ETSI ISG NFV: Architecture and Releases Overview

NFV(20)000261r2

Presented by: **Cristina Badulescu**
Ulrich Kleber
Uwe Rauschenbach
Zarrar Yousaf

For: **GSMA OPG- ETSI ISG NFV joint session**

December 14,2020

Outline

▽ **PART 1: ETSI ISG NFV – architecture and features recap** - 5 min

   ▽ ETSI NFV architecture

   ▽ Feature map (up to Rel-4)

▽ **PART 2: Cloud native VNFs orchestration and container infrastructure mgmt. (FEAT17)** – 10 min

   ▽ Step 1: Introduce Container Infrastructure Service Management (CISM)

      ▽ Introduce object model related to containerized workloads

   ▽ Step 2: Introduce Container Cluster Management (CCM)

      ▽ Completion of object model and use on all reference points

   ▽ Security in containerized environments and stage 3 work

▽ **PART 3: Support for MEC in NFV (FEAT12)** – 5 min

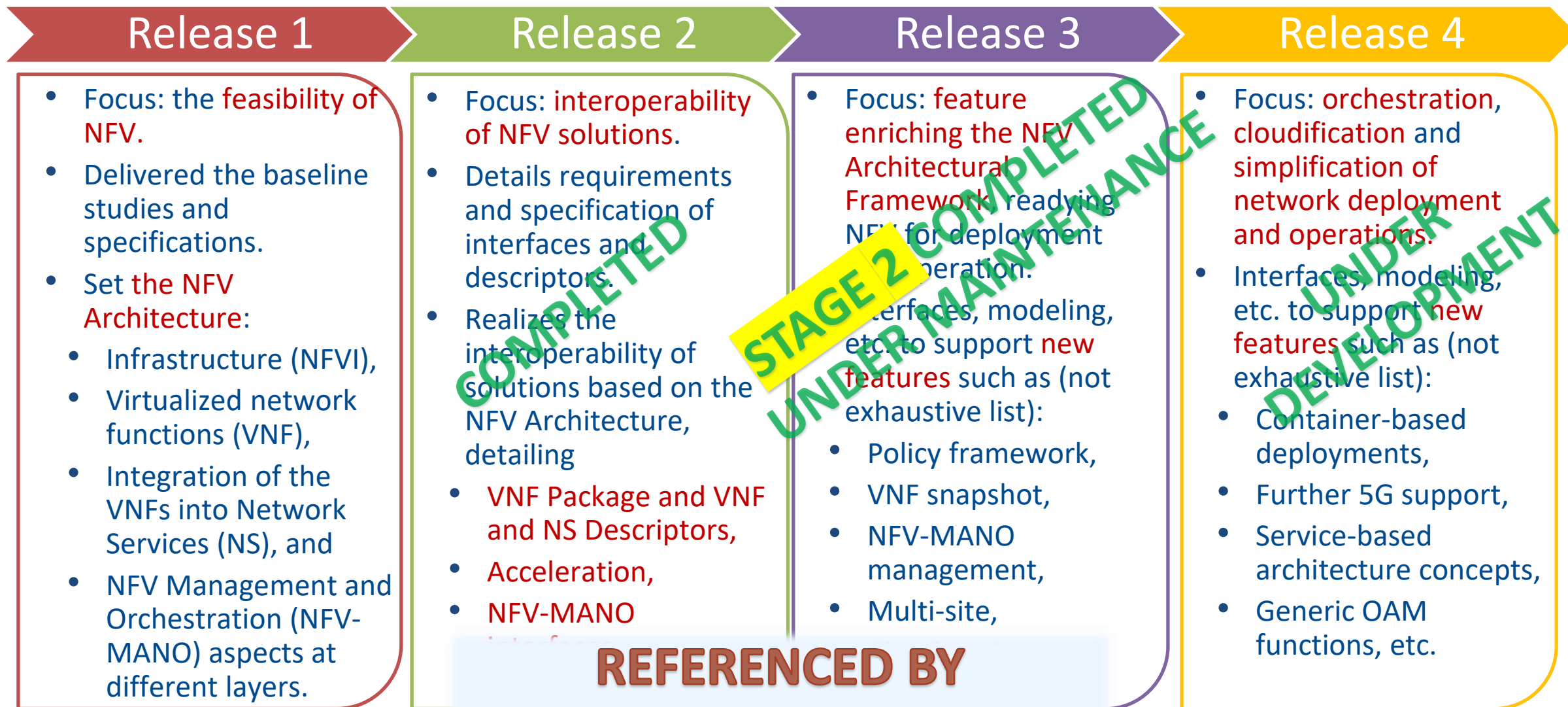   ▽ Summary of the related and pending work (Os-Ma, VNF Pkg, Ve-Vnfm impacts)

▽ **PART 4: Multi-site connectivity services (FEAT10)** – 5 min

   ▽ Overview of IFA032 and SOL017

Part 1: ETSI ISG NFV architecture and features recap

Presented by:

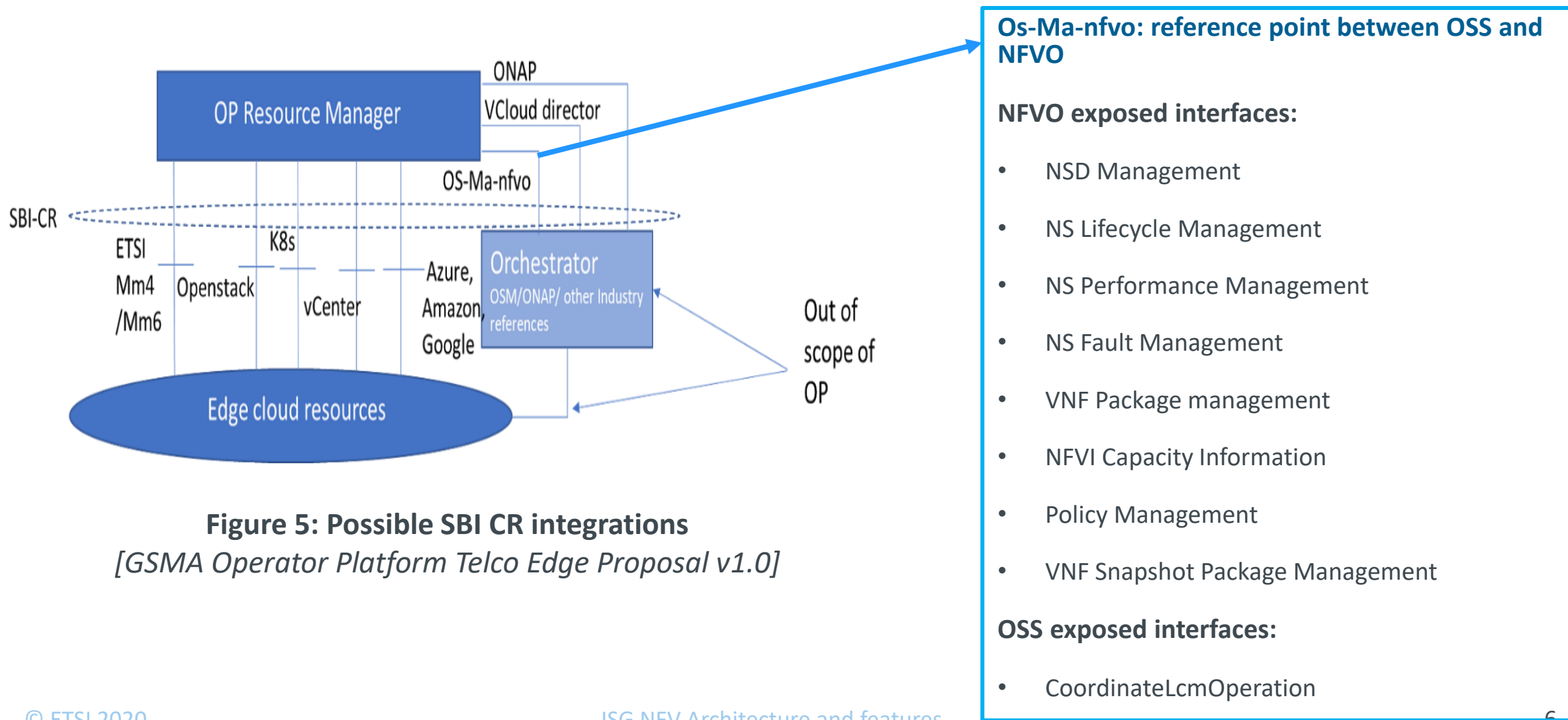Cristina Badulescu (Ericsson)

