ETSI ISG NFV: Work Program and Releases Overview

Presented by: XXX, YYY
For: XXX

Last updated: Feb. 14, 2020
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 3: NFV Release 4
- 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,
  - Multi-site,
  - Cloud-native, etc.

**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.

Just started!
ETSI NFV ongoing work

Release 2 maintenance:
- Stage 2 maintenance is frozen after the completion of 1H2019 maintenance. Maintenance ongoing on stage 3.
- Maintenance: fifth round for v2.7.1 versions (1H2019) has been completed. Sixth round for v2.8.1 (1H2020) is ongoing.

Release 3 features work:
- Stage 2 is completed after delivering 1H2019 specifications (drop #3).
  - 10 new features completed at stage 2 level from 1H2018 (aka drop #1), 2H2018 (aka drop #2), and 1H2019 (aka drop #3).
- Normative work in stage 3 is ongoing considering all completed stage 2.

Release 4 work:
- Few informative work items started in May 2019.
- Additional work items (including normative) started at NFV#27 (Sep. 2019).
Part 2: NFV Release 2
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/ReleaseDocumentation/NFV(19)000114r1_NFV_Release_2_Description_v1_9_0.pdf
Release 2: protocols and data model standardization

The content of the NFV-SOL APIs is based on the related NFV-IFA and NFV-SEC specifications. The NFV-SOL specifications are implementable representations of the design defined in the stage 2 specifications, not alternative solutions.

**Stage 2:** Requirements and information model
- NFV-IFA 007 (Or-Vnfm)
- NFV-IFA 008 (Ve-Vnfm)
- NFV-IFA 013 (Os-Ma-nfvo)
- NFV-IFA 011 (VNF Package, VNFD)
- NFV-IFA 014 (NSD and PNFD)
- NFV-IFA 010 (NFV-MANO functional requirements)

**Security:** requirements and IM
- NFV-SEC 021 (VNF package security)
- NFV-SEC 022 (API access token)

**Stage 3:** Protocols and data model
- NFV-SOL 015 (NFV-MANO SOL API conventions and guidelines)
- NFV-SOL 003 (Or-Vnfm)
- NFV-SOL 002 (Ve-Vnfm)
- NFV-SOL 005 (Os-Ma-nfvo)
- NFV-SOL 013 (Common API aspects)
- NFV-SOL 004 (VNF Packaging and PNF archive)
- NFV-SOL 001 (TOSCA VNFD, NSD)
- NFV-SOL 006 (YANG VNFD, NSD)
- NFV-SOL 007 (NSD file structure)
- NFV-SOL 014 (Virtualised resource descriptors) (in draft)
- NFV-SOL 016 (NFV-MANO procedures) (in draft)

Mapping information model to data model

Defining protocol machinery for the operations specified in stage 2

Closing gaps left open in stage 2 (e.g. error handling, technical details)

**Testing:** Benchmarking, interop, conformance
- NFV-TST 007 (testing guidelines)
- NFV-TST 010 (API conformance)

OpenAPI descriptions for all APIs specified in GS NFV-SOL 002/003/005 (v2.6.1)

GS NFV-SOL 001/006 supporting files on ETSI Forge:

Latest published versions: NFV-SOL001/002/003/004/005/006/007/013 v2.7.1 (Jan. 2020)
Release 2: maintenance work

5 rounds completed (1H2017, published as v2.3.1; 2H2017, published as v2.4.1; 1H2018, published as v2.5.1, 2H2018 published as v2.6.1, and 2H2018 published as v2.7.1).

6th round, 1H2020 maintenance is ongoing (targeting publication of affected specifications as v2.8.1).

- With a deep focus on stage 3 specifications (NFV-SOL specs). Additional stage 2 specification on security has been considered for maintenance as well.

