swagger /esc-etsi-api Explore

ESC ETSI API 5.6.0.99 OAS3

/esc-etsi-api

Documentation :

ETSI-MANO REST Northbound API

This REST API is another programmatic interface to ESC that uses a REST architecture. The API accepts and returns HTTP or HTTPS messages that contain JavaScript Object Notation (JSON).

It is the payloads for these request/responses that a defined by the European Telecommunications Standards Institute (ETSI), specifically around Management and Orchestration (MANO). It contains its own data model, designed around the ETSI-MANO specification (ETSI GS NFV-SOL 003 V2.4.1), that abstracts away from the ESC core data model.

This initial implementation of the ETSI-MANO standards for NFV is to address the Or-Vnfm reference point, i.e. the interface between the Network Function Virtualisation Orchestrator (NFVO) and the Virtual Network Function Manager (VNFM).

The Or-Vnfm reference point to details the interactions to onboard ETSI-compliant VNF packages, manage resources, and VNF lifecycle management (LCM) operations.

During the lifespan of a VNF Instance, it moves between INSTANTIATED and NOT_INSTANTIATED states, whereas operations that perform LCM operations have a more complex state machine, as per the diagram below.

The ETSI-MANO specification considers provisioning of many components of a network service outside the remit of the VNFM, namely:

- Tenants
- Images
- Flavours
- External Networks/Virtual Link
- Externally Managed Internal Virtual Link
- Subnets

This means that LCM operations on an instance of a VNF submitted to the ETSI-MANO REST API expect these resources to be created out-of-band (OOB) as far as the VNFM is concerned. It is likely that these resources are created via the NVFO, either at the time of onboarding the VNF package or onboarding the tenant, and will be represented by VIM (Virtual Infrastructure Manager) identifiers in the request to ESC.

Managing Resources

Managing Resources via the ETSI-MANO API The ETSI-MANO API communicates with NFVO for lifecycle management. A configuration template, the Virtual Network Function Descriptor (VNFD) file describes the deployment parameters and operational behaviors of a VNF type. The VNFD is used in the process of deploying a VNF and managing the lifecycle of a VNF instance. The flow of operations to deploy a VNF instance is:

1. Create VNF Identifier
2. Instantiate VNF The flow of operations to fully undeploy (and release resources used by a VNF instance) is:
3. Terminate VNF
4. Delete VNF Identifier

The other LCM operations are applicable once the VNF has been instantiated, except from Query which is applicable at any time since it does not modify the VNF.

LCM Operations

Here is an overview of the operations that can affect a VNF instance.

- **Create VNF Identifier**: Generate a new VNF Instance Id (a universally unique identifier) that is subsequently used as a handle to reference the instance upon which to execute further operations.
- **Instantiate VNF**: Deploy a new VNF instance in the VIM. The Instantiate request will contain instance-specific values and this, coupled with the VNFD and the Grant information will provide all the information required by the VIM to deploy the VNF. The VNFD is retrieved from the NFVO as part of this call flow which provides the resource requirements for the VNF to be instantiated. This data set is then further supplemented by requesting permission from the NFVO to continue with the request which returns Grant information that converts some of these resource requirements to actual resources that are reserved in the VIM.
- **Operate VNF**: Allow a VNF instance to be started or stopped. The resources are not released or changed, but the VNF instance in the VIM is toggled between these two states.
- **Query VNF**: Query one or more VNF instances known to ESC. This is a specific REST endpoint that can be filtered to find specific instances. In this initial release, the instances can be filtered by the VNF Instance Id.
- **Scale VNF**: Scale VNF instance incrementally.
- **Scale VNF to Level**: Scale VNF instance to target level.
- **Terminate VNF**: Undeploy the VNF instance in the VIM. The resources themselves remain reserved for the VNF instance, however the VNF itself is undeployed.
- **Delete VNF Identifier**: The resources are fully released in the VIM and in ESC and the associated VNF instance identifer is also released.
- **Heal VNF**: Recover a VNF.
- **Modify VNF**: Modify a VNF resource.
- **Change External VNF Connectivity**: Change the deployment flavour of a VNF instance.
- **Change VNF Flavour**: Change the deployment flavour of a VNF instance.

Authentication: At the time of publication, only Basic Authentication is supported using the ETSI Swagger API. Cisco ESC does support OAUTH 2.0 authentication. Please see the user guide for details.

Attribute Selectors: REST endpoints which are used to query multiple results support attribute selectors (see the ETSI-MANO specification for more details).

- **all_fields**: This URI query parameter requests that all complex attributes are included in the response, including those suppressed by exclude_default. It is inverse to the "exclude_default" parameter.
- **fields**: This URI query parameter requests that only the listed complex attributes are included in the response.
- **exclude_fields**: This URI query parameter requests that the listed complex attributes are excluded from the response.
- **exclude_default**: Presence of this URI query parameter requests that a default set of complex attributes shall be excluded from the response.

If no attribute selector is supplied then the default behaviour is the same as exclude_default (this can be changed to all_fields by setting the property `attribute.selector.default.all_fields` to true).

Server

Or-Vnfm vnf_instances

This resource represents VNF instances for the Or-Vnfm Referrence Point. The client can use this resource to create individual VNF instance resources, and to query VNF instances.

POST `/or_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/instantiate` Instantiate a VNF

POST `/or_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/change_ext_conn` Change the external VNF connectivity

POST `/or_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/terminate` Terminate a VNF Instance

POST `/or_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/heal` Heal a VNF Instance

POST `/or_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/scale` Scale a VNF Instance

POST `/or_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/scale_to_level` Scale a VNF Instance to Level

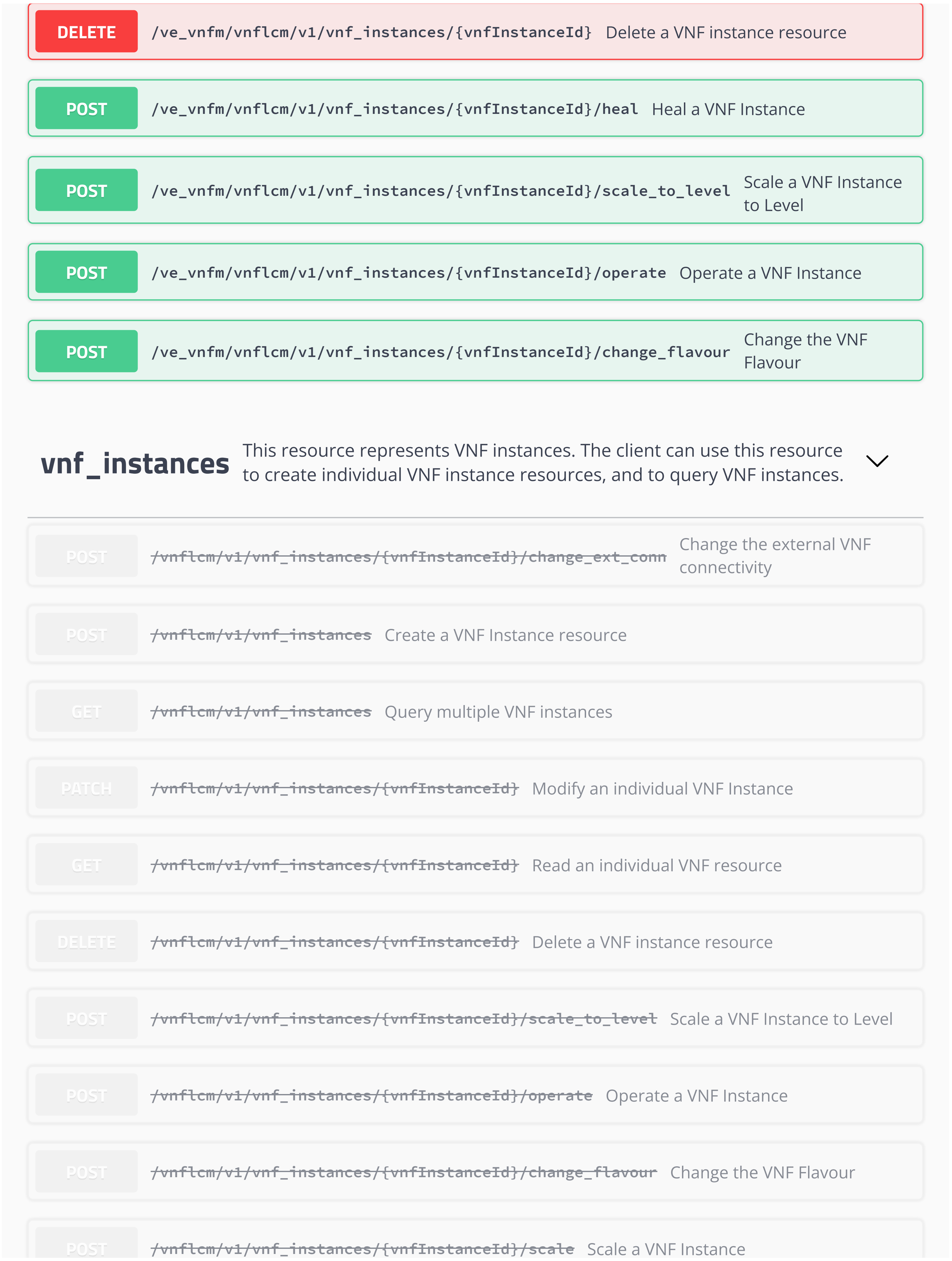
PATCH `/or_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}` Modify an individual VNF Instance

GET	`/or_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}`	Read an individual VNF resource
DELETE	`/or_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}`	Delete a VNF instance resource
POST	`/or_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/operate`	Operate a VNF Instance
POST	`/or_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/change_flavour`	Change the VNF Flavour
POST	`/or_vnfm/vnflcm/v1/vnf_instances`	Create a VNF Instance resource
GET	`/or_vnfm/vnflcm/v1/vnf_instances`	Query multiple VNF instances

Ve-Vnfm vnf_instances

This resource represents VNF instances for the Ve-Vnfm Referrence Point. The client can use this resource to create individual VNF instance resources, and to query VNF instances.