ETSI NFV Releases overview

Release 1	Release 2	Release 3	Release 4

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,
  - 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,
  - Multi-site,

Release 4
- Focus: orchestration, cloudification and simplification of network deployment and operations.
- Interfaces, modeling, etc. to support new features such as (not exhaustive list):
  - Container-based deployments,
  - Further 5G support,
  - Service-based architecture concepts,
  - Generic OAM functions, etc.

COMPLETED

STAGE 2 COMPLETED
UNDER MAINTENANCE

UNDER DEVELOPMENT

REFERENCED BY ONAP, ETSI OSM

Release 3: specification summary

Italics: in draft status **Bold: published** Underlined: published testing *Underlined + italics: referenced from other Rel.*

ETSI

NFV-IFA 010 (NFV-MANO Func. Reqs)
NFV-IFA 027 (Performance metrics)

NFV-IFA 030
NFV-SOL 011

SOL010 (VNF snapshot Pkg) **SOL004 (Packaging)**
NFV-IFA 011 (VNFD and Pkg)

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

NFV-IFA 013
NFV-SOL005

NFV-SOL007 (NSD file structure)
NFV-IFA 014 (NS templates)

NFV-SOL 001
NFV-SOL 006 (VNF and NS Descriptors)

NFV-IFA 007
NFV-SOL 003

NFV-SOL 012 (Policy API)

NFV-EVE 011 (Class cloud-native VNF)

NFV-IFA 008
NFV-SOL 002

NFV-IFA 032
SOL017 (Profiling report)

NFV-IFA 026 (Sec architecture)

NFV-EVE 001 (Hypervisor reqs)

NFV-TST 009 (NFVI benchmarking)

NFV-TST 008 (NFVI metrics)

NFV-IFA 031
NFV-SOL 009 (NFV-MANO mgmt.)

SOL013 (API common aspects)

NFV-EVE 007 (HW reqs)

NFV-IFA 005
NFV-IFA 006

NFV-SEC 021 (VNF Package security)
NFV-SEC 022 (API NFV Access Token)

Architecture diagram labels

OSS/BSS · Os-Ma · NFV Orchestrator · Or-Or · Service, VNF and Infrastructure Description · Or-Vnfm · EM 1 · EM 2 · EM 3 · VNF 1 · VNF 2 · VNF 3 · Vn-Nf · Ve-Vnfm · VNF Manager · Vi-Vnfm · NFVI · Virtual Computing · Virtual Storage · Virtual Network · Virtualisation Layer · Vl-Ha · Nf-Vi · Virtualised Infrastructure Manager · Or-Vi · Wide Area Manager · Computing Hardware · Storage · Network · Hardware resources · Execution reference

NFV Architecture used as base in CNTT RA

5

ETSI NFV: Os-Ma-nfvo interfaces

Figure 5: Possible SBI CR integrations
[GSMA Operator Platform Telco Edge Proposal v1.0]

Os-Ma-nfvo: reference point between OSS and NFVO

NFVO exposed interfaces:

- NSD Management

- NS Lifecycle Management

- NS Performance Management

- NS Fault Management

- VNF Package management

- NFVI Capacity Information

- Policy Management

- VNF Snapshot Package Management

OSS exposed interfaces:

- CoordinateLcmOperation

Release 4: overview

Release 4 Definition doc:

- available on the NFV Open Area.

- Has 4 main technical areas and 15 features

Technical areas

NFVI evolution	Enhancing NFV automation and capabilities
Evolving NFV-MANO framework	Operationalization

Features in the Release 4 definition

New features

- Network connectivity integration and operationalization
- Multi-tenancy enhancements for NFV-MANO
- NFV-MANO automation and autonomous networks
- SBA for NFV-MANO
- NFV enhancements for 5G
- VNF common management functions
- Continuous VNF integration
- Policy management models

Enhancement features

- NFV security hardening
- Specific technical enhancements

Carried over from Rel. 3

- NFV-MANO upgrade
- MEC in NFV
- Licensing management
- Cloud-native VNFs and Container Infrastructure management
- Security management

ETSI NFV Release 4 timeline

2019/Q4   2020/Q3   2020/Q4   2021/Q1   2021/Q2   2021/Q3   2021/Q4   2022/Q1

NFV Rel-4 START

NFV Rel-4 Stage 2 Drop #1 (v4.1.1)

NFV Rel-4 Stage 3 START (e.g. FEAT17)

NFV Rel-4 Stage 2 Drop #2 (v4.2.1)

NFV Rel-4 Stage 3 Drop #1 (v4.2.1 tbc)

NFV Rel-4 Stage 2 Drop #3 (v4.3.1)

NFV Rel-4 Stage 3 Drop #2 (v4.3.1 tbc)

NFV Rel-4 Stage 2 Drop #4 or maintenance (v4.4.1)

NFV Rel-4 Stage 3 Drop #3 (v4.4.1 tbc)
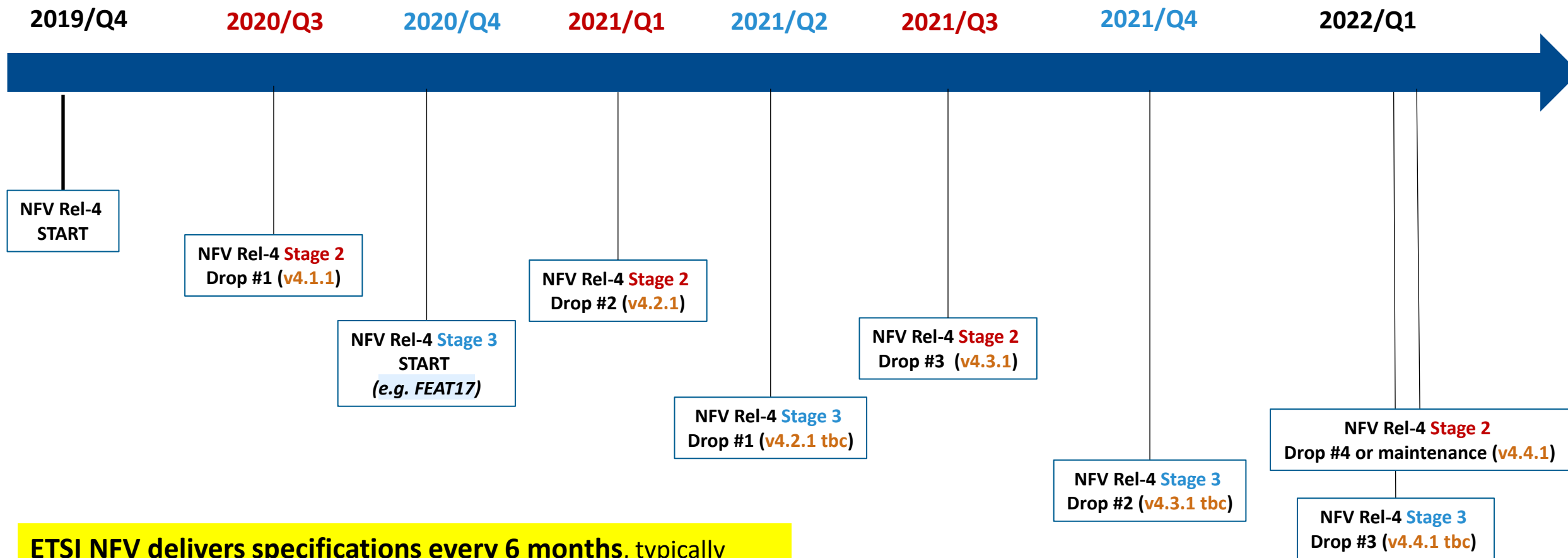
ETSI NFV delivers specifications every 6 months, typically when performing maintenance. During new features development, delivery of specifications can take place at a faster pace or upon completion of "batches of features" (aka "drops").

