



# Welcome to the World of Standards



## ETSI MANO

### Accessing NFV-MANO functionality through APIs

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# AGENDA

- APIs for accessing MANO functions
- MANO API work status and future plans
- Focus on NFVO Northbound APIs
- Using MANO APIs in ONAP

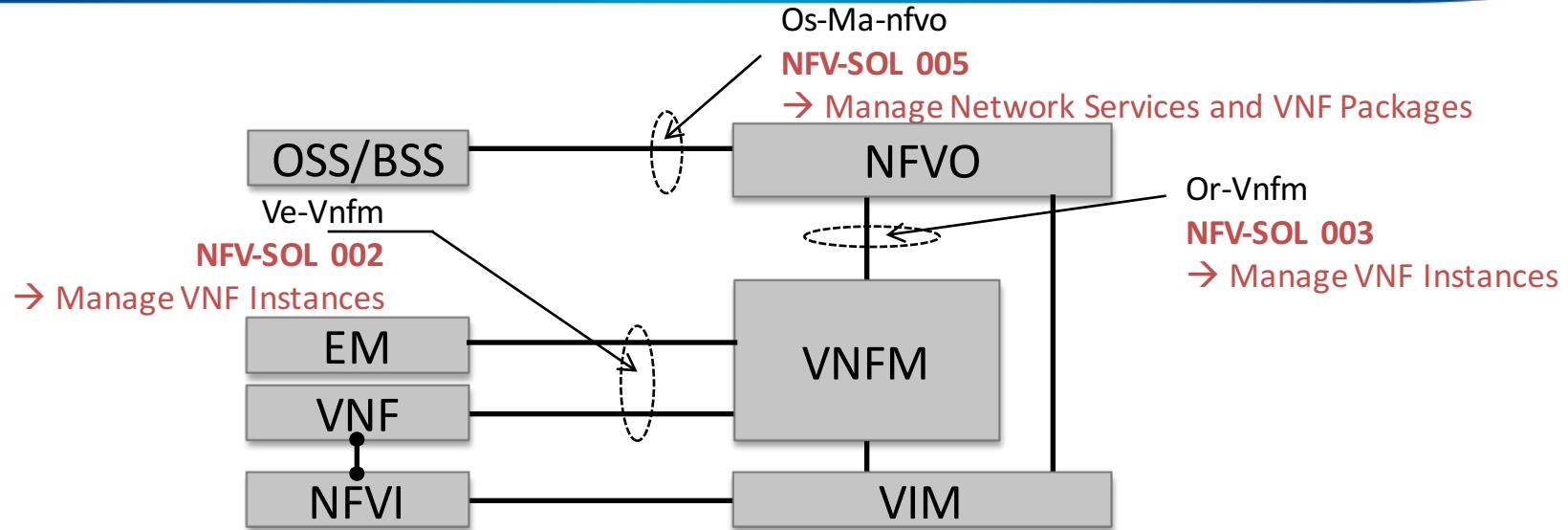
MANO = Management and Orchestration



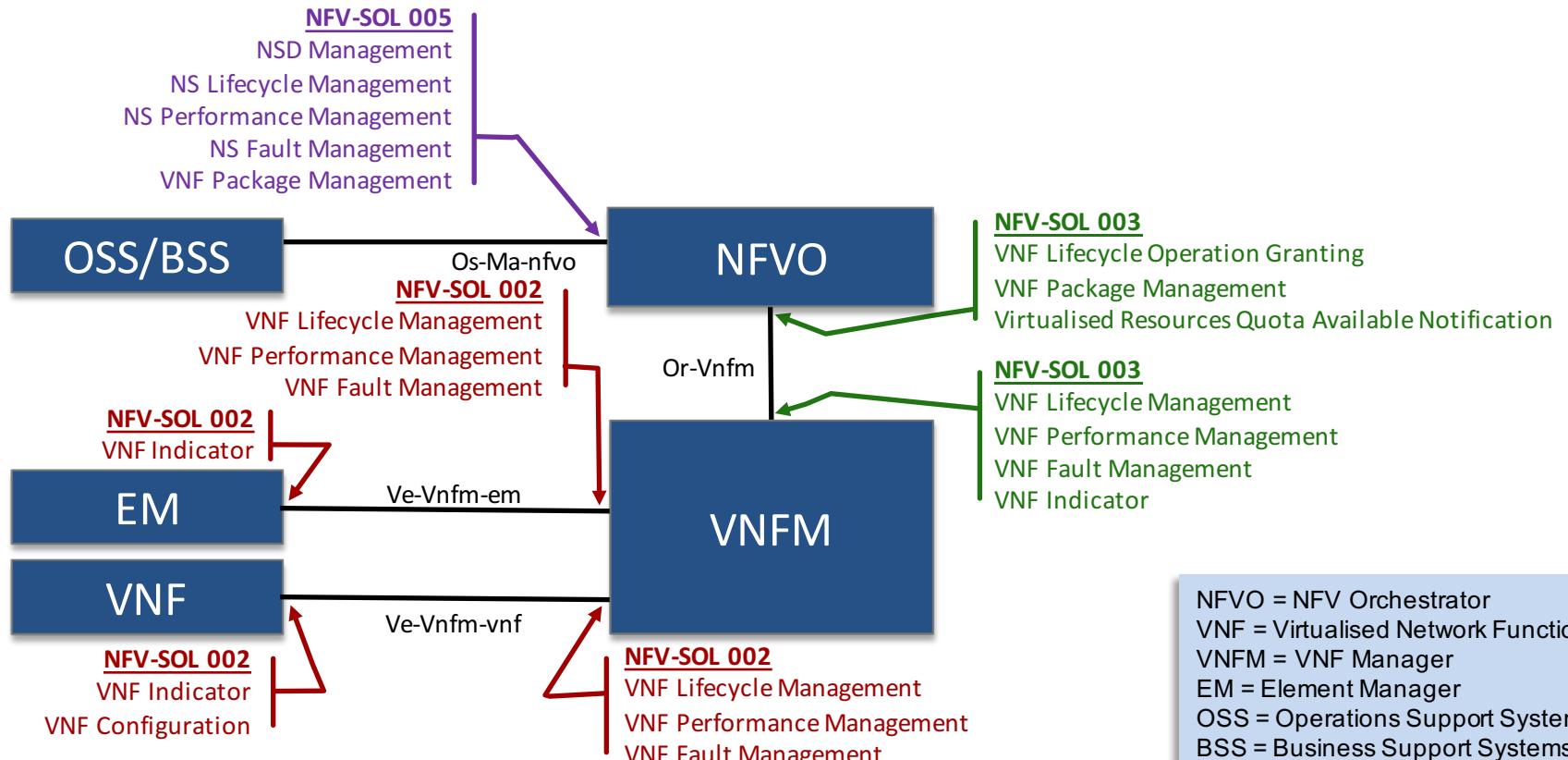
