

ETSI NFV progress in cloud-native OAM

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For: SA5 OAM rapporteur's call SA5#153.1

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Outline



- Part 1: Overall NFV-MANO framework updates
- Part 2: Container-based network function support
- Part 3: PaaS Services framework in ETSI NFV
- Part 4: VNF generic OAM framework
- Conclusion, next steps

Part 1: Overall NFV-MANO framework updates

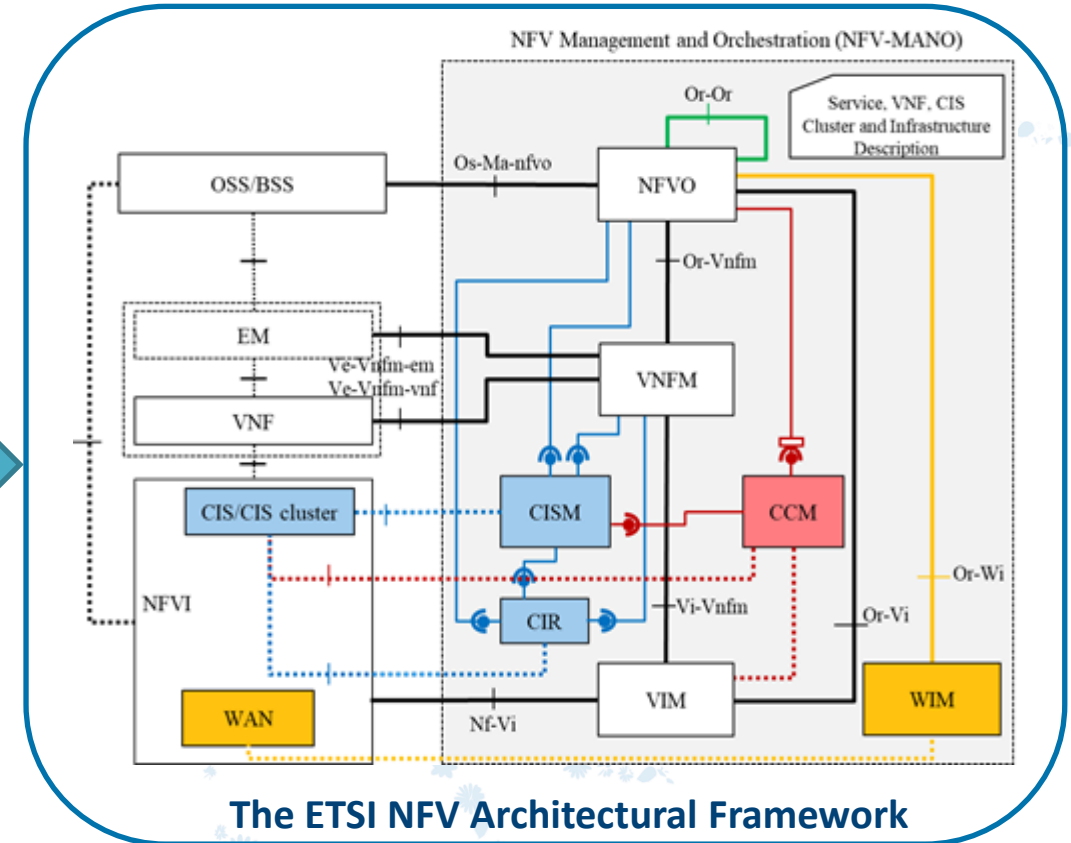
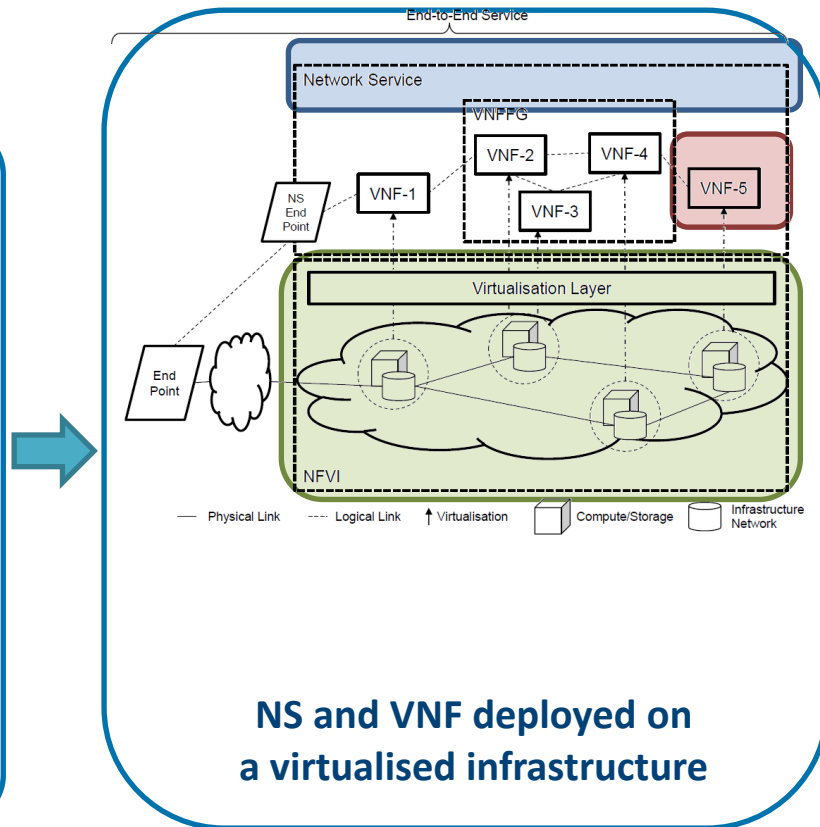
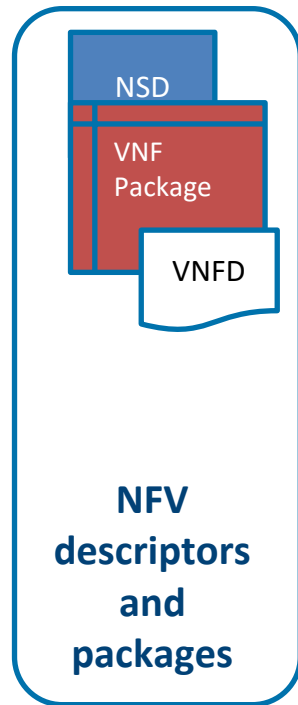


General NFV concepts

From design

to runtime

through NFV-MANO



Evolution of the NFV architectural framework (up to Release 4)

NFVO: NFV Orchestrator
 VNFM: VNF Manager
 VIM: Virtualised Infrastructure Manager
 WIM: WAN Infrastructure Manager

CIS: Container Infrastructure Services
 CISM: CIS Management
 CIR: Container Image Registry
 CCM: CIS Cluster Management

OSS/BSS: Operating support/Business support systems
 EM: Element Management
 VNF: Virtualised Network Function
 NFVI: NFV Infrastructure



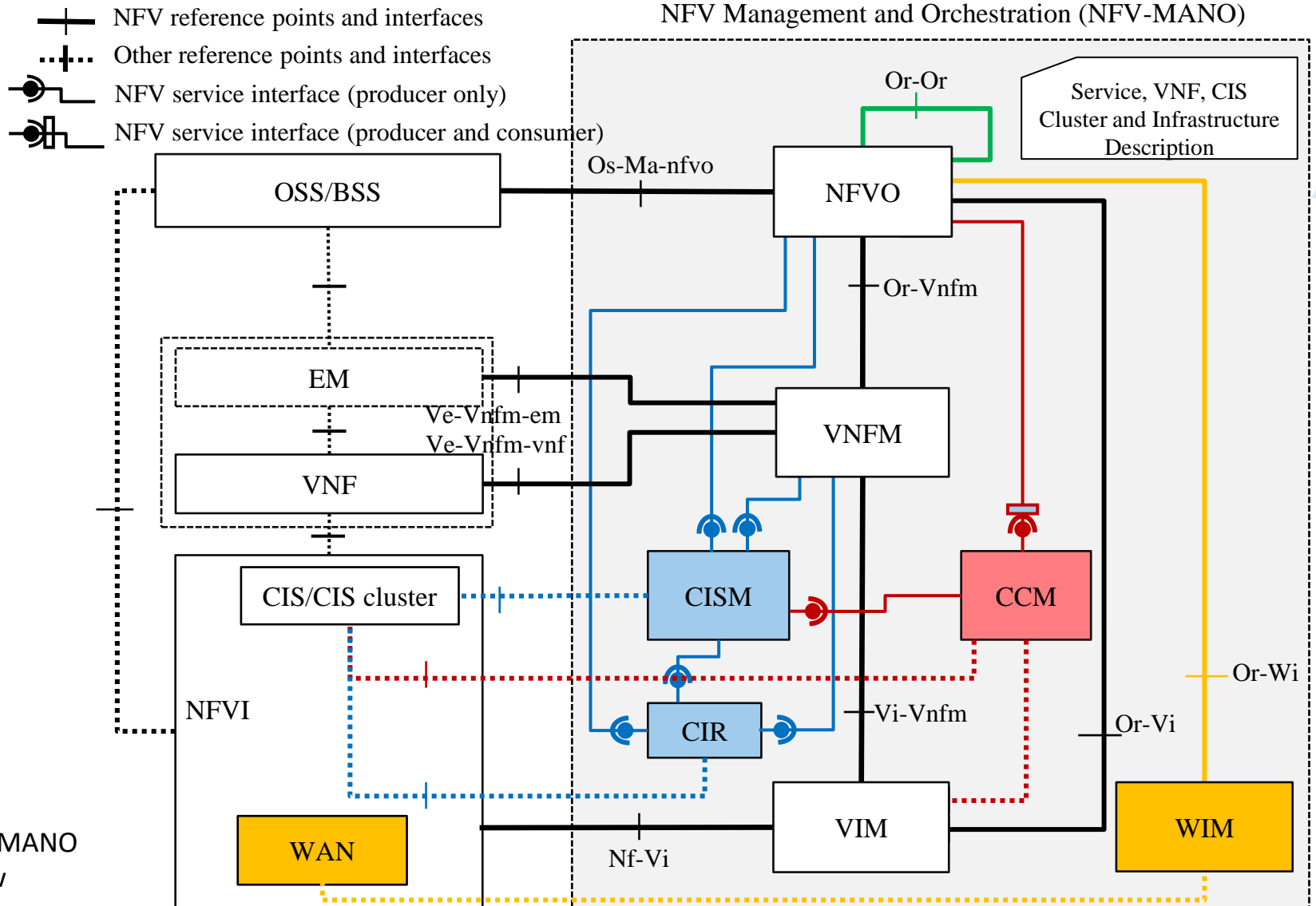
An evolution of the **Release 2** “baseline” towards 5G and beyond. Specified in ETSI GS NFV 006 (per Release version)

Release 3, addition of

- Multi-domain NS management with Or-Or.
- Multi-site connectivity services with WIM.

Release 4, addition of

- Container management and orchestration with CISM, CIR and CIS.
- CIS cluster management with CCM.