POST	`/ve_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/scale`	Scale a VNF Instance
POST	`/ve_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/terminate`	Terminate a VNF Instance
POST	`/ve_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/change_ext_conn`	Change the external VNF connectivity
POST	`/ve_vnfm/vnflcm/v1/vnf_instances`	Create a VNF Instance resource
GET	`/ve_vnfm/vnflcm/v1/vnf_instances`	Query multiple VNF instances
POST	`/ve_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/instantiate`	Instantiate a VNF
PATCH	`/ve_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}`	Modify an individual VNF Instance
GET	`/ve_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}`	Read an individual VNF resource



DELETE `/ve_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}` Delete a VNF instance resource

POST `/ve_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/heal` Heal a VNF Instance

POST `/ve_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/scale_to_level` Scale a VNF Instance to Level

POST `/ve_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/operate` Operate a VNF Instance

POST `/ve_vnfm/vnflcm/v1/vnf_instances/{vnfInstanceId}/change_flavour` Change the VNF Flavour

vnf_instances

This resource represents VNF instances. The client can use this resource to create individual VNF instance resources, and to query VNF instances.

POST ~~/vnflcm/v1/vnf_instances/{vnfInstanceId}/change_ext_conn~~ Change the external VNF connectivity

POST ~~/vnflcm/v1/vnf_instances~~ Create a VNF Instance resource

GET ~~/vnflcm/v1/vnf_instances~~ Query multiple VNF instances

PATCH ~~/vnflcm/v1/vnf_instances/{vnfInstanceId}~~ Modify an individual VNF Instance

GET ~~/vnflcm/v1/vnf_instances/{vnfInstanceId}~~ Read an individual VNF resource

DELETE ~~/vnflcm/v1/vnf_instances/{vnfInstanceId}~~ Delete a VNF instance resource

POST ~~/vnflcm/v1/vnf_instances/{vnfInstanceId}/scale_to_level~~ Scale a VNF Instance to Level

POST ~~/vnflcm/v1/vnf_instances/{vnfInstanceId}/operate~~ Operate a VNF Instance

POST ~~/vnflcm/v1/vnf_instances/{vnfInstanceId}/change_flavour~~ Change the VNF Flavour

POST ~~/vnflcm/v1/vnf_instances/{vnfInstanceId}/scale~~ Scale a VNF Instance

POST ~~/vnflcm/v1/vnf_instances/{vnfInstanceId}/terminate~~ Terminate a VNF Instance

POST ~~/vnflcm/v1/vnf_instances/{vnfInstanceId}/heal~~ Heal a VNF Instance

POST ~~/vnflcm/v1/vnf_instances/{vnfInstanceId}/instantiate~~ Instantiate a VNF

vnf_instances extensions

This resource represents extensions to VNF instances.

POST `/or_vnfm/vnflcm/v1/ext/vnf_instances/{vnfInstanceId}/monitoring/migrate` Migrate monitoring for a VNF

POST `/ve_vnfm/vnflcm/v1/ext/vnf_instances/{vnfInstanceId}/monitoring/operations` Enable/disable monitoring VNF/particular VMs

GET `/vnflcm/v1/ext/vnf_instances/{vnfInstanceId}/deployment` Extension endpoint to get deployment descriptor

POST `/or_vnfm/vnflcm/v1/ext/vnf_instances/{vnfInstanceId}/monitoring/operations` Enable/disable monitoring for VNF/particular VMs

POST `/ve_vnfm/vnflcm/v1/ext/vnf_instances/{vnfInstanceId}/monitoring/migrate` Migrate monitoring for a VNF

Or-Vnfm vnf_lcm_op_occs

This resource represents VNF lifecycle management operation occurrences for the Or-Vnfm Rreferrence Point. The client can use this resource to query status information about multiple VNF lifecycle management operation occurrences.

POST `/or_vnfm/vnflcm/v1/vnf_lcm_op_occs/{vnfLcmOpOccId}/rollback` Rollback a VNF lifecycle management operation occurrence

Retry a VNF lifecycle

POST `/or_vnfm/vnflcm/v1/vnf_lcm_op_occs/{vnfLcmOpOccId}/retry` management operation occurrence

POST `/or_vnfm/vnflcm/v1/vnf_lcm_op_occs/{vnfLcmOpOccId}/cancel` Cancel a VNF lifecycle management operation occurrence

GET `/or_vnfm/vnflcm/v1/vnf_lcm_op_occs/{vnfLcmOpOccId}` Read an individual VNF lifecycle management operation occurrence

GET `/or_vnfm/vnflcm/v1/vnf_lcm_op_occs` Query multiple VNF lifecycle management operation occurrences

POST `/or_vnfm/vnflcm/v1/vnf_lcm_op_occs/{vnfLcmOpOccId}/fail` Mark a VNF lifecycle management operation occurrence as failed

Ve-Vnfm vnf_lcm_op_occs

This resource represents VNF lifecycle management operation occurrences for the Ve-Vnfm Rreferrence Point. The client can use this resource to query status information about multiple VNF lifecycle management operation occurrences.

POST `/ve_vnfm/vnflcm/v1/vnf_lcm_op_occs/{vnfLcmOpOccId}/cancel` Cancel a VNF lifecycle management operation occurrence

POST `/ve_vnfm/vnflcm/v1/vnf_lcm_op_occs/{vnfLcmOpOccId}/rollback` Rollback a VNF lifecycle management operation occurrence

GET `/ve_vnfm/vnflcm/v1/vnf_lcm_op_occs` Query multiple VNF lifecycle management operation occurrences

POST `/ve_vnfm/vnflcm/v1/vnf_lcm_op_occs/{vnfLcmOpOccId}/fail` Mark a VNF lifecycle management operation occurrence as failed

GET `/ve_vnfm/vnflcm/v1/vnf_lcm_op_occs/{vnfLcmOpOccId}` Read an individual VNF lifecycle management operation occurrence

POST `/ve_vnfm/vnflcm/v1/vnf_lcm_op_occs/{vnfLcmOpOccId}/retry` Retry a VNF lifecycle management operation occurrence

vnf_lcm_op_occs

This resource represents VNF lifecycle management operation occurrences. The client can use this resource to query status information about multiple VNF lifecycle management operation occurrences.

POST ~~/vnflcm/v1/vnf_lcm_op_occs/{vnfLcmOpOccId}/cancel~~ Cancel a VNF lifecycle management operation occurrence

POST ~~/vnflcm/v1/vnf_lcm_op_occs/{vnfLcmOpOccId}/fail~~ Mark a VNF lifecycle management operation occurrence as failed

POST ~~/vnflcm/v1/vnf_lcm_op_occs/{vnfLcmOpOccId}/retry~~ Retry a VNF lifecycle management operation occurrence

GET ~~/vnflcm/v1/vnf_lcm_op_occs/{vnfLcmOpOccId}~~ Read an individual VNF lifecycle management operation occurrence

POST ~~/vnflcm/v1/vnf_lcm_op_occs/{vnfLcmOpOccId}/rollback~~ Rollback a VNF lifecycle management operation occurrence

GET ~~/vnflcm/v1/vnf_lcm_op_occs~~ Query multiple VNF lifecycle management operation occurrences

Or-Vnfm lccn_subscriptions

This resource represents VNF lifecycle management notification subscriptions for the Or-Vnfm Referrence Point. The client can use this resource to subscribe to notifications related to VNF lifecycle management, and to query its subscriptions.

GET `/or_vnfm/vnflcm/v1/subscriptions/{subscriptionId}` Read an individual VNF lifecycle management subscription resource

DELETE `/or_vnfm/vnflcm/v1/subscriptions/{subscriptionId}` Terminate an individual VNF lifecycle management subscription

POST `/or_vnfm/vnflcm/v1/subscriptions` Create a new subscription

GET `/or_vnfm/vnflcm/v1/subscriptions` Queries the list of active VNF lifecycle management subscriptions

This resource represents VNF lifecycle management notification subscriptions for the

Ve-Vnfm lccn_subscriptions

Ve-Vnfm Referrence Point. The client can use this resource to subscribe to notifications related to VNF lifecycle management, and to query its subscriptions.

POST `/ve_vnfm/vnflcm/v1/subscriptions` Create a new subscription

GET `/ve_vnfm/vnflcm/v1/subscriptions` Queries the list of active VNF lifecycle management subscriptions

GET `/ve_vnfm/vnflcm/v1/subscriptions/{subscriptionId}` Read an individual VNF lifecycle management subscription resource

DELETE `/ve_vnfm/vnflcm/v1/subscriptions/{subscriptionId}` Terminate an individual VNF lifecycle management subscription

lccn_subscriptions

This resource represents VNF lifecycle management notification subscriptions. The client can use this resource to subscribe to notifications related to VNF lifecycle management, and to query its subscriptions.

GET ~~/vnflcm/v1/subscriptions/{subscriptionId}~~ Read an individual VNF lifecycle management subscription resource

DELETE ~~/vnflcm/v1/subscriptions/{subscriptionId}~~ Terminate an individual VNF lifecycle management subscription

POST ~~/vnflcm/v1/subscriptions~~ Create a new subscription

GET ~~/vnflcm/v1/subscriptions~~ Queries the list of active VNF lifecycle management subscriptions

Or-Vnfm fm_subscriptions

This resource represents VNF alarm subscriptions for the Or-Vnfm Referrence Point. The client can use this resource to subscribe to notifications related to VNF alarms and to query its subscriptions.

POST `/or_vnfm/vnffm/v1/subscriptions` Create a new VNF alarm subscription

GET `/or_vnfm/vnffm/v1/subscriptions` Queries the list of active VNF alarm subscriptions

GET `/or_vnfm/vnffm/v1/subscriptions` Queries the list of active VNF alarm subscriptions

GET `/or_vnfm/vnffm/v1/subscriptions/{subscriptionId}` Read an individual VNF alarm subscription resource

DELETE `/or_vnfm/vnffm/v1/subscriptions/{subscriptionId}` Terminate an individual VNF alarm subscription

Ve-Vnfm fm_subscriptions

This resource represents VNF alarm subscriptions for the Ve-Vnfm Referrence Point. The client can use this resource to subscribe to notifications related to VNF alarms and to query its subscriptions.

