

Open Source  
**MANO**  
*by ETSI*

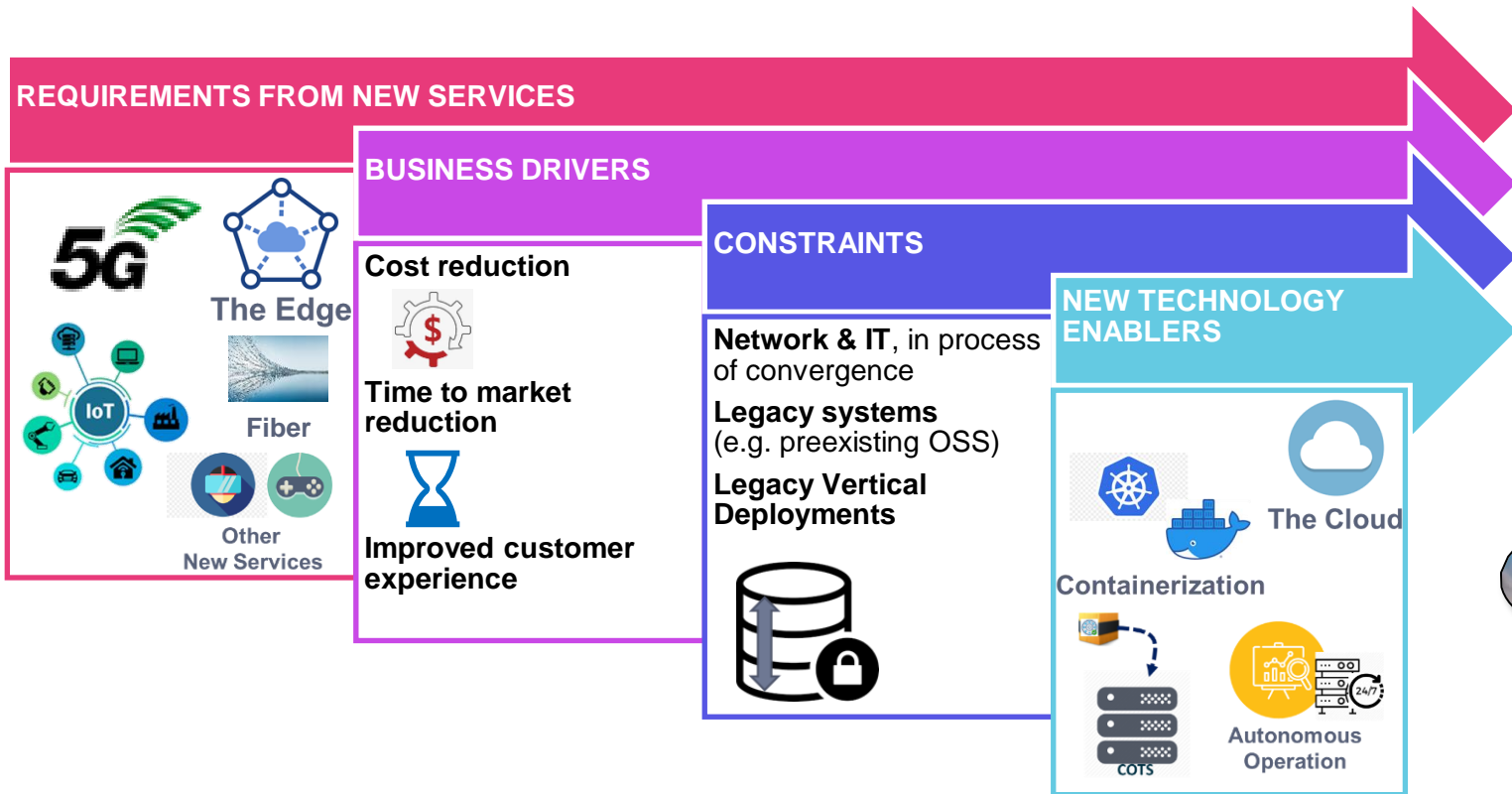
# Introduction to OSM

Gerardo García (Telefónica, OSM TSC Chair)

OSM Training Seminar - SLICES

13/02/2024

# Some requirements for the evolution of Telco Clouds...



## NEXT-GEN TELCO CLOUD





# How OSM Simplifies Telco Cloud Management...

... while keeping flexibility

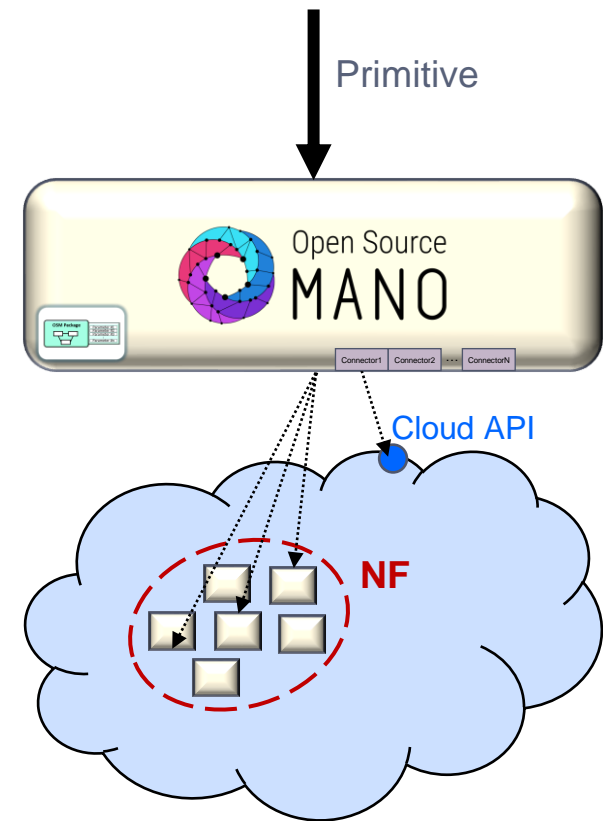


# OSM provides a platform to create Networks as a Service and to manage them conveniently later...



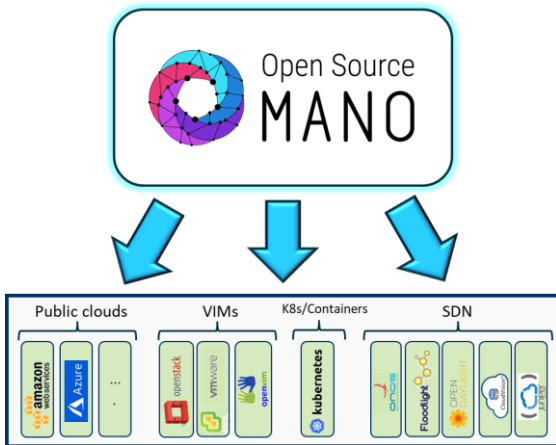
OSM manages the low-level setup for Network Functions, so that they are ready for use.

- It covers in 100% the role of a kind of **specialized PaaS for Network Functions**, with 2 key features:
  1. **Complex connectivity** setup, including EPA and underlay scenarios.
  2. Solve **inter-NF relations**.
- Returns: **NS/NF ready for its use and properly connected**:
  - Exposes the **“function” and its lifecycle, not its components**.
  - Presented as a whole (i.e., abstracts from low-level details of the NF).
  - Easy (standardized) access to NF's lifecycle operations, via **primitives**.
- This follows well-known paradigms in **IT and public clouds**.

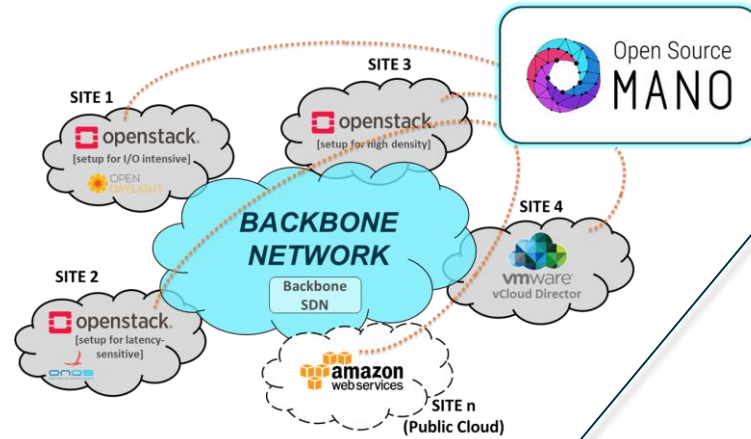


... on different types of infrastructure and across different locations...