DISCLAIMER: Specification of Release 4 NFV-MANO architecture is still in progress, and some new

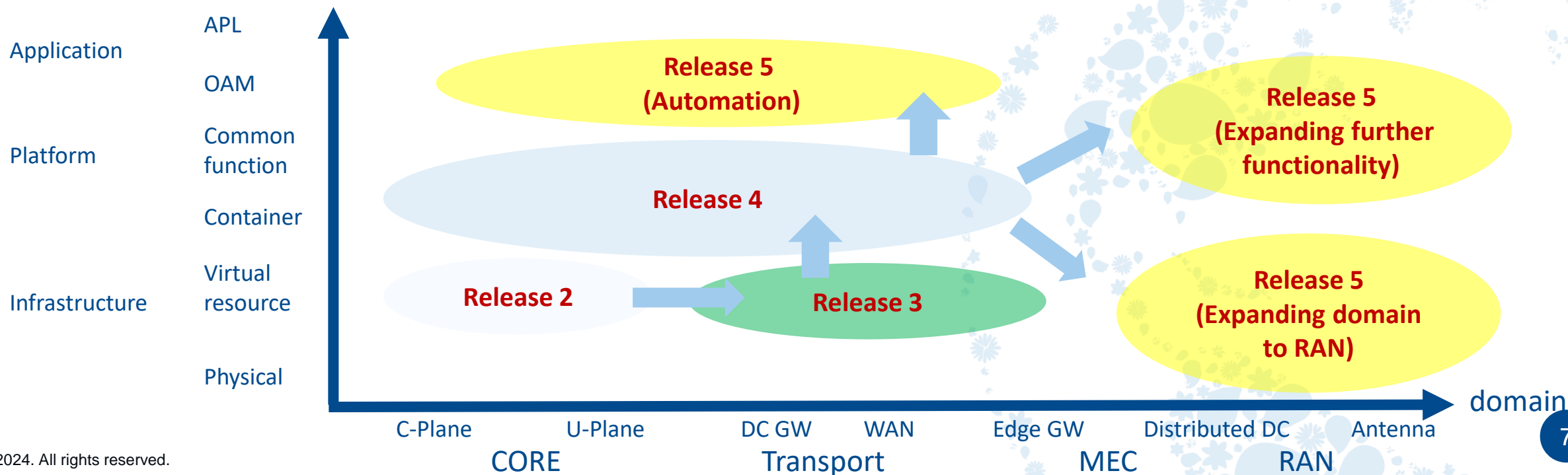
functionalities might be further specified.

ETSI NFV: scope evolution and mapping to Releases

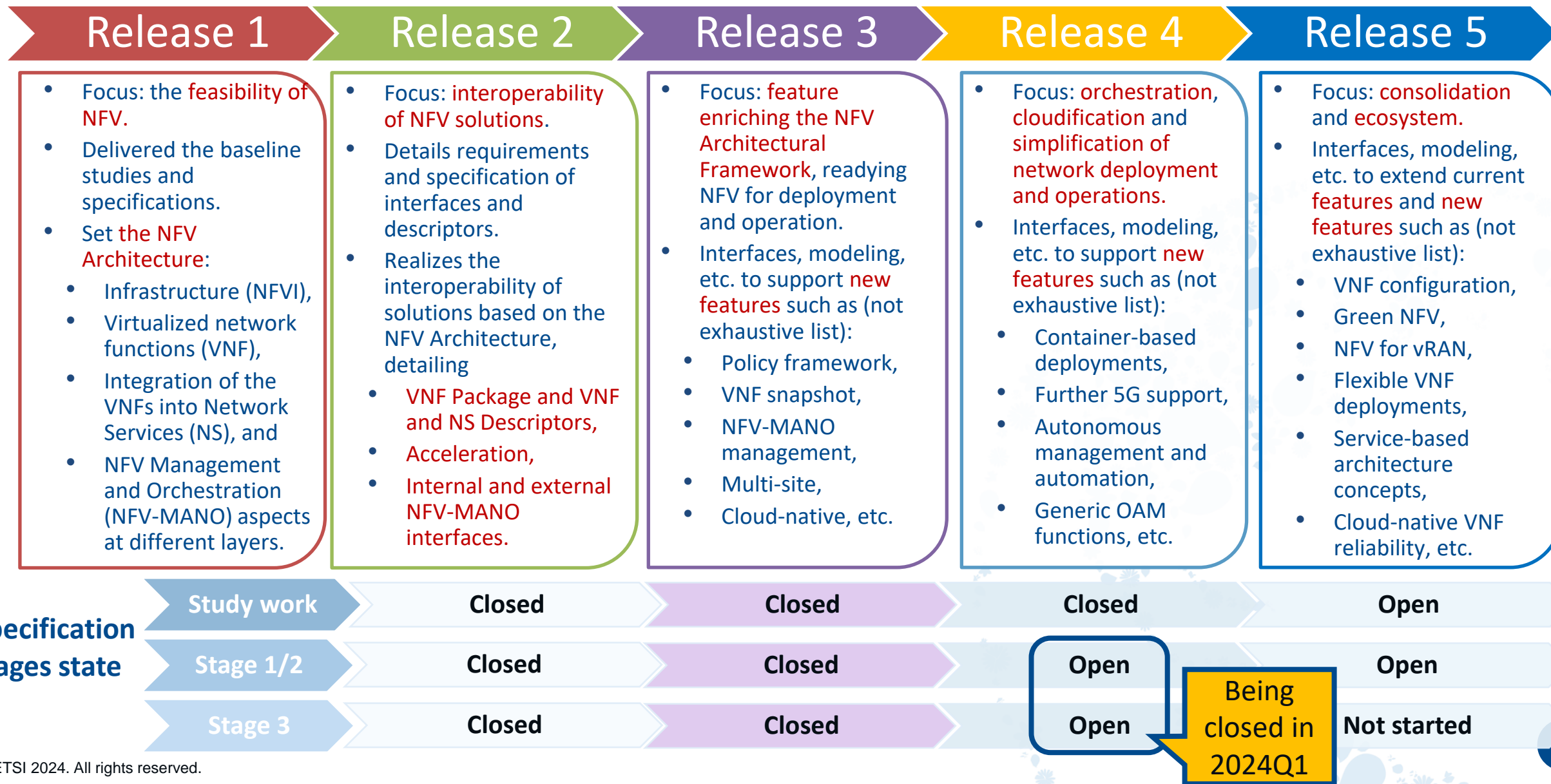
NFV started with the use of VM technology, evolved to container environments, and has evolved to support virtualization of network functions in various areas. A journey together with the community...



Cloud-native trends expand our way of working beyond virtualization layer



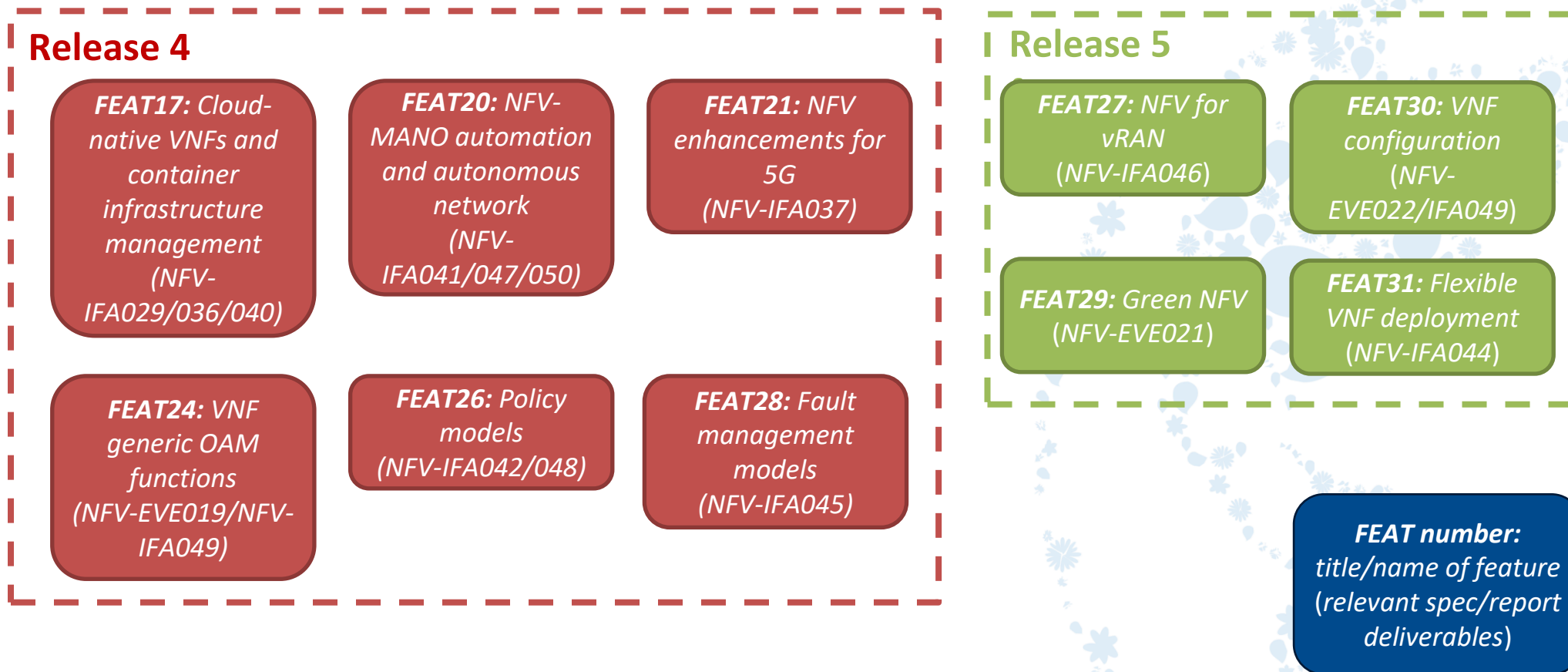
ETSI NFV: Releases overview



Release 4 and 5: feature highlights

Release 4 and 5 highlighted features that are particularly relevant for cloud-native OAM.

Useful to related feature numbers with scope.



Part 2: Container-based network function support



Release 4: NFV cloudification for 5G and beyond

Release 4 develops features and capabilities to leverage and embrace cloudification principles in various areas and further support 5G deployments (only listing below up to stage 2 specs):

- Deployment and management of **VNF as containerized workloads** (ETSI GS NFV-IFA 040 + enhancements in other NFV-MANO specifications) and container clusters management (ETSI GS NFV-IFA 036). Security aspects (DGS/NFV-SEC023).
- **Networking for container-based deployments** (ETSI GR NFV-IFA 038 + enhancements in other NFV-MANO specifications).
- **VNF generic OAM** (ETSI GR NFV-EVE 019 + ETSI GS NFV-IFA 049).
- **PaaS services and management for telco** (ETSI GR NFV-IFA 029 and solutions analysis for 5G deployments in ETSI GR NFV-IFA 037 + FEAT21 enhancements in other NFV-MANO specifications).

Published reports and specifications



ETSI GR NFV-IFA 029 V3.3.1 (2019-11)



Network Functions Virtualisation (NFV) Release 3; Architecture; Report on the Enhancements of the NFV architecture towards "Cloud-native" and "PaaS"

ETSI GS NFV-IFA 040 V4.2.1 (2021-05)



Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Requirements for service interfaces and object model for OS container management and orchestration specification

ETSI GS NFV-IFA 036 V4.3.1 (2022-09)



Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Requirements for service interfaces and object model for container cluster management and orchestration specification

Network Functions Virtualisation (NFV) Release 4; Architectural Framework; Report on VNF generic OAM functions

ETSI GR NFV-IFA 038 V4.1.1 (2021-11)



Network Functions Virtualisation (NFV) Release 4; Architectural Framework; Report on network connectivity for container-based VNF

ETSI GR NFV-IFA 037 V4.1.1 (2021-12)



Network Functions Virtualisation (NFV) Release 4; Architectural Framework; Report on further NFV support for 5G

ETSI GS NFV-SOL 018 V4.3.1 (2022-09)



Network Functions Virtualisation (NFV) Release 4; Protocols and Data Models; Profiling specification of protocol and data model solutions for OS Container management and orchestration

ETSI NFV and the open-source ecosystem

The way that ETSI NFV has specified support for container-based/cloud-native VNF deployments makes it fully compatible with de-facto open-source solutions, such as the Kubernetes® ecosystem.

