



ETSI ISG NFV: Work program and Releases overview

Presented by: **Thinh Nguyenphu; Nokia** For: **2019 ONAP Joint**
Bell Labs; ETSI NFV- **Subcommittee Silicon**
ONAP Contact **Valley**

April 1, 2019

Outline

- ✔ PART 1: ETSI ISG NFV Overview
 - ✔ ETSI NFV Releases overview
 - ✔ ETSI NFV ongoing work
- ✔ PART 2: NFV Release 2
 - ✔ What does it contain?
 - ✔ Maintenance, API development, etc.
- ✔ PART 3: NFV Release 3
 - ✔ Overview
 - ✔ Features and specification work



Part 1: ETSI ISG NFV overview

ETSI NFV Releases overview

Release 1

- Focus: the **feasibility of NFV**.
- Delivered the baseline studies and specifications.
- Set **the NFV Architecture**:
 - Infrastructure (NFVI),
 - Virtualized network functions (VNF),
 - Integration of the VNFs into Network Services (NS), and
 - NFV Management and Orchestration (NFV-MANO) aspects at different layers.

Release 2

- Focus: **interoperability of NFV solutions**.
- Details requirements and specification of interfaces and descriptors.
- Realizes the interoperability of solutions based on the NFV Architecture, detailing
 - **VNF Package and VNF and NS Descriptors**,
 - **Acceleration**,
 - **Internal and external NFV-MANO interfaces**.

Release 3

- Focus: **feature enriching the NFV Architectural Framework**, readying NFV for deployment and operation.
- Interfaces, modeling, etc. to support **new features** such as (not exhaustive list):
 - Policy framework,
 - VNF snapshot,
 - NFV-MANO management,
 - Licensing,
 - Multi-site,
 - Cloud-native, etc.

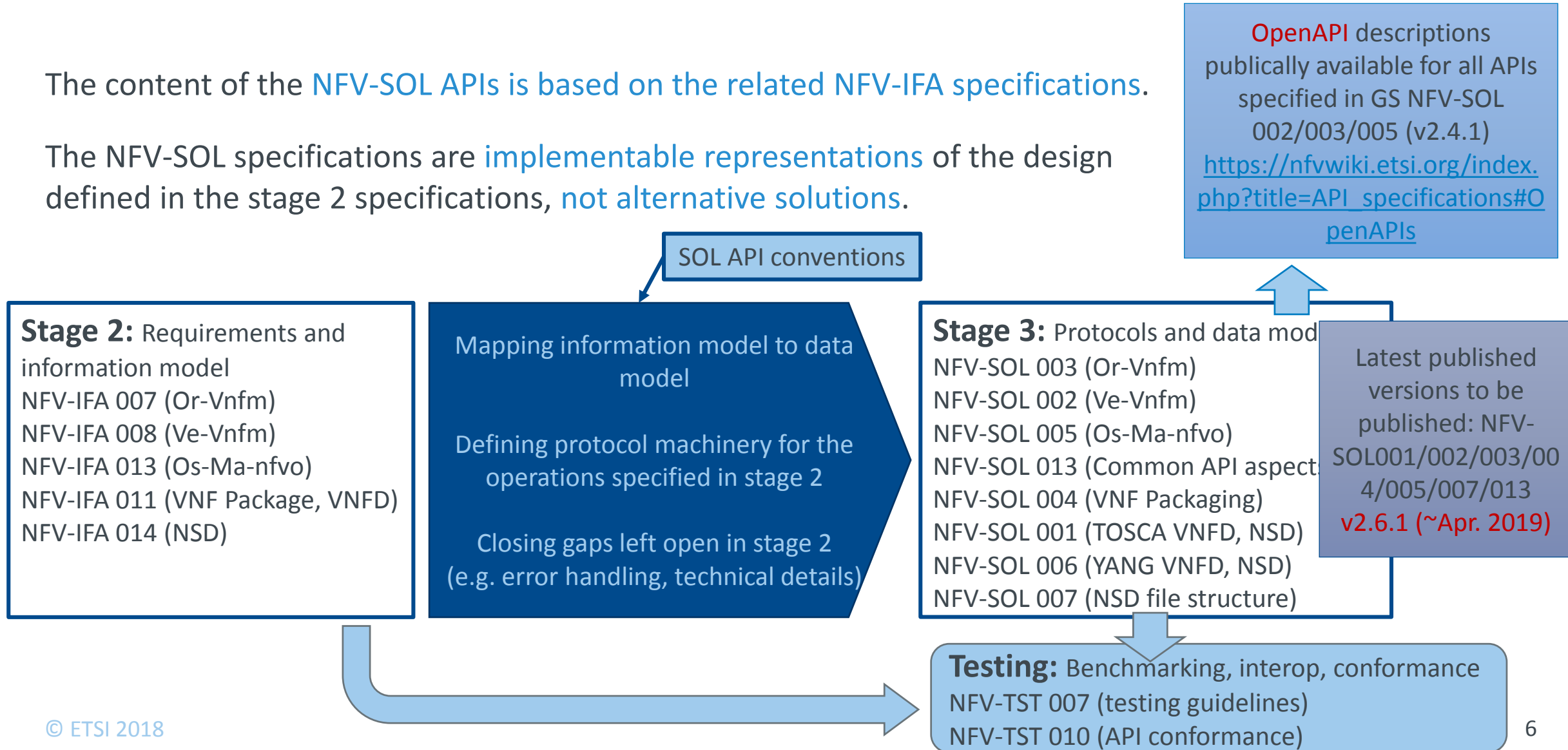
Part 2: NFV Release 2

Release 2: API standardization process



The content of the **NFV-SOL APIs** is based on the related **NFV-IFA specifications**.

The NFV-SOL specifications are **implementable representations** of the design defined in the stage 2 specifications, **not alternative solutions**.



TST010 – MANO API Conformance Test Suite

For 3 Reference Points:

- ✔ Os-Ma-Nfvo - ETSI GS NFV-SOL 005
- ✔ Or-Vnfm - ETSI GS NFV-SOL 003
- ✔ Ve-Vnfm - ETSI GS NFV-SOL 002

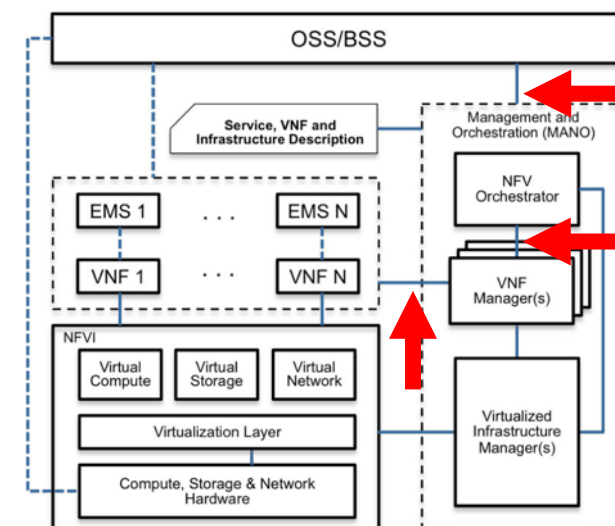
Document + Automatable Test Descriptions

- ✔ OpenAPIs developed by the SOL WG
- ✔ Using the open source Robot Framework

ETSI GS NFV-TST010 V0.0.3 (2018-07)



**Network Function Virtualisation (NFV) Release 2;
Testing;
API Conformance Testing Specification
Release #2**



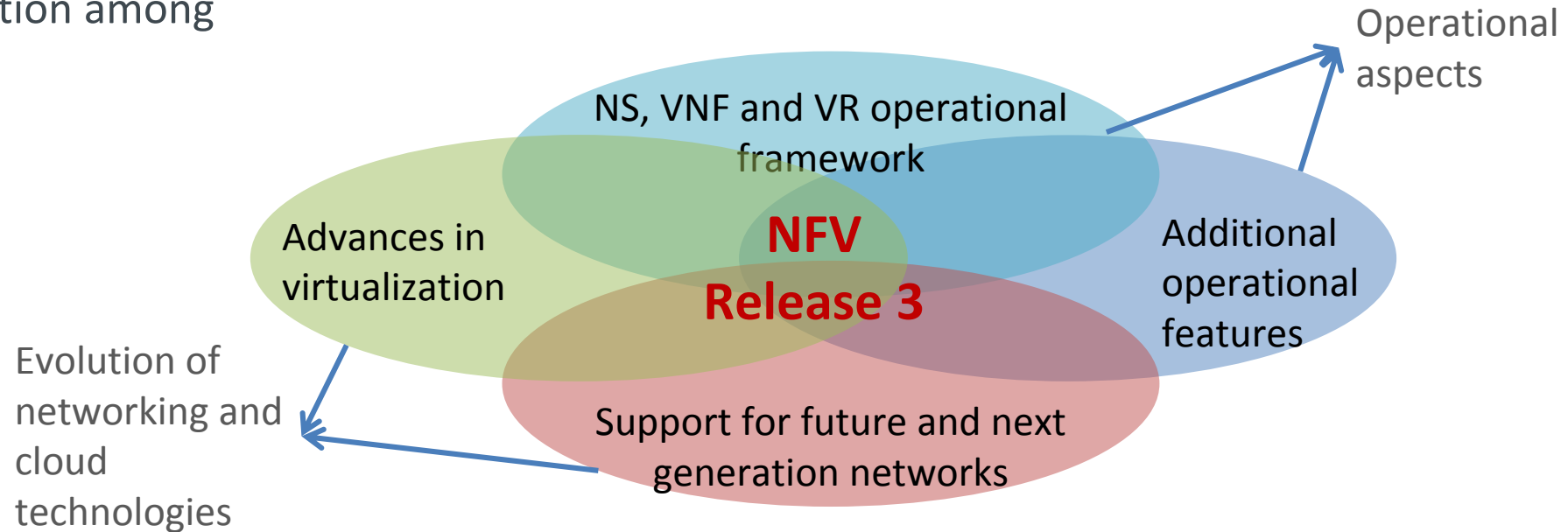
Part 3: NFV Release 3

Release 3: overview

Main focus:

- ✔ Enriching the NFV Architectural Framework, readying NFV for **expansive deployment**, **enhanced operation**, taking into account the **evolution of networking and cloud technologies**.
- ✔ In commercial deployments, operational aspects are critical!

