Dell EMC OpenManage Network Manager Version 6.5

# Network Functions Virtualization (NFV)

operations guide



# Notes and Cautions

A NOTE indicates important information that helps you make better use of your computer.

**A CAUTION indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.**

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# Preface

Dorado Software, Inc. is a leading provider of integrated Resource Management, Performance Monitoring and Service Orchestration software used to monitor, provision, configure and manage IP network infrastructures, wireless IP, virtualized network functions and commercial services.

Dorado's cost-effective management solutions for multi-vendor, multi-technology environments deliver low TCO and rapid ROI to minimize risk while providing high value solutions for both service provider and enterprise IT customers.

Dorado Software's Service Provider Solutions let operators configure, deploy, and monitor their pool of physical and virtual network resources, in addition to dynamically provision and monitor commercial services (including NFV, MPLS, MPLS video, IPTV) and mobile backhaul. By combining resource and service management with real-time monitoring, users have complete service-oriented, end-to-end operational visibility, and control over their entire networked environment.

Dorado Software's Enterprise IT solutions help network, system and windows administrators rapidly deploy services and devices, streamline IT operations, and maximize network and device availability, performance and security. Dorado Software gives administrators the power to control heterogeneous and multi-technology environments resources and commercial services via a single solution, offering an economical and efficient alternative to the multiple disparate systems traditionally used to manage datacenters.

Dorado Software was founded in 1998 as a provider of application development environments for OEM element management systems (EMS). The company has leveraged this expertise and technology leadership to build a multi-vendor management system that has evolved into the suite of Redcell products. Dorado's open architecture enabled the company to construct integrated solutions for managing latest technologies and services. This tested platform has real world validation by the industry's most influential technology companies, and is now one of the markets most versatile and powerful OSS management solutions solving complex problems for today's connected world.

Dorado Software's extensive global customer base includes leaders in finance, manufacturing, telecommunications, and a variety of industries around the world. In addition, thousands of satisfied companies such as Dell computers utilize Dorado Software via OEM relationships.

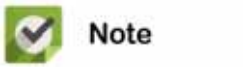
# Revision Record

The following log shows revision history for this guide. Refer to the *Redcell Release Notes* for a detailed list of features/enhancements.

| Date | Version | Description |
|---|---|---|
| Mar. 31, 2017 | 7.4.0 | Initial release. |
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| | | |

# Conventions Used

Redcell guides use the following conventions.

| Conventions | Description |
|---|---|
| *Italic* | Italic indicates document titles and variables, such as *filename*, in computer input and output. |
| **Bold** | Bold identifies important words. |
| `Courier` | Courier denotes computer input and output. |
| [abc] | Square brackets enclose optional syntax for computer input. |
| TAB | Small caps indicate actual keyboard keys, such as ENTER or SPACE. |
| File > Save | A right angel bracket separates menu options and user interface access paths. |
| Ctrl+X<br>Alt+Y | Ctrl+X means to press and hold the Ctrl key while you press the x key.<br>Alt+Y means to press and hold the Alt key while you press the y key. |
|  | A note gives readers special information about the product or procedure that is apart from the general discussion. |
|  | A caution denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a caution until you fully understand and meet the conditions. |

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# 1

# > Introduction

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As virtualized network functionality becomes central to a service provider's business model, key Network Functions Virtualization (NFV) capabilities need to be brought under management. With the Redcell NFV applications and the third-party OpenStack® operating system, service providers can quickly bring virtual network functions (VNFs) under full resource management.

## In This Guide

This guide covers the following topics related to the Redcell Virtualized Network Function (VNF) daily operations, such as stage, deploy, and undeploy:

- Introduction summarizes this document's content, describes the intended audience, shows where the Network Functions Virtualization (NFV) product fits into the Redcell suite, briefly describes the OpenStack services used, and lists prerequisites and other documents needed.
- Getting Started tells you how to sign in and sign out from the Redcell application and provides tasks to complete (such as adding pages and portlets) before you begin using the Redcell NFV features.
- Managing Virtualized Network Functions provides the instructions for instantiating a complex virtual network and a standalone VNF, monitoring network health, updating VNFs, and undeploying VNFs.
- NFV User Interface describes the NFV portlets, their usage, and their options.
- Glossary describes the terms used in this document and other related Redcell products.

## Intended Audience

This document is intended for operations technicians, system administrators, network administrators, or any one else using the Redcell and OpenStack infrastructure to perform daily operations, such as stage, deploy, and undeploy virtual network functions (VNFs).

# Overview

Service providers need to accelerate the deployment of new network services to support their revenue and growth objectives. The Redcell Network Functions Virtualization (NFV) feature and its ability to utilize the OpenStack operating system (Figure 1-1) to bring a Virtualized Network Function (VNF) under management gives service providers what they need to:

- Reduce hardware and support costs
- Minimize installation costs
- Optimize scaling and usage
- Enable innovation
- Simplify network services rollout and management
- Reduce risks associated with rolling out new services
- Improve return on investment of new services
- Support NFV packaging of virtual functions and infrastructure resource management

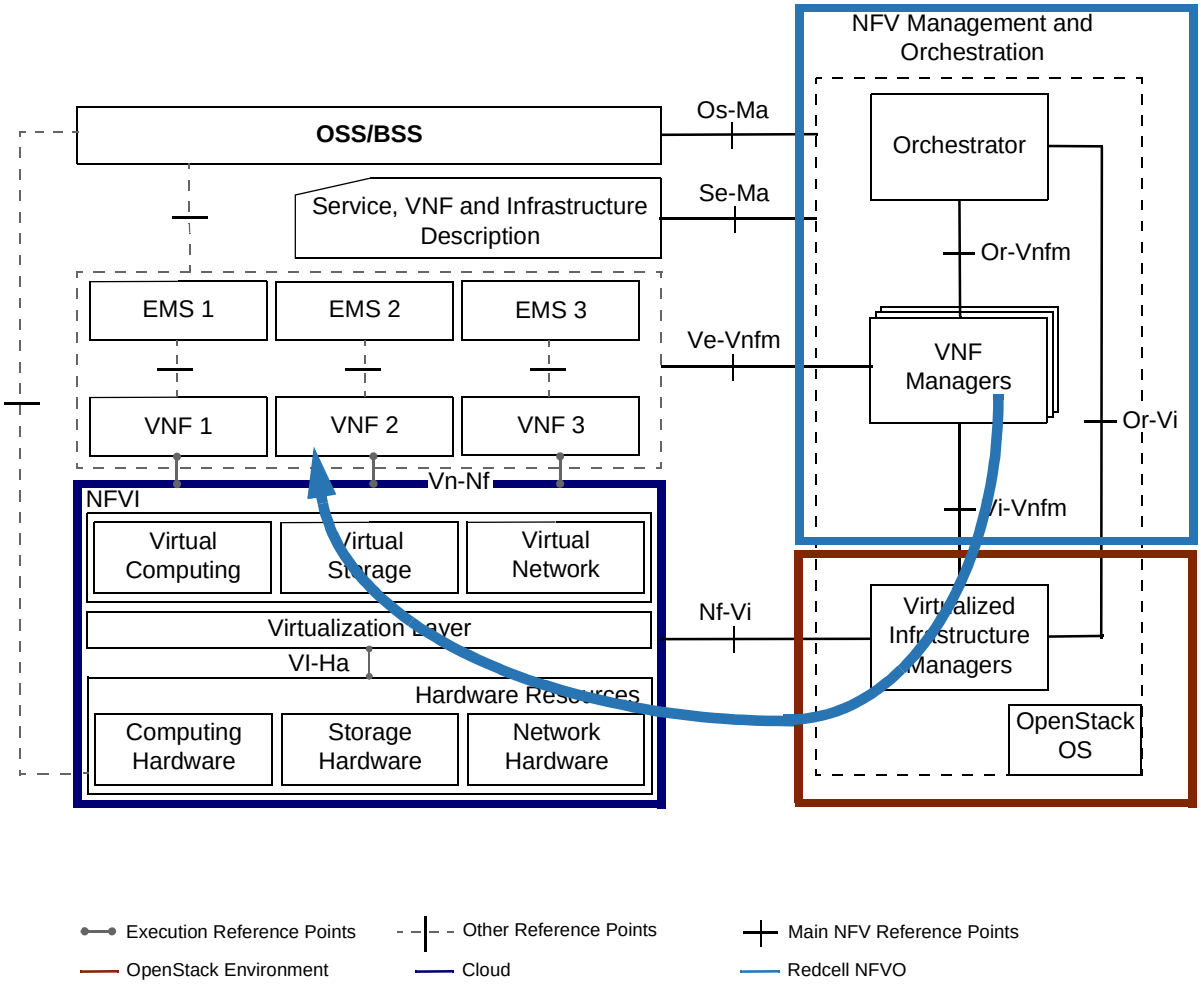



Figure 1-1 Redcell and OpenStack Interaction

The OpenStack operating system provides services used to manage (Figure 1-2):

- Instances' Lifecycle (run, reboot, suspend, resize and terminate instances)
- Compute Resources (CPU, memory, disk, and network interfaces)
- Local Area Networks (Flat, Flat DHCP, VLAN DHCP and IPv6) through programmatically allocated IPs and VLANs
- Who has access to compute resources and prevent users from impacting each other with excessive API utilization
- Virtual Machine (VM) Images (store, import, share, and query images)
- Floating IP Addresses (assign and re-assign IP addresses to VMs)
- Projects and Quotas (allocate, track and limit resource utilization)

The following example shows the services interaction in an OpenStack environment.

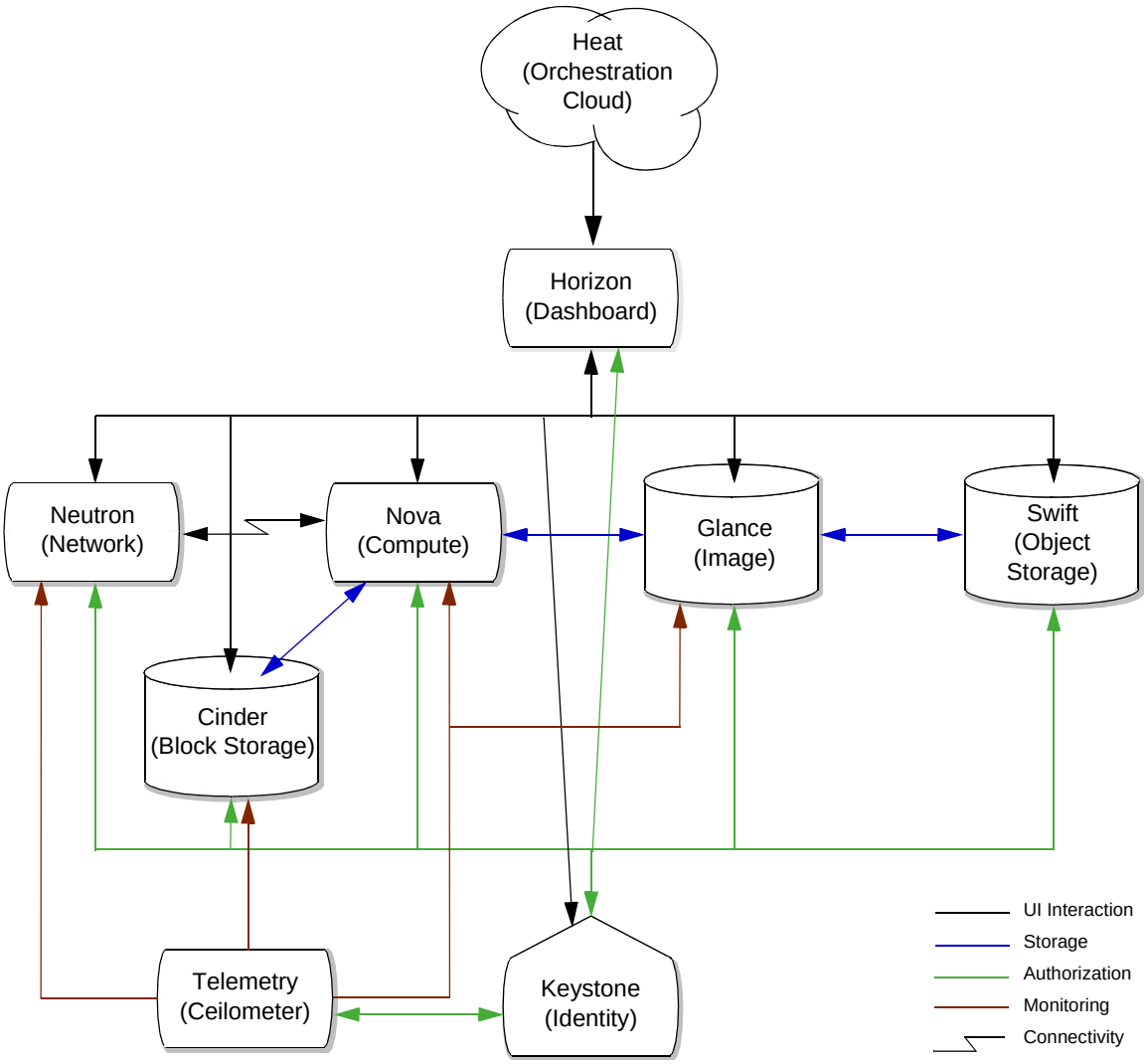



Figure 1-2 OpenStack Services (example)

The following list (Table 1-1) provides a brief description of each OpenStack service and the Heat Orchestration program provided in the previous example. The identity, compute, and image services are standard dashboard components. The other components are optional.

Details of the OpenStack system is out of scope for this document. Refer to the OpenStack documentation for more details on these services and other OpenStack services, programs, and so on.

Table 1-1 OpenStack Services

| Service Name | Service Type | Description |
|---|---|---|
| Heat | Orchestration | Implements an orchestration engine to launch multiple composite cloud applications based on templates in the form of text files that are treated like code. |
| Horizon | Dashboard | Provides the Web-based user interface used to manage OpenStack services (network, compute, image, block and object storage, and identity). |
| Neutron | Network | Provides network connectivity between interface devices managed by other OpenStack services, such as Compute. |
| Nova | Compute | Provides the ability to manage your computing resources, such as CPU, memory, disk, and network interfaces.<br>This allows you to easily migrate workloads and run them at scale with predictable, consistent performance, control, and visibility. |
| Glance | Image | Stores images from the compute service. |
| Swift | Object Storage | Provides cloud-storage software so that you can store and retrieve data with an API (application programming interface).<br>Ideal for storing unstructured data that grows without bounds, such as image files. |
| Cinder | Block Storage | Provides the ability to virtualize block storage device management and provide a self-service API for end-users to request and consume resources without knowing where their storage is actually deployed or on what type of device.<br>In our example, it stores volumes for the compute service. |
| Telemetry | Ceilometer | Monitors, collects, normalizes, and transforms data produced by OpenStack services (network, compute, image, and block storage).<br>Use this data to create different views to help solve telemetry issues. |
| Keystone | Identity | Provides authentication (authN) and high-level authorization (authZ) for the dashboard, network, compute, image, block storage, and object storage services. |

## Prerequisites

Before the operations technician can perform the tasks in this guide using the Network Functions Virtualization (NFV) product, make sure that the following software is installed and operational:

- Redcell 7.4.x application with the NFV feature

  Start the Redcell application and then select Manage > Show Version to verify your version. See Signing In/Out on page 16 if you need instructions.

  Select Add > Applications and then verify that Network Virtualization applications are listed. For a list of NFV applications, see Setting Up Redcell Application on page 17.

- OpenStack operating system, Liberty version

  The OpenStack environment is set up and defined by your system administrator. If you need access to this system, contact your system administrator.

- One of these Web browsers at the listed version or above: Chrome V45, Firefox V40, Internet Explorer V11, or Safari V8



**Note**

*This document assumes that your system administrator and network designer already defined your network environment and images, descriptors, and deployment flavors used to stage, deploy, and undeploy network services and virtualized network functions (VNFs).*

## Related Documents

This section lists the Redcell and third-party documents that contain additional information related to the virtual network functionality management tasks described in this guide.

**Redcell Guides.** The following Redcell guides may provide additional information related to the tasks provided in this guide:

- *Redcell User Guide*

**Third-Party Guides.** You might need to consult the following third-party documentation to perform the tasks described in this guide:

- OpenStack documentation

# 2

# > Getting Started

Covers these topics:

Signing In/Out – 16
Setting Up Redcell Application – 17
Testing Your Redcell Setup – 21

Before you get started managing virtualized network functions (VNFs) from the Redcell application, you should know how to start the Redcell application, set up your environment, and test your setup.

# Signing In/Out

To get started using the Redcell Network Functions Virtualization (NFV) features, you need to know how to sign in to the Redcell application and sign out when finished.

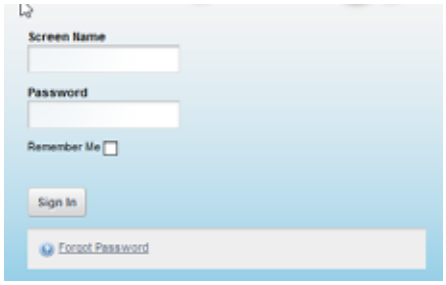
Sign in to your Redcell NFV installation from a Web browser as follows and then log off when finished.

1. Enter the Redcell URL.

   `http://appServerHost:portNumber`

   Replace *appServerHost* with your Redcell NFV server host name or IP address. The default *portNumber* is 8080.

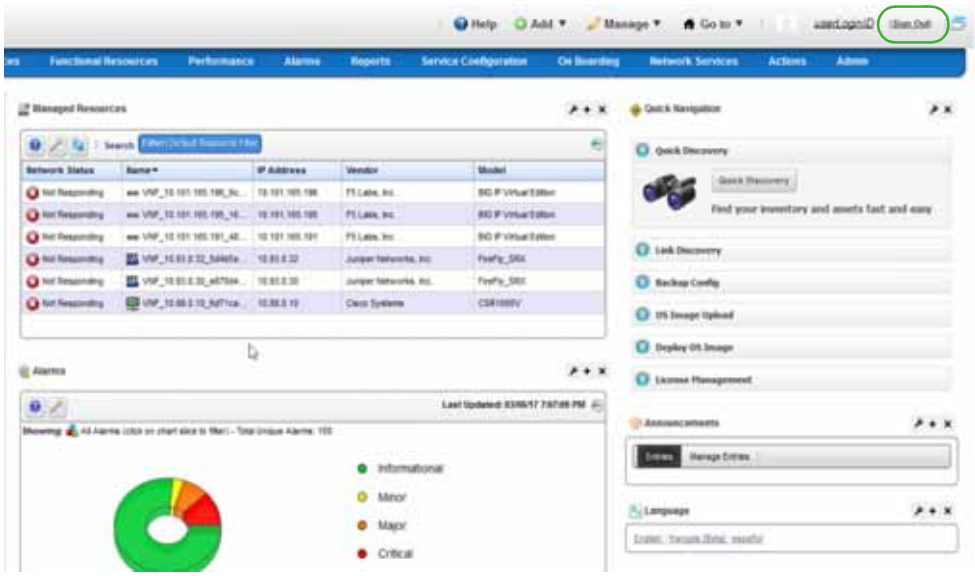
   The sign in request is displayed.




2. Enter your screen name (user name) and password.
3. Click Sign In.

   The Redcell NFV Home page is displayed.

   If you entered an incorrect user name or password, a message is displayed. Enter the information again.



4. Click Sign Out when finished with the application.

   You are returned to the sign in request page.

# Setting Up Redcell Application

Before you perform the tasks described in this guide, make sure that the NFV-specific portlets you need are added to the existing Redcell portal.

Which portlets you need, depends on your role (Table 2-1) in the management of your virtualized network environment and the deployment of network services and virtualized network functions (VNFs).

Table 2-1 User Roles and Tasks

| Role | Tasks |
|---|---|
| Administrator | Bringing VIM under management (creating the controller record)<br>Setting up the OpenStack environment (uploading vendor base images to the OpenStack controller, modifying resource flavors, creating VIM snapshots)<br>Preparing vendor-supplied images from Redcell (creating and editing VIM images)<br>Maintaining the VIMs under management, descriptors, virtual reservations, and virtual requirements |
| Network Designer/ Engineer | Defining descriptors<br>Implementing virtual reservations<br>Monitoring virtual requirements |
| Operator | Instantiating VNFs (stage, deploy)<br>Monitoring virtual requirements<br>Performing other daily operations, such as undeploying, scaling, monitoring system health, resolving issues found, *etc.* |

Depending on your permissions and how your company wants to define the work environment for all users, you have the option to add the Network Virtualization applications (portlets) to existing Redcell pages or create pages and add portlets more appropriately for each users work environment. Once the pages/portlets setup is complete, verify this setup.

Here is a list of NFV portlets (Table 2-2) and how each portlet is used by the different user roles. For a detailed description of these portlets, see NFV User Interface on page 59. If any of these portlets are **not** available, a message is displayed when you try to add it to a page.

Table 2-2 NFV Portlets (Sheet 1 of 2)

| Portlet | Operator | Administrator | Network Designer |
|---|---|---|---|
| Network Service Descriptors | View and understand NSDs | Maintain network service descriptors | Define monitoring attribute characteristics |
| Network Service Records | Stage, deploy, and undeploy (manage) network services | No activity performed by the administrator | Test an implemented network service |
| Physical Network Function Descriptors | View and understand PNFDs | Maintain PNF descriptors | Implement physical network functionality |
| Physical Network Function Records | Stage, deploy, and undeploy (manage) PNFs | Test new or modified descriptors | Test implemented PNFs |

Table 2-2 NFV Portlets (Sheet 2 of 2)

| Portlet | Operator | Administrator | Network Designer |
|---|---|---|---|
| Software Images | View and understand software images | Create a software image descriptor for a snapshot image, deploy software images, and edit the VIM software descriptor parameters | Create a software image descriptor for a snapshot image, deploy software images, and edit the VIM software descriptor parameters |
| VIM Images | View and understand VIM images | Maintain consistency across the VIM instances | Test that software images deployed/undeployed were added/removed from the VIM images list |
| Virtual Network Function Descriptors | View and understand VNFDs | Maintain VNF descriptors | Implement virtualized network functions |
| Virtual Network Function Records | Stage, deploy, and undeploy (manage) VNFs | No activity performed by the administrator | Test an implemented network service |
| Virtual Requirements | View virtual domain resource requirements and usage (such as memory, CPU, and disk). You also have the option to modify a domain's description. | | |
| Virtual Reservations | Verify that a VDU's resources were reserved after they stage a VNF record | Maintain virtual reservations | Implement virtual reservations |
| Virtualized Infrastructure Managers | View available VIMs and their resources before deploying services or VNFs | Maintain the VIMs under resource management | No activity performed by the network designer |

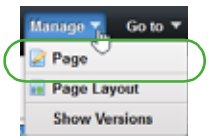
## Adding a Page

Pages allow you to organize commonly used portlets into a single location for easy access or to group portlets by tasks you perform. For example, group tasks used to monitor and resolve network health on a single page. You have the option to add NFV pages to the menu bar, add child pages to existing pages, or a combination of both.

Add any needed pages to the Redcell application as follows.

