OSM Hackfest
Introduction to OSM

Gerardo García (Telefónica)

NFV promises to go from traditional network management...
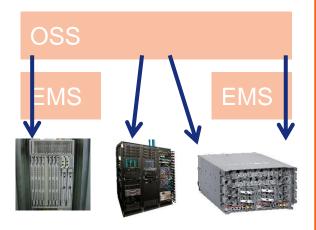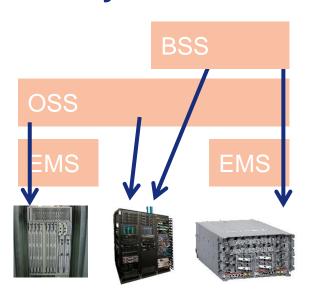

Open Source MANO

Day 0

- PNF installation
- Initial configuration to make PNF reachable (user, pwd, network, etc.)

Day 1

OSS

EMS   EMS

- License activation
- Injection of configuration
- Neighbor configuration
- Network configuration

Day 2

BSS

OSS

EMS   EMS
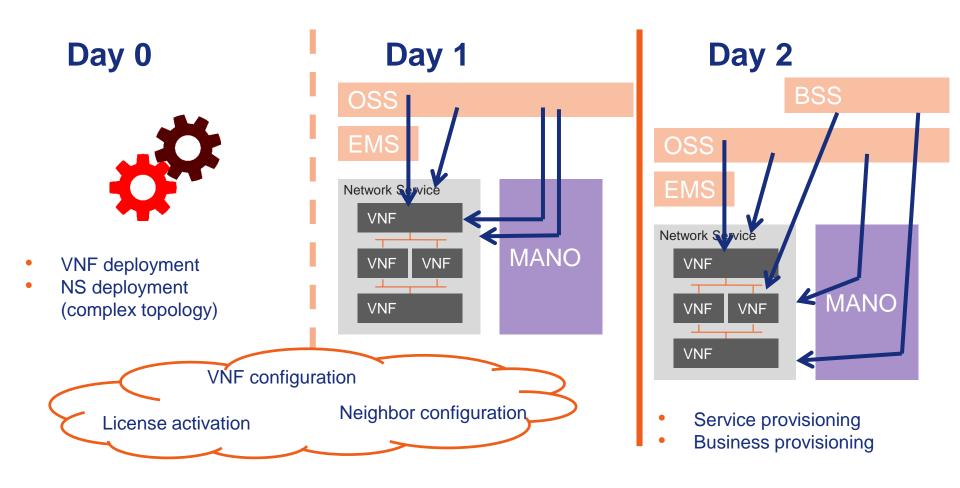

- Service provisioning
- Business provisioning
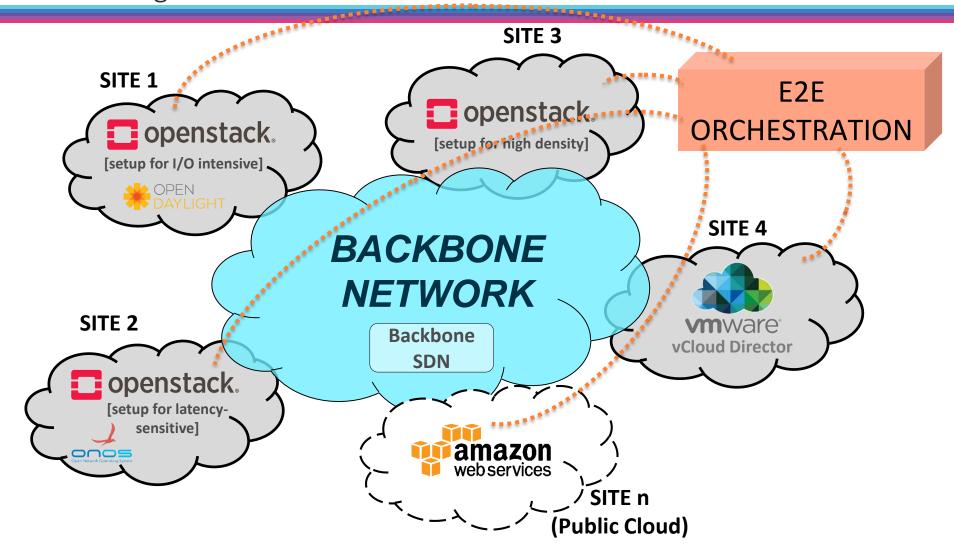
... to native NFV management, with highly efficient automation and operation

Open Source MANO

Day 0

- VNF deployment
- NS deployment (complex topology)

VNF configuration

License activation

Neighbor configuration

Day 1

OSS

EMS

Network Service

VNF

VNF VNF

VNF

MANO

Day 2

BSS

OSS

EMS

Network Service

VNF

VNF VNF

VNF

MANO

- Service provisioning
- Business provisioning
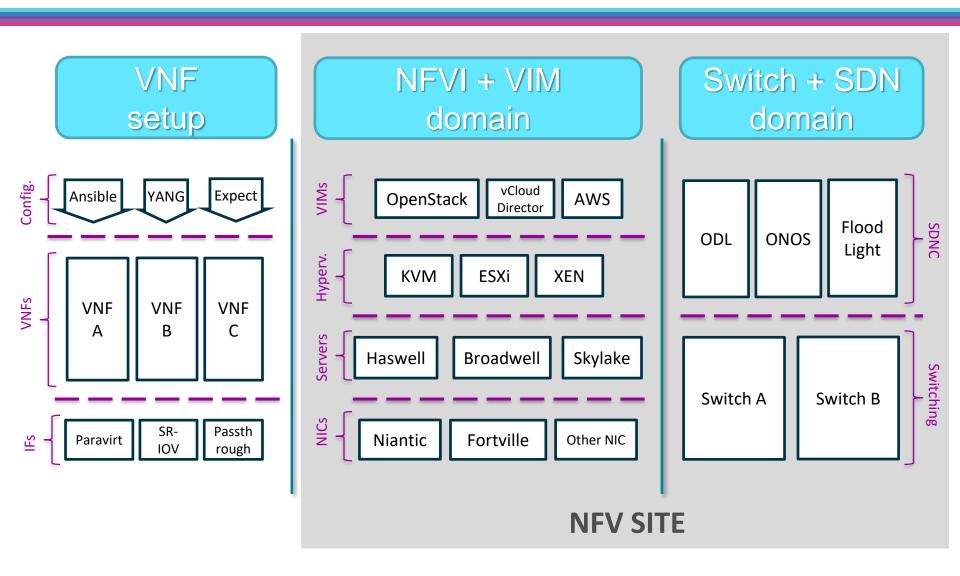
However, operating a real Virtualised Network looks more like this, with multiple sites and technologies…