ETSI NFV term

Analogy in Kubernetes® ecosystem



Container Infrastructure Service (CIS)	Kubernetes services exposing CRI, CNI, CSI
Container Infrastructure Service (CIS) instance	Kubernetes node
Container Infrastructure Service Management (CISM)	Kubernetes control plane & Helm 3 client
CIS cluster	Kubernetes cluster
Managed Container Infrastructure Object (MCIO)	Kubernetes managed objects (e.g., Deployments, StatefulSet, Persistent Volume Claim, Service, etc.)
Managed Container Infrastructure Object Package (MCIOP)	Helm charts
Managed CIS Cluster Object (MCCO)	Kubernetes Custom Resource Definition (CRD)
Container Image Repository (CIR)	Docker Registry
CIS Cluster Management (CCM)	Cluster API (CAPI)

Support for container-based/cloud-native VNFs (1/2)

The ETSI NFV specifications aimed to **remain agnostic to specific technologies and provide a framework reusable for various kinds of technologies and deployment forms**. However, at the time that ETSI NFV was created, the predominant technology of virtualization was “virtual machines” (VM).

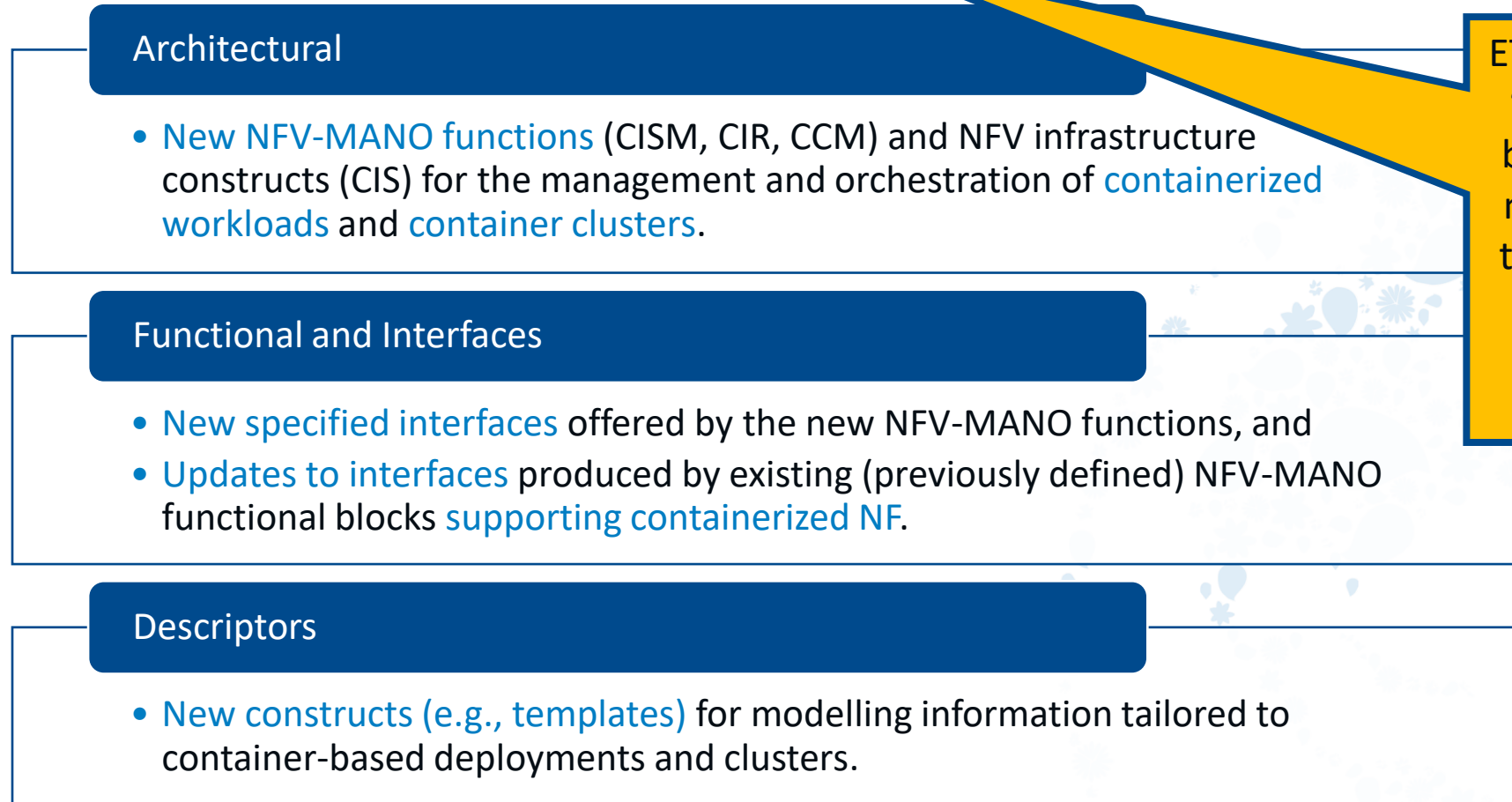
Exemplarily, use of terminology and concepts in ETSI NFV specifications (refer to definitions in ETSI GR NFV 003):

- **Virtualization deployment unit (VDU)** in the modelling of VNF descriptors,
- **VNF component (VNFC)** for modelling the “internals” of a VNF, and
- **Virtualization container**, to refer to partition of a compute node that provides an isolated virtualised computation environment. Examples of virtualization container includes virtual machine and OS container

Hence, ETSI NFV does not only cover VM-based deployments, but **enhancements in the NFV-MANO architectural framework, interfaces and modelling were further developed** in the specifications to support the advances and technology that had been developed in the industry, and mainly from known mainstream de-facto solutions.

Support for container-based/cloud-native VNFs (2/2)

Enhancements to support container-based/cloud-native VNFs can be categorized at different levels:



Architectural

- New NFV-MANO functions (CISM, CIR, CCM) and NFV infrastructure constructs (CIS) for the management and orchestration of containerized workloads and container clusters.

Functional and Interfaces

- New specified interfaces offered by the new NFV-MANO functions, and
- Updates to interfaces produced by existing (previously defined) NFV-MANO functional blocks supporting containerized NF.

Descriptors

- New constructs (e.g., templates) for modelling information tailored to container-based deployments and clusters.

ETSI NFV specs refer to “CNF” as “container-based VNF” or “cloud native VNF”, i.e., VNF terminology is reused in the context of container/cloud-native.

Specification stages

The specification work to support container-based/cloud-native VNF has been developed within the framework of FEAT17 on “Cloud-native VNFs and Container Infrastructure management”. Two main aspects have been specified:

- Containerized workloads management and enhancements to NFV models,
- CIS clusters management.

Stage 0/1 (completed Q4 2019)

Use cases, concepts
Recommendations

Informative study:
ETSI GR NFV-IFA 029 (published)

Stage 2 (completed Q3 2022)

Requirements on CISM/CIR/CCM exposed service interfaces
New/enhanced functional requirements
Enhanced information models for VNFD and interfaces

Normative specifications:
New ETSI GS NFV-IFA 040 (published)
New ETSI GS NFV-IFA 036 (published)
Enhanced ETSI GS NFV-IFA010/007/008/013 (published)
Enhanced ETSI GS NFV-IFA011/014 (published)

Stage 3 (completed Q4 2023)

Profiling (endorsement) of de-facto standard open-source solutions
Enhancement of the existing data models

Normative specifications:
New ETSI GS NFV-SOL 018 (published)
New ETSI GS NFV-SOL 020 (published)
Enhanced ETSI GS NFV-SOL001/004 (published)
Enhanced ETSI GS NFV-SOL002/003/005 (published)

New stage 2 and 3 specifications

New specifications have been delivered. Stage 3 deliverables aim at profiling de-facto open-source solutions and or existing standardized protocol and data models.

- **ETSI GS NFV-SOL 018**: “NFV Release 4; Protocols and Data Models; Profiling specification of protocol and data model solutions for OS Container management and orchestration”,
- **ETSI GS NFV-SOL 020**: “NFV Release 4; Protocols and Data Models; Specification of protocols and data models for Container Infrastructure Service Cluster Management”.

Stage 2 (interface, high-level modeling)

ETSI GS NFV-IFA 040 (published):

- Overview and framework for OS container management and orchestration.
- OS container NFV object model.
- CISM services and requirements on their interfaces.
- CIR service and reqs on its interface.

ETSI GS NFV-IFA 036 (published):

- Overview and framework for CIS cluster management.
- CIS cluster NFV object model
- CCM services and reqs on their interfaces.
- CISM services and requirements on their interfaces about CIS management.

Stage 3 (protocols and data models)

ETSI GS NFV-SOL 018 (published):

- Overview of Kubernetes® API, Helm™ CLI and OCI™ Distribution Specification API.
- NFV object model mapping to profiled solution objects.
- Input/output parameter mapping between NFV data model and profile solution data models.
- API protocol and data model profiling.

ETSI GS NFV-SOL 020 (published):

- NFV object model mapping to profiled solution objects.
- API protocol and data model profiling.



kubernetes



Kubernetes Cluster API

NFV concepts updates

ETSI NFV terms were updated to reflect better the use of VM and OS container technologies for realizing and deploying VNFs.

Term

Definition

Virtualised Network Function Component (VNFC)

Internal component of a VNF providing a VNF Provider a defined sub-set of that VNF's functionality, with the main characteristic that a single instance of this component maps 1:1 against a single instance of **an atomic deployable unit**.

NOTE: An instance of an atomic deployable unit is represented by a single **VM for hypervisor-based virtualization**, or represented by **one or a set of OS containers for OS virtualization**.

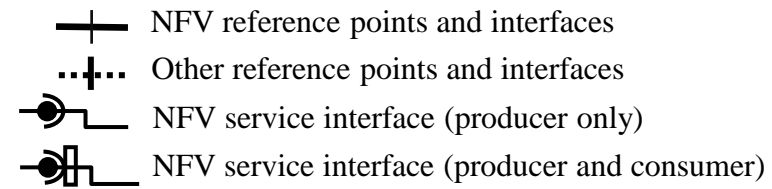
Virtualised Network Function Component (VNFC) Instance

Instance of a VNFC deployed in a specific **atomic deployable unit** instance.

NOTE: A VNFC instance has a lifecycle dependency with its parent VNF instance.

Latest published version available at: [ETSI GR NFV 003 V1.8.1 \(2023-09\)](#)

