



Understanding Virtual Network Function Descriptors

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Virtual Network Function Descriptor Overview

ESC supports a TOSCA-based Virtual Network Function Descriptor (VNFD) to describe the VNF properties. The VNFD conforms to the *GS NFV-SOL 001* specifications and standards specified by ETSI.

The VNFD file describes the instantiation parameters and operational behaviors of the VNFs. It contains KPIs, and other key requirements that can be used in the process of onboarding and managing the lifecycle of a VNF.

For VNF Lifecycle operations, see [VNF Lifecycle Operations](#).

Defining Extensions to the Virtual Network Function Descriptor

ESC implements extensions to the VNFD defined by Cisco to expose the more advanced concepts supported by ESC, but missing in the ETSI standards. These extensions are strongly typed in the Cisco types definition to describe the overridden data, node, and interface types.

VNF Configurable Properties

The VNF node type is always customized for each VNF. The Cisco extensions provide the ability to specify the recovery policy and time to wait for the VNF to recover before ESC considers any mitigating action.

For example:

```
vnf:
  type: cisco.VPC.1_0.1_0
  properties:
    descriptor_id: b98450dd-f532-4a42-8419-e3dc04327318
    descriptor_version: '3.8'
    provider: Cisco
    product_name: VPC
    software_version: 1.0
    product_info_name: 'Virtual Packet Core (VPC); 32 vCPUs, 64Gb RAM, 66Gb vStorage'
    vnfm_info:
      - '9:Cisco Elastic Services Controller:v04.04.01'
```

```

configurable_properties:
  is_autoscale_enabled: false
  is_autoheal_enabled: false
lcm_operations_configuration:
  heal:
    recovery_action: REBOOT_THEN_REDEPLOY
    recovery_wait_time: 0
flavour_id: default
flavour_description: 'Default VNF Deployment Flavour'

```

Compute

The Cisco Compute node allows for many of the ESC features to be exposed via the extended ETSI data model. This includes the following:

- Overriding the automatically generated name for a VNFC on the VIM.
- VIM flavor (overriding the ETSI capabilities specified for a VNFC).
- Supplying ESC with an expected bootup time to prevent further actions being taken until this timer has expired.
- Providing Day-0 configuration blocks to execute/store on the VNFC once deployed.
- Specifying KPI parameters and associated rules to configure the monitoring agent.
- Intra-VM Group placement rules.

For example:

```

vdu1:
  type: cisco.nodes.nfv.Vdu.Compute
  properties:
    name: Example VDU1
    description: Example VDU
    boot_order:
      - boot1-volume
  configurable_properties:
    additional_vnfc_configurable_properties:
      vim_flavor: Automation-Cirros-Flavor
      bootup_time: 1800
  name_override: my-vdu-1
  vdu_profile:
    min_number_of_instances: 1
    max_number_of_instances: 1
    static_ip_address_pool:
      network: esc-net
      ip_address_range:
        start: { get_input: VDU1_NETWORK_START }
        end: { get_input: VDU1_NETWORK_END }
      ip_addresses: { get_input: VDU1_SCALE_IP_LIST }
  kpi_data:
    VM_ALIVE-1:
      event_name: 'VM_ALIVE-1'
      metric_value: 1
      metric_cond: 'GT'
      metric_type: 'UINT32'
      metric_occurrences_true: 1
      metric_occurrences_false: 30
      metric_collector:
        type: 'ICMPPing'
        nicid: 1
        poll_frequency: 10
        polling_unit: 'seconds'

```

```

        continuous_alarm: false
admin_rules:
  VM_ALIVE-1:
    event_name: 'VM_ALIVE-1'
    action:
      - 'ALWAYS log'
      - 'FALSE recover autohealing'
      - 'TRUE esc_vm_alive_notification'
placement_type: zone
placement_target: nova
placement_enforcement: strict
vendor_section:
  cisco_esc:
    config_data:
      example.txt:
        file: ../Files/Scripts/example.txt
        variables:
          DOMAIN_NAME: { get_input: DOMAIN_NAME }
          NAME_SERVER: { get_input: NAME_SERVER }
          VIP_ADDR: { get_input: VIP_ADDR }
          VIP_PREFIX: { get_input: VIP_PREFIX }
capabilities:
  virtual_compute:
    properties:
      virtual_cpu:
        num_virtual_cpu: 8
      virtual_memory:
        virtual_mem_size: 16
requirements:
  - virtual_storage: cdrl-volume
  - virtual_storage: boot1-volume

```



Note You can supply a high number of input parameters, allowing the use of a single template for multiple deployments.

Connection Point

The Cisco extensions to the VduCp node type mainly allows for improved IP addressing capabilities and accessibility to the interface. The features added to the connection point are as follows:

- Overriding the automatically generated name for a port on the VIM
- Static IP Addresses (and pools for scaling)
- Identification of whether the port is a management port (i.e. used for monitoring)
- Allowed Address Pairs
- Support for specific network card types and interface types, e.g. SR-IOV
- Support for port binding profiles
- Whether port security is enabled

For example:

```

vdu1_nic0:
  type: cisco.nodes.nfv.VduCp
  properties:
    layer_protocols: [ ipv6 ]

```

```

protocol:
  - associated_layer_protocol: ipv6
trunk_mode: false
order: 0
nw_card_model: virtio
iface_type: direct
management: true
name_override: my-vdul-nic0
ip_subnet:
  - ip_address: { get_input: VDUI_NICO_IP }
allowed_address_pairs:
  - ip_address: { get_input: VDUI_NICO_AADR_PAIRS }
port_security_enabled: false
binding_profile:
trusted: true
requirements:
  - virtual_binding: vdu1

```

If there is a requirement to control these properties on a per-deployment basis, then replace the hard-coded values with inputs in the VNFD that can be supplied as additionalParams in the incoming request.