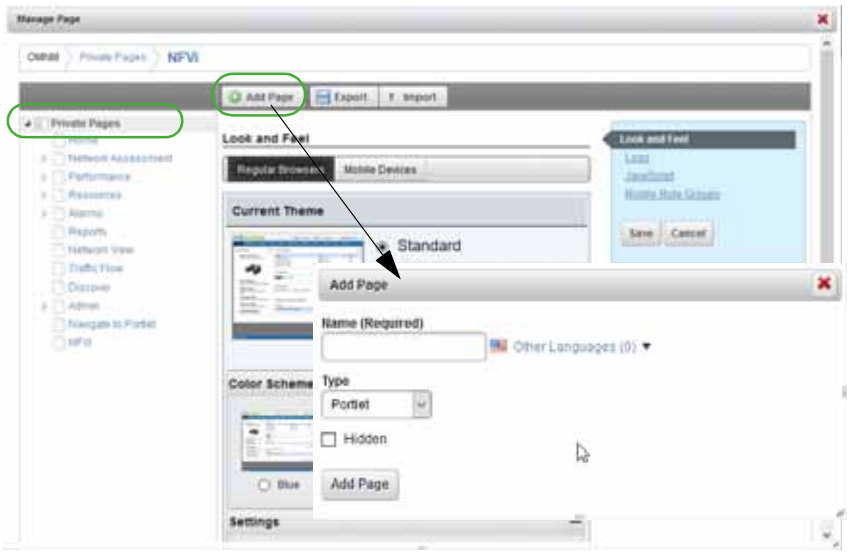
1. Select Manage > Page.

   The Manage Page window is displayed.

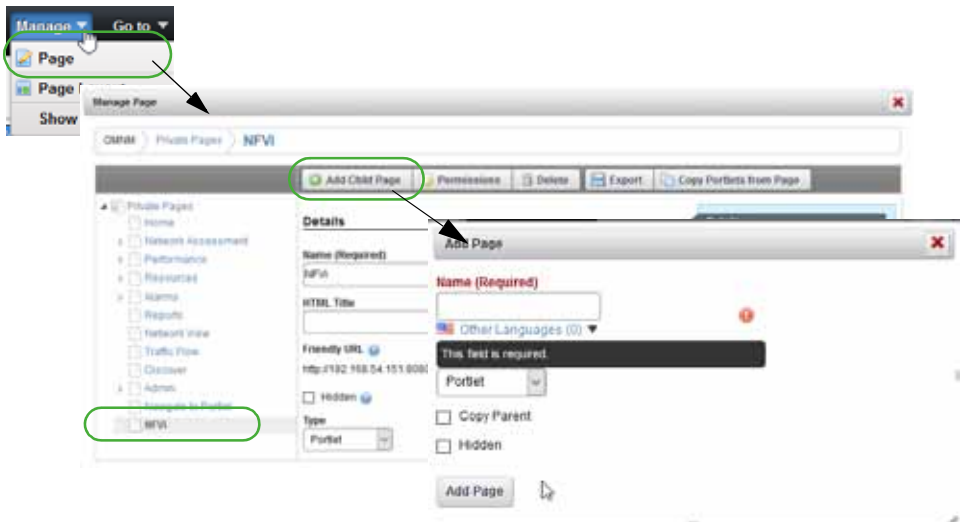



2. Add pages you want to access from the navigation panel.
   a. Select Private Pages.
   b. Specify the look and feel.
   c. Click Add Page.

      The Add Page window is displayed.
   d. Enter a name for the page.
   e. Select a type.
   f. Click Add Page.




3. Repeat steps 1 and 2 for each page you add to the navigation panel.
4. Add a child page to an existing page.
   a. Select Manage > Page.
      The Manage Page window is displayed.
   b. Select the page under which to add the child page.
   c. Click Add Child Page.
      The Add Child Page window is displayed.
   d. Enter a name for the child page.
   e. Select the type.
   f. Select whether to copy the parent or make the page hidden.
   g. Click Add Page.
   h. Repeat these steps for each child page you want to add.




Now you are ready to add portlets (applications) to the appropriate pages.

## Adding Portlets to a Page

These instructions assume that the pages to which you plan to add portlets already exist. If the pages do not exist, see Adding a Page before continuing.

Add portlets to a page from the Redcell application as follows.

1. Click the page label to which you want to add a portlet.

   The selected page is displayed.

2. Select Add > Applications.

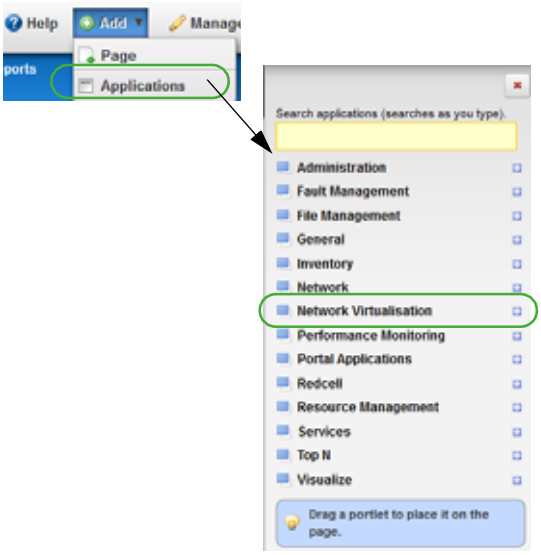
   The applications list is displayed.

3. Expand the Network Virtualization list.

   See Setting Up Redcell Application on page 17 for a brief description of each portlet, or NFV User Interface on page 59 more details.

4. Click Add for each portlet you want to add to the selected page.

   Note that the purple indicator means that you can add the portlet only once to a page. All other portlets you can add multiple instances to a page.




5. Refresh the page to show the portlet.

   If you do not have permissions to view the portlet, a message is displayed. Delete the portlet or consult your system administrator if you feel you should have access to the portlet.

6. Repeat steps 4 and 5 for each portlet you want to add to the selected page.
7. Rearrange the portlets as needed using the drag-and-drop method.
8. Repeat steps 1 through 7 for each page to which you want to add portlets.

# Testing Your Redcell Setup

It does not matter if you set up your Redcell Network Functional Virtualized (NFV) work environment (pages/portlets) or if it was defined by your system administrator, you should run **some** tests to make sure you have what you need and you can perform some basic tasks on a record, such as discover, stage, deploy, modify, undeploy, and delete. This test example uses an NFV record and assumes that you have access to the Redcell application and your OpenStack project.

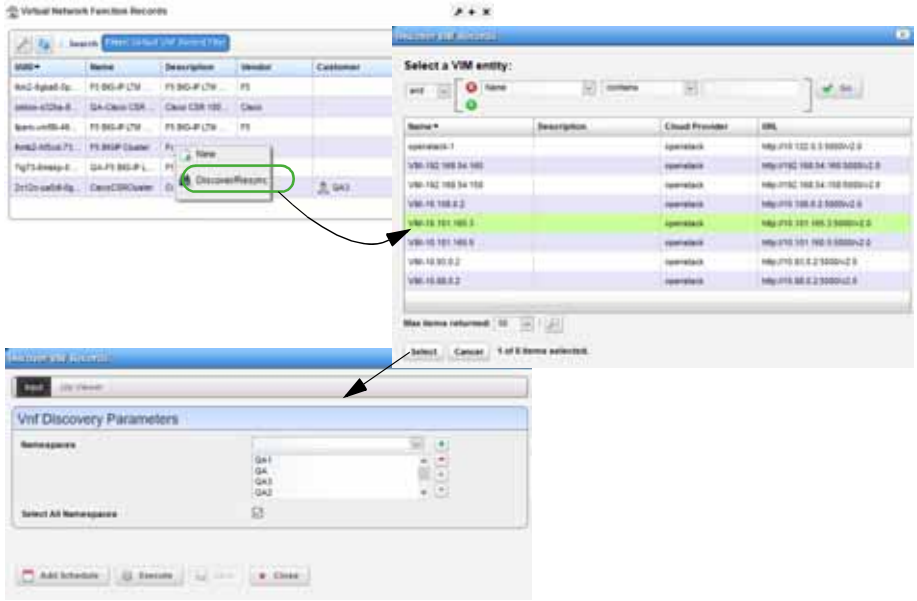
Test your NFV setup from the Redcell application as follows.

1. Sign out and then sign back in if you are already logged in.
2. Verify that your pages are accessible from the menu bar.
3. Make any necessary changes.
4. Navigate to the Virtual Network Function Records portlet.

   This is where you will complete steps 5 through 10.
5. Verify that you can **discover** VNF records.
   a. Right-click > Discover/Resync.

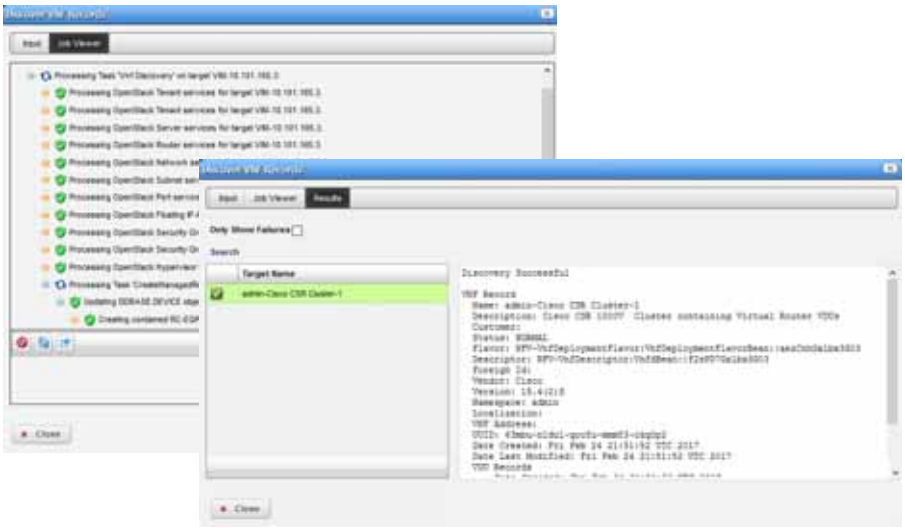
      The Discover VNF Records window is displayed.
   b. Select a VIM entity.

      The VNF Discovery parameters are displayed.
   c. Specify namespaces.




   d. Click Execute.

      The Job Viewer displays the execution progress, any errors, and success/failure, followed by the Results information.



e. Close the Discover VNF Records window.

The discovery/resync process makes sure that you have any changes from the target VIM (Virtualized Infrastructure Manager).

6. Verify that you can **stage** a record.

a. Select a record.

a. Right-click > New.

The Stage VNF window displays a list of descriptor entities.

b. Select the service you want to instantiate.

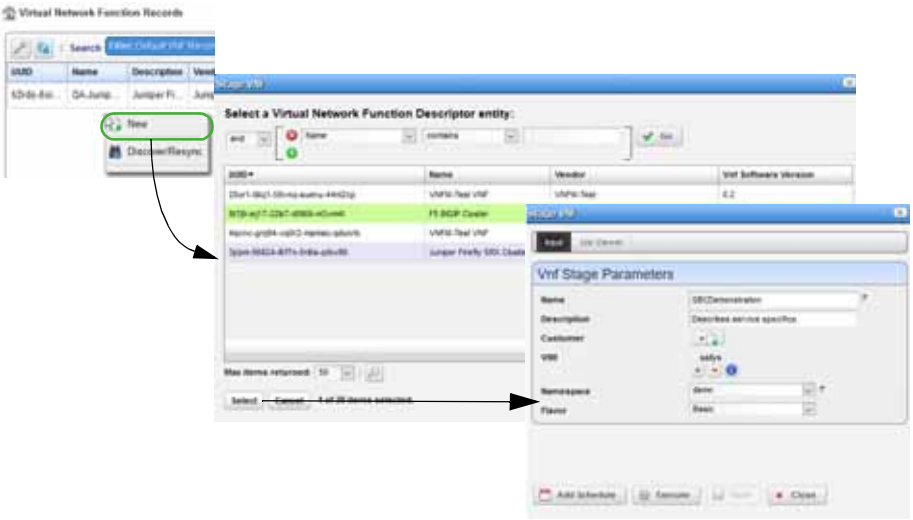
c. Click Select.

The Vnf Stage Parameters window is displayed.

d. Enter a name for the VNF and a description that includes specifics on the services.

e. Specify the parameters, such as the VIM on which to deploy.

The Name, VIM, Namespace, and Flavor fields are required.



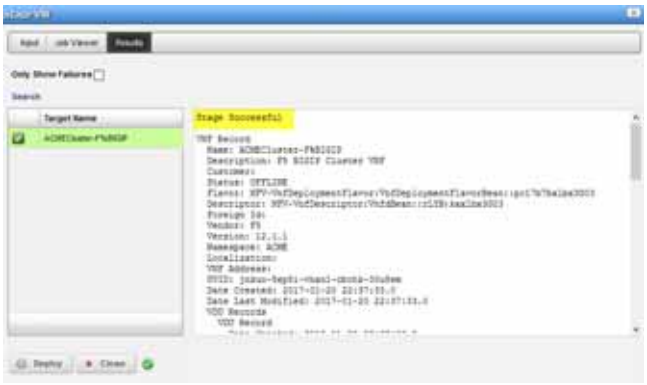

f. Click Execute.

The Job Viewer displays the execution progress, any errors, and success/failure. Upon completion, the stage results are displayed.

If staging is successful, the record is created and staged based on the descriptor information found and then resources are reserved. However, nothing is deployed to the OpenStack controller.

If staging fails, the reason for the failure is displayed.

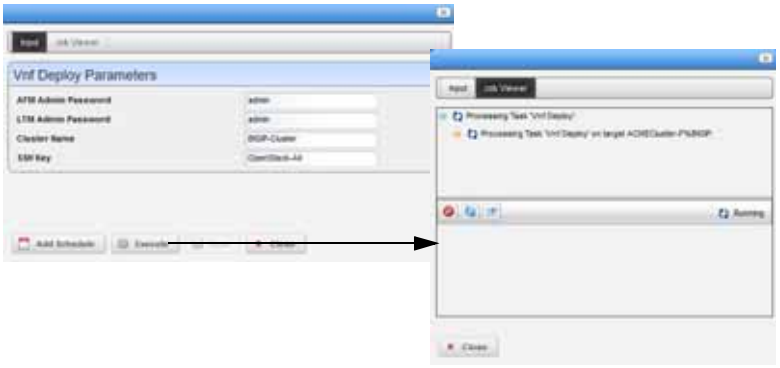
g. Close the Stage VNF window.



7. Verify that you can **deploy** the record successfully staged in step 6.
   a. Click Deploy.

      The default VNF deploy parameter values are displayed.
   b. Change the default parameters as needed.
   c. Click Execute.

      The Job Viewer displays the steps taken and the results.



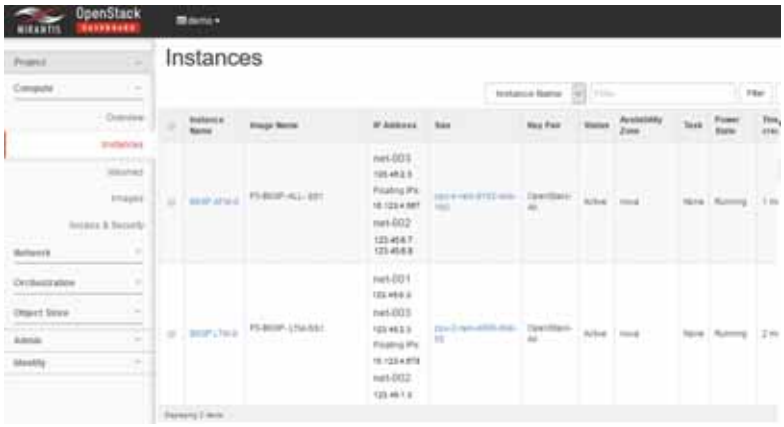

   d. Close the Job Viewer.
   e. Verify that the record status changed to Normal.



f. Go to your OpenStack dashboard for your project.

g. Click Instances.

A list of instances and their information is displayed.




h. Verify that the resource record is listed.

This indicates connectivity to your target VIM.

i. Return to the Redcell application.

8. Verify that you can **modify** the record staged in step 6.

a. Select a record.

b. Right-click > Edit.

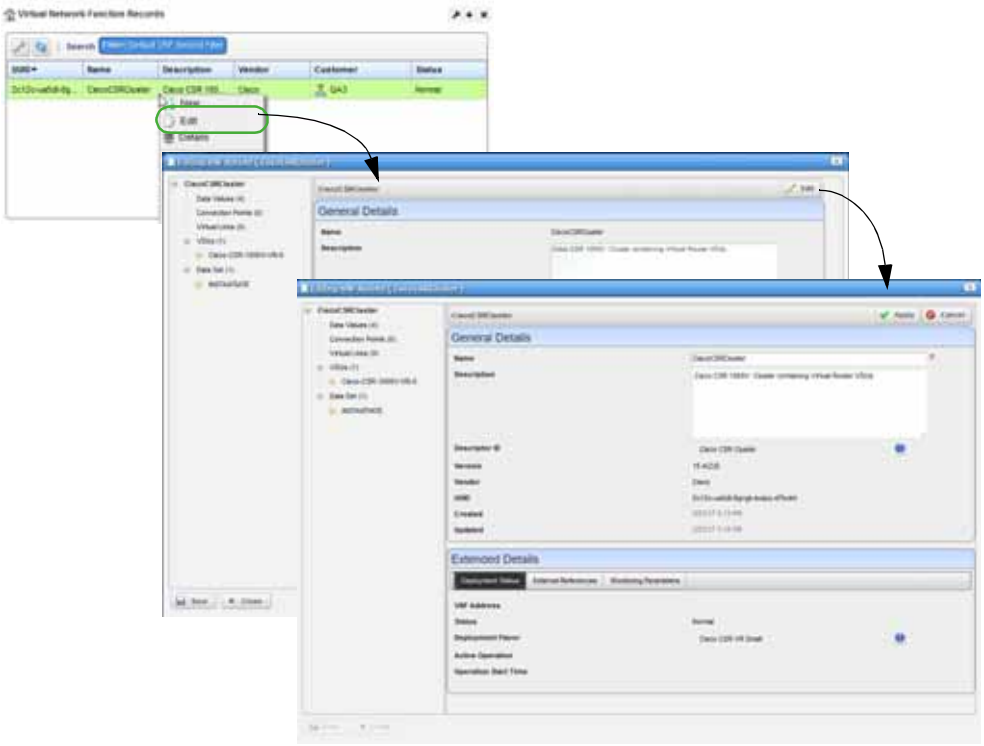
The Editing VNF Record window is displayed.

c. Click Edit.

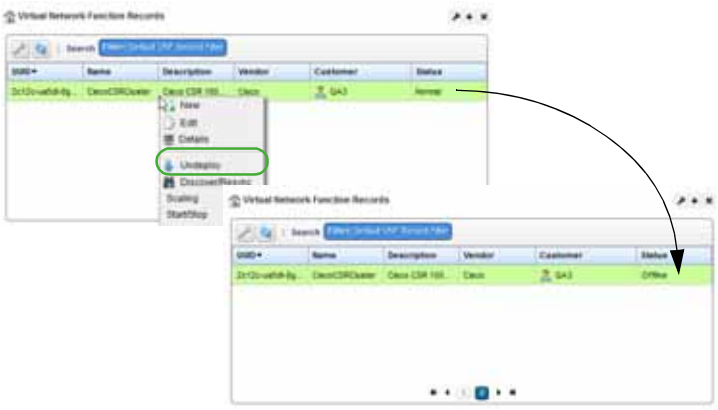
d. Modify the name or description.

e. Click Apply.

f. Click Save.



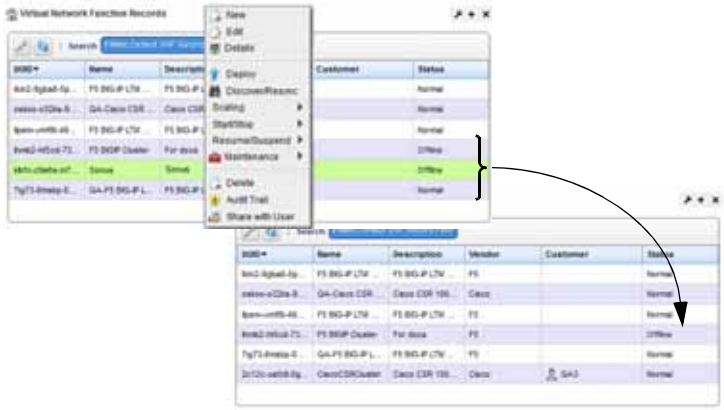

9. Verify that you can **undeploy** the record deployed in step 7.
   a. Select a record.
   b. Right-click > Undeploy.
      A confirmation message is displayed.
   c. Click Undeploy.
      The Job Viewer displays the steps taken and the results.
   d. Click Close.
   e. Verify the record's status is now Offline.



10. Verify that you can **delete** a record.
    a. Select a record.
    b. Right-click > Edit.

       A confirmation message is displayed.
    c. Click Delete.

       The Job Viewer displays the steps taken and the results.
    d. Close the Job Viewer.
    e. Verify that the record is no longer listed in the Virtual Network Function Records portlet.



# 3

# > Managing Virtualized Network Functions

Covers these topics:

Instantiating a Complex Virtual Network – 28
Instantiating a Standalone VNF Record – 42
Monitoring Network Health – 47
Updating Virtual Network Functions – 56
Undeploying Virtual Network Functions – 58

From the Redcell application, you can manage virtualized network functions (VNFs) by staging and deploying VNF resources (instantiating) and then managing those resources by monitoring network health, updating VNFs, and adding or removing VNFs as needed to resolve issues or expansion.

See NFV User Interface on page 59 for a detailed description of each portlet and the different actions that you can perform.

# Instantiating a Complex Virtual Network

This section illustrates how to instantiate a complex Virtualized Network Function (VNF) record. The example environment has a Session Boarder Controller, a client Session Initiation Protocol (SIP) server, and a DNS with internal networks that connects the virtual networks.

Instantiate a virtual network by:

- Reviewing a System's Current State
- Reviewing a VNF Descriptor
- Staging a Complex VNF Record
- Verifying Reserved Resources
- Deploying a Complex VNF Record
- Viewing Alarms and Notifications
- Verifying a Complex VNF Instantiation
- Reviewing the VNF Record Status

## Reviewing a System's Current State

The Virtualized Infrastructure Managers (VIMs) portlet lists the OpenStack controllers and VIM instances. Before you instantiate a Virtualized Network Function (VNF), it is good to know the system's current state and the OpenStack controllers and VIM instances available to which you can deploy services.

The Redcell application provides many management tools from which to access the network health and configuration, such as:

- Topology
- Resource Management
- Performance Monitoring
- Infrastructure Capacity

Review the system's current state from the Redcell Virtualized Infrastructure Managers portlet as follows.