Stage 4 (Testing and ETSI Plugtest support): not yet planned

Part 2: FEAT17

Cloud-Native VNFs and Container Infrastructure management

Presented by:
Ulrich Kleber (Huawei)

Cloud-Native VNFs and Container Infrastructure Management
Step 1: Introduce CISM and object model

Objective:

- NFV Architecture support for VNFs which follow "cloud-native" design principles.
- Introduce CISM function for workload management
- Introduce MCIO and MCIOP for modelling of containerized workloads
- Introduce Container Image Repository CIR

Use cases:

- Delivery of containerized VNFs as packages
- Lifecycle management of containerized VNFs, including OS container resource management

Specification outcomes:

- Functional requirements on new functions CISM and CIR and on VNFM and NFVO on how to consume them: ETSI GS NFV-IFA 010 V4.1.1
- Enhanced VNFD information model for containerized VNFs: ETSI GS NFV-IFA 011 V4.1.1
- Abstract NFV object model for container management and requirements on management services for CISM and CIR: ETSI GS NFV-IFA 040
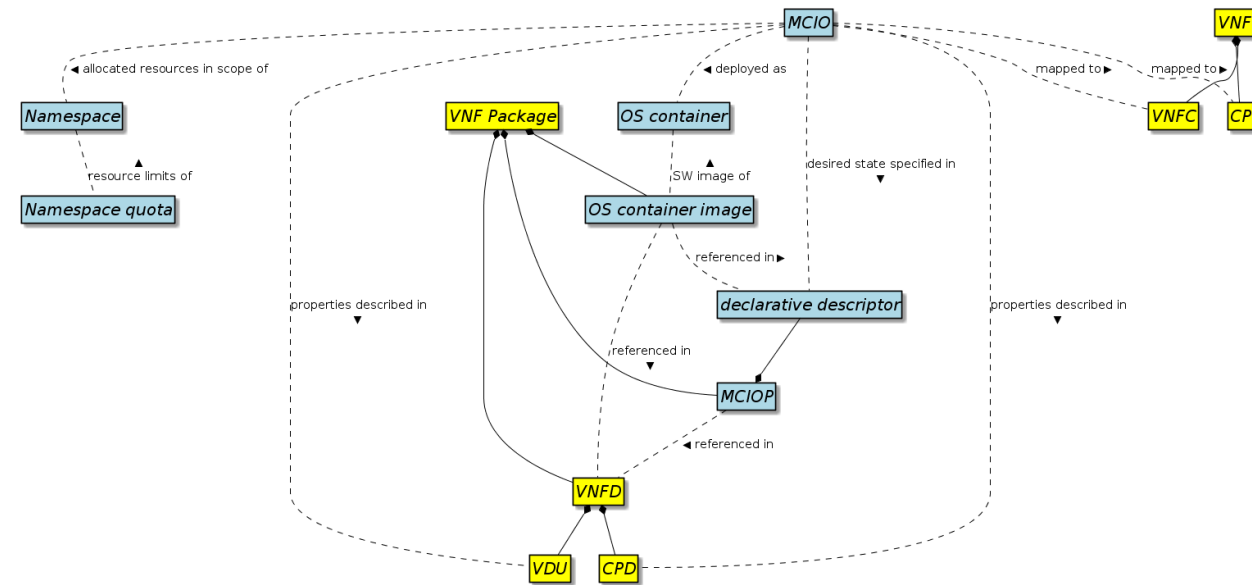
Other information:

- The normative stage 2 standard is published November 2020, based upon the study report ETSI GR NFV-IFA 029
- CISM and CIR expose service interfaces
- The stage 3 phase is started recently using profiling to avoid duplication or conflict to open source projects (e.g. K8S, Docker, Helm)

FEAT17: Cloud native VNFs and container infrastructure management

Cloud-Native VNFs and Container Infrastructure Management Step 2: Introduce CCM and complete object model

Objective:
- NFV Architecture support for Container Clusters
- Support MCIO/MCIOP in all relevant NFV reference points

Use cases:
- Lifecycle management of containerized VNFs, including OS container resource management
- Lifecycle management of container infrastructure service clusters and their nodes
- Isolation of containerized workloads in different CIS clusters

Specification outcomes:
- Updates on most specifications ongoing
- Work done in **ETSI GS NFV-IFA036**
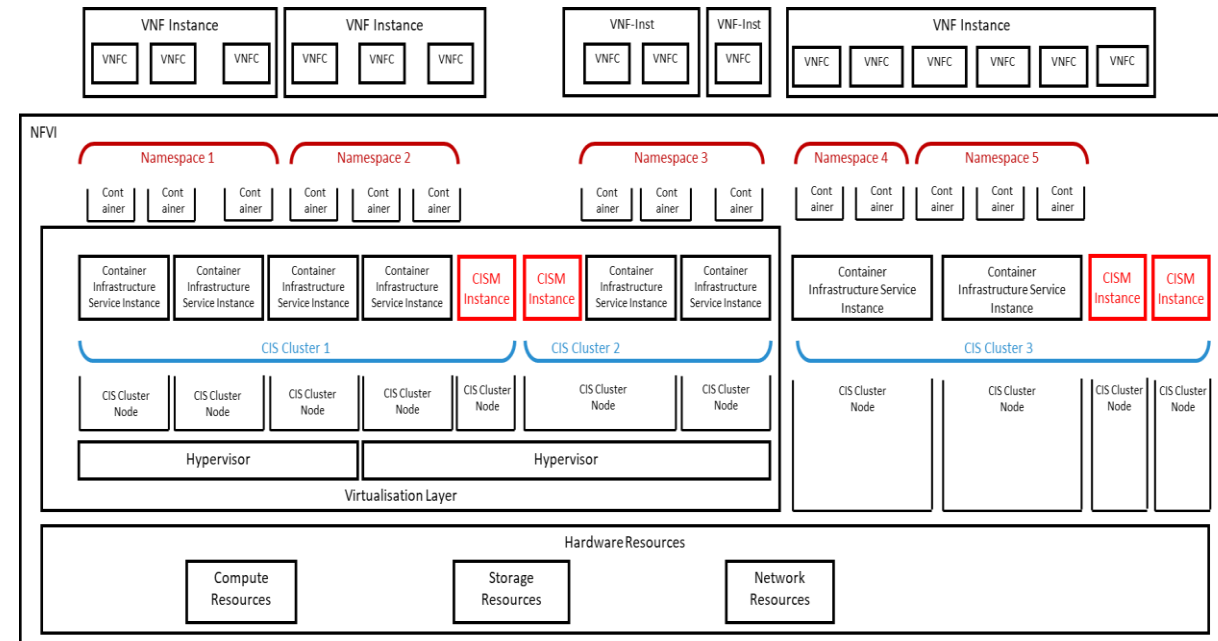
Other information:
- CCM follows same principles as CISM exposing service interfaces and stage 3 profiling
- CCM will support CIS clusters based on virtual machines and on physical (bare-metal) servers

Cloud-Native VNFs and Container Infrastructure Management Security and stage 3

Security aspects:

▽ Specify security requirements in container based NFV deployments

▽ Use cases:

    ▽ Deployment Options based on ETSI GR NFV-IFA 029:

        ▽ Container Platform: CIS deployment on bare-metal, nested, hybrid container platforms/CIS, etc.

