The Standards People

VNF Configuration
Understanding the available options

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For: **SDN- NFV World Congress**

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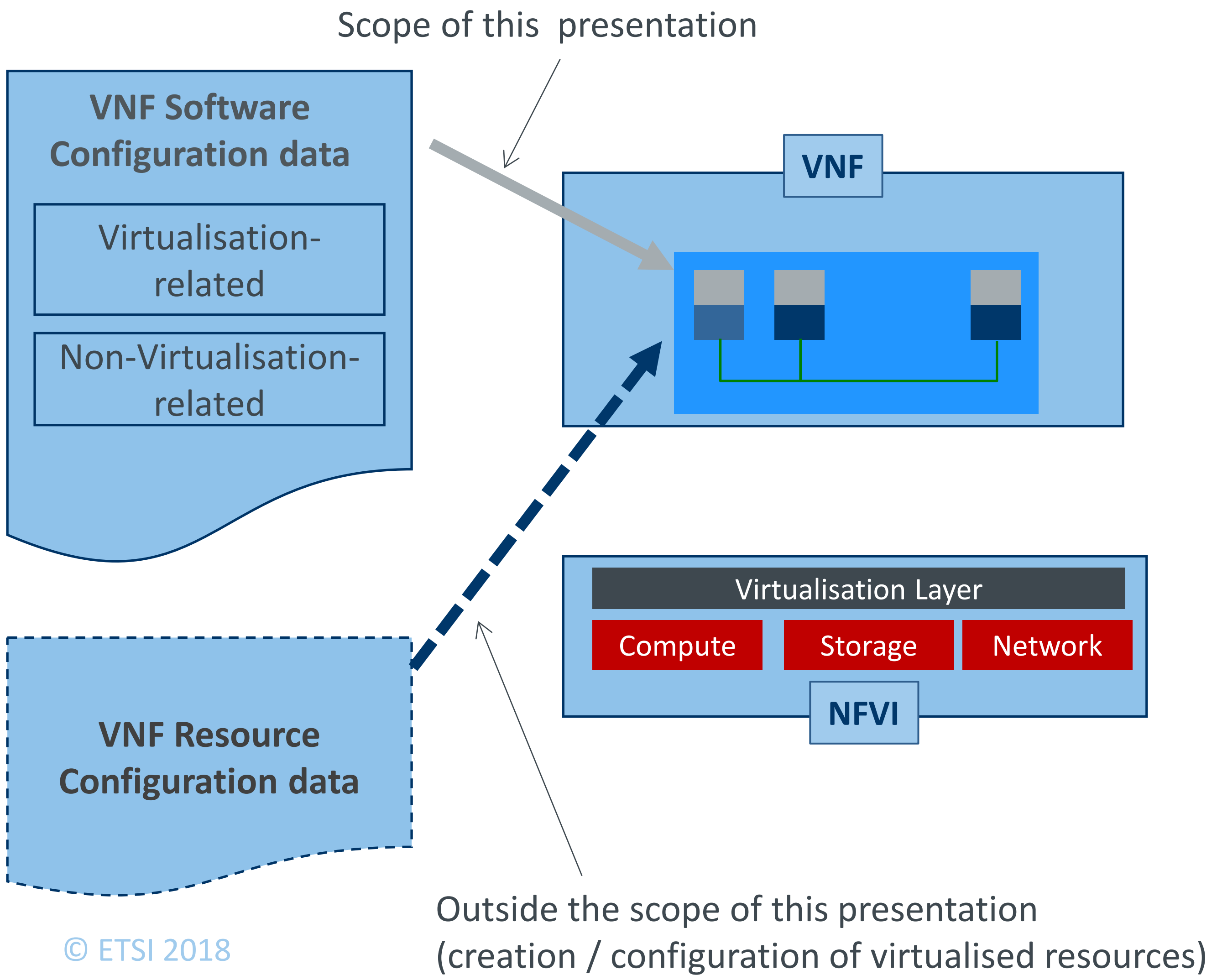
Agenda

- Introduction
- Configuration Path #1
- Configuration Path #2
- Configuration Path #3
- Summary

Classification of VNF configuration data


Scope of this presentation
VNF Software Configuration data
Virtualisation-related
Non-Virtualisation-related
VNF
VNF Resource Configuration data
Virtualisation Layer
Compute
Storage
Network
NFVI
Outside the scope of this presentation (creation / configuration of virtualised resources)

Virtualisation-related configuration parameters

- Parameters whose value is or can be influenced by processing functions in the NFVI and/or NFV-MANO
- e.g. IP address of a Connection Point of a VNFC to be configured on another VNFC

Non-virtualisation-related configuration parameters

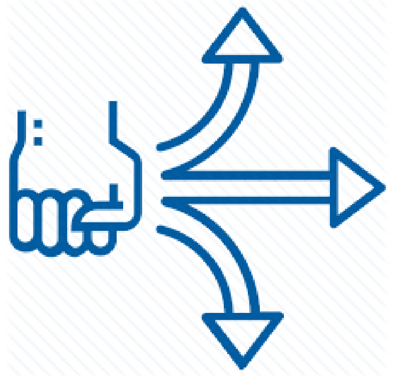
- Parameters whose value cannot be influenced by processing functions in the NFVI and/or MANO
- e.g. APN-to-GGSN mappings in a SGSN VNF

Alternative paths for VNF configuration

The ETSI NFV architectural framework enables 3 non-exclusive alternative paths to provide configuration data to a VNF software instance.

Path #A:	OSS -> (EM) -> VNF software instances
Path #B:	(OSS -> NFVO or EM ->) VNFM -> VNF software instances
Path #C:	(OSS -> NFVO or EM ->) VNFM –> VIM -> Virtualisation Container -> VNF software instances

OSS: Operations Support System
EM: Element Manager
VNFM: VNF Manager
VIM: Virtualisation Infrastructure Manager



Configuration Path #A

CONFIGURATION Path #A
OSS -> (EM) -> VNF software instance

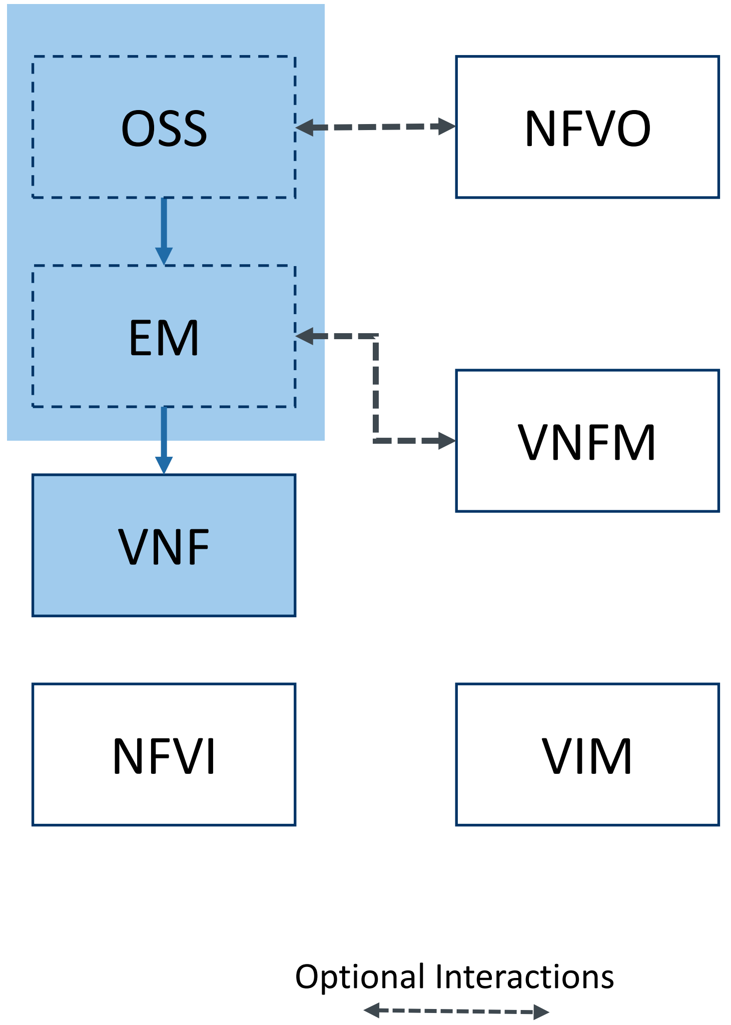
Relies on reference points currently out of the scope of the ETSI ISG NFV work: OSS-EM and/or EM-VNF.

