



NFV Release 4 Description

Contents

Foreword.....	4
1 Scope.....	4
2 References.....	4
3 Definitions and abbreviations.....	5
3.1 Definitions.....	5
3.2 Abbreviations.....	5
4 Release overview.....	5
4.1 Introduction.....	5
4.2 Overview.....	5
4.3 Summary of past Releases.....	6
4.4 Specification work state.....	6
5 Release 4 features.....	6
5.1 Overview.....	6
5.2 Functional features.....	7
5.2.1 Cloud-native VNFs and container infrastructure management (CNNFV).....	7
5.2.1.1 Description.....	7
5.2.1.2 Architecture scope.....	7
5.2.1.3 Specification results.....	8
5.2.2 NFV-MANO enhancement with SDN-based networking (ENH02.01).....	8
5.2.2.1 Description.....	8
5.2.2.2 Architecture scope.....	8
5.2.2.3 Specification results.....	8
5.2.3 NFV-MANO enhancement for NS feasibility check (ENH02.02).....	9
5.2.3.1 Description.....	9
5.2.3.2 Architecture scope.....	9
5.2.3.3 Specification results.....	9
5.2.4 Invariant identification of NSD constituents (ENH02.04).....	9
5.2.4.1 Description.....	9
5.2.4.2 Architecture scope.....	9
5.2.4.3 Specification results.....	10
5.2.5 Flexibility with scalable VNF/NS instantiation (ENH02.05).....	10
5.2.5.1 Description.....	10
5.2.5.2 Architecture scope.....	10
5.2.5.3 Specification results.....	10
5.2.6 Data flow mirroring (ENH02.03).....	11
5.2.6.1 Description.....	11
5.2.6.2 Architecture scope.....	11
5.2.6.3 Specification results.....	11
5.3 Security features.....	12
5.3.1 Security management and monitoring for NFV (SECMM).....	12
5.3.1.1 Description.....	12
5.3.1.2 Architecture scope.....	12
5.3.1.3 Specification results.....	12
6 NFV Release 4 published deliverables.....	12
6.1 Introduction.....	12
6.2 Stage 1 and stage 2 Group Specifications.....	12
6.2.1 Newly published Group Specifications.....	12
6.2.2 Evolved/propagated published deliverables from a previous Release.....	13
6.3 Stage 3 Group Specifications.....	14
6.3.1 Newly published Group Specifications.....	14
6.3.2 Evolved/propagated published deliverables from a previous Release.....	14
6.3.3 Stage 3 publication packages.....	14
6.4 Other Group Specifications.....	14
6.4.1 Security specifications.....	14
6.4.2 Testing specifications.....	15

6.5	Newly published Group Reports.....	15
7	NFV Release 4 active Work Items of unpublished deliverables.....	15
7.1	Introduction.....	15
7.2	Work Items producing new specifications or reports	16
7.3	Work Items evolving/propagating Release 3 specifications and reports	16
Annex A: Release definition 18		
A.1	Introduction.....	18
A.2	Release 4 technical areas	18
A.2	Overview	18
A.3	Features carried over from Release 3.....	19
A.3.1	Overview	19
A.3.2	NFV-MANO upgrades (SWUP-MANO, FEAT01).....	19
A.3.3	MEC in NFV (MECinNFV, FEAT12).....	19
A.3.4	Licensing management (LIC, FEAT13).....	20
A.3.5	Cloud-native VNFs and Container Infrastructure management (CNNFV, FEAT17).....	20
A.3.6	Security management (SECMM, FEAT18)	20
A.4	New features	21
A.4.1	Network connectivity integration and operationalization for NFV – container networking (NFV-Connect, FEAT19a)	21
A.4.2	NFV-MANO automation and autonomous networks (Auto, FEAT20)	21
A.4.3	NFV enhancements for 5G (5GNFV, FEAT21)	21
A.4.4	Void.....	21
A.4.5	Void.....	21
A.4.6	VNF generic management functions (VNF-OAM, FEAT24).....	21
A.4.7	Continuous VNF integration (VNF-CI, FEAT25)	21
A.4.8	Policy management models (Policy-model, FEAT26).....	22
A.5	Enhancement features.....	22
A.5.1	Introduction	22
A.5.2	NFV security hardening (enhancements) (ENH01)	22
A.5.3	Specific technical enhancements (ENH02).....	22
Annex B: Versioning of published deliverables23		
B.1	Introduction.....	23
	History	24

Foreword

The present NFV Release 4 Description defines the set of features considered in the development of the NFV Release 4 and describes those that have been specified at least up to the level of requirements, architecture, interfaces and/or information model(s).

NFV Release 4 deliverables are a subset of the whole ETSI ISG NFV's work programme. In addition to the release dependent specifications, the ETSI ISG NFV several other reports and guidelines. All NFV deliverables are available at ETSI's "Search and Browse Standards" tool [1].

NOTE: In case of discrepancies between the contents of the present document and the ETSI NFV Group Specifications/Reports, the latter source of information takes precedence.

1 Scope

The present document describes the NFV Release 4. Firstly, it identifies the informative and normative work that ETSI ISG NFV plans to develop as part of Release 4. Secondly, it documents the content of the Release 4, listing the specified features and the Group Specifications (GS) and Group Reports (GR) that comprise the Release.

The purpose of the Release Description is to also describe the normative work that ETSI ISG NFV has developed as part of Release 4 with the objective to specify a stable and internally aligned set of features.

2 References

For the purposes of the present document, the following references apply:

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

[1] ETSI, "Search and Browse Standards".

NOTE: Available online: <http://www.etsi.org/standards-search>.

[2] ETSI GR NFV 003: "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".

[3] ETSI GS NFV 002: "Network Functions Virtualisation (NFV); Architectural Framework".

[4] ETSI NFV, "NFV Release 2 Description".

NOTE: Available online: <https://docbox.etsi.org/ISG/NFV/Open/Other/ReleaseDocumentation/>

[5] ETSI NFV, "NFV Release 3 Description".

NOTE: Available online: <https://docbox.etsi.org/ISG/NFV/Open/Other/ReleaseDocumentation/>

[6] ETSI NFV, "Feature tracking: ENH01 Security enhancements".