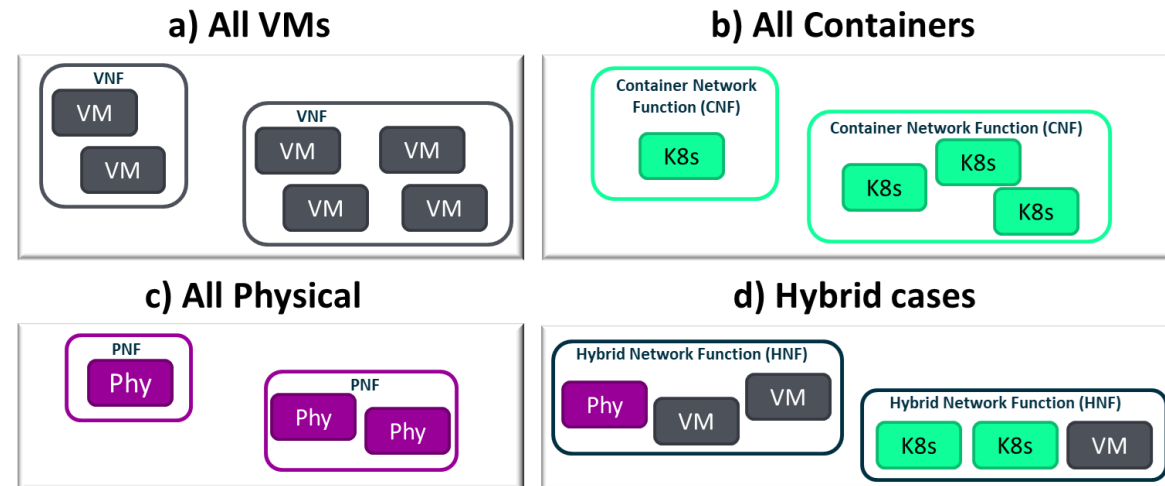
**MULTI-VIM & MULTI-SDN**



**MULTI-SITE**

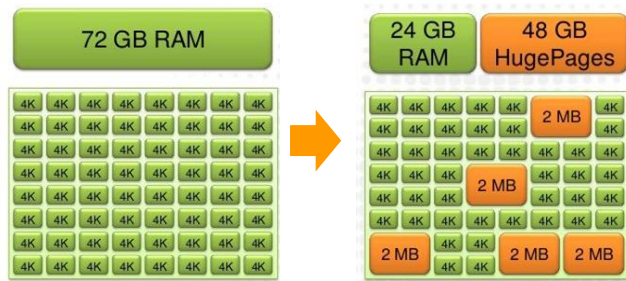


... with NFs composed of VMs, containers and/or physical elements...

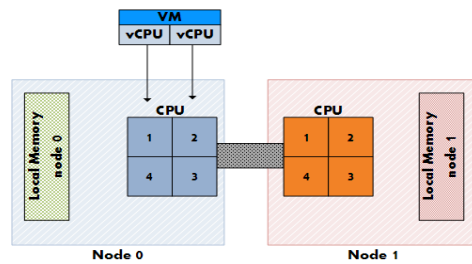


... and ready for network-specific workloads whenever needed

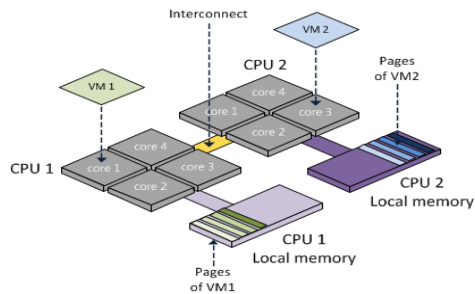
### Huge Pages



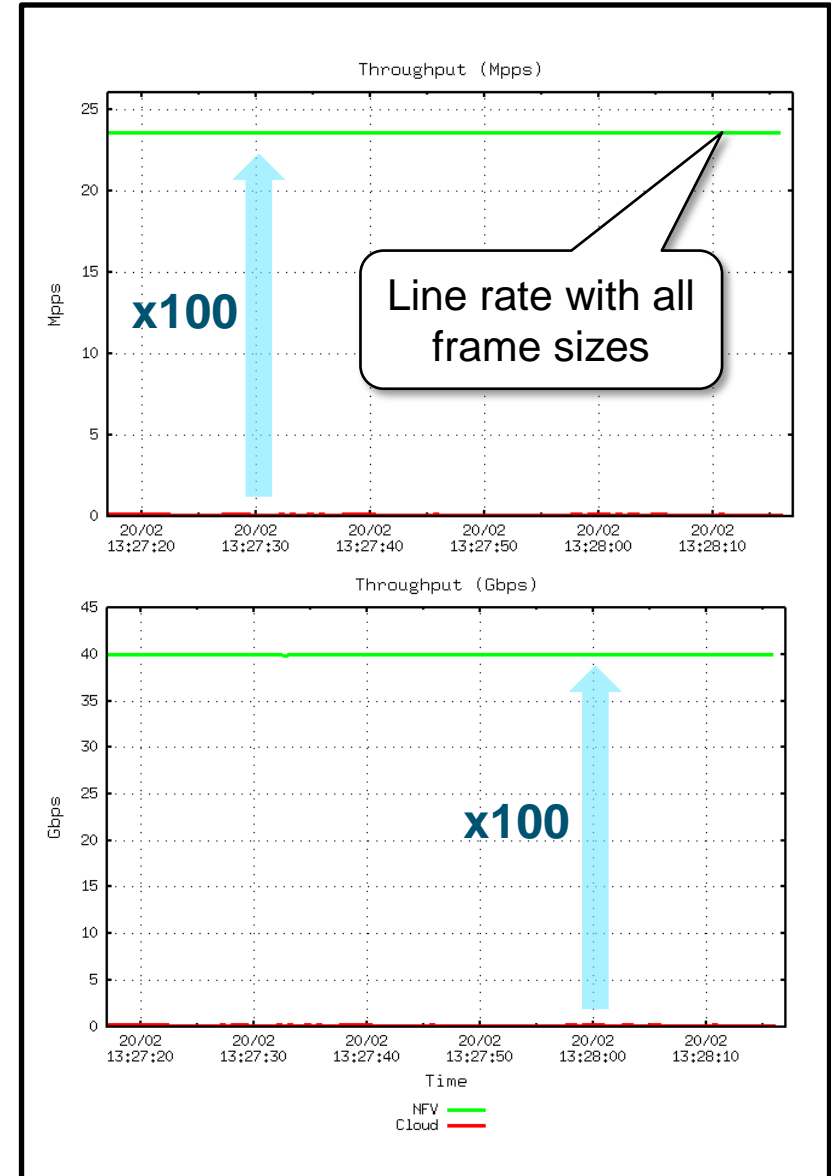
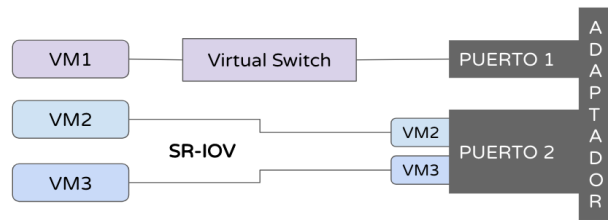
### NUMA Topology Awareness