The intersection among



Release 3: stage 1&2 completed features



Completed until 1H2018 (aka drop #1)

- ✓ Compute Host Reservation
- ✓ NFV-MANO Policy Management Framework
- ✓ VNF Snapshots
- ✓ Management of NFV-MANO
- ✓ Network Service (NS) across multiple administrative domains
- ✓ Enhancement of acceleration related features:
 - ✓ Hardware-independent acceleration
 - ✓ Network acceleration for VNF
- ✓ Virtualization technologies:
 - ✓ Hypervisor-based virtualisation
 - ✓ Hardware environment for NFV

NFV-IFA specification versions:

Drop 1H2018 → v3.1.1

Drop 2H2018 → v3.2.1

Completed in 2H2018 (aka drop #2)

- ✓ VNF software modification
- ✓ Support of network slicing
- ✓ Management and connectivity for multi-site services.

Highlighted in blue: more information on the following slides

Release 3 features: Compute Host Reservation

Objective: Enable reservation of physical hosts in the NFVI by „authorized consumers of NFVI administration“.

Use cases:

- ✔ Secure NFVI resource availability during maintenance processes.
- ✔ Hardware interoperability requirements (see [ETSI GS NFV-EVE 007](#)).
- ✔ Security regulations (see [ETSI GS NFV-SEC 012](#)).
- ✔ See also OPNFV’s Promise project: wiki.opnfv.org/display/promise/

Specification outcomes:

- ✔ Requirements and interface specification in [ETSI GS NFV-IFA 010](#) and [ETSI GS NFV-IFA 005](#) (versions v3.1.1).



Other information:

- ✔ Aligned with (Resource reservation service): <https://docs.openstack.org/blazar/> which supports reservation of virtual compute(s) and physical compute host(s).



Release 3 features: NFV-MANO Policy Management Framework

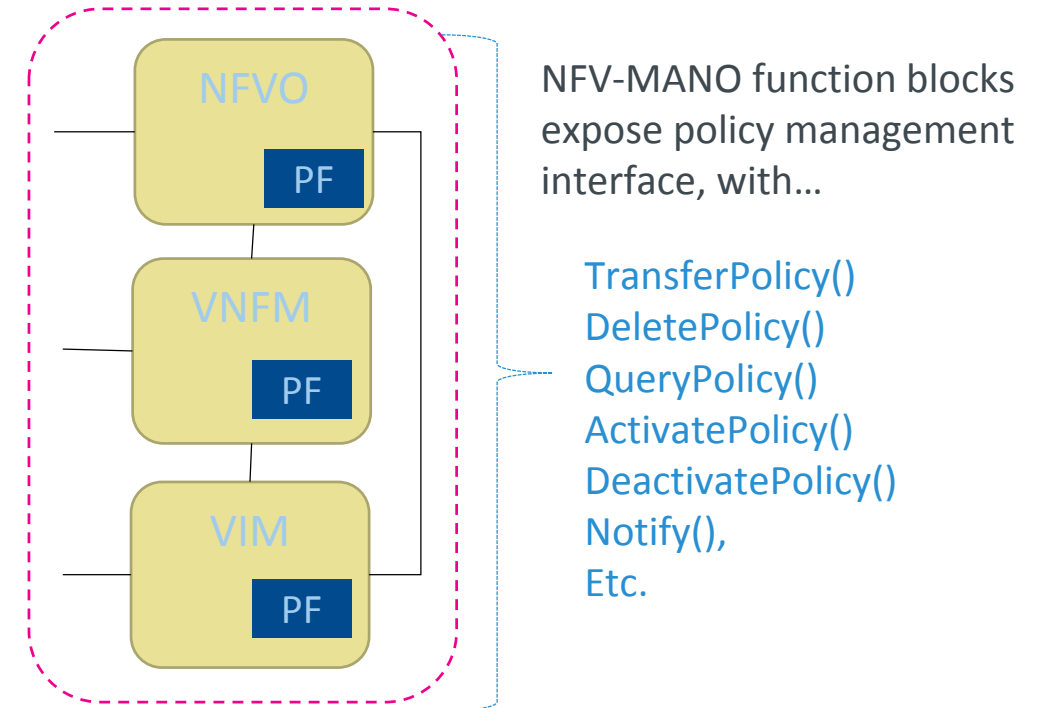
Objective: Create a policy management framework to further enhance the flexibility in NFV Management and Orchestration.

Use cases:

- ✔ Change the behaviour of VNF, NS and VR lifecycle and orchestration based on policies.
- ✔ See also use cases documented in the published report [ETSI GR NFV-IFA 023](#).

Specification outcomes:

- ✔ NFV-MANO FB (i.e., NFVO, VNFM and VIM) act as Policy Functions (PF) to enforce policies. NFV-MANO FB can also act as Policy Administration Points (PAP).
- ✔ A new policy management interface is added for each reference point, which includes operations of policy transfer, deletion, query, activation and deactivation. Specified in v3.1.1 versions of ETSI GS NFV-IFA [010/005/006/007/008/013](#).



Other information:

- ✔ RESTful protocol and data model solution (stage 3) work expected to start soon (work item proposal currently under ISG approval).

Release 3 features: VNF Snapshots

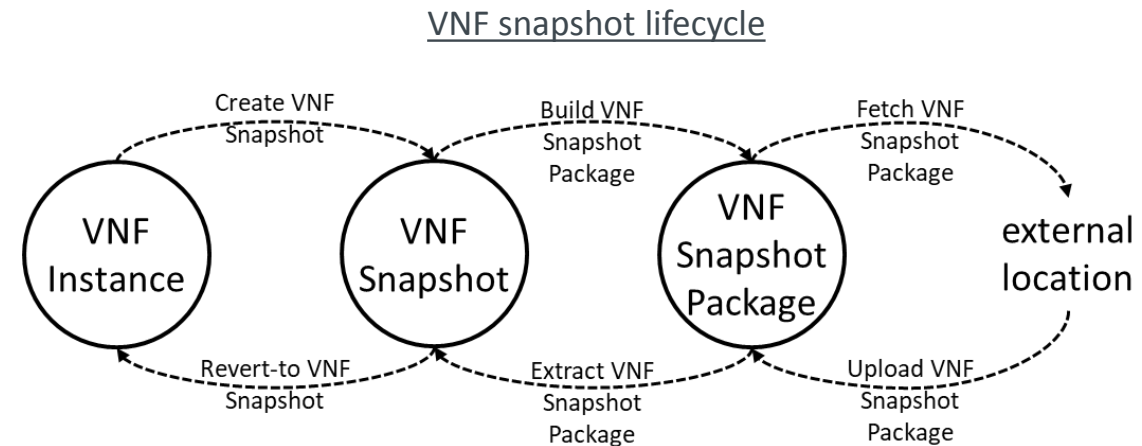
Objective: Solution to manage, store and transfer a snapshot of a VNF.

Use cases:

- ✔ Testing, troubleshooting, as fall-back in LCM procedures, e.g., quick VNF recovery.
- ✔ See also use cases documented in the published report [ETSI GR NFV-TST 005](#).

Specification outcomes:

- ✔ Extending VNF and NS lifecycle management interfaces with new operations to create and revert to snapshots. Specified in ETSI GS NFV-IFA [010/007/008/013](#).
- ✔ A new VNF Snapshot Package Management interface, for building/extracting packages from/to VNF/C snapshots. Specified in ETSI GS NFV-IFA [007/008/013](#).



Other information:

- ✔ Data model (stage 3) work for the VNF Snapshot Packages just started (work item [DGS/NFV-SOLO10](#)).