Main aspects addressed (so far) as part of maintenance:

- Correction of bugs and feedback from deployments and development: remove ambiguities, enhance APIs, etc.
- Alignment in between Stage 2 and 3 specifications.
- Security enhancements related to interfaces, descriptors and other artefacts.
- Extending constructs of VNF packaging for archiving files and artifacts of PNF.
- 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.
Part 3: NFV Release 3
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

Evolution of networking and cloud technologies
Advances in virtualization
Support for future and next generation networks
NS, VNF and VR operational framework
Additional operational features
Operational aspects
Release 3: specification status

Stage 1 and 2:

- **Stage 1 and 2 work** has been completed, but some candidate features were closed or carried over to Release 4.
- **Maintenance is ongoing**: 1st round started 2H2019 (targeting publication as v3.4.1).

Stage 3:

- **Stage 3 work** is progressing to specify the set of stage 2 completed features.
- **ETSI GS NFV-SOL 009 v3.3.1 and GS NFV-SOL 011 v3.3.1**: First specifications as part of Release 3 have been completed and published.
- **Other new NFV-SOL specification drafts** related to Release 3 features are in progress (e.g., SOL010 and SOL012).
- **Completion of first versions of evolved (from Rel. 2) SOL specs** is planned also for the beginning of 2020. A “dropping” of stage 3 work will also be performed.
Release 3: stage 1&2 completed features

Completed in 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 (drop #1) → v3.1.1
• Drop 2H2018 (drop #2) → v3.2.1
• Drop 1H2019 (drop #3) → v3.3.1

Completed in 2H2018 (aka drop #2)

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

Completed in 1H2019 (aka drop #3)

✔ NFVI software modification
✔ Service Availability Level (SAL)
Part 4: NFV Release 4
Release 4: feature-based specification

14 candidate features, including technical and security enhancements (following slides).

Approach:

✔ Main activity is now on informative work (studies).

✔ Release 4 specification progress and plans are publicly available on the NFV Public Wiki.
Release 4: overview

Strawman of the Release 4 Definition:

“Release 4 Definition”, to be made available soon, will document the candidate features for Release 4.

4 main technical areas and 14 features

- 7 new features, 5 carried-over from Release 3, and 2 enhancement features comprising “specific technical enhancements” and security aspects.

**Technical areas**

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

Features in the Release 4 definition

<table>
<thead>
<tr>
<th>New features</th>
<th>Enhancement features</th>
<th>Carried over from Rel. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Network connectivity integration and operationalization</td>
<td>- NFV security hardening</td>
<td>- NFV-MANO upgrade</td>
</tr>
<tr>
<td>- Multi-tenancy enhancements for NFV-MANO</td>
<td>- Specific technical enhancements</td>
<td>- MEC in NFV</td>
</tr>
<tr>
<td>- NFV-MANO automation and autonomous networks</td>
<td>- NFV enhancements for 5G</td>
<td>- Licensing management</td>
</tr>
<tr>
<td>- SBA for NFV-MANO</td>
<td>- VNF generic management functions</td>
<td>- Cloud-native VNFs and Container Infrastructure management</td>
</tr>
<tr>
<td>- NFV enhancements for 5G</td>
<td>- Continuous VNF integration</td>
<td>- Security management</td>
</tr>
</tbody>
</table>
Release 4:
work items and features: studies and stage 1&2 perspective

1) Framework from past releases

- 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)

2) New features

- Multi-tenancy for NFV-MANO (NFV-EVE018)
- VNF generic OAM functions (NFV-EVE019)
- Continuous VNF integration ()
- Network connectivity integration and operationalization for NFV (NFV-IFA035/038)
- NFV-MANO automation and autonomous networks (NFV-IFA041)
- NFV enhancements for 5G (NFV-IFA037)
- 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 (NFV-IFA026/033, NFV-SEC024)
- NFV-MANO upgrades (NFV-REL011)
- Licensing mgmt (NFV-EVE010, NFV-IFA034)
- Cloud-native VNFs and container infrastructure mgmt (NFV-EVE011, NFV-IFA029/036/040, NFV-SEC023, **)

