

VNF Life Cycle Management for VMware

Virtual Multimedia Resource Function

User Guide

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Contents

1	Introduction	1
2	Prerequisites	2
3	Onboarding	3
4	Procedures	7
4.1	Instantiate VNF	7
4.2	Scale VNF	13
4.3	Terminate VNF	15
	Reference List	18





1 Introduction

This document contains information for system administration tasks performed in the VNF Lifecycle Manager (VNF-LCM). VNF-LCM provides a workflow execution environment and a web-based application for managing VNF life cycle procedures.

VNF life cycle procedures are realized by executing ordered sequences of steps, called workflows. Each workflow must be provided with VNF-specific input parameters during execution.

This document covers the following life cycle management procedures, available in VMware deployments:

- [Instantiate VNF](#) on page 7
- [Scale VNF](#) on page 13
- [Terminate VNF](#) on page 15

2 Prerequisites

This section provides information on the tools and conditions that apply to the procedures in this document.

Before performing any VNF-LCM procedure, ensure that the following conditions are met:

- The software delivery package including vIMS workflows, VNF-specific Open Virtualization Format (OVF) files, example environment files, and the VNF-LCM scripts is available.
- VNF-LCM is available using either Operations Support System, Radio and Core (OSS-RC) or Ericsson Network Manager (ENM).
- The vCD is used as Virtual Infrastructure Manager (VIM).
- The VIM is configured in VNF-LCM.

Note: The VIM configuration in VNF-LCM can be checked with the `vnflcm vim list` command.

For more information on configuration and the command, refer to *VNF-Lifecycle Manager System Administration Guide*, Reference [1].

- The following minimum version requirements are met:
 - vCD: 8.11
 - vIMS workflows: 1.12.0
 - VNF-LCM: 18.12 or higher (minimum SW media version: 4.7.13)
- The workflow bundle RPM is installed as described in the relevant network management system documentation. For more information, refer to *VNF-Lifecycle Manager System Administration Guide*, Reference [1].
- The cloud environment is prepared for the deployment of the VNF, that is, the following activities are performed:
 - Cloud hardware and software preparation and configuration
 - Network topology creation
 - Subnet creation

For detailed instructions, refer to the relevant deployment instructions.



3 Onboarding

This section describes how to prepare for workflow-based VNF operations using VNF-LCM. Performing this procedure is a prerequisite for life cycle operations.

Prerequisites

- The VNF image is uploaded to the cloud environment. For more information, see the relevant [deployment instructions](#).

Steps

1. Create a directory for the VNF-specific files in `/vnflcm-ext/backups/workflows/vnfd/<VNFTYPE__VNFVersion>`.

Note: Follow the naming convention as above: VNF type and VNF version separated by "__".
2. In `/vnflcm-ext/backups/workflows/vnfd/<VNFTYPE__VNFVersion>`, create a `configurations` subdirectory with write permission for the `jboss_user`, and a child directory for each VNF configuration. This allows for storing multiple VNF configurations.

Note: Each directory in `configurations` must contain a VNF-specific `env-vcd.yaml` environment file. Each `env-vcd.yaml` file can be used for a different VNF instantiation, depending on, for example, network needs.

In the current release, the `env-vcd.yaml` must be created by the user. Create the file based on [Example 1](#), providing attribute and value pairs based on your network needs.

Provide data containing multiple line breaks, for example, private key file contents, according to the following:

- Using vIMS workflow version 1.12.0: the attribute value must be corrected manually after it is imported to the VNF.
 - Using vIMS workflow version higher than 1.12.0: replace line breaks with `\n` and provide the whole string in quotes.
3. Create a vApp template in vCloud Director by uploading the **release-specific** OVF files provided in the software delivery package.
 4. Copy the `lcmScripts` directory and its content into the directory created in `/vnflcm-ext/backups/workflows/vnfd/<VNFTYPE__VNFVersion>`.

Note: The `lcmScripts` is provided in the software delivery package.



The example below shows a directory structure with two configurations stored.