NOTE: Available online: https://nfvprivatewiki.etsi.org/index.php?title=Feature_Tracking#ENH01: Security_enhancements

[7] ETSI NFV, "Feature tracking: ENH02 Special technical enhancements".

NOTE: Available online: https://nfvprivatewiki.etsi.org/index.php?title=Feature_Tracking#ENH02: Special_technical_enhancements

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions in [2], and the following apply:

Capability: ability of an item to perform an action under given internal conditions in order to meet some demand

Feature: functionality which represents added value to the system for a defined set of users

NOTE: A user could be a network operator, service provider, VNF provider, or some other defined actor.

Function: the abstract concept of a particular piece of functionality in a device, entity or service

Functionality: sum of actions or any aspect an item can do

NOTE: Functionality can be associated to diverse items, including devices, entities, services and/or features.

Release: a set of deliverables that specify a well-defined, stable and internally consistent set of functions

NOTE: A Release differs from the previous Release by having added and/or improved functionality introduced as a result of standardization work.

Release Definition: the ensemble of Features of a particular Release

Release Description: the description of specification outputs delivered by the Release

3.2 Abbreviations

For the purposes of the present document, the abbreviations in [2], and the following abbreviations apply:

ISG	Industry Specification Group
GR	Group Report
GS	Group Specification
WI	Work Item

4 Release overview

4.1 Introduction

ETSI ISG NFV Release 4 (hereinafter referred also as Release 4 or the present Release) builds on top and leverages the results of ETSI ISG NFV documents published as part of the Release 3. The Release 4 introduces new features on top of the specified capabilities and features in previous Releases.

A high-level description of the main outcomes of the Release 4 are provided in clause 5. A high-level definition for each of the features which are considered during the development of current Release 4 work is also provided in Annex A. Clause 4.2 provides a statistical summary of the Release 4 in terms of number of specifications and reports published to date. Clause 4.3 summarizes the capabilities and features that have been specified in past Releases and clause 4.4 summarizes the specification work state at each of the specification stages. Clause 6 lists the published GR and GS comprising Release 4, while clause 7 lists the ongoing work items.

4.2 Overview

At the time the present Description document version is delivered, the Release 4 is comprised of the following number of published deliverables:

- 15 Group Specifications, among which:

- + 2 new specifications.
- + 13 specifications evolved from Release 3.
- 8 Group Reports, among which:
 - + 7 new reports.
 - + 1 reports evolved from Release 3.

4.3 Summary of past Releases

The Release 3 was built upon the capabilities and features specified as part of the NFV Release 2. The Release 2 specified requirements, information models, data models and interface protocols to enable interoperable implementations of the NFV Architectural Framework [3]. The Release 3 added the following major architectural changes:

- Addition of the Or-Or reference point in between two NFVO (Feature "NFV-MANO admin domains").
- Exposure by the NFV-MANO functional blocks of new interfaces for policy management (feature "Policy management framework").
- Exposure by the NFV-MANO functional blocks of new interfaces for the management of NFV-MANO functional blocks (feature "Management of NFV-MANO").
- Definition of the Wide Area Infrastructure Management (WIM) and exposure of interfaces for multi-site network connectivity management (feature "Management and connectivity of multi-site services").

The Release 2 Description [4] provides details about the capabilities that had been specified in the Release 2. The Release 3 Description [5] details the new features that had been specified in the Release 3.

4.4 Specification work state

Table 4.4-1 summarizes the status of the specification work at different stages. Annex B describes the meaning of the "state" of the specification work.

Table 4.4-1: Specification work state within the present Release.

Stage	Meaning	State	Additional notes
Informative (stage 0)	Informative work within a Release used to study new use cases and technical features.	Closed	None
Stage 1/2	Normative work: Service and business requirements Architecture, interfaces and information models.	Open	None
Stage 3	Normative work on protocols and data models. Informative work on studying potential profiling of existing solutions.	Open	None
Stage 4	Normative work on testing specifications for protocols and data models.	Not started	None

5 Release 4 features

5.1 Overview

The new features introduced as part of the Release 4 are listed in Table 5.1-1.

Table 5.1-1 lists only the Release 4 features whose specification has been completed with normative provisions at least from an architecture, functional and information model perspective (stage 2). The table also lists the status of the specification of normative provisions concerning protocols and data models (stage 3).

Table 5.1-1: Release 4 features

Feature name	Acronym	FEAT id	Stage 3 status
Cloud-native VNFs and Container Infrastructure management	CNNFV	FEAT17	Ongoing

Table 5.1-2 lists the Release 4 enhancement features (specific technical or security enhancements) whose specification has been completed with normative provisions at least from an architecture, functional and information model perspective (stage 2). The table also lists the status of the specification of normative provisions concerning protocols and data models (stage 3).

Table 5.1-1: Release 4 enhancement features

Feature name	ENH id	Stage 3 status
NFV-MANO enhancement with SDN-based networking	ENH02.01	Ongoing
NFV-MANO enhancement for NS feasibility check	ENH02.02	Ongoing
Data flow mirroring	ENH02.03	Ongoing
Invariant identification of NSD constituents	ENH02.04	Ongoing
Flexibility with scalable VNF/NS instantiation	ENH02.05	NOngoing

5.2 Functional features

5.2.1 Cloud-native VNFs and container infrastructure management (CNNFV)

5.2.1.1 Description

The feature enhances the NFV architectural framework to support VNFs which follow "cloud-native" design principles and the NFV-MANO to support capabilities for container and container infrastructure management and orchestration.

Regarding the container management and orchestration new NFV-MANO functions, the Container Infrastructure Services Management (CISM) and Container Image Registry (CIR), are defined, exposing a new set of service interfaces:

- OS container workload management service interface, produced by the CISM.,
- OS container compute management service interface, produced by the CISM,
- OS container storage management service interface, produced by the CISM,
- OS container network management service interface, produced by the CISM,
- OS container configuration management service interface, produced by the CISM, and
- OS container image management service interface, produced by the CIR.