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

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

Status as of Jan. 2020
# Release 4: ongoing work items for new documents

Status as of Jan. 2020

<table>
<thead>
<tr>
<th>Id</th>
<th>Title</th>
<th>Type</th>
<th>Feature mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>DGR/NFV-EVE018</td>
<td>Evolution and Ecosystem; Report on Multi-tenancy in NFV</td>
<td>GR</td>
<td>Multi-tenancy enhancements for NFV-MANO (M-Tenant, FEAT22)</td>
</tr>
<tr>
<td>DGR/NFV-EVE019</td>
<td>Architectural Framework; Report on VNF generic OAM functions</td>
<td>GR</td>
<td>VNF common management functions (VNF-OAM, FEAT24)</td>
</tr>
<tr>
<td>DGR/NFV-IFA034</td>
<td>Management and Orchestration; Report on Architectural enhancement for VNF License Management support and use of VNF licenses</td>
<td>GR</td>
<td>License management (FEAT13 [carried over from Rel. 3])</td>
</tr>
<tr>
<td>DGR/NFV-IFA035</td>
<td>Architectural Framework; Report on network connectivity integration and operationalization for NFV</td>
<td>GR</td>
<td>Network connectivity integration and operationalization for NFV (NFV-Connect, FEAT19)</td>
</tr>
<tr>
<td>DGS/NFV-IFA036</td>
<td>Management and Orchestration; Specification of requirements for the management and orchestration of container cluster nodes</td>
<td>GS</td>
<td>Cloud native VNFs and container infrastructure management (FEAT17 [carried over from Rel. 3])</td>
</tr>
<tr>
<td>DGR/NFV-IFA037</td>
<td>Architectural Framework; Report on further NFV support for 5G</td>
<td>GR</td>
<td>NFV enhancements for 5G (5GNFV, FEAT21)</td>
</tr>
</tbody>
</table>
Release 4: ongoing work items for new documents

<table>
<thead>
<tr>
<th>Id</th>
<th>Title</th>
<th>Type</th>
<th>Feature mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>DGR/NFV-IFA038</td>
<td>Architectural Framework; Report on network connectivity for container based VNF</td>
<td>GR</td>
<td>Network connectivity integration and operationalization for NFV (NFV-Connect, FEAT19)</td>
</tr>
<tr>
<td>DGR/NFV-IFA039</td>
<td>Architectural Framework; Report on Service Based Architecture (SBA) design</td>
<td>GR</td>
<td>SBA for NFV-MANO (MANO-SBA, FEAT23)</td>
</tr>
<tr>
<td>DGS/NFV-IFA040</td>
<td>Management and Orchestration; Requirements for service interfaces for OS container management and orchestration</td>
<td>GS</td>
<td>Cloud native VNFs and container infrastructure management (FEAT17 [carried over from Rel. 3])</td>
</tr>
<tr>
<td>DGR/NFV-IFA041</td>
<td>Management and Orchestration; Report on enabling autonomous management in NFV-MANO</td>
<td>GR</td>
<td>NFV-MANO automation and autonomous networks (Auto, FEAT20)</td>
</tr>
<tr>
<td>DGR/NFV-REL011</td>
<td>Management and Orchestration; Report on NFV-MANO software modification</td>
<td>GR</td>
<td>NFV-MANO upgrades (FEAT01 [carried over from Rel. 3])</td>
</tr>
<tr>
<td>DGS/NFV-SEC023</td>
<td>Security; Container Security Specification</td>
<td>GS</td>
<td>Cloud native VNFs and container infrastructure management (FEAT17 [carried over from Rel. 3]) Security management (FEAT18)</td>
</tr>
<tr>
<td>DGS/NFV-SEC024</td>
<td>Security; Security Management Specification</td>
<td>GS</td>
<td>Security management (FEAT18 [carried over from Rel. 3])</td>
</tr>
</tbody>
</table>

Status as of Jan. 2020
Conclusion
Conclusion

Release 2 documentation is almost fully complete.

✓ Only few stage 3 and testing specifications are remaining.
✓ Maintenance has been performed since 2017. Maintenance will be frozen soon (mid-2020).

Release 3 specification work is progressing.

✓ A pipeline of features has been delivered every 6 months. 10 new features had been completed since summer 2019.
✓ Focus is now on stage 3 normative specification work. Work will continue through 2020.

Release 4 just started.