Open Source
MANO

SITE 3

SITE 1

openstack
[setup for I/O intensive]
OPEN DAYLIGHT

openstack
[setup for high density]

E2E ORCHESTRATION

BACKBONE NETWORK

Backbone SDN

SITE 4

vmware vCloud Director

SITE 2

openstack
[setup for latency-sensitive]
onos
Open Network Operating System

amazon web services

SITE n
(Public Cloud)

(*) Topologies and combinations of technologies are provided as examples

… that require the configuration and coordination of an even larger set of elements…

Open Source
MANO

VNF setup	NFVI + VIM domain	Switch + SDN domain

VNF setup

Config.: Ansible, YANG, Expect

VNFs: VNF A, VNF B, VNF C

IFs: Paravirt, SR-IOV, Passthrough

NFVI + VIM domain

VIMs: OpenStack, vCloud Director, AWS

Hyperv.: KVM, ESXi, XEN

Servers: Haswell, Broadwell, Skylake

NICs: Niantic, Fortville, Other NIC

Switch + SDN domain

SDNC: ODL, ONOS, Flood Light

Switching: Switch A, Switch B

NFV SITE

... and unless we are ready to respect the layering, management gets really complicated

NS#1

VNF 2

VNF 1   VNF 3

NFV Orchestration

NFVI

Hypervisor

Hardware

VIM

Cloud Management System

SDN Controller

… and unless we are ready to respect the layering, management gets really complicated

Open Source MANO

DEPLOY

NS#1

Config.

VNF 2

Config.   Config.

VNF 1   VNF 3

NFV Orchestration

Deploy VIM-dependent template

NFVI   **VIM**

Config. vSwitch

Hypervisor

Cloud Management System

Console access to fix VNF boot

Pre-create ad hoc flavors

Hardware

SDN Controller

Config. NIC   Config. Acceleration

Customize for the use case

Create ad hoc connections

Proper modelling is required to assemble VNFs automatically... but it's not a trivial task
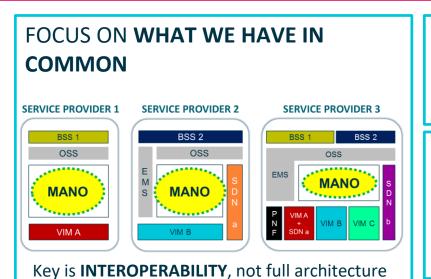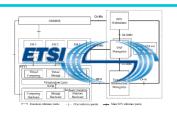
Strategy for a smart convergence

Open Source MANO

FOCUS ON **WHAT WE HAVE IN COMMON**

Key is **INTEROPERABILITY**, not full architecture

MULTIPLE VIMs & SDNs ARE HERE TO STAY (public clouds too!)

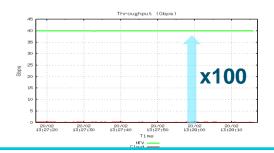## LEVERAGE ON **ETSI NFV** WORK

READY FOR **GREENFIELD** AND **BROWNFIELD**

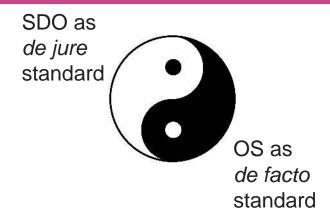## **PERFORMANCE** MATTERS FOR THE BUSINESS CASE

x100

OPEN SOURCE AS TOOL TO FACILITATE CONVERGENCE

©

3 reasons to go to open source

1. To accelerate the availability of a **reference standard**

   SDO as *de jure* standard

   OS as *de facto* standard

2. To build a **wide and competitive market** of producers and consumers
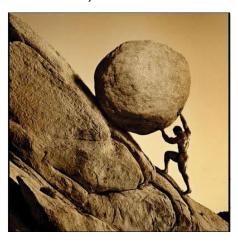
3. To answer the **BUY vs. MAKE** question

   BUY → PRODUCT

   MAKE → SOLUTION

   OPEN SOURCE as bridge

Some requirements to make Open Source MANO fit for purpose
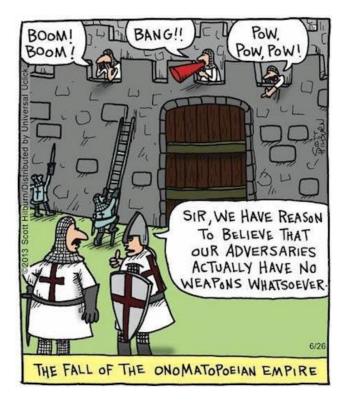
- **OPEN TO PLAYERS OF ALL SIZES**
  - Need of a diverse community
  - Adding expertise & demand

- **SUSTAINABLE AND RELIABLE**
  - The leaner, the better

  - **Focus on the core, leave the rest to INTEROP**

- **OPEN TO NEW TECHNOLOGIES**
  - Key for future-proof

- **AND READY TO DELIVER!**

ACCELERATING CONVERGENCE IN NFV ORCHESTRATION

Open Source MANO

OSM has already delivered 4 releases

MWC demo (Feb)

Kick-off (Apr)

Release ONE (Oct)

Release TWO (Apr)

Production Readiness

2016

2017

Release ZERO (May)