5.2.1.2 Architecture scope

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

- Functional blocks and functions: NFVO, VNFM, CISM (new), CIR (new).
- Reference points and interfaces: Os-Ma-nfvo, Or-Vnfm, CISM service interfaces, CIR service interface.
- Artefacts: VNFD, VNF package.

5.2.1.3 Specification results

The feature has been specified in the specifications and reports listed in table 5.2.1.3-1. Refer to clause 6 for the latest version available of the referred documents.

Table 5.2.1.3-1: Specification results of feature "Cloud-native VNFs and container infrastructure management"

Document Id.	Stage	Description of the feature specification
ETSI GS NFV-IFA 010	Stage 2	Functional requirements for the NFVO and VNFM to support the capability to consume CISM and CIR produced interfaces. Functional requirements of the CISM to and CIR.
ETSI GS NFV-IFA 007	Stage 2	Extensions to the VNF Lifecycle Management interface to support the exposure of runtime information regarding container-based VNF. Extension to the VNF lifecycle operation granting interface to handle container related resource definitions and namespaces information.
ETSI GS NFV-IFA 008	Stage 2	Extensions to the VNF Lifecycle Management interface to support the exposure of runtime information regarding container-based VNF.
ETSI GS NFV-IFA 011	Stage 2	Addition of attributes and new information elements to support the design of container-based VNF. Addition of requirements to handle additional artifacts in the VNF package related to container-based VNF.
ETSI GS NFV-IFA 013	Stage 2	Extensions to the NS Lifecycle Management interface to support the exposure of runtime information regarding container-based VNF.
ETSI GS NFV-IFA 014	Stage 2	Extensions for the affinity/anti-affinity values to support container-based VNF deployments.
ETSI GS NFV-IFA 040	Stage 2	Description of CISM and CIR services and relationship of container-based VNF with NFV models. Functional requirements of OS container compute, network, storage, configuration management service interfaces. Functional requirements of OS container workload management service interface. Functional requirements of OS container image management service interface.
ETSI GS NFV-SOL 001	Stage 3	Addition of node and data types to support the design of container-based VNF.

5.2.2 NFV-MANO enhancement with SDN-based networking (ENH02.01)

5.2.2.1 Description

The enhancement feature enhances the NFV-MANO functionality regarding the virtualised network management, lifecycle management and template information model to support the integration of SDN-based network in the framework of NFV-MANO by exposing a new type of routing resource and the capability to handle affinity/anti-affinity requirements for determining the needed resources for the connectivity of NS.

5.2.2.2 Architecture scope

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

- Functional blocks and functions: NFVO, VIM.
- Reference points and interfaces: Os-Ma-nfvo, Or-Vi.
- Artefacts: NSD.

5.2.2.3 Specification results

The feature has been specified in the specifications and reports listed in table 5.2.2.3-1. Refer to clause 6 for the latest version available of the referred documents.

Table 5.2.2.3-1: Specification results of enhancement feature "NFV-MANO enhancement with SDN-based networking"

Document Id.	Stage	Description of the feature specification
ETSI GS NFV-IFA 010	Stage 2	Updates to the functional requirements of NFVO to request management of routing resources against the VIM and to consider affinity/anti-affinity rules for network resources needed for the connectivity of NS.
ETSI GS NFV-IFA 005	Stage 2	Extensions in the virtualised network resource management interfaces to model and manage routing resources.
ETSI GS NFV-IFA 014	Stage 2	Extending the scope of affinity/anti-affinity to consider L2 network isolation to guide NFV-MANO determining the needed routing resources.

5.2.3 NFV-MANO enhancement for NS feasibility check (ENH02.02)

5.2.3.1 Description

The enhancement feature adds the capability of feasibility check of Network Service to the lifecycle management. The capability allows for a consumer of the NS LCM to request to NFV-MANO to determine the availability of network constituents.

5.2.3.2 Architecture scope

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

- Functional blocks and functions: NFVO.
- Reference points and interfaces: Os-Ma-nfvo.

5.2.3.3 Specification results

The feature has been specified in the specifications and reports listed in table 5.2.3.3-1. Refer to clause 6 for the latest version available of the referred documents.

Table 5.2.3.3-1: Specification results of enhancement feature "NFV-MANO enhancement for NS feasibility check"

Document Id.	Stage	Description of the feature specification
ETSI GS NFV-IFA 010	Stage 2	New functional requirements for the NFVO to support the capability to handle feasibility check and reserve resources needed during the feasibility check.
ETSI GS NFV-IFA 013	Stage 2	Extensions to the NS Lifecycle Management interface to support the capability to perform feasibility check as part of NS instantiation and NS update.

5.2.4 Invariant identification of NSD constituents (ENH02.04)

5.2.4.1 Description

The enhancement feature adds the capability to identify the VNFDs, nested NSDs and PNFDs of an NSD by invariant identities as an alternative option to the defined descriptor identifiers. Such a capability avoid having to change and create a new NSD when its components (VNFDs, PNFDs or nested NSDs) are replaced by another version and this replacement does not require changes in the rest of the NSD.

5.2.4.2 Architecture scope

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

- Functional blocks and functions: NFVO.
- Reference points and interfaces: Os-Ma-nfvo.

- Artefacts: VNFD, NSD.

5.2.4.3 Specification results

The feature has been specified in the specifications and reports listed in table 5.2.4.3-1. Refer to clause 6 for the latest version available of the referred documents.

Table 5.2.4.3-1: Specification results of enhancement feature "Invariant identification of NSD constituents"

Document Id.	Stage	Description of the feature specification
ETSI GS NFV-IFA 010	Stage 2	Addition of functional requirements for the NFVO to support the capability to use invariant identifiers when creating or adding constituents to the NS instances.
ETSI GS NFV-IFA 011	Stage 2	Addition of new attribute to the VNFD to identify a VNFD in a version independent (invariant) manner.
ETSI GS NFV-IFA 013	Stage 3	Additional interface requirement for the NS Lifecycle Management interface to support providing invariant descriptor identifiers for constituents to be instantiated or added to the NS. Updates to the functional and information model descriptor of the Instantiate and Update NS operations to support the use of invariant descriptor identifiers.
ETSI GS NFV-IFA 014	Stage 2	Addition of attributes to VNF, PNF and NS profiles to use invariant identifiers for VNF, PNF and NS constituents in the NSD. Addition of new attribute to the NSD to identify a NSD in a version independent (invariant) manner. Addition of new attribute to the PNFD to identify a PNFD in a version independent (invariant) manner.