Architectural enhancements

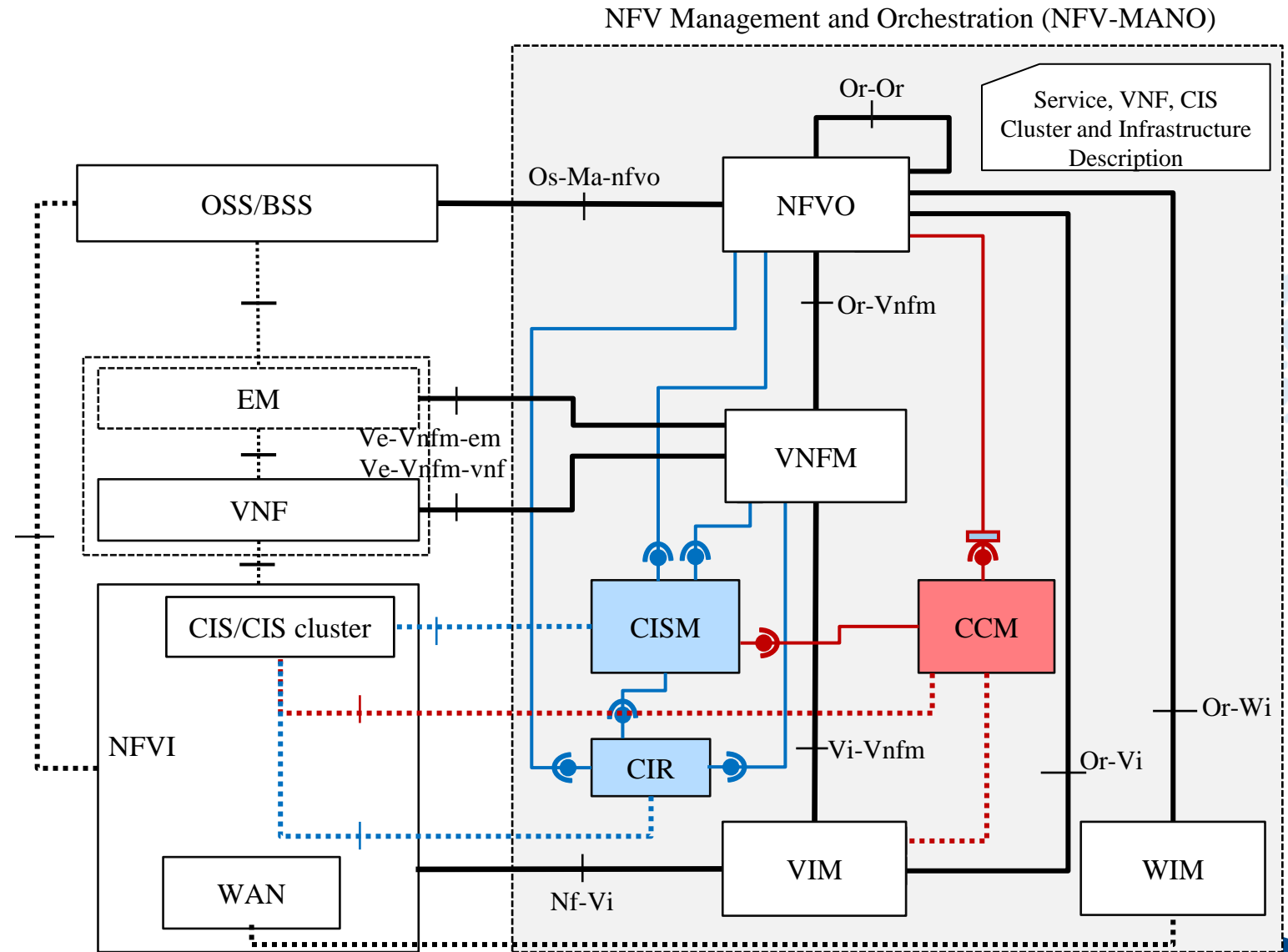


NFV-MANO architectural framework extended with 3 new functions:

- Container Infrastructure Service Management (CISM)
- Container Image Repository (CIR)
- Container Cluster Management (CCM)

NFVI includes the “container infrastructure services” (CIS):

- Container Infrastructure Services (CIS)



Functional and interface enhancements

The NFV-MANO framework has been enhanced with new NFV-MANO functions dedicated to containerized workload and cluster management. Existing NFV-MANO functional blocks have also been enhanced.

- LCM granting references to cluster constraints, namespaces, OS container resources, etc.
- Access information for OS image registries and MCIOP repositories
- Consumer management of namespaces, namespace quotas, policies and configurations
- Consumer management of OS container images

- VNF LCM mapping of VNF runtime information to corresponding new container objects.
- Secondary network attachment definitions.
- Consumer management of OS container images
- Consume containerized workload and MCIOP services from CISM.

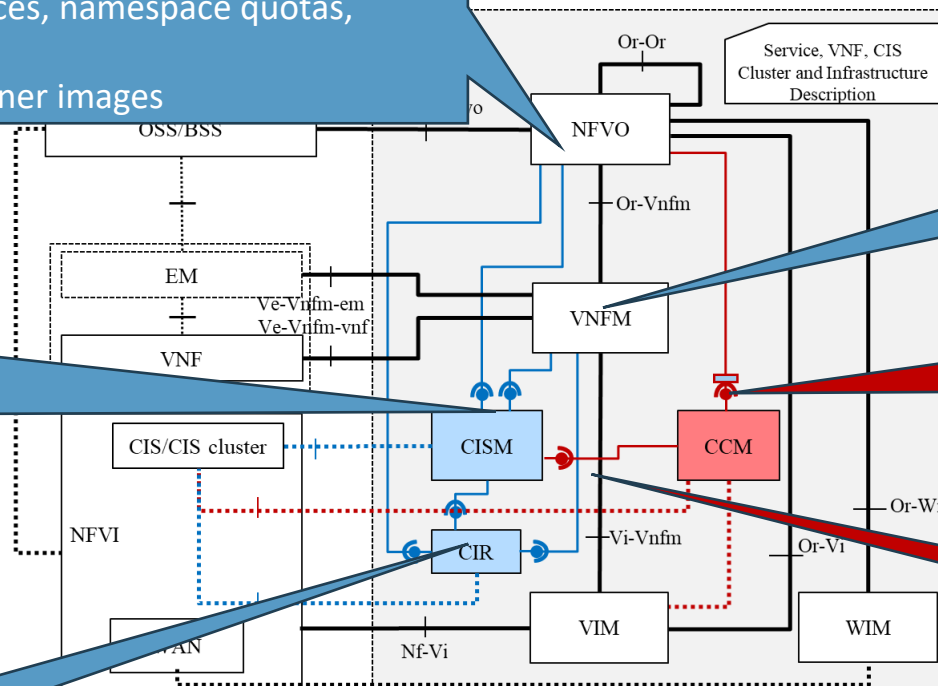
- Containerized workloads management, compute/storage/network MCIOP management, MCIOP configuration management

- CIS cluster lifecycle, fault, configuration, performance and security management



- OS container image management

- CIS instance management, MCCO management



Kubernetes Cluster API

Descriptors enhancements

Existing VNF descriptor (VNFD) was enhanced to convey design-time information when realizing a VNF or any of its VNFC as a set of OS containers. (Ongoing) Assessment of VNFD for cloud-native and further enhancements are being studied in the ETSI GR NFV-IFA 051.

VNF package content: to contain one or more MCIOPs (e.g., Helm Charts)

Info model for new descriptors are specified for CIS cluster management.

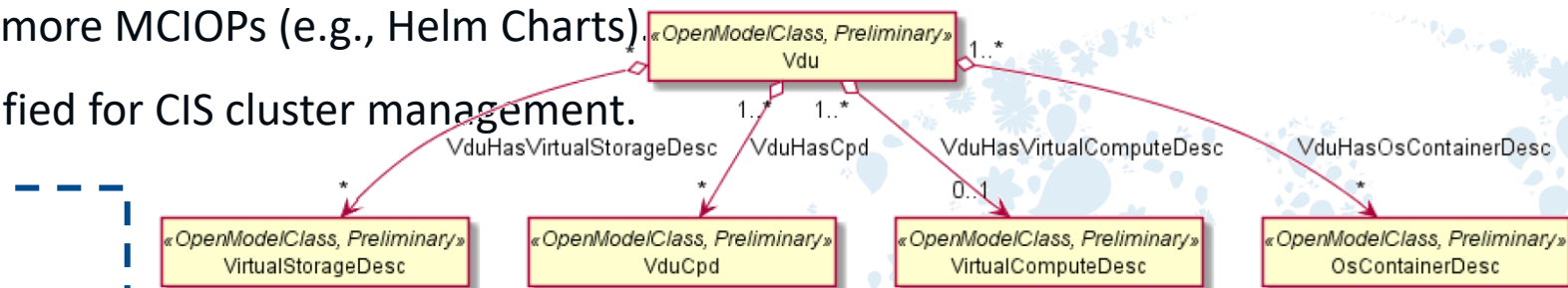


Figure 7.1.6.2.1-1: Vdu deployment view
From ETSI GS NFV-IFA 011

New IE for multiple container descriptors in one VDU

CIS cluster descriptor (CCD): characteristics of the cluster

CIS cluster node descriptor (CCND): characteristics of a CIS cluster node.

CIS cluster node resource descriptor (CCNRD): resource characteristics of a CIS cluster node.

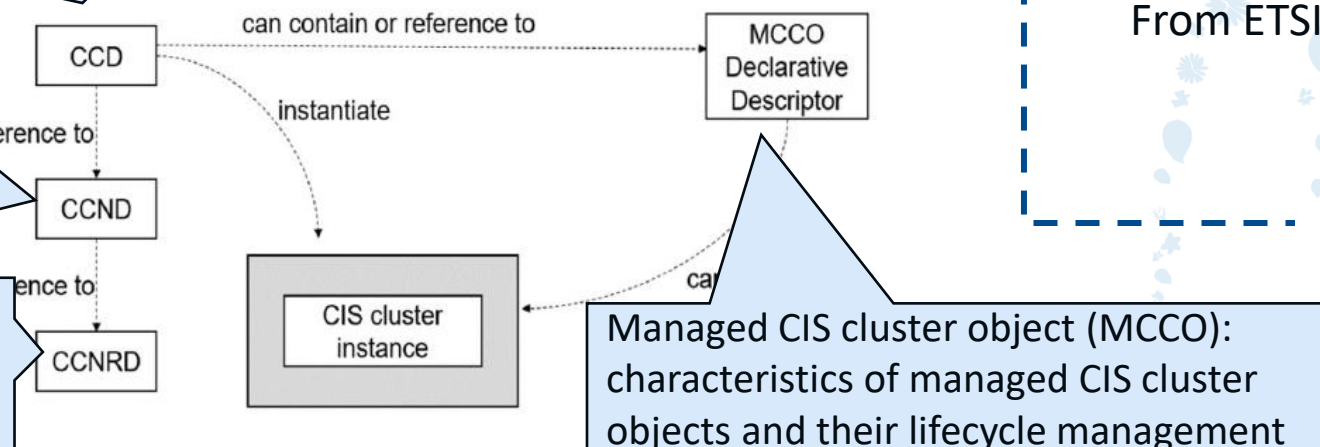


Figure 6.1-1: CCM related declarative descriptors relationship

From ETSI GS NFV-IFA 036

Managed CIS cluster object (MCCO): characteristics of managed CIS cluster objects and their lifecycle management

Part 3: PaaS Services framework in NFV



PaaS Services framework development in NFV

ETSI GR NFV-IFA 029 v3.3.1 (2019-11)



GROUP REPORT

Network Functions Virtualisation (NFV) Release 3;
Architecture;
Report on the Enhancements of the NFV architecture towards
"Cloud-native" and "PaaS"

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https://www.etsi.org/deliver/etsi_gr/NFV-IFA/001_099/029/03.03.01_60/gr_NFV-IFA029v030301p.pdf

ETSI GR NFV-EVE 019 v5.1.1 (2023-10)



GROUP REPORT

Network Functions Virtualisation (NFV) Release 5;
Architectural Framework;
Report on VNF generic OAM functions

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ETSI GS NFV-IFA 049 v5.0.2 (2024-02)



GROUP SPECIFICATION

Network Functions Virtualisation (NFV) Release 5;
Architectural Framework;
VNF generic OAM functions and PaaS services specification

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[https://docbox.etsi.org/ISG/NFV/IFA/05-CONTRIBUTIONS/2024//NFVIFA\(24\)000142_Draft_contribution_GS_NFV-IFA049_v5_0_2.zip](https://docbox.etsi.org/ISG/NFV/IFA/05-CONTRIBUTIONS/2024//NFVIFA(24)000142_Draft_contribution_GS_NFV-IFA049_v5_0_2.zip)

PaaS Services framework development



Initial work on PaaS

ETSI GR NFV-IFA 029 V3.3.1 (2019-11)



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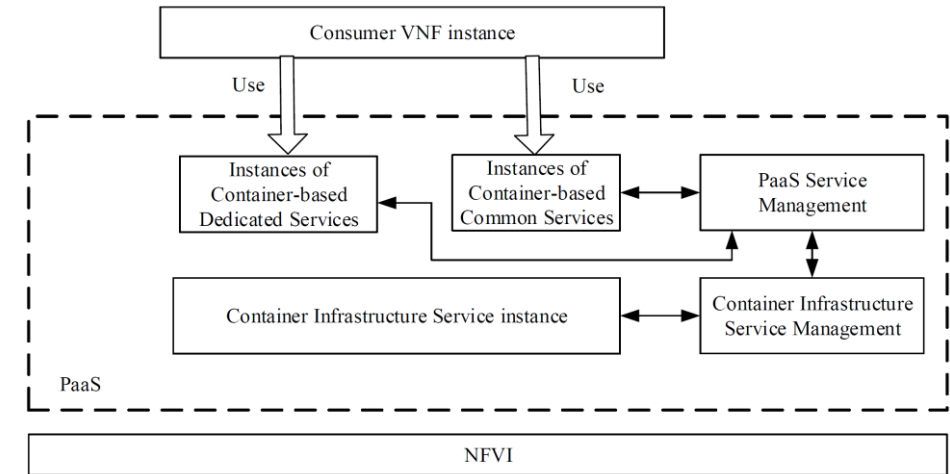
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Platform as a Service (PaaS): capability provided to the consumer to deploy onto the cloud infrastructure consumer created or acquired applications.