Example

```
`-- vMRF__<version_number>
   |-- vnflcmOperationsConfiguration.json
   |-- configurations
   |   |-- example_config_1
   |   |   |-- env-vcd.yaml
   |   |-- example_config_2
   |   |   |-- env-vcd.yaml
   |-- lcmScripts
```

Depending on the vIMS workflow version, store the private and public SSH keys:

- If using vIMS workflow version 1.12.0 or lower, continue with the next step.
 - If using vIMS workflow version 1.13.0 or higher, continue with [Step 6](#).
5. Add the private SSH key to the /home/jboss_user/.ssh/ folder, and the public SSH key in the admin_authorized_key parameter of the env-vcd.yaml file.

Note: If the SSH key is not available yet, create it using the `ssh-keygen -t rsa` command, as jboss_user:

```
sudo -u jboss_user bash -c 'ssh-keygen -t rsa -f
~/.ssh/id_rsa && cat ~/.ssh/id_rsa.pub'
```

6. If missing, add the private SSH key to the /vnflcm-ext/backups/private_keys/workflows/default/.ssh folder, and the corresponding public SSH key in the admin_authorized_key parameter of the env.yaml file of each configuration stored.

The public key can be obtained by using the following command:

```
sudo -u jboss_user cat /vnflcm-ext/backups/workflows/
private_keys/default/.ssh/id_rsa.pub
```

If the SSH key or the .ssh folder is not available, create them using the following command, as jboss_user:

```
sudo -u jboss_user bash -c 'cd /vnflcm-ext/backups/workflows/
private_keys/default && mkdir .ssh && chmod 0700 .ssh && ssh-
keygen -P "" -t rsa -f .ssh/id_rsa'
```