5.2.5 Flexibility with scalable VNF/NS instantiation (ENH02.05)

5.2.5.1 Description

The enhancement feature adds the capability to indicate scale levels as input during instantiation to support flexible scalable VNF/NS instantiation. The VNFs/NSs supporting flexible instantiations are identified with VNFD/NSD level attribute(s). This enhancement provides flexibility for the service providers to adjust instantiation level when instantiating a VNF and supports instantiate a VNF with required size in one single operation.

5.2.5.2 Architecture scope

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

- Functional blocks and functions: NFVO, VNFM.
- Reference points and interfaces: Os-Ma-nfvo, Or-Vnfm, Ve-Vnfm.
- Artefacts: VNFD, NSD.

5.2.5.3 Specification results

The feature has been specified in the specifications and reports listed in table 5.2.5.3-1. Refer to clause 6 for the latest version available of the referred documents.

Table 5.2.5.3-1: Specification results of enhancement feature "Flexibility with scalable VNF/NS instantiation"

Document Id.	Stage	Description of the feature specification
ETSI GS NFV-IFA 007	Stage 2	Extending the VNF lifecycle operation granting interface to signal target scale level for VNF instantiation. Extension to the VNF Lifecycle Management interface to support signaling target scale level during VNF instantiation and change VNF flavour operations.
ETSI GS NFV-IFA 008	Stage 2	Extension to the VNF Lifecycle Management interface to support signaling target scale level during VNF instantiation and change VNF flavour operations.
ETSI GS NFV-IFA 011	Stage 2	Updating the attributes that affect the invocation of VNF instantiation to indicate the support for sing target scale levels.
ETSI GS NFV-IFA 013	Stage 2	Extensions to the NS Lifecycle Management interface to support the capability to perform feasibility check as part of NS instantiation and NS update.
ETSI GS NFV-IFA 014	Stage 2	Updates to the VNF and NS profiles to indicate the target scale levels for instantiation.

5.2.6 Data flow mirroring (ENH02.03)

5.2.6.1 Description

The enhancement feature enhances the NFV-MANO functionality to enable data flow mirroring management. The feature adds the support to manage intra NFVI-PoP data flow mirroring jobs, which can be derived based on requirements expressed in the NSD or provided by the OSS/BSS to the NFVO via the Os-Ma-nfvo reference point interfaces.

5.2.6.2 Architecture scope

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

- Functional blocks and functions: NFVO, VIM.
- Reference points and interfaces: Os-Ma-nfvo, Or-Vi.
- Artefacts: NSD.

5.2.6.3 Specification results

The feature has been specified in the specifications and reports listed in table 5.2.6.3-1. Refer to clause 6 for the latest version available of the referred documents.

Table 5.2.6.3-1: Specification results of enhancement feature "Data flow mirroring"

Document Id.	Stage	Description of the feature specification
ETSI GS NFV-IFA 005	Stage 2	New "Data flow mirroring management" interface provided by the VIM, with operations and respective information modelling enabling the creation, deletion, update and query of information about data flow mirroring jobs.
ETSI GS NFV-IFA 010	Stage 2	Addition of functional requirements to the NFVO and VIM to support the management of data flow mirroring jobs. Addition of use cases illustrating the data flow mirroring management driven by NSD and through the NS LCM interface produced by the NFVO.
ETSI GS NFV-IFA 013	Stage 2	Addition of interface requirements and updates to the NS LCM update operation to management the creation, deletion and update of data flow mirroring jobs. Specification of information elements related to data flow mirroring.
ETSI GS NFV-IFA 014	Stage 2	Addition to the VirtualLinkProfiles the capability to describe design-time requirements for data flow mirroring associated to the NS instances created based on the NSD. Specification of corresponding information elements.

5.3 Security features

5.3.1 Security management and monitoring for NFV (SECMM)

5.3.1.1 Description

The feature concerns to NFV security lifecycle management for the establishment of consistent security policies and uniform enforcement of the policies on virtualised networks. As part of the feature outcomes, enhancements to the architecture are introduced whereby different functional blocks responsible for security monitoring and management interface with other NFV blocks such as NFVI, VNF and NFV-MANO functional blocks.

In addition, the feature considers the needed security requirements for the NFV-MANO functional blocks and the reference points in between and to/from the NFV-MANO functional blocks to reduce the security risks in terms of authenticity, integrity, confidentiality and privacy.

5.3.1.2 Architecture scope

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

- Functional blocks: Security Manager (SM), NFVO, VNFM, VIM.
- Reference points:
 - + Security reference points Sc-Vi, Sc-Vnfm, and Sc-Or for security monitoring and management.

5.3.1.3 Specification results

The feature has been specified in the specifications and reports listed in table 5.3.1.3-1. Refer to clause 6 for the latest version available of the referred documents.

Table 5.3.1.3-1: Specification results of feature "Security management and monitoring for NFV"

Document Id.	Stage	Description of the feature specification
ETSI GS NFV-IFA 033	Stage 2	Requirements applicable to the interfaces supported over the Sc-Or, Sc-Vnfm, Sc-Vi reference points as well as the operations invoked over these interfaces, which aim to support the security monitoring and and management as specified in ETSI GS NFV-SEC 013.

6 NFV Release 4 published deliverables

6.1 Introduction

The present clause 6 lists the published deliverables (Group Specifications and Group Reports) associated to the Release 4. The NFV Release 4 is comprised of multiple specification and reports, which can be categorized according to different specification stages (stage 1, stage 2, etc.) and compliance (normative or informative).

NOTE 1: The versions among the different deliverables may differ, e.g., a deliverable may have been updated and published with a newer version due to maintenance, whereas some other deliverable not. The latest available published version of each deliverable is indicated in the following tables.