Release 3 features: Management of NFV-MANO

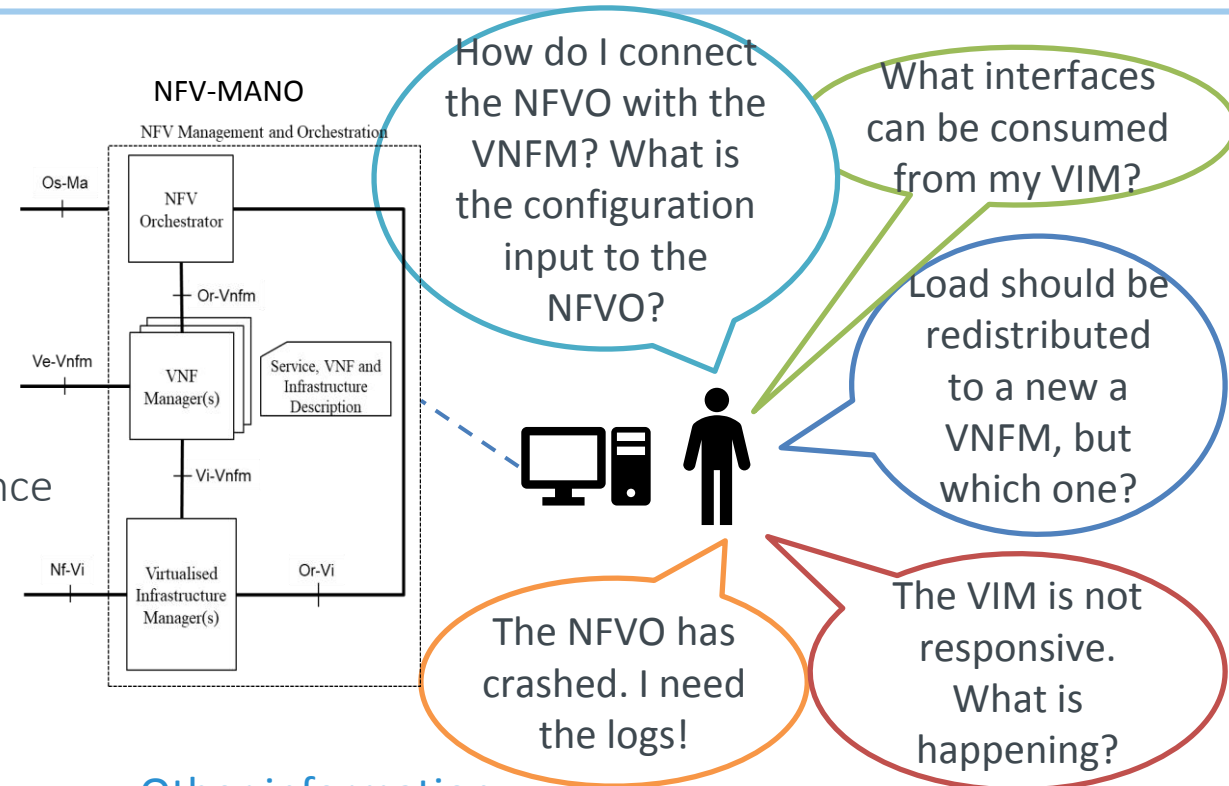
Objective: Create a framework for flexible NFV-MANO management to ease the integration/interworking of NFV-MANO system with network operators support systems.

Use cases:

- NFV-MANO functions need to be configured for interworking, and monitored against fault and performance issues.
- See also use cases documented in the published report [ETSI GR NFV-IFA 021](#).

Specification outcomes:

- Set of requirements, interfaces and information model for the operation, management and maintenance of NFV-MANO (see also [ETSI GS NFV-IFA 031](#)).



Other information:

- RESTful protocol and data model solution (stage 3) work just started (work item [DGS/NFV-SOL009](#)).



Fault management



Configuration management



Performance management



State management



Log management

Release 3 features: NS across multiple administrative domains

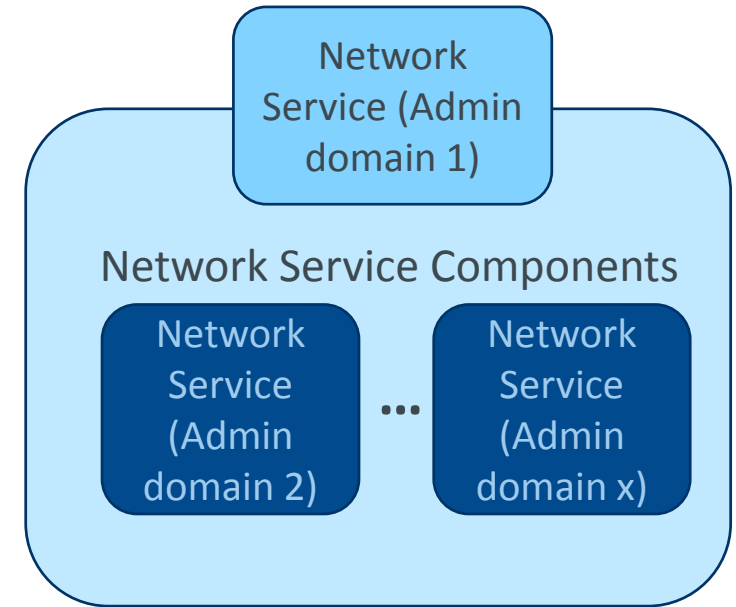
Objective: Enable different business models where the NFV infrastructure or Network Services are provided by another administrative domain.

Use cases:

- ✔ NS provisioning and lifecycle management require coordination between two NFVOs in different administrative domains.
- ✔ See also use cases documented in the published report [ETSI GR NFV-IFA 028](#).

Specification outcomes:

- ✔ Enable a new reference point Or-Or with the functionality mainly referencing to the existing ETSI GS NFV-IFA 013 operations. Developed in the [ETSI GS NFV-IFA 030](#).



Other information:

- ✔ RESTful protocol and data model solution (stage 3) work just started (work item [DGS/NFV-SOL011](#)).

Release 3 features: VNF software modification

Objective: Minimize the impact of VNF software modification on service continuity.

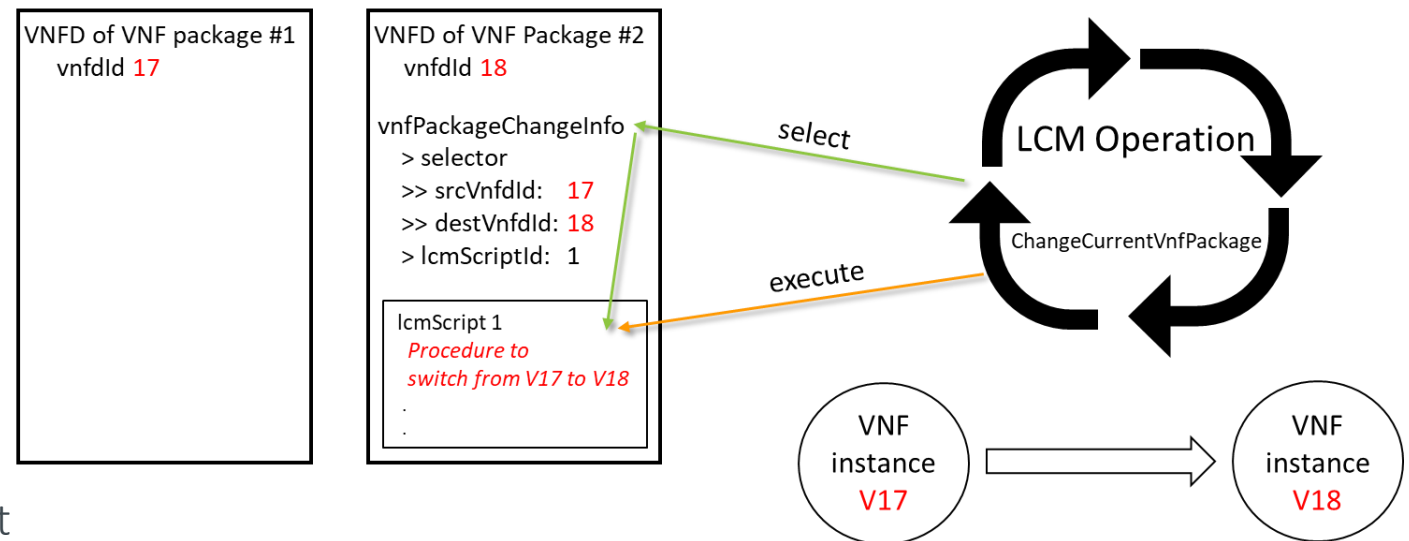
Use cases:

- ✔ Change software version of deployed VNF.
- ✔ See also use cases documented in published report [ETSI GS NFV-REL 006](#).

Specification outcomes:

- ✔ Extending functional requirements to support the change of a VNF Package to update the VNF instance as specified in ETSI GS NFV-IFA 010.
- ✔ Extending VNF lifecycle management interfaces with new operations to change to a VNF Package containing a modified VNF as specified in ETSI GS NFV-IFA 007/008/[010](#)/[011](#)/[013](#).

VNF software modification



Other information:

- ✔ The LCM supports the change of a VNF Package to allow for upgrade and downgrade of VNF instances.