1st ETSI NFV Plugtest (Jan)
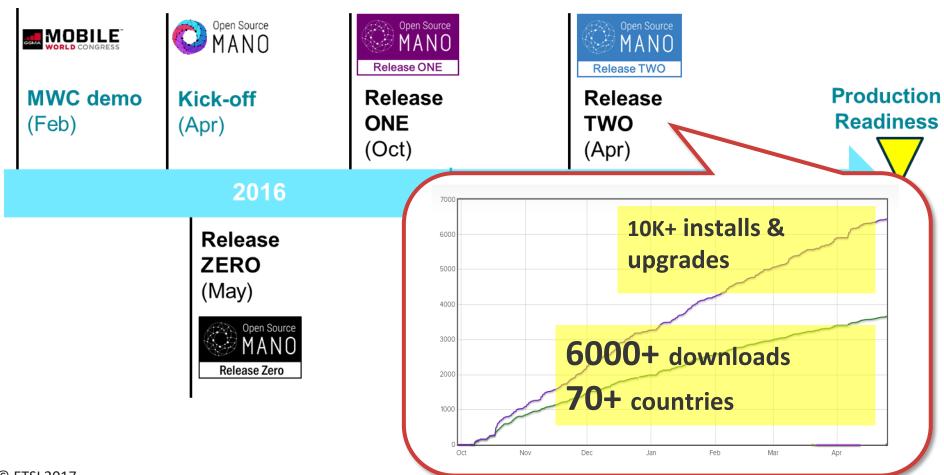
Release THREE (Oct)

OSM has already delivered 4 releases

MWC demo (Feb)

Kick-off (Apr)

Release ONE (Oct)

Release TWO (Apr)

Production Readiness

2016

Release ZERO (May)

10K+ installs & upgrades

6000+ downloads

70+ countries

Release TWO brought already a really comprehensive set of capabilities...

Multi-VIM

Multi-SDN
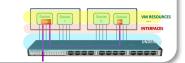
Open Source MANO

Release TWO

SDN assist for underlay chaining with EPA

Enables EPA deployments E2E for VIMs with no underlay support

One-click installer (multiple formats)

Network Service scaling

Full Day 0 & Day 1 operations

Multi-site Network Services

... and many improvements in interoperability, stability, security, etc.

© ET
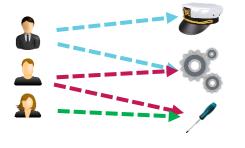
... that **Release THREE** has extended with a new set of advanced features

Open Source
MANO

Role-Based Access Control

Tenants/Projects
in orchestration

Open Source
MANO
Release THREE
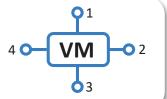
Monitoring (experimental)

Plugin Model, NFVI to VDU correlation, App metrics, normalization

Explicit port ordering & Device Role Tagging

1
4 — VM — 2
3

Full Interop with VIO 4

openstack
vmware

Anti-affinity rules for VNF resiliency

ACTV   STBY

VIM emulator
(OpenStack-like)

... and many improvements in interoperability, stability, security, etc.
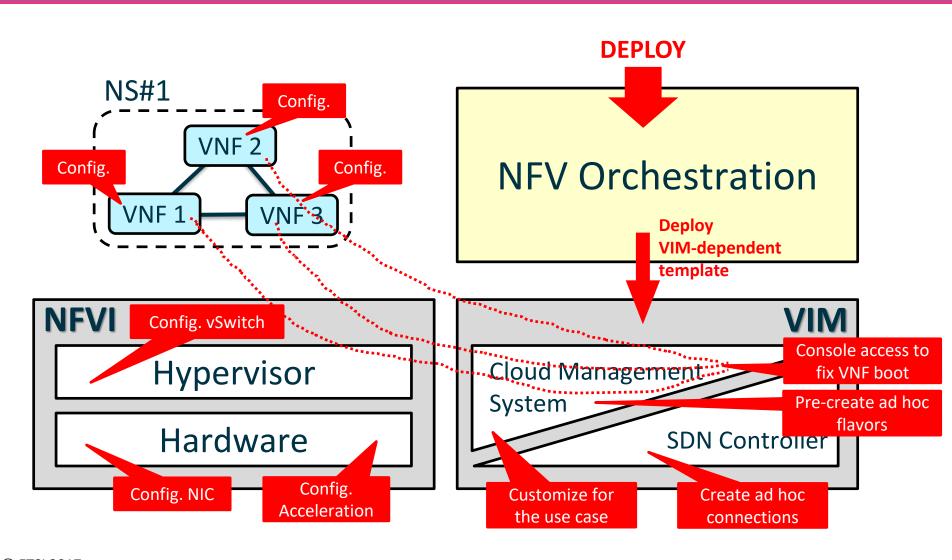
BUT... HOW DOES IT WORK IN PRACTICE?
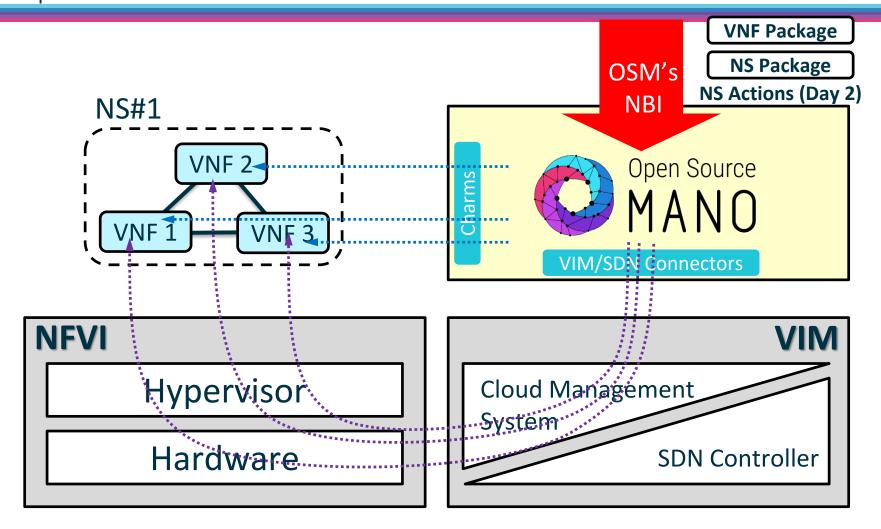
REMEMBER?