POST `/ve_vnfm/vnffm/v1/subscriptions` Create a new VNF alarm subscription

GET `/ve_vnfm/vnffm/v1/subscriptions` Queries the list of active VNF alarm subscriptions

GET `/ve_vnfm/vnffm/v1/subscriptions/{subscriptionId}` Read an individual VNF alarm subscription resource

DELETE `/ve_vnfm/vnffm/v1/subscriptions/{subscriptionId}` Terminate an individual VNF alarm subscription

fm_subscriptions

This resource represents VNF alarm subscriptions. The client can use this resource to subscribe to notifications related to VNF alarms and to query its subscriptions.

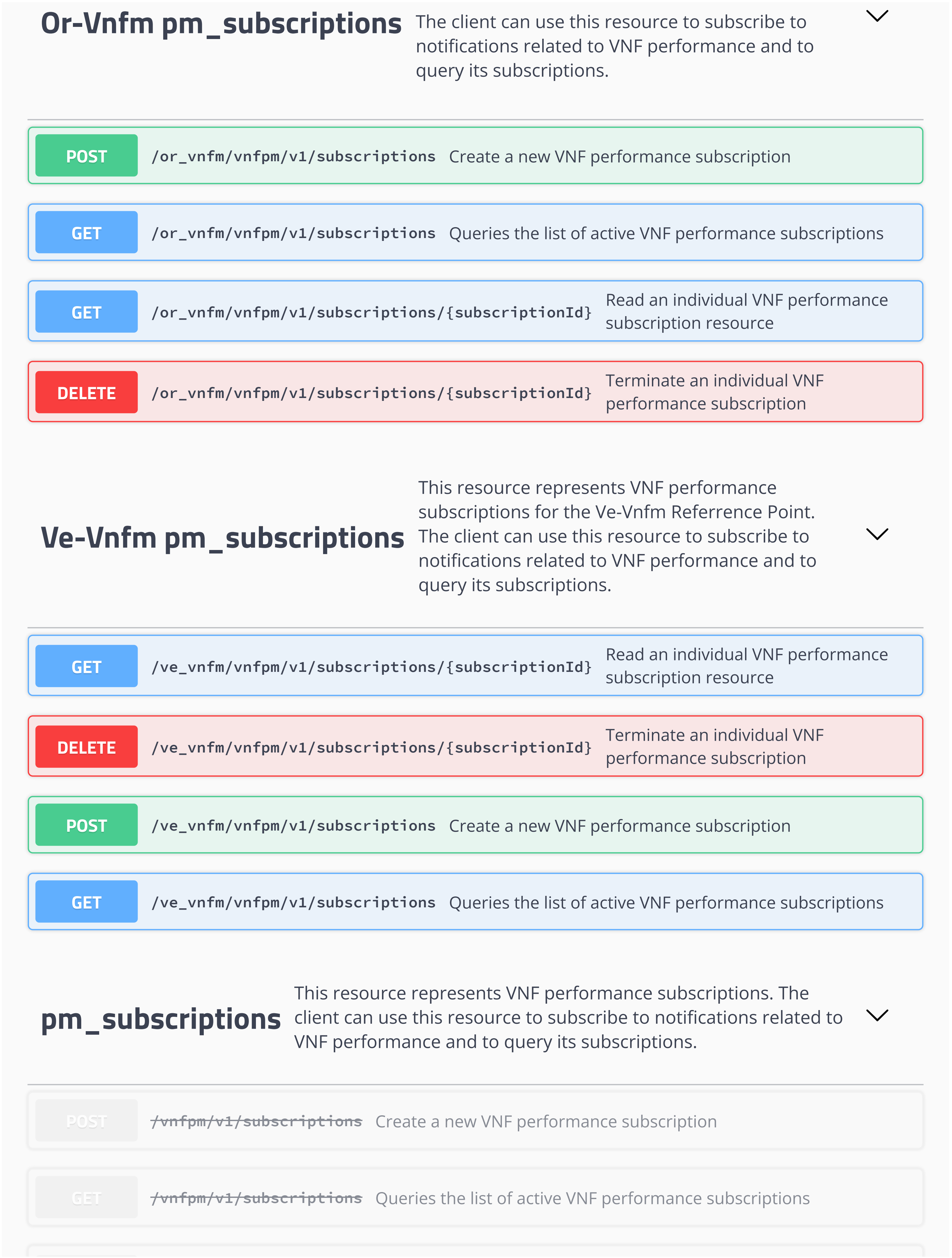
GET ~~/vnffm/v1/subscriptions/{subscriptionId}~~ Read an individual VNF alarm subscription resource

DELETE ~~/vnffm/v1/subscriptions/{subscriptionId}~~ Terminate an individual VNF alarm subscription

POST ~~/vnffm/v1/subscriptions~~ Create a new VNF alarm subscription

GET ~~/vnffm/v1/subscriptions~~ Queries the list of active VNF alarm subscriptions

This resource represents VNF performance subscriptions for the Or-Vnfm Referrence Point.



Or-Vnfm pm_subscriptions

The client can use this resource to subscribe to notifications related to VNF performance and to query its subscriptions.

POST `/or_vnfm/vnfpm/v1/subscriptions` Create a new VNF performance subscription

GET `/or_vnfm/vnfpm/v1/subscriptions` Queries the list of active VNF performance subscriptions

GET `/or_vnfm/vnfpm/v1/subscriptions/{subscriptionId}` Read an individual VNF performance subscription resource

DELETE `/or_vnfm/vnfpm/v1/subscriptions/{subscriptionId}` Terminate an individual VNF performance subscription

Ve-Vnfm pm_subscriptions

This resource represents VNF performance subscriptions for the Ve-Vnfm Referrence Point. The client can use this resource to subscribe to notifications related to VNF performance and to query its subscriptions.

GET `/ve_vnfm/vnfpm/v1/subscriptions/{subscriptionId}` Read an individual VNF performance subscription resource

DELETE `/ve_vnfm/vnfpm/v1/subscriptions/{subscriptionId}` Terminate an individual VNF performance subscription

POST `/ve_vnfm/vnfpm/v1/subscriptions` Create a new VNF performance subscription

GET `/ve_vnfm/vnfpm/v1/subscriptions` Queries the list of active VNF performance subscriptions

pm_subscriptions

This resource represents VNF performance subscriptions. The client can use this resource to subscribe to notifications related to VNF performance and to query its subscriptions.

POST ~~`/vnfpm/v1/subscriptions`~~ Create a new VNF performance subscription

GET ~~`/vnfpm/v1/subscriptions`~~ Queries the list of active VNF performance subscriptions

GET ~~/vnfpm/v1/subscriptions/{subscriptionId}~~ Read an individual VNF performance subscription resource

DELETE ~~/vnfpm/v1/subscriptions/{subscriptionId}~~ Terminate an individual VNF performance subscription

Or-Vnfm alarms

These are all the resources and methods provided for the VNF fault management interface for the Or-Vnfm Referrence Point.

GET `/or_vnfm/vnffm/v1/alarms` Get all alarm resource

PATCH `/or_vnfm/vnffm/v1/alarms/{alarmId}` This can be used to change the acknowledgement status of an alarm

GET `/or_vnfm/vnffm/v1/alarms/{alarmId}` Get an individual alarm resource

Ve-Vnfm alarms

These are all the resources and methods provided for the VNF fault management interface for the Ve-Vnfm Referrence Point.

GET `/ve_vnfm/vnffm/v1/alarms` Get all alarm resource

PATCH `/ve_vnfm/vnffm/v1/alarms/{alarmId}` This can be used to change the acknowledgement status of an alarm

