

VNF Life Cycle Management

Virtual Multimedia Resource Function

User Guide

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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:

- [Instantiate VNF](#) on page 7
- [Upgrade VNF](#) on page 12
- [Scale VNF](#) on page 16
- [Heal VNF](#) on page 19
- [Terminate VNF](#) on page 20

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 Heat Orchestration Template (HOT) 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 workflow bundle RPM is installed as described in the relevant network management system documentation. For more information, see *VNF-Lifecycle Manager System Administration Guide*, Reference [1].
- The following minimum version requirements are met:
 - Virtual Infrastructure Managers (VIMs):
 - CEE: R6 or newer
 - OpenStack: Mitaka or newer
 - vIMS workflows: 1.11.1
 - VNF-LCM: 18.07 or higher (minimum LAF image version: 4.3.13.)
- 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, see *VNF-Lifecycle Manager System Administration Guide*, Reference [2].
- 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
 - Flavor creation
 - Network topology creation
 - Subnet creation

For detailed instructions, refer to the relevant deployment instructions.



3 Prepare VNF Deployment Parameters

The VNF-LCM uses the parameters of the `env.yaml` file as input for VNF instantiation, therefore they must be defined to match your network environment.

The `mrf_config` parameter of the `env.yaml` file contains the VNF configuration either from a backup of an older VNF, or prepared by Ericsson, to be used for instantiation. This procedure describes how to prepare VNF deployment parameters with detailed instructions on providing the value for the `mrf_config` parameter.

Note: The `.yaml` files included in the `examples` folder of the software delivery package serve as examples for a possible network configuration. They can be modified to match your network environment.

Steps

1. Extract the `node_configuration/is.xml` file from the compressed configuration file.

Note: The compressed configuration file can either be a `.tar` or a `.zip` file.

2. Pack the `is.xml` file to the `mrsv-config.tar.gz` file using the following command:

```
./vmrs_config_update.py -c mrsv-config.tar.gz -sxf is.xml
```

Note: The `mrsv-config.tar.gz` file must exist before using this command; running `vmrs_config_update.py` does not create the `tar.gz` file. If there is no previous backup file available, use the example configuration file (`example_config.tar.gz`) from the software delivery package.

For more information on the example configuration file, see [Initial Configuration Guide](#).

3. Generate a Base64-encoded value of the VNF configuration for the `mrf_config` parameter using the following command:

```
base64 -w 0 <file_path_of_mrsv-config.tar.gz> >
<file_for_Base64_encoded_string>
```

4. Add the Base64-encoded string from the `<file_for_Base64_encoded_string>` file as a value of the `mrf_config` parameter in the `env.yaml` file.



5. Ensure that **all** deployment HOT file parameters specified in the `/vnflcm-ext/backups/workflows/vnfd/<VNFType__VNFVersion>/configurations/example_configuration_1/env.yaml` folder are assigned a correct value.
6. Add any missing deployment parameters and their default values to the `env.yaml` file.



4 Onboard the VNF Package on VNF-LCM

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, refer to the relevant [deployment instructions](#).

Steps

1. Create a `<VNFType__VNFVersion>` directory for the VNF-specific files in `/vnflcm-ext/backups/workflows/vnfd/` and copy the **release-specific** .zip file provided in the software delivery package into it.

Note: Grant read permission to the `<VNFType__VNFVersion>` directory for `jboss_user`, and execute permissions to its subdirectories.

The directory name in the examples follows the naming convention as above: VNF type and VNF version separated by "__". It is not mandatory to follow this naming convention.

```
mkdir /vnflcm-ext/backups/workflows/vnfd/<VNFType__VNFVersion>
```

```
cp <release-specific_zip_file_path> /vnflcm-ext/backups/workflows/vnfd/<VNFType__VNFVersion>/
```

2. In `/vnflcm-ext/backups/workflows/vnfd/<VNFType__VNFVersion>`, unzip the release-specific .zip file.

```
cd /vnflcm-ext/backups/workflows/vnfd/<VNFType__VNFVersion>/ && unzip <release-specific_zip_file_name>
```

Result: The directory `Resources` and the `vmrf.yaml` file are created in `/vnflcm-ext/backups/workflows/vnfd/<VNFType__VNFVersion>`.

3. Identify the value of the `vnfdId` using the following command:

```
grep vnfdId Resources/VnfdWrapperFiles/VNFD_Wrapper.json
```

```
"vnfdId": "<vnfdId_in_VNFD_Wrapper.json>"
```

4. Rename the directory created in [Step 1](#) to the value of the `vnfdId` using the following command:



```
mv /vnflcm-ext/backups/workflows/vnfd/<VNFType__VNFVersion> /
vnflcm-ext/backups/workflows/vnfd/
<vnfdId_from_grep_"vnfdId"_command_printout>
```

5. In /vnflcm-ext/backups/workflows/vnfd/
<vnfdId_from_grep_"vnfdId"_command_printout>, 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 shall contain a VNF-specific env.yaml environment file. Each env.yaml file can be used for a different VNF instantiation, depending on, for example, network needs.