PaaS service types:

- VNF Common Service: modular service or a function with a lifecycle independent from its consumers and that is consumable by either one or multiple services.
- VNF Dedicated Service: modular service or a function with a lifecycle dependent on its consumers and that can only be consumed by a specific set of applications or services.

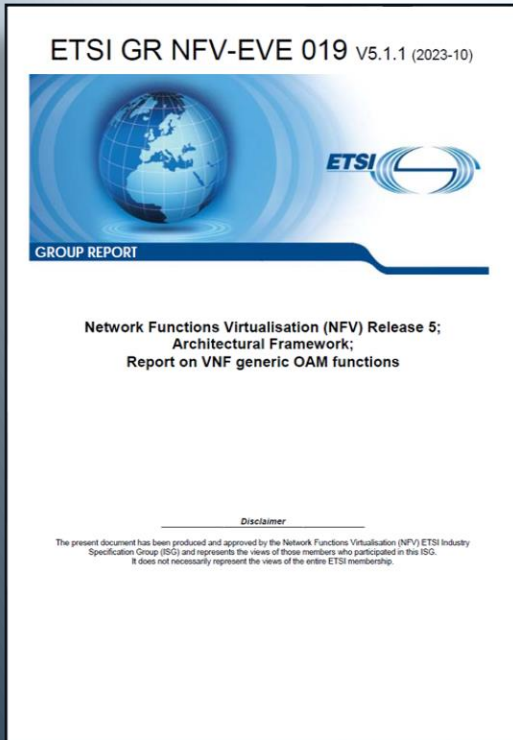


Three main design options can be envisioned:

- PaaS services are modelled as VNFs.
- PaaS services are modelled as a new type of NFVI resources.
- PaaS services are modelled as a new type of object specific to the PaaS layer.

VNF generic OAM functions (EVE019)

VNF Generic OAM functions



- Use cases related to LCM of VNF generic OAM functions
- Use cases related to type of VNF generic OAM functions
- Use cases: Management aspects related to VNF connectivity
- Use cases: VNF generic OAM functions for autonomous management
- Framework and potential solutions
- Recommendations

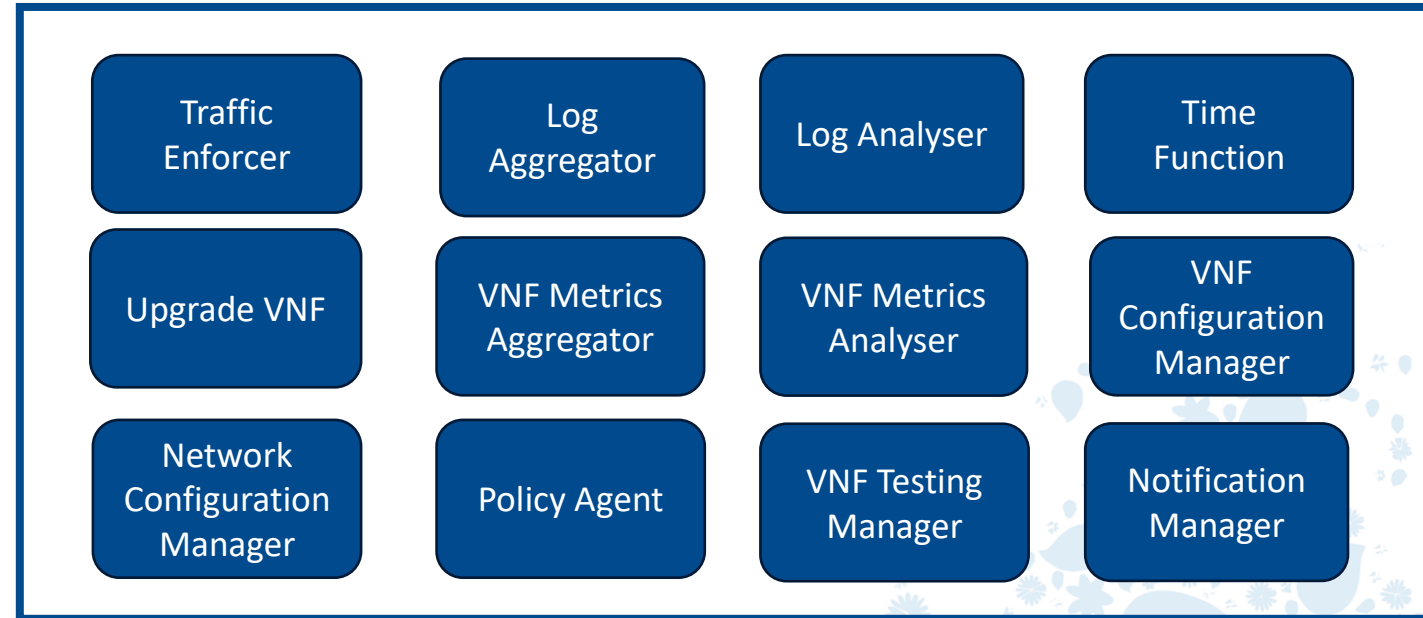
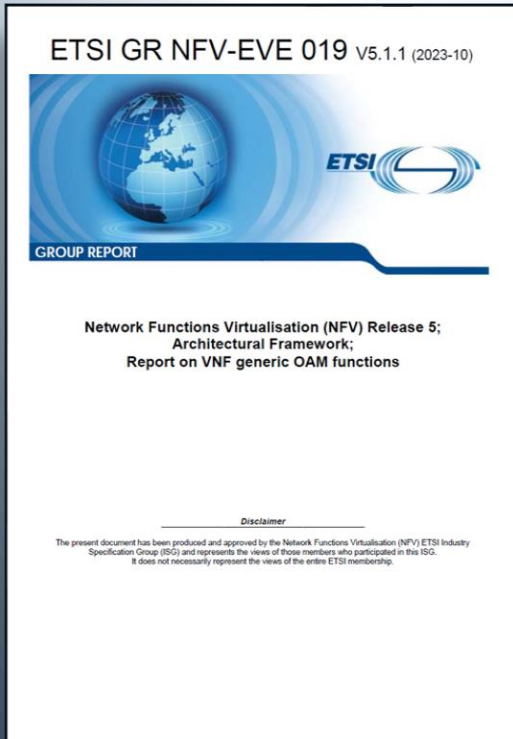
NOTE: ETSI GR NFV-EVE 019 release 4 was used as a baseline for the previous Cloud-native OAM support study in 3GPP SA5.

https://www.etsi.org/deliver/etsi_gr/NFV-EVE/001_099/019/05.01.01_60/gr_NFV-EVE019v050101p.pdf

VNF generic OAM functions (EVE019)

Release 5

VNF Generic OAM functions



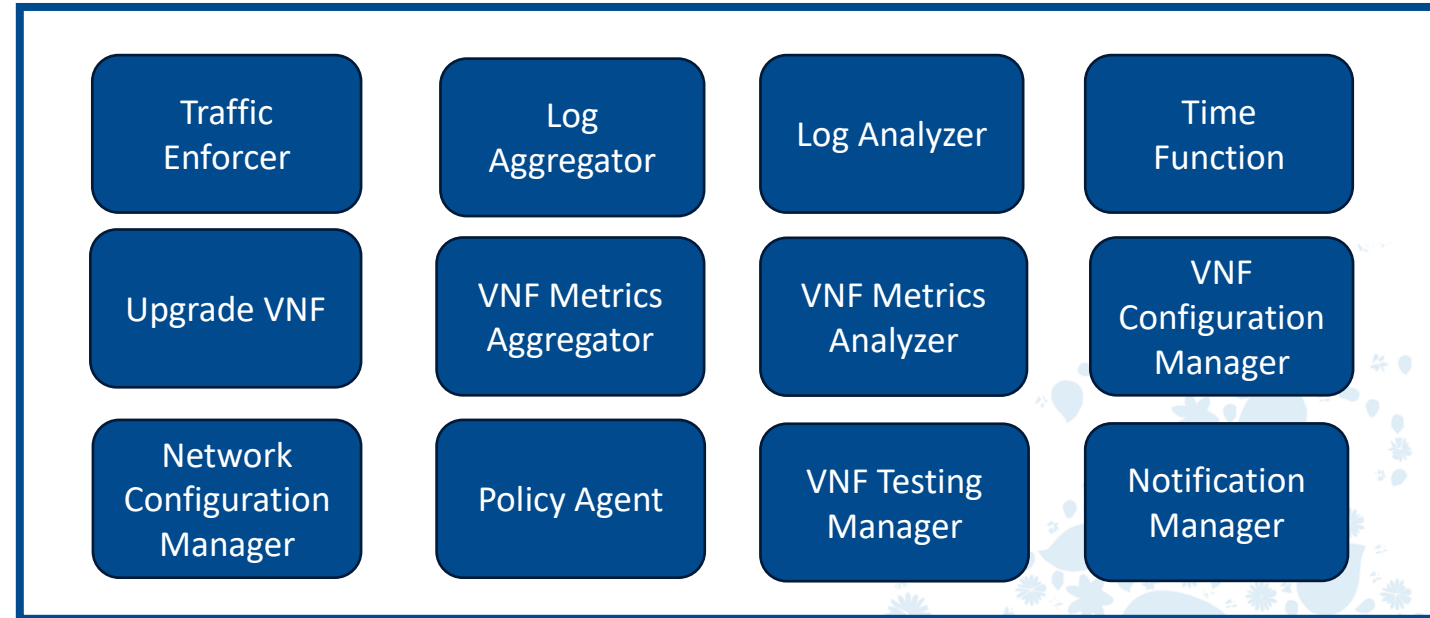
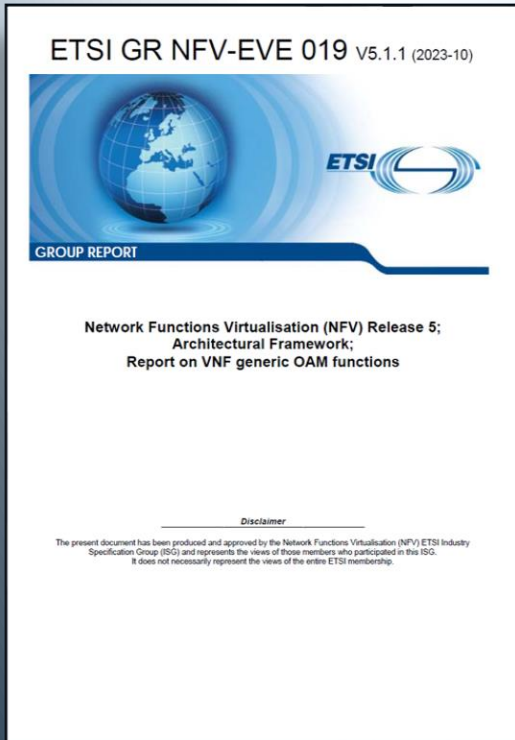
- **Use cases related to type of VNF generic OAM functions**
- Use cases related to LCM of VNF generic OAM functions
- Use cases: Management aspects related to VNF connectivity
- Use cases: VNF generic OAM functions for autonomous management
- Framework and potential solutions
- Recommendations