### CPU Pinning

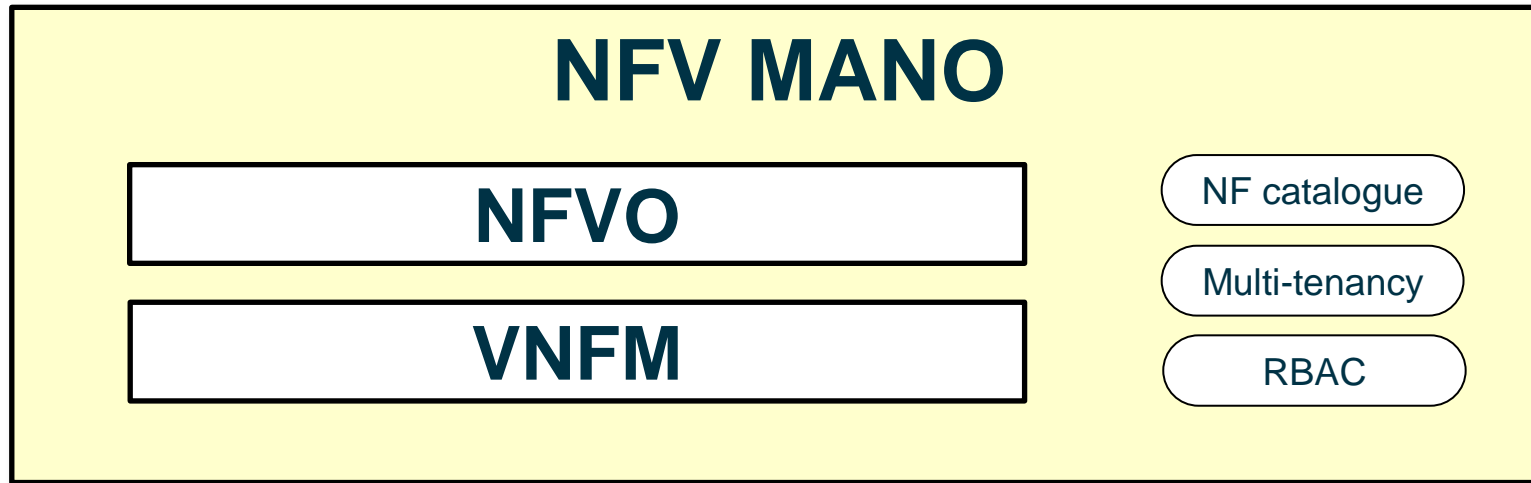


### Data Plane assignment



# OSM functionality is based on ETSI NFV reference framework

**NF and NS as a Service**

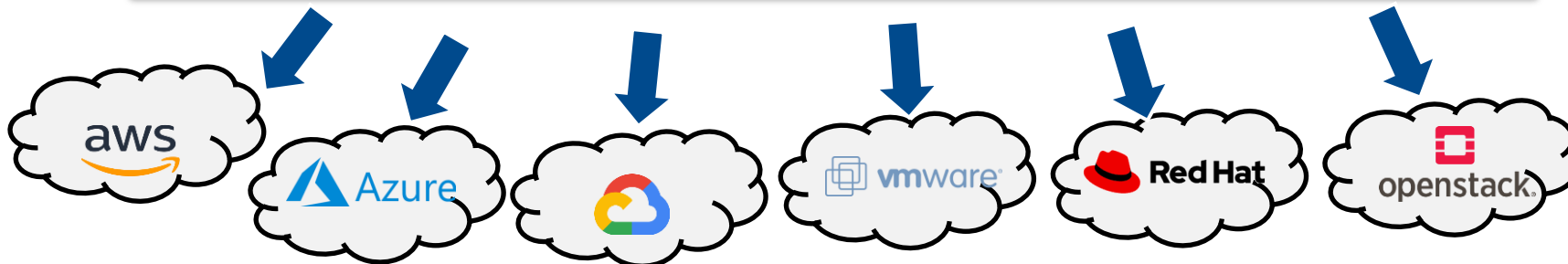


**NB interface (REST API)  
based on SOL005 (+SOL003)**

**Common model for NS and NF  
packages (SOL004, SOL007) and  
descriptors (SOL001, SOL006)**

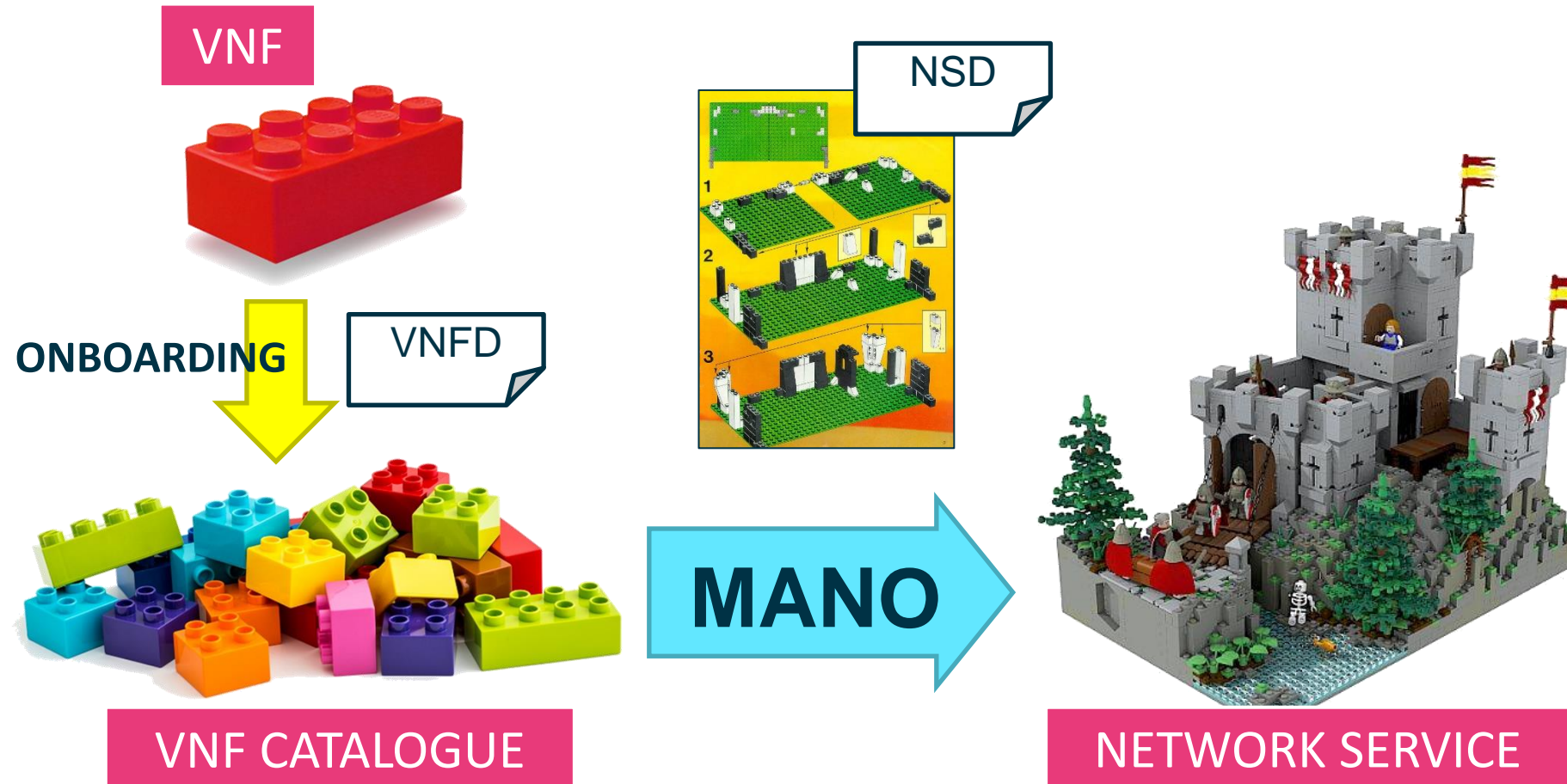


**Multi-site and multi-cloud  
southbound interaction**



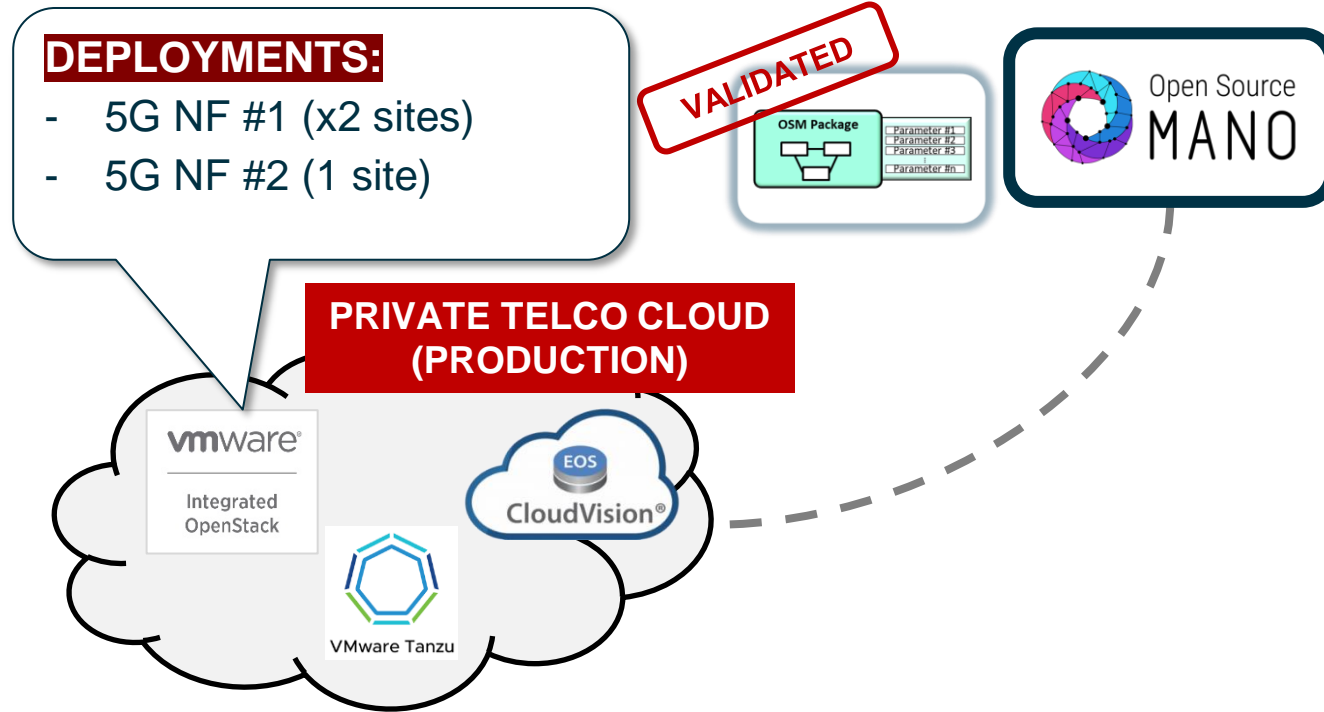
# Key concept: replicability and predictability