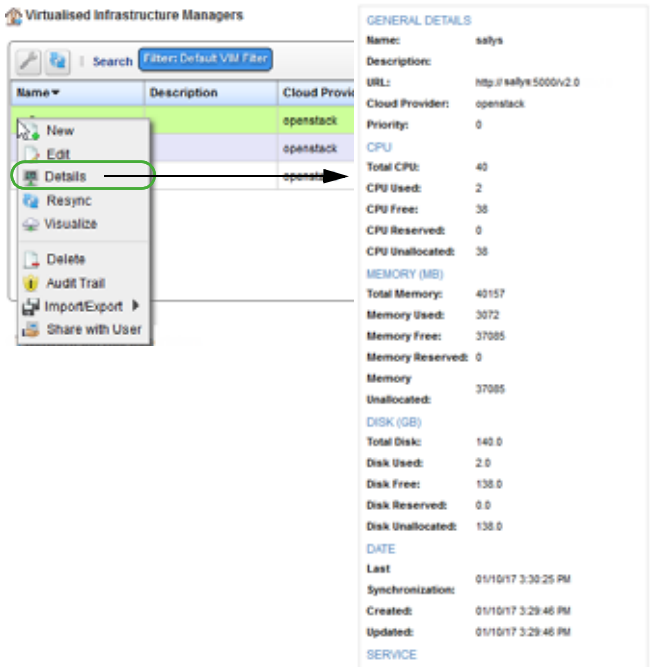


**Note**

*The Virtualized Infrastructure Managers portlet location is dependant on your company's Redcell NFV installation and configuration.*

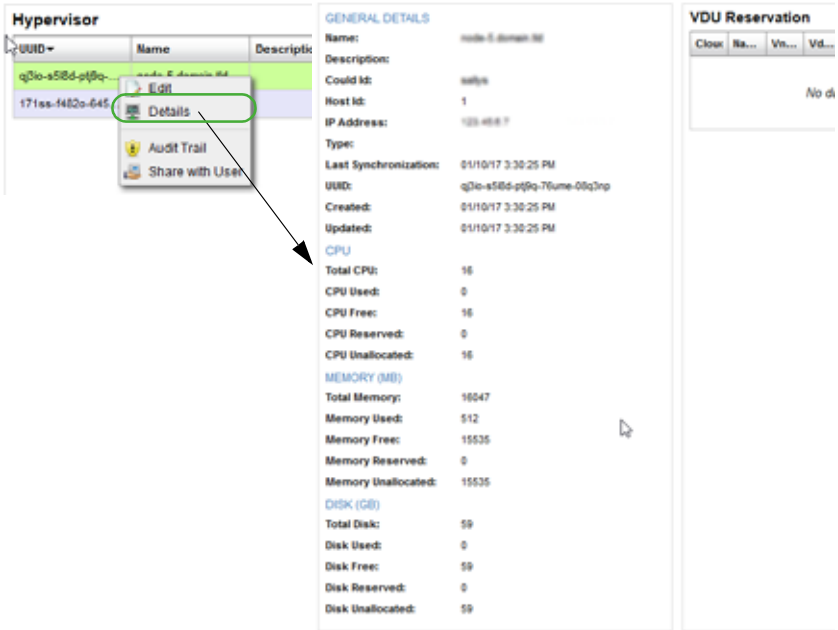
1. Select a VIM or OpenStack controller.
2. Right-click > Details.

   The selected instance's details display CPU, memory, and disk capacity, service and health status, and lists any constraints and hypervisor records.




3. Select a hypervisor server.
4. Right-click > Details.

   The selected hypervisor details are displayed, such as CPU, memory, and disk capacity and any related VDU reservations.



5. Go to the OpenStack dashboard to view information about the server to which you are going to deploy, such as the network topology, networks, instances, and so on.
6. Return to the Redcell application.

Next review the VNF descriptor you plan to deploy to gain an understanding of its fuctionality.

## Reviewing a VNF Descriptor

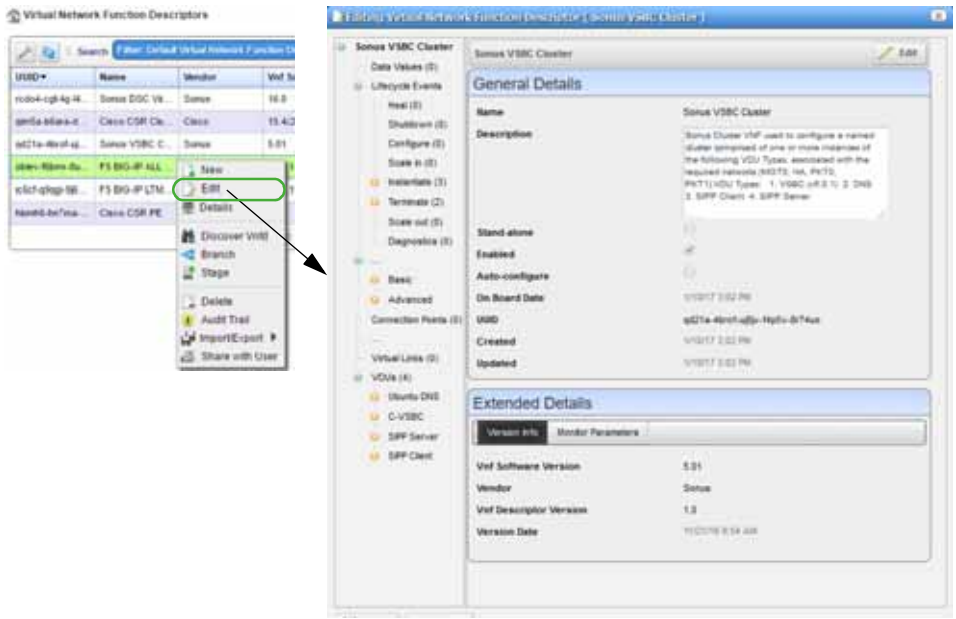
The Redcell Virtual Network Function Descriptors portlet provides a list of the Virtualized Network Function (VNF) descriptors available. Before using a descriptor to deploy a VNF, review the descriptor to gain a better understanding of its functionality.

Review a VNF descriptor from the Virtual Network Function Descriptors portlet as follows.

1. Select a VNF descriptor.
2. Right-click > Edit.

   The Editing Virtual Network Function Descriptor window is displayed.
3. Review the descriptor details, such as VDU components used to connect internal networks to the VNF, lifecycle events (terminate/instantiate), deployment flavors (models), and so on. It needs to be complete and at a deployable state.

   Note that when instantiating a complex VNF, the stand-alone option is **not** selected.
4. Click Close when finished.




Now you are ready to stage a VNF record.

## Staging a Complex VNF Record

The staging process creates and stages a VNF record based on the selected descriptors information found and then reserves resources. The staging process only reserves resources, it does not deploy the VNF record to the OpenStack controller.

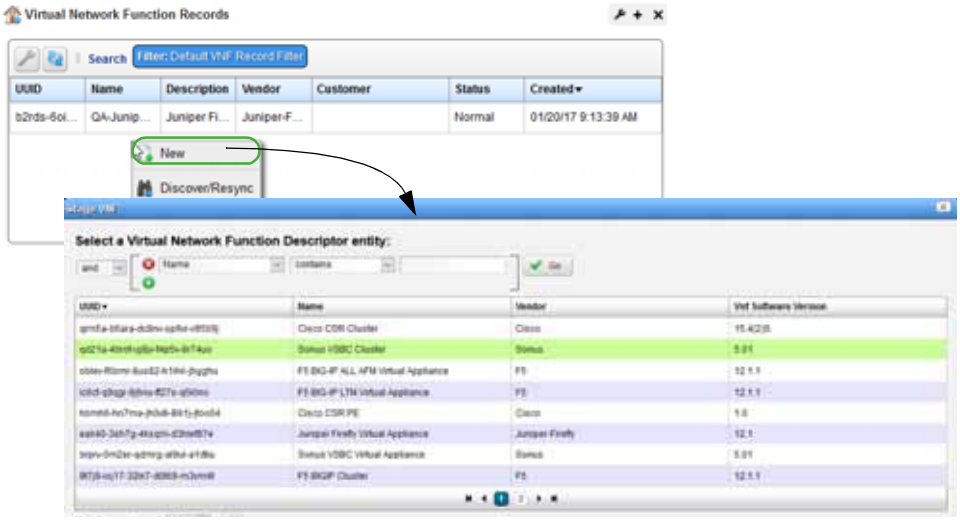
Stage a complex VNF record from the Virtual Network Function Records portlet as follows.

**Note**

*The portlet's location depends on your company's configuration.*

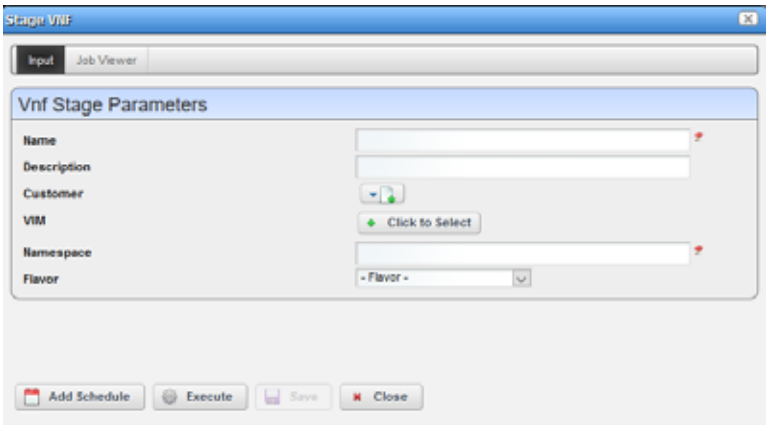
1. Right-click > New.

   The Stage VNF window displays a list of descriptor entities.




2. Select the service to instantiate.
3. Click Select.

   The Vnf Stage Parameters window is displayed.

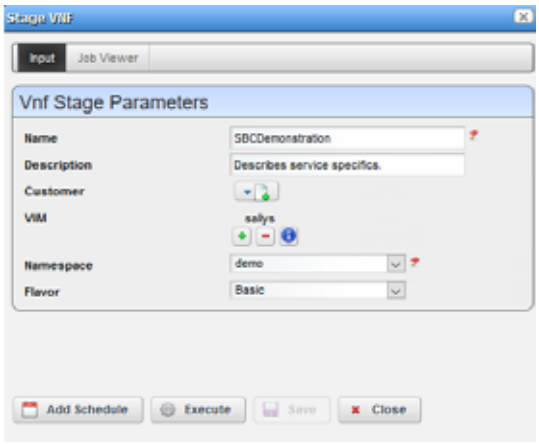



4. Enter a name for the VNF and a description that includes specifics on the services.

5. Specify the parameters, such as the VIM (Virtualized Infrastructure Manager) on which to deploy.

**Note**

*If you do not specify the VIM, the system determines the appropriate VIM. The Name, VIM, Namespace, and Flavor fields are required.*




6. Click Execute.

   Upon completion, the stage results are displayed.

   If staging is successful, the record is created and staged based on the descriptor information found and resources are reserved. However, nothing is deployed to the OpenStack controller.

   If staging fails, the reason for the failure is displayed.



7. Click Deploy once the staging operation successfully completes.

   Otherwise, optionally verify that the resources were reserved and then deploy the VNF record.

## Verifying Reserved Resources

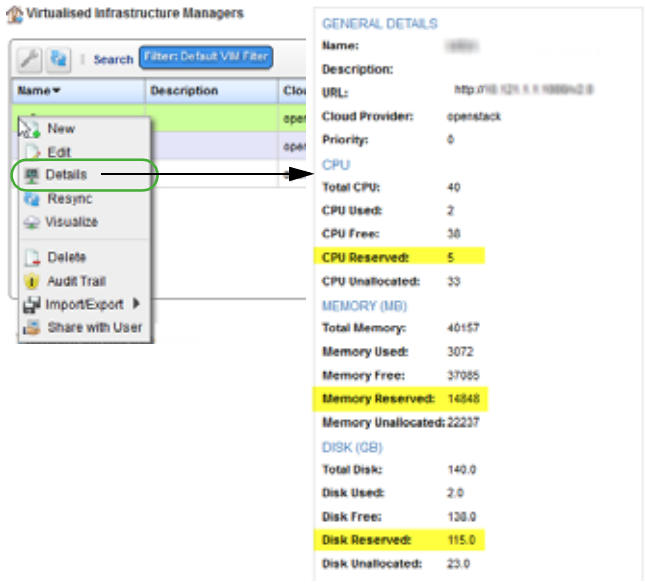
Verify that the resources were reserved from the Virtualized Infrastructure Managers portlet as follows. You can also view the capacity details.

**Note**

*The portlet's location depends on your company's configuration.*

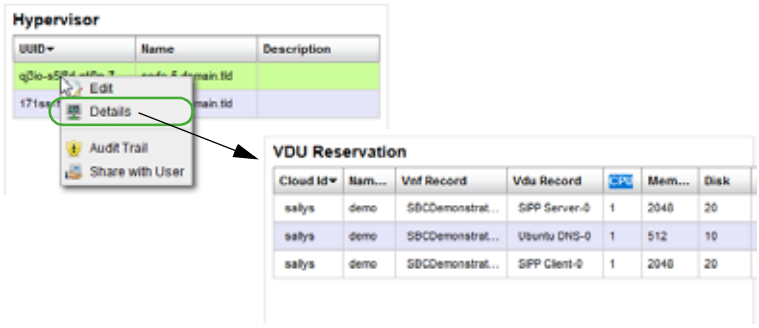
1. Select a VIM.
2. Right-click > Details.

   The Details are displayed. Notice the reserved CPU, memory, and disk values.



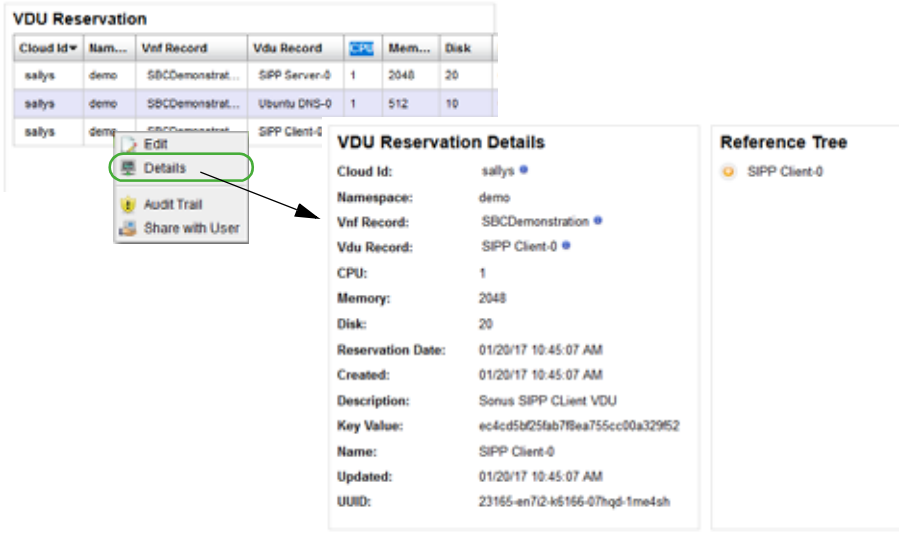

3. Go to the Hypervisor list.
4. Select a hypervisor.
5. Right-click > Details.

   The VDU Reservation details show the reservations for the virtual networks to instantiate.



6. Select a VDU.
7. Right-click > Details.

   The VDU Reservation details are displayed.




Once you optionally verified the reserved resources, deploy the VNF record.

## Deploying a Complex VNF Record

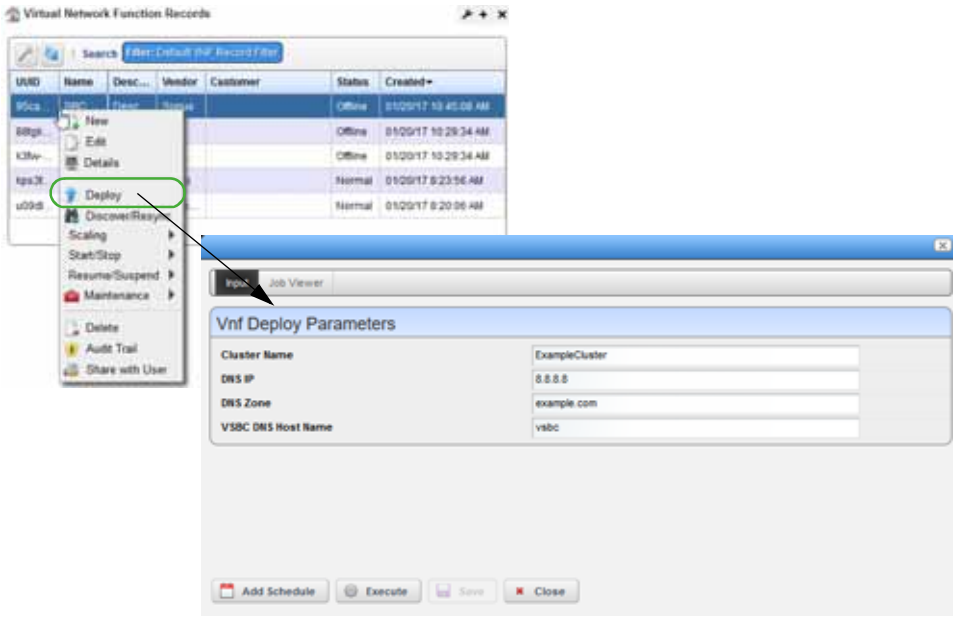
The deployment process sets up the network connectivity for a stagged VNF record. Deploy a complex VNF record from the Virtual Network Functions Records portlet as follows.

**Note**

*The portlet's location depends on your company's configuration.*

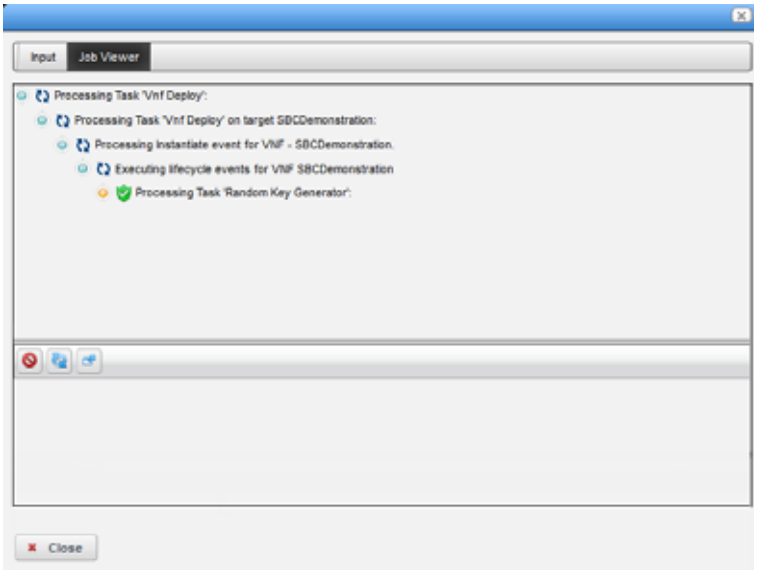
1. Select the VNF record you staged.
2. Right-click > Deploy.

   The default Vnf Deploy Parameters are displayed.




3. Change default parameters as needed.
4. Click Execute.

   The Job Viewer displays the deploy operation results, such as the steps taken to instantiate the networks needed to talk to each other and the information on the individual Virtualization Deployment Units (VDUs).

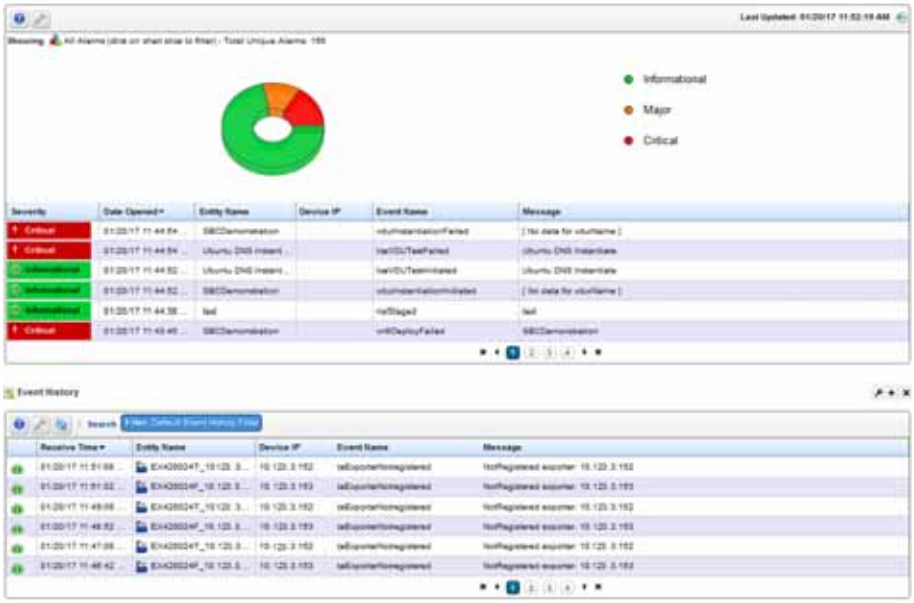



5. Click Close.

Once deployed, you can view VNF information provided, verify the instantiated VNF, and review the VDUR status.

## Viewing Alarms and Notifications

The Redcell Alarms page allows you to view the alarms, notifications, and event history provided for the selected VNF.

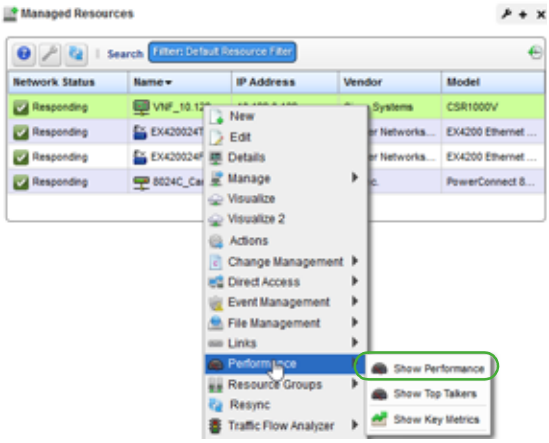



Next verify the instantiated VNF and then review the VDUR status

## Verifying a Complex VNF Instantiation

Verify the VNF instantiation from the Functional Resources page as follows.

1. Verify that the Managed Resources portlet lists the VNF record that you created.




2. Select a virtual network.
3. Right-click > Performance > Show Performances to see that you are collecting call rate data.

   The Performance Dashboard is displayed.




4. Navigate to the Virtual Network Function Records portlet.
5. Verify that the record status is Normal.



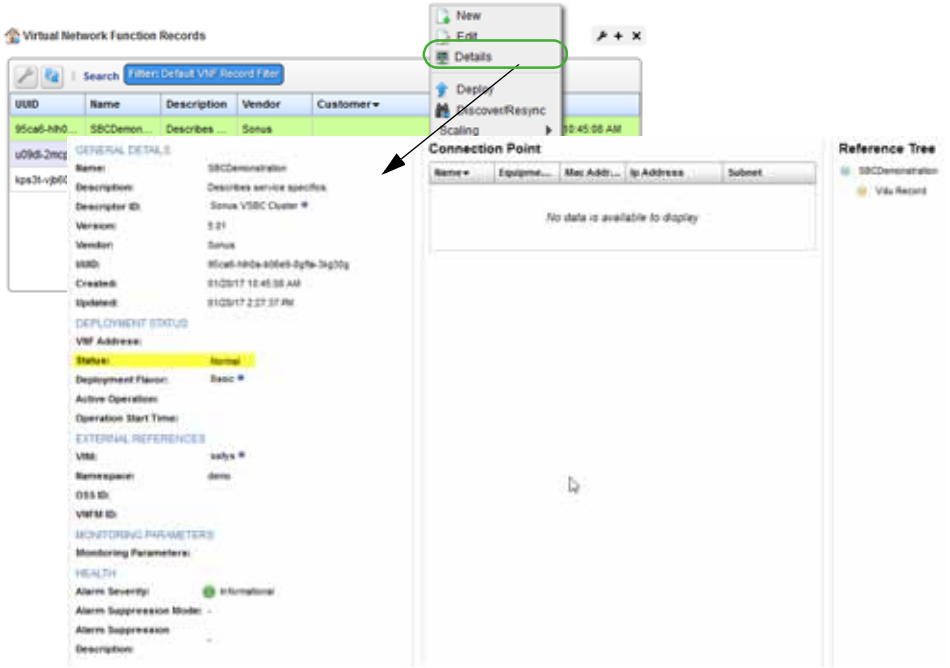

The last step is to review the VNF record status.

