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 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
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

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.

How was this originated?

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?

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?

Bringing “cloud efficiencies” to the Telecom Industry

Classical Network Appliance Approach

- Fragmented non-commodity hardware.
- Physical install per appliance per site.
- Hardware development large barrier to entry for new vendors, constraining innovation & competition.

Network Virtualisation Approach
Conjunction of 4 mature technologies

- Commodity Hardware
- Software Defined Networks
- Virtualization / Cloud
- Open Source

- The only way the industry is being able to catch up the customer needs.
- Massive & Automated networking is required
- A lot of compute power, at a reasonable cost.
- A lot of Virtual Machines that need to be orchestrated

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1) Commodity Hardware

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

<table>
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<th>Quantity</th>
<th>Description</th>
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<tr>
<td>8x</td>
<td>= 224 physical Cores</td>
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<tr>
<td>96x</td>
<td>= 6 TB of RAM</td>
<td></td>
</tr>
<tr>
<td>24x</td>
<td>= 96 TB of SSD</td>
<td></td>
</tr>
<tr>
<td>4x</td>
<td>= 16 x 10G Ports</td>
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</table>
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

**Open Source**
- KVM
- XenServer

Fuente: 2017 Openstack Survey
3) SDN / Open Networking

High Capacity switching chipsets

Next Performance Node Drivers
- Deep Learning Clusters
- NVMe over Fabrics
- Evolved DC Pod Architecture

Critical Enablers for 1-Year Step to 12.8Tbps
- 40% Reduced Power/Port
- Scalable Architecture
- Robust 50G PAM-4 Serdes IP
- Ultra-efficient design in 16nm
- >1 year lead over 7nm solutions

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3) SDN / Open Networking

Most vendors adopting “Merchant Silicon”

- Juniper QFX3500
- Cisco Nexus® 3064
- IBM BNT RackSwitch G8264
- Alcatel-Lucent OmniSwitch 6900
- Dell Force10 S4810
- HP 5900AF 48XG
- Arista 7050S-64
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:
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

• 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.
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_NFV002v01_0201p.pdf](http://www.etsi.org/deliver/etsi_gs/NFV/001_099/002/01.02.01_60/gs_NFV002v01_0201p.pdf)

- **NFV Infrastructure Overview**
  [http://www.etsi.org/deliver/etsi_gs/NFV-INF/001_099/001/01.01.01_60/gs_NFV-INF001v010101p.pdf](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_NFV002v01_0201p.pdf](http://www.etsi.org/deliver/etsi_gs/NFV/001_099/002/01.02.01_60/gs_NFV002v01_0201p.pdf)
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

Common Cloud and VNF Requirements

- Multi-tenancy (Reservation and Separation)
- Self Service
- Low Latency / Low Jitter (i.e. Voice / Gaming / M2M / Small Packets)
- Application High Availability
- General QoS (IOPS, CPU, Resources)
- Orchestration
  - Inventory, Event/Log Management, Config Management, CI/CD/Testing, Monitoring, ITSM/ITIL/FCAPS/OSS, Probing/CALEA
- Brownfield App/VNF Support (Cattle Transition)

Unique Telco Cloud VNF Requirements

High Packet Per Second Throughput (i.e. DNS, Network I/O)

Migration of HA pet to midget cow VNFs (i.e. BGP, HA, VRRP, etc.)

Geo-Dependency of Workloads to Connections (i.e. Service mobility and network availability)

Network QoS (Marking and Treatment)

KPI Measurements of VNF Requirements (i.e. Rich Network Analytics)

Operational Transitions/Events (Workload and DC Dry Out)

Dynamic/Tiered Topology Creation, Scale Out and Service Chaining

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

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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)
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.
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 Manager
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.
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.
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.
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

Day-0, Day-1 and Day-2

Day 0:
Instanciate Isolated VNFs

Day 1:
Build Service (automated)

Day 2:
Operate (on demand)

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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/
Introduction to OSM Release Five
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

Layering
Abstraction

Modularity
Simplicity

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),
   - NST (Network Slice Template), NSI (Network Slice Instance)
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.
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 an external SDN Controller, to fulfill the connectivity requirements.
Integration with SDN Controller

**SDN Assist**
Allows OSM to control SDN connectivity, even when not possible by the VIM (eg: PCI Passthrough, SR-IOV)
Release FOUR+ architectural view

1. Unified message bus for async communications
2. Integrated components for policy, fault and performance management (auto-scaling, monitoring, etc)
3. N2VC-VCA Juju controller for VNF configuration & indicator management
4. Complete orchestrator: LifeCycle Management (LCM) component
5. Unified Northbound Interface
6. Complete control through CLI and stand-alone new UI

.right

1. NBI
2. OSM IM
3. VCA
4. POL
5. MON
6. osmclient
7. light-ui

Common Services

- OSM IM
- Common Database (NoSQL)
- Object Storage
- TSDB (Metrics)
- Auth

Common DB, storage, authentication and TSDB systems

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Release FOUR+ architecture

Microservice architecture to enable extensibility
Why is OSM Awesome?

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?

It is well organized for producing production-ready upstream code
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Why is OSM Awesome?

It is well organized for producing production-ready upstream code

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Why is OSM Awesome?

It is well organized for producing production-ready upstream code

END USER ADVISORY GROUP

Andy Reid

VNF ONBOARD TASK FORCE

Gianpietro Lavado
Why is OSM Awesome?

It prioritizes features for production readiness...

**APRIL 2017**
- Multi-VIM
  - OpenStack, AWS, VMWare
- Multi-SDN
  - ODL, ONOS, Floodlight
- One-click installer
- Network Service Scaling
- Multi-Site, and more!

**OCTOBER 2017**
- Multi-tenancy & RBAC
- Monitoring Module
- Enhanced VIM support & emulation
- NB API Consolidation
- Affinity/Anti-Affinity Rules
- CI/CD Workflow
- Information Model Consolidation

**MAY 2018**
- Model-driven NBI
- Monitoring Improvements
- Cloud-native deployment
- Improved modeling
- Service Chaining
- Native Charms
- Enhanced usability

**NOVEMBER 2018**
- Network Slicing
- Monitoring Improvements
- Multi-site Extensions
- Improved modeling
- Hybrid Network Services
- Auto-Scaling
- Enhanced usability
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
Contributing to the Community
Joining the OSM Community

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

**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.