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VNF generic OAM functions (EVE019)

Release 5

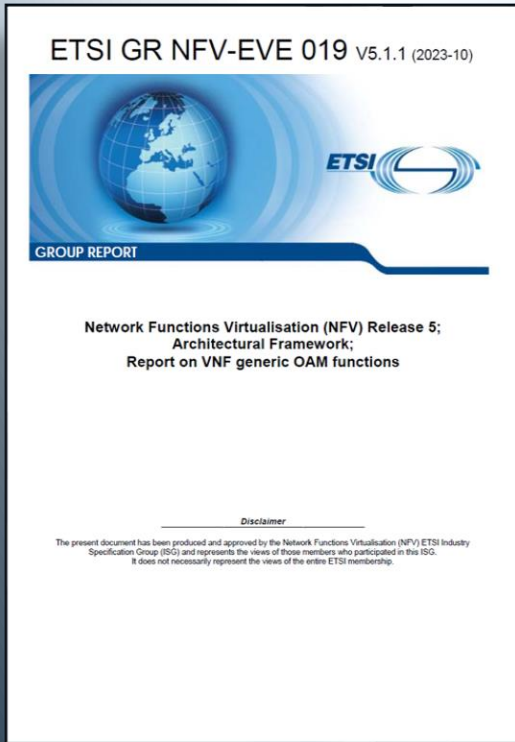
VNF Generic OAM functions



- **Use cases related to LCM of VNF generic OAM functions**
 - Instantiation/termination of VNFs using VNF generic OAM functions managed by NFV-MANO
 - Lifecycle management of VNF generic OAM function managed by NFV-MANO

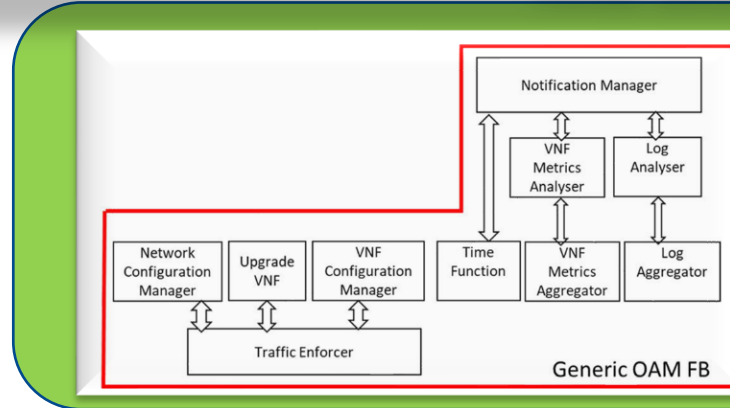
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VNF Generic OAM functions



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Three solutions have been evaluated



Solution A: Introducing generic OAM as a new functional block.



* NOTE: in the normative work, it is not regarded as a “functional block”, but rather as a “functional set”, that is composable as needed by applications, operator, etc. please refer to slide #29.

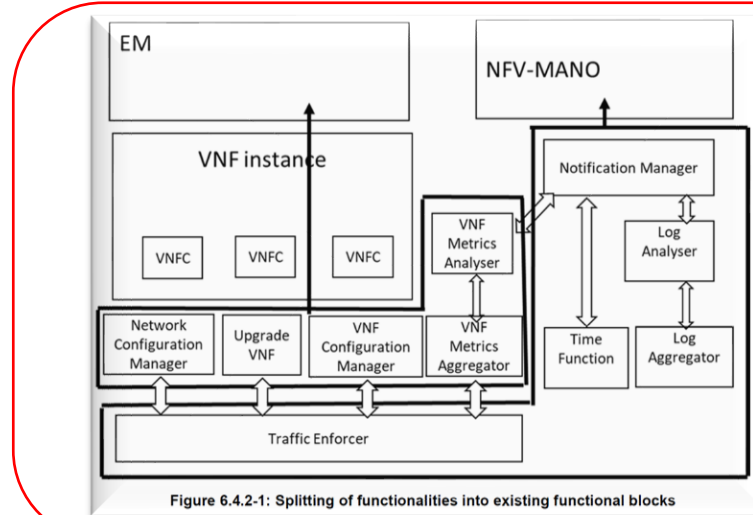


Figure 6.4.2-1: Splitting of functionalities into existing functional blocks

Solution B: Extending existing functional blocks for Generic OAM functionality



PaaS services as VNFs according to ETSI NFV GR IFA029

Solution C: Generic OAM functions as VNFs



endorsed

PaaS Services framework development

Release 5

PaaS in NFV

ETSI GS NFV-IFA 049 V5.0.2 (2024-02)



Network Functions Virtualisation (NFV) Release 5;
Architectural Framework;
VNF generic OAM functions and PaaS services specification

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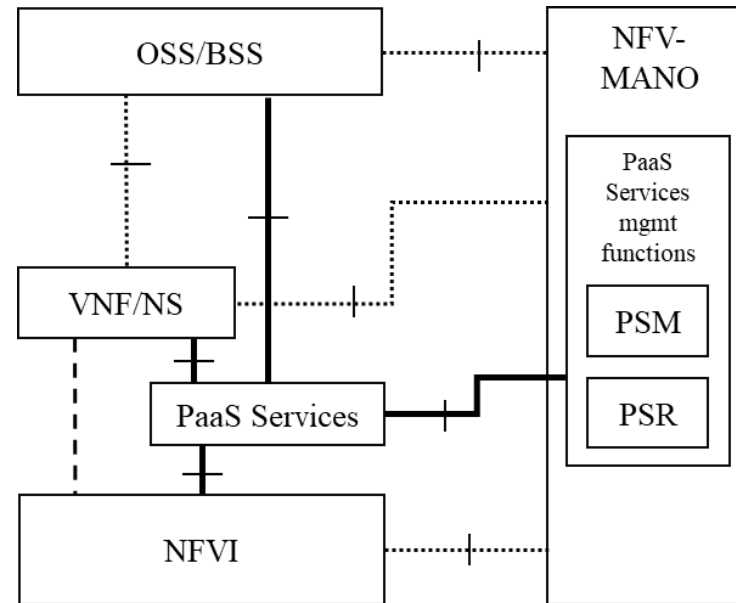
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

-  PaaS Service interfaces
-  Other interfaces
-  Execution interfaces

Figure 4.2.2a-1: PaaS Services framework

IFA049 approach on generic OAM

Key point 1

A VNF generic OAM function = (is a) PaaS Service

In current Release 5 normative specification work (to be part of ETSI GS NFV-IFA 049 of Release 5), the relationship between VNF generic OAM functions and PaaS Services is further clarified.

Clause 4.2.1.2: “A VNF generic OAM function is a PaaS Service whose scope is to provide and handle generic OAM functionality for VNFs.”

PaaS Services framework development

PaaS in NFV

ETSI GS NFV-IFA 049 V5.0.2 (2024-02)



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2 Draft contribution GS NFV-IFA049 v5 0 2.zip

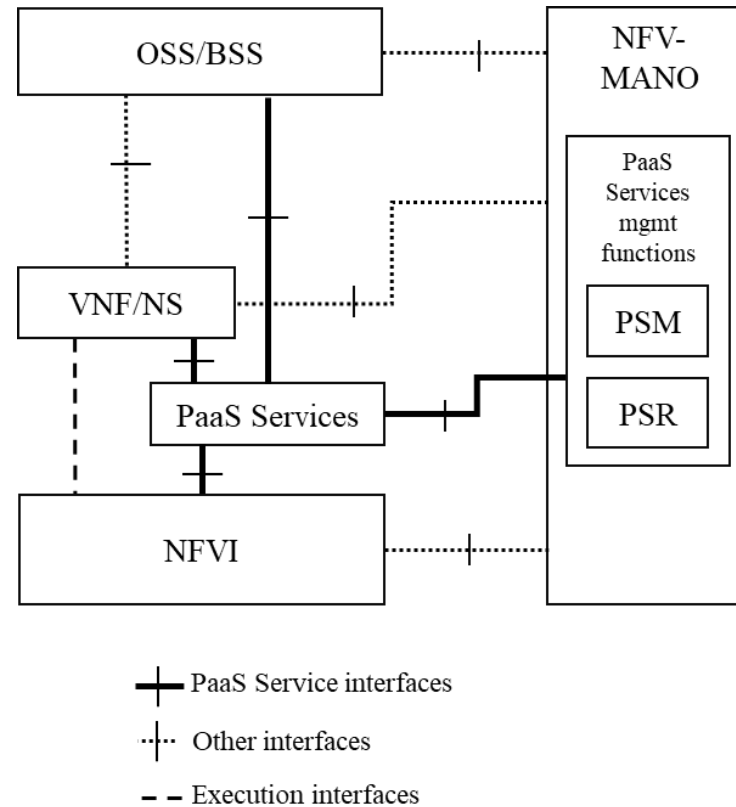


Figure 4.2.2a-1: PaaS Services framework

IFA049 approach on generic OAM

Key point 2

- **A logical grouping** of a set of different VNF generic OAM functions is considered, **not a new FB**.
- **The logical set is not a managed object**, rather each VNF generic OAM function can be operated and managed independently from others.
- The set of VNF generic OAM functions can interact with other functional blocks and functions (like NFV-MANO, NFVI, etc.) over defined interfaces, either produced by the VNF generic OAM functions or produced by other functional blocks and functions.

Interactions and interfaces specification



PaaS in NFV

ETSI GS NFV-IFA 049 V5.0.2 (2024-02)

GROUP SPECIFICATION

Network Functions Virtualisation (NFV) Release 5; Architectural Framework; VNF generic OAM functions and PaaS services specification

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Northbound-Management (NB-M): interface(s) exposed by the PaaS Service towards one or multiple corresponding management entity for the purpose of managing the PaaS Service.

Northbound-Function (NB-F): interface(s) exposed by the PaaS Service with specific functionality tailored to that PaaS Service.

Southbound-VNF (SB-V): it comprises the interface(s) used to interact with the VNF instances that are being managed with the VNF generic OAM function.

Southbound-Function (SB-F): to perform the intended functionality, a PaaS Service can interact with different function producer entities (i.e. OSS, NFV-MANO, NFVI or other PaaS Services).