Release 3 features: Network Slicing

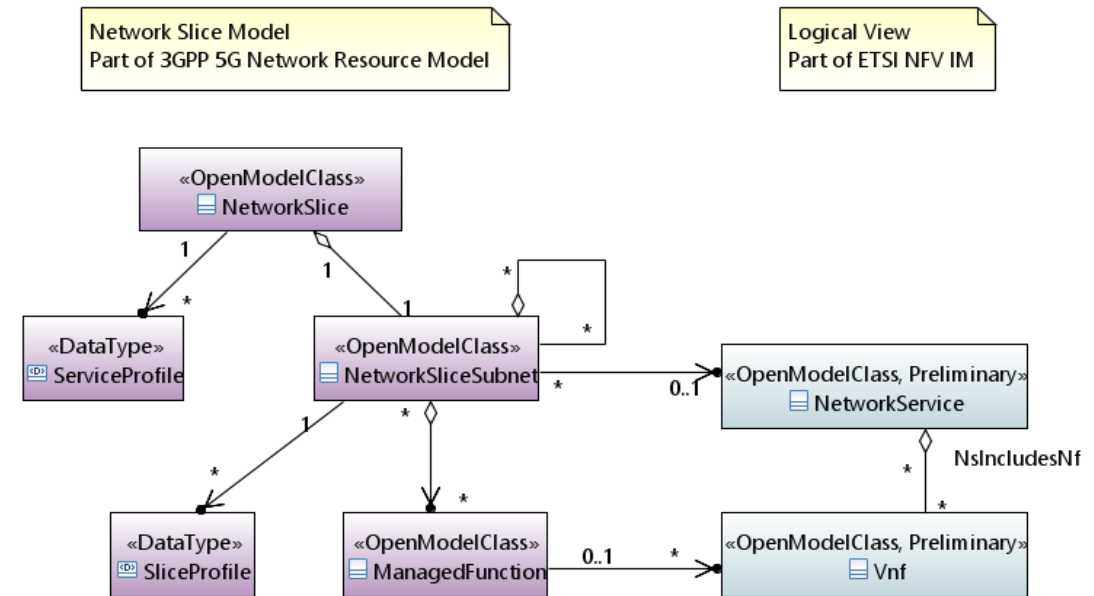
Objective: Support Network Slicing by defining the necessary requirements and enhancements of interfaces and descriptors.

Use cases:

- ✔ NFV network services as constituents for network slices.
- ✔ See also use cases documented in the published report [ETSI GR NFV-EVE 012](#).

Specification outcomes:

- ✔ New touchpoint in [ETSI GR NFV-IFA 024](#).
- ✔ Updated NS descriptor in [ETSI GS NFV-IFA 014](#): The NSD includes in the Deployment Flavour the „priority“ attribute, which is assigned by the consumer (OSS/NSMF/NSSMF), based on the priority of the slice that uses the NS instance.
- ✔ Requirements and interface specification in [ETSI GS NFV-IFA 010](#) and [NFV-IFA 013](#): Os-Ma-nfvo support for the LCM coordination notifications to enable the consumer to subsequently resolve priority conflicts.



Other information:

- ✔ Mgmt. of Network Services already supports most requirements for the use network slice management functions (e.g. multi-tenancy, nested NSs).
- ✔ Main new requirement: Priority attribute for Network Service instances to be used to resolve conflicts during resource allocation

Release 3 Feature: Management & Connectivity of Multi-Site Services

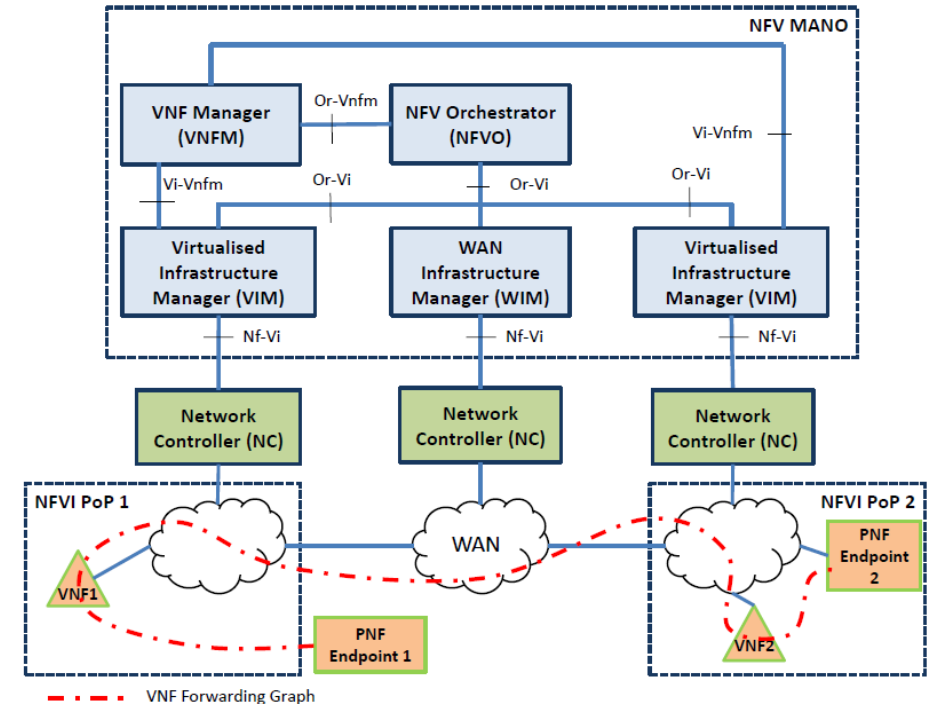
Objective: Specify management aspects for enabling inter-connectivity between, and management of network services across, multiple NFVI-PoPs over WAN infrastructure.

Use cases:

- ✔ A set of requirements, interfaces and information models for the WAN Infrastructure Manager (WIM).
- ✔ See also use cases documented in the published report [ETSI GR NFV-IFA 022](#).

Specification outcomes:

- ✔ 4 management interfaces (Multi-site connectivity service, Capacity, Performance, Fault management) to provision and manage multi-site connectivity services (refer to [ETSI GS NFV-IFA 032](#)).
- ✔ Updates on ETSI GS NFV-IFA 005/007/[010](#)/[013](#)/[014](#) specifications to support exposure of connectivity information and multi-site service deployment.



Other information:

- ✔ PoC#42: Mapping ETSI-NFV onto Multi-Vendor, Multi-Domain Transport SDN 4.
- ✔ PoC#42 report available on <https://www.etsi.org/technologies/nfv/nfv-poc>.
- ✔ Proposal to develop Stage 3 related work is planned as a next step.

Conclusion

Conclusion

Release 2 documentation is almost fully complete.

- ✔ Only few stage 3 and testing specifications are remaining.
- ✔ Maintenance has been performed since 2017, and it continues (focusing particularly on protocols and data model specifications) until Release 3 is completed.

Release 3 specification work is progressing.

- ✔ Few informative/study work items are remaining.
- ✔ Focus is mostly on stage 2 normative specification work. A pipeline of features is being delivered every 6 months.
- ✔ Stage 3 work has just started on a set of features completed at stage 2 level in the summer 2018.
- ✔ Work will continue through 2019.

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)

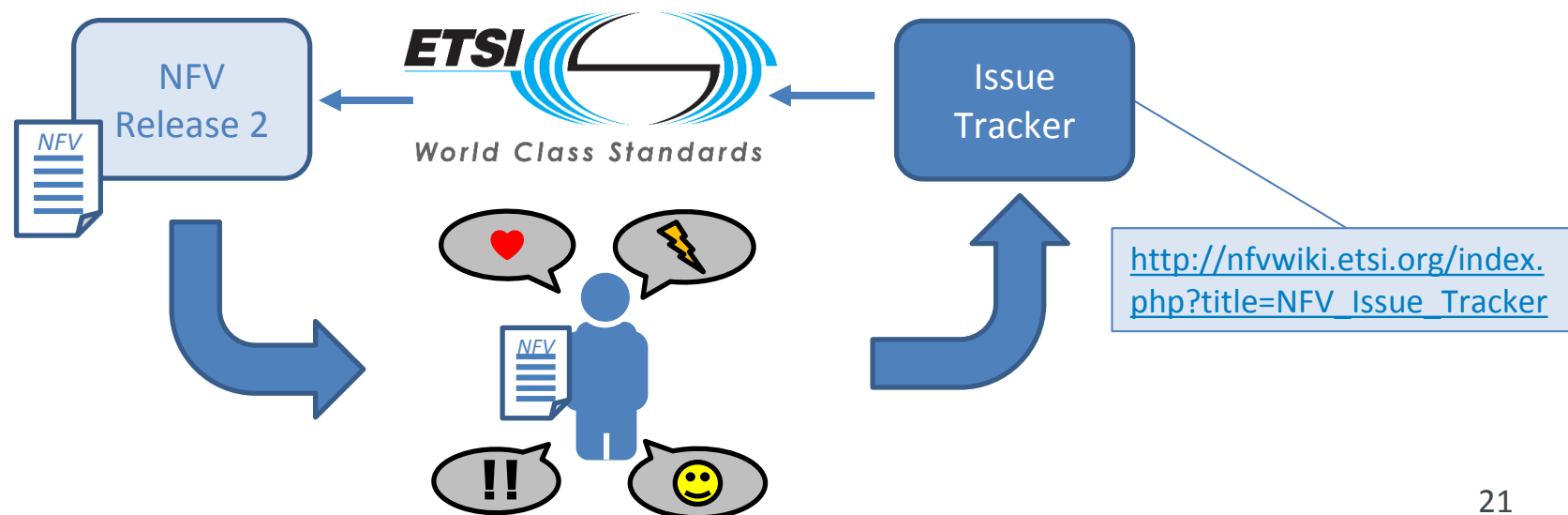
<http://www.etsi.org/nfv-poc>

NFV Plugtest (information &
registration)

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

Open Area:

- ✔ Published Docs: https://docbox.etsi.org/ISG/NFV/Open/Publications_pdf
- ✔ Working Drafts <http://docbox.etsi.org/ISG/NFV/Open/Drafts/>
- ✔ Issue tracker http://nfvwiki.etsi.org/index.php?title=NFV_Issue_Tracker
- ✔ Detailed Release 3 specification progress can be found at: https://nfvwiki.etsi.org/index.php?title=Feature_Tracking



Backup slides

Release 2: specification summary

Published documents

Release 2, published documentation (26): 21 Group Specification (GS) and 5 Group Report (GR).