Example 1 env-vcd.yaml File Example

```
# Format: <network name in the OVF>: <organization vDC network name>
org_networks:
  nbi: "vmrf-net-oam" # The operation and maintenance network
  mrfSignalling: "vmrf-net-signaling" # The vMRF Signalling network
  trustedMedia: "vmrf-net-trusted" # The trusted Media network

# Definitions of vApp network. Based on these definitions,
```



```
# the workflows create these networks as part of vApp creation,
# and maps networks declared in OVF to these networks.
# The vApp networks are available only for the vApp the networks belongs to.
# These vApp networks will be isolated, i.e. not connected to any organization vDC →
networks.
vapp_networks:
  - network_name: "clusterInternal" # Name of the vApp network
rk
  default_gateway: "192.0.2.1" # Default gateway of the network.
  start_address: "192.0.2.100" # The first valid IP address of the IP address pool range.
  end_address: "192.0.2.199" # The last valid IP address of the IP address pool range.
  subnet_mask: "255.255.255.0" # The subnet mask of the network.

product_section_parameters:
  # Management IP address of the instance
  OAM_IPAddress: "172.16.3.2"
  # (optional) Specifies public OAM IP address of the VNF,
  # when OAM_IPAddress resides beyond NAT.
  Public_OAM_IPAddress: "191.0.6.1"
  # Username for the O&M ssh connection
  Username: "DummyAdmin"
  # Password has for the user above. Generated with: mkpasswd -m sha-512 MySecret →
  Password: "$6$gxizwdYh$MaZx9Hf9gZu7NC398yzbQ0cZ0GJIWh3oxFr2tyRKY/bZ0EDyweHHPv5Yb →
  JbEfsY6bVBts/ZkZXSPncrqHv2w0"
  # Public key of jboss user of the VNF-LCM machine
  Ssh_public_key: "ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAQACvdTLIPOAiL2xCndQud3b9rCLdV →
  5BzHLA5nP8d1JwW17VQWwZicus1 →
  DKMsYyPEelQduXNh845/hqWt+HhHc3umcnsReBHXRS5A0yq2oGXU+Lx0bnZ1Nw+pEByAtOp8TmSkm7fS1o →
  tGjdrZn0ze83iilpCiPMIEvbbY0 →
  yIfUK3ZILVjBFEx7rBh8WP401hgLHOMa1D+L7z1T3dDLlqSQ1+o60604M/FeG/6goKsgwAexFw+1lBkEHF →
  0CzcC9BiXWl1L/+MJ2VBg3qgBTm →
  gIQ9/y+4+DQ4FF8iMIILEPrRNsdkGd9CyHol3cAbXLIX02mw0mrFzJFr9wMbVF2PdTUZ"
  # Multiple NTP addresses can be provided with a space delimiter
  Ntp_addresses: "192.0.7.2"
  # Initial configuration. .tar.gz formatted configuration in base64 string
  Init_config: "qp2ZD2GjPDrSxo29sbgmdJfKmd8aXWvWULg9FqxqJif4N2BPi2mZHA+kYTA8P/cJP →
  fHRPzZJl3cda+oBuTABH4cjRd2I →
  7YaaqQtTA0/KgCMtvWxVhHYN6Op+nfsRsTyEITRoghRmVcU1DYP2176t0cGeh2quZraqAW9wJ+S13wBtwB →
  8IYmIHQDf2anaWlIo9tpwVS47y0 →
  8vmFMyAQBgT0960hxrxdIOVktB13guG3bEknfsHwerUrBFvnhyhQ9aHrb2QGIT+G3p4dXN54J42lej/nWVd →
  Q4i+yCJemtANrBW0dRxn7pJXRCX →
  nzYYpMZ0AGhI8T0Bk5/97CLfjfcDN7VA=="
  # Shared storage configuration
  Shared_storage_server_username: dummy_user
  Shared_storage_server_path: "/home/vmrfvmware1/shared_storage/"
  Shared_storage_server_ip: "192.168.71.89"
  Shared_storage_server_port: 22
  Shared_storage_server_fingerprint: '131.160.94.101 ecDSA-sha2-nistp256 AAAAE2Vj →
  ZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBBKFUShoQyxnvofm2fv0g0q8/MQ37wkdT7zuQPN →
  fV16p3Fv0B+vRDRNGUMV/erDZPvZgTQDbiBpg9fB1LfeFmH8Y=\n13 →
  1.160.94.101 ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIHVgKowKydPJzs990CFW/gfDXG5173Zgk →
  +yechAjn0FU\n'
  Shared_storage_ssh_private_key: '-----BEGIN RSA PRIVATE KEY-----
  \nMIICXQIBAAKBgQDF60kPVTtczzKVaKAQuQw+/zwYgJgMr7GuU75/YR+6NhHVns9\ndhLQuW9yB53int →
  RX8DHiG+1Zk20ng51GRGw1SmIT8uqJA2xYtBYrcFPvBVyW0BN3\ntyCNEbZogcN6YDb442w/2H/NvA5EfS →
  UNrhTdoUhpY7XDHvs8oRAjySZEJQIDAQAB\nAoGBAMT2Narwozbl+ →
  2MRV7fCPTYfbnan3Zgkm5uILbMbvaezzX56UHEGpvYB0W\nv2T7s04gV0Qxjq8KLCKasDphdVVDHnro1C →
  /dW85mQzdS3rvoXTv0pxD9ys1XL9Ji\nfXUmm+vY0ireglqS0TRCmsFTETVsm7jYst72bdKhpwFsgTYxAK →
  EA5gTs23J+q20+\nSd0erxGks7vyoJoZRVLDXsNfIu012qcGpAe3G2 →
  EPx36RNWwik1TzgBtJ0McyXK9gF\nBEfmX+VBmwJBANxGLLNVVxEn/Lmf0ITRoHjF8g1xxLFZr5no7uCVf →
  tMTkxGa+DR\nlaGdiUgV00pwJ0cnYN5+fJ1jphWr00K2zT8CQQDjLD4ZxygyljYmkVx6nzxBXwCT\nn6V3H →
  /70umFpfh0IK/ycp3YzUd5oz9ybGzuDsytUwJ64meN9cp+7ceX5ne2 →
  69AkA\nnncQi+0n1Ac7w4xXAJtBcKrtEZbKzWvT6Ru2q56naDrNbVhsM9GY/PBjtg+2fDgP3\nnhn0XDv0h →
  WUA1WDjT0+DjAkBu+yu5aEoq2idarCXI3UVK8PPLAfczXKwjJL2N3zMB\nn6j6U14mJzY/wT7IC/qzyMbMc →
  YS5h9I6w6IqBM9hBon6U\n
  -----END RSA PRIVATE KEY-----\n'
  # Announcement storage configuration
  announcement_storage_server_username: vmrf_vnf_user
  announcement_storage_server_path: "/home/vmrfvmware1/announcement_storage/"
  announcement_storage_server_ip: "192.168.37.82"
  announcement_storage_server_port: 22
  announcement_storage_server_fingerprint: '131.160.94.101 ecDSA-sha2-nistp256 AA →
  AAE2VjZHNhLXNoYTItbmlzdHAyNTYAAAAIbmlzdHAyNTYAAABBBKFUShoQyxnvofm2fv0g0q8/MQ37wkdT →
  7zuQPNfV16p3Fv0B+vRDRNGUMV/erDZPvZgTQDbiBpg9fB1LfeFmH8 →
  Y=\n131.160.94.101 ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIHVgKowKydPJzs990CFW/gfDXG5 →
  173Zgk+yechAjn0FU\n'
  announcement_storage_ssh_private_key: '-----BEGIN RSA PRIVATE KEY-----
```



```
\nMIICXAIBAAKBgQDDVN00GLJgwrPcG04MayJXo1fRwDv7Csbro4bSI01eUpipB5p0\nVZq10xbuwTBq0V →  
ZXTymiIjMpzXAS9S4iX3wpI10xN81bHvE07NRV94qB3370L0wc\n1QfLEB5GdZzT5joqwOW10W8AgBrYMN →  
1VbkYw20dz1zRYIIVcVmzowdngJwIDAQAB\nAoGBAIOh9ZNr10HX1⇒  
Cd98WYTCKiv8aibeJBcGe0QZvnSThJPbStzwUwmrsR1FqY9\nnMKi7fAkIgxENJReFp4JPEhD98ggFKX+SB →  
hVV3q060b3tKjMvcaCz11E6nZb5SqNy\nnHgrA8NxPZz9XUb6Xj049+TF2XIWZicTm90yQnqYydJznV86BA →  
kEA7Xu1NDSRPHrc\nnt2B5TP0aFgJs8PdNk410MMW/ceYN+4eAN1ZFR⇒  
ZerJcwWGuH/pmqbnsphFuytmFhq\nnsiQWW3IowQJBANKPvphAHK/mWsAk8GXaJ3RR3LH1GIL6tpvipDka →  
jNNFGy32u4L2\nneCM7ae0USZ7ywm+fzEYyMB4GJjzyUEsTmucCQFFnw3CWyGZD817Eqi/y3rtGr5NW\nnIn →  
h+ypv1rUzV/2tsAxwPCSj3d4B/F3QtHkKr0z+b51pfXhfYf8MsJxcQ⇒  
o+MECQGMo\nnnHo4nwnbMluQScG9ZZ0qvALuv4dXKE3rAq19rloED10sAQwgo9z7qtcoyy7WZeij\nnWXqpQ →  
e2xuaoz9soUVnsCQCnT7efEjD601+9eK0+ymMhbu0gYpmEjqI+NScUxMT4S\nnK1b5QBJsACQI505/zizKY →  
/Wqz18pa5vB0Deex3tsunI=\n-----END RSA PRIVATE KEY-----\n'\n# PM data monitoring configuration (Grafana)\nPm_data_monitoring_hosts_ip_address:\nPm_data_monitoring_hosts_port:
```