## Reviewing the VNF Record Status

Review the VNF Record status from the Virtual Network Function Records portlet. By default, the Status column shows each VNF record's status. However, you can also review all VNF component's status from the Details portlets as follows.

1. Select a VNF record.
2. Right-click > Details.

   The General details are displayed. Notice that the status is normal.




   a. Click the VDU Information tab.

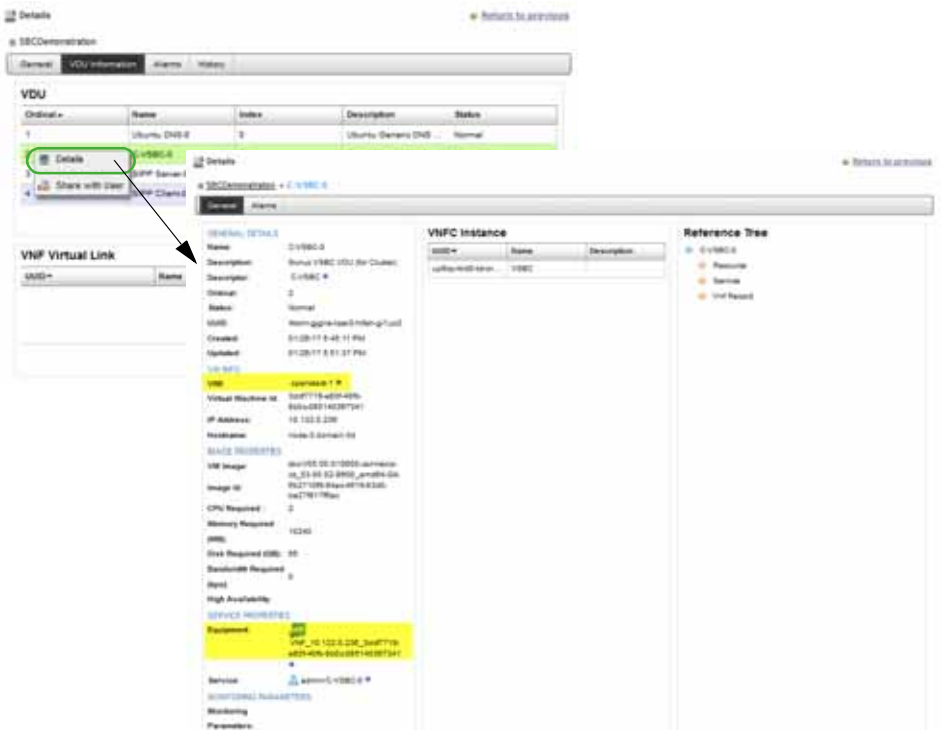
      VDU and VNF Virtual Links portlets are displayed and show that the VDUs came up successfully.

   b. Select a VDU.

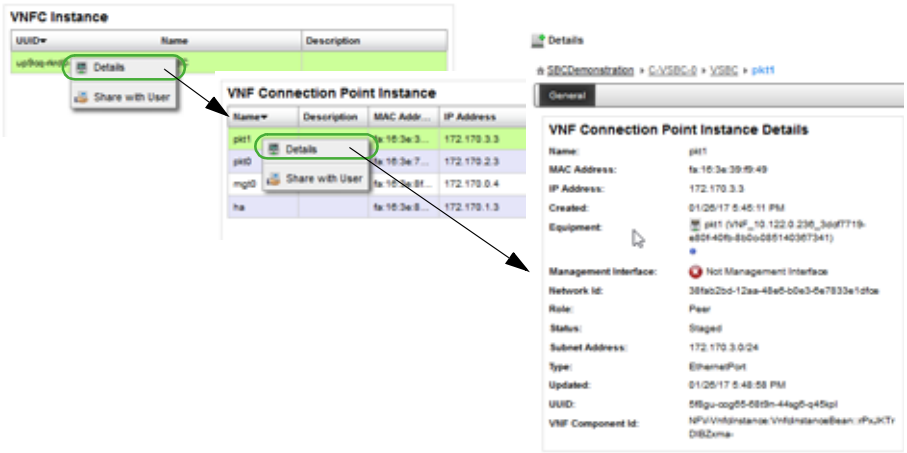
   c. Right-click > Details.

      The General details for the selected VDU are displayed.

      The virtual machine ID is used to manage the VDU. The equipment ID is used to interact with the virtual network in Redcell as if it were a device.




3. View the VNF connection instance details.
   a. Select a VNF connection.
   b. Right-click > Details.
      The VNF Connection Point Instance list is displayed.
   c. Select a connection instance.
   d. Right-click > Details.
      The VNF's General connection point details are displayed.

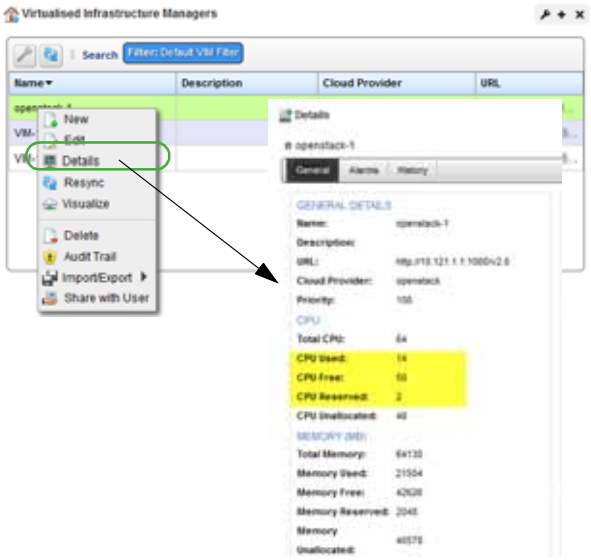


4. View the resource details.
   a. Click the NFVI Resources tab.

      The Virtualized Infrastructure Managers portlet is displayed.

   b. Select a resource.
   c. Right-click > Details.

      The General details are displayed. Notice the change in CPU usage.

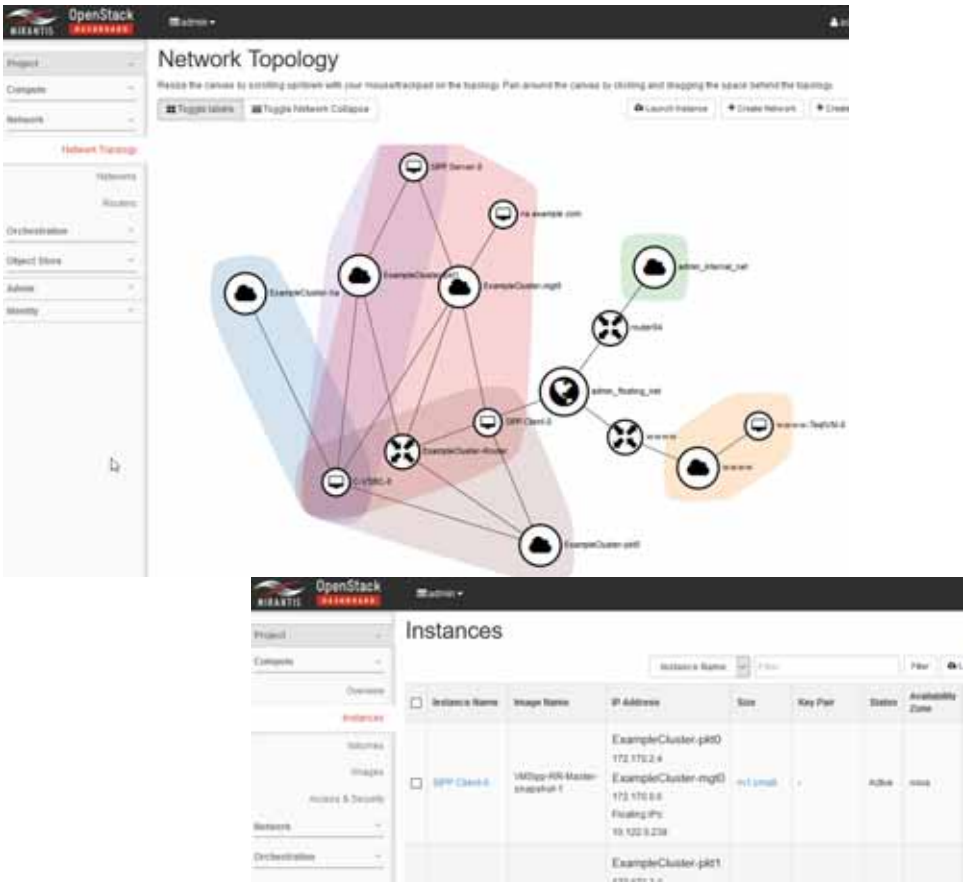



   d. Select a hypervisor.
   e. Right-click > Details.

      Note that there are no more reservations and the CPU, memory, and disk usage is higher.



5. View network topology and compute instances from the OpenStack dashboard.




Once you instantiate a complex VNF (stage and deploy), you can perform daily operations on the VNF, such as monitoring alarms, updating virtual network functions (scale in/out), and undeploying virtual network functions.

# Instantiating a Standalone VNF Record

This section shows how to instantiate a standalone Virtualized Network Function (VNF) record. The example standalone VNF descriptor used contains all lifecycle events (LCEs) required to create a set of Virtualization Deployment Units (VDUs) and contains the networks required to interconnect VDUs in the OpenStack environment. In this example, only a VNF record is required because there are no other VNFs required to interconnect with the VNF descriptor, and because the same target OpenStack project space contains all the VDUs.

Instantiate a standalone VNF record by:

- Staging a Standalone VNF Record
- Deploying a Standalone VNF Record
- Verifying VM Network Connections

## Staging a Standalone VNF Record

The staging process creates and stages a Virtualized Network Function (VNF) record based on the selected descriptor's information found and then reserves resources. The staging process does not deploy the VNF record to the OpenStack controller.

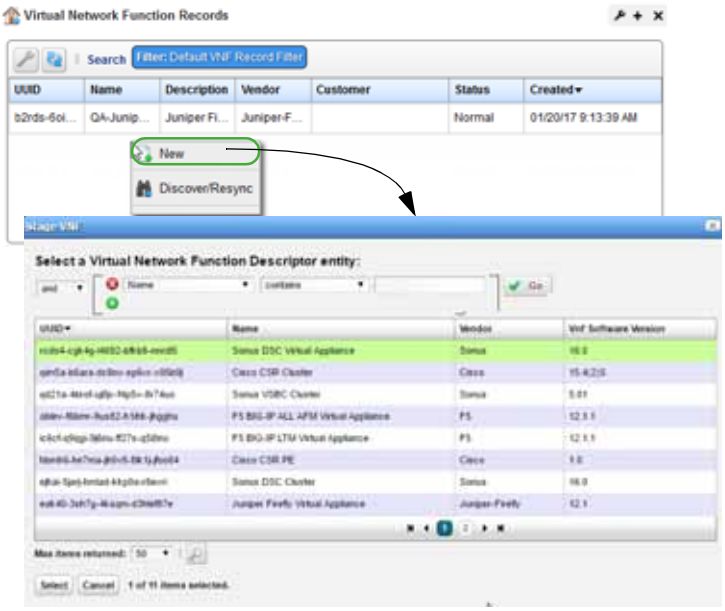
Stage a standalone VNF record from the Virtual Network Function Records portlet as follows.

**Note**

*The portlet's location depends on your company's configuration.*

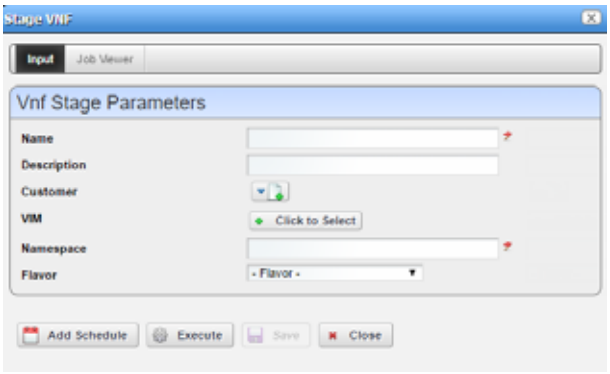
1. Right-click > New.

   The Stage VNF window displays a list of descriptor entities.




2. Select the service you want to instantiate.
3. Click Select.

   The Vnf Stage Parameters window is displayed.

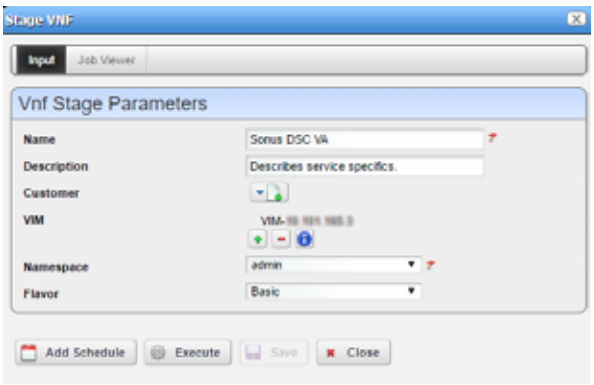



4. Enter a name for the VNF and a description that includes specifics on the services.
5. Specify the parameters, such as the VIM (Virtualized Infrastructure Manager) on which to deploy.

   The Name, VIM, Namespace, and Flavor fields are required.

**Note**

*If you do not specify the VIM, the system determines the appropriate VIM. The Name, VIM, Namespace, and Flavor fields are required.*

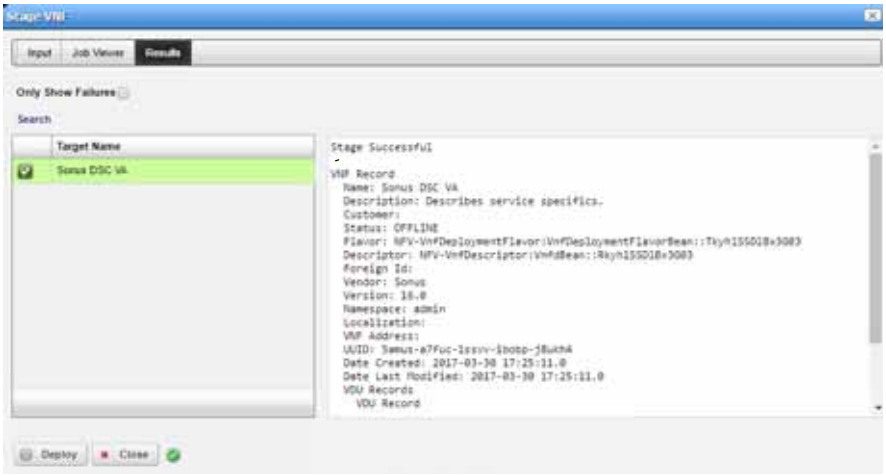



6. Click Execute.

   Upon completion, the stage results are displayed.

   If staging is successful, the record is created and staged based on the descriptor information found and resources are reserved. However, nothing is deployed to the OpenStack controller.

   If staging fails, the reason for the failure is displayed.




Now that the stage process successfully completed, it is time to deploy the VNF record.

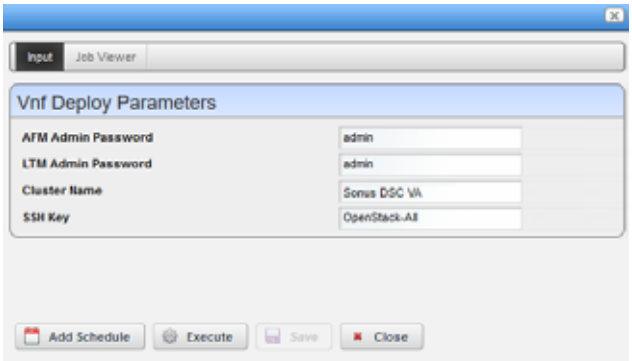
## Deploying a Standalone VNF Record

Deploy a standalone Virtualized Network Function (VNF) record from the Stage VNF Results panel or the VNF record from the Virtual Network Function Records portlet as follows. The example instructions here deploy a VNF from the Stage VNF Results panel.

Deploy a standalone VNF record from the Stage VNF Results panel as follows.

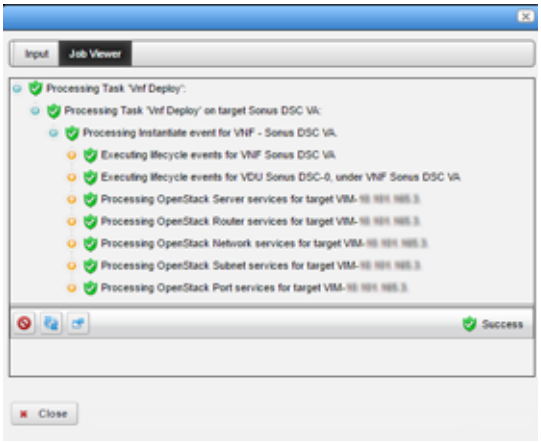
1. Click Deploy.

   The default VNF deploy parameter values are displayed.




2. Change the default parameters as needed.
3. Click Execute.

   The Job Viewer displays the deploy operation results, such as the steps taken to instantiate the networks needed to talk to each other and the information on the individual Virtualization Deployment Units (VDUs).



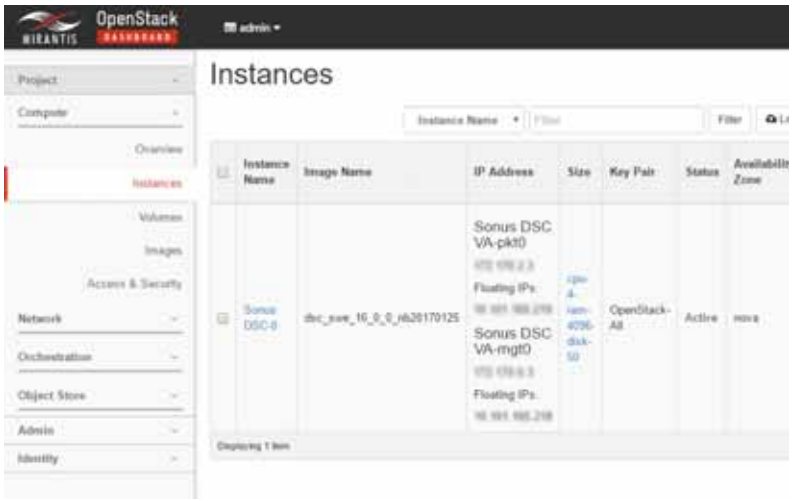

After successfully deploying the VNF record, make sure that the VM's network connections are up and okay.

## Verifying VM Network Connections

Verify that the VM's network connections are up and okay from the OpenStack dashboard as follows.

1. Select Project > Compute > Instances.

   A list of instances and their information is displayed.

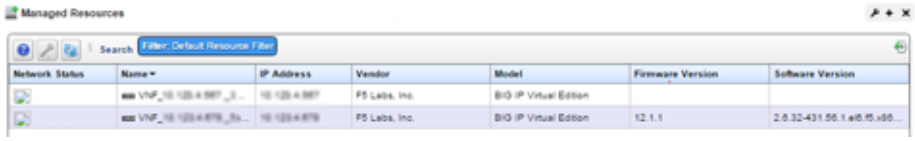



2. Verify that the resource records were deployed.
   a. Wait 5 minutes.
   b. Go to the Managed Resources portlet.

      The list shows the created Virtualized Network Function (VNF) records deployed to the OpenStack system. If the firmware and software versions show, the device is ready for SNMP requests.

**Note**

*If you do not have resource management implemented, ignore step 2.*




When the Redcell system detects that the device is up, the system automatically runs the Resync and other Discovery Profile tasks for the VNF record. If successful, the VNF resource shows up as a managed resource.



3. Check network connectivity to each VNF descriptor using its management interface, the assigned floating IP address, and both ping and ssh commands.

Once you instantiate a VNF (stage and deploy), you can perform daily operations on the VNF, such as monitoring alarms, updating virtual network functions (scale in/out), and undeploying virtual network functions.

# Monitoring Network Health

The Redcell application has many tools to monitor network health, determine whether any action is required, and then take the appropriate action, such as stage and deploy new virtual services or devices, scale network usage in/out, or undeploying virtual services or devices.

Here are a few of the tasks to monitor network health:

- Monitoring Alarms
- Viewing Managed Resources Performance
- Viewing VNF Record Details
- Viewing VIM Details
- Viewing Resource Monitors and Thresholds
- Reviewing Event Rules

## Monitoring Alarms

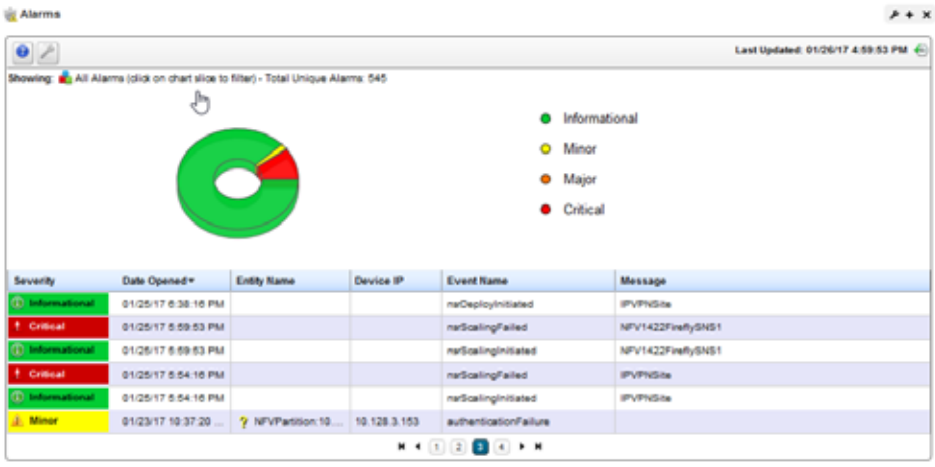
Monitor alarms from the Alarms portlet. Here are the actions that you can perform on alarms:

- Take ownership of those alarms you plan to address (Acknowledge Alarm).
- Assign selected alarms to another user on the system to resolve (Assign User).
- Remove resolved alarms from the list and mark them for database archiving (Clear Alarm).
- Remove many alarms that are old, low severity, or both at the same time (Clear Group of Alarms). For example, you have many information alarms that are over a week old and do not want to clear them one at a time. This action requires a filter for the alarm group and the **action is irreversible**.

For a detailed description of this portlet and its options, refer to the *Redcell User Guide*.

Monitor alarms from the Redcell application as follows.

1. Navigate to the Alarms portlet.
2. Review alarms who's severity is Warning, Minor, Major, or Critical.



3. Acknowledge those alarms that you plan to address.

   Address alarms from the most sever state to the least sever state (Critical, Major, Minor, and Warning).