Network designs can leverage on replaceable components that can be safely and automatically assembled

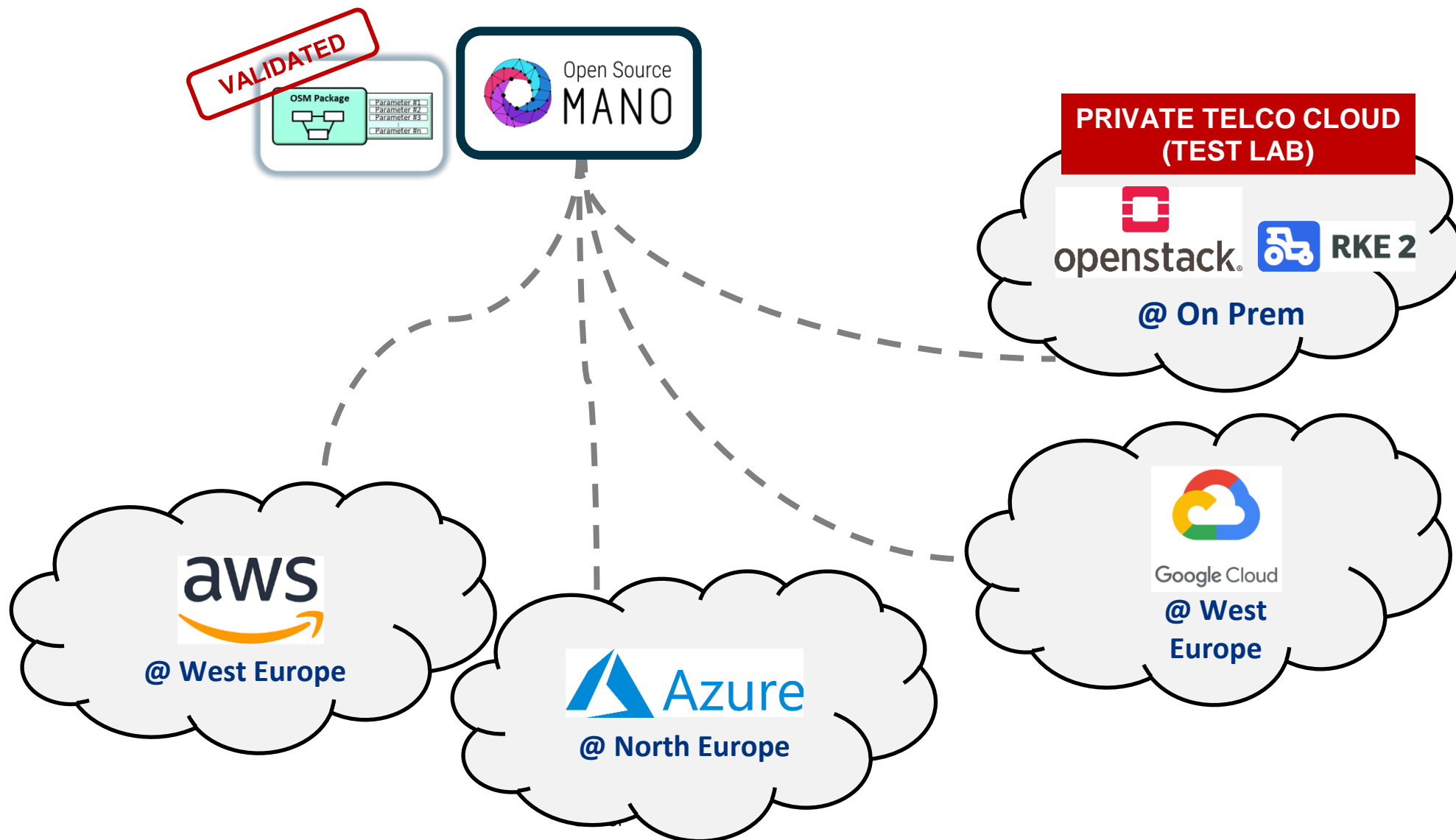




# Using the exact same packages, the same service can be deployed in multiple types of clouds and sites



# Using the exact same packages, the same service can be deployed in multiple types of clouds and sites



# As a result, OSM brings big operational benefits for the challenges of a modern Telco Cloud

## Reduction of complexity

- Via abstraction & layering

Reliable  
deployment in  
multiple locations

Independent of the  
type of cloud

Vendor-agnostic

## Reliable and unambiguous testing

- Ideal for CI/CD

Error minimization

Minimal Time to  
Market for  
second  
deployments

Easier capacity  
growth among  
clouds

Ability to move  
workloads  
between clouds

Allows for  
advanced  
redundancy  
schemas

Reduction of  
efforts



# A Vibrant and Thriving Community



# OSM Community is really **LARGE AND DIVERSE**, with **153** members today, but always **OPEN** to new participants



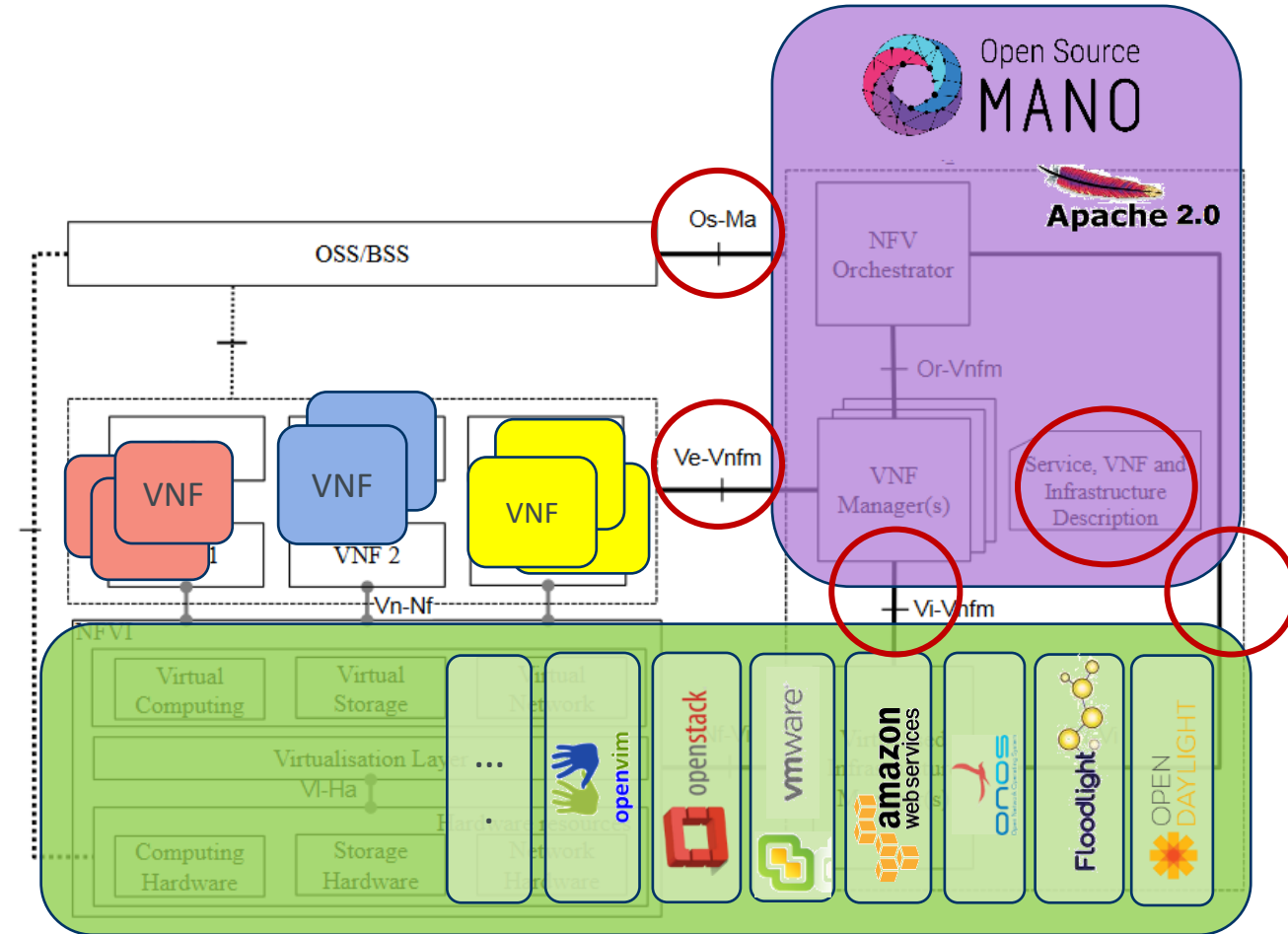
- 15 Global Service Providers
- Leading IT/Cloud players
- VNF providers