## PART 1

### APIs for accessing ETSI MANO functions

# RESTFUL APIs IN THE ETSI NFV MANO ARCHITECTURE

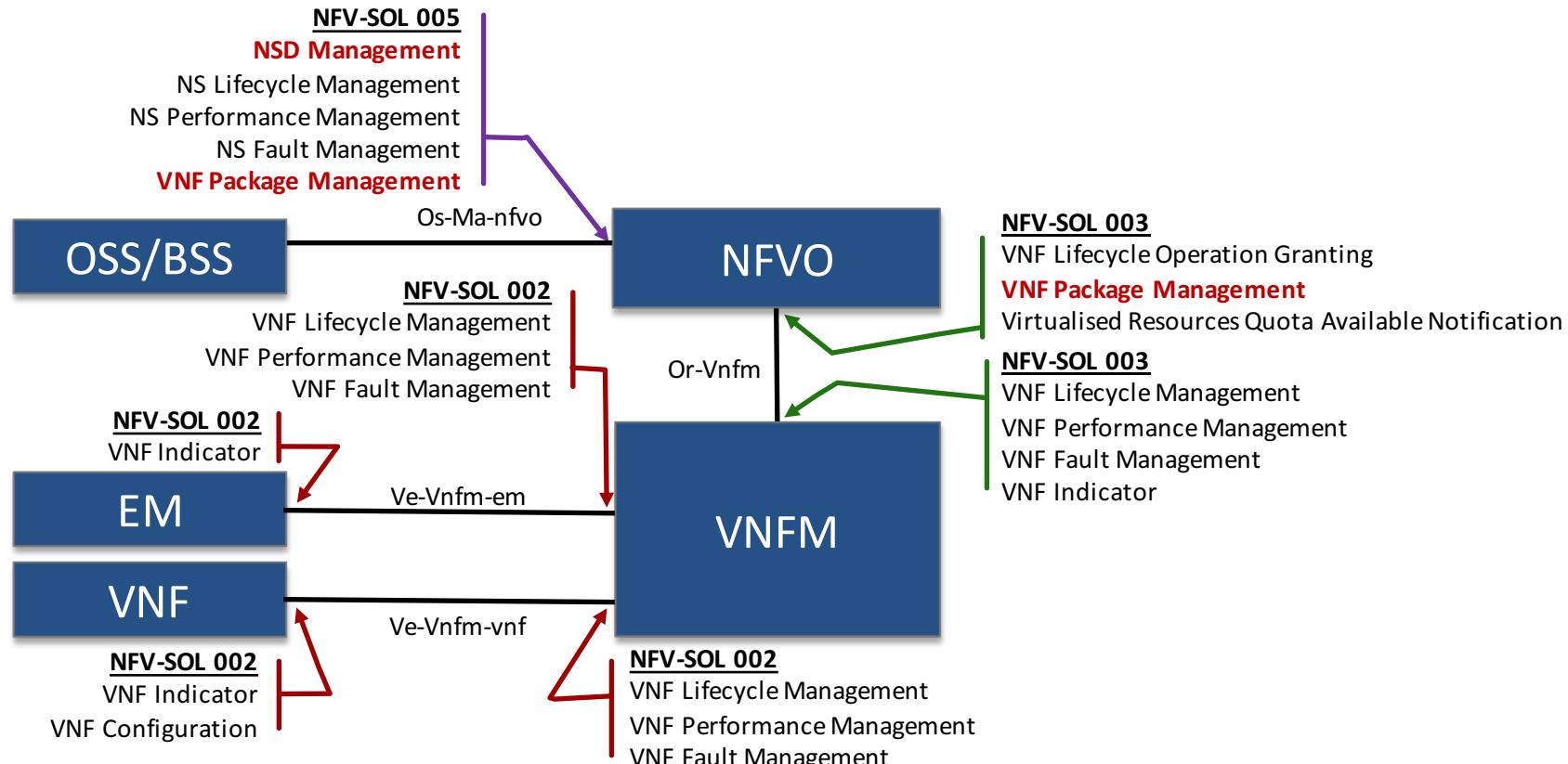


- The ETSI Group Specifications (GS) NFV-SOL 002, NFV-SOL 003 and NFV-SOL 005 define **RESTful APIs** for the Ve-Vnfm, Or-Vnfm, and Os-Ma-nfvo reference points, respectively.
- They enable multi-vendor integration on these reference points.