        ▽ Orchestration and Management: characteristics, particularly those important for security aspects (e.g. external/internal interfaces, shared/isolated access to resources etc.) for the different CISM deployment options, CIR locations

▽ Specification outcomes:

    ▽ Ongoing work in **ETSI GS NFV-SEC023**

Part 3: FEAT12

MEC in NFV

Presented by:

Uwe Rauschenbach (Nokia)

Release 4 features:
Completion of FEAT12: MEC in NFV

Objective: Use NFV-MANO to manage the lifecycle of MEC apps (i.e., MEC app appears like a VNF to ETSI NFV MANO) – see ETSI GR MEC 017

Use cases:
- Build MEC deployment based on NFV technology
- Build shared MEC-NFV deployments

Specification outcomes:
- SOL004: Non-MANO artifacts to include MEC-specific content in VNF Package (finalized)
- IFA008/SOL002: LCM coordination interface for use by MEPM-V (stage 2 done, stage 3 started)
- IFA013/SOL005: Additional location constraints (done)
- IFA013/SOL005: Coordination interface between NFVO and MEAO (stage 2 done, stage 3 to be started)
- IFA011/SOL001: Declaration of LCM coordinations (stage 2 done, stage 3 to be started)
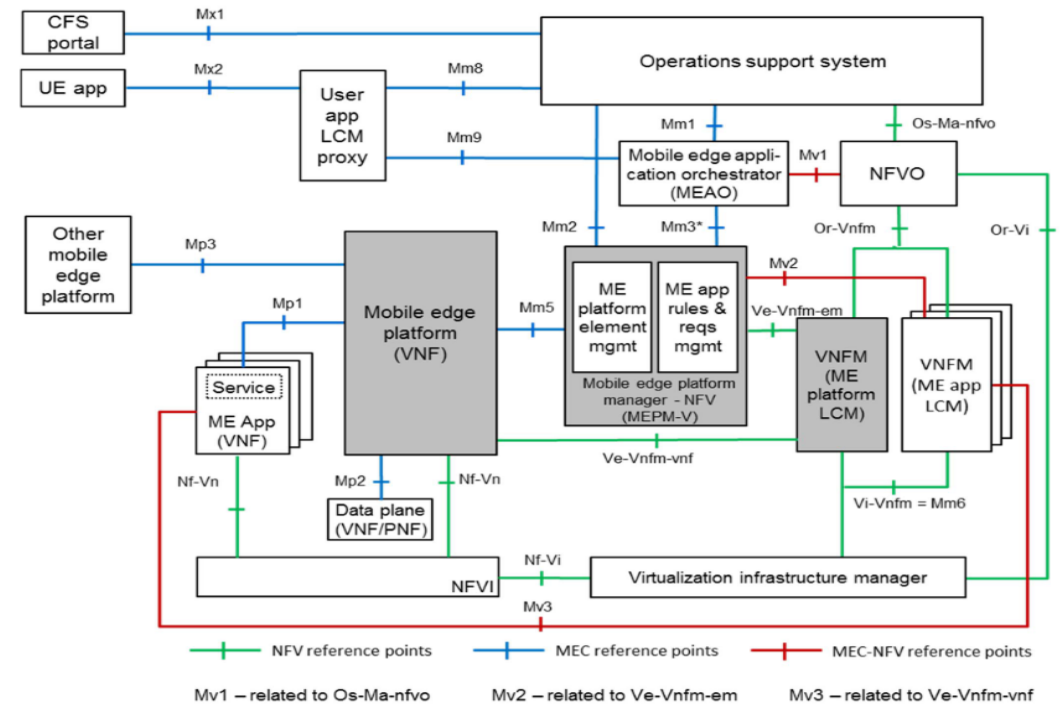
Other information:
- **Vnf package:** embed MEC artifacts
- **Ve-Vnfm:** LCM coordination e.g. for graceful termination
- **Os-Ma:** Geolocation constraints, LCM coordination for pre-emption in case of resource scarceness

Part 4:
FEAT10

Multi-site connectivity services (MSCS)

Presented by:

Zarrar Yousaf (NEC)

Release 3 features:
Management & Connectivity of Multi-Site Services (1/2)

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 v3.3.1.

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 v3.4.1).
- Updates on ETSI GS NFV-IFA 005/007/010/013/014 specifications to support exposure of connectivity information and multi-site service deployment.
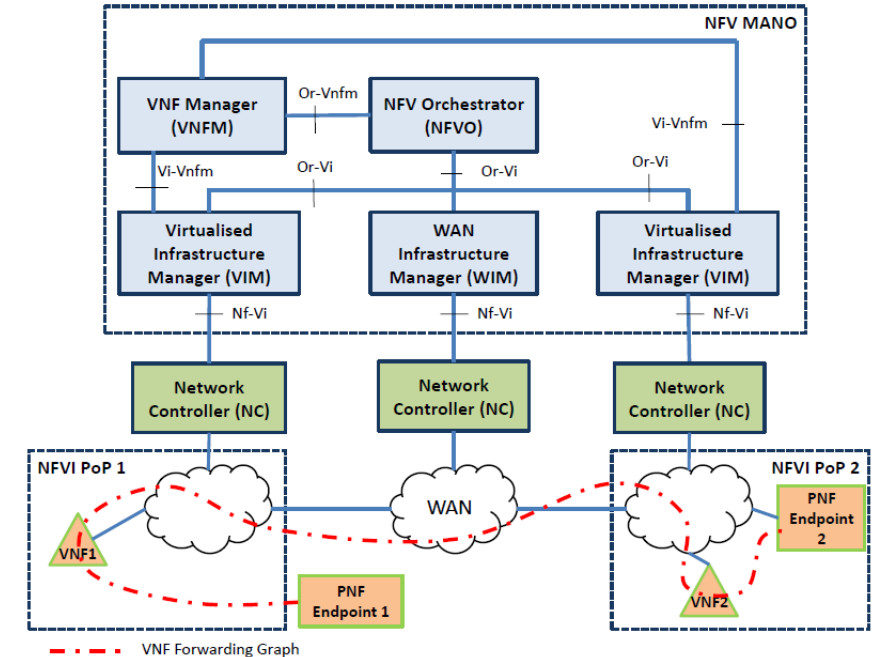
Other information:

- The informative profiling activity is in-progress (DGR/NFV-SOL017) for stage 3 planning with reference to: a) ONF Transport SDN API, and b) IETF ACTN
- PoC activities: PoC#42: Mapping ETSI-NFV onto Multi-Vendor, Multi-Domain Transport SDN 4. Report is available at (https://www.etsi.org/technologies/nfv/nfv-poc.