NOTE 2: The present clause 6 only lists GS and GR that contain the specification of features listed in clause 5.

6.2 Stage 1 and stage 2 Group Specifications

6.2.1 Newly published Group Specifications

The published new specifications associated to the Release 4 are listed in Table 6.2.1-1.

Table 6.2.1-1: Newly published stage 1 and stage 2 Group Specifications

Id.	Version(s)	Title	Related feature(s)
ETSI GS NFV-IFA 040	V4.3.1 Old: V4.2.1 V4.1.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Requirements for service interfaces and object model for OS container management and orchestration specification	FEAT17: Cloud-native VNFs and Container Infrastructure management

6.2.2 Evolved/propagated published deliverables from a previous Release

The published deliverables associated to the Release 4 that have been evolved/propagated from a previous Release are listed in table 6.2.2-1.

Table 6.2.2-1: Published stage 1 and stage 2 deliverables evolved/propagated from a previous Release

Id.	Version(s)	Title	Related feature(s)
ETSI GS NFV-IFA 005	V4.3.1 Old: V4.2.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Or-Vi reference point - Interface and Information Model Specification	ENH02.01: SDN-based networking
ETSI GS NFV-IFA 006	V4.3.1 Old: V4.2.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Vi-Vnfm reference point - Interface and Information Model Specification	N/A (see note).
ETSI GS NFV-IFA 007	V4.3.1 Old: V4.2.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Or-Vnfm reference point - Interface and Information Model Specification	FEAT17: Cloud-native VNFs and Container Infrastructure management ENH02.05: Scalable VNF/NS instantiation
ETSI GS NFV-IFA 008	V4.3.1 Old: V4.2.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Ve-Vnfm reference point - Interface and Information Model Specification	FEAT17: Cloud-native VNFs and Container Infrastructure management ENH02.05: Scalable VNF/NS instantiation
ETSI GS NFV-IFA 010	V4.3.1 Old: V4.2.1 V4.1.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Functional requirements specification	FEAT17: Cloud-native VNFs and Container Infrastructure management ENH02.01: SDN-based networking ENH02.02: NS feasibility check ENH02.04: Invariant identification of NSD constituents
ETSI GS NFV-IFA 011	V4.3.1 Old: V4.2.1 V4.1.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; VNF Descriptor and Packaging Specification	FEAT17: Cloud-native VNFs and Container Infrastructure management ENH02.04: Invariant identification of NSD constituents ENH02.05: Scalable VNF/NS instantiation
ETSI GS NFV-IFA 013	V4.3.1 Old: V4.2.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Os-Ma-Nfvo reference point - Interface and Information Model Specification	FEAT17: Cloud-native VNFs and Container Infrastructure management ENH02.02: NS feasibility check ENH02.04: Invariant identification of NSD constituents ENH02.05: Scalable VNF/NS instantiation

Id.	Version(s)	Title	Related feature(s)
ETSI GS NFV-IFA 014	V4.3.1 Old: V4.2.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration Network Service Templates Specification	FEAT17: Cloud-native VNFs and Container Infrastructure management ENH02.01: SDN-based networking ENH02.04: Invariant identification of NSD constituents ENH02.05: Scalable VNF/NS instantiation
ETSI GR NFV-IFA 024	V4.3.1 Old: V4.2.1	Network Functions Virtualisation (NFV) Release 4; Information Modeling; Report on External Touchpoints related to NFV Information Model	N/A (see note).
ETSI GS NFV-IFA 027	V4.3.1 Old: V4.2.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Performance Measurements Specification	N/A (see note).
ETSI GS NFV-IFA 030	V4.3.1 Old: V4.2.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Multiple Administrative Domain Aspect Interfaces Specification	N/A (see note).
ETSI GS NFV-IFA 031	V4.3.1 Old: V4.2.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Requirements and interfaces specification for management of NFV-MANO	N/A (see note).
ETSI GS NFV-IFA 032	V4.3.1 Old: V4.2.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Interface and Information Model Specification for Multi-Site Connectivity Services	N/A (see note).
NOTE:	The specification has been updated into the present Release 4, but without outcomes of specific Release 4 features (e.g., maintenance performed in Release 3 specification versions).		

6.3 Stage 3 Group Specifications

6.3.1 Newly published Group Specifications

None currently published.

6.3.2 Evolved/propagated published deliverables from a previous Release

The published deliverables associated to the Release 4 that have been evolved/propagated from a previous Release are listed in table 6.3.2-1.

Table 6.3.2-1: Published stage 3 deliverables evolved/propagated from a previous Release

Id.	Version(s)	Title	Related feature(s)
ETSI GS NFV-SOL 001	V4.2.1	Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; NFV descriptors based on TOSCA specification	FEAT17: Cloud-native VNFs and Container Infrastructure management

6.3.3 Stage 3 publication packages

Editor's Note: content is FFS. Wait for completion of first major drop by SOL, expected to be SOLed431.

6.4 Other Group Specifications

6.4.1 Security specifications

The published new deliverables of Release 4 specifying security aspects are listed in table 6.4.1-1.

Table 6.4.1-1: Published deliverables related to security

Id.	Version(s)	Title	Related feature(s)
ETSI GS NFV-IFA 033	V4.1.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Sc-Or, Sc-Vnfm, Sc-Vi reference points – Interface and Information Model Specification	FEAT18: Security management

6.4.2 Testing specifications

None currently published.

6.5 Newly published Group Reports

The newly published reports associated to the Release 4 are listed in Table 6.5-1.