GET `/ve_vnfm/vnffm/v1/alarms/{alarmId}` Get an individual alarm resource

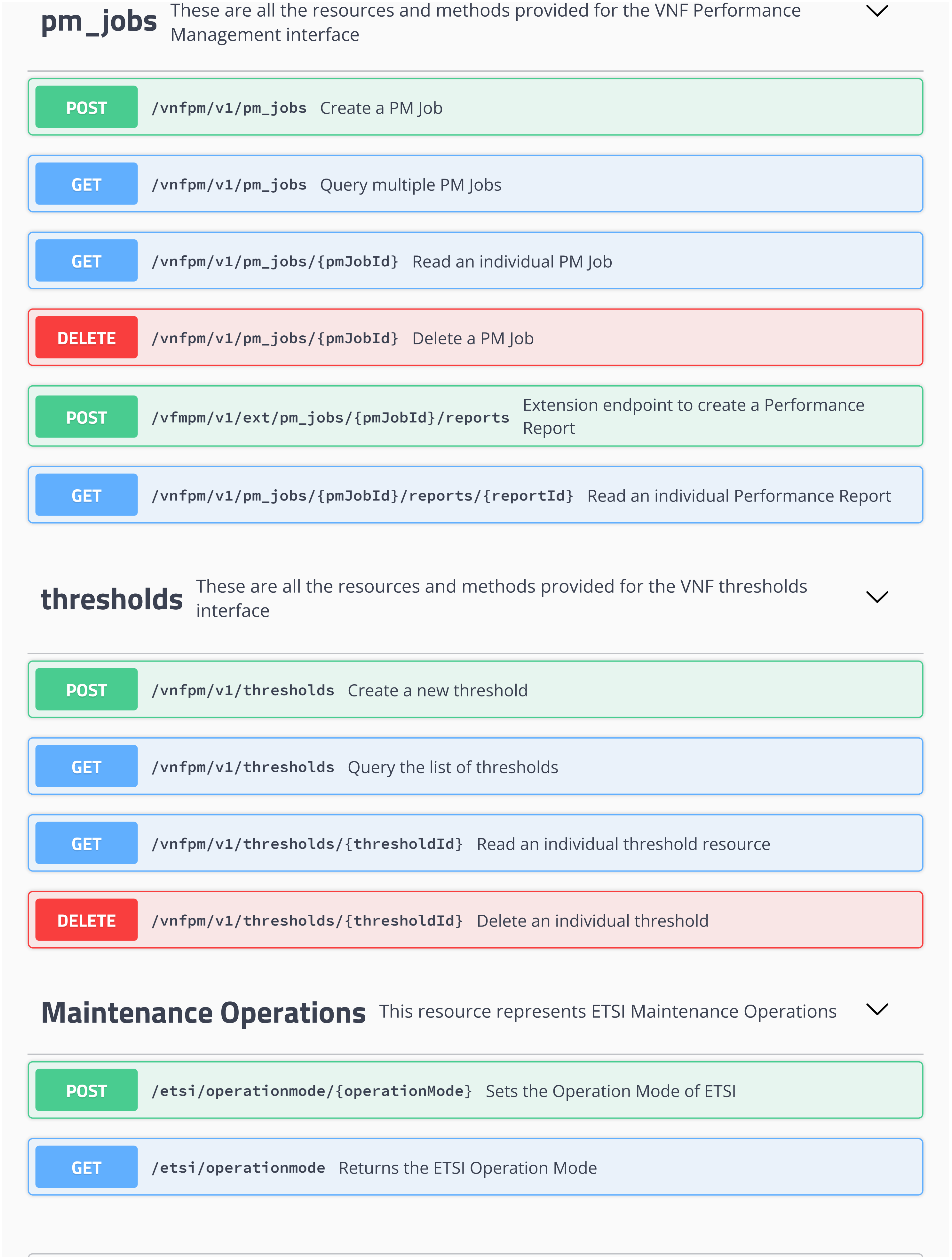
alarms

These are all the resources and methods provided for the VNF fault management interface.

PATCH ~~/vnffm/v1/alarms/{alarmId}~~ This can be used to change the acknowledgement status of an alarm

GET ~~/vnffm/v1/alarms/{alarmId}~~ Get an individual alarm resource

GET ~~/vnffm/v1/alarms~~ Get all alarm resource



pm_jobs

These are all the resources and methods provided for the VNF Performance Management interface

POST `/vnfpm/v1/pm_jobs` Create a PM Job

GET `/vnfpm/v1/pm_jobs` Query multiple PM Jobs

GET `/vnfpm/v1/pm_jobs/{pmJobId}` Read an individual PM Job

DELETE `/vnfpm/v1/pm_jobs/{pmJobId}` Delete a PM Job

POST `/vfmpm/v1/ext/pm_jobs/{pmJobId}/reports` Extension endpoint to create a Performance Report

GET `/vnfpm/v1/pm_jobs/{pmJobId}/reports/{reportId}` Read an individual Performance Report

thresholds

These are all the resources and methods provided for the VNF thresholds interface

POST `/vnfpm/v1/thresholds` Create a new threshold

GET `/vnfpm/v1/thresholds` Query the list of thresholds

GET `/vnfpm/v1/thresholds/{thresholdId}` Read an individual threshold resource

DELETE `/vnfpm/v1/thresholds/{thresholdId}` Delete an individual threshold

Maintenance Operations

This resource represents ETSI Maintenance Operations

POST `/etsi/operationmode/{operationMode}` Sets the Operation Mode of ETSI

GET `/etsi/operationmode` Returns the ETSI Operation Mode

Models

FmNotificationsFilter {
- *description:* *This type represents a subscription filter related to notifications about VNF faults.*
- perceivedSeverities > [...]
- faultyResourceTypes > [...]
- probableCauses > [...]
- vnfInstanceSubscriptionFilter VnfInstanceSubscriptionFilter > {...}
- notificationTypes > [...]
- eventTypes > [...]

}

OperateVnfRequestSol2 {
- *description:* *This type represents request parameters for the "Operate VNF" operation.*
- vnfcInstanceId string($uuid)
  Identifier of VNFC instances. Cardinality can be "0" to denote that the request applies to the whole VNF and not a specific VNFC instance.
- additionalParams KeyValuePairs > {...}
- stopType string
  It signals whether forceful or graceful stop is requested. Ignored if changeStateTo=STARTED.

  Enum:

  > Array [1]
- changeStateTo* VnfOperationalStateType string
  Enum:

  > Array [2]

}

HealVnfRequestSol2 {
- *description:* *This type represents request parameters for the "Heal VNF" operation.*
- healScript string
  Provides link to a script that should be executed as part of the healing action or a set of rules for healing procedure.
- vnfcInstanceId > [...]
- additionalParams KeyValuePairs > {...}
- cause string
  Indicates the reason why a healing procedure is required.

}

```
AffectedVirtualStorage {
    description:          This type provides information about added, deleted, modified
                          and temporary virtual storage resources

    changeType*           string
                          Signals the type of change.

                          Enum:
                           > Array [ 4 ]
    virtualLinkDescId*    string($uuid)
                          Identifier of the related VirtualStorage descriptor in the VNFD.

    id*                   string($uuid)
                          Identifier of the storage instance, identifying the applicable
                          "virtualStorageResourceInfo" entry in the "VnfInstance" data
                          type

    storageResource*      ResourceHandle > {...}
}
```

```
EventType  string
Enum:
 > Array [ 5 ]
```

```
ScaleInfo {
    description:          This type represents the scale level of a VNF instance related
                          to a scaling aspect.

    scaleLevel*           integer($int32)
                          Indicates the scale level. The minimum value shall be 0 and the
                          maximum value shall be <= maxScaleLevel as described in the
                          VNFD.

    aspectId*             string($uuid)
                          Identifier of the scaling aspect

}
```

```
InstantiateVnfRequest {
    description:             This type represents request parameters for the "Instantiate
                             VNF" operation.

    extManagedVirtualLinks    > [...]
    flavourId*               string($uuid)
                             Identifier of the VNF deployment flavour to be instantiated.

    instantiationLevelId     string($uuid)
                             Identifier of the instantiation level of the deployment
                             flavour to be instantiated. If not present, the default
                             instantiation level as declared in the VNFD is instantiated.

    vimConnectionInfo         > [...]
    additionalParams         KeyValuePairs > {...}
    extVirtualLinks           > [...]
    localizationLanguage   string
                           Localization language of the VNF to be instantiated.

}
```

```
VnfInfoModificationRequest ∨ {
    description:              This type represents attribute modifications for an
                              "Individual VNF instance" resource, i.e. modifications to a
                              resource representation based on the "VnfInstance" data
                              type.

    metadata                  KeyValuePairs > {...}
    extensions                KeyValuePairs > {...}
    vimConnectionInfo          > [...]
    vnfPkgId                  string($uuid)
                              New value of the "vnfPkgId" attribute in "VnfInstance". The
                              value "null" is not permitted.

    vnfConfigurableProperties KeyValuePairs > {...}
    vnfInstanceName           string
                              New value of the "vnfInstanceName" attribute in
                              "VnfInstance", or "null" to remove the attribute.

    vnfInstanceDescription    string
                              New value of the "vnfInstanceDescription" attribute in
                              "VnfInstance", or "null" to remove the attribute.

}
```

```
ChangeExtVnfConnectivityRequestSol2 ∨ {
    description:          This type represents request parameters for the "Change external
                          VNF connectivity" operation to modify the external connectivity
                          of a VNF instance.

    additionalParams      KeyValuePairs > {...}
    extVirtualLinks*       > [...]
}
```

```
VnfInstanceSol2 ∨ {
    description:              This type represents a VNF instance as per Ve-Vnfm
                              Reference Point.

    vnfProductName*           string
                              Name to identify the VNF Product. The value is copied from
                              the VNFD.

    vnfdVersion*              string
                              Identifies the version of the VNFD. The value is copied
                              from the VNFD.

    metadata                  KeyValuePairs > {...}
    vnfProvider*              string
                              Provider of the VNF and the VNFD. The value is copied from
                              the VNFD.
    _links*                   > {...}
    vnfPkgId*                 string($uuid)
                              Identifier of information held by the NFVO about the
                              specific VNF package on which the VNF is based. This
                              identifier was allocated by the NFVO.

    vnfConfigurableProperties KeyValuePairs > {...}
    vnfdId*                   string($uuid)
                              Identifier of the VNFD on which the VNF instance is based.

    instantiationState*       string
                              The instantiation state of the VNF.

                              Enum:
                               > Array [ 2 ]
    vnfInstanceDescription    string
                              Human-readable description of the VNF instance.

    extensions                KeyValuePairs > {...}
    instantiatedVnfInfo        > {...}
    vnfInstanceName           string
                              Name of the VNF instance.

    id*                       string($uuid)
                              Identifier of the VNF instance.

    vnfSoftwareVersion*       string
                              Software version of the VNF. The value is copied from the
                              VNFD.

}
```

```
VimConnectionInfo v {
    description:          This type represents parameters needed to connect to a VIM for
                          managing the resources of a VNF instance.

    vimType*              string
                          Discriminator for the different types of the VIM information.

    vimId                 string($uuid)
                          The identifier of the VIM instance. This identifier is managed
                          by the NFVO.

    extra                 KeyValuePairs > {...}
    interfaceInfo         KeyValuePairs > {...}
    id*                   string($uuid)
                          The identifier of the VIM Connection. This identifier is managed
                          by the NFVO.

    accessInfo            KeyValuePairs > {...}
}
```

```
CancelModeType  string
Enum:
 > Array [ 2 ]
```

```
TerminateVnfRequest ⌄ {
    description:              This type represents request parameters for the "Terminate
                              VNF" operation.

    gracefulTerminationTimeout integer($int32)
                              This attribute is only applicable in case of graceful
                              termination. It defines the time to wait for the VNF to be
                              taken out of service before shutting down the VNF and
                              releasing the resources. The unit is seconds.

    additionalParams          KeyValuePairs > {...}
    terminationType*          string
                              Indicates whether forceful or graceful termination is
                              requested.

                              Enum:
                               > Array [ 2 ]
}
```

```
CreatePmJobRequest ⌄ {
    description:          This type represents a request to create a PM job

    objectInstanceIds*     > [...]
    criteria*             PmJobCriteria > {...}
}
```

```
LifecycleChangeNotificationsFilter ⌄ {
    description:                    This type represents a subscription filter related to
                                    notifications about VNF lifecycle changes

    operationStates                  > [...]
    vnfInstanceSubscriptionFilter   VnfInstanceSubscriptionFilter > {...}
    notificationTypes                > [...]
    operationTypes                   > [...]
}
```

```
LccnLinks ⌄ {
    description:          This type represents the links to resources that a notification
                          can contain

    subscription*         Link > {...}
    vnfLcmOpOcc           Link > {...}
    vnfInstance*          Link > {...}
}
```

```
VnfExtCpConfig ⌄ {
    description:          This type represents an externally provided link port or network
                          address information per instance of an external connection
```

```
                         point.

    linkPortId           string($uuid)
                         Identifier of a pre-configured link port to which the external
                         CP will be associated.

    cpProtocolData
                          > [...]
    cpInstanceId         string($uuid)
                         Identifier of the external CP instance to which this set of
                         configuration parameters is requested to be applied.

}
```

```
ScaleVnfToLevelRequest ⌄ {
    description:         This type represents request parameters for the "Scale VNF to
                         Level" operation.

    instantiationLevelId string($uuid)
                         Identifier of the target instantiation level of the current
                         deployment flavour to which the VNF is requested to be scaled.

    scaleInfo
                          > [...]
    additionalParams
                         KeyValuePairs > {...}
}
```

```
HealVnfRequest ⌄ {
    description:         This type represents request parameters for the "Heal VNF"
                         operation.

    vnfcInstanceId
                          > [...]
    additionalParams
                         KeyValuePairs > {...}
    cause                string
                         Indicates the reason why a healing procedure is required.

}
```

```
LcmOperationType   string
The enumeration LcmOperationType represents those lifecycle operations that trigger a
VNF lifecycle management operation occurrence notification.

Enum:
 > Array [ 9 ]
```

```
ChangeVnfFlavourRequest ⌄ {
    description:           This type represents request parameters for the "Change VNF
                           flavour" operation.

    extManagedVirtualLinks
                            > [...]
    instantiationLevelId   string($uuid)
                           Identifier of the instantiation level of the deployment
                           flavour to be instantiated. If not present, the default
                           instantiation level as declared in the VNFD is instantiated.
    vimConnectionInfo      > [...]
    additionalParams       KeyValuePairs > {...}
    extVirtualLinks        > [...]
    newFlavourId*          string($uuid)
                           Identifier of the VNF deployment flavour to be instantiated.

}
```