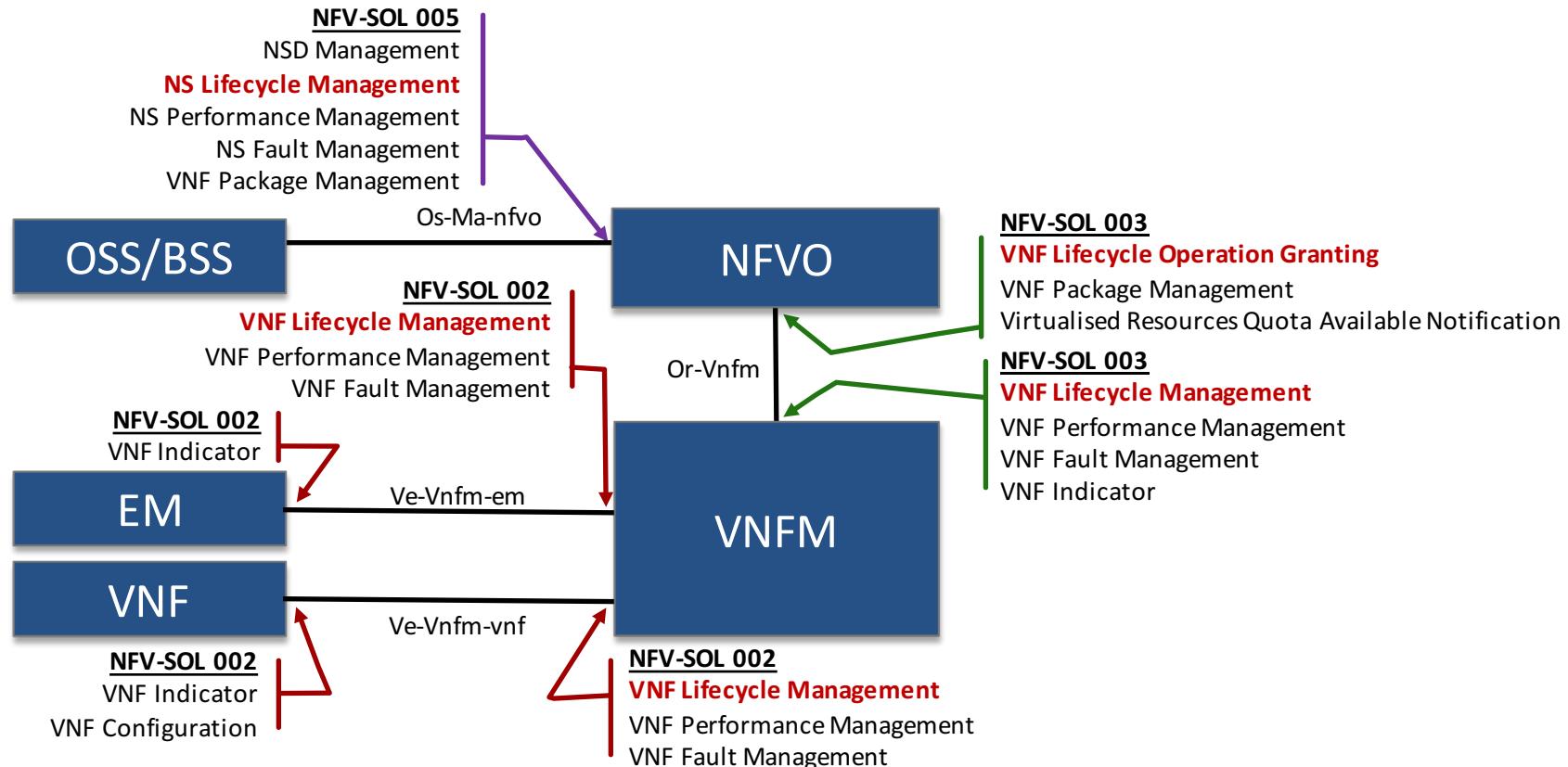


**NFVO** = NFV Orchestrator  
**VNF** = Virtualised Network Functions  
**VNFM** = VNF Manager  
**EM** = Element Manager  
**OSS** = Operations Support Systems  
**BSS** = Business Support Systems