Open Source MANO

DEPLOY

NS#1

Config.

VNF 2

Config.

Config.

VNF 1

VNF 3

NFV Orchestration

Deploy VIM-dependent template

NFVI

Config. vSwitch

Hypervisor

Hardware

Config. NIC

Config. Acceleration

VIM

Cloud Management System

Console access to fix VNF boot

Pre-create ad hoc flavors

SDN Controller

Customize for the use case

Create ad hoc connections

© ETSI 2017
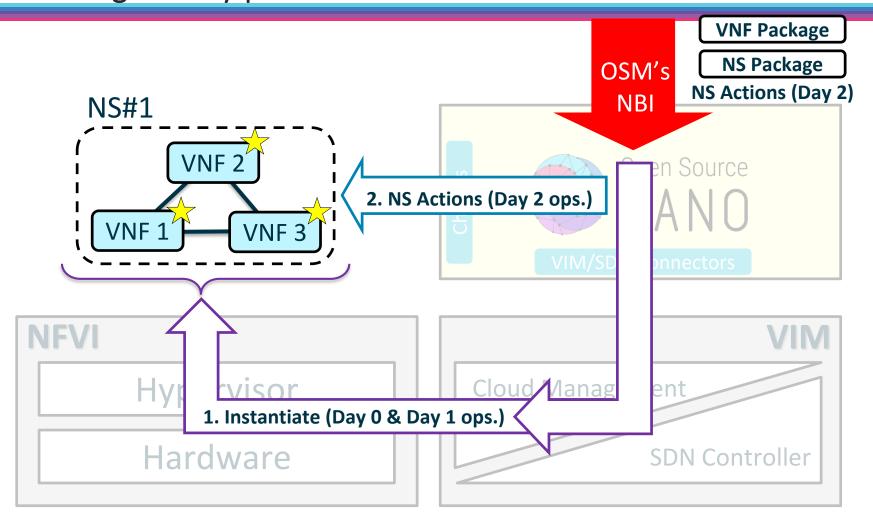
Open Source MANO provides a unique entry point for management, even for Day 2 operation…

NS#1

VNF 2
VNF 1
VNF 3

Charms

Open Source MANO

VIM/SDN Connectors

OSM's NBI

VNF Package
NS Package
NS Actions (Day 2)

NFVI

Hypervisor

Hardware

VIM

Cloud Management System

SDN Controller

… so that all that matters from operation perspective is the Network Service itself, with **one single entry point**

NS#1

VNF 2

VNF 1 — VNF 3

OSM's NBI

VNF Package

NS Package

NS Actions (Day 2)

2. NS Actions (Day 2 ops.)

Open Source MANO

VIM/SDN Connectors

NFVI

Hypervisor

Hardware

VIM

Cloud Management

SDN Controller

1. Instantiate (Day 0 & Day 1 ops.)

Having an appropriate Information Model, agnostic to VIM and VNF config, is key for NFV Orchestration
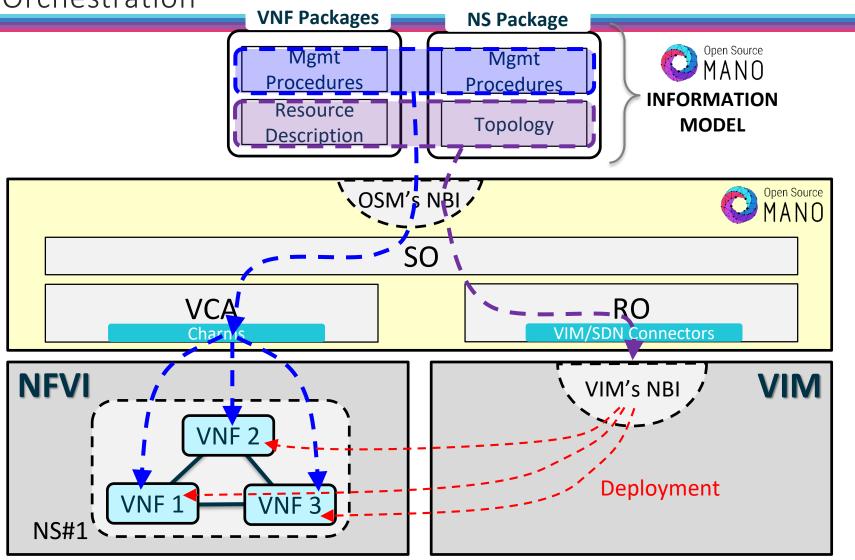
Open Source MANO