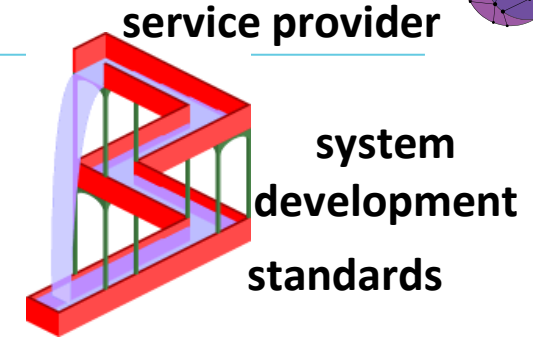
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# ETSI OSM & ETSI NFV

- **ETSI NFV:** Industry Specification Group on Network Functions Virtualisation
- **ETSI OSM:** ETSI hosted Open Source project developing a Management and Orchestration (MANO) stack aligned with ETSI NFV Architectural Framework and IM

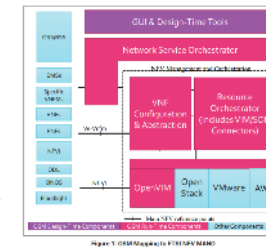
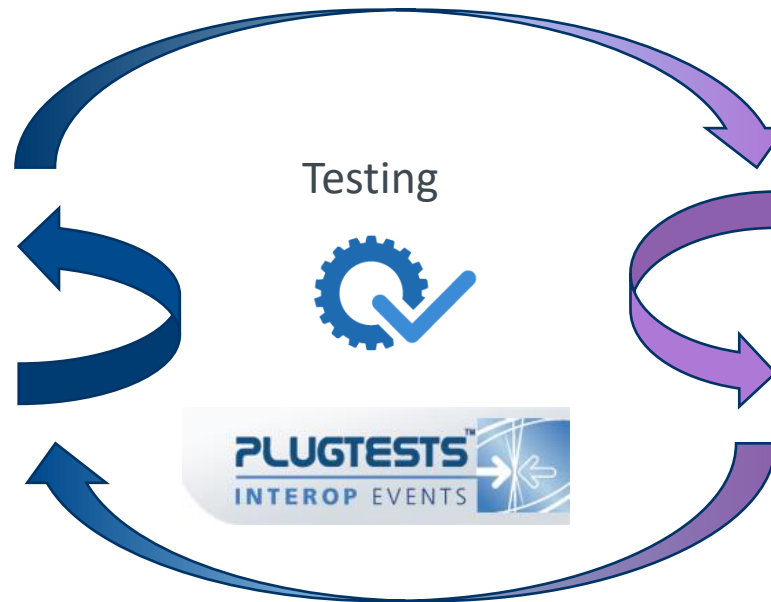
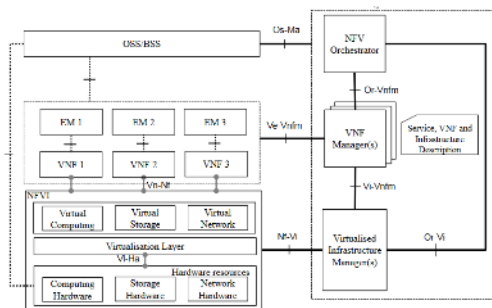


# OSM activities create continuous feedback loops with other ETSI initiatives...

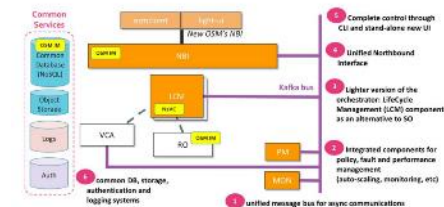


- Architectural Framework
- Information/Data Model (IM/DM)
- API definitions
- Test Specs

## ETSI NFV



```
<!DOCTYPE html>
<html id="home-layout">
<head>
  <meta http-equiv="content-type" cont...
  <title>Source Code Pro</title>
  <!-- made with <3 and AFDKO -->
  <meta name="keywords" content="sans,
  monospace, open source, coding, for...
  <link rel="stylesheet" type="text/css...
</head>
<body>
  <div id="main">
```



- [Release White Papers](#)
- IM improvements (100+ points raised), bugs in APIs
- Lessons learnt [EUAG White Paper](#)