Table 6.5-1: Newly published Group Reports

Id.	Version(s)	Title	Related feature(s)
ETSI GR NFV-REL 011	V4.1.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Report on NFV-MANO software modification	FEAT01: NFV-MANO upgrades
ETSI GR NFV-EVE 019	V4.1.1	Network Functions Virtualisation (NFV) Release 4; Architectural Framework; Report on VNF generic OAM functions	FEAT24: VNF generic management functions
ETSI GR NFV-IFA 034	V4.1.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Report on Architectural enhancement for VNF License Management support and use of VNF licenses	FEAT13: Licensing management
ETSI GR NFV-IFA 037	V4.1.1	Network Functions Virtualisation (NFV) Release 4; Architectural Framework; Report on further NFV support for 5G	FEAT21: NFV enhancements for 5G
ETSI GR NFV-IFA 038	V4.1.1	Network Functions Virtualisation (NFV) Release 4; Architectural Framework; Report on network connectivity for container based VNF	FEAT19a: Network connectivity integration and operationalization
ETSI GR NFV-IFA 041	V4.1.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Report on enabling autonomous management in NFV-MANO	FEAT20: NFV-MANO automation and autonomous networks
ETSI GR NFV-IFA 042	V4.1.1	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Report on policy information and data models for NFV-MANO	FEAT26: Policy management models

7 NFV Release 4 active Work Items of unpublished deliverables

7.1 Introduction

The present clause 7 lists the active Work Items associated to the Release 4.

Clause 7.2 lists the Work Items that will produce new specifications and reports (i.e., complete new deliverables). Clause 7.3 lists the Work Items that will produce a new version of a specification or report that has been published in a previous Release and which is evolved/propagated in order to document the needed Release 4 features.

7.2 Work Items producing new specifications or reports

The current Work Items associated to the Release 4 and that will produce new specification or reports are listed in Table 7.2-1.

NOTE: For tracking purposes, Work Items listed in Table 7.2-1 include both informative and normative work. The final list of Release-dependent deliverables will be listed within the Release Description upon publication of the deliverables..

Table 7.2-1: NFV Release 4 Work Items producing new specification or reports.

Work Item	Full Title	Type	Related Feature(s)
DGS/NFV-IFA036	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Specification of requirements for the management and orchestration of container cluster nodes	Specification	FEAT17: Cloud-native and Container Infrastructure management
DGS/NFV-IFA047	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Management data analytics Service Interface and Information Model Specification	Specification	FEAT20: NFV-MANO automation and autonomous networks
DGS/NFV-IFA048	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Policy Information Model Specification	Specification	FEAT26: Policy management models
DGS/NFV-IFA049	Network Functions Virtualisation (NFV) Release 4; Architectural Framework; VNF generic OAM functions specification	Specification	FEAT24: VNF generic management functions
DGS/NFV-IFA050	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Intent Management Service Interface and Intent Information Model Specification	Specification	FEAT20: NFV-MANO automation and autonomous networks
DGS/NFV-SEC023	Network Functions Virtualisation (NFV) Release 4; Security; Container Security Specification	Specification	FEAT17: Cloud-native and Container Infrastructure management
DGS/NFV-SEC024	Network Functions Virtualisation (NFV) Release 4; Security; Security Management Specification	Specification	FEAT18: Security management
DGS/NFV-SEC025	Network Functions Virtualisation (NFV) Release 4; Security; Secure End-to-End VNF and NS management specification	Specification	FEAT18: Security management
DGS/NFV-SEC026	Network Functions Virtualisation (NFV) Release 4; Security; Isolation and trust domain specification	Specification	FEAT18: Security management
DGR/NFV-SEC027	Network Functions Virtualisation (NFV) Release 4; Security; Report on security assurance of NFVI	Report	N/A
DGS/NFV-SOL018	Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; Profiling specification of protocol and data model solutions for OS container management and orchestration	Specification	FEAT17: Cloud-native and Container Infrastructure management

7.3 Work Items evolving/propagating Release 3 specifications and reports

A set of deliverables from Release 3 are evolved/propagated into the Release 4. The corresponding Work Items are listed in Table 7.3-1. These Work Items will produce a new version of a previously published specification or report.

Table 7.3-1: NFV Release 4 Work Items of propagated/evolved Release 3 deliverables.

Work Item	Full Title	Type	Related Feature(s)
RGS/NFV-IFA 026ed441	Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Architecture enhancement for Security Management Specification	Specification	N/A (see note).
RGS/NFV- SOL002ed431	Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; RESTful protocols specification for the Ve-Vnfm Reference Point	Specification	FEAT17: Cloud-native and Container Infrastructure management ENH02.05: Scalable VNF/NS instantiation
RGS/NFV- SOL003ed431	Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; RESTful protocols specification for the Or-Vnfm Reference Point	Specification	FEAT17: Cloud-native and Container Infrastructure management ENH02.05: Scalable VNF/NS instantiation
RGS/NFV- SOL004ed431	Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; VNF Package and PNFD Archive specification	Specification	N/A (see note).
RGS/NFV- SOL005ed431	Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; RESTful protocols specification for the Os-Ma-nfv Reference Point	Specification	FEAT17: Cloud-native and Container Infrastructure management ENH02.02: NS feasibility check ENH02.04: Invariant identification of NSD constituents ENH02.05: Scalable VNF/NS instantiation
RGS/NFV- SOL006ed431	Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; NFV descriptors based on YANG Specification	Specification	FEAT17: Cloud-native and Container Infrastructure management
RGS/NFV- SOL007ed431	Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; Network Service Descriptor File Structure Specification	Specification	N/A (see note).
RGS/NFV- SOL009ed431	Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; RESTful protocols specification for the management of NFV-MANO	Specification	N/ N/A (see note).
RGS/NFV- SOL011ed431	Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; RESTful protocols specification for the Or-Or Reference Point	Specification	N/A (see note).
RGS/NFV- SOL012ed431	Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; RESTful protocols specification for the Policy Management Interface	Specification	N/A (see note).
RGS/NFV- SOL013ed431	Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; Specification of common aspects for RESTful NFV MANO APIs	Specification	N/A (see note).
RGS/NFV- SOL014ed431	Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; Specification of common aspects for RESTful NFV MANO APIs	Specification	N/A (see note).
RGS/NFV- SOL016ed431	Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; NFV-MANO procedures specification	Specification	N/A (see note).
NOTE: Set of corresponding features is to be determined.			

Annex A: Release definition

A.1 Introduction

The present annex defines the set of features that the ETSI NFV plans to develop as part of the Release 4 work programme. Clause A.2 provides high-level information about the main technical areas envisioned for Release 4. Clauses A.3, A.4 and A.5 list and provide a high-level definition of the features.