VNF Packages

NS Package

| Mgmt Procedures | Mgmt Procedures |

| Resource Description | Topology |

Open Source MANO

INFORMATION MODEL

Open Source MANO

OSM's NBI

SO

VCA

Charms

RO

VIM/SDN Connectors

NFVI

NS#1

VNF 2

VNF 1

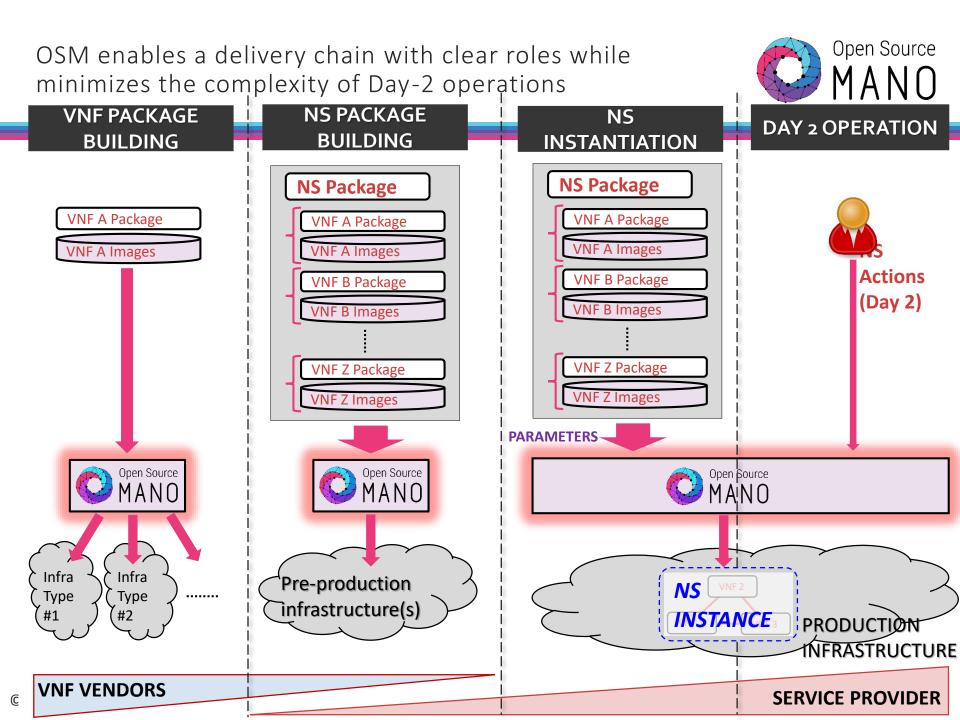VNF 3

VIM's NBI

Deployment

VIM

OSM Information Model is open and all the information is publicly available

- Wiki page:
  https://osm.etsi.org/wikipub/index.php/OSM_Information_Model

- YANG models:
  - Gitweb (master): https://osm.etsi.org/gitweb/?p=osm/IM.git;a=tree
  - Folder: models/yang

- IM tree representation of YANG models both in text and navigable format:
  - VNFD: http://osm-download.etsi.org/ftp/osm-doc/vnfd.html
  - VNFR: http://osm-download.etsi.org/ftp/osm-doc/vnfr.rec.html
  - NSD: http://osm-download.etsi.org/ftp/osm-doc/nsd.html
  - NSR: http://osm-download.etsi.org/ftp/osm-doc/nsr.rec.html

OSM enables a delivery chain with clear roles while minimizes the complexity of Day-2 operations

Open Source MANO

VNF PACKAGE BUILDING	NS PACKAGE BUILDING	NS INSTANTIATION	DAY 2 OPERATION

VNF A Package

VNF A Images

Open Source MANO

Infra Type #1   Infra Type #2   ....

NS Package

VNF A Package

VNF A Images

VNF B Package

VNF B Images

⋮

VNF Z Package

VNF Z Images

Open Source MANO

Pre-production infrastructure(s)

NS Package

VNF A Package

VNF A Images

VNF B Package

VNF B Images

⋮

VNF Z Package

VNF Z Images

PARAMETERS

Open Source MANO

NS INSTANCE

VNF 2

PRODUCTION INFRASTRUCTURE

NS Actions (Day 2)

Open Source MANO

VNF VENDORS

SERVICE PROVIDER

©

OSM ARCHITECTURE

Architectural Principles for OSM

- **LAYERING**
  - Require clear delineation between the layers and modules.
  - Should be broadly aligned with ETSI-NFV

- **ABSTRACTION**
  - Moving up/down the layers should offer clear differentiation in the levels of abstraction/detail presented.

- **MODULARITY**
  - Even within layers, clear modularity enabled with a plugin model preferred to facilitate module replacements as OSM community develops.

- **SIMPLICITY**
  - Solution must have the minimal complexity necessary to be successful and no more.
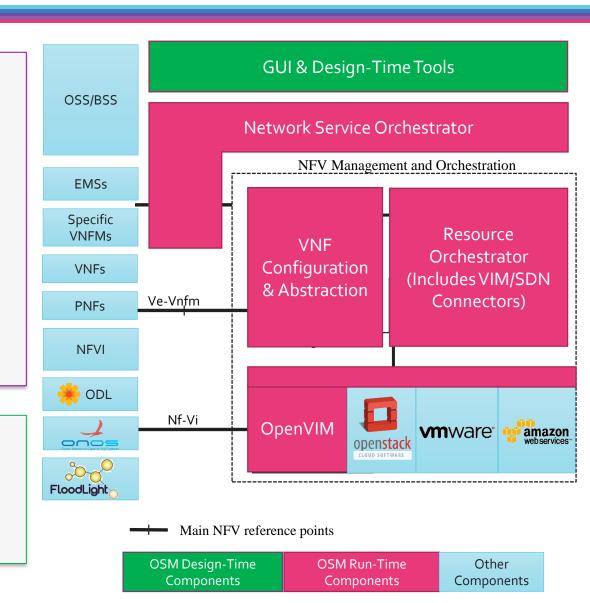
OSM scope

RUN-TIME SCOPE

- Automated E2E Service Orchestration
- Superset of ETSI NFV MANO
- Plugin model for integrating multiple SDN controllers
- Plugin model for integrating multiple VIMs
- Integrated Generic VNFM with support for integrating Specific VNFMs
- Support for Physical Network Function integration
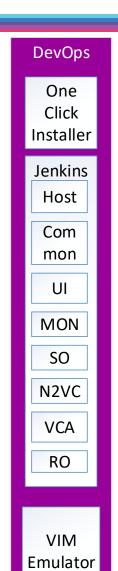- Greenfield and brownfield deployments

DESIGN-TIME SCOPE

- Network Service Definition
- Model-Driven Environment with Data Models aligned with ETSI NFV
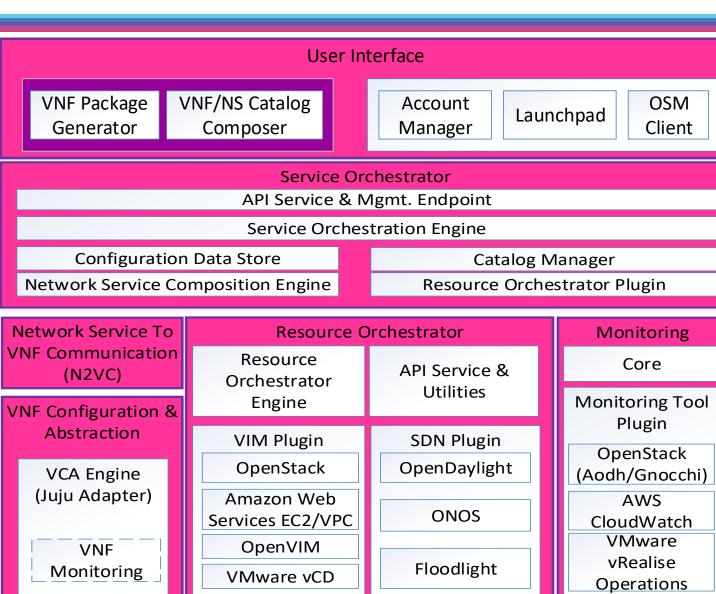- VNF Package Generation
- GUI