✓ With 2 new normative work items on container-based deployments, 9 new informative work items on various technical areas, and 2 normative work items on security aspects.
✓ Scope: 7 new features, 2 enhancement features on specific technical enhancements and security, and 5 features carried over from Release 3 are considered.
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
Backup slides

Release 2 specification summary
Release 2: specification summary

Published documents


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

Active work items

Currently, 3 ongoing unpublished active WI:

- 2 Stage 3 GS drafts (NFV-SOL014/016).
- 1 GS draft on conformance testing (NFV-TST010).

5 rounds of maintenance have been completed (1H2017, 2H2017, 1H2018, 2H2018, and 1H2019) and one additional round is ongoing (1H2020):

- Versioning: 1st round: v2.3.1; 2nd round: v2.4.1; 3rd round: v2.5.1 (some specs without maintenance remain in v2.4.1); 4th round: v2.6.1 (some specs w/o maintenance remain in v2.4.1 or v2.5.1); and 5th round: v2.7.1.

Refer to regular updates of the Release 2 Description (latest version v1.9.0, Sep. 2019).
Release 2: specification summary

- 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)
- NFV-SOL005
- NFV-IFA 008
- NFV-SOL 002
- NFV-IFA 013
- NFV-SOL005
- NFV-IFA 002 (Acceleration)
- NFV-IFA 003 (Acceleration)
- NFV-IFA 010 (NFV-MANO Functional Reqs)
- NFV-IFA 027 (Performance metrics)
- SOL004 (NSD file structure)
- NFV-IFA 011 (VNF and VNFD)
- NFV-IFA 014 (NS templates)
- NFV-SOL007
- NFV-SOL 001 (VNF and NS Descriptors)
- NFV-SOL 006 (VNFD and VNF Pkg)
- NFV-TST 007 (NFV-MANO interop guidelines)
- NFV-TST 010 (API conformance)
- NFV-IFA 006
- NFV-IFA 007
- NFV-SOL 003
- NFV-IFA 004 (Performance metrics)
- NFV-IFA 005 (VR mgmt descriptor)
- NFV-IFA 027
- NFV-IFA 001 (VNF Package security)
- NFV-SEC 021 (API NFV Access Token)
- NFV-SEC 022 (API NFV Access Token)

Published! Stage 3

Status as of Jan. 2020

© ETSI 2020
Release 2: 
stage 2 published documents (for reference) 

<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional requirements</td>
<td></td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 010 v2.7.1</td>
<td>MANO; Functional requirements specification</td>
</tr>
<tr>
<td>Acceleration (with interfaces)</td>
<td></td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 002 v2.4.1</td>
<td>Acceleration Technologies; VNF Interfaces Specification</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 003 v2.4.1</td>
<td>Acceleration Technologies; vSwitch Benchmarking and Acceleration Specification</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 004 v2.4.1</td>
<td>Acceleration Technologies; Management aspects Specification</td>
</tr>
<tr>
<td>NFV-MANO reference points and interfaces</td>
<td></td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 005 v2.7.1</td>
<td>MANO; Or-Vi reference point - Interface and Information Model Specification</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 006 v2.7.1</td>
<td>MANO; Vi-Vnfm reference point - Interface and Information Model Specification</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 007 v2.7.1</td>
<td>MANO; Or-Vnfm reference point - Interface and Information Model Specification</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 008 v2.7.1</td>
<td>MANO; Ve-Vnfm reference point - Interface and Information Model Specification</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 013 v2.7.1</td>
<td>MANO; Os-Ma-Nfvo reference point - Interface and Information Model Specification</td>
</tr>
</tbody>
</table>

Status as of Jan. 2020
# Release 2: stage 2 published documents (for reference)