Release 3 features:
Management & Connectivity of Multi-Site Services (2/2)

ETSI GS NFV-IFA 032 specifies:

Interfaces produced by the WAN Infrastructure Manager (WIM) addressing the fulfillment and assurance aspects of network connectivity across multiple sites.

- Multi-site connectivity services (MSCS) management interface
- Capacity Management interface
- Fault Management interface
- Performance Management interface

Plus, associated information modeling
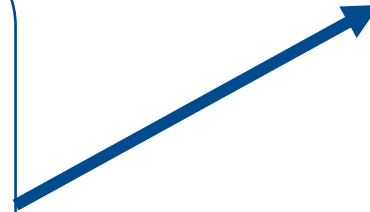
DGR/NFV-SOL017 (to be ETSI GR NFV-SOL 017):

Profiles existing standards which map to the functionality defined by ETSI GS NFV-IFA 032:

- ONF Transport API (TAPI).
- IETF Abstraction and Control of Traffic Engineered Networks (ACTN).

And concludes with recommendations on further normative specification of protocol and data models, e.g., about endorsing with profiling the referred standards

(NOTE: work item is in progress and thus its content might still be changed before final approval and publication).

- NOTE: For the establishment of the network connectivity, the WIM may rely on network controllers that handle the fulfilment of the connectivity at a lower level, potentially making use of different network technologies and protocols.

For information

More information

NFV Technology Page (information / main website)
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 and other tools:

- Published Documents
- Working Drafts
- Issue tracker
- Releases documentation: Rel. 2 Description, Rel. 3 Description, Rel. Definition
- Detailed Release 3 and 4 specification progress wiki pages:
- OpenAPI representations of GS NFV-SOL NFV-MANO APIs
- GS NFV-SOL 001/006 supporting files on ETSI Forge
- GS NFV-TST 010 Robot API test files
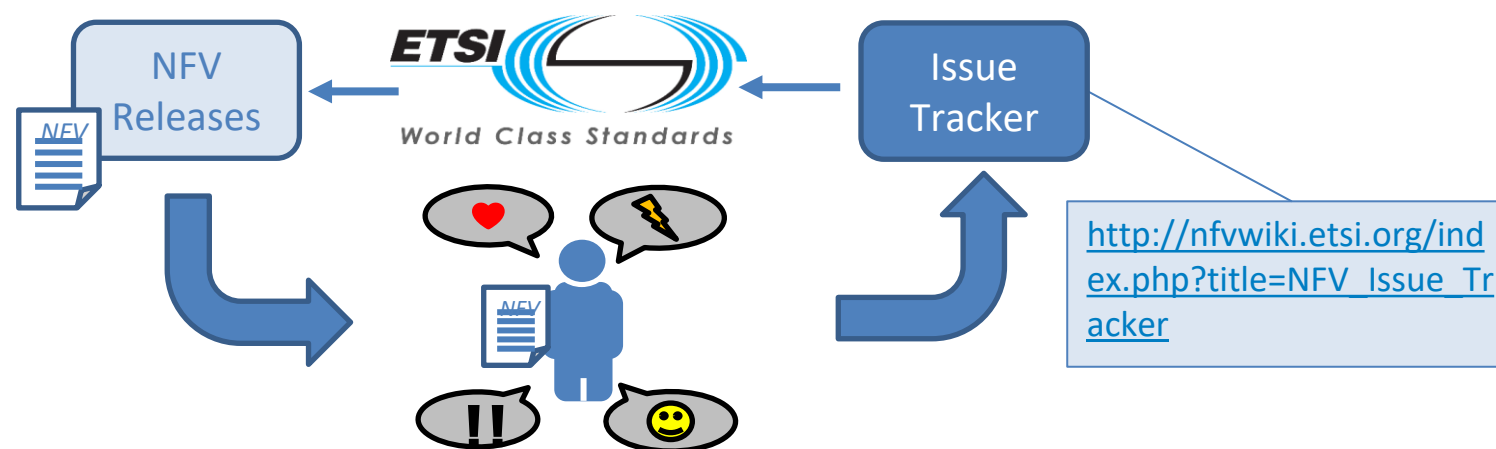
NFV Releases

Issue Tracker

http://nfvwiki.etsi.org/index.php?title=NFV_Issue_Tracker

Release 2:
stage 2 published documents (for reference)

Status as of Dec. 2020

ID	Title
Functional requirements	
ETSI GS NFV-IFA 010 v2.7.1	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 v2.7.1	MANO; Or-Vi reference point - Interface and Information Model Specification
ETSI GS NFV-IFA 006 v2.7.1	MANO; Vi-Vnfm reference point - Interface and Information Model Specification
ETSI GS NFV-IFA 007 v2.7.1	MANO; Or-Vnfm reference point - Interface and Information Model Specification
ETSI GS NFV-IFA 008 v2.7.1	MANO; Ve-Vnfm reference point - Interface and Information Model Specification
ETSI GS NFV-IFA 013 v2.7.1	MANO; Os-Ma-Nfvo reference point - Interface and Information Model Specification

Release 2: stage 2 published documents (for reference)

Status as of Dec. 2020

ID	Title
Descriptors and artefacts	
ETSI GS NFV-IFA 011 v2.7.1	MANO; VNF Descriptor and Packaging Specification
ETSI GS NFV-IFA 014 v2.7.1	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 v2.7.1	MANO; Performance Measurements Specification

Release 2:
stage 3 published documents (for reference)

ID	Title
NFV-MANO APIs	
ETSI GS NFV-SOL 002 v2.8.1	Protocols and Data Models; RESTful protocols specification for the Ve-Vnfm Reference Point
ETSI GS NFV-SOL 003 v2.8.1	Protocols and Data Models; RESTful protocols specification for the Or-Vnfm Reference Point
ETSI GS NFV-SOL 005 v2.8.1	Protocols and Data Models; RESTful protocols specifications for the Os-Ma-nfvo Reference Point
ETSI GS NFV-SOL 013 v2.8.1	Protocols and Data Models; Specification of common aspects of RESTful NFV-MANO APIs
Artifacts	
ETSI GS NFV-SOL 001 v2.8.1	Protocols and Data Models; NFV descriptors based on TOSCA specification
ETSI GS NFV-SOL 004 v2.8.1	Protocols and Data Models; VNF Package and PNFD Archive specification
ETSI GS NFV-SOL 006 v2.8.1	Protocols and Data Models; NFV descriptors based on YANG specification
ETSI GS NFV-SOL 007 v2.8.1	Protocols and Data Models; Network Service Descriptor File Structure Specification
ETSI GS NFV-SOL 014 v2.8.1	Protocols and Data Models; YAML data model specification for descriptor-based virtualised resource management
Procedures	
ETSI GS NFV-SOL 016 v2.8.1	Protocols and Data Models; NFV-MANO procedures

Release 2:
other published documents (for reference)

ID	Title
Testing	
ETSI GR NFV-TST 007 v2.6.1	Testing; Guidelines on Interoperability Testing for MANO
ETSI GS NFV-TST 010 v2.6.1	Testing; API Conformance Testing Specification
Security	
ETSI GS NFV-SEC 021 v2.6.1	Security; VNF Package Security Specification
ETSI GS NFV-SEC 022 v2.8.1	Security; Access Token Specification for API Access