© ETSI 2017

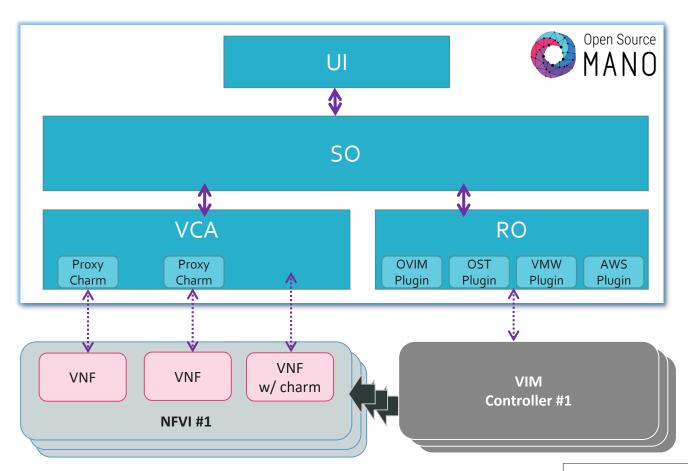**OSS/BSS**

EMSs

Specific VNFMs

VNFs

PNFs

NFVI

ODL

onos
Open Network Operating System

FloodLight

GUI & Design-Time Tools

Network Service Orchestrator

NFV Management and Orchestration

VNF Configuration & Abstraction

Resource Orchestrator (Includes VIM/SDN Connectors)

Ve-Vnfm

Nf-Vi

OpenVIM

openstack
CLOUD SOFTWARE

vmware™

amazon
web services™

Main NFV reference points

| OSM Design-Time Components | OSM Run-Time Components | Other Components |

OSM Architecture

Open Source MANO

DevOps

One Click Installer

Jenkins

Host

Common

UI

MON

SO

N2VC

VCA

RO

VIM Emulator

© ET

User Interface

VNF Package Generator	VNF/NS Catalog Composer

Account Manager	Launchpad	OSM Client

Service Orchestrator

API Service & Mgmt. Endpoint

Service Orchestration Engine

Configuration Data Store	Catalog Manager
Network Service Composition Engine	Resource Orchestrator Plugin

Network Service To VNF Communication (N2VC)

VNF Configuration & Abstraction

VCA Engine (Juju Adapter)

VNF Monitoring

Resource Orchestrator

Resource Orchestrator Engine	API Service & Utilities

VIM Plugin	SDN Plugin
OpenStack	OpenDaylight
Amazon Web Services EC2/VPC	ONOS
OpenVIM	Floodlight
VMware vCD	

Monitoring

Core

Monitoring Tool Plugin

OpenStack (Aodh/Gnocchi)

AWS CloudWatch

VMware vRealise Operations

OSM Data Model (IM)

OSM Architecture
Simplified view
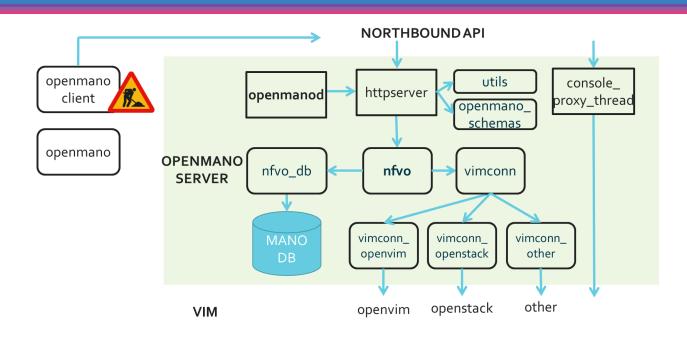

UI: User interface
SO: Service Orchestrator
VCA: VNF Configuration & Abstraction
RO: Resource Orchestrator

The **plugin model** facilitates interop with different clouds and controllers

CMS PLUGINS	SDN PLUGINS
• OpenStack (several flavours) • OpenVIM • VMware (vCD) • AWS • Add your plugin here	• ODL • ONOS • FloodLight • Add your plugin here

EPA support combined with SDN Assist enables chaining of high performance VNFs

1. Accurate assignment of resources at VM level
2. Proper assignment of I/O interfaces to the VM
3. **SDN gives the ability to create underlay L2 connections**
   - Interconnecting VMs
   - Attaching external traffic sources
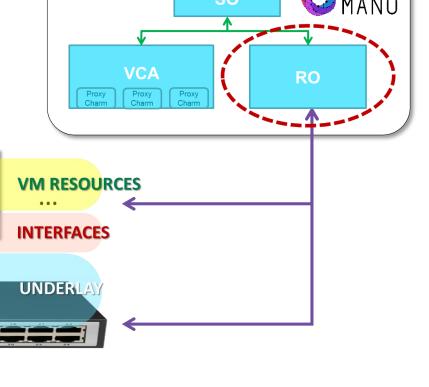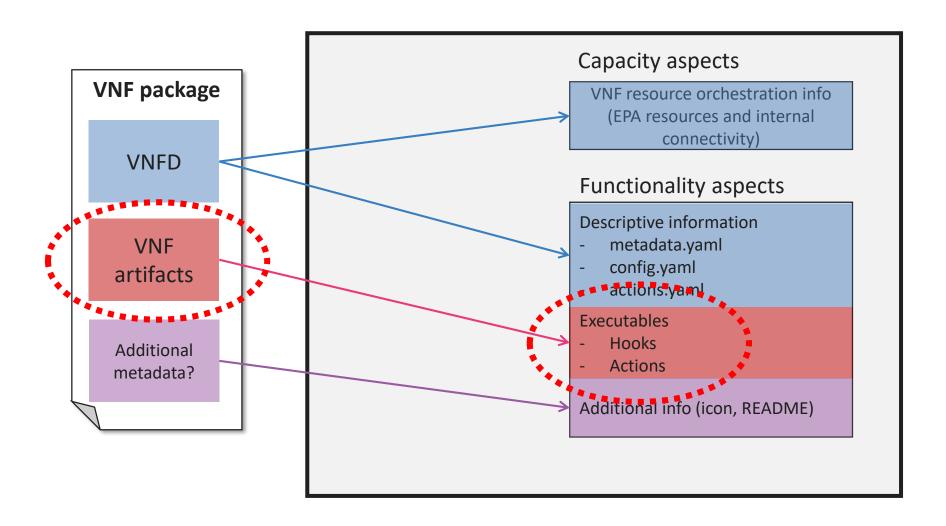
Operations and lifecycle with OSM