<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Descriptors and artefacts</strong></td>
<td></td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 011 v2.7.1</td>
<td>MANO; VNF Descriptor and Packaging Specification</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 014 v2.7.1</td>
<td>MANO; Network Service Templates Specification</td>
</tr>
<tr>
<td><strong>Information modeling</strong></td>
<td></td>
</tr>
<tr>
<td>ETSI GR NFV-IFA 015 v2.5.1</td>
<td>MANO; Report on NFV Information Model</td>
</tr>
<tr>
<td>ETSI GR NFV-IFA 016 v2.5.1</td>
<td>IM; Papyrus Guidelines</td>
</tr>
<tr>
<td>ETSI GR NFV-IFA 017 v2.5.1</td>
<td>IM; UML Modeling Guidelines</td>
</tr>
<tr>
<td>ETSI GR NFV-IFA 024 v2.1.1</td>
<td>IM; Report on External Touchpoints related to NFV Information Model</td>
</tr>
<tr>
<td><strong>Metrics, measurements</strong></td>
<td></td>
</tr>
<tr>
<td>ETSI GS NFV-TST 008 v2.5.1</td>
<td>Testing; NFVI Compute and Network Metrics Specification</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 027 v2.4.1</td>
<td>MANO; Performance Measurements Specification</td>
</tr>
</tbody>
</table>

Status as of Jan. 2020
Release 2:
stage 3 published documents (for reference)

<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NFV-MANO APIs</strong></td>
<td></td>
</tr>
<tr>
<td>ETSI GS NFV-SOL 002 v2.7.1</td>
<td>Protocols and Data Models; RESTful protocols specification for the Ve-Vnfm Reference Point</td>
</tr>
<tr>
<td>ETSI GS NFV-SOL 003 v2.7.1</td>
<td>Protocols and Data Models; RESTful protocols specification for the Or-Vnfm Reference Point</td>
</tr>
<tr>
<td>ETSI GS NFV-SOL 005 v2.7.1</td>
<td>Protocols and Data Models; RESTful protocols specifications for the Os-Ma-nfvo Reference Point</td>
</tr>
<tr>
<td>ETSI GS NFV-SOL 013 v2.7.1</td>
<td>Protocols and Data Models; Specification of common aspects of RESTful NFV-MANO APIs</td>
</tr>
<tr>
<td><strong>Artefacts</strong></td>
<td></td>
</tr>
<tr>
<td>ETSI GS NFV-SOL 001 v2.7.1</td>
<td>Protocols and Data Models; NFV descriptors based on TOSCA specification</td>
</tr>
<tr>
<td>ETSI GS NFV-SOL 004 v2.7.1</td>
<td>Protocols and Data Models; VNF Package specification</td>
</tr>
<tr>
<td>ETSI GS NFV-SOL 006 v2.7.1</td>
<td>Protocols and Data Models; NFV descriptors based on YANG specification</td>
</tr>
<tr>
<td>ETSI GS NFV-SOL 007 v2.7.1</td>
<td>Protocols and Data Models; Network Service Descriptor File Structure Specification</td>
</tr>
</tbody>
</table>
## Release 2:
other published documents (for reference)

<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing</td>
<td></td>
</tr>
<tr>
<td>ETSI GR NFV-TST 007 v2.5.1</td>
<td>Testing; Guidelines on Interoperability Testing for MANO</td>
</tr>
<tr>
<td>Security</td>
<td></td>
</tr>
<tr>
<td>ETSI GS NFV-SEC 021 v2.6.1</td>
<td>Security; VNF Package Security Specification</td>
</tr>
<tr>
<td>ETSI GS NFV-SEC 022 v2.7.1</td>
<td>Security; Access Token Specification for API Access</td>
</tr>
</tbody>
</table>
Release 2: maintenance work (1/2)

5 rounds completed (1H2017, published as v2.3.1; 2H2017, published as v2.4.1; 1H2018, published as v2.5.1, 2H2018 published as v2.6.1, and 2H2018 published as v2.7.1).

6th round, 1H2020 maintenance is ongoing (targeting publication of affected specifications as v2.8.1).

- With a deep focus on stage 3 specifications (NFV-SOL specs). Additional stage 2 specifications on security have been considered for maintenance as well.

Main aspects addressed (so far) as part of maintenance:

- Correction of bugs and feedback from deployments and development: remove ambiguities, enhance APIs, etc.
- Alignment in between Stage 2 and 3 specifications.
- Security enhancements related to interfaces, descriptors and other artifacts.
- 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.
- Adding support for flexible upload of VNF package’s software images.
- Adding support for security groups, trunking, etc.
Release 3: feature-based specification

- Following a feature-based specification approach.
- 18+ candidate features (see backup slides).
- "stage 2 level" specification has been completed, and now developing "stage 3 level" work.