4 Procedures

The following sections describe how to perform LCM operations.

VNF-LCM procedures utilize workflow instances. [Figure 1](#) shows an example of a workflow instance, where workflow progress can be tracked in the **Workflow Diagram** view. The **Workflow Diagram** only represents stages of the various procedures, operations are performed in the **Task** view.

It is not recommended to execute a workflow instance on a VNF while another one is in progress, as it can lead to unexpected behavior. If a new workflow procedure is needed, the ongoing one must be terminated before starting a new one.

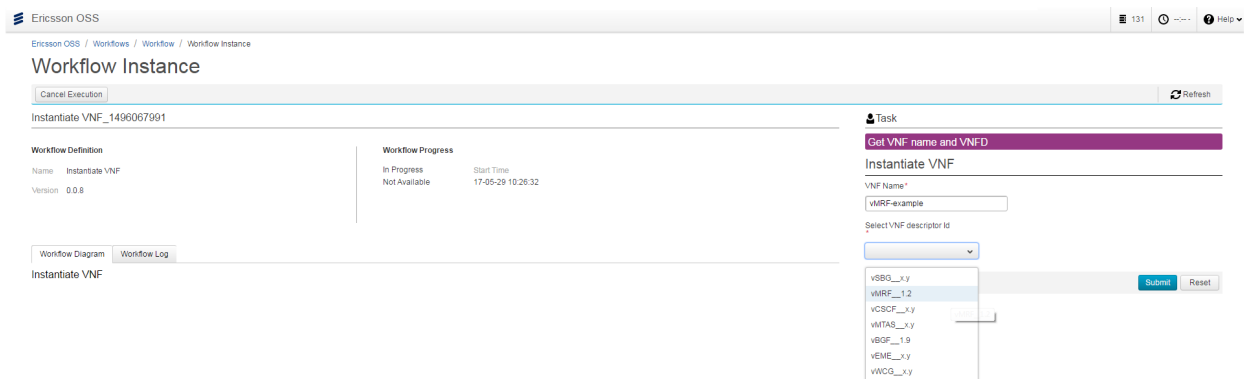


Figure 1 Workflow Instance Overview

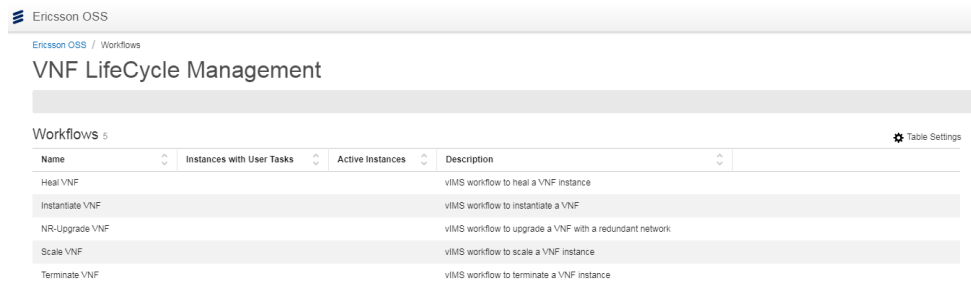
4.1 Instantiate VNF

This section describes how to instantiate a VNF using VNF-LCM.

Note: When instantiating a VNF on a VIM running on BSP, make sure there are no active Capture Jobs on BSP, or the instantiation fails.

Steps

1. In the VNF-LCM **Workflows** screen, select **Instantiate VNF**, and click the **Start a New Instance** button.



The screenshot shows the 'VNF LifeCycle Management' page in the Ericsson OSS interface. It features a table with 5 workflows. The table has columns for Name, Instances with User Tasks, Active Instances, and Description. The workflows listed are: Heal VNF, Instantiate VNF, NR-Upgrade VNF, Scale VNF, and Terminate VNF. Each workflow has a corresponding description.

Name	Instances with User Tasks	Active Instances	Description
Heal VNF			vims workflow to heal a VNF instance
Instantiate VNF			vims workflow to instantiate a VNF
NR-Upgrade VNF			vims workflow to upgrade a VNF with a redundant network
Scale VNF			vims workflow to scale a VNF instance
Terminate VNF			vims workflow to terminate a VNF instance

Figure 2 Select Workflow

2. On the **Start a Workflow** screen, fill out the **Instance Name** field, and click **Submit**.
3. Select the newly created workflow from the **Instance Activity** panel.
4. On the **Get VNF name and VNFD** screen, add **VNF Name** and **VNF Instance Description**, select VNF to instantiate, and click **Submit**.

Select the **Add Network Element in ENM/OSS-RC** check box to add the new VNF in the network management application.

Note: The **VNF Name** is also used as the Heat stack name. It is not recommended to add version information in this field, as the name is unchanged after VNF upgrades.