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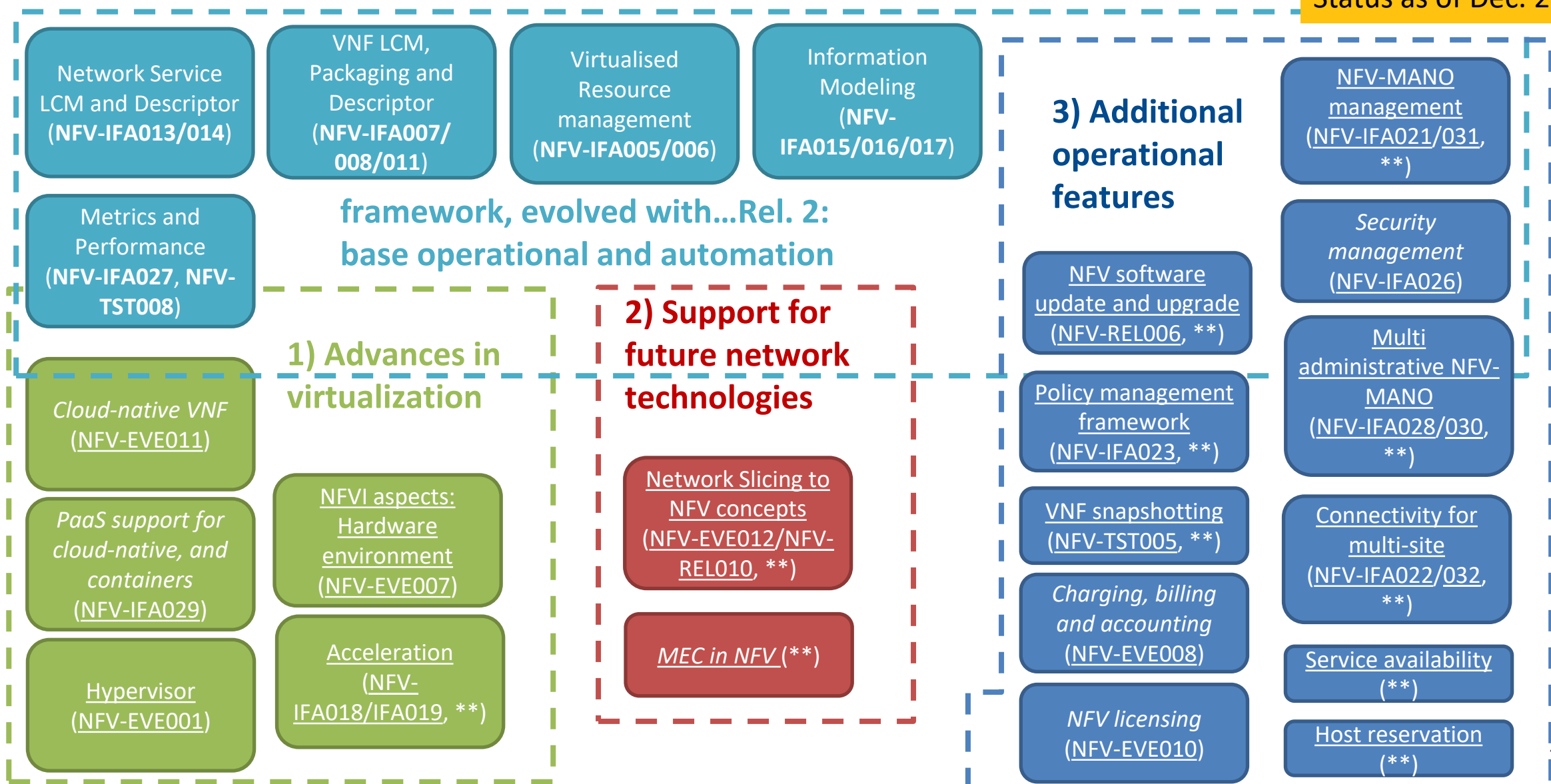# work items and features from stage 1&2 perspective

Completed: <u>underlined</u>
Ongoing/not fully completed: *italics*
Evolved: in **bold**

(**): other normative work is part of evolved work items

NOTE: might not be a full complete list due to lack of space

ETSI

Status as of Dec. 2020

Network Service LCM and Descriptor **(NFV-IFA013/014)**

VNF LCM, Packaging and Descriptor **(NFV-IFA007/ 008/011)**

Virtualised Resource management **(NFV-IFA005/006)**

Information Modeling **(NFV-IFA015/016/017)**

3) Additional operational features

NFV-MANO management (<u>NFV-IFA021/031</u>, **)

Metrics and Performance **(NFV-IFA027, NFV-TST008)**

framework, evolved with...Rel. 2: base operational and automation

Security management (NFV-IFA026)

1) Advances in virtualization

2) Support for future network technologies

<u>NFV software update and upgrade</u> (<u>NFV-REL006</u>, **)

Multi administrative NFV-MANO (NFV-IFA028/<u>030</u>, **)

Cloud-native VNF (NFV-EVE011)

<u>Policy management framework</u> (<u>NFV-IFA023</u>, **)

PaaS support for cloud-native, and containers (NFV-IFA029)

NFVI aspects: Hardware environment (<u>NFV-EVE007</u>)

<u>Network Slicing to NFV concepts</u> (<u>NFV-EVE012/NFV-REL010</u>, **)

<u>VNF snapshotting</u> (<u>NFV-TST005</u>, **)

Connectivity for multi-site (<u>NFV-IFA022/032</u>, **)

Charging, billing and accounting (<u>NFV-EVE008</u>)

Hypervisor (<u>NFV-EVE001</u>)

Acceleration (<u>NFV-IFA018/IFA019</u>, **)

MEC in NFV (**)

NFV licensing (<u>NFV-EVE010</u>)

Service availability (**)

<u>Host reservation</u> (**)

24

Release 3:
stage 2 published documents (for reference)

Status as of Dec. 2020

ID	Title
Functional requirements	
ETSI GS NFV-IFA 010 v3.4.1	MANO; Functional requirements specification
NFV-MANO reference points and interfaces	
ETSI GS NFV-IFA 005 v3.4.1	MANO; Or-Vi reference point - Interface and Information Model Specification
ETSI GS NFV-IFA 006 v3.4.1	MANO; Vi-Vnfm reference point - Interface and Information Model Specification
ETSI GS NFV-IFA 007 v3.4.1	MANO; Or-Vnfm reference point - Interface and Information Model Specification
ETSI GS NFV-IFA 008 v3.4.1	MANO; Ve-Vnfm reference point - Interface and Information Model Specification
ETSI GS NFV-IFA 013 v3.4.1	MANO; Os-Ma-Nfvo reference point - Interface and Information Model Specification
ETSI GS NFV-IFA 030 v3.4.1	MANO; Multiple Administrative Domain Aspect Interfaces
ETSI GS NFV-IFA 032 v3.4.1	MANO; Interface and Information Model Specification for Multi-Site Connectivity Services
Descriptors and artefacts	
ETSI GS NFV-IFA 011 v3.4.1	MANO; VNF Descriptor and Packaging Specification
ETSI GS NFV-IFA 014 v3.4.1	MANO; Network Service Templates Specification

Release 3:
stage 2 published documents (for reference)

Status as of Dec. 2020

ID	Title
Acceleration (with interfaces), virtualization technologies and NFVI	
ETSI GS NFV-EVE 001 v3.1.1	Virtualisation Technologies; Hypervisor Domain Requirements specification
ETSI GS NFV-EVE 007 v3.1.2	NFV Evolution and Ecosystem, Hardware Interoperability Requirements Specification
ETSI GS NFV-IFA 018 v3.1.1	Acceleration Technologies; Network Acceleration Interface Specification
ETSI GS NFV-IFA 019 v3.1.1	Acceleration Technologies; Acceleration Resource Management Interface Specification
Information modeling	
ETSI GR NFV-IFA 015 v3.4.1	MANO; Report on NFV Information Model
ETSI GR NFV-IFA 016 v3.4.1	IM; Papyrus Guidelines
ETSI GR NFV-IFA 017 v3.4.1	IM; UML Modeling Guidelines
ETSI GR NFV-IFA 024 v3.2.1	IM; Report on External Touchpoints related to NFV Information Model
Metrics, measurements	
ETSI GS NFV-TST 008 v3.3.1	Testing; NFVI Compute and Network Metrics Specification
NFV-MANO management	
ETSI GS NFV-IFA 031 v3.4.1	Management and Orchestration; Requirements and interfaces specification for management of NFV-MANO