Non-virtualisation-related configuration data

- Similar approach as for a Physical Network Function (PNF), with no MANO involvement.

Virtualisation-related configuration data

- Requires that the OSS gets the virtualisation-dependent values from the NFVO, through the NS LCM API defined in ETSI GS NFV-SOL 005 (e.g. use of the Query NS operation).



Configuration Path #B

CONFIGURATION PATH B:
(OSS -> NFVO or EM ->) VNFM -> VNF software instance

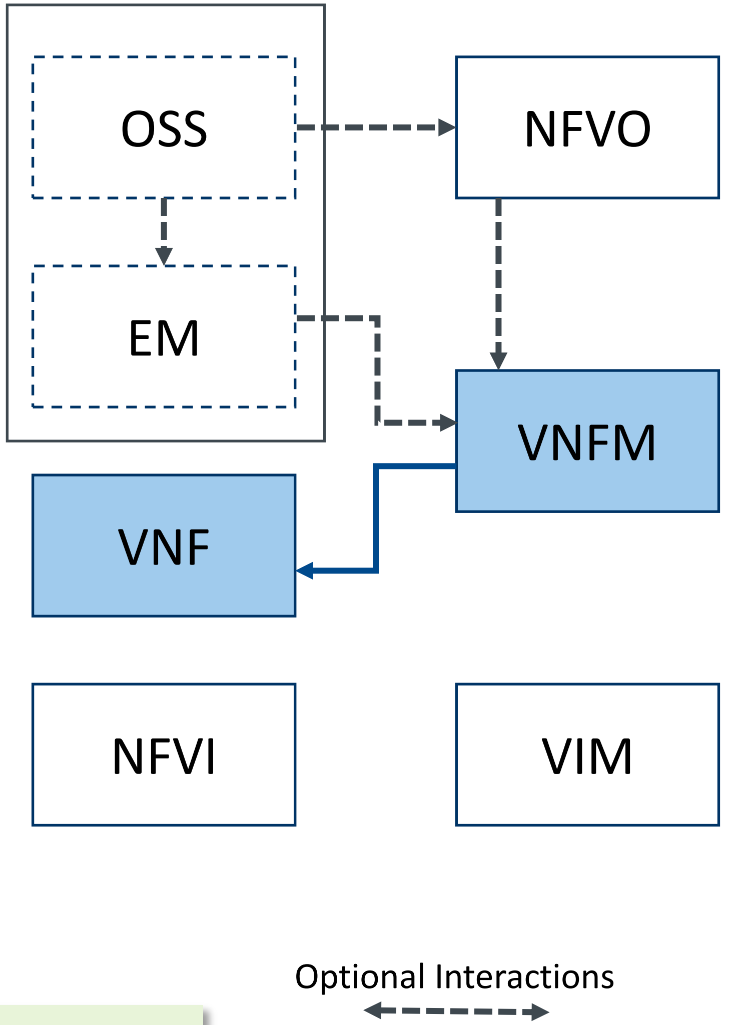
Relies on the support of the optional VNF Configuration interface (push mode) or on VNF LCM notifications followed by a Query VNF operation (Pull Mode) defined in ETSI GS NFV-IFA 008.

Non-virtualisation-related configuration data

- Relies on the configurable properties declared in the VNFD
- NFVO and VNFM are used as a "tunnelling" mechanism between the OSS and the VNF Application

Virtualisation-related configuration data

- Relies on the configurable properties declared in the VNFD and/or on pre-defined parameters available in VnfInfo (DHCP server address to use, Addresses and ports assigned to the Connection Points)



VnfInfo represents the runtime view of a VNF instance exposed by a VNFM.

Configurable properties

Configuration properties must be declared in the VNFD:

- at the VNF level: VnfConfigurableProperties
- and/or VDU level: VnfcConfigurableProperties

VNF configuration properties include

- Standard properties to enable/disable auto scaling and auto healing in a VNF instance.
- Additional configuration properties to be defined by VNF providers

VNFC configuration properties only include additional configuration properties to be defined by VNF providers

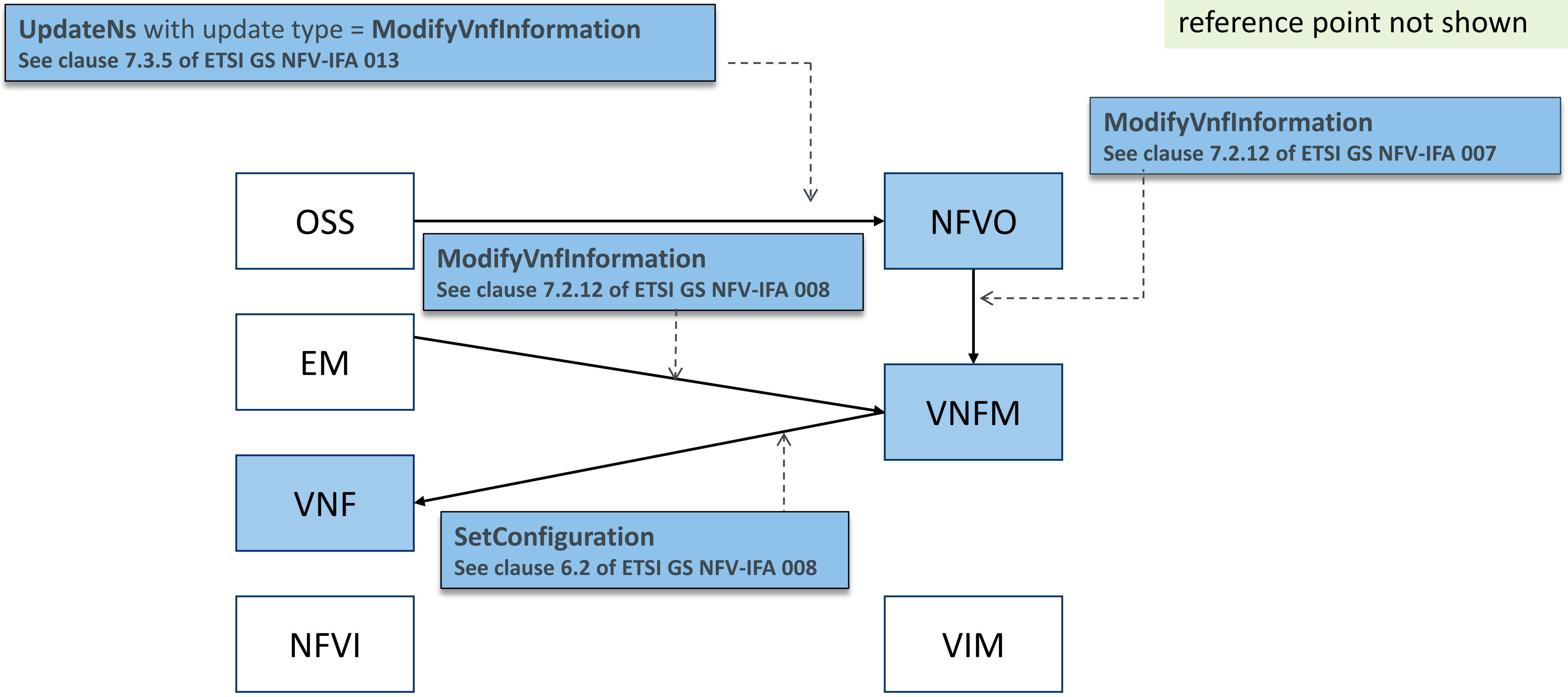
CONFIGURATION PATH B: PUSH and PULL Mode