ThresholdCriteria ⌄ {

```
    description:           This type represents criteria that define a threshold.

    simpleThresholdDetails  > {...}
    performanceMetric*     string
                           Defines the performance metric associated with the threshold,
                           as specified in an external measurement specification.

    thresholdType*         string
                           Type of threshold. This attribute determines which other
                           attributes are present in the data structure.

                           Enum:
                            > Array [ 1 ]
}
```

PerceivedSeverityType `string`

```
Enum:
 > Array [ 6 ]
```

OperationMode `string`

This type includes the Operation Mode of ETSI

MonitoringMigrateRequest ⌄ {

```
    description:         This type represents request parameters for the operate
                         operation available on ext API.

    key*                 string
                         This is the key in which the value for the monitoring agent
                         should be stored.

    monitoringAgent*     string
                         Deployment identifier of the monitoring agent. In the event the
                         agent is local to ESC, the string should be set to
                         "dmonaName://local_mona".

}
```

Threshold ⌄ {

```
    description:         This type represents a threshold

    objectInstanceId*    string($uuid)
                         Identifier of the VNF instance associated with the threshold.
    _links*                      > {...}
    criteria*                   ThresholdCriteria > {...}
    id*                         string($uuid)
                                Identifier of this threshold resource.

}
```

```
PmSubscriptionRequest v {
    description:                This type represents a subscription request related to
                                notifications about VNF performance.

    filter                      PmNotificationsFilter > {...}
    callbackUri*                string($uri)
                                The URI of the endpoint to send the notification to.

    authentication              SubscriptionAuthentication > {...}
}
```

```
VnfcInfoModifications v {
    description:                      This type represents modifications of an entry in an
                                      array of "VnfcInfo" objects.

    vnfcConfigurableProperties*KeyValuePairs > {...}
    id*                               string($uuid)
                                      Identifier of the VNFC instance of which the information
                                      is to be modified.

}
```

```
LccnSubscription v {
    description:                This type represents a subscription related to notifications
                                about VNF lifecycle changes.

    filter                      LifecycleChangeNotificationsFilter > {...}
    _links*                      > {...}
    callbackUri*                string($uri)
                                The URI of the endpoint to send the notification to.

    id*                         string($uuid)
                                Identifier of this subscription resource.

}
```

```
VnfInfoModificationRequestSol2 v {
    description:                      This type represents attribute modifications for an
                                      "Individual VNF instance" resource, i.e. modifications
                                      to a resource representation based on the
                                      "VnfInstance" data type.

    vnfcInfoModifications              > [...]
    metadata                          KeyValuePairs > {...}
    extensions                      KeyValuePairs > {...}
    vnfcInfoModificationsDeleteIds  string($uuid)
                                    List of identifiers entries to be deleted from the
                                    "vnfcInfoModifications" attribute array to be used as
                                    "deleteIdList".

    vnfPkgId                        string($uuid)
                                    New value of the "vnfPkgId" attribute in
                                    "VnfInstance". The value "null" is not permitted.

    vnfConfigurableProperties       KeyValuePairs > {...}
    vnfInstanceName                 string
                                    New value of the "vnfInstanceName" attribute in
                                    "VnfInstance", or "null" to remove the attribute.

    vnfInstanceDescription          string
                                    New value of the "vnfInstanceDescription" attribute in
                                    "VnfInstance", or "null" to remove the attribute.

}
```

```
ExtLinkPort ⌄ {
    description:           This type represents a link port of an external VL, i.e. a port
                           providing connectivity for the VNF to an NS VL.

    resourceHandle*        ResourceHandle > {...}
    id*                    string($uuid)
                           Identifier of this link port as provided by the entity that has
                           created the link port.

    cpInstanceId           string($uuid)
                           Identifier of the external CP of the VNF to be connected to this
                           link port.

}
```

```
AffectedVirtualLink ⌄ {
    description:           This type provides information about added, deleted, modified
                           and temporary VLs

    networkResource*       ResourceHandle > {...}
    changeType*            string
                           Signals the type of change.

                           Enum:
                            > Array [ 6 ]
    virtualLinkDescId*     string($uuid)
                           Identifier of the related VLD in the VNFD.

    id*                    string($uuid)
                           Identifier of the virtual link instance, identifying the
                           applicable "vnfVirtualLinkResourceInfo" entry in the
                           "VnfInstance" data type

}
```

```
LcmOperationStateType string
Enum:
 > Array [ 7 ]
```

```
VnfOperationalStateType string
Enum:
 > Array [ 2 ]
```

```
CreateVnfRequest ⌄ {
    description:         This type represents request parameters for the "Create VNF
                         identifier" operation.

    vnfdId*              string($uuid)
                         Identifier that identifies the VNFD which defines the VNF
                         instance to be created.

    vnfInstanceName      string
                         Human-readable name of the VNF instance to be created.

    vnfInstanceDescriptionstring
                         Human-readable description of the VNF instance to be created.

}
```

```
VnfIdentifierCreationNotification ⌄ {
    description:        This type represents a VNF identifier creation notification,
                        which informs the receiver of the creation of a new VNF instance
                        resource and the associated VNF instance identifier

    timeStamp*          string($date-time)
                        Date-time of the generation of the notification.

    vnfInstanceId*      string($uuid)
                        The created VNF instance identifier

    _links*             LccnLinks > {...}
    id*                 string($uuid)
                        Identifier of this notification

    notificationType*   string
                        Discriminator for the different notification types.

    subscriptionId      string($uuid)
                        Identifier of the subscription that this notification relates
                        to.

}
```

```
MacAddress string
```

```
ChangeExtVnfConnectivityRequest ⌄ {
    description:        This type represents request parameters for the "Change external
                        VNF connectivity" operation to modify the external connectivity
```

```
                              of a VNF instance.

    vimConnectionInfo          > [...]
    additionalParams          KeyValuePairs > {...}
    extVirtualLinks*           > [...]
}
```

```
PmNotificationsFilter ˅ {
    description:                  This type represents a filter that can be used to
                                  subscribe for notifications related to performance
                                  management events.

    vnfInstanceSubscriptionFilter VnfInstanceSubscriptionFilter > {...}
    notificationTypes              > [...]
}
```

```
PmJobCriteria ˅ {
    description:          This type represents collection criteria for PM jobs

    collectionPeriod*     integer($int32)
                          Specifies the periodicity at which the producer will collect
                          performance information.

    reportingPeriod*      integer($int32)
                          Specifies the periodicity at which the producer will report to
                          the consumer about performance information.

    reportingBoundary     string($date-time)
                          Identifies a time boundary after which the reporting will
                          stop. The boundary shall allow a single reporting as well as
                          periodic reporting up to the boundary.

    performanceMetricGroup  > [...]
    performanceMetric       > [...]
}
```

```
PerformanceReport ˅ {
    description:         This type defines the format of a performance report provided by
                         the VNFM to the NFVO as a result of collecting performance
                         information as part of a PM job.

    entries*              > [...]
}
```

```
CpProtocolData ˅ {
    description:         This type represents network protocol data.

    ipOverEthernet        > [...]
    layerProtocol        string
                         Identifier of layer(s) and protocol(s). Permitted values:
                         IP_OVER_ETHERNET
```

```
                          Enum:
                           > Array [ 1 ]
}
```

```
VirtualStorageResourceInfo ⌄ {
    description:          This type represents the information that allows addressing a
                          virtualised resource that is used by a VNF instance

    metadata              KeyValuePairs > {...}
    reservationId         string($uuid)
                          The reservation identifier applicable to the resource. It shall
                          be present when an applicable reservation exists.

    virtualStorageDescId* string($uuid)
                          Identifier of the VirtualStorageDesc in the VNFD.

    id*                   string($uuid)
                          Identifier of this VirtualStorageResourceInfo instance.

    storageResource       ResourceHandle > {...}
}
```

```
FmSubscription ⌄ {
    description:         This type represents a subscription related to notifications
                         about VNF faults.

    filter               FmNotificationsFilter > {...}
    _links*               > {...}
    callbackUri*         string($uri)
                         The URI of the endpoint to send the notification to.

    id*                  string($uuid)
                         Identifier of this subscription resource.

}
```

```
FmSubscriptionRequest ⌄ {
    description:         This type represents a subscription request related to
                         notifications about VNF faults.

    filter               FmNotificationsFilter > {...}
    callbackUri*         string($uri)
                         The URI of the endpoint to send the notification to.

    authentication       SubscriptionAuthentication > {...}
}
```

```
AlarmSol2 ⌄ {
    description:            The alarm data type encapsulates information about an alarm.

    isRootCause*            boolean
```

```
                           Attribute indicating if this fault is the root for other
                           correlated alarms. If TRUE, then the alarms listed in the
                           attribute CorrelatedAlarmId are caused by this fault.

    rootCauseFaultyResource*  FaultyResourceInfo > {...}
    alarmRaisedTime*       string($date-time)
                           Time stamp indicating when the alarm is raised by the
                           managed object.

    alarmClearedTime       string($date-time)
                           Time stamp indicating when the alarm was cleared. It shall
                           be present if the alarm has been cleared

    eventType*             EventType  string
                           Enum:
                             > Array [ 5 ]
    alarmChangedTime       string($date-time)
                           Time stamp indicating when the alarm was last changed. It
                           shall be present if the alarm has been updated.

    ackState*              string
                           Acknowledgement state of the alarm.

                           Enum:
                             > Array [ 2 ]
    managedObjectId*       string($uuid)
                           Identifier of the affected VNF instance.

    perceivedSeverity*     PerceivedSeverityType  string
                           Enum:
                             > Array [ 6 ]
    probableCause*         string
                           Information about the probable cause of the fault.