The **Select VNF descriptor Id** field displays VNF releases available for instantiation in the `/vnflcm-ext/backups/workflows/vnfd/` directory.

Figure 3 Get VNF name and VNFD



Task

Get VNF name and VNFD

Instantiate VNF

VNF name*

VNF instance description*

Select VNF descriptor ID*

☒ Add Network Element in ENM/OSS-RC

5. On the **Select VIM** screen, select the VIM to be used, and click **Submit**.

Task


Select VIM

Select VIM:

Figure 4 Select VIM

6. On the **Select Tenant** screen, select the tenant to be used, and click **Submit**.



 Task

Select Tenant

Select Tenant*


fi14 ▼

Submit

Reset

Figure 5 Select Tenant

7. On the **Select VDC** screen, select the virtual Data Center (vDC) in which the new VNF is instantiated, and click **Submit**.

 Task

Select VDC

Select vDataCenter to deploy into

vDataCenter*

▼

Submit

Reset

Figure 6 Select vDC

8. On the **Get Instance Configuration** screen, select a VNF configuration to instantiate, and click **Submit**.

Note: The **Select Configuration for the VNF instance** field displays VNF configurations available for instantiation in the `/vnflcm-ext/current/vnf_package_repo/<VNFTYPE__VNFVersion>/configurations` directory.



Task

Get Instance Configuration Data

Get Instance Configuration

Select Configuration for the VNF instance*

example_config_1

example_config_2

example_config_1

Submit

Reset

Figure 7 Get Instance Configuration

9. If the ENM network management application is used, provide VNF-related parameters for ENM, and click **Submit**.

This step is optional. It is only required if the **Add Network Element in ENM/OSS-RC** check box was selected in [Step 4](#).

Note: To fill out the **Network element version supported by OSS/ENM** field, check the supported VNF version with the following command:

```
cmedit describe --netype <VNF_type>
```



Task

Get OSS/ ENM parameters

Enter the parameters required by OSS/ENM

VNF username*

VNF password*

Network element type in OSS/ENM*

Network element version supported by OSS/ENM*

Node IP address*

SNMP port used*

Netconf port used*

The Src type of network element*

The associated site.*

Figure 8 Get OSS/ENM Parameters

Results

The VNF is instantiated, it starts handling traffic after configuration data is provided. For more information on providing configuration data, see [Deployment](#)



Guide for VMware vSphere or Deployment Guide for VMware vCloud Director, and Initial Configuration Guide.

4.2 Scale VNF

This section describes how to scale a VNF using VNF-LCM.

Continue with this procedure only if the VNF to be scaled was instantiated using the VNF-LCM.

Steps

1. In the VNF-LCM click **Start a Workflow**, select **Scale VNF**, and click the **Start a New Instance** button.

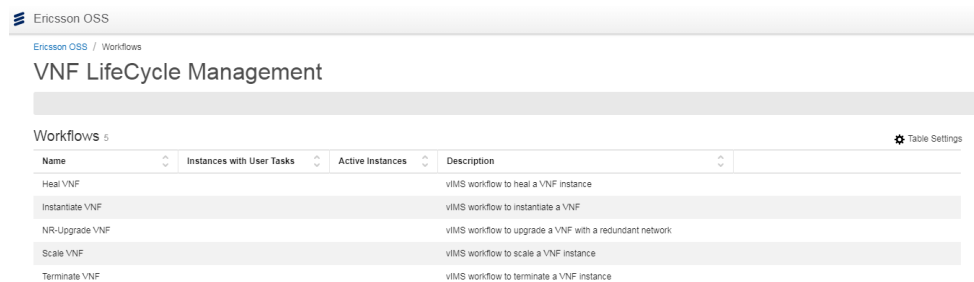


Figure 9 Select Workflow

2. On the **Start a Workflow** screen, fill out the **Instance Name** field, and click **Submit**.
3. Select the newly created workflow from the **Instance Activity** panel.
4. On the **Workflow Instance** screen, specify the following details and click **Submit**:
 - VNF instance to be removed
 - Scaling type
 - Number of VMs to be added or removed



Task

Collect user data for Scale

Scale VNF instance

Scale Data

Select VNF instance*

scaletest (a0493190-2ab... ▼

Select scaling type*

Scale In ▼

Number of VMs to scale*

1

Submit Reset

Figure 10 VNF Scaling Details

5. If **Scale In** was selected, specify the needed parameters, on the **Collect extra parameters** screen. Otherwise, the scaling procedure is completed.