Configuration data can be provided to a VNF instance in push or pull mode

- The VNFM sends a SetConfiguration operation to the VNF instance as soon as a modification occurs of the VNF configuration interface.
- At boot time or upon receipt of a notification that some information has changed, the VNF instance sends a QueryVnf operation to the VNFM.

Setting and transferring VNF configurable properties

*Pull mode on the VNF – VNFM reference point not shown


UpdateNs with update type = **ModifyVnfInformation**
See clause 7.3.5 of ETSI GS NFV-IFA 013
ModifyVnfInformation
See clause 7.2.12 of ETSI GS NFV-IFA 007
OSS
NFVO
ModifyVnfInformation
See clause 7.2.12 of ETSI GS NFV-IFA 008
EM
VNFM
VNF
SetConfiguration
See clause 6.2 of ETSI GS NFV-IFA 008
NFVI
VIM

Configuration Path #C

CONFIGURATION PATH C
(OSS -> NFVO or EM) -> VNFM -> VIM -> NFVI -> VNF

Relies on the contents of the VNFD and the support by the NFVI and VIM of a mechanism to push initial configuration data to a virtualisation container (e.g. a VM)

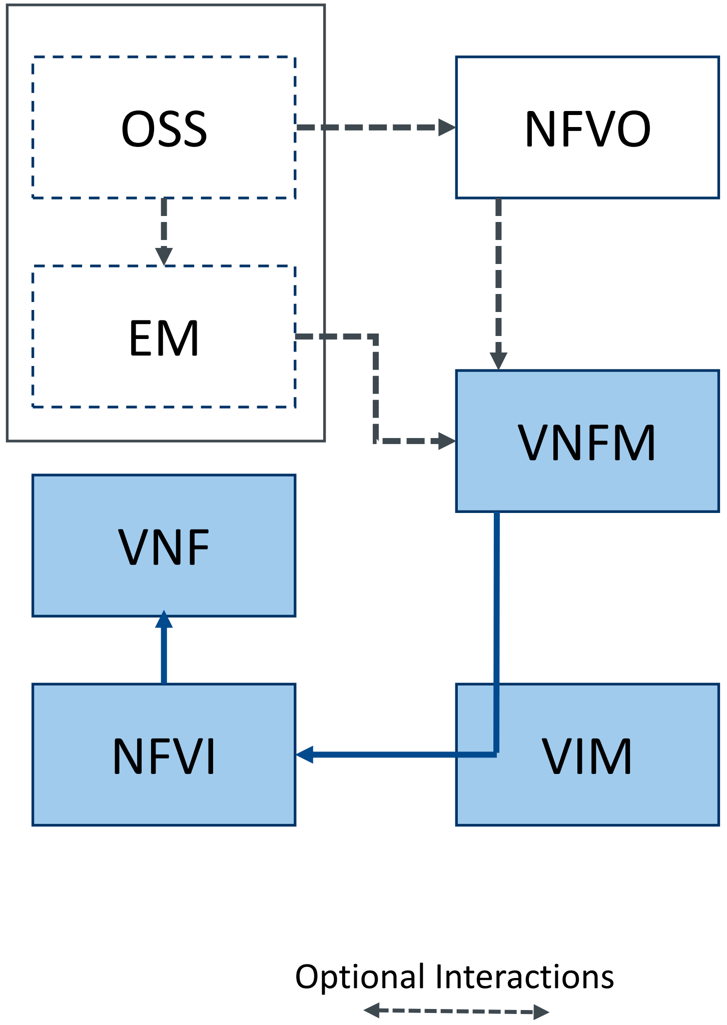
- e.g. Cloud_Init

Non-virtualisation-related configuration data

- Boot data available in the VNFD are pushed to the VNF instance via the NFVI. Might be customized with OSS-provided values.

Virtualisation-related configuration data

- Boot data available in the VNFD are customized by the VNFM and pushed to the VNF instance via the NFVI.



The Boot data mechanism

Boot data is an attribute of a VDU (in the VNFD), representing initialisation data to be sent to VNFC instances, via the VIM and the virtualisation containers hosting them.

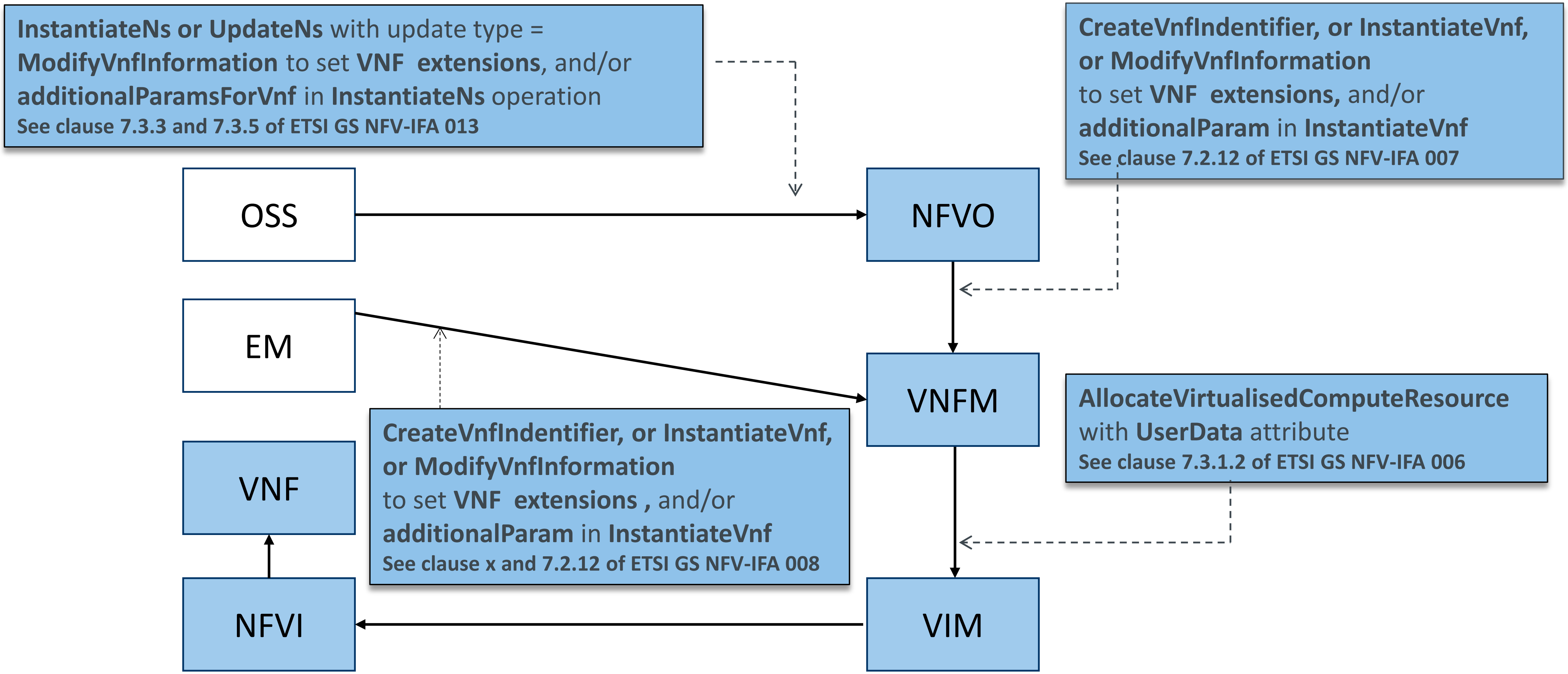
- Using the AllocateVirtualisedComputeResource operation defined in clause 7.3.1.2 of ETSI GS NFV-IFA 006