# ... while providing a highly effective bridge between Standards and Research Projects

ETSI NFV



```
<!DOCTYPE html>
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    <meta http-equiv="content-type" conte
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```



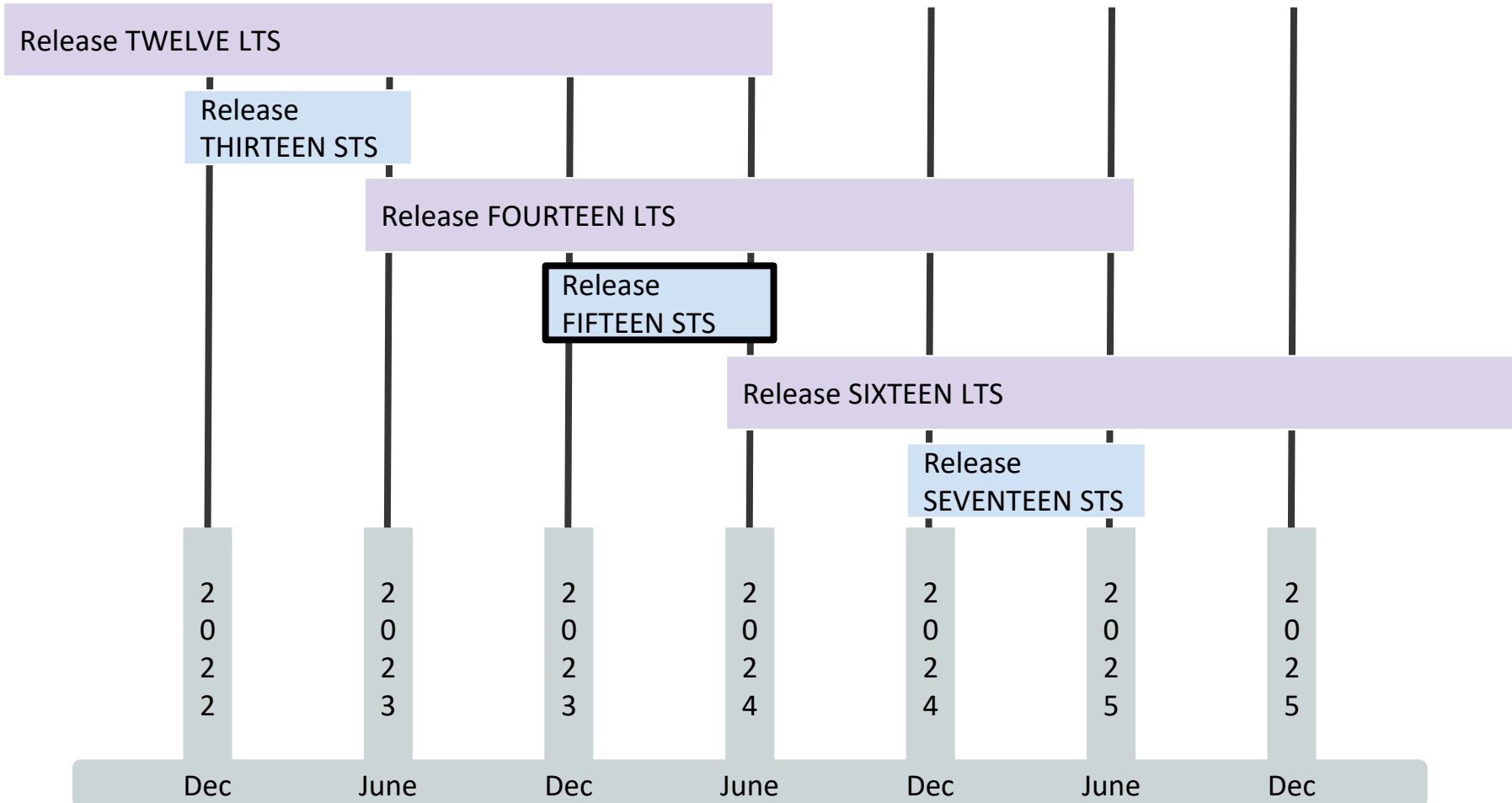
<https://osm.etsi.org/wikipub/index.php/Research>





OSM in production:  
two releases per year

# OSM Release cadence



LTS Releases (Long Term Support)	STS Releases (Short Term Support)
24 months community support	6 months community support
Oriented to production	Oriented to innovation & development
Focus on stability	Focus on innovation & agility
Community grants upgrade between LTS's	Upgrade on a best effort basis

# Release FIFTEEN brings a whole set of new functionalities ...



**Release FIFTEEN**

## NS instantiation and lifecycle mgmt

- Cancel operation task.
- Service Function Chaining.
- AZ for Cinder.
- Dual-Stack IP Support for VNFs in SOL003 VNFM interface.



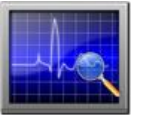
## Kubernetes support

- Support of OCI registries for Helm-based KDU
- Deprecation of Helm v2.



## Closed-loop life cycle in public clouds

- Resource consumption metrics from GCP.



## OSM installation

- Use of upstream MongoDB Helm chart in community installer.
- Make juju installation optional in community installer.
- Update of OSM Helm installer to latest versions.



## E2E Testing

- Public Cloud Robot tests in OSM pipeline.
- Robot framework linting for E2E tests.



# ... which are added on top of an already long set of features.

## Release ZERO

- Simplified on-boarding process
- Human-readable
- Multi-VIM support
- EPA Support, as
- Underlay configuration
- Web interface
- Comprehensive
  - Installation guide
  - How-to guides
  - Data Model
  - Minimal infrastructure
  - Videos
  - ...

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## Release ONE

Multi-VIM

Multi-SDN

Network Service scaling

Monitoring

Full Day 0 & D operations

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## Release ELEVEN brings new features to foster current and new deployments

### SOL004 and SO package format

### Brand-new support for Google Cloud

- Completing the in for 3 largest public

### Fine-grained operation

- Start and stop server
- Run one-shot containers
- Files API

### ... and other improvements

- On-demand configuration
- Push notification
- Policy support

### IMPROVED MOD

- Full support of
- Consistency check
- MAC address selection
- Support of alternative

