFV
Network Function Virtualization provides a mean to make the network more flexible by minimizing dependence on HW constraints.

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
- DPI
- BRAS
- CG-NAT
- GGSN/SGSN
- Firewall
- PE Router
- VIRTUAL APPLIANCES
- ORCHESTRATED, AUTOMATIC & REMOTE INSTALL

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

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

**APPLIANCE APPROACH**

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

**VIRTUAL APPLIANCE APPROACH**

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

**SESSION MGT LIMITATIONS PER NODE LEADING TO 2nd NODE PURCHASE**

<table>
<thead>
<tr>
<th>SESSION MGT RESOURCES</th>
<th>SWITCHING RESOURCES</th>
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<tbody>
<tr>
<td>LOAD = 95%</td>
<td>LOAD = 40%</td>
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**PROCESSING CAPACITY BECOMES COMMODITY & MANAGED AS A CONTINUUM**

SPARE CAPACITY FOR EXTRA GROWTH (in any functionality)

SESSION MGT

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

FUNCTION (semantics)

CAPACITY (resource mgmt)

Decoupled
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
ETSI NFV ISG: NFV architecture under standardization
We are looking for a **unified and generic virtualization infrastructure**, compatible with any vendor’s Virtual Networking Function (VNF), so **standardization is a must**.
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.
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](https://www.etsi.org/technologies/nfv)
ETSI Working Groups


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 NFV Architecture

The NFV architecture is described in the **NFV Architectural Framework GS (NFV002)**
The NFV architecture is described in the **NFV Architectural Framework GS (NFV002)**
ETSI NFV architecture and specifications

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
ETSI OSM: the orchestration layer
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.
... on different types of infrastructure and across different locations...

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

a) All VMs

b) All Containers

c) All Physical
d) Hybrid cases
All in OSM is model-driven to make VNFs and scenarios as portable and reusable as possible

- **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.

(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:

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.

- Can be easily customized upon instantiation
- OSM Package: Parametrized
  - Parameter #1
  - Parameter #2
  - Parameter #3
  - Parameter #n
- Models include full lifecycle
- Model agnostic to infrastructure
  - Multi-VIM Multi-SDN
  - VNF vendor does not need to know the details of our infrastructure upfront
- Day-2 can be run from OSM
  - Recurrent operations are greatly simplified
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”

1. Instantiate Network Services/Slices, making VNFs manageable (“Day 0”)
2. Initialize VNFs so they provide the expected service (“Day 1”)
3. Operate the service: monitoring, reconfigurations and (closed-loop) actions (“Day 2”)

... 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

Resource description aspects
- NS topology

Management procedures
- NS primitives
  - Day-1
  - Day-2
- Charms

Additional info
- Icon, README, etc.
A glimpse to the NS package

**VNF package**
- VNFD
- VNF artifacts
- Additional metadata?

**Resource description aspects**
- VNF resource orchestration info
  - (EPA resources and internal connectivity)

**Management procedures**
- VNF primitives
  - Day-1
  - Day-2
- Charms/EE

**Additional info**
- Icon, README, etc.
A vibrant and thriving community
ETSI OSM community is really LARGE AND DIVERSE, with 150 members today

- 15 Global Service Providers
- Leading IT/Cloud players
- VNF providers

... with a significant number of commercial offers related to OSM (“OSM Ecosystem”)
OSM organization

LEADERSHIP GROUP

LG member
TSC Chair
TSC member
MDG lead

TSC

Committer
Contributors
Adv Group Member
Users

MDG

Committers

Contributors

END USER ADVISORY GROUP

Users
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...

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

SOL004 and SOL007 package formats

Brand-new support for Google Cloud
- Completing the infrastructure support for 3 largest public clouds

Fine-grained operations in CNFs
- Start and stop services
- Run one-shot commands
- Files API

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

Available at: [osm.etsi.org](http://osm.etsi.org)
... to be added on top of an already long set of features...
At this point, it is becoming easier explaining OSM features in practice.

MAGMA EPC DEMO (2020)

https://osm.etsi.org/gerrit/vnf-boarding/osm-packages/tree/master/magma

OSM#11 Hackfest

11 teams onboarding 8 NFs in just one week!

Asterisk

Multi-Cloud Deployments

Release TEN Webinar
Edge orchestration with OSM

OSM-MR#11 Hackfest

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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/opensourcemanano/shared_invite/zt-4fkraa92-7VGPbFtOQn6pJSWzVV8Bxw
Open Source MANO

For more information:

osm.etsi.org
osm.etsi.org/wikipub
osm.etsi.org/docs/user-guide
Openstack: the reference VIM

With subtitle
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

Openstack architecture

Core services

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

Openstack architecture (advanced)

Source: Openstack doc designs. [https://docs.openstack.org/arch-design/design.html](https://docs.openstack.org/arch-design/design.html)
Openstack example: creating a VM

Let’s Follow a Request..