    eventTime*             string($date-time)
                           Time stamp indicating when the fault was observed.

    faultType              string
                           Additional information to clarify the type of the fault.

    correlatedAlarmIds       > [...]
    faultDetails             > [...]
    id*                    string($uuid)
                           Identifier of this Alarm information element.

    vnfcInstanceIds*         > [...]
}
```

```
VnfInfoModificationsSol2 v {
    description:            This type represents attribute modifications that were
                            performed on an "Individual VNF instance" resource. The
                            attributes that can be included consist of those requested
                            to be modified explicitly in the
                            "VnfInfoModificationRequest" data structure, and additional
                            attributes of the "VnfInstance" data structure that were
                            modified implicitly e.g. when modifying the referenced VNF
                            package.

    vnfProductName          string
                            If present, this attribute signals modifications of the
                            "vnfProductName" attribute in "VnfInstance".
    metadata                    KeyValuePairs > {...}
    extensions                  KeyValuePairs > {...}
    vnfdVersion                 string
                                If present, this attribute signals modifications of the
                                "vnfdVersion" attribute in "VnfInstance".

    vnfProvider                 string
                                If present, this attribute signals modifications of the
                                "vnfProvider" attribute in "VnfInstance".

    vnfConfigurableProperties   KeyValuePairs > {...}
    vnfPkgId                    string($uuid)
                                If present, this attribute signals modifications of the
                                "vnfPkgId" attribute in "VnfInstance".

    vnfdId                      string($uuid)
                                If present, this attribute signals modifications of the
                                "vnfdId" attribute in "VnfInstance".

    vnfInstanceName             string
                                If present, this attribute signals modifications of the
                                "vnfInstanceName" attribute in "VnfInstance".

    vnfInstanceDescription      string
                                If present, this attribute signals modifications of the
                                "vnfInstanceDescription" attribute in "VnfInstance".

    vnfSoftwareVersion          string
                                If present, this attribute signals modifications of the
                                "vnfSoftwareVersion" attribute in "VnfInstance".

}
```

```
CancelMode v {
    description:            This type represents a parameter to select the mode of
                            cancelling an ongoing VNF LCM operation occurrence.

    cancelMode*             CancelModeType  string
                            Enum:
                              > Array [ 2 ]
}
```

```
VnfIdentifierDeletionNotification v {
    description:            This type represents a VNF identifier deletion notification,
                            which informs the receiver of the deletion of a new VNF instance
                            resource and the associated VNF instance identifier.

    timeStamp*              string($date-time)
                            Date-time of the generation of the notification.

    vnfInstanceId*          string($uuid)
                            The deleted VNF instance identifier

    _links*                 LccnLinks > {...}
    id*                     string($uuid)
                            Identifier of this notification

    notificationType*       string
                            Discriminator for the different notification types.
    subscriptionId        string($uuid)
                          Identifier of the subscription that this notification relates
                          to.

}
```

```
Link ⌄ {
    description:          This type represents a link to a resource.

    href*                 string($uri)
                          URI of the referenced resource.

}
```

```
VnfcResourceInfo ⌄ {
    description:          This type represents the information on virtualised compute and
                          storage resources used by a VNFC in a VNF instance

    metadata              KeyValuePairs > {...}

    storageResourceIds     > [...]
    reservationId         string($uuid)
                          The reservation identifier applicable to the resource. It shall
                          be present when an applicable reservation exists.

    vnfcCpInfo             > {...}
    id*                   string($uuid)
                          Identifier of this VnfcResourceInfo instance

    vduId*                string($uuid)
                          Reference to the applicable VDU in the VNFD.

    computeResource       ResourceHandle > {...}
}
```

```
ExtManagedVirtualLinkData ⌄ {
    description:          This type represents an externally-managed internal VL.

    resourceId*           string($uuid)
                          The identifier of the resource in the scope of the VIM or the
                          resource provider.

    vimConnectionId       string($uuid)
                          Identifier of the VIM connection to manage this resource. This
                          attribute shall only be supported and present if VNF-related
                          resource management in direct mode is applicable.

    virtualLinkDescId*    string($uuid)
                          The identifier of the VLD in the VNFD for this VL.

    id*                   string($uuid)
                          The identifier of the externally-managed internal VL instance.

    resourceProviderId    string($uuid)
                          Identifies the entity responsible for the management of this
                          resource. This attribute shall only be supported and present if
                          VNF-related resource management in indirect mode is applicable.
}
```

```
MonitoringParameter ⌄ {
    description:            This type represents a monitoring parameter that is tracked by
                            the VNFM

    timeStamp*              string($date-time)
                            Represents the point in time when the measurement has been
                            performed, as known to the VNFM.

    name                    string
                            Human readable name of the monitoring parameter, as defined in
                            the VNFD.

    id*                     string($uuid)
                            Identifier of the monitoring parameter defined in the VNFD.

    value*                    > {...}
}
```

```
InstantiateVnfRequestSol2 ⌄ {
    description:            This type represents request parameters for the "Instantiate
                            VNF" operation.

    extManagedVirtualLinks    > [...]
    flavourId*              string($uuid)
                            Identifier of the VNF deployment flavour to be instantiated.

    instantiationLevelId    string($uuid)
                            Identifier of the instantiation level of the deployment
                            flavour to be instantiated. If not present, the default
                            instantiation level as declared in the VNFD is instantiated.

    additionalParams        KeyValuePairs > {...}
    extVirtualLinks           > [...]
    localizationLanguage    string
                            Localization language of the VNF to be instantiated.

}
```

```
ScaleVnfRequest ⌄ {
    description:            This type represents request parameters for the "Scale VNF"
                            operation.

    numberOfSteps           integer($int32)
                            Number of scaling steps to be executed as part of this Scale VNF
                            operation. It shall be a positive number and the default value
                            shall be 1.

    additionalParams        KeyValuePairs > {...}
    aspectId*               string($uuid)
                            Identifier of the scaling aspect.

    type*                   string
                            Indicates the type of the scale operation requested.
```

```
                         Enum:
                          > Array [ 2 ]
}
```

```
OperateVnfRequest ∨ {
    description:           This type represents request parameters for the "Operate VNF"
                           operation.

    additionalParams       KeyValuePairs > {...}
    stopType               StopType  string
                           Enum:
                            > Array [ 2 ]
    gracefulStopTimeout    integer($int32)
                           The time interval (in seconds) to wait for the VNF to be taken
                           out of service during graceful stop, before stopping the VNF.
                           Ignored if changeStateTo=STARTED.

    changeStateTo*         VnfOperationalStateType  string
                           Enum:
                            > Array [ 2 ]
}
```

```
VnfLcmOpOccGeneric ∨ {
    description:              This type represents a VNF lifecycle management operation
                              occurrence.

    grantId                   string($uuid)
                              Identifier of the grant related to this VNF LCM operation
                              occurrence, if such grant exists.

    _links*                    > {...}
    operationState*           LcmOperationStateType  string
                              Enum:
                               > Array [ 7 ]
    error                     ProblemDetails > {...}
    vnfInstanceId*            string($uuid)
                              Identifier of the VNF instance to which the operation applies.

    resourceChanges            > {...}
    cancelMode                CancelModeType  string
                              Enum:
                               > Array [ 2 ]
    operationParams*           > {...}
    stateEnteredTime*         string($date-time)
                              Date-time when the current state was entered.

    changedExtConnectivity     > [...]
    startTime*                string($date-time)
                              Date-time of the start of the operation.

    id*                       string($uuid)
                              Identifier of this VNF lifecycle management operation
                              occurrence.

    isAutomaticInvocation*    boolean
```

```
                          Set to true if this VNF LCM operation occurrence has been
                          triggered by an automated procedure inside the VNFM (i.e.
                          ScaleVnf / ScaleVnfToLevel triggered by auto-scale, or HealVnf
                          triggered by auto-heal). Set to false otherwise.

    operation*            LcmOperationType  string
                          The enumeration LcmOperationType represents those lifecycle
                          operations that trigger a VNF lifecycle management operation
                          occurrence notification.

                          Enum:

                           > Array [ 9 ]
    isCancelPending*      boolean
                          If the VNF LCM operation occurrence is in "STARTING",
                          "PROCESSING" or "ROLLING_BACK" state and the operation is
                          being cancelled, this attribute shall be set to true.
                          Otherwise, it shall be set to false.

}
```

```
ExtManagedVirtualLinkInfo v {
    description:          This type provides information about an externally-managed
                          virtual link.

    networkResource*      ResourceHandle > {...}
    id*                   string($uuid)
                          Identifier of the externally-managed internal VL and the
                          related externally-managed VL information instance.

    vnfVirtualLinkDescId* string($uuid)
                          Identifier of the VNF Virtual Link Descriptor (VLD) in the
                          VNFD.

    vnfLinkPorts           > [...]
}
```

```
VnfLcmOperationOccurrenceNotification v {
    description:            This type represents a VNF lifecycle management operation
                            occurrence notification, which informs the receiver of
                            changes in the VNF lifecycle caused by a VNF LCM operation
                            occurrence.

    notificationStatus*     string
                            Indicates whether this notification reports about the start
                            of a lifecycle operation or the result of a lifecycle
                            operation.

                            Enum:

                             > Array [ 2 ]
    affectedVirtualLinks     > [...]
    affectedVirtualStorages  > [...]
    affectedVnfcs            > [...]
    _links*                 LccnLinks > {...}
    operationState*         LcmOperationStateType  string