4. Address alarm issues appropriately.

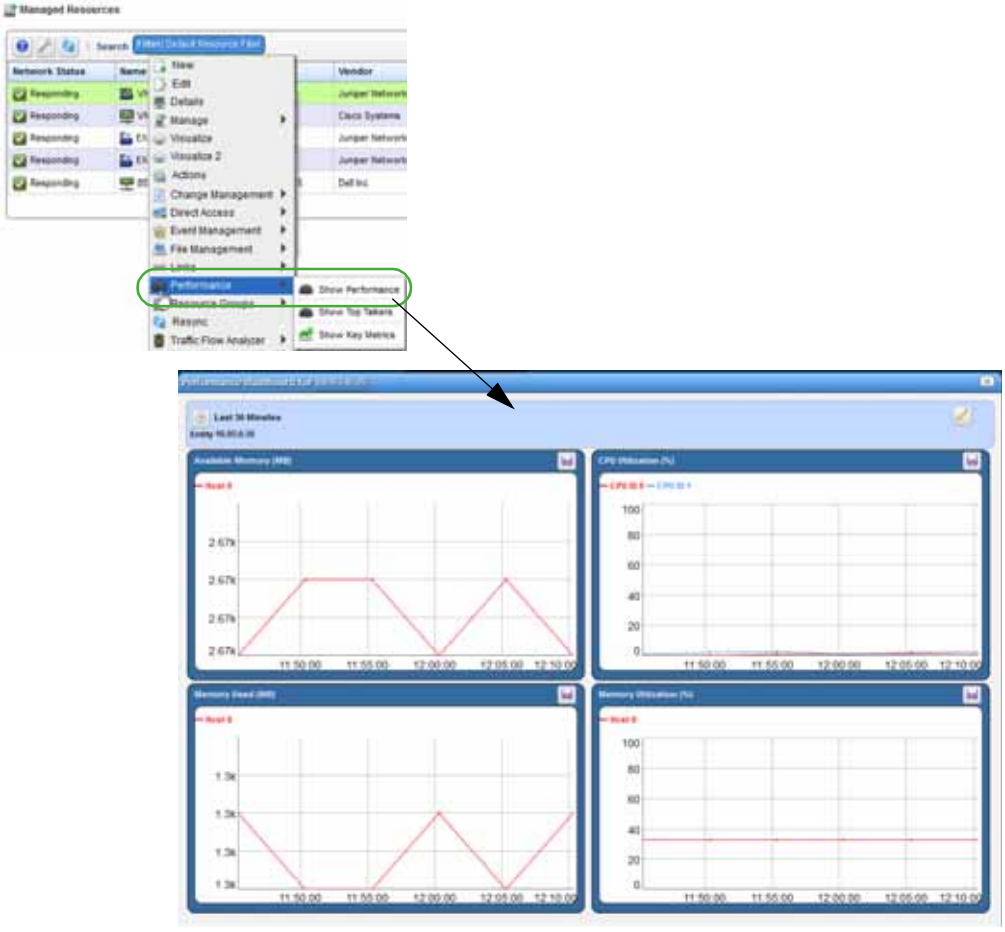
## Viewing Managed Resources Performance

A managed resource's Performance Dashboard shows patterns for CPU and memory utilization, packet counts, RTT (round-trip time) measurements, and so on. Viewing VIM Details on page 51 also shows resource usage (memory, CPU, and disk). For a detailed description of this portlet and its options, refer to the *Redcell User Guide*.

View a managed resource's performance from the Managed Resources portlet as follows.

1. Select a resource.
2. Right-click > Performance > Show Performance.

   The Performance Dashboard displays data patterns based on the defined properties, entities, and view attributes defined.



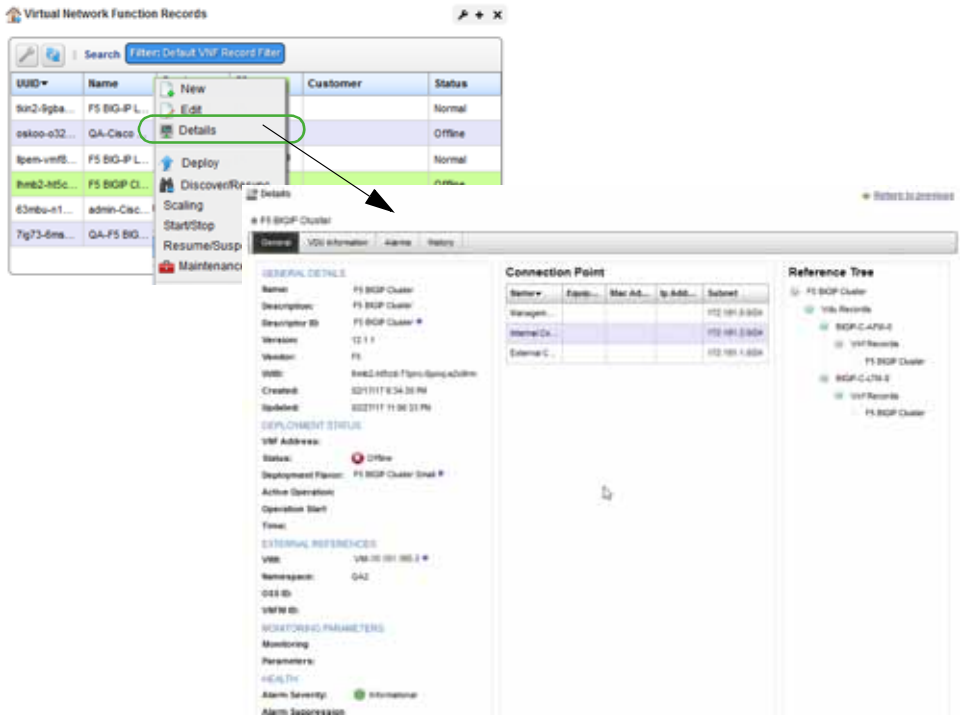
## Viewing VNF Record Details

View a VNF record's details to see its general information, deployment status, external references, monitoring parameters, and health. The VNF record details also provide information about connection points, VDUs, VNF virtual links, alarms, event history, and actions audit trail.

View VNF record details from the Virtual Network Function Records portlet as follows.

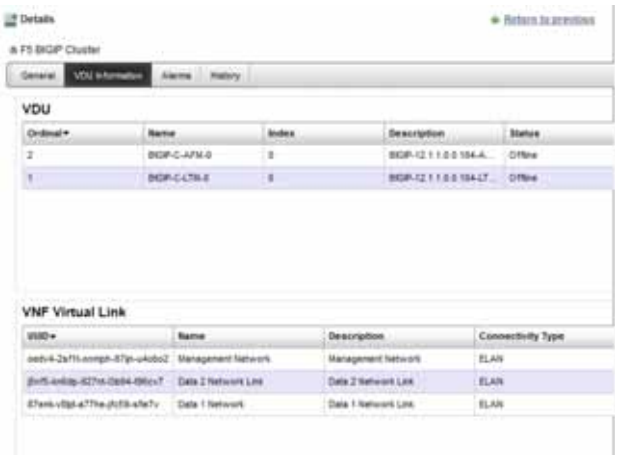
1. Select a record.
2. Right-click > Details.

   The General details are displayed, which includes general details, deployment status, external references, monitoring parameters, health, connection points, and a reference tree.



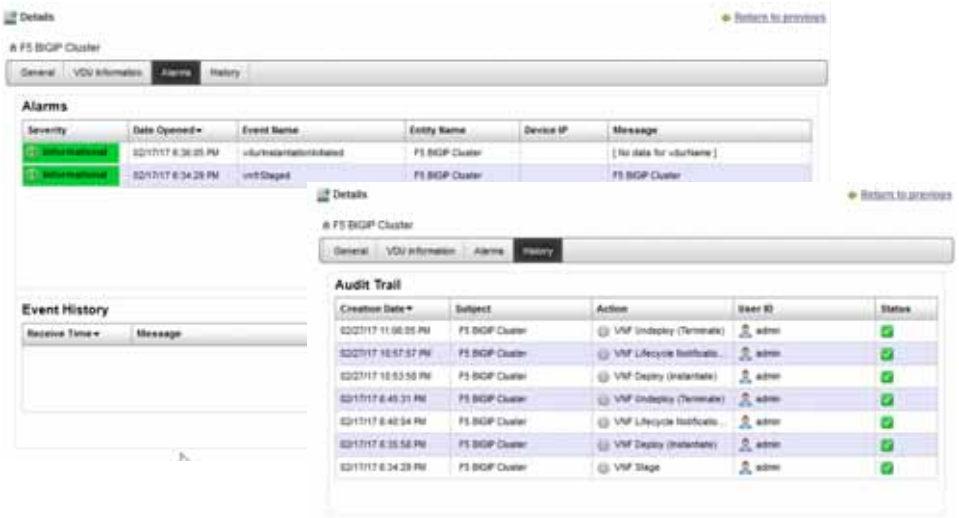

3. Click the VDU Information tab.

   A list of related VDUs and VNF virtual links are displayed.




4. Click Alarms or History.

   The Alarms details provides a list of alarms and a list of event history. The History details is an audit trail of actions.



## Viewing VIM Details

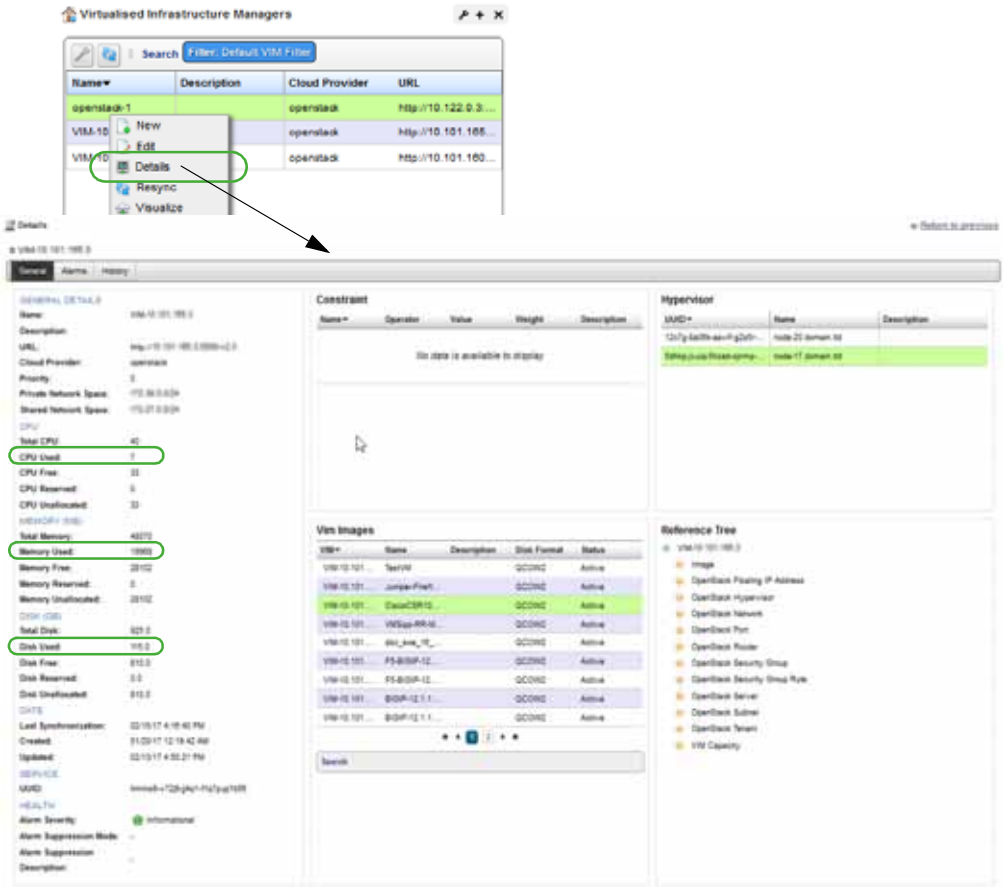
The Virtualized Infrastructure Managers (VIM) details includes resource information (CPU, memory and disk usage), any constraints, images, hypervisors, reference tree, alarms, event history, and action audit trail. Viewing Managed Resources Performance on page 48 shows usage patterns.

~~You can also view information about the VIM from your OpenStack system if you have permissions to access that system.~~

View VIM details from the Virtualized Infrastructure Managers portlet and the OpenStack system as follows.

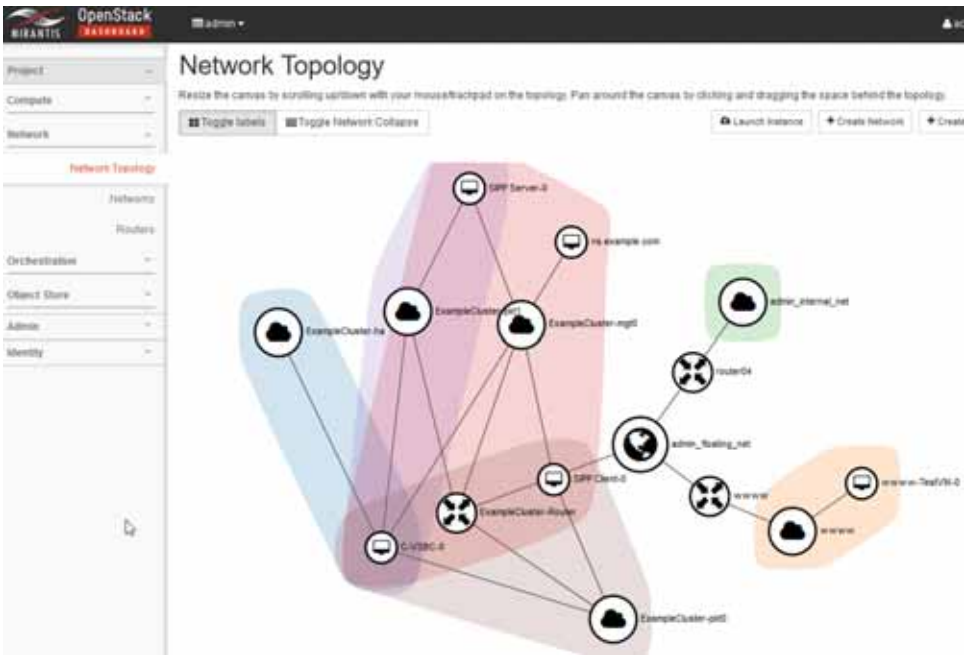
1. Select a resource.
2. Right-click > Details.

   The General details are displayed. Notice the amount of CPU, memory, and disk being used.

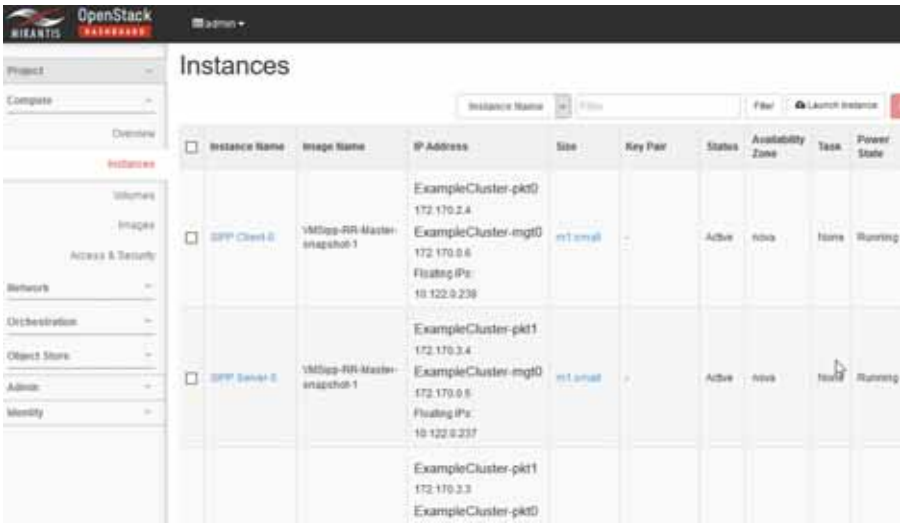



3. Go to the OpenStack dashboard.
4. Select Project > Network > Network Topology.

5. Review the network topology.
   Notice the networks and VDUs deployed.




6. Select Project > Compute > Instances.
   A list of instances are displayed.




7. Return to the Redcell application.

## Viewing Resource Monitors and Thresholds

Look at your resource monitor configuration to understand the parameters set that could generate alerts and determine whether changes are needed as the network changes. Resource monitor configuration settings include:

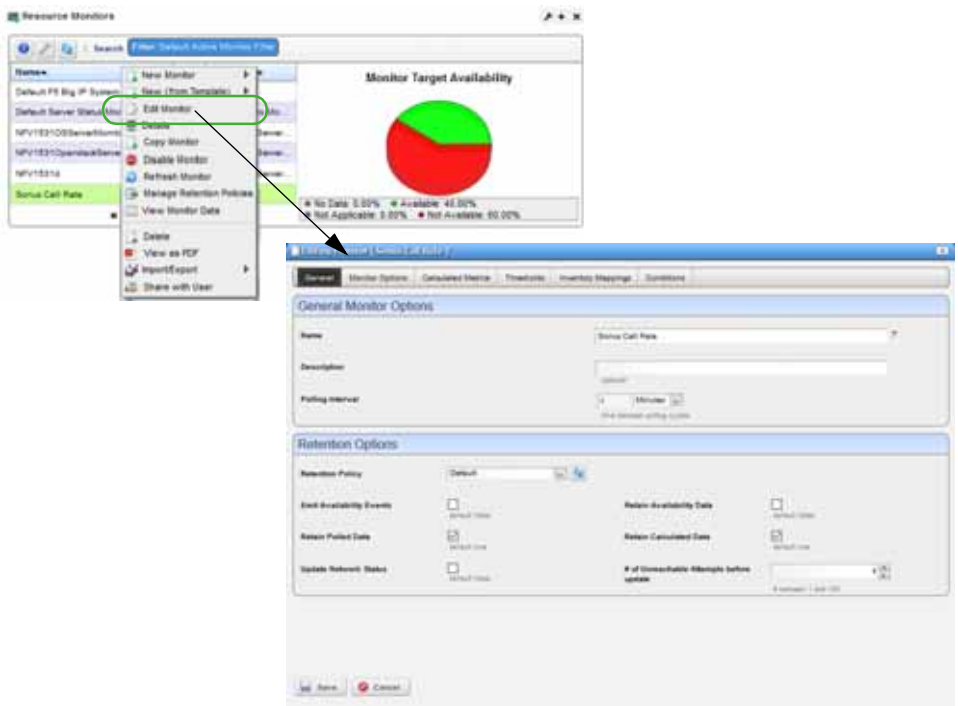
- General Monitor and Retention options that are common to all different monitor types.
- Monitor Options that specify monitor targets and options specific to a monitor type.
- Calculated Metrics, where you create attributes that are calculated from existing monitor attributes.
- Thresholds, where you set threshold intervals on attributes in the monitor.
- Inventory Mapping, where you associate predefined inventory metrics with a monitored attribute to normalize the attribute if an VNF does not report metrics in a way that matches the monitored attribute's name or format. Available metrics include CPU utilization percentage, memory utilization percentage, bandwidth utilization percentage, and so on.
- Conditions, where you define conditions.

For a detailed description of this portlet and its options, refer to the *Redcell User Guide*.

View resource monitors and threshold information from the Resource Monitors portlet as follows.

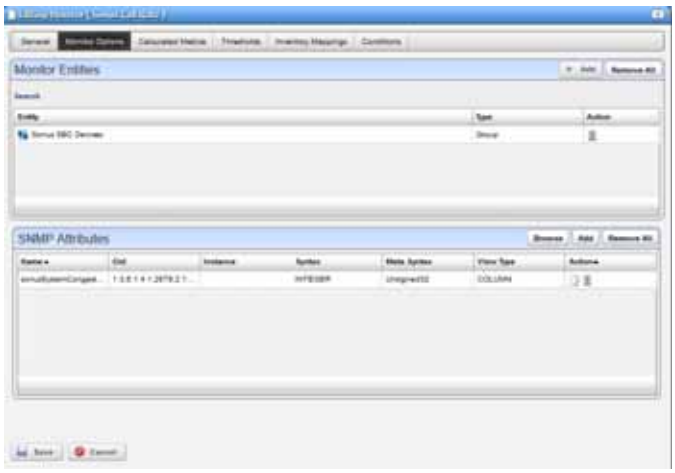
1. Select a resource monitor.
2. Right-click > Edit Monitor.

   The General monitor and retention options currently monitoring the call rate are displayed.



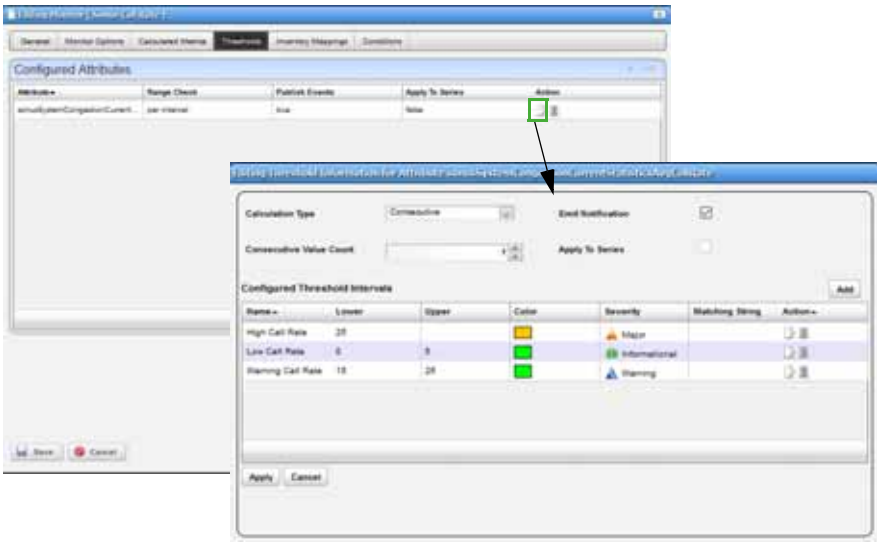

3. Click the Monitor Options tab.

Notice the monitor's entities and SNMP attributes.




4. Click the Thresholds tab.

   The Configured Attributes are displayed.




5. Click the Edit action.

   The configured threshold intervals are displayed, such as high, low, and warning call rates.

6. Review other configurations by clicking the appropriate tab.
7. Cancel out of the monitoring windows when you are done.

## Reviewing Event Rules

Event processing rules define how the Redcell system responds to events. By default, seeded rules exist. However, if you have permission to, you can create your own rules (New Protocol Translation, Stream Based Correlation, Event Definition Override, or Automation), copy or modify existing rules, delete them, or Import rules from and Export rules to files. For a detailed description of this portlet and its options, refer to the *Redcell User Guide*.

Review event rules from the Event Processing Rules portlet as follows.

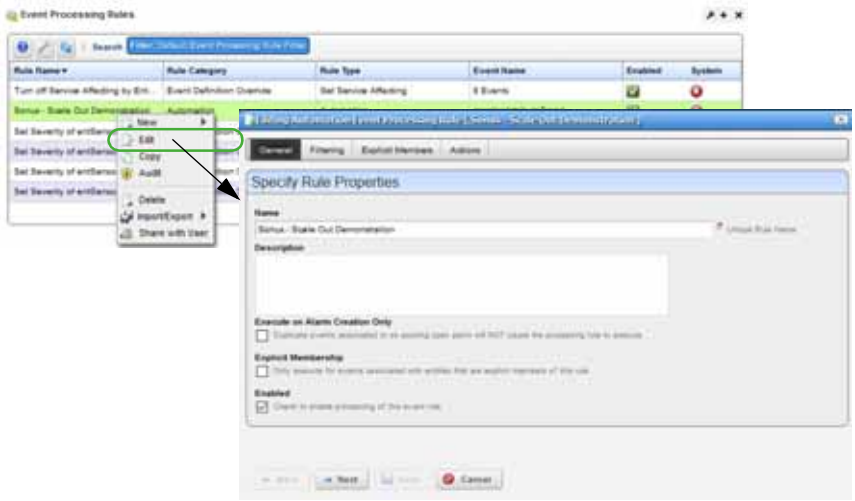
1. Search for the processing rules.