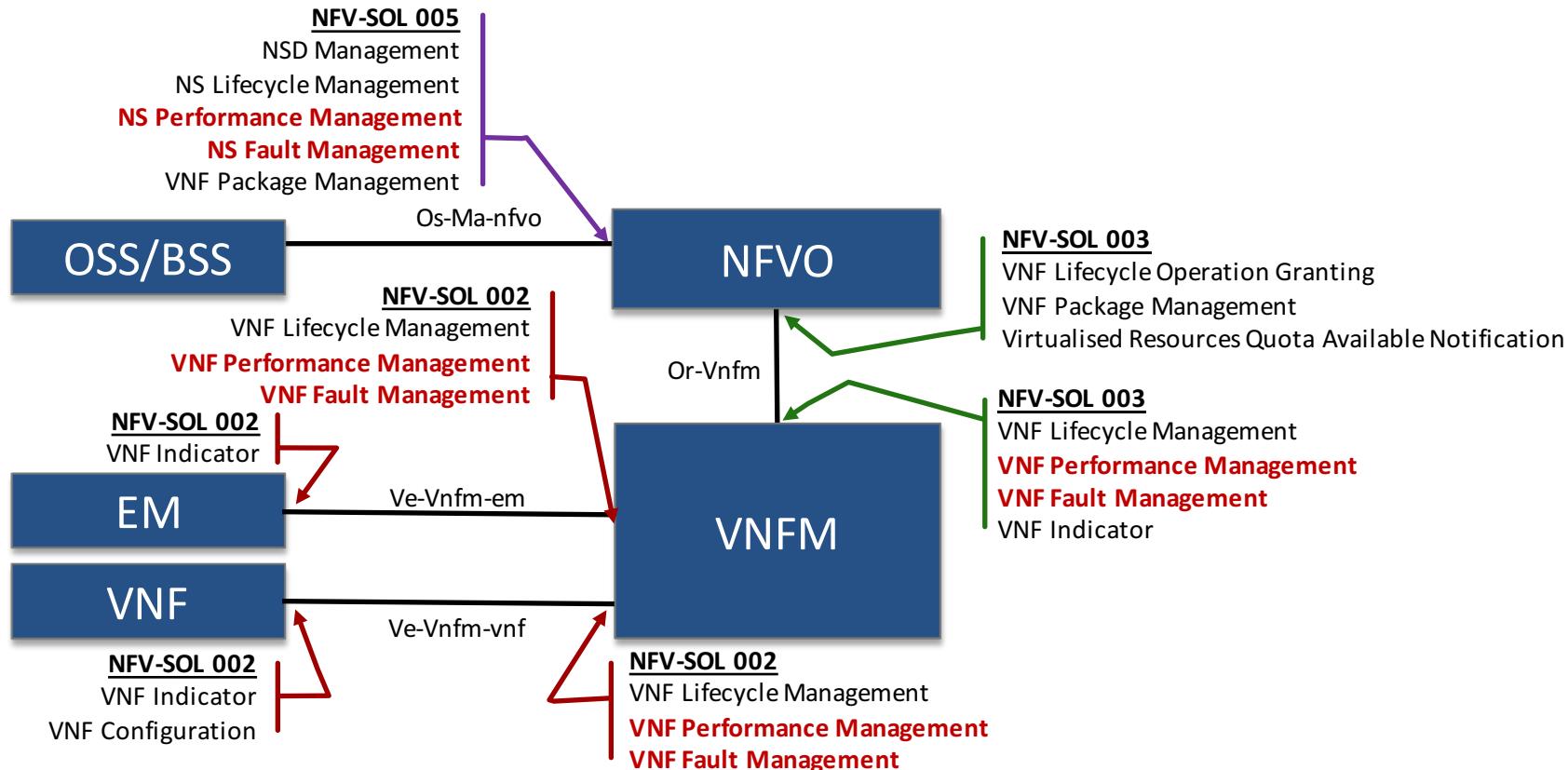
# A functional view: NSD and VNF package management