                            Enum:

                             > Array [ 7 ]
    notificationType*       string
                            Discriminator for the different notification types.

    error                    > [...]
    timeStamp*              string($date-time)
                            Date-time of the generation of the notification.

    vnfInstanceId*          string($uuid)
                            The identifier of the VNF instance affected

    vnfLcmOpOccId*          string($uuid)
                            The identifier of the VNF lifecycle management operation
                            occurrence associated to the notification.

    changedInfo             VnfInfoModifications > {...}

    changedExtConnectivity   > [...]
    id*                     string($uuid)
                            Identifier of this notification

    subscriptionId          string($uuid)
                            Identifier of the subscription that this notification relates
                            to.

    isAutomaticInvocation*  string($boolean)
                            Set to true if this VNF LCM operation occurrence has been
                            triggered by an automated procedure inside the VNFM (i.e.
                            ScaleVnf / ScaleVnfToLevel triggered by auto-scale, or
                            HealVnf triggered by auto-heal).

    operation*              LcmOperationType  string
                            The enumeration LcmOperationType represents those lifecycle
                            operations that trigger a VNF lifecycle management operation
                            occurrence notification.

                            Enum:

                             > Array [ 9 ]
}
```

```
VnfLcmOpOccSol2 ∨ {
    description:           This type represents a VNF lifecycle management operation
                           occurrence.

    grantId                string($uuid)
                           Identifier of the grant related to this VNF LCM operation
                           occurrence, if such grant exists.

    _links*                 > {...}
    operationState*        LcmOperationStateType  string
                           Enum:

                            > Array [ 7 ]
    error                  ProblemDetails > {...}
    vnfInstanceId*         string($uuid)
                           Identifier of the VNF instance to which the operation applies.

    resourceChanges         > {...}
    cancelMode             CancelModeType  string
                           Enum:

                            > Array [ 2 ]
    operationParams*        > {...}
    stateEnteredTime*      string($date-time)
                           Date-time when the current state was entered.

    changedExtConnectivity
                            > [...]
    startTime*             string($date-time)
                           Date-time of the start of the operation.

    id*                    string($uuid)
                           Identifier of this VNF lifecycle management operation
                           occurrence.

    isAutomaticInvocation* boolean
                           Set to true if this VNF LCM operation occurrence has been
                           triggered by an automated procedure inside the VNFM (i.e.
                           ScaleVnf / ScaleVnfToLevel triggered by auto-scale, or HealVnf
                           triggered by auto-heal). Set to false otherwise.

    operation*             LcmOperationType  string
                           The enumeration LcmOperationType represents those lifecycle
                           operations that trigger a VNF lifecycle management operation
                           occurrence notification.

                           Enum:

                            > Array [ 9 ]
    isCancelPending*       boolean
                           If the VNF LCM operation occurrence is in "STARTING",
                           "PROCESSING" or "ROLLING_BACK" state and the operation is
                           being cancelled, this attribute shall be set to true.
                           Otherwise, it shall be set to false.

    changedInfo            VnfInfoModificationsSol2 > {...}
}
```

```
NetworkAddressInfo v {
    description:          This type represents information about a network address that
                          has been assigned

    macAddress*           MacAddress  string
    subnetIpRanges
                           > [...]
    ipAddress             IpAddress  string
}
```

```
VnfInfoModifications v {
    description:              This type represents attribute modifications that were
                              performed on an "Individual VNF instance" resource. The
                              attributes that can be included consist of those requested
                              to be modified explicitly in the
                              "VnfInfoModificationRequest" data structure, and additional
                              attributes of the "VnfInstance" data structure that were
                              modified implicitly e.g. when modifying the referenced VNF
                              package.

    vnfProductName            string
                              If present, this attribute signals modifications of the
                              "vnfProductName" attribute in "VnfInstance".

    metadata                  KeyValuePairs > {...}

    extensions                KeyValuePairs > {...}
    vimConnectionInfo           > [...]
    vnfdVersion                 string
                                If present, this attribute signals modifications of the
                                "vnfdVersion" attribute in "VnfInstance".

    vnfProvider                 string
                                If present, this attribute signals modifications of the
                                "vnfProvider" attribute in "VnfInstance".

    vnfConfigurableProperties   KeyValuePairs > {...}
    vnfPkgId                    string($uuid)
                                If present, this attribute signals modifications of the
                                "vnfPkgId" attribute in "VnfInstance".

    vnfdId                      string($uuid)
                                If present, this attribute signals modifications of the
                                "vnfdId" attribute in "VnfInstance".

    vnfInstanceName             string
                                If present, this attribute signals modifications of the
                                "vnfInstanceName" attribute in "VnfInstance".

    vnfInstanceDescription      string
                                If present, this attribute signals modifications of the
                                "vnfInstanceDescription" attribute in "VnfInstance".

    vnfSoftwareVersion          string
                                If present, this attribute signals modifications of the
                                "vnfSoftwareVersion" attribute in "VnfInstance".

}
```

```
AffectedVnfc {
    description:                This type provides information about added, deleted,
                                modified and temporary VNFCs.

    addedStorageResourceIds     > [...]
    changeType*                 string
                                Signals the type of change

                                Enum:
                                 > Array [ 4 ]
    id*                         string($uuid)
                                Identifier of the Vnfc instance, identifying the applicable
                                "vnfcResourceInfo" entry in the "VnfInstance" data type

    vduId*                      string($uuid)
                                Identifier of the related VDU in the VNFD.

    computeResource*            ResourceHandle > {...}
    removedStorageResourceIds   > [...]
}
```

```
IpOverEthernetAddressData {
    description:           This type represents network address data for IP over Ethernet.

    macAddress             string($mac)
                           MAC address.
    ipAddresses              > [...]
}
```

```
Entry ⌄ {
    description:          Performance information entry

    objectInstanceId*     string
                          The object instance (i.e. VNF instance) for which the
                          performance metric is reported.

    performanceMetric*    string
                          Name of the metric collected.

    performanceValues*     > [...]
    objectType*           string
                          Defines the object type for which performance information is
                          reported

}
```

```
VnfVirtualLinkResourceInfo ⌄ {
    description:           This type represents the information that allows addressing a
                           virtualised resource that is used by an internal VL instance in
                           a VNF instance.

    metadata               KeyValuePairs > {...}
    reservationId          string($uuid)
                           The reservation identifier applicable to the resource. It shall
                           be present when an applicable reservation exists.

    networkResource*       ResourceHandle > {...}
    id*                    string($uuid)
                           Identifier of this VnfVirtualLinkResourceInfo instance.

    vnfVirtualLinkDescId*  string($uuid)
                           Identifier of the VNF Virtual Link Descriptor (VLD) in the
                           VNFD.

    vnfLinkPorts            > [...]
}
```

```
VnfInstance ⌄ {
    description:               This type represents a VNF instance.

    vnfProductName*            string
                               Name to identify the VNF Product. The value is copied from
                               the VNFD.

    vnfdVersion*               string
                               Identifies the version of the VNFD. The value is copied
                               from the VNFD.

    vimConnectionInfo           > [...]
    metadata                   KeyValuePairs > {...}
    vnfProvider*               string
```

```
                                 Provider of the VNF and the VNFD. The value is copied from
                                 the VNFD.

    _links*                       > {...}
    vnfPkgId*                    string($uuid)
                                 Identifier of information held by the NFVO about the
                                 specific VNF package on which the VNF is based. This
                                 identifier was allocated by the NFVO.

    vnfConfigurableProperties    KeyValuePairs > {...}
    vnfdId*                      string($uuid)
                                 Identifier of the VNFD on which the VNF instance is based.

    instantiationState*          string
                                 The instantiation state of the VNF.

                                 Enum:
                                  > Array [ 2 ]
    vnfInstanceDescription       string
                                 Human-readable description of the VNF instance.

    extensions                   KeyValuePairs > {...}
    instantiatedVnfInfo           > {...}
    vnfInstanceName              string
                                 Name of the VNF instance.

    id*                          string($uuid)
                                 Identifier of the VNF instance.

    vnfSoftwareVersion*          string
                                 Software version of the VNF. The value is copied from the
                                 VNFD.

}
```

```
KeyValuePairs ⌄ {
    description:         This type represents a list of key-value pairs. The order of the
                         pairs in the list is not significant.

}
```

```
VnfcInfo ⌄ {
    description:                  This type represents the information about a VNFC instance
                                  that is part of a VNF instance

    vnfcState*                    string
                                  State of the VNFC instance.

                                  Enum:
                                   > Array [ 2 ]
    vnfcConfigurableProperties    KeyValuePairs > {...}
    id*                           string($uuid)
                                  Identifier of the VNFC instance.

    vduId*                        string($uuid)
                                  Reference to the applicable VDU information element in the
                                  VNFD.
}
```

```
TerminateVnfRequestSol2 ⌄ {
    description:          This type represents request parameters for the "Terminate VNF"
                          operation.

    additionalParams      KeyValuePairs > {...}
    terminationType*      string
                          Indicates whether forceful or graceful termination is requested.

                          Enum:
                           > Array [ 1 ]
}
```

```
VnfInstanceSubscriptionFilter ⌄ {
    description:              This type represents subscription filter criteria to match
                              VNF instances.

    vnfdIds                     > [...]
    vnfProductsFromProviders    > [...]
    vnfInstanceNames            > [...]
    vnfInstanceIds              > [...]
}
```

```
PmSubscription ⌄ {
    description:          This type represents a subscription related to notifications