- ✔ 13 Stage 2 GS (12 from IFA, 1 from TST).
- ✔ 8 Stage 3 GS (SOL).
- ✔ 4 Stage 2 GR (IFA).
- ✔ 1 testing GR (TST).

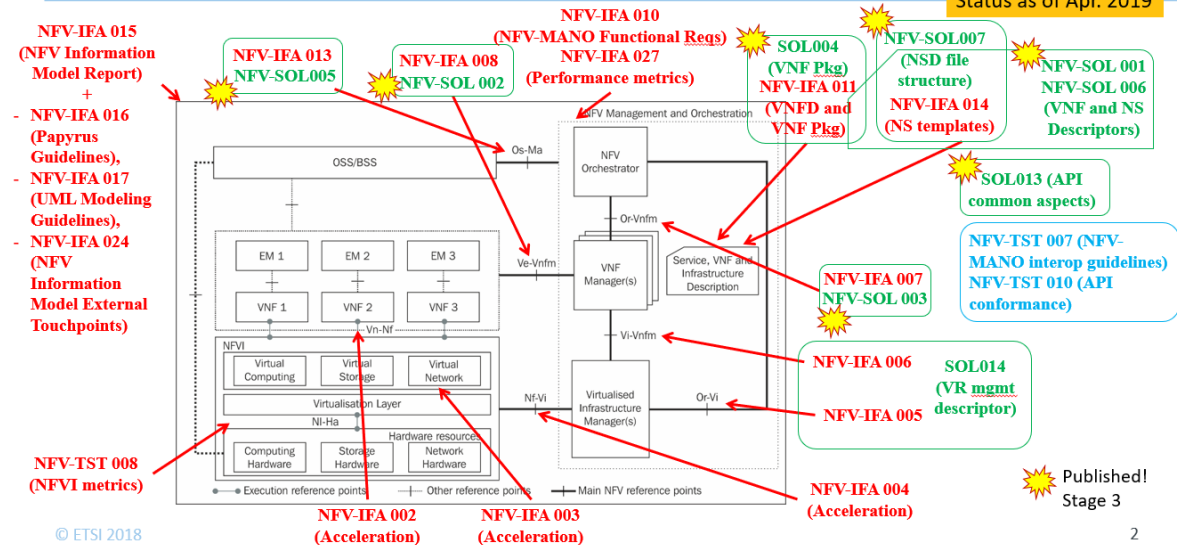
Active work items

Currently, 5 ongoing unpublished active WI:

- ✔ 2 Stage 3 GS drafts (NFV-SOL006/014).
- ✔ 2 GS drafts related to security (NFV-SEC021/022).
- ✔ 1 GS draft on conformance testing (NFV-TST010).

Refer to regular updates on the Release 2 Description (latest version [v1.7.1](#), Dec. 2018, to be updated in Apr. 2019).

Release 2: specification summary



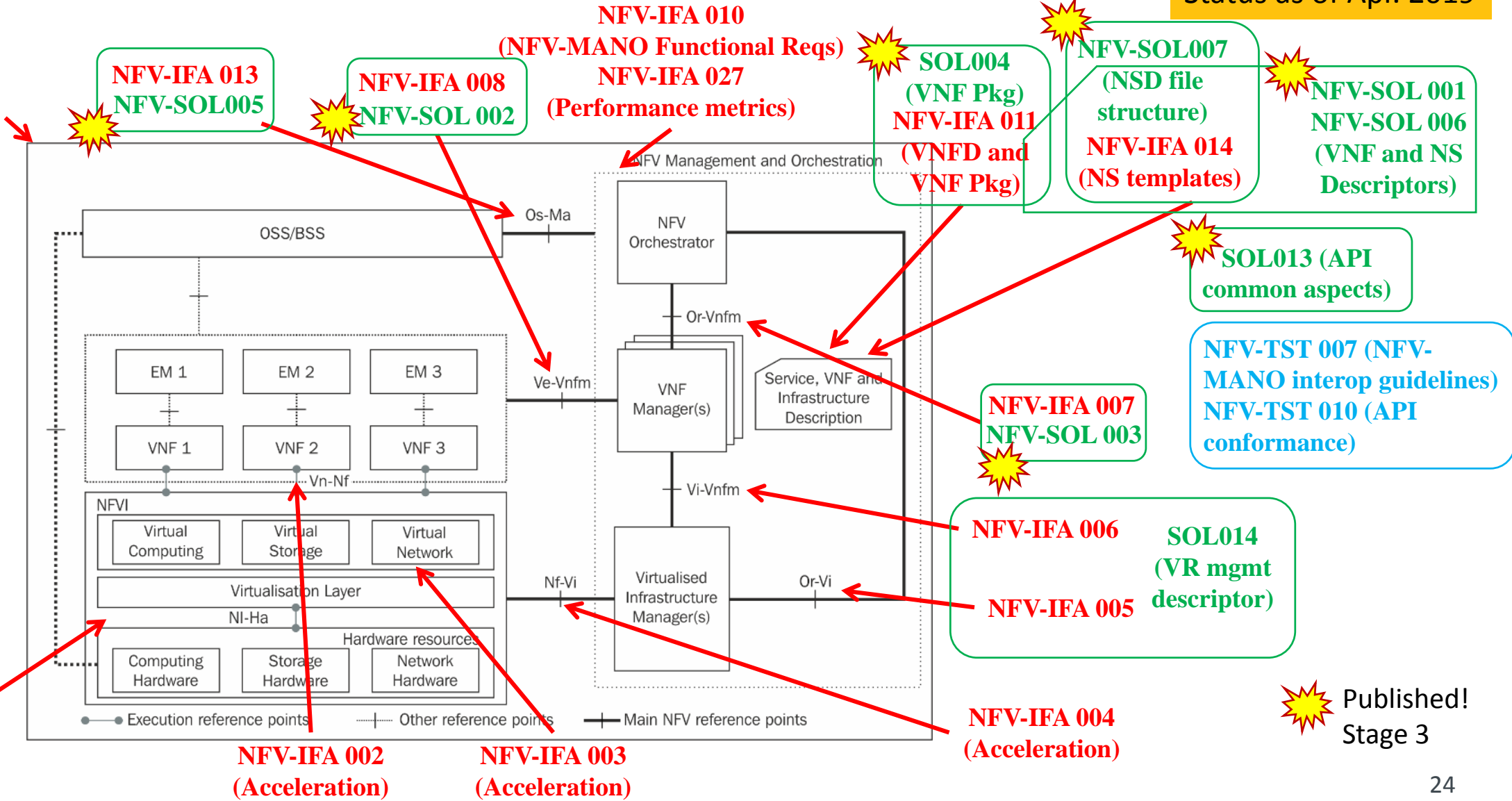
4 rounds of maintenance have been completed (1H2017, 2H2017, 1H2018 and 2H2018), and 1 round is now ongoing for 1H2019:

- ✔ Versioning: First round: v2.3.1; Second round: v2.4.1; Third round: v2.5.1 (some specs without maintenance remain in v2.4.1); and Fourth round: v2.6.1 (some specs w/o maintenance remain in v2.4.1 or v2.5.1)

Release 2: specification summary

Status as of Apr. 2019

- NFV-IFA 015**
(NFV Information Model Report)
- +
- **NFV-IFA 016**
(Papyrus Guidelines),
- **NFV-IFA 017**
(UML Modeling Guidelines),
- **NFV-IFA 024**
(NFV Information Model External Touchpoints)



Release 2: stage 2 published documents (for reference)