Release 3:
stage 3 published documents (for reference)

ID	Title
NFV-MANO APIs	
ETSI GS NFV-SOL 002 v3.3.1	Protocols and Data Models; RESTful protocols specification for the Ve-Vnfm Reference Point
ETSI GS NFV-SOL 003 v3.3.1	Protocols and Data Models; RESTful protocols specification for the Or-Vnfm Reference Point
ETSI GS NFV-SOL 005 v3.3.1	Protocols and Data Models; RESTful protocols specifications for the Os-Ma-nfvo Reference Point
ETSI GS NFV-SOL 011 v3.3.1	Protocols and Data Models; RESTful protocols specification for the Or-Or Reference Point
ETSI GS NFV-SOL 012 v3.4.1	Protocols and Data Models; RESTful protocols specification for the Policy Management Interface
ETSI GS NFV-SOL 013 v3.3.1	Protocols and Data Models; Specification of common aspects of RESTful NFV-MANO APIs
NFV-MANO management APIs	
ETSI GS NFV-SOL 009 v3.3.1	Protocols and Data Models; RESTful protocols specification for the management of NFV-MANO
Artifacts	
ETSI GS NFV-SOL 001 v3.3.1	Protocols and Data Models; NFV descriptors based on TOSCA specification
ETSI GS NFV-SOL 004 v3.3.1	Protocols and Data Models; VNF Package and PNFD Archive specification
ETSI GS NFV-SOL 006 v3.3.1	Protocols and Data Models; NFV descriptors based on YANG specification
ETSI GS NFV-SOL 007 v3.3.1	Protocols and Data Models; Network Service Descriptor File Structure Specification
ETSI GS NFV-SOL 010 v3.3.1	Protocols and Data Models; VNF Snapshot Package specification

Release 3:
other areas, published documents (for reference)

ID	Title
Testing	
ETSI GR NFV-TST 009 v3.3.1	Testing; Specification of Networking Benchmarks and Measurements
Security	
ETSI GS NFV-IFA 026 v3.4.1	MANO; Architecture enhancement for Security Management Specification
ETSI GS NFV-SEC 012 v3.1.1	Security; system architecture specification for execution of sensitive components
ETSI GS NFV-SEC 013 v3.1.1	Security; Security Management and Monitoring specification
ETSI GS NFV-SEC 014 v3.1.1	NFV Security; Security Specification for MANO Components and Reference Points
Reliability	
ETSI GS NFV-REL 006 v3.1.1	Reliability; Maintaining Service Availability and Continuity Upon Software Modification
Other non-functional requirements	
ETSI GS NFV-EVE 011 v3.1.1	Virtualised Network Function; Specification of the Classification of Cloud Native VNF implementations

Release 3:
published reports (for reference)

ID	Title
Reports	
ETSI GR NFV-EVE 012 v3.1.1	Evolution and Ecosystem; Report on Network Slicing Support with ETSI NFV Architecture Framework
ETSI GR NFV-IFA 021 v3.1.1	MANO; Report on management of NFV-MANO and automated deployment of EM and other OSS functions
ETSI GR NFV-IFA 022 v3.1.1	MANO; Report on Management and Connectivity for Multi-Site Services
ETSI GR NFV-IFA 023 v3.1.1	MANO; Report on Policy Management in MANO
ETSI GR NFV-IFA 028 v3.1.1	MANO; Report on architecture options to support multiple administrative domains
ETSI GR NFV-IFA 029 v3.3.1	Architecture; Report on the Enhancements of the NFV architecture towards "Cloud-native" and "PaaS"
ETSI GR NFV-REL 010 v3.1.1	Reliability; Report on NFV Resiliency for the Support of Network Slicing
ETSI GR NFV-TST 005 v3.1.1	Continuous Development and Integration; Report on use cases and recommendations for VNF Snapshot

Release 4:
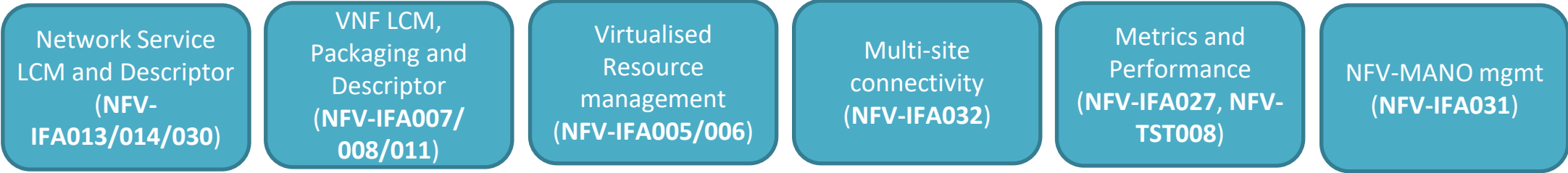## work items and features: studies and stage 1&2 perspective

Completed: <u>underlined</u>
Ongoing/not fully completed: *italics*
Evolved: in **bold**

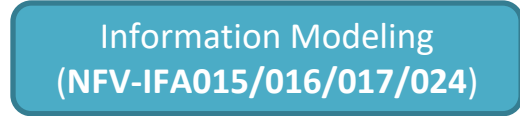(**): other normative work is part of evolved work items

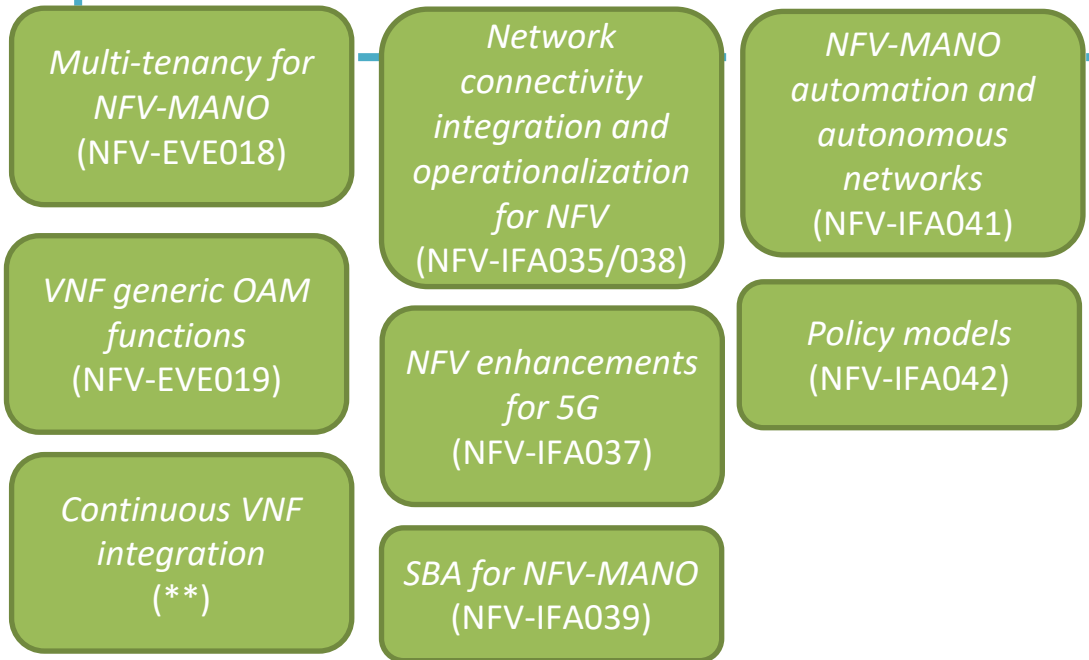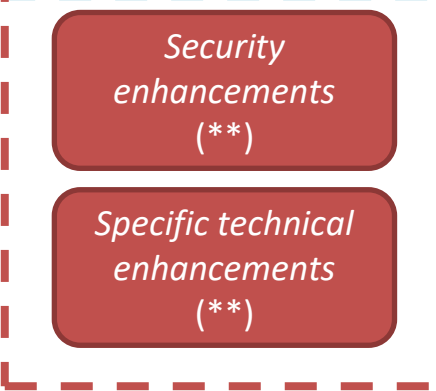**NOTE:** might not be a full complete list due to lack of space