                          about VNF performance.

    filter                PmNotificationsFilter > {...}
    _links*                > {...}
    callbackUri*          string($uri)
                          The URI of the endpoint to send the notification to.

    id*                   string($uuid)
                          Identifier that identifies the subscription.

}
```

```
AlarmModifications ⌄ {
    description:          This type represents attribute modifications for an "Individual
                          alarm" resource

    ackState*             string
                          New value of the "ackState" attribute in "Alarm".

                          Enum:
                           > Array [ 1 ]
}
```

```
VnfLinkPort {
    description:          This type represents a link port of an internal VL of a VNF

    resourceHandle*       ResourceHandle > {...}
    id*                   string($uuid)
                          Identifier of this link port as provided by the entity that has
                          created the link port.

    cpInstanceId          string($uuid)
                          Identifier of the external CP of the VNF to be connected to this
                          link port.

}
```

```
CreateThresholdRequest {
    description:          This type represents a request to create a threshold

    objectInstanceId*     string($uuid)
                          Identifier of the VNF instance associated with this threshold.

    criteria*             ThresholdCriteria > {...}
}
```

```
Report {
    description:          Information about available reports collected by this PM job.

    readyTime*            string($date-time)
                          The time when the report was made available.

    fileSize              integer($int32)
                          The size of the report file in bytes, if known.

    expiryTime            string($date-time)
                          The time when the report will expire.

    href*                 string($uri)
                          The Uri where the report can be obtained.

}
```

```
ExtVirtualLinkData {
    description:          This type represents an external VL.

    resourceId*           string($uuid)
                          The identifier of the resource in the scope of the VIM or the
                          resource provider.

    vimConnectionId       string($uuid)
                          Identifier of the VIM connection to manage this resource. This
                          attribute shall only be supported and present if VNF-related
                          resource management in direct mode is applicable.

    id*                   string($uuid)
                          The identifier of the external VL instance.

    resourceProviderId    string($uuid)
```

```
                         Identifies the entity responsible for the management of this
                         resource. This attribute shall only be supported and present if
                         VNF-related resource management in indirect mode is applicable.

   extCps                 > [...]
}
```

```
ChangeVnfFlavourRequestSol2 ∨ {
   description:           This type represents request parameters for the "Change VNF
                          flavour" operation.

   extManagedVirtualLinks  > [...]
   instantiationLevelId   string($uuid)
                          Identifier of the instantiation level of the deployment
                          flavour to be instantiated. If not present, the default
                          instantiation level as declared in the VNFD is instantiated.

   additionalParams       KeyValuePairs > {...}
   extVirtualLinks         > [...]
   newFlavourId*          string($uuid)
                          Identifier of the VNF deployment flavour to be instantiated.

}
```

```
ProblemDetails ∨ {
   description:          A JSON representation of a "ProblemDetails" data structure
                         according to IETF RFC 7807 that provides additional details of
                         the error

   instance              string($uri)
                         A URI reference that identifies the specific occurrence of the
                         problem.

   detail*               string
                         A human-readable explanation specific to this occurrence of the
                         problem.

   type                  string($uri)
                         A URI reference according to IETF RFC 3986 [5] that identifies
                         the problem type.

   title                 string
                         A short, human-readable summary of the problem type.

   status*               integer($int32)
                         The HTTP status code for this occurrence of the problem

   additionalAttributes   > [...]
}
```

```
VnfExtCpData ∨ {
   description:          This type represents an external CP.

   cpdId*                string($uuid)
                         The identifier of the CPD in the VNFD.

   cpConfig*
```

```
                            > [...]
}
```

```
StopType   string
Enum:
 > Array [ 2 ]
```

```
OperateRequest ⌄ {
    description:          This type represents request parameters for the operate
                          operation available on ext API.

    additionalParams      KeyValuePairs > {...}

    vnfcInstanceIds        > [...]

    operation*             > {...}
}
```

```
VnfLcmOpOcc ⌄ {
    description:             This type represents a VNF lifecycle management operation
                             occurrence.

    grantId                  string($uuid)
                             Identifier of the grant related to this VNF LCM operation
                             occurrence, if such grant exists.

    _links*
                              > {...}
    operationState*          LcmOperationStateType  string
                             Enum:
                              > Array [ 7 ]
    error                    ProblemDetails > {...}
    vnfInstanceId*           string($uuid)
                             Identifier of the VNF instance to which the operation applies.

    resourceChanges
                              > {...}
    cancelMode               CancelModeType  string
                             Enum:
                              > Array [ 2 ]
    operationParams*
                              > {...}
    stateEnteredTime*        string($date-time)
                             Date-time when the current state was entered.

    changedExtConnectivity
                              > [...]
    startTime*               string($date-time)
                             Date-time of the start of the operation.

    id*                      string($uuid)
                             Identifier of this VNF lifecycle management operation
                             occurrence.

    isAutomaticInvocation*   boolean
                             Set to true if this VNF LCM operation occurrence has been
                             triggered by an automated procedure inside the VNFM (i.e.
                             ScaleVnf / ScaleVnfToLevel triggered by auto-scale, or HealVnf
                             triggered by auto-heal). Set to false otherwise.

    operation*            LcmOperationType  string
                             The enumeration LcmOperationType represents those lifecycle
                             operations that trigger a VNF lifecycle management operation
                             occurrence notification.

                             Enum:

                              > Array [ 9 ]
    isCancelPending*      boolean
                             If the VNF LCM operation occurrence is in "STARTING",
                             "PROCESSING" or "ROLLING_BACK" state and the operation is
                             being cancelled, this attribute shall be set to true.
                             Otherwise, it shall be set to false.

    changedInfo           VnfInfoModifications > {...}
}
```

```
SubscriptionAuthentication v {
    description:                  A data structure that defines the authorization
                                  requirements.

    paramsOauth2ClientCredentials  > {...}
    paramsBasic                    > {...}
    authType*                      > [...]
}
```

```
LccnSubscriptionRequest v {
    description:          This type represents a subscription request related to
                          notifications about VNF lifecycle changes.

    filter                LifecycleChangeNotificationsFilter > {...}
    callbackUri*          string($uri)
                          The URI of the endpoint to send the notification to.

    authentication        SubscriptionAuthentication > {...}
}
```

```
FaultyResourceType  string
Enum:
 > Array [ 3 ]
```

```
FaultyResourceInfo v {
    description:          This type represents the faulty virtual resources that have a
                          negative impact on a VNF

    faultyResource*       ResourceHandle > {...}
    faultyResourceType*   FaultyResourceType  string
                          Enum:
                           > Array [ 3 ]
    id*                     string($uuid)
                            Unique identifier of the Faulty Resource Info object

}
```

```
Alarm ⌄ {
    description:              The alarm data type encapsulates information about an alarm.

    isRootCause*              boolean
                              Attribute indicating if this fault is the root for other
                              correlated alarms. If TRUE, then the alarms listed in the
                              attribute CorrelatedAlarmId are caused by this fault.

    rootCauseFaultyResource*  FaultyResourceInfo > {...}
    alarmRaisedTime*          string($date-time)
                              Time stamp indicating when the alarm is raised by the
                              managed object.

    alarmClearedTime          string($date-time)
                              Time stamp indicating when the alarm was cleared. It shall
                              be present if the alarm has been cleared

    eventType*                EventType  string
                              Enum:

                               > Array [ 5 ]
    alarmChangedTime          string($date-time)
                              Time stamp indicating when the alarm was last changed. It
                              shall be present if the alarm has been updated.

    ackState*                 string
                              Acknowledgement state of the alarm.

                              Enum:

                               > Array [ 2 ]
    managedObjectId*          string($uuid)
                              Identifier of the affected VNF instance.

    perceivedSeverity*        PerceivedSeverityType  string
                              Enum:

                               > Array [ 6 ]
    probableCause*            string
                              Information about the probable cause of the fault.

    eventTime*                string($date-time)
                              Time stamp indicating when the fault was observed.

    faultType                 string
                              Additional information to clarify the type of the fault.

    correlatedAlarmIds
                               > [...]
    faultDetails
                               > [...]
    id*                       string($uuid)
                              Identifier of this Alarm information element.

}
```

```
ResourceHandle ⌄ {
    description:            This type represents the information that allows addressing a
                            virtualised resource that is used by a VNF instance. Information
```

```
                         about the resource is available from the VIM.

    resourceId*          string($uuid)
                         Identifier of the resource in the scope of the VIM or the
                         resource provider.

    vimConnectionId      string($uuid)
                         Identifier of the VIM connection to manage the resource.

    vimLevelResourceType string
                         Type of the resource in the scope of the VIM or the resource
                         provider.

    resourceProviderId   string($uuid)
                         Identifier of the entity responsible for the management of the
                         resource.

}
```

```
ExtVirtualLinkInfo v {
    description:         This type represents information about an external VL.

    resourceHandle*      ResourceHandle > {...}

    linkPorts             > [...]
    id*                  string($uuid)
                         Identifier of the external VL and the related external VL
                         information instance

}
```

```
IpAddress   string
```

```
PmJob v {
    description:         This type represents a PM job

    reports               > [...]
    objectInstanceIds*    > [...]
    criteria*            PmJobCriteria > {...}
    id*                  string($uuid)
                         Identifier of this PM job.

}
```

```
PerformanceValue v {
    description:         Performance value with associated timestamp

    value*                > {...}
    timestamp*           string($date-time)
                         Time stamp indicating when the data was collected.

}
```