Day-0, Day-1, and Day-2

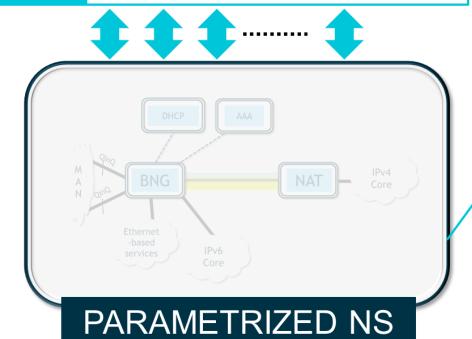# VNF's operational procedures are already embedded in their VNF Package…

… ready to be used in **complex Network Services**, which **define their own E2E operational procedures**…

HIGH-LEVEL PRIMITIVES

E.g.:
- Add subscriber
- Add service profile
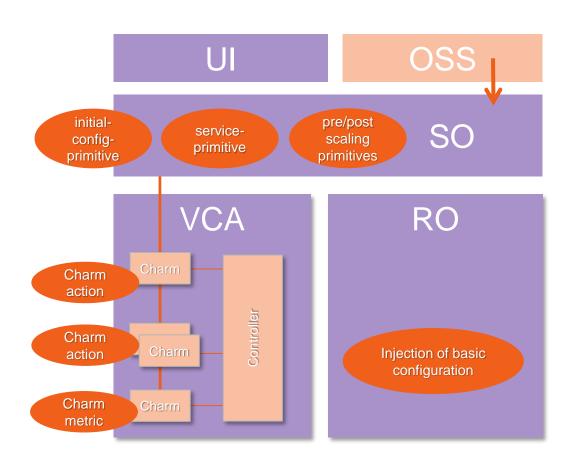- Update subscriber profile
- Add service access to subscriber

…

PARTICULARIZATION

IP pools = x1
QoS1 definition = x2
QoS2 definition = x3

…

PARAMETRIZED NS

OSM enablers for NFV management

OSM NB API:
- Create new NS instance
- Get NS instance record
- Get VNF metrics
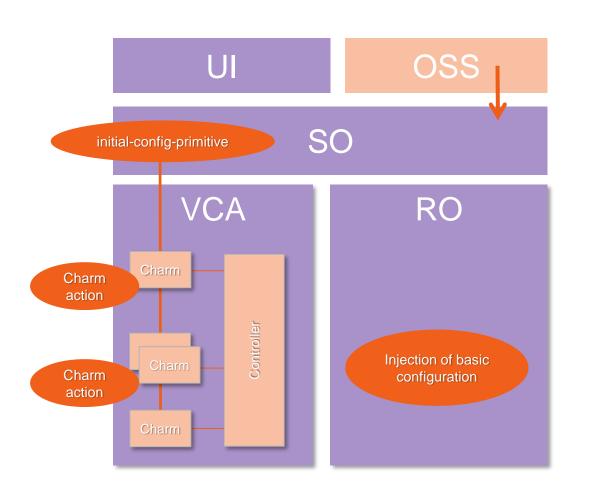- Call NS primitive
- Scale in/out NS instance

VNFD:
- Basic configuration (SSH keys, hostname, user-data scripts, etc.)
- Initial config primitive
- Config primitive
- *Charms → Actions*
- *Charms → Metrics*

NSD:
- Initial config primitive
- Service primitive
- Scaling groups
- Pre and post scaling primitives
- *Scripts*

Day-0 / Day-1 configuration (at instantiation time) is descriptor-based

Open Source MANO

UI

OSS

SO

initial-config-primitive

VCA

RO

Charm

Charm action

Charm

Charm action

Charm

Controller

Injection of basic configuration

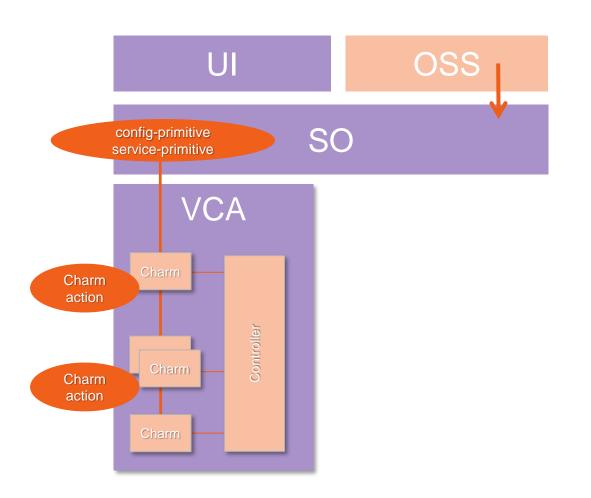OSM NB API:
- Create new NS instance

VNFD:
- Basic configuration (SSH keys, hostname, user-data scripts, etc.)
- Initial-config-primitive
- *Charms -> Actions*

NSD:
- Initial config primitive
- *Scripts*

Day-2 configuration

Day-2 elasticity (scaling)