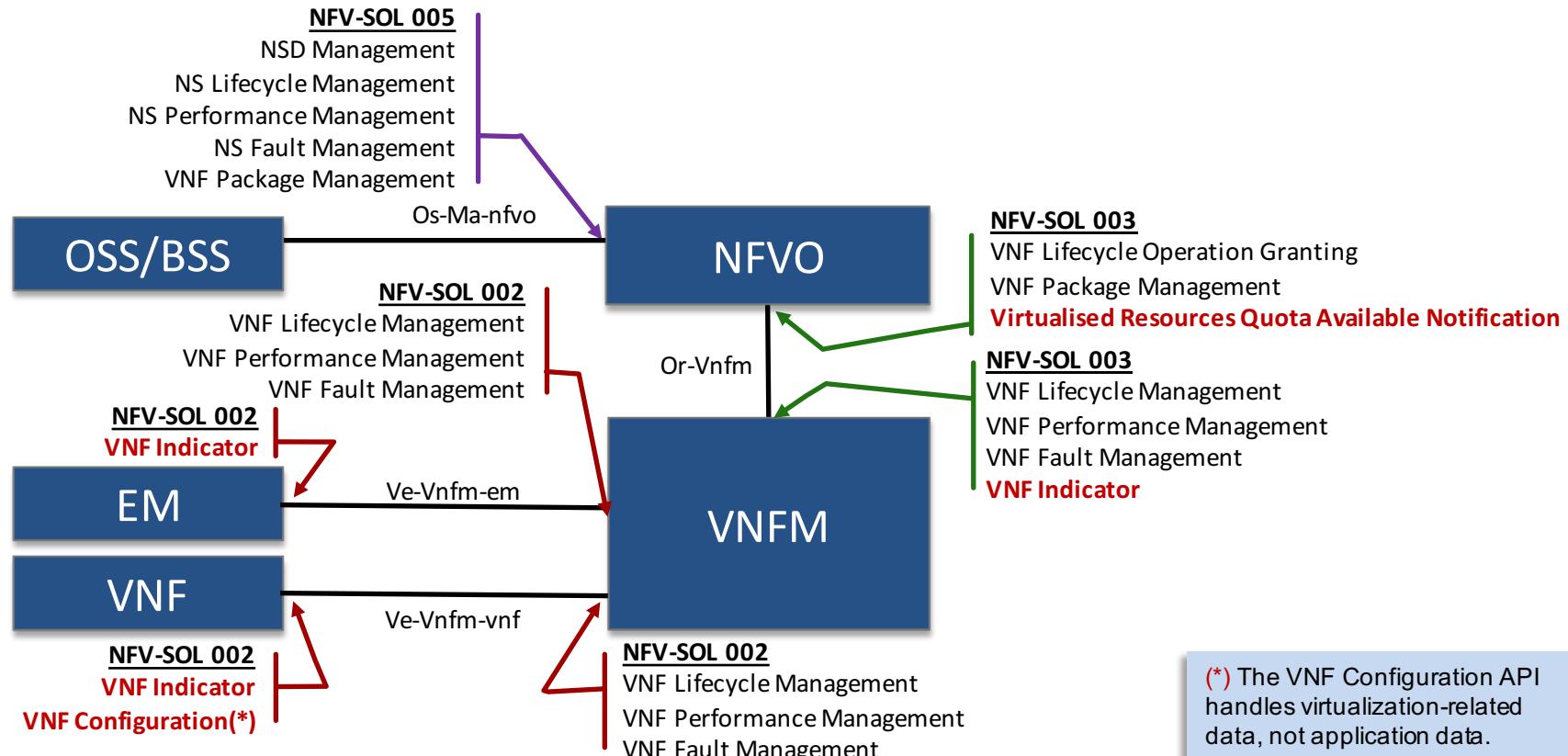
# A functional view: NS and VNF LCM



# A functional view: FM/PM



# A functional view: Miscellaneous functions





## PART 2

### Work progress and future plans

# NFV-MANO API WORK PROGRESS

OpenAPI descriptions publically available for all APIs specified in GS NFV-SOL 002/003 (version 2.4.1)

- 1<sup>st</sup> publication of GS NFV-SOL 005 (version 2.4.1).
- Publication of revised versions of GS NFV-SOL 002/003 (Version 2.4.1)

- 1<sup>st</sup> publication of GS NFV-SOL 002 (version 2.3.1).
- 1<sup>st</sup> publication of GS NFV-SOL 003 (version 2.3.1).

July 2017

February 2018

March 2018

# OpenAPI for NFV-MANO



[https://nfvwiki.etsi.org/index.php?title=API\\_specifications#OpenAPIs](https://nfvwiki.etsi.org/index.php?title=API_specifications#OpenAPIs)

- OpenAPI descriptions available as YAML, JSON and PDF form.
- Direct Links to open YAML files in the Swagger UI or Editor.
- In case of discrepancies the published ETSI Group Specification (GS) takes precedence.
- Bugs can be reported using Bugzilla

A screenshot of a web browser displaying the Swagger UI for the ETSI NFV Network Functions Virtualisation API. The browser title bar shows "Swagger UI". The address bar contains the URL "https://forge.etsi.org/swagger-ui?url=https://forge.etsi.org/jenkins/job/NFV-Network%20Functions%20Virtualisation". The main content area is titled "default". It lists several API endpoints for the "/vnf\_instances" resource, each with a method (POST, GET, PATCH, DELETE) and its corresponding URL path. The endpoints are color-coded: POST, GET, and PATCH are in green boxes, while DELETE is in a red box.

Method	Endpoint
POST	/vnf_instances
GET	/vnf_instances
GET	/vnf_instances/{vnfInstanceId}
PATCH	/vnf_instances/{vnfInstanceId}
DELETE	/vnf_instances/{vnfInstanceId}
POST	/vnf_instances/{vnfInstanceId}/instantiate
GET	/vnf_instances/{vnfInstanceId}/instantiate
PATCH	/vnf_instances/{vnfInstanceId}/instantiate
DELETE	/vnf_instances/{vnfInstanceId}/instantiate

# 2018H1 NFV-MANO API ENHANCEMENTS

- NFV-SOL002/003
  - Support of API client authentication/authorization based on **TLS-supported certificates** as an alternative to Oauth
  - Clarifying normative statements regarding the support of the resources and HTTP methods
  - Various small bug fixes and editorial corrections
- NFV-SOL 003
  - **Major bug fix to the configuration parameters** for external connection points
  - Update of the VNF Package Management interface to allow consistent cross-API design in NFV-SOL 005
- NFV-SOL 002
  - Fixing misalignment between stage 2 and stage 3 w.r.t. **treatment of VNFC in PM interface**



# API FUTURE WORK PLAN

- 2018H1 maintenance ongoing for NFV-SOL002, 003 and 005
  - Bug fixing
  - Consolidation of the API framework by addressing version management.
- Enhance existing APIs to support NFV **Release 3** features.
- Develop **OpenAPI descriptions** for the NFV-SOL 005 APIs.
- Specifications of new APIs on new reference points identified as part of the Release 3 specification effort (e.g. NFVO-NFVO).
- Work started on **conformance testing specifications** for MANO APIs. A Specialists Task Force (STF) is about to be set-up to accelerate the work.



## PART 3

### Focus on NFVO Northbound APIs

The following APIs are exposed by the NFVO towards the OSS/BSS

- NSD Management
  - NS Lifecycle Management
  - NS Performance Management
  - NS Fault Management
  - VNF Package Management
- 🌐 Different OSS/BSS components can consume different APIs.

# NS LIFECYCLE MANAGEMENT (LCM) OVERVIEW

- After the necessary descriptors have been on-boarded to the NFVO using the VNF Package Management and NSD Management APIs, the OSS/BSS can deploy, manage, modify and then remove NS instances using the NS LCM API.
- ETSI GS NFV-SOL 005 specifies the resources and methods that the OSS/BSS can use to perform Lifecycle Management operations on Network Services.