A.2 Release 4 technical areas

The ETSI NFV Release 4 aims to specify around the following technical areas.

- A) NFVI evolution, focusing on:
 - A.1) Enhancements to support lightweight virtualization technologies,
 - A.2) Optimizing NFVI abstraction for reducing the coupling of VNFs to infrastructure, and
 - A.3) Optimizing networking integration into the infrastructure fabric and ease the connectivity for VNFs and NS.
- B) Enhancing NFV automation and capabilities, focusing on:
 - B.1) Improving life-cycle management and orchestration,
 - B.2) Simplification of VNF and NS management aspects leveraging virtualization, and
 - B.3) Handling advances in autonomous networking.
- C) Evolving the NFV-MANO framework, focusing on:
 - C.1) Optimizing internal NFV-MANO capabilities exposure and usage.
- D) Operationalization, focusing on:
 - D.1) Simplification of NFV to ease development and deployment of sustainable NFV based solutions,
 - D.2) Verification (and certification) procedures and mechanisms, and
 - D.3) Operationalization, integration and use of NFV with other management and network frameworks.

In addition to the above technical areas, additional aspects about security hardening of NFV (enhancements), and other specific technical enhancements are necessary to maximize the impact of virtualization and future NFV deployments.

Within the areas of work that are introduced above, the following more specific top-level (“umbrella”) features are derived as described in the following clauses.

A.2 Overview

The candidate new features introduced as part of the Release 4 are listed in Table A.2-1.

Table A.2-1: Release 4 features and enhancement features

Feature name	Acronym	FEAT id	Notes
NFV-MANO upgrade	SWUP-MANO	FEAT01	Carried over from Release 3.
MEC in NFV	MECinNFV	FEAT12	Carried over from Release 3.
Licensing management	LIC	FEAT13	Carried over from Release 3.
Cloud-native VNFs and Container Infrastructure management	CNNFV	FEAT17	Carried over from Release 3.

Security management	SECMM	FEAT18	Carried over from Release 3
Network connectivity integration and operationalization for NFV – container networking	NFV-Connect	FEAT19a	New feature
Network connectivity integration and operationalization for NFV	NFV-Connect	FEAT19b	Carried over to Release 5. See note.
NFV-MANO automation and autonomous networks	Auto	FEAT20	New feature
NFV enhancements for 5G	5GNFV	FEAT21	New feature
Multi-tenancy enhancements for NFV-MANO	M-Tenant	FEAT22	New feature
SBA for NFV-MANO	MANO-SBA	FEAT23	Carried over to Release 5. See note.
VNF generic management functions	VNF-OAM	FEAT24	New feature
Continuous VNF integration	VNF-CI	FEAT25	New feature
Policy Management Models	Policy-model	FEAT26	New feature
NOTE: The work and specification of this feature has been carried over to Release 5. For more information, refer to the Release 5 documentation.			

A.3 Features carried over from Release 3

A.3.1 Overview

This clause introduces areas of work that were not completed in Release 3 timeframe and are included in Release 4.

Minor adaptations on the scope from Release 3 may be done as part of the Release definition.

References to feature identifiers (e.g., FEAT01) are provided referring the Annex B of the NFV Release 3 Definition document.

Clause 7 lists current open work items and published specifications and the specific features that are covered in their scope where available.

A.3.2 NFV-MANO upgrades (SWUP-MANO, FEAT01)

The feature was started in Release 3 as FEAT01.

The scope of the feature covers the following areas:

- Update and upgrade of NFV-MANO software components in an NFV context (or environment).
- Identification of use cases for update and upgrade of NFV-MANO.
- Identification of the required set of update/upgrade controlling functions to facilitate software updates/upgrades.
- Specification of requirements for software update/upgrade controlling functions.

The "technical areas" covered by this feature are: C.1), D.2) and D.3).

A.3.3 MEC in NFV (MECinNFV, FEAT12)

The feature was started in Release 3 as FEAT12.

The scope of the remaining work of the feature covers the following areas:

- Enhancement support for multi-access edge computing (MEC) in NFV deployments
- Support coordination of NFV-MANO with consumers (in particular MEC) for graceful termination / stop support
- Enhancements on the placement and network constraints during resource allocation for network service and VNF instances

The "technical areas" covered by this feature are: B.2), B.3), D.1) and D.3).

A.3.4 Licensing management (LIC, FEAT13)

The feature was started in Release 3 as FEAT13, based on ETSI GR NFV-EVE 010.

The scope of the feature covers the following areas:

- NFV license management framework aspects to ensure Service Providers can deploy VNFs quickly without customizing the licensing mechanisms for each VNF and each VNF Provider.

The feature specification work scope encompasses:

- Develop use cases related to license management.
- Derive requirements from license management use cases.
- Identify what NFV Architectural Framework support and enhancements are needed to cover license management requirements.

The "technical areas" covered by this feature are: B.1), B.3), D.1) and D.3).

A.3.5 Cloud-native VNFs and Container Infrastructure management (CNNFV, FEAT17)

The feature was started in Release 3 as FEAT17, based on ETSI GS NFV-EVE 011 and ETSI GR NFV-IFA 029.

The scope of the feature covers the following areas:

- NFV Architecture support for VNFs which follow "cloud-native" design principles.
- Enhance NFV-MANO capabilities to support container technologies based on ETSI GR NFV-IFA 029.
- Enhance NFV-MANO capabilities for container management and orchestration
- Enhance information model for containerized VNFs both using bare metal or nested virtualization technologies

The "technical areas" covered by this feature are: A.1), A.2), B.2) and C.1).

A.3.6 Security management (SECMM, FEAT18)

The feature was started in Release 3 as FEAT18.

The scope of the feature covers the following areas:

- Security management and monitoring for NFV for planning, enforcement and monitoring targeting at holistic security policies and functions.
- Enhancements to current NFV Architectural for NFV Security Management.
- Secure sensitive components in the NFV framework.
- Secure hosts on which sensitive components will be hosted.
- Secure the broader context in which sensitive components will be hosted.
- Physical, logical and operational measures related to securing sensitive components.
- Provisioning and de-provisioning sensitive components.
- Specification of requirements for sensitive components.