   The Event Processing Rules portlet displays the search results.

2. Select the rule.

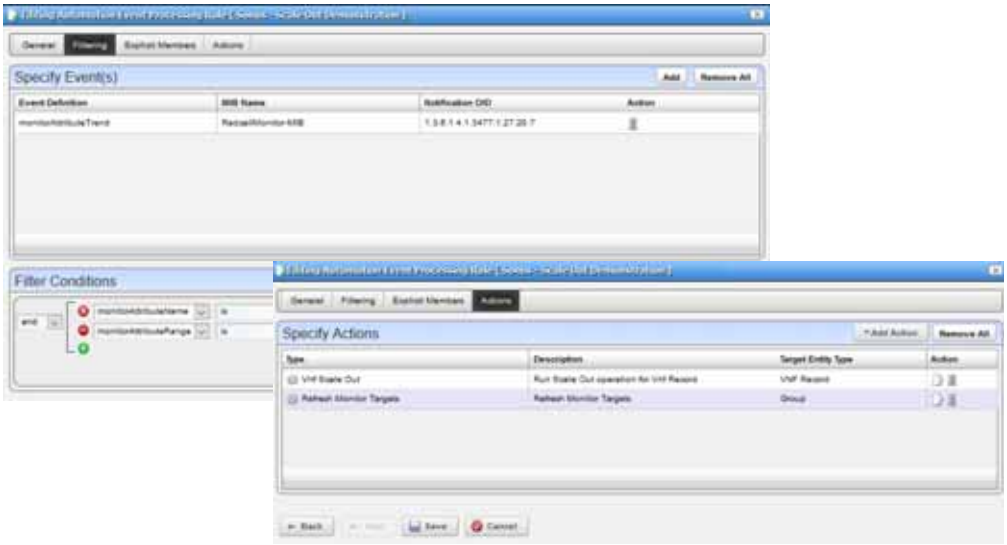
3. Right-click > Edit.

   The definition for the selected rule is displayed.




4. Review the event definition, filtering conditions, and actions to take.

   A scale out scales the VNF to the next highest deployment flavor.



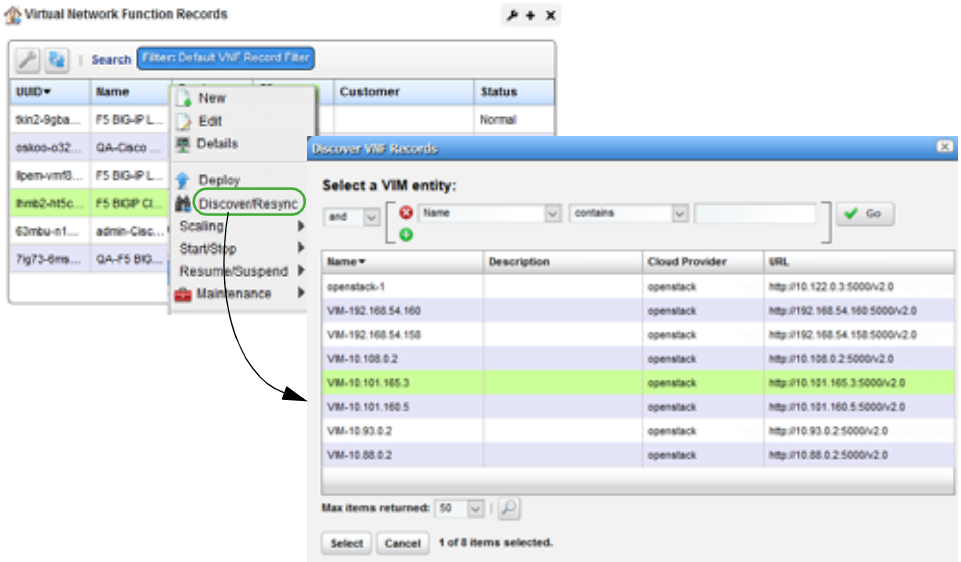
# Updating Virtual Network Functions

You should update your virtualized network functions (VNFs) on a regular basis to make sure that you always have the latest definition and changes from the target VIM (Virtualized Infrastructure Manager.

Update a VNF from the Virtual Network Function Records portlet as follows.

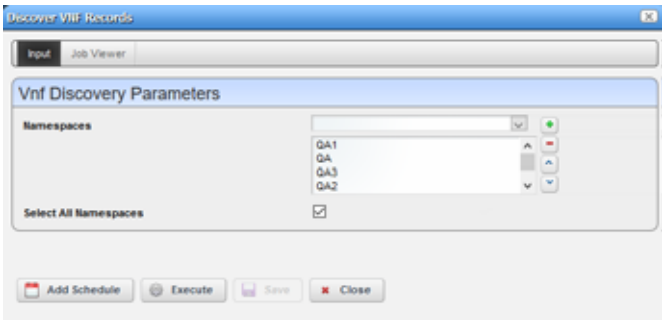
1. Select a record.
2. Right-click > Discover/Resync.

   The Discover VNF Records window is displayed.




3. Select the appropriate VIM entity.
4. Click Select.

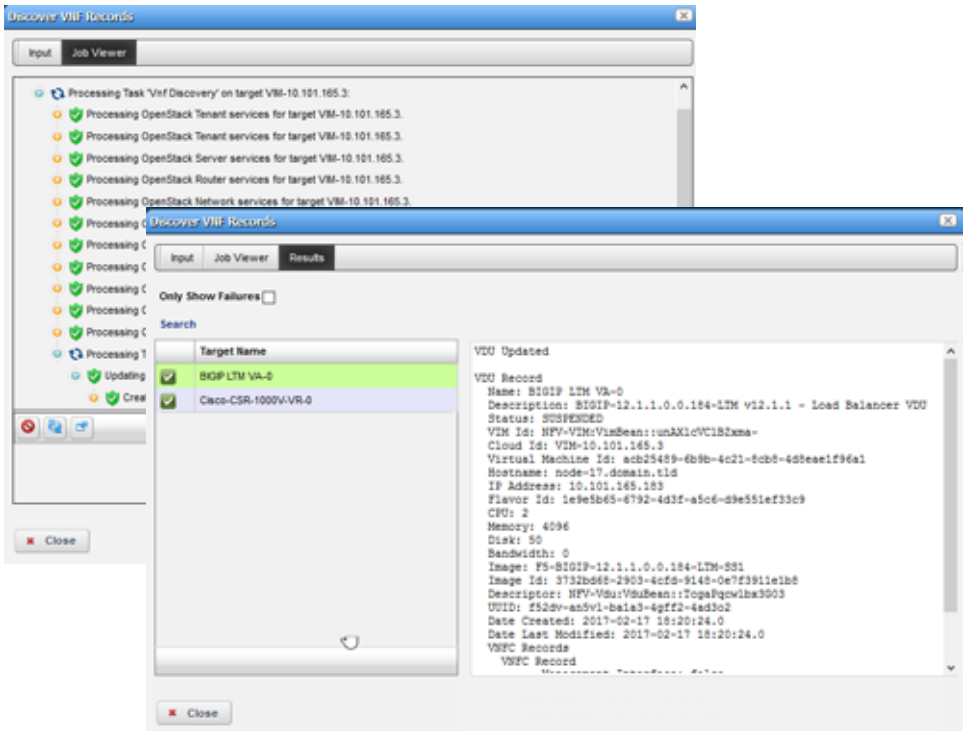
   The Vnf Discovery Parameters are displayed.




5. Select the namespaces.
6. Click Execute.

   The Job Viewer displays the execution progress, any errors, and success/failure, followed by the Results information, such as VDU, VNFC, and other record information. If you VNF is up to date, the following message is displayed.

   `No vnfs/changes found on VIM.`




7. Close the Discover VNF Records window.

# Undeploying Virtual Network Functions

Undeploy virtualized network functions (VNFs) from the Virtual Network Function Records portlet as follows.

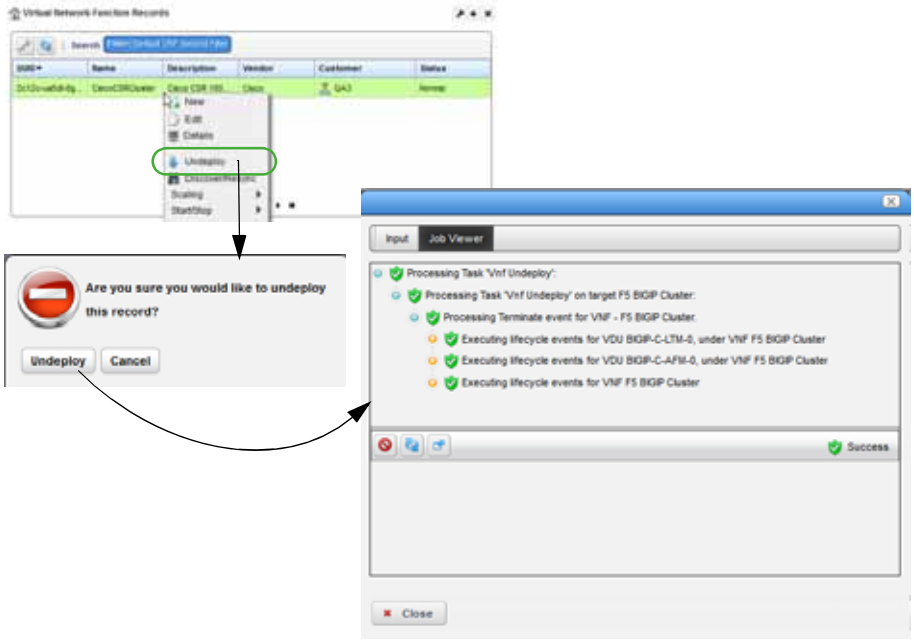
a. Select a record.

b. Right-click > Undeploy.

   A confirmation message is displayed.

c. Click Undeploy.

   The Job Viewer displays the steps taken and the results.




d. Click Close.

e. Verify the record's status is now Offline.



A

# > NFV User Interface

Covers these topics:


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Virtualized Network Function Portlets – 100
Virtual Requirements Portlet – 118
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This section describes the portlets, windows, menu options, and other aspects for the Network Functions Virtualization (NFV) user interface.

# General Information

The Network Functions Virtualization (NFV) user interface adds functionality to the Redcell application. This section covers only NFV portlets available to perform tasks discussed in this guide.

Whether you have access to a portlet and from which page a portlet is accessed is defined by your system administrator. In your environment, a portlet could be accessed from multiple pages. See the description of each portlet for more details.

All **time stamps** are based on the users timezone. It is based upon Greenwich Mean Time (GMT) and changes depending upon the timezone that you are in when viewing a record.

The following **portlet tools and options** (Table A-1) apply to all NFV portlets, where available. Specific portlet features and functions are described in their respective section.

Table A-1 Portlet Tools and Options

| Tool | Description |
|---|---|
|  | Provides access to the following options:<br>• **Look and Feel**, where you configure the portlet text styles, background, border, margin and padding, advanced, and WAP styles.<br>• **Configuration**, where you specify whether users have view, add to page, configuration, and permissions based on their assigned role. You can also specify whether to share the portlet with a website, Facebook, OpenSocial gadget, Netvibes, or Friends. |
| + | Displays a maximized portlet and provides additional information and options. Click Return to previous to return to the initial portlet view.<br>This tool shows only for those portlets that have the Maximize option. |
| X | Removes the portlet from the existing page. |
| Return to previous | Takes you back to the previous page (initial portlet). |
|  | Displays online help for the selected portlet. Once you access the online help, you also have the option to search the help for other topics. |
|  | Opens a Settings window, where you filter the results and specify which columns to include and their settings.<br>**Note:** Column selections from the portlet are not propagated to the maximized view. If you want the same columns for both views, you must select them for each view. |
|  | Refreshes the portlets data. |
| Search | Filters the list to show more specific items. Select from the list of user-defined filters. |
|  | Displays the first page in the list. |
|  | Displays the previous page in the list. |
|  | Displays the next page in the list. |
|  | Displays the last page in the list. |

## Maximized Portlet

Use the maximized portlet (Figure A-1) to define different columns and their settings, different sorts, filters (advanced or quick search), and export the table to portable document format (PDF) or Excel or CSV formats. If you have many instances of a portlet in your environment, the changes made to the maximized portlet are not global, they apply only to the portlet's maximized view.

Click the portlet's Maximize tool to access this view.

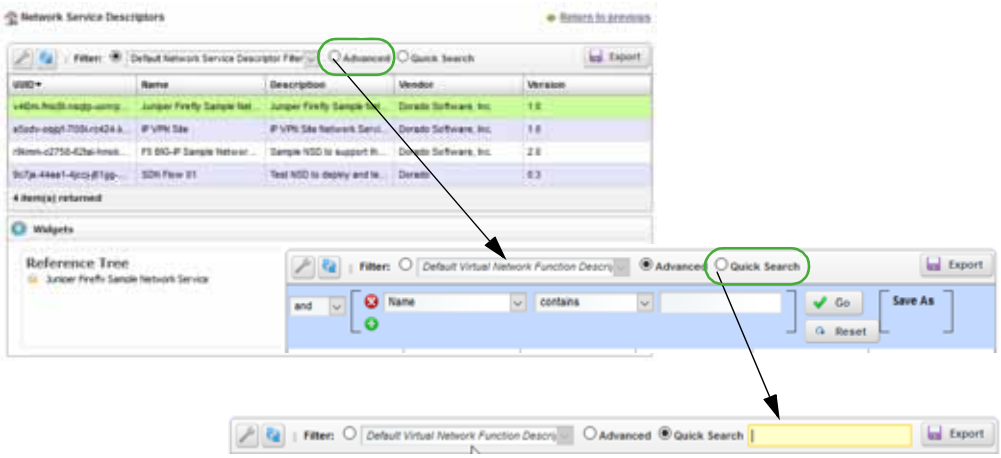



Figure A-1 Maximized Portlet (example)

The maximized portlet provides additional options (Table A-2).

Table A-2 Maximized Portlet Options

| Option | Description |
|---|---|
| Return to previous | Takes you back to the previous page (initial portlet). |
|  | Opens a Settings window, where you filter the results and specify which columns to include and their settings.<br>**Note:** Column selections are specific to the maximized view. If you want the same columns for both views, you must select them for each view. |
|  | Refreshes the portlets data. |
| Filter | Displays the default filter and any user-defined filters available. Select a filter from the list. Otherwise, select the Advanced or Quick Search option. |
| Advanced | Provides options to create conditional (AND, OR) filter statements. Once you create a conditional statement, click GO to view the results. Click Save As to save the filter. Click Reset to create another conditional filter. Otherwise, use the Filter or Quick Search option. |
| Quick Search | Activates a field, where you type a phrase and then press ENTER. Otherwise, use the Advanced or Filter option. |
| Export | Saves the current table to PDF, Excel, or CSV format. Click Export, select the format type, and then click Generate Export. |
| Widgets | Displays one or more detail widgets, such as the Reference Tree. You have the option to show or hide the widget details. |

## Settings Window

Use the Settings window (Figure A-2) to set the return results parameters, define a filter, and select the context mode. You can also specify which columns the portlet shows and the settings for each column.

The Filter/Results panel is displayed by default. Click the Columns tab to display the Columns panel.

**Note**

*Column selections from the portlet are not propagated to the maximized view. If you want the same columns for both views, you must select them for each view.*

Click the portlets Settings tool to access this window.

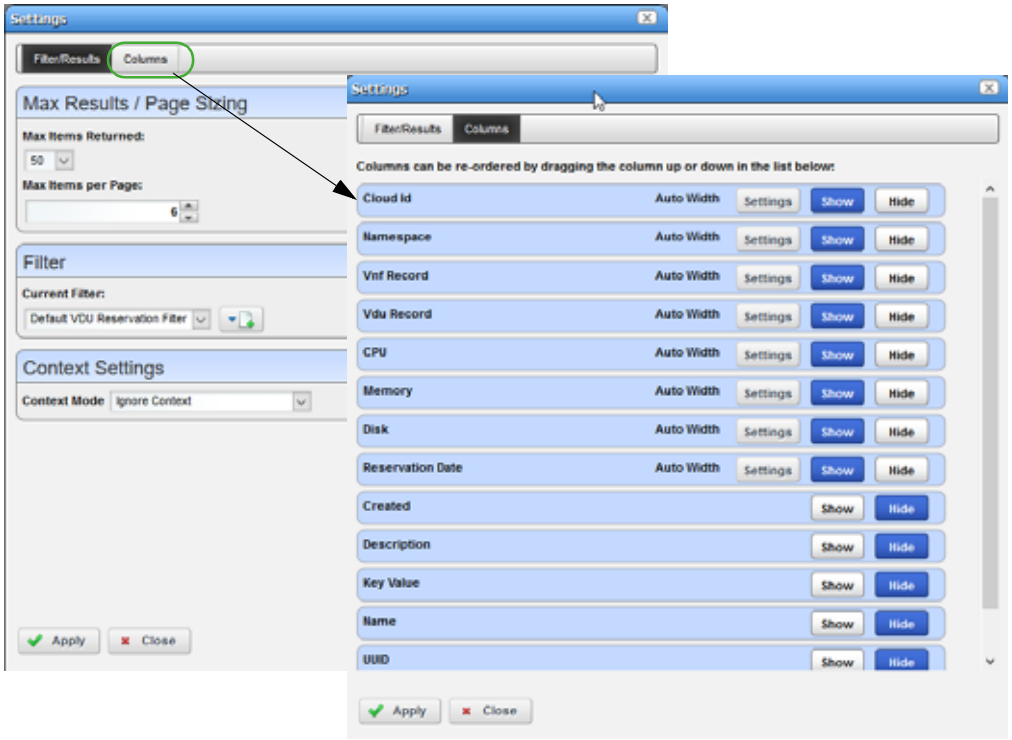



Figure A-2 Settings Window

The Settings window provides the following fields and options (Table A-3).

Table A-3 Settings Window Fields and Options

| Field/Option | Description |
|---|---|
| Max Items Returned | Sets the maximum number of items the filter returns. Valid values are 2, 25, 50, 75, 100, 200, 300, or 500. |
| Max Items per Page | Sets the maximum number of items displayed per page. Valid values are 4 to 100. |
| Current Filter | Provides a list of user-defined filters from which to choose. The product ships with a default filter.<br>Depending on your permissions, you have the option to create a filter or copy the currently selected filter from which you create a filter. |
| Context Mode | Specifies which of the following context modes the selected portlet uses:<br>• Listen for Context<br>• Ignore Context (default)<br>• Broadcast Context<br>• Broadcast and Listen for Context<br>**Note:** Not all portlets have all option. |
| Columns | Displays a list of columns, their settings, and whether a column is hidden. Select the Column tab to display the columns. The default columns displayed and the available columns vary with each portlet.<br>If you have many instances of a portlet in your environment, the changes made to the portlet or maximized portlet are not global, they apply only to the current portlet or its maximized portlet.<br>Click the Settings button to specify whether the width is automatically set or specify a specific pixel width.<br>The highlighted Show/Hide button indicates the selection for the column. |

# Image Portlets

Use the following image portlets to view, create, and manage image descriptors that are used to manage, deploy, or migrate images:

- Software Images Portlet
- VIM Images Portlet

## Software Images Portlet

Use the Software Images portlet (Figure A-3) to view and manage software image descriptors. The software image descriptors are used to manage, deploy, or migrate images.

From the Software Images portlet, a system administrator creates and maintains the image snapshots used to create descriptors, a network designer could also create and maintain image snapshots, and operators (if they have the proper permissions) view descriptors to gain knowledge.

The Software Images portlet also has a maximized view. Both views have the same pop-up menu options and by default the same columns. See Maximized Portlet on page 61 for a description of its standard options provided.

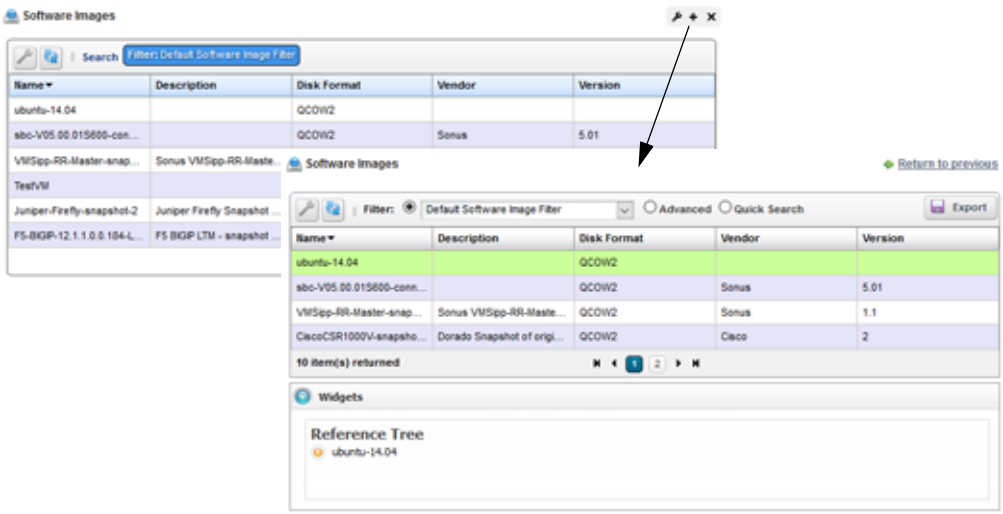



Figure A-3 Software Images Portlet

### Pop-Up Menu

The Software Images pop-up menu provides access to the following options. Right-click a row to access these options (Table A-4).

Table A-4 Software Images Pop-Up Menu Options

| Menu Option | Description |
|---|---|
| New | Opens the Creating new Software Image window, where you specify the details used to create an image. You can also create an image using the Manage option. |
| Edit | Opens the Editing Software Image window, where you modify the general image details or simply view the image details.<br>Click Vim Images > Edit icon to view the VIM image details or select whether the image is a master copy. By default, Master Copy is not selected. |

Table A-4 Software Images Pop-Up Menu Options

| Menu Option | Description |
|---|---|
| Details | Displays the general details provided when you created the image, a reference tree, alarms, and event history details for the selected image. Click Return to previous to return to the Software Images portlet. |
| Manage | Opens the Manage new Software Image from VIM Parameters window, where you create a software image so it is available from the catalog to deploy to other VIMs. This method of creating a software image is useful when you are not sure of all the parameters needed when creating an image using the New option. |
| Download | Opens the Save VIM Image to Disk Parameters window, where you specify where to store the image backup and then execute the download. |
| Deploy | Pushes the software image out to VIMs under management so that the same image is available across all your VIMs or datacenters. A deployed image can then be turned up (activated and provisioned) for a specific virtualization deployment unit (VDU) within a virtualized network function (VNF). |
| Undeploy | Removes the selected image's availability from your VIMS or datacenters. Some reasons for undeploying an image that is no longer needed are the service is no longer offered or perhaps the VDU was updated to a newer image and the only image is no longer needed.<br>**Caution:** This also removes the OpenStack project image instance, which can cause issues with anything using that image. |
| Delete | Removes the selected images from the system.<br>**Caution:** Deleting an image can cause anything using that image to fail. |
| Audit Trail | Opens the Audit Trail Viewer window, which displays a list of actions that occurred for the selected image. Select an audit record and the job record displays its status and any other job-related information. |
| Import/Export | Provides the following actions when available for the selected image:<br>• Import retrieves a file containing XML image descriptions. Some imports can come from a URL.<br>• Export Selection exports the selected image description to an XML file.<br>• Export All exports all image descriptions to an XML file.<br>Click Download Export File to specify where to save the file.<br>The Import/Export option is useful as a backup or to share descriptors with other projects. |
| Share with User | Opens the Share with User window, where you select a user to which you want to share the selected asset and then enter a message. You can share with colleagues existing on your system.<br>**Note:** Sharing only handles one item so it uses the first one in the selection. |

## Columns

Other than the general navigation and configuration options, the Software Images portlet includes the following columns/fields (Table A-5).