Can be a string or a URL to an initialization file contained in the VNF package.

May include volatile and/or persistent variable parts declared in other information of the VNFD

- VnfLcmOperationsConfiguration information element (see clause 7.1.5.2 of ETSI GS NFV-IFA 011) for volatile data available during the lifetime of a VNF lifecycle management operation, and/or
- Extension attribute of the VnfInfoModifiableAttribute information element (see clause 7.1.14 of ETSI GS NFV-IFA 011) for persistent data available during the lifetime of a VNF instance (i.e. set in VnfInfo).

Setting variable parts and transferring boot data to a VNF



InstantiateNs or UpdateNs with update type = **ModifyVnfInformation** to set **VNF extensions**, and/or **additionalParamsForVnf** in **InstantiateNs** operation
See clause 7.3.3 and 7.3.5 of ETSI GS NFV-IFA 013

CreateVnfIndentifier, or InstantiateVnf, or ModifyVnfInformation
to set **VNF extensions,** and/or
additionalParam in **InstantiateVnf**
See clause 7.2.12 of ETSI GS NFV-IFA 007

CreateVnfIndentifier, or InstantiateVnf, or ModifyVnfInformation
to set **VNF extensions ,** and/or
additionalParam in **InstantiateVnf**
See clause x and 7.2.12 of ETSI GS NFV-IFA 008

AllocateVirtualisedComputeResource
with **UserData** attribute
See clause 7.3.1.2 of ETSI GS NFV-IFA 006

Key Takeaways

In summary: The NFV architectural framework provides different options for configuring VNF instances

Path #A: OSS -> (EM) -> VNF software instances

- NFV-independent method, application configuration files may be included in the VNF Package
- Typical Use Case: Non-virtualisation related configuration, e.g. APN configuration in a PDN-GW

Path #B: (OSS -> NFVO ->) VNFM -> VNF software instances

- Supported by MANO operations and configurable properties declared in the VNFD.
- Typical Use Case: Configure a VNFC instance with information related to another VNFC instance (e.g. internal load balancer configuration)

Path #C: (OSS -> NFVO ->) VNFM –> VIM -> Virtualisation Container -> VNF software instances

- Supported by NFV-MANO operations and the “boot data” attribute declared in the VNFD. Communication with the VNF instances relies on NFVI/VIM mechanisms such as “Cloud_Init”.
- Typical Use Case: Root password, SSH keys, DNS server, custom script, etc.

ETSI NFV Specifications and Reports

ETSI NFV on etsi.org:

- http://www.etsi.org/technologies-clusters/technologies/nfv

Published deliverables:

- http://www.etsi.org/technologies-clusters/technologies/nfv#specifications
- http://docbox.etsi.org/ISG/NFV/Open/Published/

Draft deliverables (ongoing work):

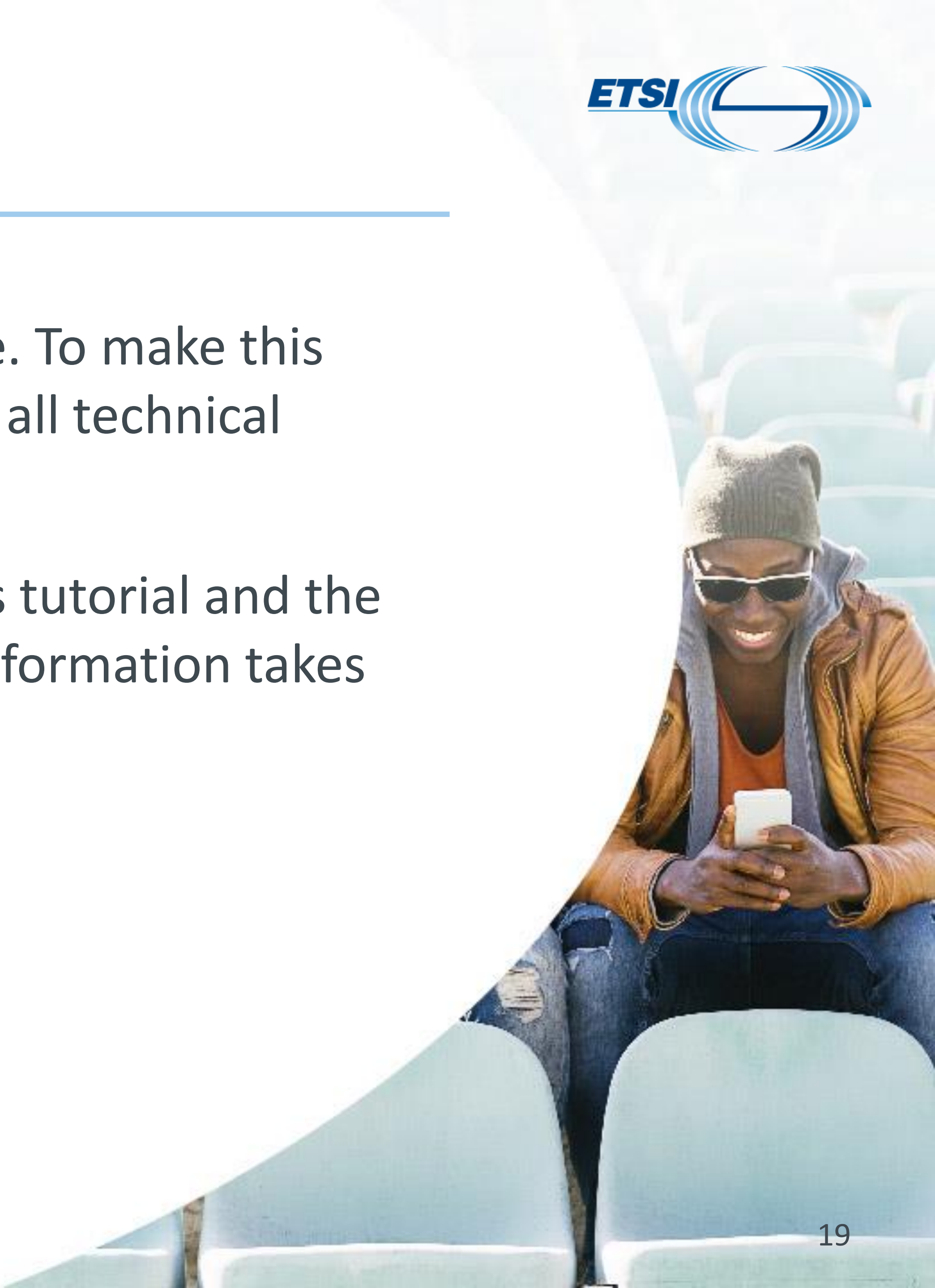
- http://docbox.etsi.org/ISG/NFV/Open/Drafts/

API Specifications
https://nfvwiki.etsi.org/index.php?title=API_specifications#API_specifications

DISCLAIMER

The contents of this presentation is of tutorial nature. To make this presentation easy to understand to non-experts, not all technical details are shown.