Release specification progress and plans are publicly available on the [NFV Public Wiki](https://www.nfv-etsi.org). List of candidate features is available in the Release 3 Definition (latest v0.14.0 Sep. 2019). List of completed features is available in the Release 3 Description (latest v0.4.0 Dec. 2019). See also backup slides.

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

2) Stage 2 level specification was completed in 1H2019.

3) Stage 3 work undergoing in 2019 and first half of 2020.

4) Other activities needed after specification outcomes, e.g., testing, plugtests, etc.
Release 3: specification summary

Published documents


- 4 Stage 1/2 GS (NFV-EVE001/007/011, NFV-REL006).
- 5 Stage 2 GS (NFV-IFA018/019/030/031/032).
- Stage 2 evolved from Release 2: 9 GS (NFV-IFA005/006/007/008/010/011/013/014 and NFV-TST008) and 4 GR (NFV-IFA015/016/017/024).
- 2 new Stage 3: 2 GS (NFV-SOL009/011).
- 4 GS on security (NFV-IFA026, NFV-SEC012, NFV-SEC013, NFV-SEC014).
- 11 GR (NFV-EVE008/010/012, NFV-IFA012/021/022/023/028/029, NFV-TST005, NFV-REL010).
- 1 GS on testing/benchmarking (NFV-TST009).

Refer to regular updates of the Release 3 Description (latest version is v0.4.0, Dec. 2019).

Active work items

Release 3, ongoing unpublished work items (refer to Release 3 Definition): 14 WI.

- 1 Stage 2 GS draft (NFV-IFA033).
- 1 GS drafts on security (NFV-SEC020).
- Evolved Rel. 2 deliverables from stage 2 and 3, and testing: 9 GS (NFV-SOL001/002/003/004/005/006/007/013 and NFV-TST010).
- 2 GS drafts on newly stage 3 (NFV-SOL010/012).
- 1 GR draft on newly stage 3 (NFV-SOL017).

Release 3, ongoing “maintenance work”: 19 WI.

- Propagated/evolved Rel. 2 deliverable drafts: 10 Stage 2 GS (NFV-IFA005/006/007/008/010/011/013/014/027, NFV-TST008), and 3 GR (NFV-IFA015/016/017).
- Newly added by Release 3: 4 Stage 2 GS (NFV-IFA026/030/031/032), 1 testing GS (NFV-TST009), and 1 security (NFV-SEC014).
Release 3: work items and features from stage 1&2 perspective

1) Advances in virtualization

- Cloud-native VNF (NFV-EVE011)
- PaaS support for cloud-native, and containers (NFV-IFA029)
- Hypervisor (NFV-EVE001)

2) Support for future network technologies

- VNF LCM, Packaging and Descriptor (NFV-IFA007/008/011)
- Virtualised Resource management (NFV-IFA005/006)
- Information Modeling (NFV-IFA015/016/017)
- Network Slicing to NFV concepts (NEV-EVE012/NFV-REL010, **)

3) Additional operational features

- NFV-MANO management (NFV-IFA021/031, **)
- Security management (NFV-IFA026/033)
- Policy management framework (NFV-IFA023, **)
- VNF snapshotting (NFV-TST005, **)
- Charging, billing and accounting (NFV-EVE008, **)
- NFV licensing (NFV-EVE010, NFV-IFA034, **)

NOTE: might not be a full complete list due to lack of space
# Release 3: stage 2 published documents (for reference)