Note: This step is optional, leave the fields blank if none of these parameters are needed.

Figure 11 Scale-in VNF Instance



Task

Collect extra parameters

Input additional parameters for workflow

Optional: List of VM UUIDs to scale-in

Scale-in type

GRACEFUL



Optional: Graceful scale-in timeout

-1

Submit

Reset

The following optional scale-in parameters are available:

- UUIDs of specific VMs to be scaled-in

Note: If the number of UUIDs specified is lower than the number of VMs given in the previous step, the workflow automatically scales-in the remaining VMs.

- VM locking method, that is, graceful or forceful
- If VMs are locked gracefully, a timer for graceful lock

4.3 Terminate VNF

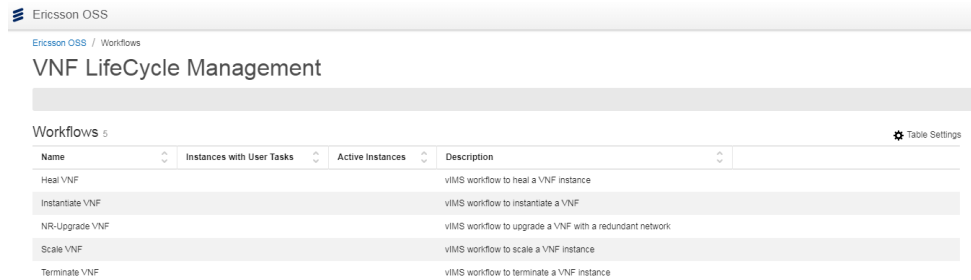
This section describes how to terminate a VNF using VNF-LCM.

Continue with this procedure only if the VNF to be terminated was instantiated using the VNF-LCM.



Steps

1. In the VNF-LCM **Workflows** screen select **Terminate VNF**, and click the **Start a New Instance** button.



Name	Instances with User Tasks	Active Instances	Description
Heal VNF			vIMS workflow to heal a VNF instance
Instantiate VNF			vIMS workflow to instantiate a VNF
NR-Upgrade VNF			vIMS workflow to upgrade a VNF with a redundant network
Scale VNF			vIMS workflow to scale a VNF instance
Terminate VNF			vIMS workflow to terminate a VNF instance

Figure 12 Select Workflow

2. On the **Start a Workflow** screen, fill out the **Instance Name** field, and click **Submit**.
3. Select the newly created workflow from the **Instance Activity** panel.
4. On the **Workflow Instance** screen, select the VNF to terminate, termination options, and click **Submit**.



Task

Collect user data for Terminate

Terminate VNF instance

Termination Data

Select VNF instance*

vMRF-12 ▼

Termination type:

Graceful

Graceful termination timeout (sec)

-1

Submit Reset

Figure 13 Terminate VNF

The following termination options are available:

- | | |
|-----------------|---|
| Graceful | The VMs in the cluster are gracefully locked, the VNF instance gradually stops processing traffic. The VNF is terminated after the expiration of the graceful termination period. |
| Forceful | The VNF is terminated immediately, all ongoing traffic is lost. This option must be confirmed on the next screen, as it stops all traffic. |

Graceful termination timeout (sec)

The graceful termination timeout value defines after how many seconds the VNF is terminated when graceful termination has been applied but there is still ongoing traffic. Default value: -1, meaning that there is no graceful termination period, that is, the VNF is terminated only after all VMs stopped processing traffic.

Results

The VMs in the cluster are terminated with the method selected in [Step 4](#), the VNF instance stops processing traffic, and is terminated.



Reference List

- [1] *System Administration Guide*, 1543-CNH 160 9180
- [2] *VNF-Lifecycle Manager System Administration Guide*, 1543-APR 901 0578