In case of discrepancies between the contents of this tutorial and the ETSI NFV Group Specifications, the latter source of information takes precedence.



Thank You!

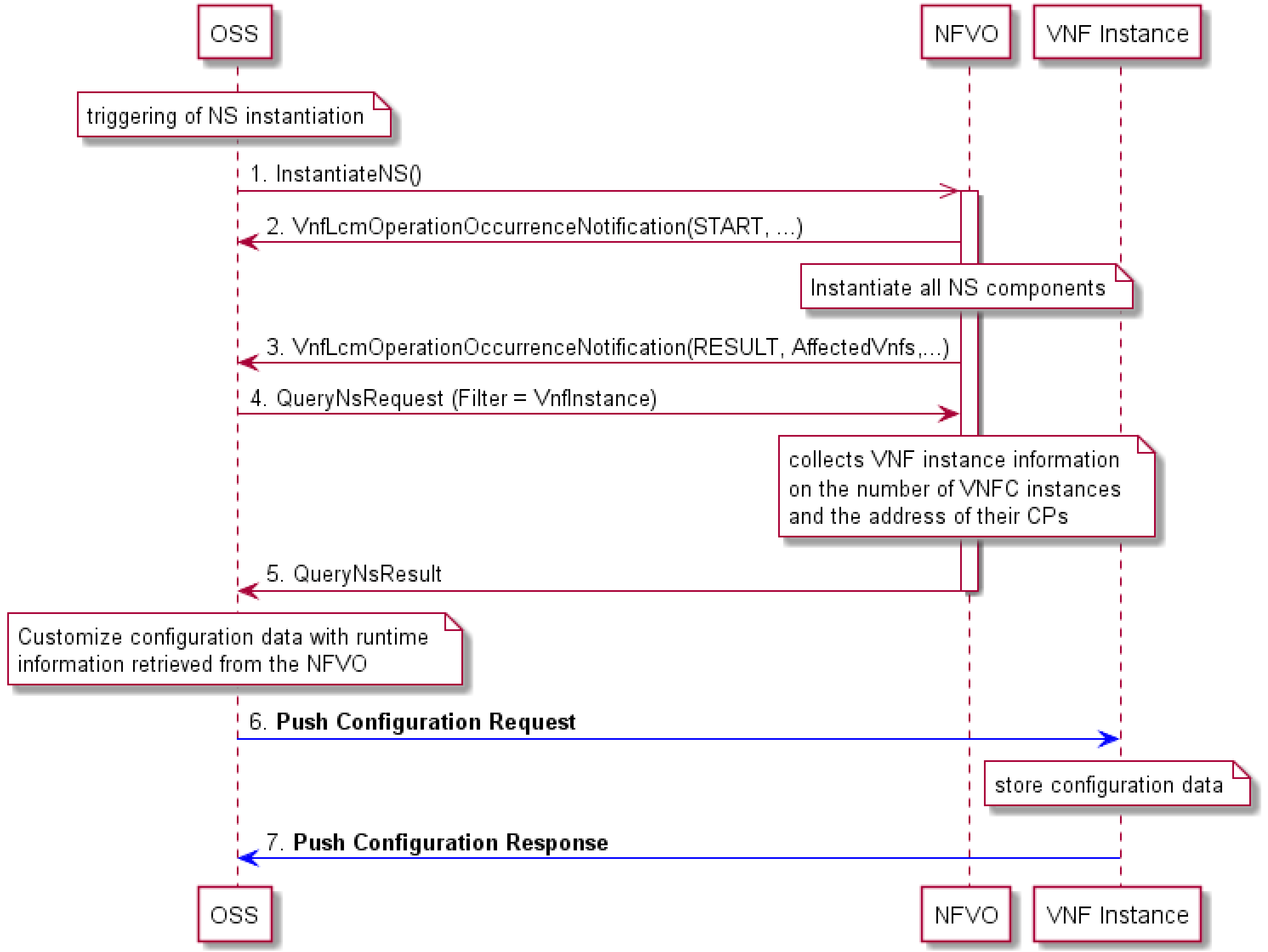
Backup slides

Configurable Properties vs. Extensions and Metadata

Configurable Properties	VNF-specific configuration parameters to be set on VNF instances *Example: EM address (IFA011), name_prefix_in_vim, and dns_server (SOL001)*
Extensions	VNF-specific attributes that affect the lifecycle management of VNF instances in the VNFM *Example: http_proxy (SOL001)*
Metadata	VNF-specific metadata describing the VNF instance *Example: Tag in the VNFM a VNF instance as being going down soon*

In the VNFD, Extensions and Metadata form the **VNF modifiable attributes** information element

CONFIGURATION Path #A
Virtualisation-dependent configuration data example


OSS
NFVO
VNF Instance
triggering of NS instantiation
1. InstantiateNS()
2. VnfLcmOperationOccurrenceNotification(START, ...)
Instantiate all NS components
3. VnfLcmOperationOccurrenceNotification(RESULT, AffectedVnfs,...)
4. QueryNsRequest (Filter = VnfInstance)
collects VNF instance information on the number of VNFC instances and the address of their CPs
5. QueryNsResult
Customize configuration data with runtime information retrieved from the NFVO
6. **Push Configuration Request**
store configuration data
7. **Push Configuration Response**
OSS
NFVO
VNF Instance

The actual messages implementing the Push Configuration Request / Response information flow are outside the scope of ETSI NFV standardization.

The configuration data model can – but not need to - rely on application configuration templates embedded in the VNF Package (as non-MANO artefacts) along with – but not referenced from - the VNFD.

Configurable properties

Configurable properties represent data to be configured on a VNF instance.