<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional requirements</td>
<td>MANO; Functional requirements specification</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 010 v3.3.1</td>
<td>MANO; Functional requirements specification</td>
</tr>
<tr>
<td>NFV-MANO reference points and interfaces</td>
<td></td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 005 v3.3.1</td>
<td>MANO; Or-Vi reference point - Interface and Information Model Specification</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 006 v3.3.1</td>
<td>MANO; Vi-Vnfm reference point - Interface and Information Model Specification</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 007 v3.3.1</td>
<td>MANO; Or-Vnfm reference point - Interface and Information Model Specification</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 008 v3.3.1</td>
<td>MANO; Ve-Vnfm reference point - Interface and Information Model Specification</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 013 v3.3.1</td>
<td>MANO; Os-Ma-Nfvo reference point - Interface and Information Model Specification</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 030 v3.3.1</td>
<td>MANO; Multiple Administrative Domain Aspect Interfaces</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 032 v3.3.1</td>
<td>MANO; Interface and Information Model Specification for Multi-Site Connectivity Services</td>
</tr>
<tr>
<td>Descriptors and artefacts</td>
<td></td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 011 v3.3.1</td>
<td>MANO; VNF Descriptor and Packaging Specification</td>
</tr>
<tr>
<td>ETSI GS NFV-IFA 014 v3.3.1</td>
<td>MANO; Network Service Templates Specification</td>
</tr>
</tbody>
</table>
# Release 3:
stage 2 published documents (for reference)

<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acceleration (with interfaces), virtualization technologies and NFVI</strong></td>
<td></td>
</tr>
<tr>
<td>ETSI GS NF-V-EVE 001 v3.1.1</td>
<td>Virtualisation Technologies; Hypervisor Domain Requirements specification</td>
</tr>
<tr>
<td>ETSI GS NF-V-EVE 007 v3.1.2</td>
<td>NFV Evolution and Ecosystem, Hardware Interoperability Requirements Specification</td>
</tr>
<tr>
<td>ETSI GS NF-V-IFA 018 v3.1.1</td>
<td>Acceleration Technologies; Network Acceleration Interface Specification</td>
</tr>
<tr>
<td>ETSI GS NF-V-IFA 019 v3.1.1</td>
<td>Acceleration Technologies; Acceleration Resource Management Interface Specification</td>
</tr>
<tr>
<td><strong>Information modeling</strong></td>
<td></td>
</tr>
<tr>
<td>ETSI GR NF-V-IFA 015 v3.1.1</td>
<td>MANO; Report on NFV Information Model</td>
</tr>
<tr>
<td>ETSI GR NF-V-IFA 016 v3.1.1</td>
<td>IM; Papyrus Guidelines</td>
</tr>
<tr>
<td>ETSI GR NF-V-IFA 017 v3.1.1</td>
<td>IM; UML Modeling Guidelines</td>
</tr>
<tr>
<td>ETSI GR NF-V-IFA 024 v3.2.1</td>
<td>IM; Report on External Touchpoints related to NFV Information Model</td>
</tr>
<tr>
<td><strong>Metrics, measurements</strong></td>
<td></td>
</tr>
<tr>
<td>ETSI GS NF-V-TST 008 v3.2.1</td>
<td>Testing; NFVI Compute and Network Metrics Specification</td>
</tr>
<tr>
<td><strong>NFV-MANO management</strong></td>
<td></td>
</tr>
<tr>
<td>ETSI GS NF-V-IFA 031 v3.3.1</td>
<td>Management and Orchestration; Requirements and interfaces specification for management of NFV-MANO</td>
</tr>
</tbody>
</table>
Release 3: other areas, published documents (for reference)

<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing</td>
<td>ETSI GR NFV-TST 009 v3.2.1 Testing; Specification of Networking Benchmarks and Measurements</td>
</tr>
<tr>
<td>Security</td>
<td>ETSI GS NFV-IFA 026 v3.2.1 MANO; Architecture enhancement for Security Management Specification</td>
</tr>
<tr>
<td></td>
<td>ETSI GS NFV-SEC 012 v3.1.1 Security; system architecture specification for execution of sensitive components</td>
</tr>
<tr>
<td></td>
<td>ETSI GS NFV-SEC 013 v3.1.1 Security; Security Management and Monitoring specification</td>
</tr>
<tr>
<td></td>
<td>ETSI GS NFV-SEC 014 v3.1.1 NFV Security; Security Specification for MANO Components and Reference Points</td>
</tr>
<tr>
<td>Reliability</td>
<td>ETSI GS NFV-REL 006 v3.1.1 Reliability; Maintaining Service Availability and Continuity Upon Software Modification</td>
</tr>
<tr>
<td>Other non-functional requirements</td>
<td>ETSI GS NFV-EVE 011 v3.1.1 Virtualised Network Function; Specification of the Classification of Cloud Native VNF implementations</td>
</tr>
</tbody>
</table>
Release 3: stage 3 published documents (for reference)