6. Copy the lcmScripts directory and its content into the directory renamed in [Step 4](#).

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

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

Example

```
`-- <vnfdId>
  |-- vnflcmOperationsConfiguration.json
  |-- configurations
  |   |-- example_config_1
  |   |   |-- env.yaml
  |   |-- example_config_2
  |   |   |-- env.yaml
  |-- main.yaml
  |-- scaling_group.yaml
  |-- lcmScripts
```

7. 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.yaml file of each configuration stored.

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'
```



5 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.

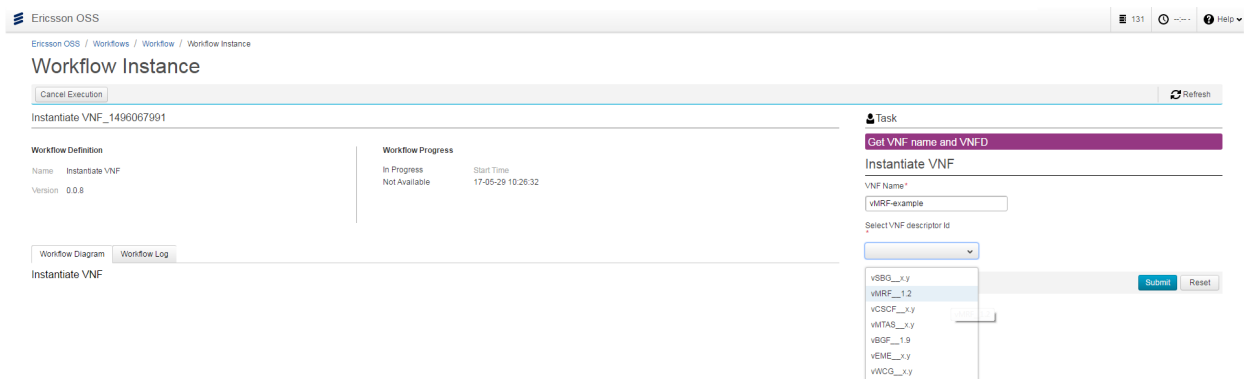


Figure 1 Workflow Instance Overview

5.1 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' interface in the Ericsson OSS. It features a table titled 'Workflows' with 5 rows. The table has columns for Name, Instances with User Tasks, Active Instances, and Description. The rows list various workflows: Heal VNF, Instantiate VNF, NR-Upgrade VNF, Scale VNF, and Terminate VNF, each with a brief description of its function.

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 **Workflow Instance** 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 Instantiate VNF



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**.

Figure 5 Select Tenant

7. 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/backups/workflows/vnfd/<VNFTYPE__VNFFVersion>/configurations` directory.

Figure 6 Get Instance Configuration

If the **Add Network Element in ENM/OSS-RC** check box was selected in [Step 4](#):

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

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*

mrsv-admin

VNF password*

Network element type in OSS/ENM*

vMRF

Network element version supported by OSS/ENM*

vMRF-1.5.0

Node IP address*

131.160.102.122

SNMP port used*

161

Netconf port used*

830

The Src type of network element*

CBA

The associated site.*

FINLAND

Submit

Reset

Figure 7 Get OSS or ENM Parameters

Results

The VNF is instantiated, it starts handling traffic after configuration data is provided. For more information on providing configuration data, refer to [Deployment Guide for OpenStack](#) or [Deployment Guide for Cloud Execution Environment \(CEE\)](#), and [Initial Configuration Guide](#).



5.2 Upgrade VNF

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

To perform this procedure without traffic stoppage, it is required that two VNFs are available in parallel during normal operation. During the upgrade process, configuration data is exported from the VNF selected to be upgraded. The VNF then is locked and removed. A new version of the VNF is deployed with configuration data of the previously removed VNF.

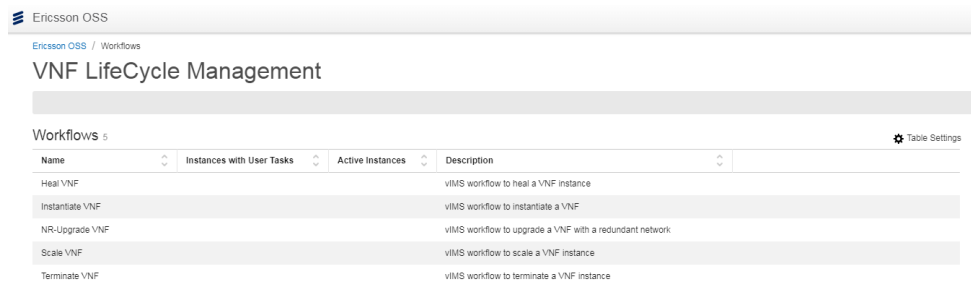
Prerequisites

- All parameters are transferred from the old VNF, except for `mrf_image`.
- The configuration file (`env.yaml`) of the new VNF contains the parameter `mrf_image` with the new image version ID from OpenStack.
- Parameters introduced in the new VNF version are set in the configuration file.

Note: Other parameters in the target configuration file are overwritten by the exported ones.

Steps

1. In the VNF-LCM **Workflows** screen, select **NR-Upgrade 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 8 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.



- On the **Workflow Instance** screen, select the VNF to upgrade, termination options, and set automatic rollback timer, and click **Submit**.

Task

Select VNF to upgrade

Upgrade VNF

Stacks

Select VNF to upgrade*

vMRF-12 ▼

VNF Termination type:

Graceful

Graceful termination timeout (sec)

-1

Automatic rollback after upgrade(min)

-1

Submit **Reset**

Figure 9 Select VNF to Upgrade

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.