Property values can be set

- In the VNFD (default values)
- By lifecycle management (LCM) scripts referenced in the VNFD
- The NFVO or the EM using the Modify VNF Information operation
  - See ETSI GS NFV-IFA 008 Clause 9.2.2.2

TOSCA representation of VNF configurable properties

```
tosca_definitions_version: tosca_simple_yaml_1_2

node_types:
  MyCompany.SunshineDB.1_0.1_0:
    derived_from: tosca.nodes.nfv.VNF
    properties:
      flavour_id:
        constraints:
          - valid_values: [ simple, complex ]
      configurable_properties:
        type: MyCompany.datatypes.nfv.VnfConfigurableProperties
```

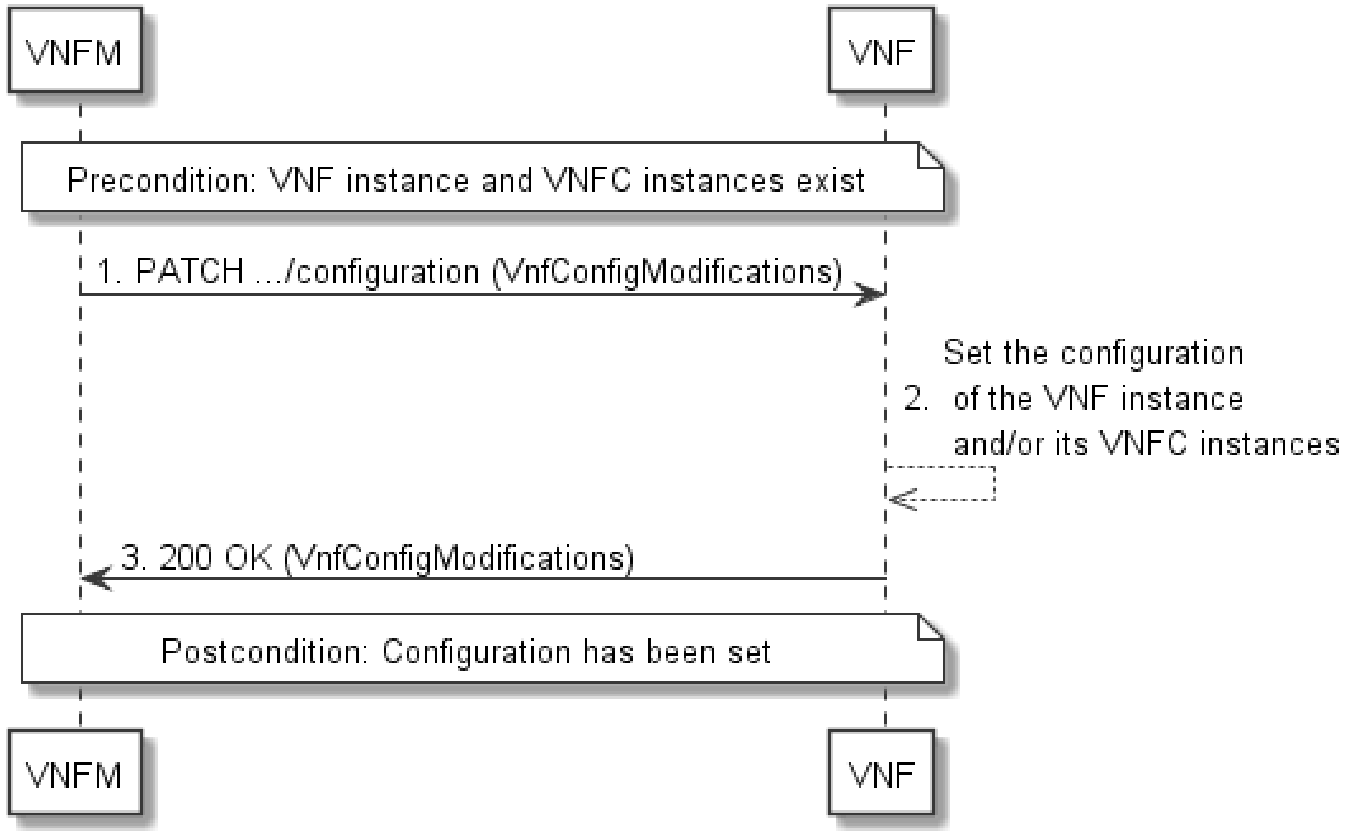
```
data_types:
  Mycompany.datatypes.nfv.VnfConfigurableProperties:
    derived_from: tosca.datatypes.nfv.VnfConfigurableProperties
    properties:
      additional_configurable_properties:
       type: MyCompany.datatypes.nfv.VnfAdditionalConfigurableProperties

  MyCompany.datatypes.nfv.VnfAdditionalConfigurableProperties:
    derived_from: tosca.datatypes.nfv.VnfAdditionalConfigurableProperties
    properties:
      name_prefix_in_vim:
        type: string
        required: false
      dns_server:
        type: string
        required: true
```

✍ The TOSCA representation of a VNFD is specified in Draft ETSI GS NFV-SOL001
A YANG representation is also available in Draft ETSI GS NFV-SOL 006