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## Release SIX

### NBI and operation

- RBAC improvement
- Re-enable NS profile

### Monitoring

## Release TWELVE adds features well connected with key use cases and field demands

### NF Healing

- VDU Healing
- Auto-healing

### SOL003 support

- SOL003 support
- SOL003 subscription

### NS Lifecycle

- Upgrade of VNF instance (upgrade of charms)
- Removal of VNF instance from running NS.

### ... and other improvements

- Dynamic inter-DC connection
- WIM plugin model
- Multi-VIM Enhancement

### MONITORING IMPROVEMENTS

- Extended interoperability
- Policy support
- VNF + VIM Metrics Collection

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## Release THIRTEEN adds features well connected with key use cases and field demands

### New closed-loop

- VM status, NS topology acquired via Airflow.
- Prometheus Rec. Rules
- Configurable Prometheus

### Internal LCM evolution

- Saga-based LCM Milestones
  - Configuration via Helm
  - LCM-RO communication

### Execution Environment

- Server-side authentication
- Execution Environment
- Upgrade of Helm-based
- New convention for

## Release FOURTEEN brings a whole set of new functionalities ...

### Closed-loop life cycle architecture

- GA of new monitoring architecture for closed loops.
- Service KPI of VNF using exporter endpoint.
- Autoheal switch and autoscale switch.

### Security enhancements

- Replacement Pycrypto with PycryptoDome.
- Pod Admission Policy for Helm-based EE.
- Authenticated gRPC for Helm-based EE.

### Usability and platform management

- User management enhancements.
- Audit logs generation for OSM

### Infra modelling and NF lifecycle

- RO performance optimization.
- IPv6 support.
- Transport API (TAPI) WIM connector
- Support of volume multi-attach.
- IP address and hostname for horizontally scaled VM.
- Use existing flavor-id as an instantiation parameter.
- Instantiation parameters for Juju bundles.

### OSM installation

- Helm Charts for deploying OSM on K8s.
- Update/Upgrade of OSM services.

- Better event and log visualization
- Docker, Vagrant and VM image install

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6

### Enter access to M's subscription API

M client extension



### Monitoring of availability

IM resources



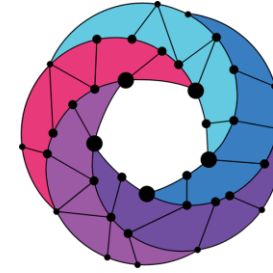
### Learnings of latest OSM production deployments

Open Source MANO

Release TEN

Soon available at: [osm.etsi.org](https://osm.etsi.org)





Open Source  
**MANO**  
*by ETSI*