Mandatory NS LCM Operations for the NFVO
Create NS Identifier
Instantiate NS
Scale NS
Update NS
Query NS
Terminate NS
Delete NS Identifier
Heal NS
Get Operation Status
Subscribe
Notify
Terminate Subscription
Query Subscription

# VNF LIFECYCLE MANAGEMENT VIA THE NFVO LCM API

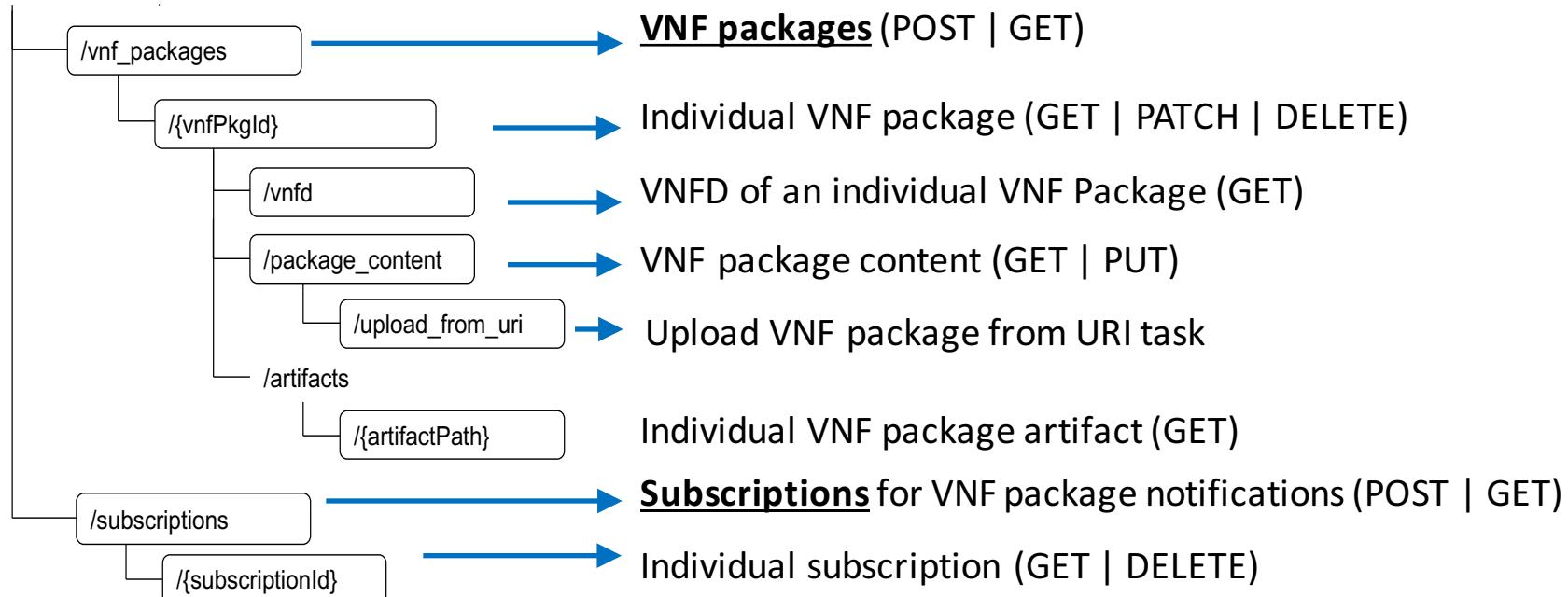


- For an OSS/BSS to affect a VNF, that VNF must be associated with at least one Network Service Instance under its control.
- A simplified mapping of VNF LCM operations to NS LCM operations is shown here.

VNF operation	Triggered by NS LCM operation(s)
VNF instantiation	Instantiate NS or Update NS or Scale NS
VNF Scaling	Scale NS
VNF Healing	Heal NS
VNF Termination	Terminate NS or Update NS or Scale NS
Other VNF operations (e.g. changing: VNF deployment flavour, VNF operational state, configurable properties...)	Update NS