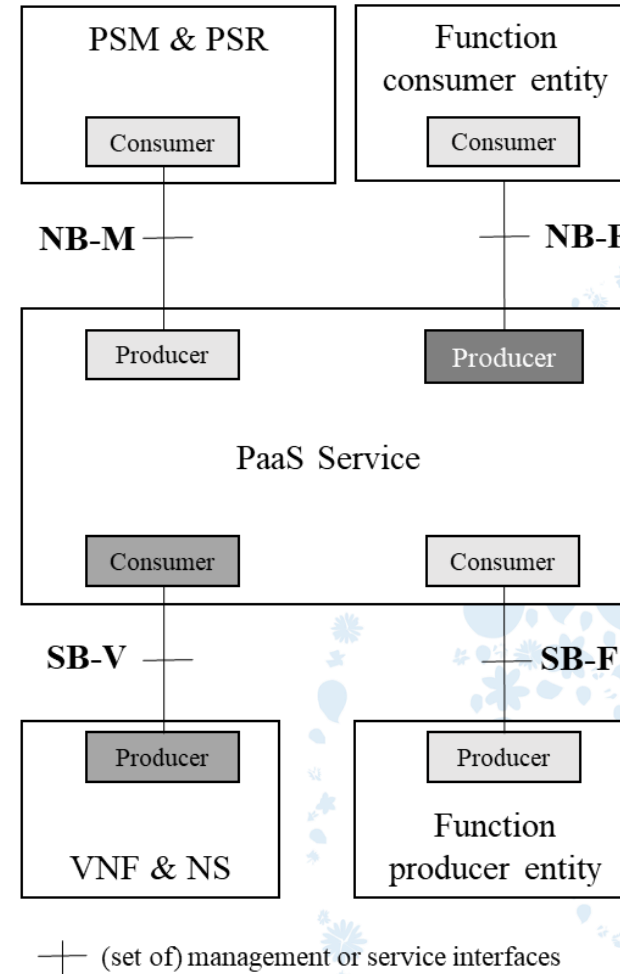
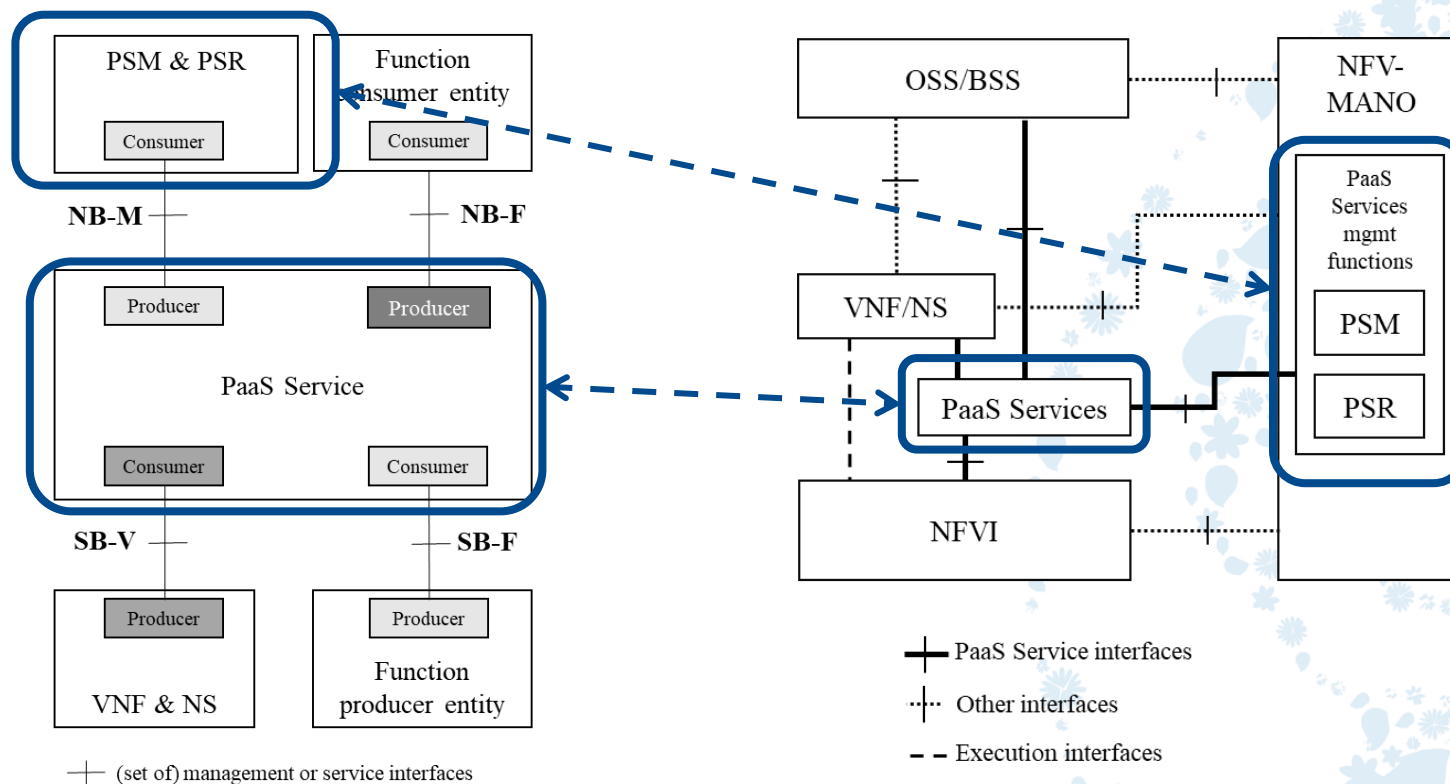


Figure 4.2.3-1: Interfaces and service level interactions of PaaS Services

FEAT24 “VNF generic OAM”: VNF generic OAM functions and PaaS Services

PaaS Services have corresponding management functions for their lifecycle and repository aspects:

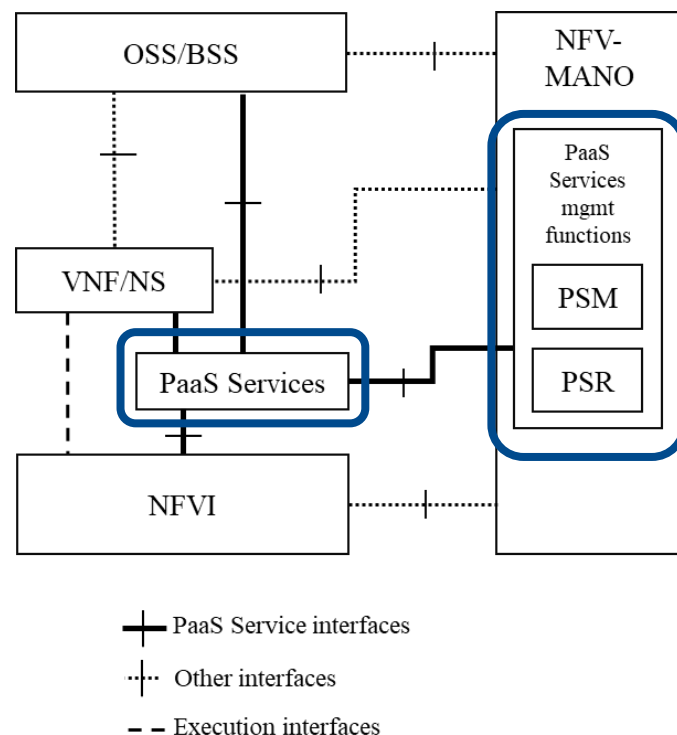
- PaaS Services Manager (PSM) and
- PaaS Services Repository (PSR).



PSM and PSR when placed as NFV-MANO functions

FEAT24 “VNF generic OAM”: VNF generic OAM functions and PaaS Services

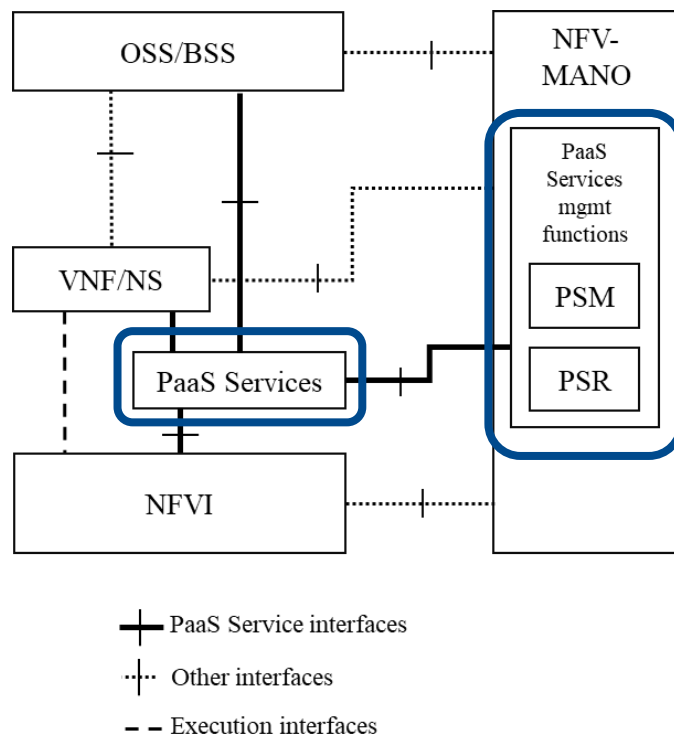
PaaS Services have corresponding management functions for their lifecycle and repository aspects: **PaaS Services Manager (PSM)** and **PaaS Services Repository (PSR)**.



Numbering	Functional requirements description
Psm.Psslcm.001	The PSM function shall support the capability to instantiate PaaS Services.
Psm.Psslcm.002	The PSM function shall support the capability to terminate existing PaaS Services instances.
Psm.Psslcm.003	The PSM function shall support the capability to scale out/in an existing PaaS Service instance. See note 1.
Psm.Psslcm.004	The PSM function shall support the capability to use deployment information from the PSDs for the lifecycle management of the PaaS Services.
Psm.Psslcm.005	The PSM function shall support the capability to notify about the lifecycle changes of PaaS Services.
Psm.Psslcm.006	The PSM function shall support the capability to manage the subscription to notifications about lifecycle changes of PaaS Services.
Psm.Psslcm.007	The PSM function shall support the capability to request an operation granting before executing the lifecycle operation procedure of the PaaS Service in procedures that require changes in terms of virtualised resources or CIS cluster resources usage and on procedures that can result in an impact on the VNF/NS using PaaS Service instances. See note 2 and 3.
NOTE 1: If the PaaS Service is deployed as a VNF, scaling the PaaS Service is realized by scaling the deployed VNF. If the PaaS Service is deployed as NFVI resources or as MCCO, scaling the PaaS Service is realized by adding/removing virtualised resources or MCCOs.	
NOTE 2: This includes procedures related to the instantiation, scaling and termination of PaaS Services.	
NOTE 3: Impacts to VNF/NS using PaaS Service instances could include, e.g. terminating a PaaS Service instance that is currently being used by a VNF instance which is still running and not expected to be terminated.	

FEAT24 “VNF generic OAM”: VNF generic OAM functions and PaaS Services

PaaS Services have corresponding management functions for their lifecycle and repository aspects: [PaaS Services Manager \(PSM\)](#) and [PaaS Services Repository \(PSR\)](#).



- When PaaS Services are deployed as a VNF, the PSM interacts with the VNFM to execute the corresponding lifecycle management of the VNF.
- When PaaS Services are deployed as one or multiple virtualised resources offered as new type of NFVI resource, the PSM interacts with the VIM.
- When PaaS Services are deployed as one or multiple managed CIS cluster objects (MCCO*) as new type of NFVI resource, the PSM interacts with the CISM.