# Thank You!

[osm.etsi.org](https://osm.etsi.org)

[osm.etsi.org/docs/user-guide](https://osm.etsi.org/docs/user-guide)

[osm.etsi.org/wikipub](https://osm.etsi.org/wikipub)

# Evolution of NFV orchestration

# In 2012, a white paper was written by the world's leading telecom network operators, leading to the foundation of Network Function Virtualization

Network Functions Virtualisation – Introductory White Paper Issue 1

## Network Functions Virtualisation

*An Introduction, Benefits, Enablers, Challenges & Call for Action*

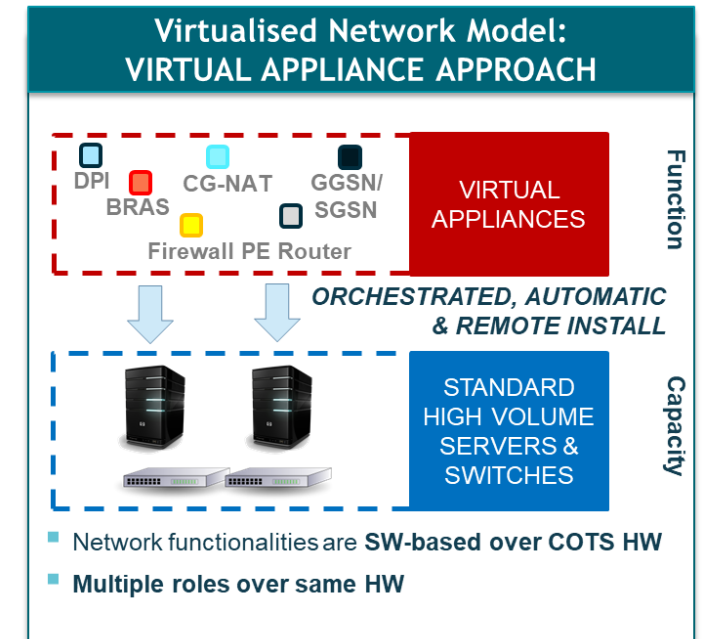
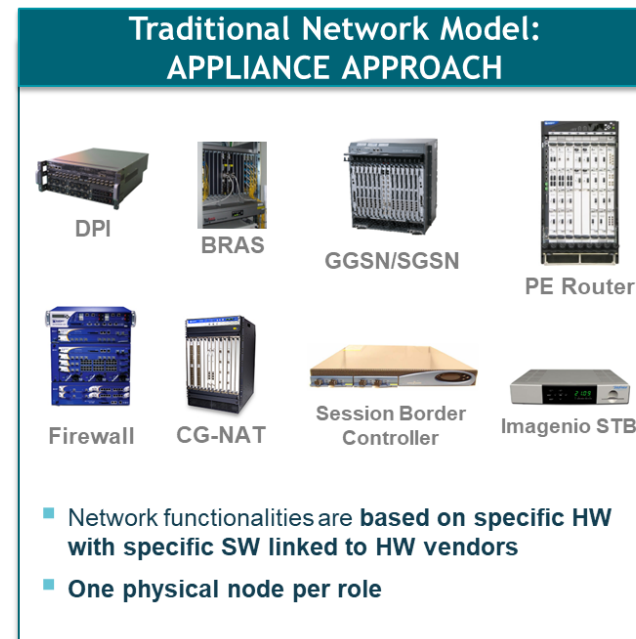
**OBJECTIVES**  
This is a non-proprietary white paper authored by network operators.

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**

<b>AT&amp;T:</b>	Margaret Chiosi.
<b>BT:</b>	Don Clarke, Peter Willis, Andy Reid.
<b>CenturyLink:</b>	James Feger, Michael Bugenhagen, Waqar Khan, Michael Fargano.
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<b>Deutsche Telekom:</b>	Uwe Michel, Herbert Damker.
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<b>NTT:</b>	Masaki Fukui, Katsuhiro Shimano.
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<b>Telstra:</b>	Frank Ruhl.
<b>Verizon:</b>	Prodip Sen.

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

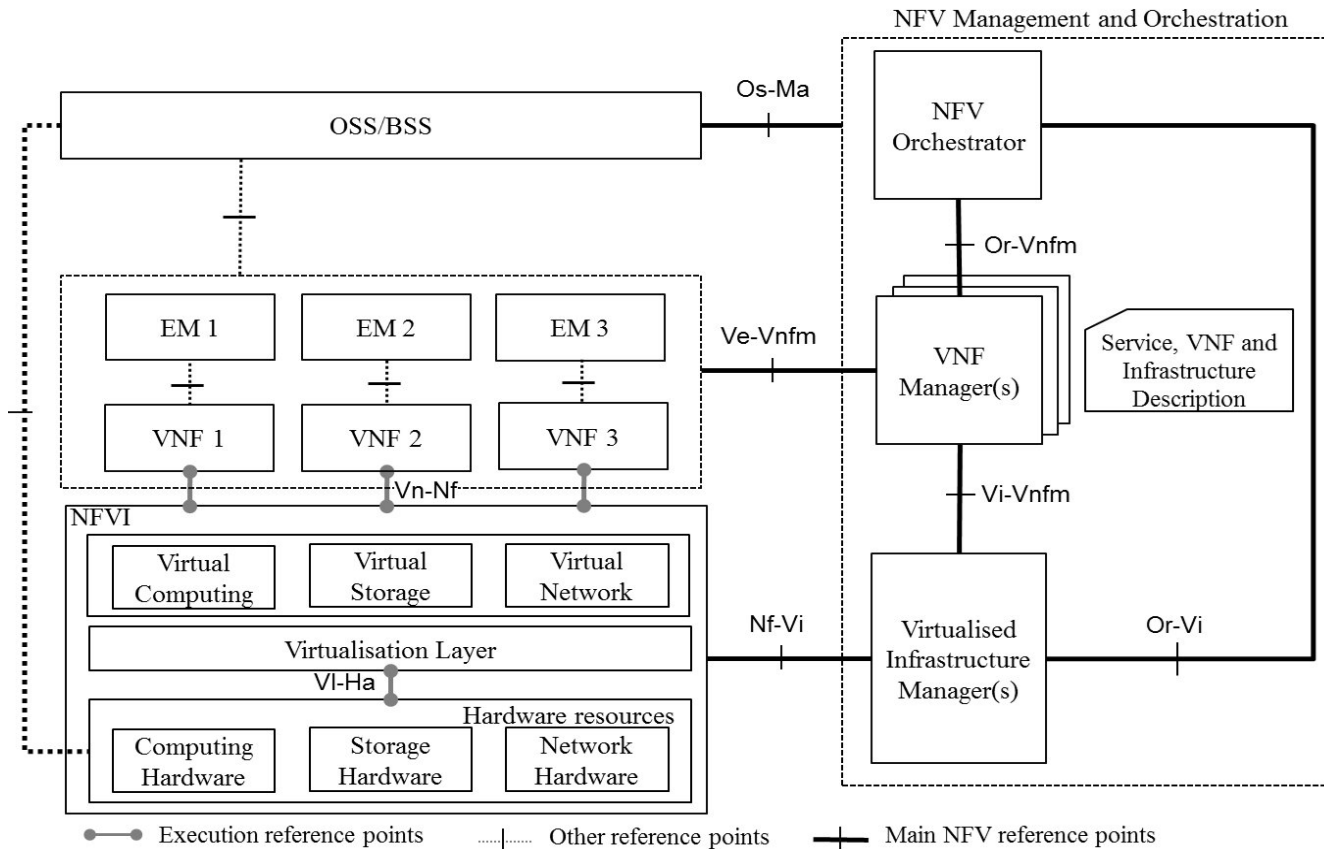


## Promises:

- CAPEX reduction through commodity HW
- OPEX reduction thanks to the automation of a SW-based network

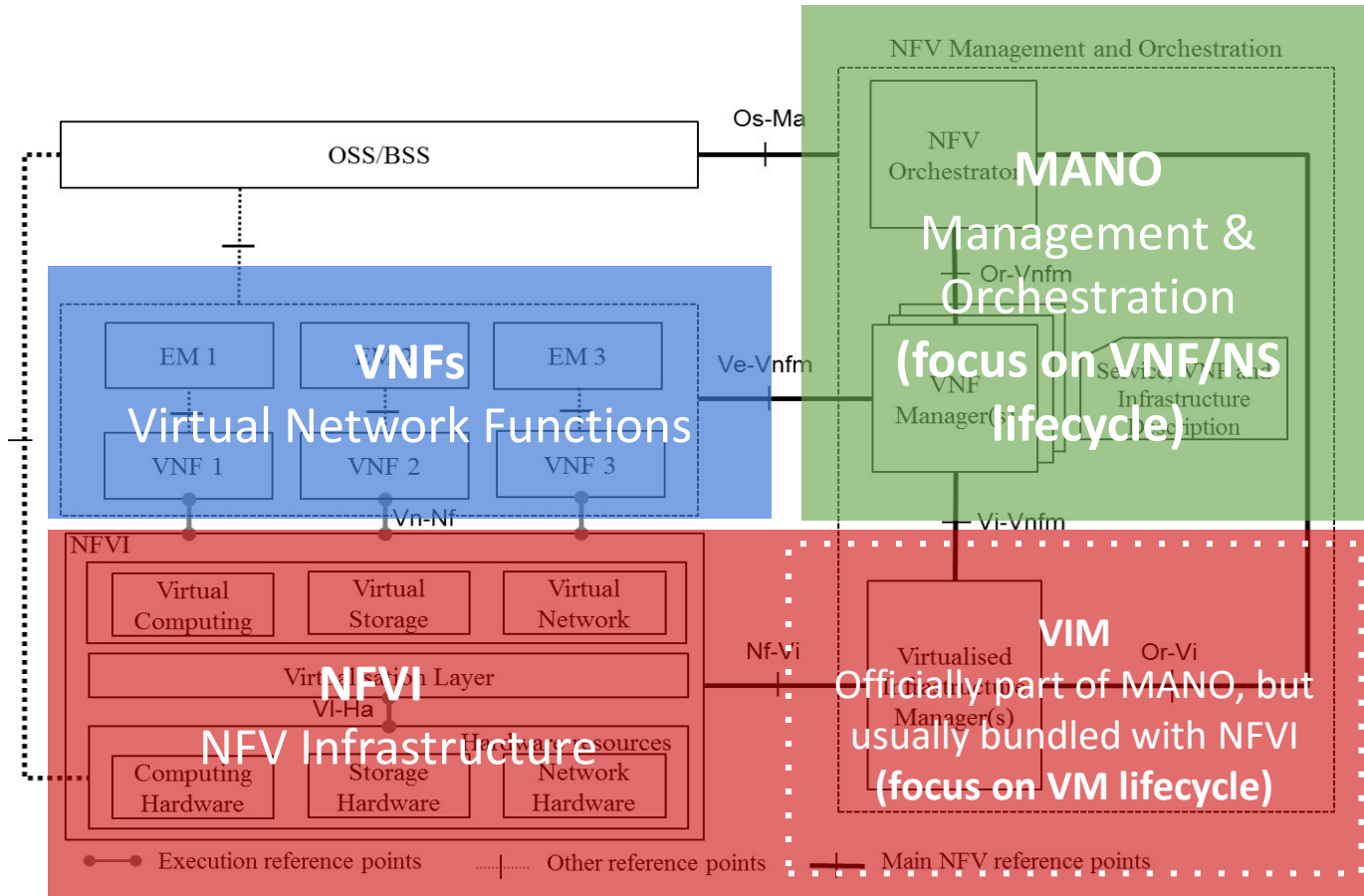
[https://portal.etsi.org/nfv/nfv\\_white\\_paper.pdf](https://portal.etsi.org/nfv/nfv_white_paper.pdf)

# Under ETSI's umbrella, the industry elaborated a first NFV architecture





# Under ETSI's umbrella, the industry elaborated a first NFV architecture



# NFV architecture has evolved over time, incorporating new elements



**2013: NFV Release 1**  
First NFV architecture

**2015-2016: NFV Release 2**  
First interface specifications  
(SOL specs)

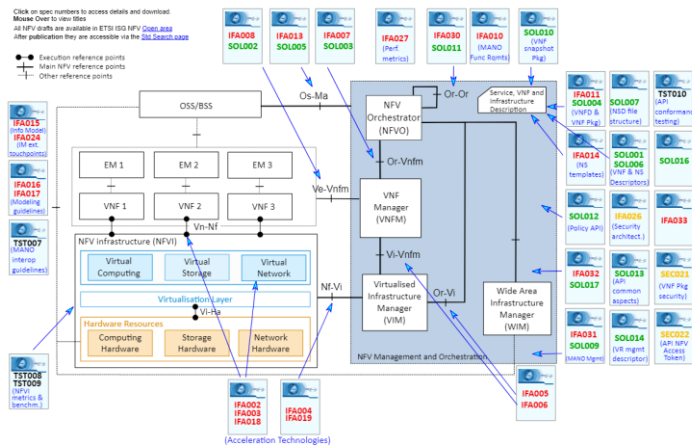
**2017-2018: NFV Release 3**  
Multi-domain NS mgmt. via Or-Or  
Multi-site connectivity services with WIM

**2019-2020: NFV Release 4**  
Container mgmt. and orchestration  
with CISM, CIR and CIS  
CIS Cluster mgmt. with CCM

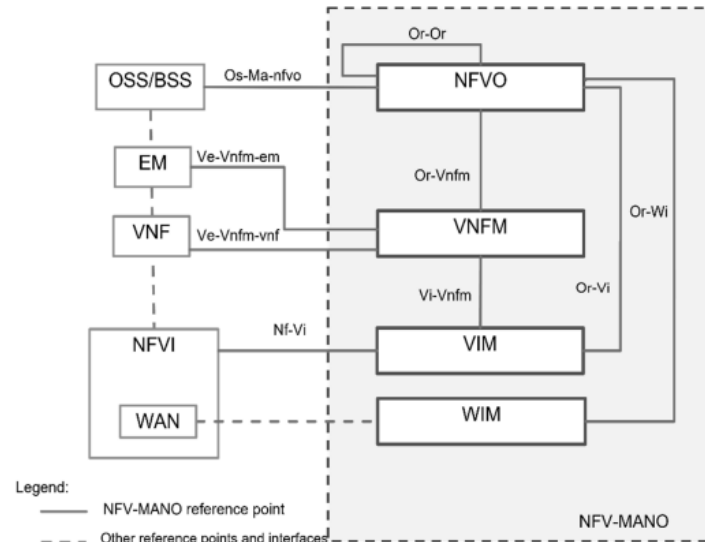
2012

2023

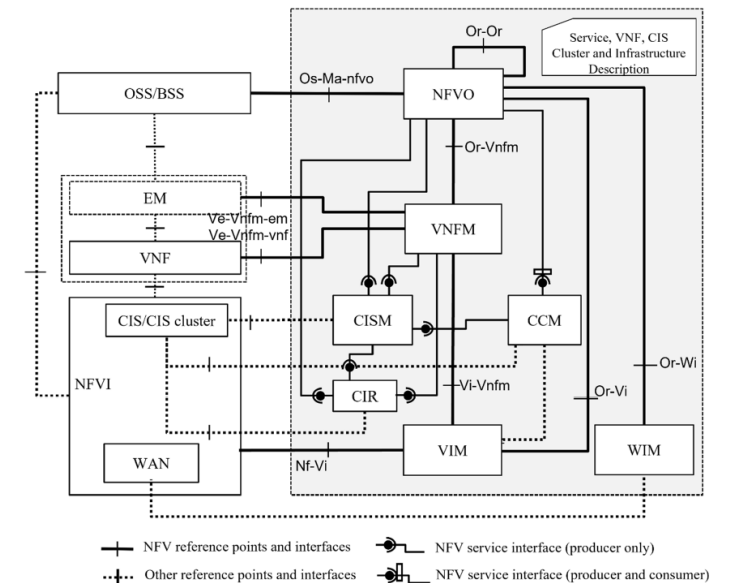
## NFV architecture and interfaces specifications



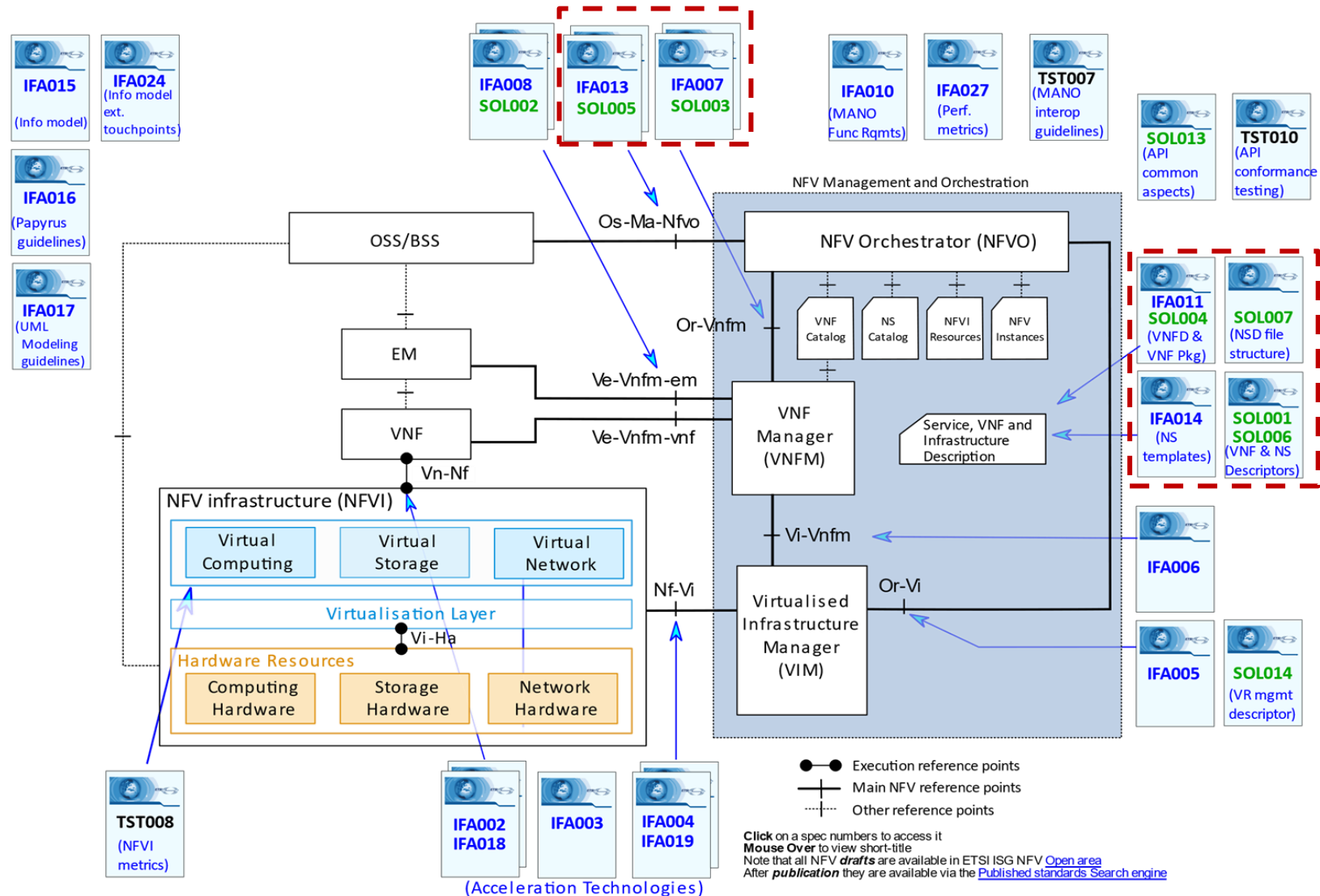
## NFV architecture in Release 3



## NFV architecture in Release 4



# ETSI NFV Architecture



# OSM in ETSI NFV Architecture