Note The port binding profile is available for Pike and above versions of OpenStack.

Volume

ESC supports out-of-band volume as a Cisco extension. This allows the specification of the persistent volume UUID as the resourceId property against the cisco.nodes.nfv.Vdu.VirtualBlockStorage node to be used in place of the ephemeral volume defined in the VNFD. Instead of adding extra properties, ESC allows to override the volume specified in the VNFD and supplies its own persistent (deployed out-of-band) storage by identifying it with a UUID from the VIM.

For example:

```

boot1-volume:
  type: cisco.nodes.nfv.Vdu.VirtualBlockStorage
  properties:
    resource_id: { get_input: VDUI_BOOT_VOL_UUID }
    virtual_block_storage_data:
      size_of_storage: 4GB
      vdu_storage_requirements:
        vol_id: 1
        bus: ide
        type: LUKS
    sw_image_data:
      name: 'Automation_Cirros'
      version: '1.0'
      checksum: 9af30fce37a4c5c831e095745744d6d2
      container_format: bare
      disk_format: qcow2
      min_disk: 2 GB
      size: 2 GB
  artifacts:
    sw_image:
      type: tosca.artifacts.nfv.SwImage
      file: ../Files/Images/Automation-Cirros.qcow2

```

To specify the out-of-band resource in place of ephemeral resource, ESC allows you to use the incoming request to match tags in the VNFD during instantiation. A new data structure is appended to the existing InstantiateVnfRequest.

For example,

```
{
  "flavourId": "default",
  "instantiationLevelId": "default",
  "extVirtualLinks": [{}],
  "extManagedVirtualLinks": [{}],
  "extManagedVolumes": [
    {
      "virtualStorageDescId": "cf-cdr1-volume",
      "resourceId": "vol1123"
    },
    {
      "virtualStorageDescId": "cf-boot1-volume",
      "resourceId": "vol1456"
    }
  ],
  ...
}
```



Note The VNFD or InstantiateVnfRequest accepts the volume or software image size in mebibyte-based units such as MiB, GiB or TiB equivalent. If the volume or software image size is in megabyte-based units such as MB, GB or TB, ESC converts the size to mebibyte-based equivalent and adjusts to the nearest value. Ensure you use mebibyte-based units for volume or software image size for clarity.

Security Group Rule

As per the handling of the volume above, ESC provides the ability to specify an out-of-band security group instead of configuring one in the VNFD. This is because the verbs used to describe the security group in the standards documentation are too simplistic for a very complicated configuration.

For example:

```
- NETWORK_ORCH_SEC_GRP_1:
  type: cisco.policies.nfv.SecurityGroupRule
  group_name: { get_input: VIM_NETWORK_ORCH_SEC_GRP_1 }
  targets: [ vdul_nic0 ]
```

Custom VM Name

The Cisco extension allows you to customize the VNFC (VM) name in a deployment using additional parameters. The ESC ETSI includes the additional parameters to customize VM names.

To configure the VM name on the VIM, you must first define the data type and then extend the Cisco node type for the compute node:

```
tosca_definitions_version: tosca_simple_yaml_1_2
data_types:
  cisco.datatypes.nfv.VnfcAdditionalConfigurableProperties:
    derived_from: tosca.datatypes.nfv.VnfcAdditionalConfigurableProperties
    properties:
      vim_flavor:
        type: string
        required: true
      bootup_time:
        type: integer
        required: true
```

```

vm_name_override:
  type: string
  required: false

```

These definitions allow the VNFD node_templates to use the inputs to map to the Compute node:

```

topology_template:
  inputs:
    ...

  node_templates:

#####
# VDU configuration #
#####
  cl:
    type: cisco.nodes.nfv.Vdu.Compute
    properties:
      name: control-function 1
      description: Vdul of an active:standby (1:1) redundant pair of CF VMs
      ...
    configurable_properties:
      additional_vnfc_configurable_properties:
        vim_flavor: { get_input: CF_FLAVOR }
        bootup_time: { get_input: BOOTUP_TIME_CF }
        vm_name_override: { get_input: VIM_C1_VM_NAME }
      ...
    capabilities:
      virtual_compute:
        properties:
          virtual_cpu:
            num_virtual_cpu: 8
          virtual_memory:
            virtual_mem_size: 16 GiB
      requirements:
        - virtual_storage: cf-cdr1-volume
        - virtual_storage: cf-boot1-volume

```

Specify *vm_name_override* under configurable properties of the compute node. If *vm_name_override* is not specified, ESC will auto generate the VM names.

ESC stores the VNFC specific value in

VnfInstance.instantiatedVnfInfo.vnfcResourceInfo.metadata.vim_vm_name for the VNFC identified by the vduId, which matches the label given to the Compute node representing the VNFC.

For information on lifecycle management operations, see [Managing the VNF Lifecycle](#).

SR-IOV

ESC ETSI NFV MANO supports SR-IOV properties using the Cisco data types. You can configure the interface to associate the VNFC with an SR-IOV pass through adapter.

Cisco data type:

```

cisco.datatypes.nfv.L2ProtocolData:
  derived_from: tosca.datatypes.nfv.L2ProtocolData
  properties:
    segmentation_id:
      type: integer
      required: false

```

Example VNFD:

```
virtual_link_protocol_data:  
- associated_layer_protocol: ethernet  
  l2_protocol_data:  
    network_type: vlan  
    physical_network: vlan_network  
    segmentation_id: { get_input: VL1_SEG_ID }
```