The "technical areas" covered by this feature are: C.1) and D.3).

A.4 New features

A.4.1 Network connectivity integration and operationalization for NFV – container networking (NFV-Connect, FEAT19a)

The scope of the feature covers the following areas:

- The management and orchestration of secondary container cluster networks for the VNF and NS deployments.
- Enhancements to the NFV-MANO to manage the secondary container cluster networks.

The "technical areas" covered by this feature are: A.2), and A.3).

A.4.2 NFV-MANO automation and autonomous networks (Auto, FEAT20)

The scope of the feature covers the following areas:

- NFV-MANO support for managing autonomous networks.
- Enabling higher level of automation for NFV-MANO.
- Intent-based principles for external exposure network services management.

The "technical areas" covered by this feature are: B.1), B.3), and C.1).

A.4.3 NFV enhancements for 5G (5GNFV, FEAT21)

The scope of the feature covers the following areas:

- NFV support for deploying 5G networks, capabilities and associated requirements.
- 5G network capabilities and features interworking and relationship with NFV.
- Determine and profile how NFV can support 5G deployments.

The "technical areas" covered by this feature are: A.1) and D.3).

A.4.4 Void

A.4.5 Void

A.4.6 VNF generic management functions (VNF-OAM, FEAT24)

The scope of the feature covers the following areas:

- Definition of a set of common management functions for VNFs to ease their provisioning, connectivity, configuration and monitoring on a virtualized platform.
- Reducing dependencies of the VNF from underlying resources, hosts and network, thus realizing a full network function decoupling from the infrastructure.
- VNFs reusing generic and common management functionality provided as virtualization platform functionalities.
- Leveraging PaaS capabilities as a means for providing common management functions.

The "technical areas" covered by this feature are: A.2), B.2) and D.1).

A.4.7 Continuous VNF integration (VNF-CI, FEAT25)

The scope of the feature covers the following areas:

- Optimization of the VNF Package structure and VNF.

- Test execution of test functions and feedback to VNF provider/developer.
- VNF/VNFC software component update/upgrade supporting continuous development and integration paradigms.

The "technical areas" covered by this feature are: A.2), D.1), and D.2).

A.4.8 Policy management models (Policy-model, FEAT26)

The scope of the feature covers the following areas:

- Analyse existing policy information and data models and identify solutions that potentially could be applied to NFV-MANO.
- Clarify the main alternative for policy management (between NFV-MANO and OSS/BSS).
- Determine the objectives and management alternatives for policy management applicable to NFV-MANO.
- Identify policy expression information model applicable to NFV-MANO.
- Identify policy expression data model applicable to NFV-MANO.

NOTE 1: The specification of a policy engine, with its procedures, interfaces and handling of the input events, goals and output/actions is not in scope of this feature.

NOTE 2: The specification of interfaces as part of the policy framework is part of the Release 3.

The "technical areas" covered by this feature are: B.1), B.3), and D.3).

A.5 Enhancement features

A.5.1 Introduction

This clause introduces areas of work in which specific technical and security enhancements are expected to be specified.

A.5.2 NFV security hardening (enhancements) (ENH01)

The scope of the feature covers different technical working areas to enhance the ETSI NFV specifications and the already specified past Releases features/capabilities with the required security levels.

NOTE: The list of possible security enhancements is not determined in the present Release definition. Updates and tracking of this type of enhancements are available on the feature tracking wiki pages [6].

A.5.3 Specific technical enhancements (ENH02)

The scope of the feature covers different technical working areas to enhance the ETSI NFV specifications and the already specified past Releases features/capabilities with specific technical enhancements which are considered of low complexity and not addressed already by other Release 4 features.

NOTE: The list of possible technical enhancements is not determined in the present Release definition. Updates and tracking of this type of enhancements are available on the feature tracking wiki pages [7].

Annex B: Versioning of published deliverables

B.1 Introduction

Annex A in the ETSI NFV Release 3 Description (from v0.8.0) provides information about the versioning of the deliverables published by the ETSI ISG NFV.

Annex B in the same reference Release 3 Description document describes the meaning of the Release specification states.

History

Document history		
Version	Date	Changes
0.1.0	Jun. 2021	First draft reusing the Release 4 Definition v0.3.0 as baseline and to be uploaded to the Portal.
0.2.0	Sep. 2021	<ul style="list-style-type: none"> - Clause 4.2: update the number of completed deliverables. - Clause 5.3.1.3: document the feature specification work of IFA033. - Clause 6.5: update the list of newly published group reports. Update the corresponding table in clause 7.2. - Clause 7.3: added all the newly opened work items propagating stage 3 specs from Release 3. - Annex B: new annex providing a reference to information about deliverables versioning documented in the Release 3 Description document.
0.3.0	Nov. 2021	<ul style="list-style-type: none"> - Feature FEAT19 split into two: FEAT19a for container networking, and FEAT19b for "connectivity integration and operationalization". - Annex A.4: features FEAT22, FEAT23 and FEAT19b are deleted from the document because of carrying over them into Release 5.
0.3.1	Dec. 2021	<ul style="list-style-type: none"> - Updated the completion of IFA037 and IFA038, thus moved the entries from table 7.2-1 to table 6.5-1. - Clause 4.4: marked the informative (stage 0) as closed. - Clause 4.2: updated the number of published/completed documents.
0.4.0	May 2022	<ul style="list-style-type: none"> - Clause 5.1: updated the list of completed enhancement features from stage 2 pov. - Clause 5.2.1.3: added the SOL001 to the list of published deliverables specifying part of the FEAT17. - Clause 5.2.6 (new): documentation of the data flow mirroring enhancement feature. - Clause 6.3.2: updated the list of completed deliverables, i.e., SOL001 v4.2.1. - Clause 7.3: deleted the SOL001ed421, since a first version has been completed and published (see clause 6.3.2). - Clause 6.2.2: updated latest version of published deliverables, basically IFA v4.3.1 specs. - Clause 7.2: added the new stage 2 work items of Release 4 features FEAT20, FEAT24 and FEAT26, i.e., IFA047, IFA048, IFA049 and IFA050.