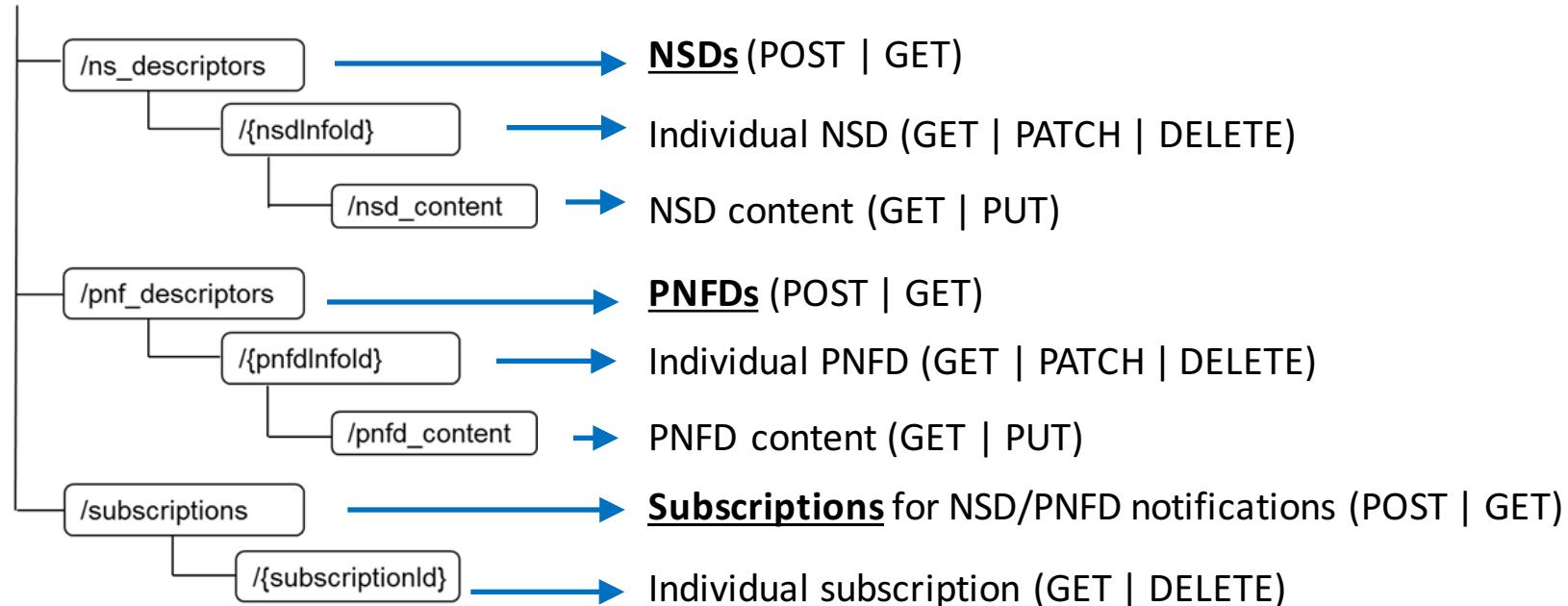
# RESOURCE URI STRUCTURE OF THE VNF PACKAGE MANAGEMENT INTERFACE

{apiRoot}/vnfpkmg/v1

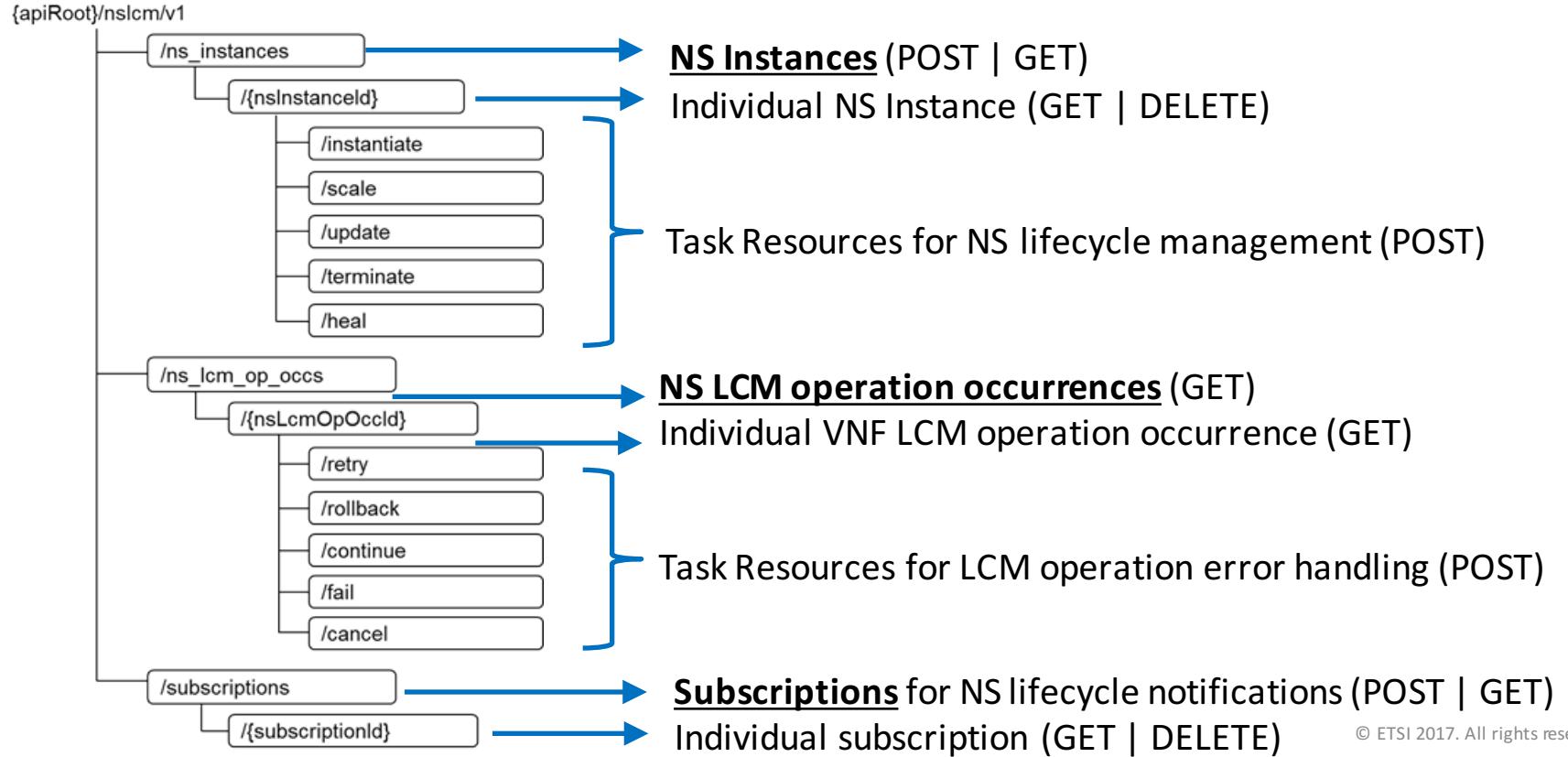


# RESOURCE URI STRUCTURE OF THE NSD MANAGEMENT INTERFACE

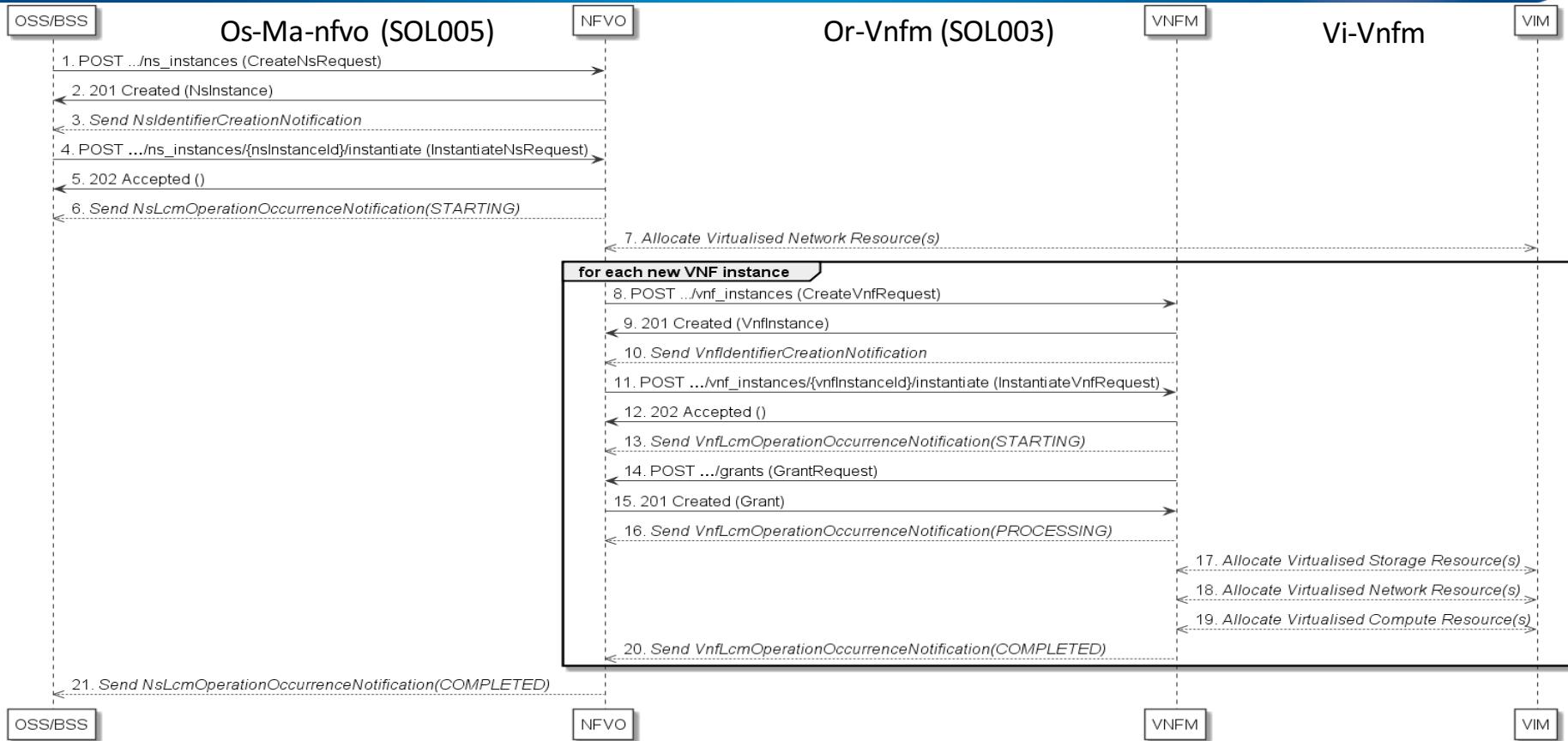
{apiRoot}/nsd/v1



# RESOURCE URI STRUCTURE OF THE NETWORK SERVICE LIFECYCLE MANAGEMENT INTERFACE



# NS LIFECYCLE MANAGEMENT EXAMPLE: NS INSTANTIATION





## PART 4

Using MANO APIs in ONAP or other E2E management platforms

# NFV-MANO vs ONAP scope



- ➊ The Os-Ma-Nfvo reference point represents the boundary between application-independent resource-oriented service management and application-specific service management.
- ➋ MANO can be regarded as a **building block** of a wider end-to-end service management platform.
- ➌ “Application”-Layer FCAPS management and other Operations Support Systems (OSS) functions (incl. application-aware service orchestration) **deliberately left out of the scope of NFV-MANO** to enable
  - Re-use of already fielded components
  - **Use of independently specified new components** (e.g. service orchestrators, IA/analytics modules, etc.)
- ➍ Many components of the ONAP architecture are outside the scope of NFV-MANO and **can complement MANO functions** to create an end-to-end platform, **providing that the ONAP software architecture exposes the NFV-SOL APIs**.



## More information:

NFV Technology Page (information)

<http://www.etsi.org/nfv>

NFV Portal (working area)

<http://portal.etsi.org/nfv>

NFV Proofs of Concept (information)

<http://www.etsi.org/nfv-poc>

NFV Plugtest (information & registration)

<http://www.etsi.org/nfvplugtest>

Access to specifications and feedback:

Drafts in Open Area: <http://docbox.etsi.org/ISG/NFV/Open/Drafts/>

Published specifications: <http://www.etsi.org/standards-search>

Issue tracker [http://nfvwiki.etsi.org/index.php?title=NFV\\_Issue\\_Tracker](http://nfvwiki.etsi.org/index.php?title=NFV_Issue_Tracker)