Status as of Apr. 2019

ID	Title
Functional requirements	
ETSI GS NFV-IFA 010 v2.5.1	MANO; Functional requirements specification
Acceleration (with interfaces)	
ETSI GS NFV-IFA 002 v2.4.1	Acceleration Technologies: VNF Interfaces Specification
ETSI GS NFV-IFA 003 v2.4.1	Acceleration Technologies; vSwitch Benchmarking and Acceleration Specification
ETSI GS NFV-IFA 004 v2.4.1	Acceleration Technologies; Management aspects Specification
NFV-MANO reference points and interfaces	
ETSI GS NFV-IFA 005 v2.5.1	MANO; Or-Vi reference point - Interface and Information Model Specification
ETSI GS NFV-IFA 006 v2.5.1	MANO; Vi-Vnfm reference point - Interface and Information Model Specification
ETSI GS NFV-IFA 007 v2.5.1	MANO; Or-Vnfm reference point - Interface and Information Model Specification
ETSI GS NFV-IFA 008 v2.5.1	MANO; Ve-Vnfm reference point - Interface and Information Model Specification
ETSI GS NFV-IFA 013 v2.5.1	MANO; Os-Ma-Nfvo reference point - Interface and Information Model Specification

Release 2: stage 2 published documents (for reference)



Status as of Apr. 2019

ID	Title
Descriptors and artefacts	
ETSI GS NFV-IFA 011 v2.6.1	MANO; VNF Descriptor and Packaging Specification
ETSI GS NFV-IFA 014 v2.6.1	MANO; Network Service Templates Specification
Information modeling	
ETSI GR NFV-IFA 015 v2.5.1	MANO; Report on NFV Information Model
ETSI GR NFV-IFA 016 v2.5.1	IM; Papyrus Guidelines
ETSI GR NFV-IFA 017 v2.5.1	IM; UML Modeling Guidelines
ETSI GR NFV-IFA 024 v2.1.1	IM; Report on External Touchpoints related to NFV Information Model
Metrics, measurements	
ETSI GS NFV-TST 008 v2.5.1	Testing; NFVI Compute and Network Metrics Specification
ETSI GS NFV-IFA 027 v2.4.1	MANO; Performance Measurements Specification

NOTE: v2.6.1 versions of specs (see tables) will be published in April. These are currently under pre-processing by ETSI editing team.

Release 2: stage 3 published documents (for reference)



Status as of Apr. 2019

ID	Title
NFV-MANO APIs	
ETSI GS NFV-SOL 002 v2.6.1	Protocols and Data Models; RESTful protocols specification for the Ve-Vnfm Reference Point
ETSI GS NFV-SOL 003 v2.6.1	Protocols and Data Models; RESTful protocols specification for the Or-Vnfm Reference Point
ETSI GS NFV-SOL 005 v2.6.1	Protocols and Data Models; RESTful protocols specifications for the Os-Ma-nfvo Reference Point
ETSI GS NFV-SOL 013 v2.6.1	Protocols and Data Models; Specification of common aspects of RESTful NFV-MANO APIs
Artefacts	
ETSI GS NFV-SOL 004 v2.6.1	Protocols and Data Models; VNF Package specification
ETSI GS NFV-SOL 001 v2.6.1	Protocols and Data Models; NFV descriptors based on TOSCA specification
ETSI GS NFV-SOL 007 v2.6.1	Protocols and Data Models; Network Service Descriptor File Structure Specification

NOTE: v2.6.1 versions of specs (see tables) will be published in April. These are currently under pre-processing by ETSI editing team.

Release 2: other published documents (for reference)



Status as of Apr. 2019

ID	Title
Testing	
ETSI GR NFV-TST 007 v2.5.1	Testing; Guidelines on Interoperability Testing for MANO

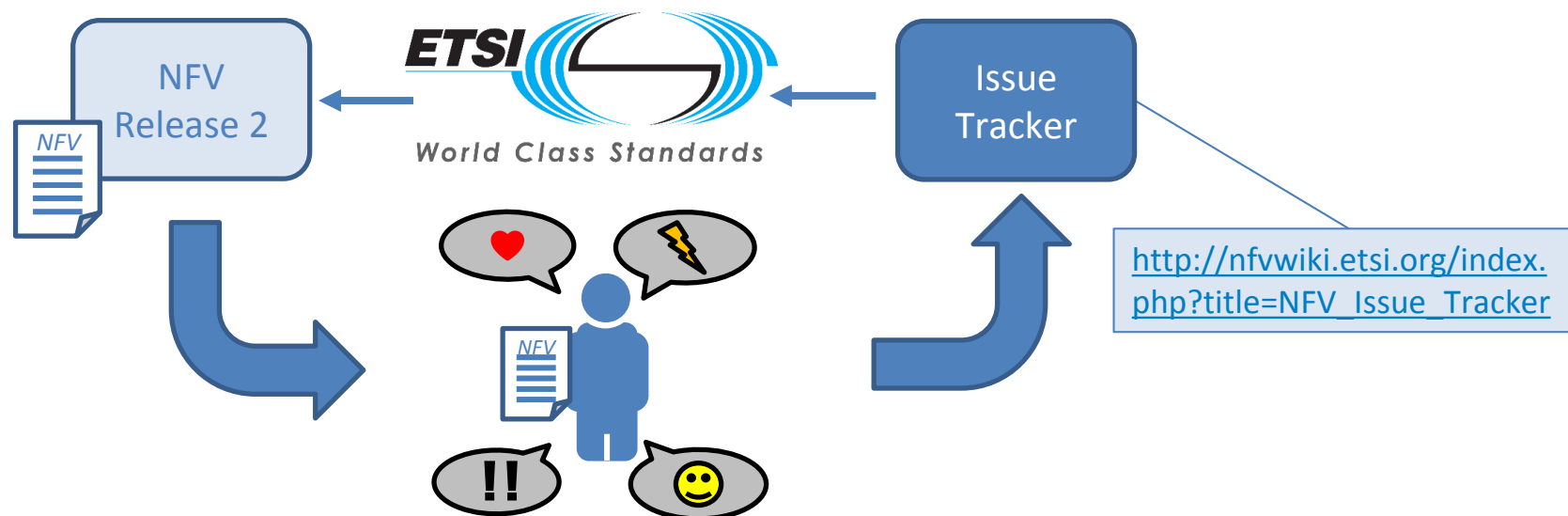
Release 2: more information and feedback

More information about Release 2 features:

📄 [https://docbox.etsi.org/isg/nfv/open/Other/ReleaseDocumentation/NFV\(18\)000241r1_NFV_Release_2_Description_v1_7_1.pdf](https://docbox.etsi.org/isg/nfv/open/Other/ReleaseDocumentation/NFV(18)000241r1_NFV_Release_2_Description_v1_7_1.pdf)

Ongoing work (drafts) publicly available here:

📄 <https://docbox.etsi.org/ISG/NFV/Open/Drafts/>



Release 3: specification summary



Status as of Apr. 2019

Published documents

Release 3, published documentation (35): 22 Group Specification (GS) and 13 Group Report (GR).

- ✔ 4 Stage 1/2 GS (NFV-EVE001/007/011, NFV-REL006)
- ✔ 5 Stage 2 GS (NFV-IFA018, NFV-IFA019, NFV-IFA030, NFV-IFA031, NFV-IFA032).
- ✔ 9 Stage 2 GS evolved from Release 2 (NFV-IFA005/006/007/008/010/011/013/014 and NFV-TST008) and 4 GR (NFV-IFA015/016/017/024).
- ✔ 3 GS on security (NFV-SEC012, NFV-SEC013, NFV-SEC014).
- ✔ 9 GR (NFV-EVE008/010/012, NFV-IFA012/021/022/023/028, NFV-TST005).
- ✔ 1 GS on testing/benchmarking (NFV-TST009).

Refer to regular updates of the Release 3 Definition (latest version [v0.12.0](#) Dec. 2018, to be updated in Apr. 2019).

Active work items

Release 3, ongoing unpublished work items (refer to Release 3 Definition): 18 WI.

- ✔ 1 Stage 1/2 GS draft (NFV-REL009).
- ✔ 2 Stage 2 GS draft (NFV-IFA026/033).
- ✔ 3 GR draft (NFV-IFA029/034, NFV-REL010).
- ✔ 2 GS drafts on security (NFV-SEC019, NFV-SEC020).
- ✔ Evolved Rel. 2 deliverables from stage 2 and 3: 6 GS (NFV-IFA002, and NFV-SOL002/003/004/005/013).
- ✔ 4 GS drafts on newly stage 3 (NFV-SOL009/010/011/012).

Release 3, ongoing “continuation and maintenance work”: 11 WI.

- ✔ Propagated/evolved Rel. 2 deliverable drafts: 9 Stage 2 GS (NFV-IFA005/006/007/008/010/011/013/014, NFV-TST008).
- ✔ Newly added by Release 3: 2 Stage 2 GS (NFV-IFA030/031).

Release 3: feature-based specification

Release 3 Definition (regularly updated, latest version [v0.12.0](#) Dec. 2018, to be updated in Apr. 2019).



18 candidate features, including Release 3 definition features and small enhancements.

Approach:

- ✔ 6-month delivery cadence.
- ✔ Main workload is still on stage 2 level specifications.
- ✔ But stage 3 work has started.
- ✔ Release 3 specification progress and plans are publicly available on the [NFV Public Wiki](#).

Refer also to Release 3 Definition Annex B for a summary of work, impacted specifications and features tracking.

First version [v0.1.0](#) of Release 3 Description with the 1H2018 specification outcomes is now available. To be updated in Apr. 2019 with the 2H2018 spec outcomes.