ETSI

Network Service LCM and Descriptor (**NFV-IFA013/014/030**)

VNF LCM, Packaging and Descriptor (**NFV-IFA007/008/011**)

Virtualised Resource management (**NFV-IFA005/006**)

Multi-site connectivity (**NFV-IFA032**)

Metrics and Performance (**NFV-IFA027, NFV-TST008**)

NFV-MANO mgmt (**NFV-IFA031**)

Information Modeling (**NFV-IFA015/016/017/024**)

1) Framework from past releases

2) New features

Multi-tenancy for NFV-MANO (NFV-EVE018)

Network connectivity integration and operationalization for NFV (NFV-IFA035/038)

NFV-MANO automation and autonomous networks (NFV-IFA041)

VNF generic OAM functions (NFV-EVE019)

NFV enhancements for 5G (NFV-IFA037)

Policy models (NFV-IFA042)

Continuous VNF integration (**))

SBA for NFV-MANO (NFV-IFA039)

3) Technical enhancements

Security enhancements (**)

Specific technical enhancements (**)

4) Carried-over from Rel. 3
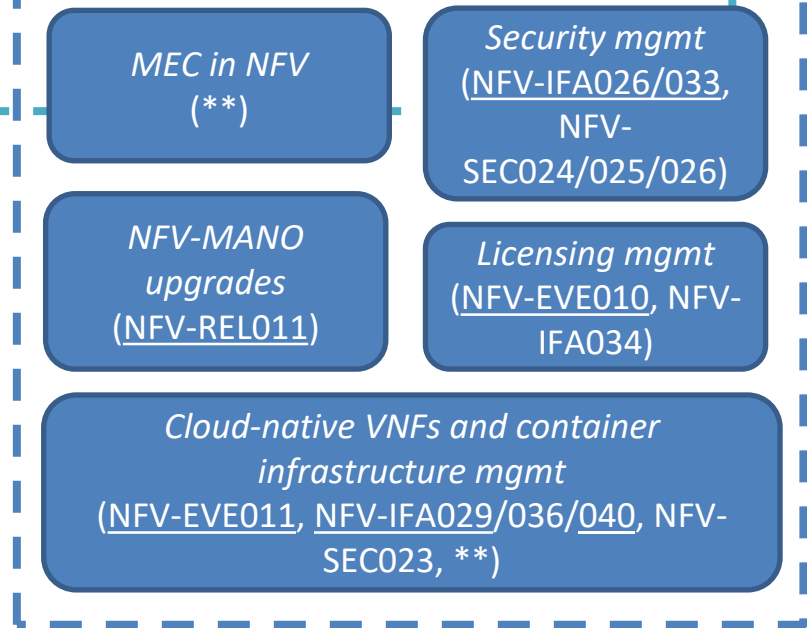
MEC in NFV (**)

Security mgmt (<u>NFV-IFA026/033</u>, NFV-SEC024/025/026)

NFV-MANO upgrades (<u>NFV-REL011</u>)

Licensing mgmt (<u>NFV-EVE010</u>, NFV-IFA034)

Cloud-native VNFs and container infrastructure mgmt (<u>NFV-EVE011</u>, <u>NFV-IFA029</u>/036/<u>040</u>, NFV-SEC023, **)

30

Release 4:
ongoing work items for new documents

Id	Title	Type	Feature mapping
DGR/NFV-EVE018	Evolution and Ecosystem; Report on Multi-tenancy in NFV	GR	Multi-tenancy enhancements for NFV-MANO (M-Tenant, FEAT22)
DGR/NFV-EVE019	Architectural Framework; Report on VNF generic OAM functions	GR	VNF common management functions (VNF-OAM, FEAT24)
DGR/NFV-IFA034	Management and Orchestration; Report on Architectural enhancement for VNF License Management support and use of VNF licenses	GR	License management (FEAT13 [carried over from Rel. 3])
DGR/NFV-IFA035	Architectural Framework; Report on network connectivity integration and operationalization for NFV	GR	Network connectivity integration and operationalization for NFV (NFV-Connect, FEAT19)
DGS/NFV-IFA036	Management and Orchestration; Specification of requirements for the management and orchestration of container cluster nodes	GS	Cloud native VNFs and container infrastructure management (FEAT17 [carried over from Rel. 3])

Release 4:
ongoing work items for new documents

Id	Title	Type	Feature mapping
DGR/NFV-IFA037	Architectural Framework; Report on further NFV support for 5G	GR	NFV enhancements for 5G (5GNFV, FEAT21)
DGR/NFV-IFA038	Architectural Framework; Report on network connectivity for container based VNF	GR	Network connectivity integration and operationalization for NFV (NFV-Connect, FEAT19)
DGR/NFV-IFA039	Architectural Framework; Report on Service Based Architecture (SBA) design	GR	SBA for NFV-MANO (MANO-SBA, FEAT23)
DGS/NFV-IFA040	Management and Orchestration; Requirements for service interfaces and object model for OS container management and orchestration specification	GS	Cloud native VNFs and container infrastructure management (FEAT17 [carried over from Rel. 3])
DGR/NFV-IFA041	Management and Orchestration; Report on enabling autonomous management in NFV-MANO	GR	NFV-MANO automation and autonomous networks (Auto, FEAT20)
DGR/NFV-IFA042	Management and Orchestration; Report on policy information and data models for NFV-MANO	GR	Policy management models (Policy-models, FEAT26)

Release 4:
ongoing work items for new documents

Id	Title	Type	Feature mapping
DGS/NFV-SEC023	Security; Container Security Specification	GS	Cloud native VNFs and container infrastructure management (FEAT17 [carried over from Rel. 3]) Security management (FEAT18)
DGS/NFV-SEC024	Security; Security Management Specification	GS	Security management (FEAT18 [carried over from Rel. 3])
DGS/NFV-SEC025	Security: Secure End-to-End VNF and NS management specification	GS	Security management (FEAT18 [carried over from Rel. 3])
DGS/NFV-SEC026	Security: Isolation and trust domain specification	GS	Security management (FEAT18 [carried over from Rel. 3])

Release 4:
other areas, published documents (for reference)

ID	Title
Testing	
Security	
ETSI GS NFV-IFA 033 v4.1.1	MANO; Or-Vi reference point - Interface and Information Model Specification
Reliability	
Other non-functional requirements	

Release 4:
published reports (for reference)

ID	Title
Reports	
ETSI GR NFV-REL 011 v4.1.1	MANO; Report on NFV-MANO software modification