UI

OSS

pre/post-scaling-primitive

SO

VCA

RO

Charm action

Charm

Charm

Controller

Charm action

Charm

Injection of basic configuration

OSM NB API:
- Get NS instance record
- Scale in/out NS instance

VNFD:
- Basic configuration (SSH keys, hostname, cloud-init scripts, etc.)
- *Charms → Actions*

NSD:
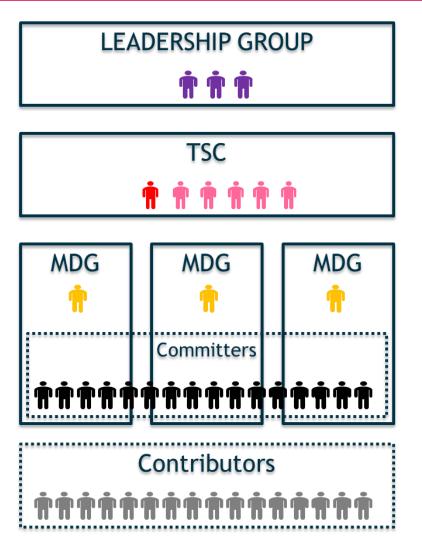- Scaling groups
- Pre and post scaling primitives

OSM organization

OSM has an organization oriented to the production of upstream code…
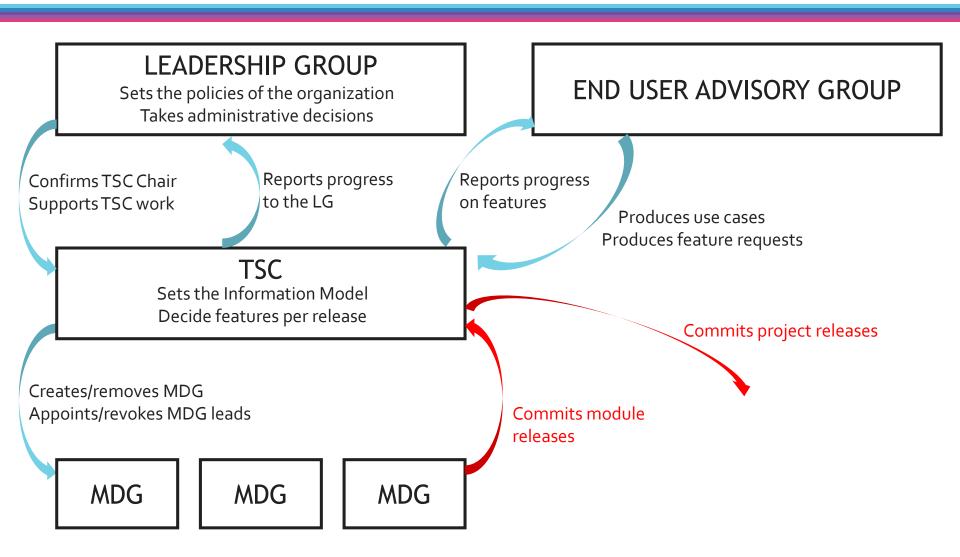

LEADERSHIP GROUP

TSC

MDG | **MDG** | **MDG**

Committers

Contributors

END USER ADVISORY GROUP

Users

Legend:
- LG member
- TSC Chair
- TSC member
- MDG lead
- Committer
- Contributors
- Adv Group Member
- Users

… which favours efficient decision taking

LEADERSHIP GROUP
Sets the policies of the organization
Takes administrative decisions

END USER ADVISORY GROUP

Confirms TSC Chair
Supports TSC work

Reports progress
to the LG

Reports progress
on features

Produces use cases
Produces feature requests

TSC
Sets the Information Model
Decide features per release

Commits project releases

Creates/removes MDG
Appoints/revokes MDG leads

Commits module
releases

MDG   **MDG**   **MDG**

OSM CI/CD

OSM has a rich CI/CD Pipeline…

Code Commit → **Trigger per-module pipelines**

Stage 1

Stage 2

Scan | U Test | Build | Archive

Scan | U Test | Build | Archive

artifactory

Artifact Storage

Stage 4

VNF

NFVI & VIM

System Tests ← **Smoke Tests**

OSM Release Server

System Install

Stage 3
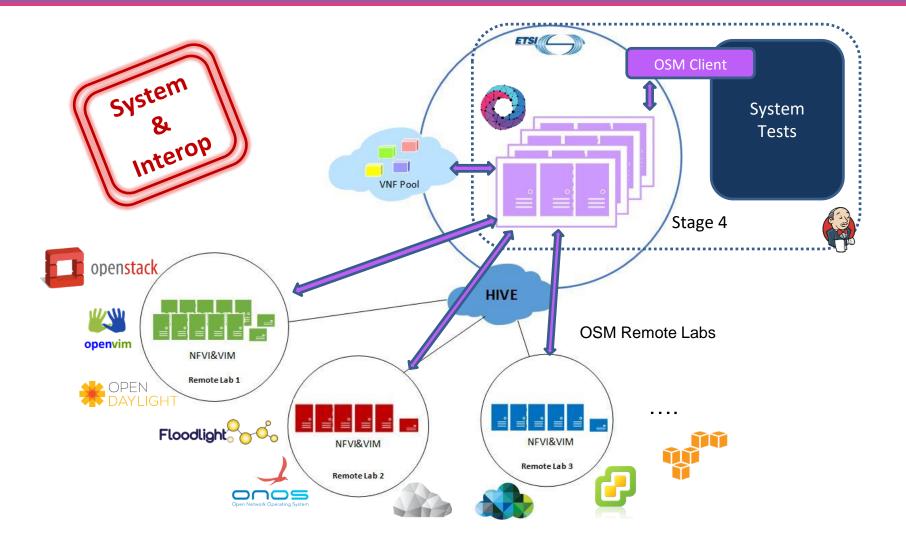
... that enjoys the connection to OSM's Network of Remote Labs to test interop with different VIMs and NFVIs

Find us at:
osm.etsi.org
osm.etsi.org/wikipub