ETSI GS NFV-IFA 010 V5.0.1 (2023-11)

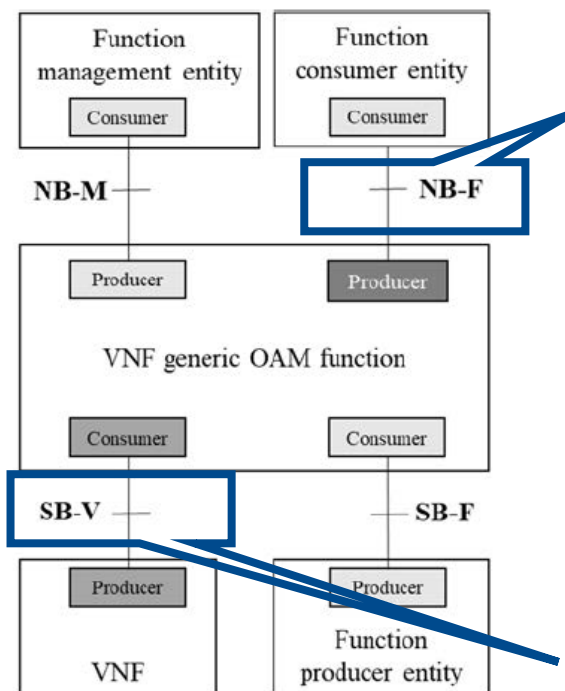
*MCCO: Managed CIS Cluster Object

Part 4: VNF generic OAM functions

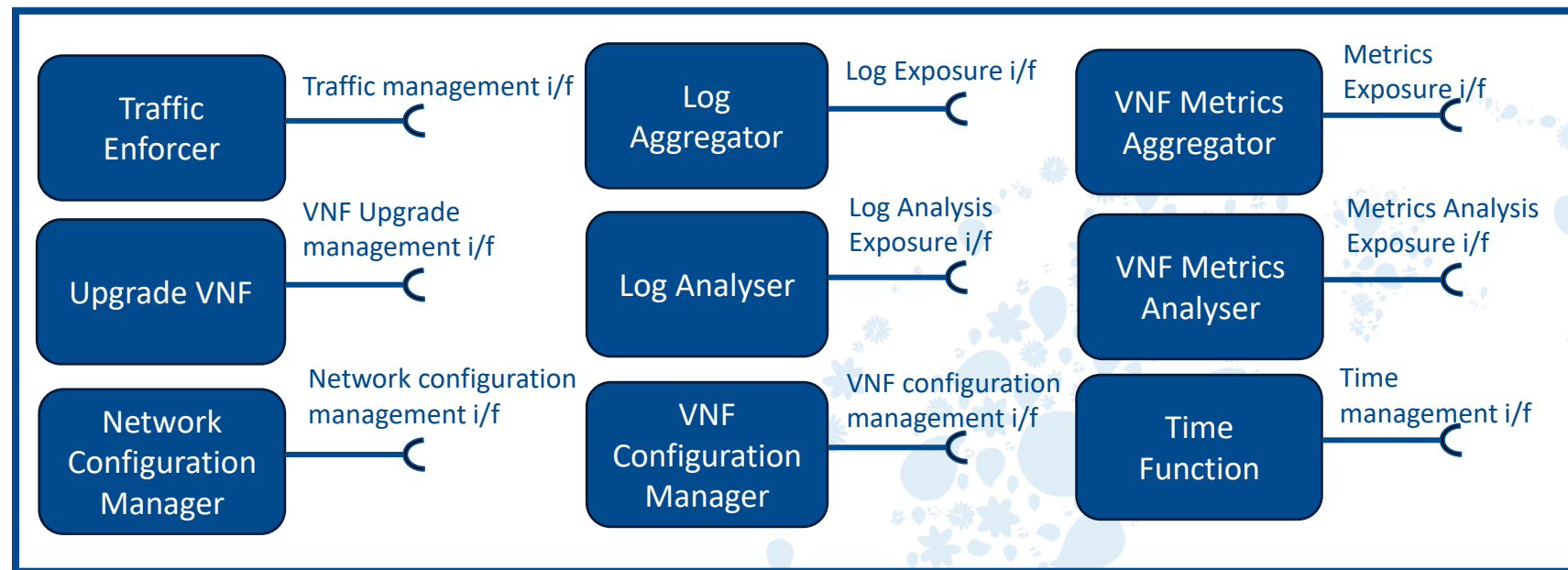


FEAT24 “VNF generic OAM”: VNF generic OAM functions interfaces

❖ ETSI GS NFV-IFA 049 specifies various interfaces exposed/consumed by VNF generic OAM functions, primarily...



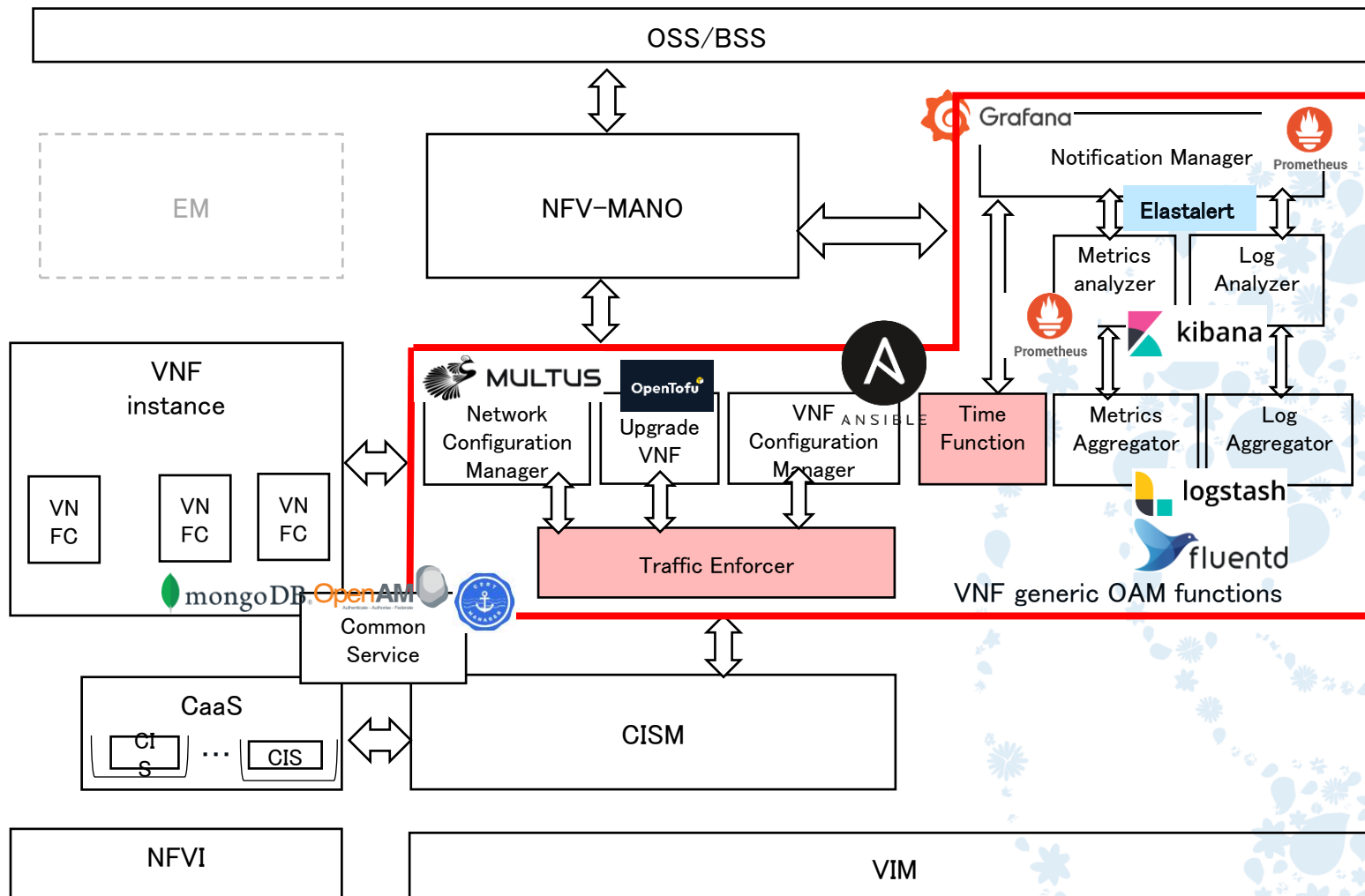
+ (set of) management or service interfaces



Service interaction requirements between VNF generic OAM functions and VNF (over SB-V)

- Configuration: push and pull mechanism: applicable to Traffic Enforcer, Network Configuration Manager, Upgrade VNF, Time Function and VNF Configuration Manager
- Monitoring: streaming and file-based mechanisms, applicable to VNF Metrics Aggregator
- Logging: pull mechanism to collect logs, and collection of events/messages with logging data, applicable to Log Aggregator.

FEAT24 “VNF generic OAM”: VNF generic OAM framework: potential mapping with open source solutions (example)



DISCLAIMER
 These are only potential options, that have neither been fully discussed in the ISG community, nor endorsed any specific one.
 Purpose is to only visualize potential options that might also be relevant to the open-source community.

FEAT24 “VNF generic OAM”: stage 3 work

- NWI Proposal in [NFV\(24\)000014r1](#)
- Summary of Stage 3 activities:
 - *This work item will analyse existing solutions against ETSI GS NFV-IFA 049 requirements.*
 - *The WI will develop the protocol and data model for the NB-F interfaces of VNF generic OAM functions, prominently using the CRD schema format where feasible, and other formats for some VNF generic OAM functions if CRD is not feasible.*
 - *The WI will specify requirements for the protocol(s) on the SB-V interfaces toward the VNF.*

Approval is expected in NFV#45 plenary
March 11th-15th, 2024 Paris, France

FEAT24 “VNF generic OAM”: stage 3 options - declarative API based on CRD (example)

❖ Potential touchpoint of standardization with open source development:

- Standardize CRD (define schema, one or maybe more).
- Open-source development of CR controller and other artifacts.

NWI Proposal in [NFV\(24\)000014r1](#)

Standard

```

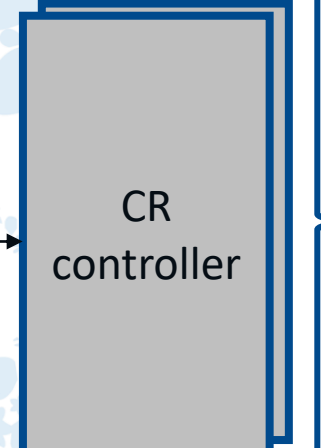
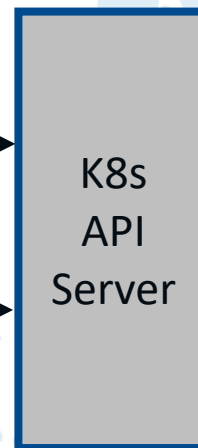
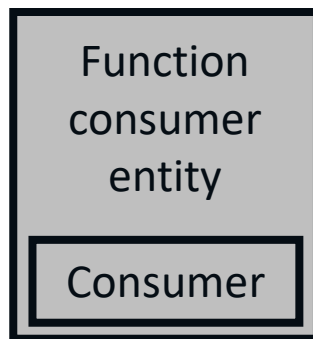
apiVersion: apiextensions.k8s.io/v1
kind: CustomResourceDefinition
metadata:
  name: myCustomResource.etsi.nfv
spec:
  group: etsi.nfv
  scope: Namespaced
  names:
    kind: MyCustomResource
  versions:
    - name: v1alpha1
  schema:
    openAPIV3Schema:
      description: Schema for MyCustomResource API
      properties:
        ...
      spec:
        description: Desired state of MyCustomResource.
        properties:
          ...
    type: object
  
```

CRD

```

apiVersion: etsi.nfv/v1alpha1
kind: MyCustomResource
metadata:
  name: sample
spec:
  ...
  
```

CR



Open source project

Create/update CR object

Get status CR object

Conclusion, next steps



Conclusion, next steps

ETSI NFV framework and its specifications have been enhanced to better support container-based/cloud-native VNF management and more cloud-native OAM.

Next steps in ETSI NFV (highlights):

- VNF generic OAM and other PaaS Services (part of FEAT21 and FEAT24 development)
 - Completion of stage 2 work as part of Release 5 ed511.
 - Discussion and proposals for stage 3 for specifying VNF generic OAM functions are ongoing.
- Container-based NF:
 - Simplification of VNF descriptors (part of FEAT35 development).
 - Flexible VNF deployment: LCM enhancements to adapt/select specific “modules” (e.g., specific services) offered by a VNF (part of FEAT31 development).
- NFV architecture evolution:
 - Study being developed as part of DGR/NFV-IFA054 (to produce ETSI GR NFV-IFA 054).
 - Evaluation of different concepts, approaches and solutions to make the NFV architecture simpler and more flexible, wherein Telco PaaS for cloud-native OAM and NF plays a key role.



Thank you for your attention

Follow us on:    

Any questions?

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katsalis@docomolab-euro.com



Where to find further information

NFV Bits on YouTube:

<https://www.youtube.com/user/ETSIstandards>

ETSI NFV drafts and Releases documentation:

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

ETSI NFV published standards:

<https://www.etsi.org/committee/1427-nfv>

ETSI NFV blog:

<https://www.etsi.org/newsroom/blogs/blog-nfv>

ETSI NFV webpage:

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