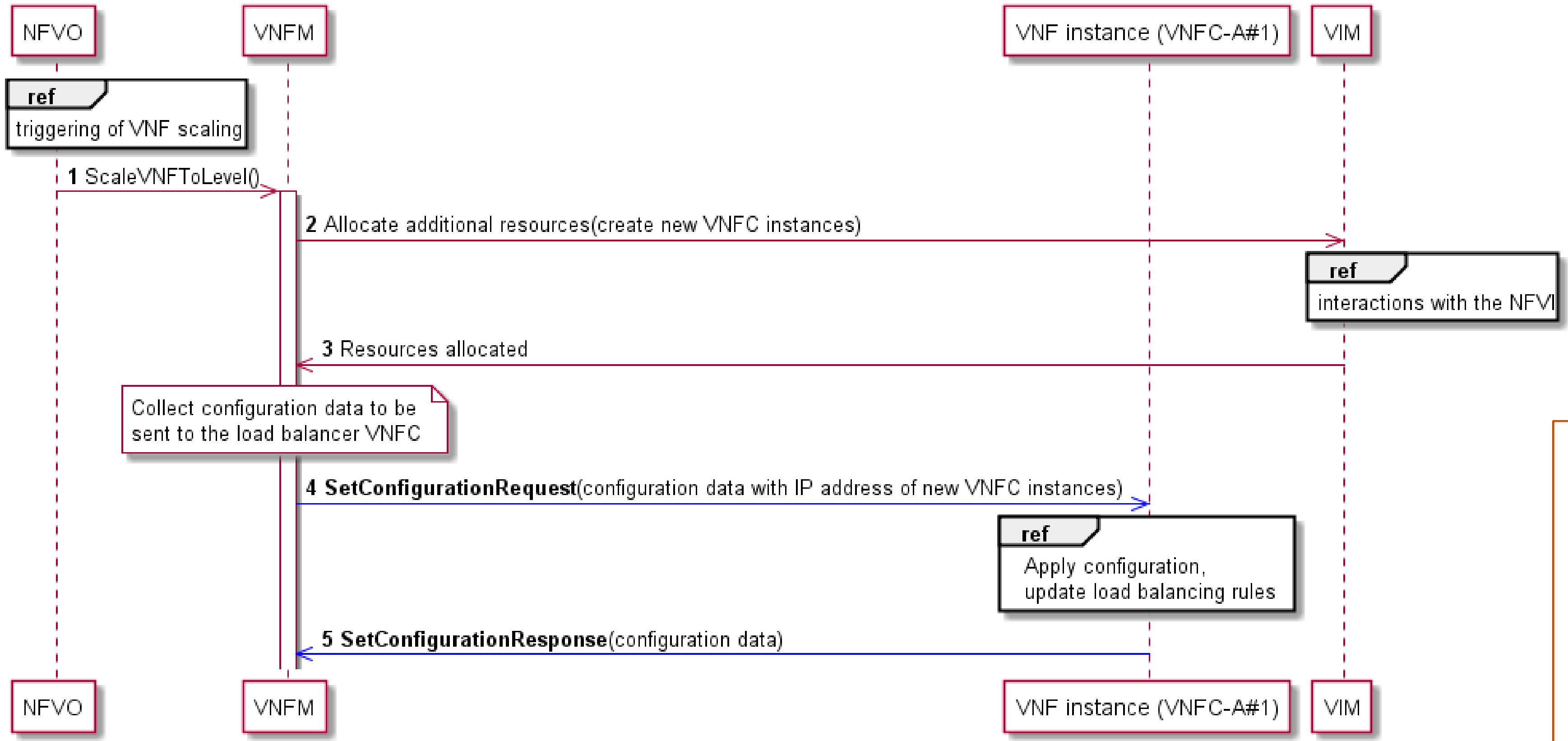
VNF Configuration interface

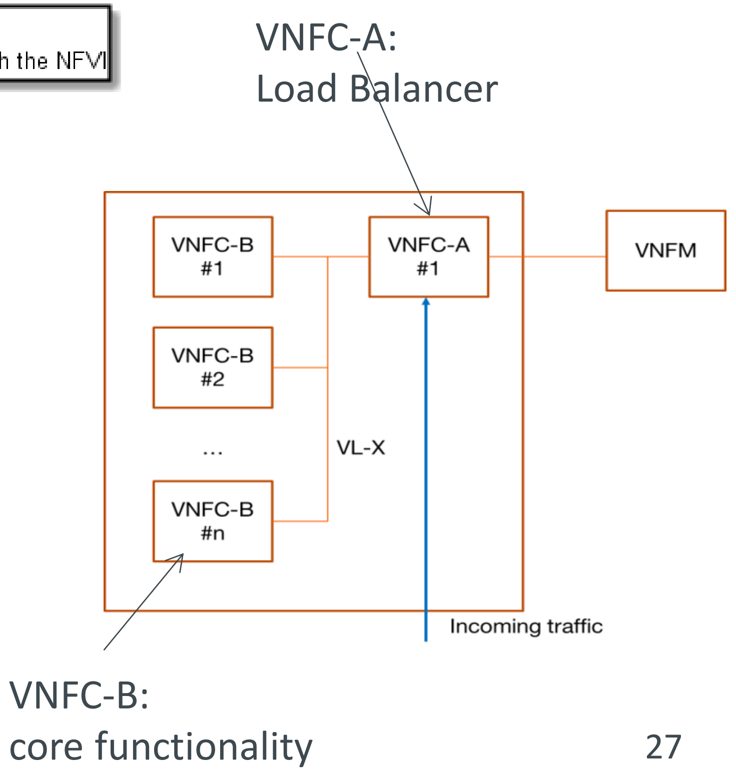
- This interface allows the VNFM to set the configuration of a VNF instance and/or its VNFC instance(s).
  - Configurable properties
  - DHCP server address
  - Addresses and ports assigned to the Connection Points
- It contains a single operation: SetConfiguration
- This operation is implemented using an HTTP PATCH method.
- The support of the VNF configuration interface is optional.

See also clause 6.2 of ETSI GS NFV-IFA 008 (Stage 2) and Clause 9 of ETSI GS NFV-SOL 002 (Stage 3).

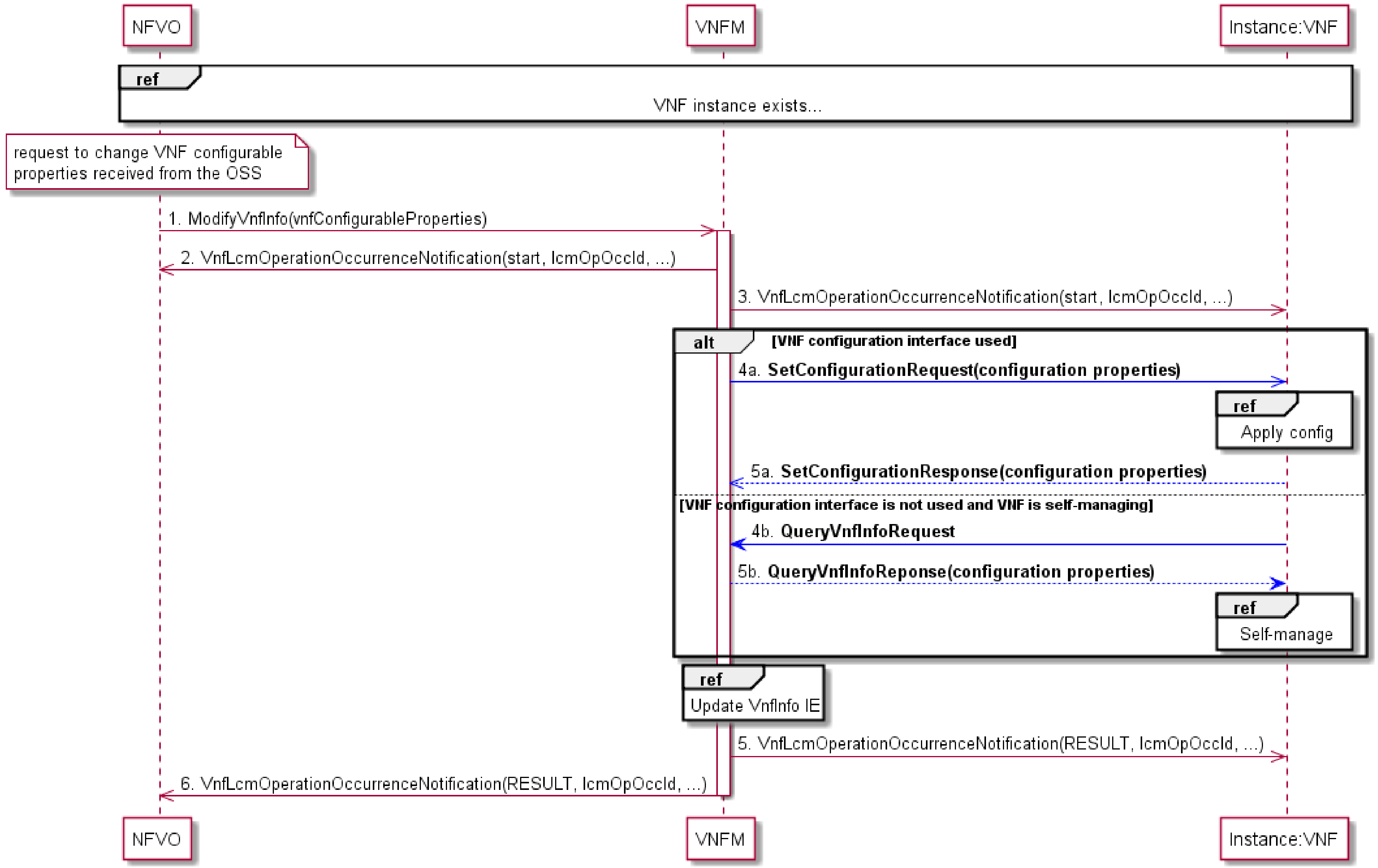

VNFM
VNF
Precondition: VNF instance and VNFC instances exist
1. PATCH .../configuration (VnfConfigModifications)
2. Set the configuration of the VNF instance and/or its VNFC instances
3. 200 OK (VnfConfigModifications)
Postcondition: Configuration has been set
VNFM
VNF