<table>
<thead>
<tr>
<th>ID</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFV-MANO management APIs</td>
<td>Protocols and Data Models; RESTful protocols specification for the management of NFV-MANO</td>
</tr>
<tr>
<td>ETSI GS NFV-SOL 009 v3.3.1</td>
<td>Protocols and Data Models; RESTful protocols specification for the management of NFV-MANO</td>
</tr>
<tr>
<td>NFV-MANO APIs</td>
<td>Protocols and Data Models; RESTful protocols specification for the Or-Or Reference Point</td>
</tr>
<tr>
<td>ETSI GS NFV-SOL 011 v3.3.1</td>
<td>Protocols and Data Models; RESTful protocols specification for the Or-Or Reference Point</td>
</tr>
</tbody>
</table>
## Release 3: published reports (for reference)

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

Release 3 features
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.

Other information:
✓ Data model (stage 3) work for the VNF Snapshot Packages started (work item DGS/NFV-SOL010).
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).
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*](https://www.etsi.org/deliver/etsi_gs/100000_100099/100000/10000001/01.01.01.05.ps)

**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*.

**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.

**Specification outcomes:**
- Updated NS descriptor in [ETSI GS NFV-IFA 014](https://www.etsi.org/deliver/etsi_gs/030400_030699/030500_030699/030518_601/0001_601/etsi_gs_030518_601v030518p.pdf): 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.

**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 features:
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:
- Proposal to develop Stage 3 related work is planned as a next step.
Release 3 features: Service availability level (SAL)

**Objective:** Enable the NFV system to select the optimal resources to achieve a given level of availability.

**Use cases:**
- During instantiation of a network service, virtualised resources are assigned. Expected service availability level is taken into account for this resource assignment.

**Specification outcomes:**
- Extending functional requirements to support the selection of a service availability level in ETSI GS NFV-IFA 010.
- Include SAL value into VNFD and NS deployment flavour in ETSI GS NFV-IFA 014.

**Other information:**
- The mechanisms how to include SAL value in the selection of the virtualized resource has not been specified in Release 3.
Release 3 features:
NFVI software modification

Objective: Minimize the impact of NFVI operation and maintenance (O&M), e.g. upgrade, on service continuity.

Use cases:
- Allow VNFs to prepare for upcoming impacts due to NFVI O&M on virtualised resources they use.
- See also use cases documented in the published ETSI GS NFV-REL 006 specification.

Specification outcomes:
- Extension of the functional requirements specified in ETSI GS NFV-IFA 010 with support for NFVI O&M constraints and for advanced notification of VNF instances about upcoming impacts.
- Extension of the VNFD and policy management interface specified in ETSI GS NFV-IFA 005/006/008/011 to include NFVI O&M constraints.
- Extension of the fault management/resource change interfaces specified in ETSI GS NFV-IFA 005/006/008 to allow for notifications for upcoming impacts due to NFVI O&M.
Backup slides

Release 4 specification summary
Release 4: specification summary

Published documents

Release 4, published documentation (0): 0 Group Specification (GS) and 0 Group Report (GR).

None at this moment.

Active work items

Release 4, ongoing unpublished work items (refer to Release 4 Definition): 31 WI.

- 9 GR work items (NFV-EVE018/019, NFV-IFA034/035/037/038/039/041, NFV-REL011)
- 3 Stage 2 GS draft (NFV-IFA033/036/040).
- 2 GS drafts on security (NFV-SEC023/SEC024).
- Propagate/evolved Rel. 3 deliverables: 17 WI:
  - 12 Stage 2 GS (NFV-IFA005/006/007/008/010/011/013/014/026/030/031/032),
  - 4 GR (NFV-IFA015/016/017/024), and
  - 1 security GS (NFV-SEC012).

Release 4, ongoing “maintenance work”: 0 WI.

None at this moment.

Refer to Release 4 Definition (to be available soon).