5. On the **Set VNF and target VNF version** screen, add new VNF name, description, and version descriptor ID.

 Task

Set VNF and target VNF version

Upgrade VNF

New VNF name*

VNF instance description*

Select new VNF version descriptor ID*

Figure 10 Set VNF and Target VNF Version

6. On the **Select Target Instance Configuration Data** screen, select configuration data for the new VNF.

If the **Add Network Element in ENM/OSS-RC** check box was selected during VNF instantiation:

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

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.*

Submit

Reset

After this step, the old VNF is terminated according to the termination method chosen in [Step 4](#), and the new version is instantiated with the configuration data selected in [Step 6](#).

If the new VNF fails to instantiate, it is automatically terminated and the old VNF is recreated with the `_x` suffix in its stack name.

If the new VNF is instantiated successfully, the **Confirm upgrade** screen is displayed, and the automatic rollback timer set in [Step 4](#) is started.

8. Check that traffic processing in the new VNF version is working properly.
 - If the operation of the new version is considered acceptable, select **Confirm** and click **Submit**.
 - If there are problems with the new version that cannot be solved and that are considered unacceptable, select **Rollback** and click **Submit**. The rollback procedure terminates the VNF and recreates the old VNF with the `_r` suffix in its stack name.

Task

Confirm upgrade

Check the if the upgrade was successful. Rollback or finish?

Time left until automatical rollback (minute)

59

☐ Rollback

Submit

Reset

Figure 12 Confirm Upgrade or Rollback

Note: If neither option is chosen before the automatic rollback timer expires, the new VNF is removed and the old one is instantiated automatically.

Results

After the upgrade procedure is confirmed, the new version VNF continues accepting new incoming traffic.

5.3

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.



Ericsson OSS

Ericsson OSS / Workflows

VNF LifeCycle Management

Workflows 5 Table Settings

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 13 Select Workflow

- On the **Start a Workflow** screen, fill out the **Instance Name** field, and click **Submit**.
- Select the newly created workflow from the **Instance Activity** panel.
- 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 14 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 15 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



5.4 Heal VNF

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

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

Steps

1. In the VNF-LCM **Workflows** screen, select **Heal 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 16 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 be healed, and click **Submit**.

Task

Collect user data for Healing

Heal VNF instance

Healing Data

Select VNF instance*

vMRF-12

Submit

Reset

Figure 17 Heal VNF

- On the **Input additional parameters for workflow** screen, specify VMs to be removed from the cluster, and click **Submit**.

Task

Collect extra parameters

Input additional parameters for workflow

List of VM UUIDs to heal*

335705df-98ad-4b8f-b379-33dc5af679

Submit

Reset

Figure 18

Results

The VNF instance is scaled-in, the specified VMs are forcefully removed from the cluster. After this, the VNF instance is scaled-out, the same number of VMs is added to the cluster.

5.5 Terminate VNF

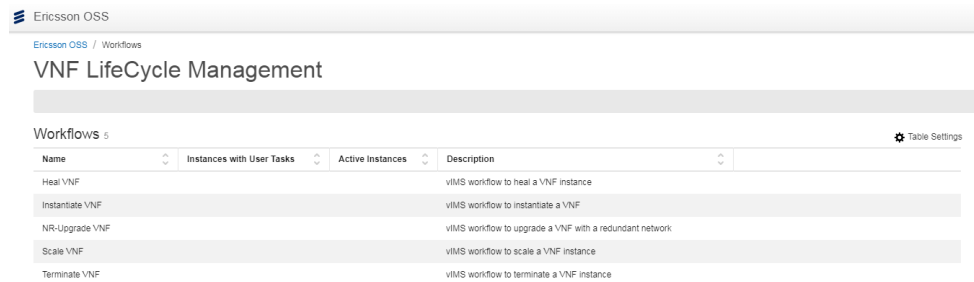
This section describes how to terminate a VNF using VNF-LCM.

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 19 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 20 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