CONFIGURATION PATH B: Example with standard properties


NFVO
VNFM
VNF instance (VNFC-A#1)
VIM
ref
triggering of VNF scaling
1 ScaleVNFToLevel()
2 Allocate additional resources(create new VNFC instances)
ref
interactions with the NFVI
3 Resources allocated
Collect configuration data to be sent to the load balancer VNFC
4 SetConfigurationRequest(configuration data with IP address of new VNFC instances)
ref
Apply configuration, update load balancing rules
5 SetConfigurationResponse(configuration data)
NFVO
VNFM
VNF instance (VNFC-A#1)
VIM



CONFIGURATION PATH B:
Example with VNF Configurable Properties

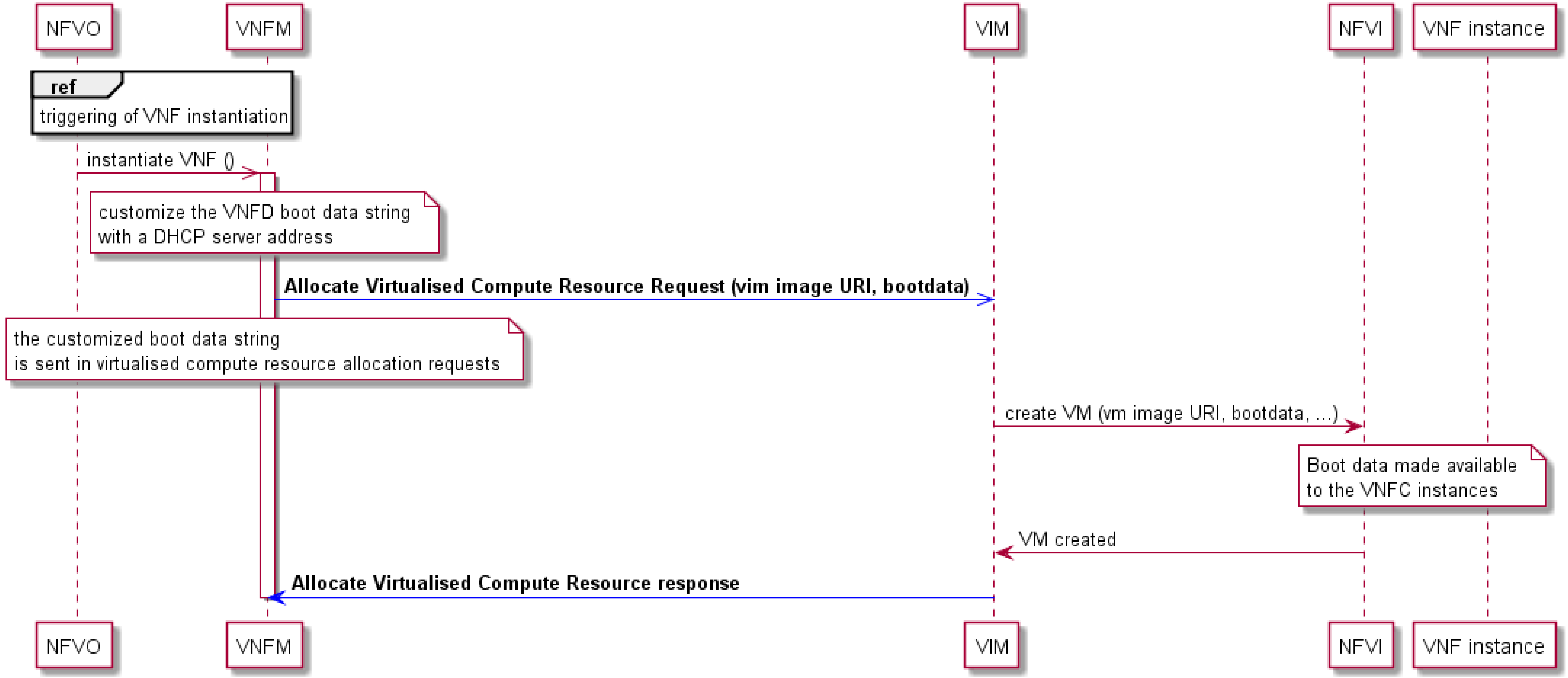


NFVO
VNFM
Instance:VNF
ref
VNF instance exists...
request to change VNF configurable properties received from the OSS
1. ModifyVnfInfo(vnfConfigurableProperties)
2. VnfLcmOperationOccurrenceNotification(start, lcmOpOccId, ...)
3. VnfLcmOperationOccurrenceNotification(start, lcmOpOccId, ...)
alt
[VNF configuration interface used]
4a. SetConfigurationRequest(configuration properties)
ref
Apply config
5a. SetConfigurationResponse(configuration properties)
[VNF configuration interface is not used and VNF is self-managing]
4b. QueryVnfInfoRequest
5b. QueryVnfInfoReponse(configuration properties)
ref
Self-manage
ref
Update VnfInfo IE
5. VnfLcmOperationOccurrenceNotification(RESULT, lcmOpOccId, ...)
6. VnfLcmOperationOccurrenceNotification(RESULT, lcmOpOccId, ...)
NFVO
VNFM
Instance:VNF

Simplified

(Not all information flows are shown)

CONFIGURATION PATH C
Example: DHCP server address configuration


NFVO
VNFM
VIM
NFVI
VNF instance
ref
triggering of VNF instantiation
instantiate VNF ()
customize the VNFD boot data string with a DHCP server address
Allocate Virtualised Compute Resource Request (vim image URI, bootdata)
the customized boot data string is sent in virtualised compute resource allocation requests
create VM (vm image URI, bootdata, ...)
Boot data made available to the VNFC instances
VM created
Allocate Virtualised Compute Resource response
NFVO
VNFM
VIM
NFVI
VNF instance

TOSCA representation of boot data in a VNFD

```
tosca_definitions_version: tosca_simple_yaml_1_2
..
node_types:
  mycompany.nodes.nfv.SunshineDB.1_0.1_0:
    derived_from: tosca.nodes.nfv.VNF
    properties:
      ..
      modifiable_attributes:
        type: mycompany.datatypes.nfv.VnfInfoModifiableAttributes
    ..
data_types:
  mycompany.datatypes.nfv.VnfInfoModifiableAttributes:
    derived_from: tosca.datatypes.nfv.VnfInfoModifiableAttributes
    properties:
     extensions:
       type: mycompany.datatypes.nfv.VnfInfoModifiableAttributesExtensions
       required: false

  mycompany.datatypes.nfv.VnfInfoModifiableAttributesExtensions:
    derived_from: tosca.datatypes.nfv.VnfInfoModifiableAttributesExtensions
    properties:
      http_proxy:
        type: string
        required: true
      https_proxy:
        type: string
        required: false
```

```
topology_template:
  inputs:
    modifiable_attributes:
      type: mycompany.datatypes.nfv.VnfInfoModifiableAttributes

  substitution_mappings:
    node_type: mycompany.nodes.nfv.SunshineDB.1_0.1_0
    ..

  node_templates:
    vnf:
      type: mycompany.nodes.nfv.SunshineDB.1_0.1_0
      properties:
        ..
        modifiable_attributes: { get_input: modifiable_attributes }

    dbBackend:
      type: tosca.nodes.nfv.Vdu.Compute
      properties:
        ..
      boot_data: { concat: [
          "#!/bin/bash\n",
          "echo setting HTTP proxy to: ", { get_property: [vnf, modifiable_attributes,
extensions, http_proxy ] }, "\n",
          "..."
        ] }
      ..
```