You can view the value for most of the hidden columns by right-clicking a row and selecting Details. The other option is to add the column by clicking the Settings tool, selecting the Columns tab, clicking Show for the appropriate column, and the applying the change.

Table A-5 Software Images Columns

| Column | Description |
|---|---|
| Name | The user-specified software image identifier. |
| Description | The optional details about the software image, such as its purpose.<br>For example, mentions customizations made for your use and the original vendor-provided image from which you created the software image. |
| Disk Format | The file format in which the image is to be created, such as QCOW2. Valid formats are AKI, AMI, ARI, ISO, QCOW2, RAW, UNRECOGNIZED, VDI, VHD, VMDK. |
| Vendor | The vendor's name that supplied the initial image used to create the software image descriptor. |
| Version | The vendor-supplied image version. |
| Boot Wait Time | The number of seconds to wait for an image to finish booting. By default, this field is not shown. |
| Checksum | The data used to detect errors introduced during transmission or storage. By default, this field is not shown. |
| Cloud Provider | The target locations where you plan to deploy the image. By default, this field is not shown. |
| Container Format | The target format to which you plan to deploy the image. For example, a target Bare Metal (BARE) OpenStack controller. Valid values are AKI, AMI, ARI, BARE, DOCKER, OVF, and UNRECOGNIZED. By default, this field is not shown. |
| Created | The system-generated timestamp for the image instance creation. By default, this field is not shown. |
| Discovery Profile | The resource profile selected for the image. By default, this field is not shown. |
| Min Disk | The minimum disk size required in gigabytes (such as 2GB) for the image to boot and operate. By default, this field is not shown. |
| Min Ram | The minimum RAM required in megabytes for the image to boot and operate, such as 2048. By default, this field is not shown. |
| Size | The binary image size in gigabytes. By default, this field is not shown. |
| Sys Object Id | The system's object ID number provided during creation. This ID is a universally unique identifier that tells what type of resource the device is. For example:<br>`1.3.6.1.4.1.3375.2.1.3.4.43`<br>By default, this field is not shown. |
| URL | The local environment's file server or disk location where the snapshot image file (.qcow2) is stored, for example:<br>`ftp://caserverIP/vnf/images/juniper/firefly/Juniper-Firefly-shapshot-2.qcow2`<br>By default, this field is not shown. |
| UUID | A unique 128-bit, system generated value assigned to each network service image descriptor created. By default, this field is not shown. |
| Updated | The system-generated timestamp for the latest image changes. By default, this field is not shown. |

## Creating new Software Image Window

Use the Creating new Software Image window (Figure A-4) to create software images, bring that images under management so that you can deploy the images to the various VIMs that you have under management. This promotes consistency across the VIMs and simplifies the process of deploying a new image to multiple VIMs (Openstack installations).

You can create an software image from an existing image snapshot listed in the Software Image portlet or a new snapshot image from the original image located in the specified URL.

Access this window by navigating to the Software Images window, right-clicking the portlet or a selected image, and then selecting New.

After you provide the required information, you can save the image and then edit the image to provide the additional information later.

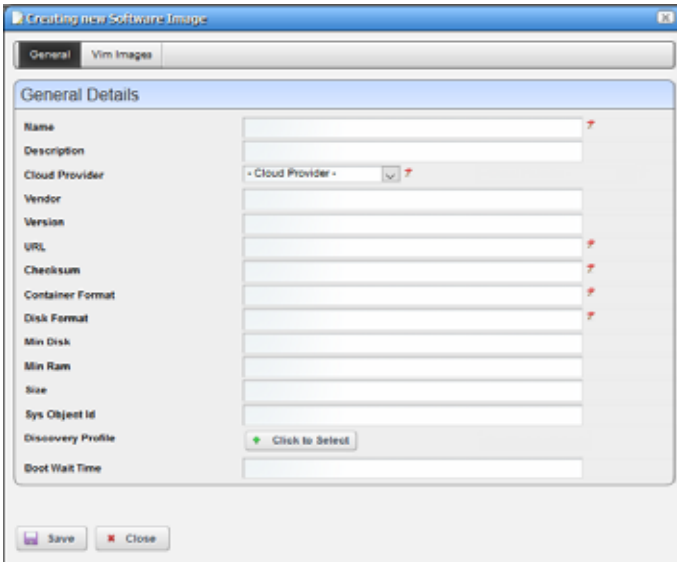



Figure A-4 Creating new Software Image Window

The Creating new Software Image window includes the following editable fields and options (Table A-6).

Table A-6 Creating New Software Image Fields/Options (Sheet 1 of 2)

| Field/Options | Description |
|---|---|
| Name | Enter a name that allows you to identify the software image. |
| Description | Enter more details about the software image.<br>For example, mention customizations made for your use and the original vendor-provided image from which you created the software image. |
| Cloud Provider | Select the target container where you plan to deploy the image. When you select a provider, the Container Format and Disk Format lists are populated based. |
| Vendor | Enter a name for the vendor that supplied the initial image used to create this software image descriptor. |
| Version | Enter the version for the vendor-supplied image. |
| URL | Enter the local environment's file server or disk location where the snapshot image file (.qcow2) is stored, for example:<br>`ftp://caserverIP/vnf/images/juniper/firefly/Juniper-Firefly-shapshot-2.qcow2` |
| Checksum | Enter the value assigned to the image snapshot instance located in your OpenStack environment. For example, an F5-BIGIP LTM-SS1 image could look like this:<br>`9275adf3c578c60754b3d56dcbbed5c8`<br>This value is used to detect errors introduced during transmission or storage and it is provided by the image manufacturer. |

Table A-6 Creating New Software Image Fields/Options (Sheet 2 of 2)

| Field/Options | Description |
|---|---|
| Container Format | Select a format for the target container to which you deploy the image. For example, if your target container is a Bare Metal OpenStack controller, select BARE. Valid values are AKI, AMI, ARI, BARE, DOCKER, OVF, and UNRECOGNIZED. |
| Disk Format | Select the file format of the image provided by the manufacturer, such as QCOW2. Valid formats are AKI, AMI, ARI, ISO, QCOW2, RAW, UNRECOGNIZED, VDI, VHD, VMDK. |
| Min Disk | Enter a minimum disk size required in gigabytes, such as 2. The default is 0 (zero) if you do not enter a value.<br>This identifies how much disk space is required for the image to boot and operate. |
| Min Ram | Enter the minimum RAM required in megabytes, such as 2048. The default is 0 (zero) if you do not enter a value.<br>This identifies how much RAM is required for the image to boot and operate. |
| Size | Enter the binary image size in gigabytes, such as 3.5. The default is 0 (zero) if you do not enter a value. |
| Sys Object Id | The system's object ID number provided during creation. This ID is a universally unique identifier that tells what type of resource the device is. For example:<br>`1.3.6.1.4.1.3375.2.1.3.4.43` |
| Discovery Profile | Select a resource profile. |
| Boot Wait Time | Enter how many seconds to wait for an image to finish booting. The default is 0 (zero) if you do not enter a value. |
| Vim Images | View the list of VIM images after you deploy the image by clicking the Vim Images tab. |
| Save | Save the image you created and exits the window. |
| Close | Exist the current window without creating the image. |

## Editing Software Image Window

Use the Editing Software Image window (Figure A-5) to modify the existing software image details.

Access this window by navigating to the System Images portlet, right-clicking an image, and then selecting Edit.

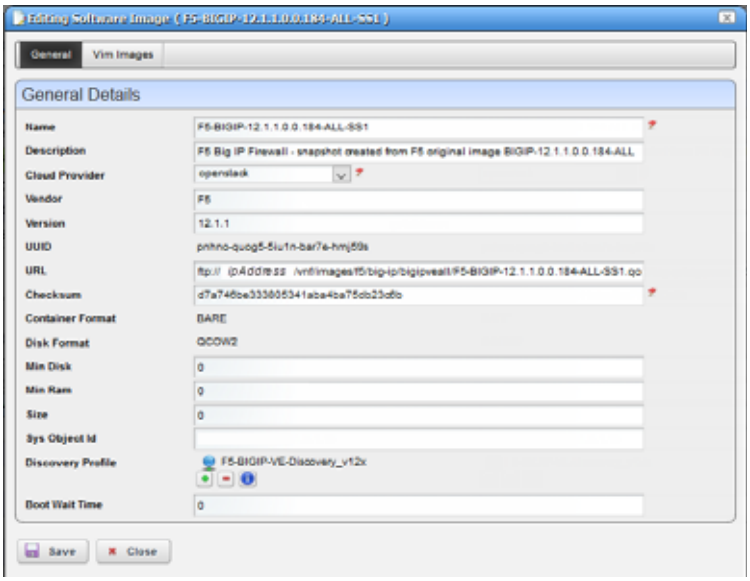



Figure A-5 Editing Software Image Window

The Editing Software Image window allows you to change the following fields and options as required (Table A-7).

Table A-7 Editing Software Image Fields/Options

| Field/Options | Description |
|---|---|
| Name | Modify the name that allows you to identify the software image. |
| Description | Provide more details about the software image.<br>For example, mention customizations made for your use and the original vendor-provided image from which you created the software image. |
| Cloud Provider | Select a different target container where you plan to deploy the image. When you select a provider, the Container Format and Disk Format lists are populated based. |
| Vendor | Modify the name for the vendor that supplied the initial image used to create this software image descriptor. |
| Version | Modify the version for the vendor-supplied image. |
| URL | Provide a different local environment's file server or disk location where the snapshot image file (.qcow2) is stored, for example:<br>`ftp://caserverIP/vnf/images/juniper/firefly/Juniper-Firefly-shapshot-2.qcow2` |
| Checksum | Enter the value assigned to the image snapshot instance located in your OpenStack environment. For example, an F5-BIGIP LTM-SS1 image could look like this:<br>`9275adf3c578c60754b3d56dcbbed5c8`<br>This value is used to detect errors introduced during transmission or storage and it is provided by the image manufacturer. |
| Min Disk | Modify the minimum disk size required in gigabytes, such as 2. The default is 0 (zero) if you do not enter a value.<br>This identifies how much disk space is required for the image to boot and operate. |
| Min Ram | Modify the minimum RAM required in megabytes, such as 2048. The default is 0 (zero) if you do not enter a value.<br>This identifies how much RAM is required for the image to boot and operate. |
| Size | Modify the binary image size in gigabytes, such as 3.5. The default is 0 (zero) if you do not enter a value. |
| Sys Object Id | The system's object ID number provided during creation. This ID is a universally unique identifier that tells what type of resource the device is. For example:<br>`1.3.6.1.4.1.3375.2.1.3.4.43` |
| Discovery Profile | Select a different resource profile. |
| Boot Wait Time | Modify how many seconds to wait for an image to finish booting. The default is 0 (zero) if you do not enter a value. |
| Vim Images | Select whether a VIM image is the master copy by clicking the Vim Images tab, clicking the Edit this entry icon for the appropriate image, selecting/deselecting the Master Copy option, and then saving the change. |
| Save | Saves any changes made and closes the window. |
| Close | Exits the current window without saving the changes. |

## Manage new Software Image from VIM Parameters Window

Use the Manage new Software Image from VIM parameters window (Figure A-6) to bring an image under management that is already deployed to a VIM. This method of creating a software image is useful when you are not sure of all the parameters needed when creating an image using the New option.

Access this window by navigating to the Software Images portlet, right-clicking an image, and selecting Manage.

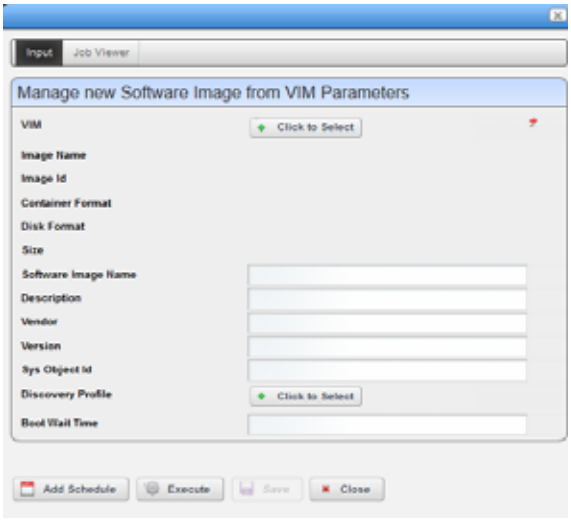



Figure A-6 Manage new Software Image VIM Parameters Window

The Managing new Software Image from VIM Parameters window includes the following fields and options (Table A-8).

Table A-8 Manage New Software Image Fields/Options (Sheet 1 of 2)

| Field/Options | Description |
|---|---|
| VIM | Select the VIM where the source software image is deployed. The Image Name list is populated based on the selected VIM. |
| Image Name | Select the appropriate image from the list. Based on the image selected, the following fields are populated:<br>• **Image Id** is the system-generated identifier.<br>• **Container Format** is the target format specified during image creation.<br>• **Disk Format** is the format in which the image was saved.<br>• **Size** is a value in gigabytes.<br>• **Software Image Name** is an editable field to specify a name identifier. |
| Description | Enter more details about the software image.<br>For example, mention customizations made for your use and the original vendor-provided image from which you created the software image. |
| Vendor | Enter a name for the vendor that supplied the initial image used to create this software image descriptor. |
| Version | Enter the version for the vendor-supplied image. |
| Sys Object Id | The system's object ID number provided during creation. This ID is a universally unique identifier that tells what type of resource the device is. For example:<br>`1.3.6.1.4.1.3375.2.1.3.4.43` |

Table A-8 Manage New Software Image Fields/Options (Sheet 2 of 2)

| Field/Options | Description |
|---|---|
| Discovery Profile | Select a resource profile. |
| Boot Wait Time | Enter how many seconds to wait for an image to finish booting. The default is 0 (zero) if you do not enter a value. |
| Add Schedule | Set the following schedule parameters used to automatically execute the manage new software image from VIM task.<br>• Starting On sets the date and time to execute the task.<br>• Recurrence sets whether the task executes Only Once, Only at Startup, every X minutes (Increment), or Every *X* minutes, hours, days, weekdays, weekend days, weeks, months, years.<br>• Stopping On sets when the task stops executing. Valid values are Never, By Occurrence, or By Date and Time. |
| Execute | Runs the manage new software image from VIM task. |
| Save | Saves the parameters and exits the window. |
| Close | Exits the current window without saving the VIM parameters. |

## Save VIM Image to Disk Parameters Window

Use the Save VIM Image to Disk Parameters window (Figure A-7) to define the settings used to download a VIM image to disk.

Access this window by navigating to the Software Images portlet, right-clicking an image, and then selecting Download.

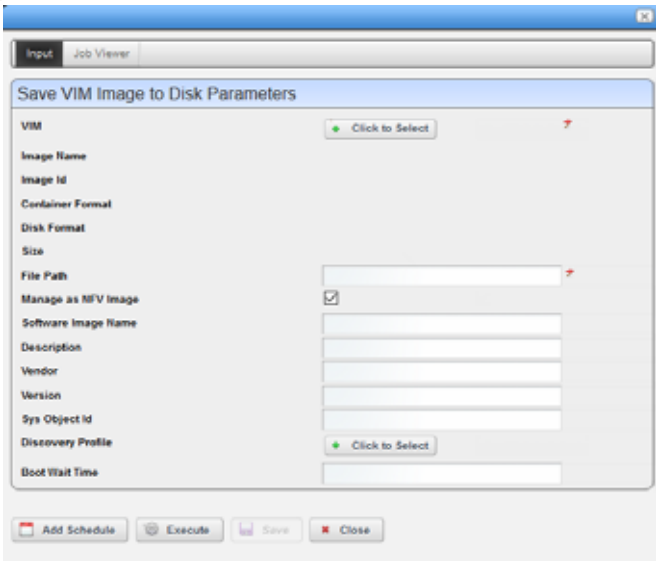



Figure A-7 Save VIM Image to Disk Parameters Window

The Save VIM Image to Disk Parameters window includes the following fields and options (Table A-9).

Table A-9 Save VIM Image to Disk Parameters Fields/Options

| Field/Options | Description |
|---|---|
| VIM | Select the VIM where the source software image is deployed. The Image Name list is populated based on the selected VIM. |
| Image Name | Select the appropriate image from the list. Based on the image selected, the following fields are populated:<br>• **Image Id** is a system-generated identifier.<br>• **Container Format** is the target format specified during image creation.<br>• **Disk Format** is the format in which the image was saved.<br>• **Size** is a value in gigabytes.<br>• **Software Image Name** is an editable field to specify a name identifier. |
| File Path | Enter the full path to where you want to save the image. |
| Manage as NFV Image | Select whether to manage this image as a network functions virtualized image. This option is selected by default. |
| Description | Enter more details about the VIM image.<br>For example, mention customizations made for your use and the original vendor-provided image from which you created the software image. |
| Vendor | Enter a name for the vendor that supplied the initial image used to create this software image descriptor. |
| Version | Enter the version for the vendor-supplied image. |
| Sys Object Id | The system's object ID number provided during creation. This ID is a universally unique identifier that tells what type of resource the device is. For example:<br>`1.3.6.1.4.1.3375.2.1.3.4.43` |
| Discovery Profile | Select a resource profile. |
| Boot Wait Time | Enter how many seconds to wait for an image to finish booting. The default is 0 (zero) if you do not enter a value. |
| Add Schedule | Set the following schedule parameters used to automatically execute the manage new software image from VIM task.<br>• Starting On sets the date and time to execute the task.<br>• Recurrence sets whether the task executes Only Once, Only at Startup, every X minutes (Increment), or Every *X* minutes, hours, days, weekdays, weekend days, weeks, months, years.<br>• Stopping On sets when the task stops executing. Valid values are Never, By Occurrence, or By Date and Time. |
| Execute | Runs the manage new software image from VIM task. |
| Save | Saves any changes and exits the window. |
| Close | Exits the current window. |

## VIM Images Portlet

Use the VIM Images portlet (Figure A-8) to view a list of VIMs to which software images are deployed and details about the images or share software images with others users on your current system.

From the VIM Images portlet, a system administrator maintains consistency across the VIM instances or network designer views the list of VIMs to test that the software image they deployed/undeployed was added to the list or removed from the list, respectively.

The VIM Images portlet also has a maximized view. Both views have the same pop-up menu options and by default the same columns. See Maximized Portlet on page 61 for a description of its standard options provided.

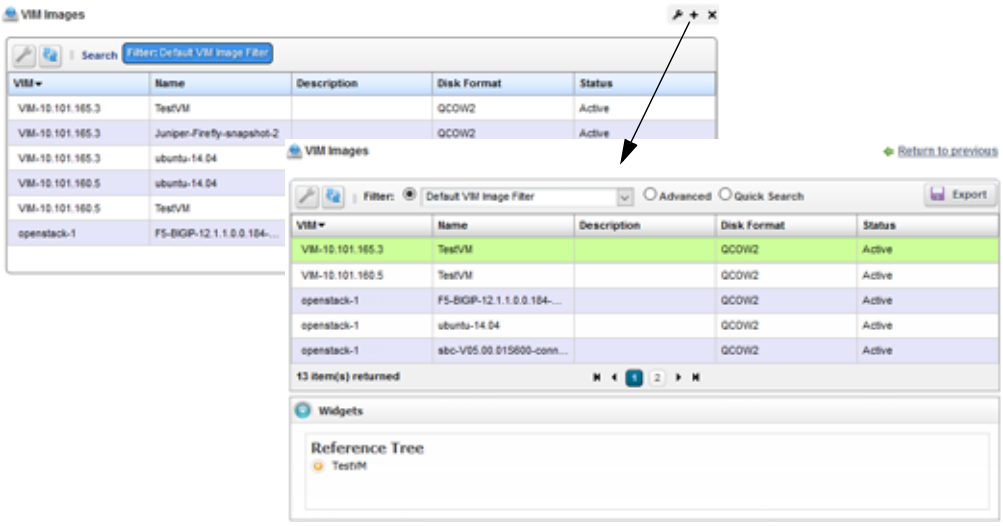



Figure A-8 VIM Images Portlet

### Pop-Up Menu

The VIM Images pop-up menu provides access to the following options. Right-click a row to access these options (Table A-10).

Table A-10 VIM Images Pop-Up Menu Options

| Menu Option | Description |
|---|---|
| Details | Displays details provided when you created the image and reference tree for the selected image. Click Return to previous to return to the Software Images portlet. |
| Share with User | Opens the Share with User window, where you select a user to which you want to share the selected asset and then enter a message. You can share with colleagues existing on your system.<br>**Note:** Sharing only handles one item so it uses the first one in the selection. |

## Columns

Other than the general navigation and configuration options, the VIM Images portlet includes the following columns/fields (Table A-11).

You can view the value for most of the hidden columns by right-clicking a row and selecting Details. The other option is to add the column by clicking the Settings tool, selecting the Columns tab, clicking Show for the appropriate columns, and the applying the change.

Table A-11 VIM Images Columns

| Column | Description |
|---|---|
| VIM | The name of the virtualized Infrastructure Manager that houses the image. |
| Name | The user-specified image identifier. |
| Description | Details that explain more about the image, such as its purpose.<br>For example, mentions customizations made for your use and the original vendor-provided image from which you created the software image. |
| Disk Format | The file format in which the image is to be created, such as QCOW2. Valid formats are AKI, AMI, ARI, ISO, QCOW2, RAW, UNRECOGNIZED, VDI, VHD, VMDK. |
| Status | The image status, such as Active. |
| Checksum | The data used to detect errors introduced during transmission or storage. By default, this field is not shown. |
| Container Format | The target format to which you deploy the image. For example, if the target is a Bare Metal OpenStack controller, the container format is BARE. Valid values are AKI, AMI, ARI, BARE, DOCKER, OVF, and UNRECOGNIZED. By default, this field is not shown. |
| Created | The system-generated timestamp for the image instance creation. By default, this field is not shown. |
| Image Id | The number assigned to the image when it was created. By default, this field is not shown. |
| Image URL | The local environment's file server or disk location where the snapshot image file (.qcow2) is stored, for example:<br>`ftp://caserverIP/vnf/images/juniper/firefly/Juniper-Firefly-shapshot-2.qcow2`<br>By default, this field is not shown. |
| Master Copy | An indicator that shows whether this is a master copy or not. By default, this field is not shown. |
| Min Disk | The minimum disk size required in gigabytes (such as 2GB) for the image to boot and operate. By default, this field is not shown. |
| Min Ram | The minimum RAM required in megabytes for the image to boot and operate, such as 2048. By default, this field is not shown. |
| Size | The binary image size in gigabytes. By default, this field is not shown. |
| UUID | A unique 128-bit, system generated value assigned to each image descriptor created. By default, this field is not shown. |
| Updated | The system-generated timestamp for the latest image changes. By default, this field is not shown. |
| VIM URL | The address used to access the VIM from your browser, for example:<br>`http://ipAddress:5000/v2.0`<br>By default, this field is not shown. |
| Version | The vendor-supplied image version. By default, this field is not shown. |

# Network Service Portlets

This section describes the following Network Service portlets:

- Network Service Descriptors Portlet
- Network Service Records Portlet
- Details Portlets

## Network Service Descriptors Portlet

Use the Network Service Descriptors portlets (Figure A-9) to maintain a list of network service descriptors. These descriptors are templates used to create network service records that provision virtualized network functions (VNFs) and physical network functions (PNFs) used to produce connectivity.