5.2.7 Policy management framework (POLICY)

5.2.7.1 Description

The feature introduces a policy management framework for NFV-MANO, including distribution of policy, policy conflict detection and resolution, and federation of policy domains. The feature addresses the interface operation definition when policy management is introduced into NFV-MANO.

As part of the feature, a new interface applicable to multiple reference points (see clause 5.2.7.2) is introduced. The interface allows to invoke policy management operations towards the corresponding NFV-MANO functional block. The interface defines the follow operations: transfer, delete, query, activate and deactivate policy. The interface also exposes the subscription and notification mechanism for issuing notifications concerning policy handling.

5.2.7.2 Architecture scope

The feature concerns to the following main functional blocks and references points:

- Functional blocks: NFVO, VNFM, VIM.
- Reference points: Os-Ma-nfvo, Or-Vnfm, Or-Vi, Vi-Vnfm, and Ve-Vnfm.

5.2.7.3 Specification results

The feature has been specified in the specifications and reports listed in table 5.2.7.3-1. Refer to clause 6 for the latest version available of the document.

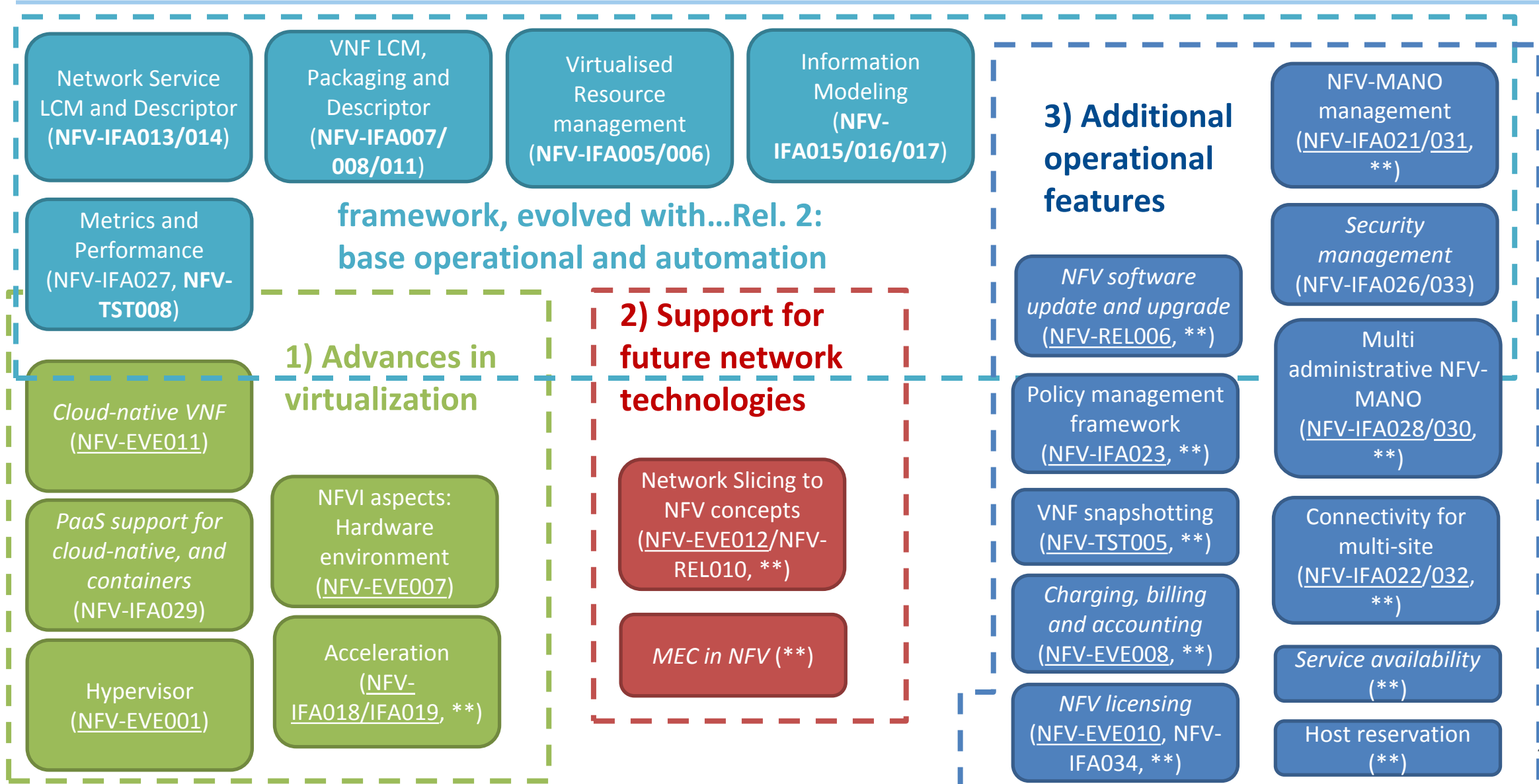
Table 5.2.7.3-1: Specification results of feature "policy management framework"

Document Id.	Stage	Description of the feature specification
ETSI GR NFV-IFA 023	Stage 0	Feasibility study of the feature. Use cases related to the introduction of policy usage and management into NFV-MANO.
ETSI GS NFV-IFA 010	Stage 1 and 2	Functional requirements for NFV-MANO functional blocks (NFVO, VNFM and VIM) to support the capability to manage NFV-MANO policies. Definition of scope and category of policies applicable to the different reference points (informative).
ETSI GS NFV-IFA 005	Stage 2	Functional requirements of the Policy Management interface on the Or-Vi reference point. Functional and information model description of the Policy Management interface.
ETSI GS NFV-IFA 006	Stage 2	Functional requirements of the Policy Management interface on the Vi-Vnfm reference point.

Table 5.1-1: Release 3 features

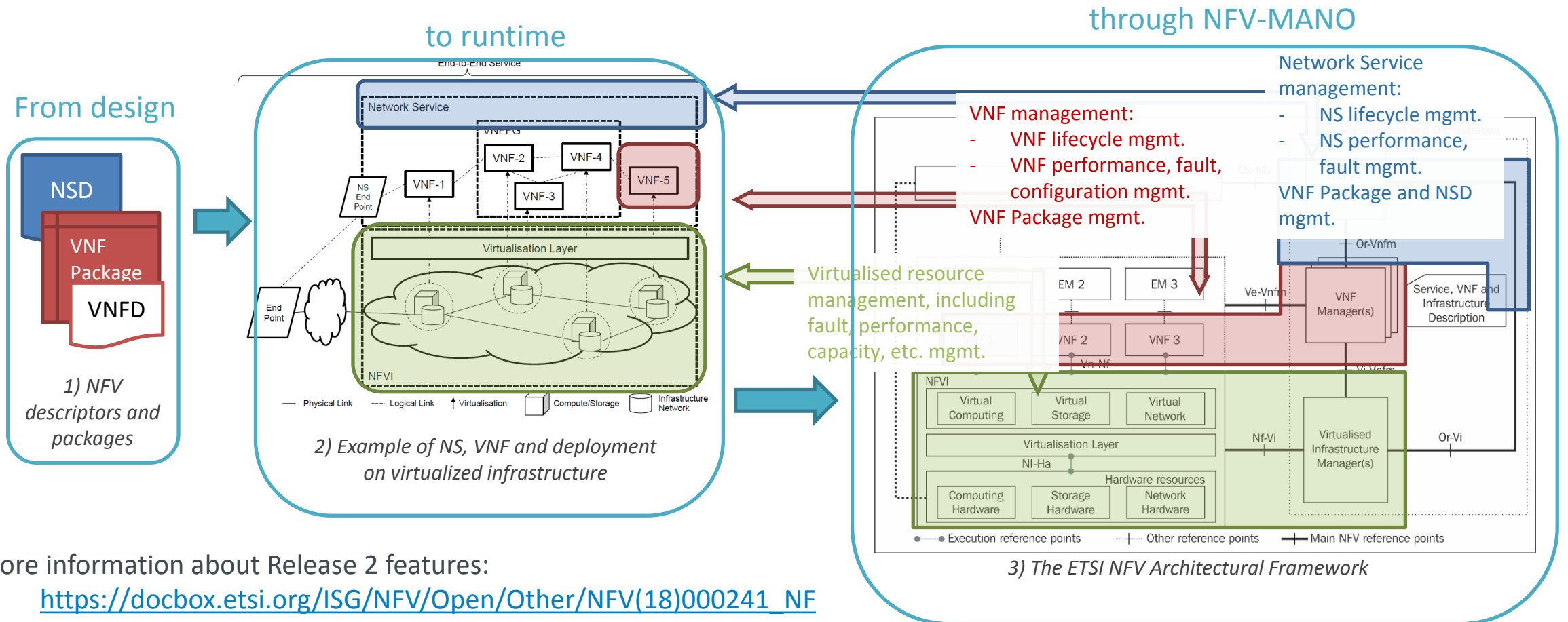
Feature title	Acronym	Id (from the Definition document)
Hardware-independent acceleration	ACCEL	R02.CAP12
Network Acceleration for VNF	FASTSWITCH	R03.F07
Hypervisor-based virtualisation	HYPER	R03.F16
Hardware environment for NFV	HWENV	R03.F13
Management of NFV-MANO	NFV_M&Ms	R03.F04
VNF Snapshotting	VNF_PHOTO	R03.F11
Policy management framework	POLICY	R03.F14
NFV-MANO admin domains	MANOMD	R03.F18

Release 3: work items and features from stage 1&2 perspective



Release 2: what does it contain?

Release 2 specifications set up the NFV framework with essential capabilities related to NS, VNF and VR management.



More information about Release 2 features:

[https://docbox.etsi.org/ISG/NFV/Open/Other/NFV\(18\)000241_NF](https://docbox.etsi.org/ISG/NFV/Open/Other/NFV(18)000241_NF)

ETSI NFV ongoing work

Release 2 maintenance:

- ✓ Fourth round (2H2018) was completed.
- ✓ Fifth round (1H2019) is underway.

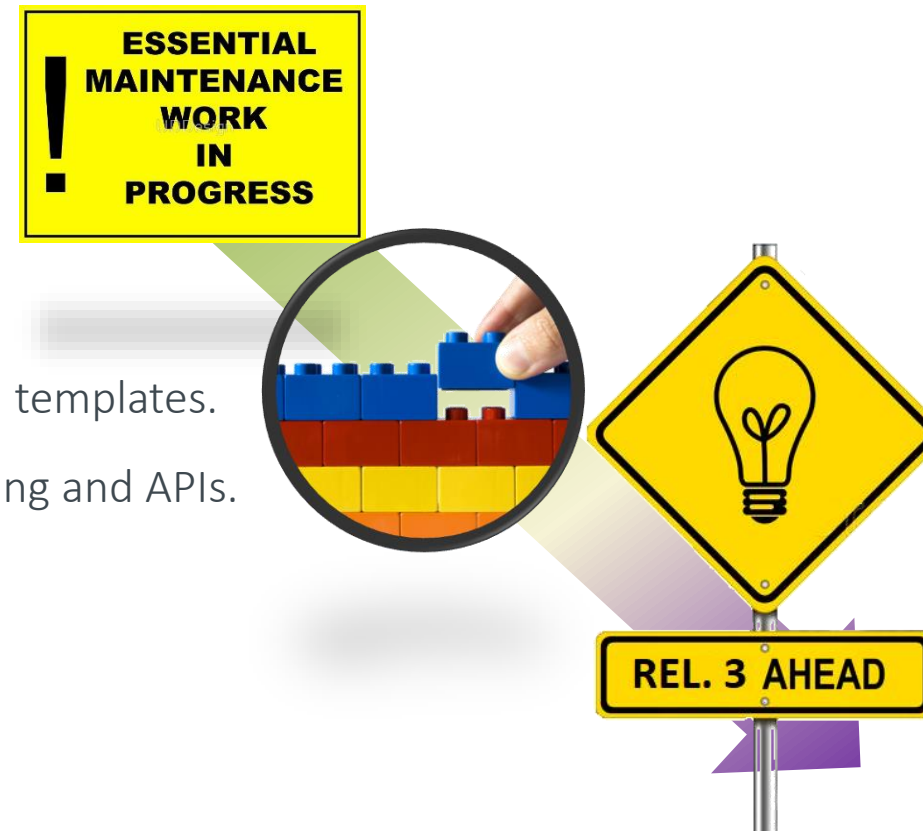
Release 2 ongoing work for new specifications:

- ✓ Some stage 3 specification, e.g., YANG based VNFD and NSD, VR mgmt. templates.
- ✓ Specific technical gaps, such as security enhancements for VNF Packaging and APIs.
- ✓ Testing specifications, including API conformance testing.

Release 3 features work:

- ✓ Few remaining informative/study works.
- ✓ Most of the stage 2 normative specification. Based on a feature set, whereby features may deliver new specifications or evolve current Release 2 specifications.

- ✓ ETSI 2018 Several features completed at stage 2 level.



Release 2: maintenance work (1/2)



4 rounds completed (1H2017, published as [v2.3.1](#); 2H2017, published as [v2.4.1](#); 1H2018, published as [v2.5.1](#), and 2H2018 published as [v2.6.1](#)).

1H2019 maintenance is ongoing (targeting publication of affected specifications as [v2.7.1](#)).

- ✔ Focus is on [stage 3 specifications \(NFV-SOL specs\)](#), and stage 2 specifications closely related to unfinished Rel. 2 stage 3 specifications (NFV-IFA011/014). Additional stage 2 specifications are considered for maintenance as well.

Main [aspects addressed \(so far\) as part of maintenance](#):

- ✔ Correction of bugs.
- ✔ Feedback received from deployments and development: remove ambiguities, enhance certain APIs, etc.
- ✔ Alignment in between Stage 2 and 3 specifications.
- ✔ Feedback from open source projects, e.g., OpenStack gap analysis and alignment to NFV-IFA005 and NFV-IFA006, OSM information model feedback to NFV-IFA011 and NFV-IFA014, contributions to NFV-IFA011 and NFV-SOL004 by companies participating in ONAP providing feedback, etc.

Release 2: maintenance work (2/2)



Capability changes and enhancements developed during maintenance (not an exhaustive list) since first published version of the specs (i.e., v2.1.1 and v2.2.1):

- ✔ Adding support for compute flavour management.
- ✔ Merging of VNF and NS lifecycle change notifications into VNF and NS LCM interfaces, respectively.
- ✔ Merging of VNF configuration and instance information mgmt. into VNF LCM interface.
- ✔ Adding support for changing the external VNF connectivity.
- ✔ Enhancements and consistency to alarm management within the fault management interfaces.
- ✔ Enhancements in the information and data modelling of network connectivity.

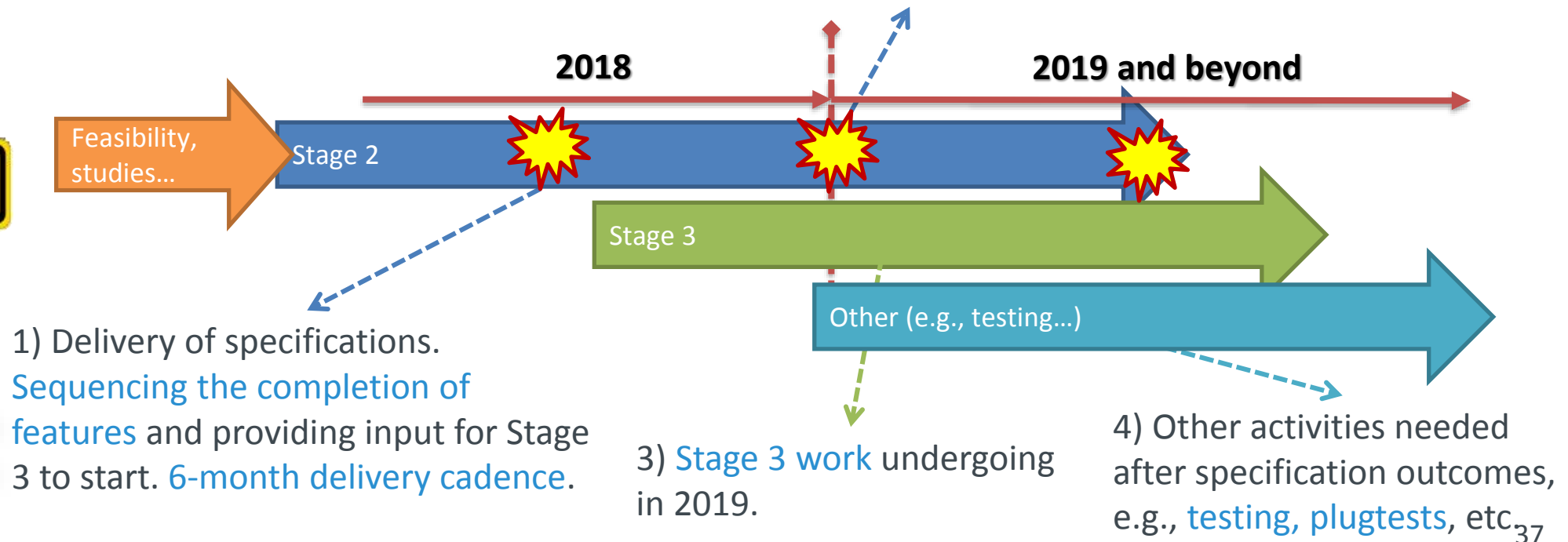
Release 3: feature-based specification and next steps



- ✓ Following a [feature-based specification approach](#).
- ✓ [17+ candidate features](#) (see backup slides).
- ✓ “stage 2 level” specification is well underway, and now transitioning into “stage 3 work.”

Release specification progress and plans are publicly available on the [NFV Public Wiki](#). List of features is available in the Release 3 Definition (periodically updated, latest [v0.12.0](#) Dec. 2018). See also backup slides.

2) [Stage 2](#) level specification is expected to be [completed in 2019](#).



1) Delivery of specifications. Sequencing the completion of features and providing input for Stage 3 to start. [6-month delivery cadence](#).

3) [Stage 3](#) work undergoing in 2019.

4) Other activities needed after specification outcomes, e.g., [testing](#), [plugtests](#), etc₃₇