From the Network Service Descriptors portlet, a system administrator creates and maintains the descriptors, a network designer implements network services, and operators (if they have the proper permissions) view descriptors to gain knowledge.

The Network Service Descriptors portlet also provides a maximized view that includes additional filtering and the ability to export the table to a portable document format (PDF), Excel format, or CSV format.

Both views have the same pop-up menu options and by default the same columns. See Maximized Portlet on page 61 for a description of its standard options provided.

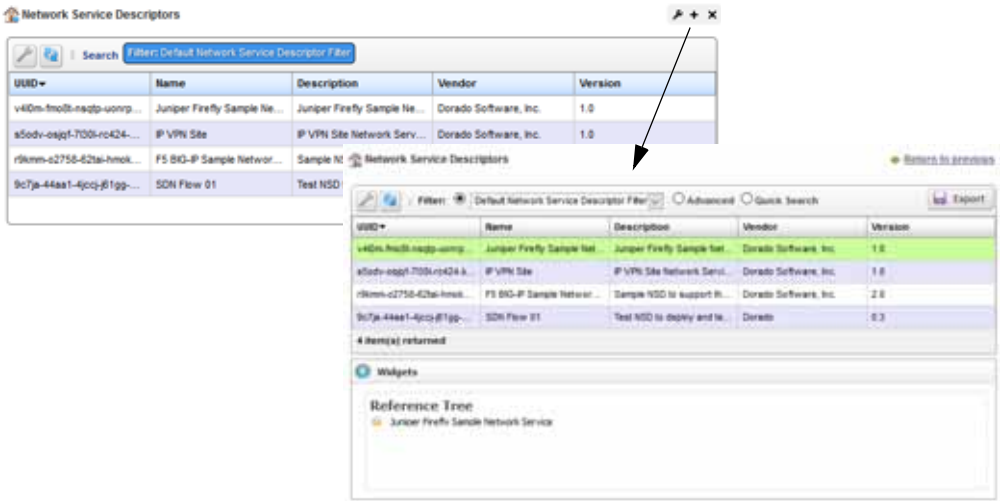



Figure A-9 Network Service Descriptors Portlets

### Pop-Up Menu

The Network Service Descriptors portlet provides access to the following pop-up menu options. Right-click a row to access these options (Table A-12).

Table A-12 Network Service Descriptor Pop-Up Menu Options (Sheet 1 of 2)

| Option | Description |
|---|---|
| New | Opens the Editing Network Service Descriptor window, where you define a new descriptor. |
| Edit | Opens the Editing Network Service Descriptor window, where you can change the description for the selected descriptor. |

Table A-12 Network Service Descriptor Pop-Up Menu Options (Sheet 2 of 2)

| Option | Description |
|---|---|
| Details | Displays the general details, such as identification information, version information, monitor parameters, a list of VNF forwarding descriptors, and a reference tree.<br>You can also view network functions details, connection details, service flavor details, alarms and event details, and history details by selecting the appropriate tab. |
| Visualize | Opens the Visualize portlet, where you define a multi-layered, customizable topology view of your network to help track network devices state. Refer to the *Redcell User Guide* for more details on configuring the Visualize portlet. |
| Stage | Opens the Stage new Network Service window, where you set the staging parameters and then execute the staging task. |
| Delete | Deletes the selected network service. |
| Audit Trail | Opens the Audit Trail Viewer window, which displays a list of actions that occurred for the selected descriptor. Select an audit record and the job record displays its status and any other job-related information. |
| Import/Export | Provides the following actions when available for the selected image:<br>• Import retrieves a file containing XML network service descriptions. Some imports can come from a URL.<br>• Export Selection exports the selected network service description to an XML file.<br>• Export All exports all network service descriptions to an XML file.<br>Click Download Export File to specify where to save the file.<br>The Import/Export option is useful as a backup or to share descriptors with other projects. |
| Share with User | Opens the Share with User window, where you select a user to which you want to share the selected asset and then enter a message. You can share with colleagues existing on your system.<br>**Note:** Sharing only handles one item so it uses the first one in the selection. |

## Columns

Other than the general navigation and configuration options, the Network Service Descriptors portlet includes the following columns (Table A-13).

You can view the value for most of the hidden columns by right-clicking a row and selecting Details. The other option is to add the column by clicking the Settings tool, selecting the Columns tab, clicking Show for the appropriate column, and the applying the change.

Table A-13 Network Service Descriptors Columns (Sheet 1 of 2)

| Column | Description |
|---|---|
| UUID | A unique 128-bit, system generated value assigned to each network service descriptor created. |
| Name | The user-provided name that identifies the network service descriptor. |
| Description | More details about the network service descriptor, such as its functionality and purpose. |
| Vendor | The name that identifies from which vendor image this descriptor was created. |
| Version | The vendor image version. |
| Created | The system-generated timestamp for the descriptor creation. By default, this field is not shown. |
| Enabled | An indicator that shows whether the descriptor is available (checkmark) or not (X). By default, this field is not shown. |

Table A-13 Network Service Descriptors Columns (Sheet 2 of 2)

| Column | Description |
|---|---|
| Monitoring Parameters | Displays any monitoring parameters provided when the descriptor was created. By default, this field is not shown. |
| Notifications | This feature is not currently implemented. By default, this field is not shown. |
| On Board Date | The system-generated timestamp when the service was instantiated. By default, this field is not shown. |
| Updated | The system-generated timestamp for the latest descriptor changes. By default, this field is not shown. |
| Version Date | The timestamp provided during descriptor creation. By default, this field is not shown. |

## Editing Network Service Descriptor Window

Use the Editing Network Service Descriptor window (Figure A-10) to define a new network service (NS) descriptor, modify an existing NS descriptor, or view an NS descriptor configuration.



**Note**

*Network Service descriptor creation and maintenance requires administrative permissions.*

The navigation tree allows you to select and view a network service descriptor's details for:

- VNF Dependencies lists any defined VNF dependencies.
- Data Values lists any defined data values.
- Lifecycle Events provides access to any defined list of events for the Heal, Shutdown, Configure, Scale in, Instantiate, Terminate, Scale out, and Diagnostics lifecycle events.
- Connection Points lists any defined connection points.
- Forwarding Graphics lists any defined forwarding graphs.
- Deployment Flavors lists the default or defined deployment flavors.

  There are deployment flavors available by default. However, your system administrator can create and maintain the deployment flavors available.
- Virtual Links lists any defined virtual links.
- PNF and VNF Descriptors lists any defined PND/VNF descriptors.

Select an item from the navigation tree and the available definitions are displayed in the general or extended details. If you have administrative permissions, you can add, modify, or deletes definitions.

Access this window by navigating to the Network Service Descriptors portlet, right-clicking a descriptor or the portlet, and then selecting Edit or New.

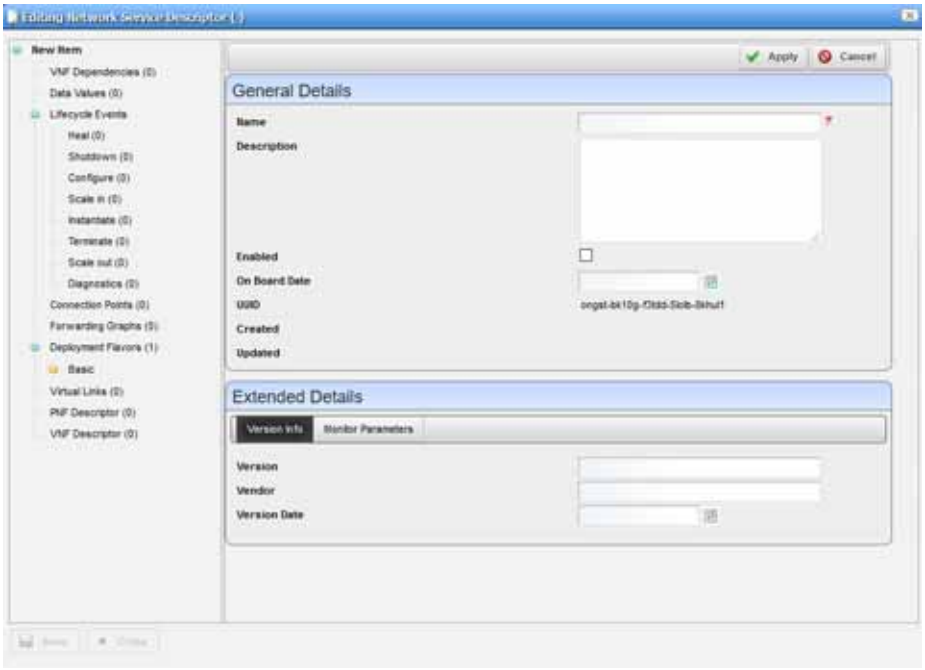



Figure A-10 Editing Network Service Descriptor Window

The Editing Network Service Descriptor window has the following editable fields and options (Table A-14) by default. The fields not listed are system-generated fields, such UUID, Created, and Updated.

Table A-14 Editing Network Service Descriptor Fields/Options

| Field/Option | Description |
|---|---|
| Name | Enter a name that identifies the network service descriptor. |
| Description | Provide more details about the network service descriptor purpose. |
| Enabled | Select whether the descriptor is available. Select this option to make the descriptor available. The default is no (not selected). |
| On Board Date | Select a date and time to instantiate the network service. Once instantiated, it displays the date of instantiation. |
| Version Info | Enter the network service descriptor version, vendor/provider, and date. |

## Stage new Network Service Window

Use the Stage new Network Service window (Figure A-11) to specify network service staging parameters.

Access this window by navigating to the Network Service Descriptors portlet, right-clicking a descriptor, and then selecting Stage.

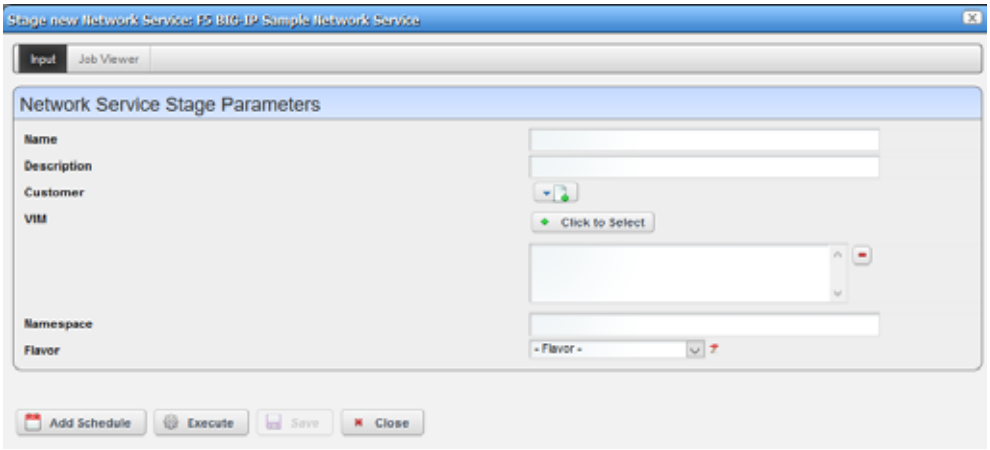



Figure A-11 Stage new Network Service Parameters Window

The Stage new Network Service window has the following fields and options (Table A-15).

Table A-15 Stage new Network Service Parameters Fields/Options

| Field/Option | Description |
|---|---|
| Name | Enter a name that identifies the service you want to stage. |
| Description | Enter a more detailed description of the service you want to stage. |
| Customer | Select the person, group, or organization that requested the service. If the customer is not listed, create it. |
| VIM | Select the Virtualized Infrastructure Manager to which you to instantiate the network service. |
| Namespace | Select the name for the project that houses the VIM. This list is populated when you select a deployment flavor. |
| Flavor | Select a target deployment model (flavor). Valid values vary depending on the service selected. Selecting a flavor populates the Namespace list. |
| Add Schedule | Set the following schedule parameters used to automatically execute the network service staging task.<br>• Starting On sets the date and time to execute the task.<br>• Recurrence sets whether the task executes Only Once, Only at Startup, every X minutes (Increment), or Every *X* minutes, hours, days, weekdays, weekend days, weeks, months, years.<br>• Stopping On sets when the task stops executing. Valid values are Never, By Occurrence, or By Date and Time. |
| Execute | Runs the network service stage task. |
| Save | Preserves your staging configuration. |
| Close | Exits the Stage new Network Service window. |

## Network Service Records Portlet

Use the Network Service Records portlets (Figure A-12) to maintain a list of records that provision virtualized network functions (VNFs) connectivity.

From the Network Services Records portlet, operators stage, deploy, and undeploy network services. A network designer would use this portlet to test a new or modified network service descriptor.

The Network Service Records portlet also provides a maximized view that includes additional filtering and the ability to export the table to a PDF, Excel, or CSV format.

Both views have the same pop-up menu options and by default the same columns. See Maximized Portlet on page 61 for a description of its standard options provided.

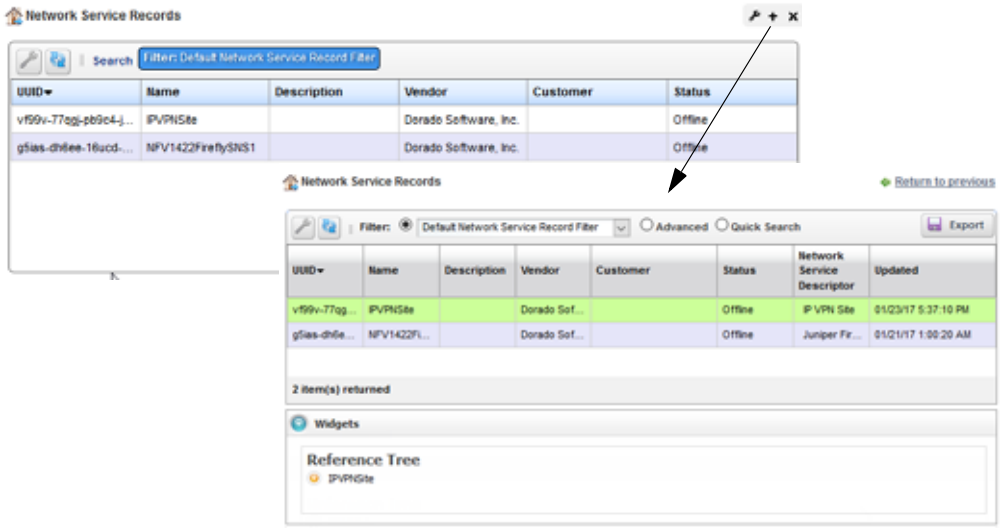



Figure A-12 Network Service Records Portlets

### Pop-Up Menu

The Network Service Records portlet provides access to the following pop-up menu options. Right-click a row to access these options (Table A-16).

Table A-16 Network Service Record Pop-Up Menu Options (Sheet 1 of 2)

| Option | Description |
|---|---|
| New | Opens the Stage NSR window, where you define a network service record. Select the service descriptor from which you want to create the record. |
| Edit | Opens the Editing Network Service Record window, where you view the selected service record definition or modify the:<br>• Record name, description, or monitoring parameters<br>• Connection point name or description<br>• Virtual links name, description, or QOS options |
| Details | Displays the general details, such as identification information, VNF health, and a reference tree showing related virtual link records and VNF records.<br>You can also view network functions details, connection details, alarms and event details, and history details by selecting the appropriate tab. |

Table A-16 Network Service Record Pop-Up Menu Options (Sheet 2 of 2)

| Option | Description |
|---|---|
| Visualize | Opens the Visualize portlet, where you define a multi-layered, customizable topology view of your network to help track network devices state. Refer to the *Redcell User Guide* for more details on configuring the Visualize portlet. |
| Deploy | Implements a network service in the specified VIM by establishing network connectivity, processing the VNF instantiate event, and re-syncing VIM resources. |
| Undeploy | Removes the network service from the specified VIM by processing the VNF terminate event and re-syncing VIM resources. |
| Deploy Virtual Links | Executes the Service Link Deploy task on the target NFV, processing the Instantiate event for each defined network service. |
| Discover/Resync | Executes the Network Service Discovery task to identify services in the network and performs a resync action to ensure services are up to date. |
| Scaling | Provides access to the following scaling options:<br>• **Scale In** opens the Network Service Sale In Parameters window, where you specify a deployment flavor name and increment number, and then execute the Scale-in event to reduce the service scope.<br>• **Scale Out** opens the Network Service Scale Out Parameters window, where you specify a deployment flavor name and increment number, and then execute the Scale-out event to increase the service scope. |
| Maintenance | Executes the following network service tasks on the target VNF:<br>• **Diagnostics** runs the Diagnostics event for the selected service and the VNF. The user defines these events.<br>• **Heal** runs the Heal event for the network service and the VNF.<br>• **Upgrade** runs the Upgrade event for the selected service and the VNF to ensure that the latest descriptor is used.<br>• **Disaster Recovery** runs the Disaster Recovery event for the selected service and the VNF. The user defines these events. |
| Delete | Removes the selected network service record from the system. |
| Shutdown | Gracefully shuts down the selected network service. |
| Audit Trail | Opens the Audit Trail Viewer window, which displays a list of actions that occurred for the selected record. Select an audit record and the job record displays its status and any other job-related information. |
| Share with User | Opens the Share with User window, where you select a user to which you want to share the selected asset and then enter a message. You can share with colleagues existing on your system.<br>**Note:** Sharing only handles one item so it uses the first one in the selection. |

## Columns

Other than the general navigation and configuration options, the Network Service Record portlet includes the following columns (Table A-17).

You can view the value for most of the hidden columns by right-clicking a row and selecting Details. The other option is to add the column by clicking the Settings tool, selecting the Columns tab, clicking Show for the appropriate column, and the applying the change.

Table A-17 Network Service Records Columns (Sheet 1 of 2)

| Column | Description |
|---|---|
| UUID | A unique 128-bit, system generated value assigned to each network service record created. |

Table A-17 Network Service Records Columns (Sheet 2 of 2)

| Column | Description |
|---|---|
| Name | A name that identifies the network service record. |
| Description | More details about the network service record, such as its functionality and purpose. |
| Vendor | The name for the vendor that created the record, such as Dorado Software. |
| Customer | The customer selected during record creation. |
| Status | The network service record's status, such as Offline, Normal, *etc.* |
| Active Operation | The current operation being performed on the network service. Because network service operations are long running, this lets you know when the network service is ready to receive another operation. By default, this field is not shown. |
| Alarm Severity | The alarm severity for each record, such as Critical, Major, Minor, Informational, Normal, Warning. By default, this field is not shown. |
| Alarm Suppression Description | A text description of alarm suppression. By default, this field is not shown. |
| Alarm Suppression Mode | An indicator that shows whether alarm suppression is on or off. By default, this field is not shown. |
| Created | The system-generated timestamp for the record creation. By default, this field is not shown. |
| Deployment Flavor | The deployment selected for each record, such as Basic, Standard Basic, *etc.* By default, this field is not shown. |
| Network Service Descriptor | The descriptor used to create the network service record. By default, shows only on the maximized view. |
| Operation Start Time | The time the active operation started. By default, this field is not shown. |
| Updated | The system-generated timestamp for the latest record modifications. Initially this date is the same as the Created date. By default, shows only on the maximized view. |
| Version | The network service version. By default, this field is not shown. |

## Stage NSR Window

Use the Stage NSR window (Figure A-13) to define and stage a network service record.

Access this window by navigating to the Network Service Records portlet, right-clicking the portlet, and the selecting New.

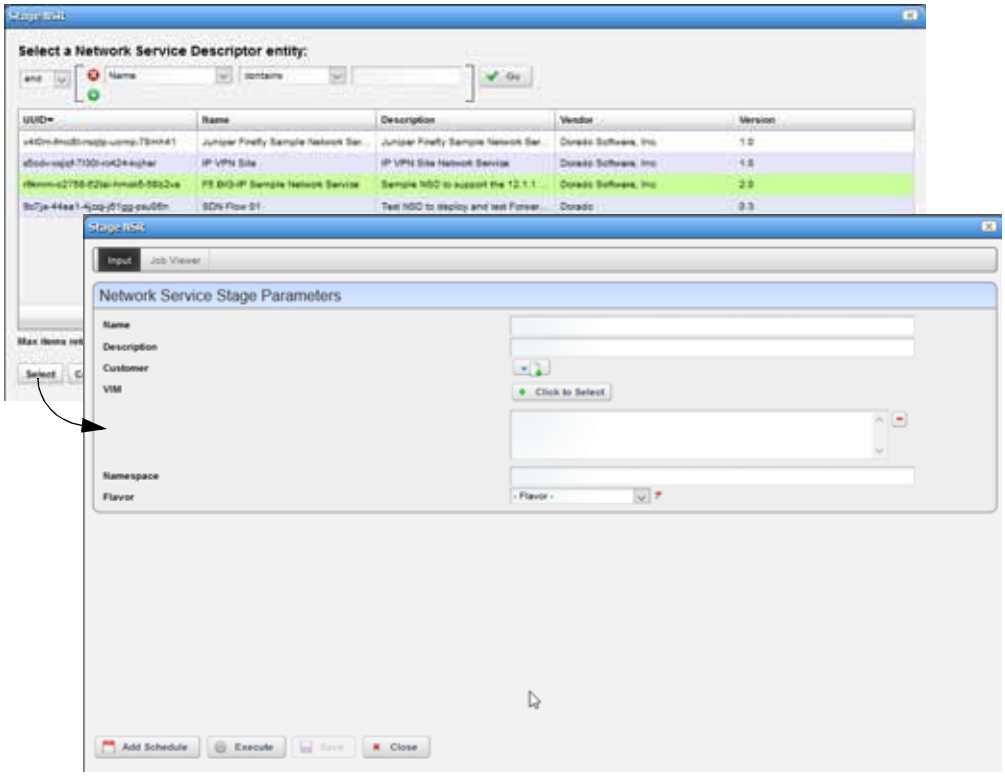



Figure A-13 Stage NSR Window

The Stage NSR window has the following fields and options (Table A-18).

Table A-18 Stage NSR Fields/Options (Sheet 1 of 2)

| Field/Option | Description |
|---|---|
| Conditional Search Parameters | Define conditional search criteria to find the appropriate descriptor. |
| Available Descriptors List | Select a descriptor from which to create a network service record and then click Select. The Network Service Stage Parameters input fields are displayed. |
| Name | Enter a name for the network service record you are creating. |
| Description | Enter a detailed description to understand the service function. |
| Customer | Select the customer requesting the service. If the customer is not on the list, add it. |
| VIM | Select the managed VIM to which you want to instantiate the network service. |
| Namespace | Select the name for the project that houses the VIM. This list is populated when you select a deployment flavor. |
| Flavor | Select a target deployment model (flavor). Valid values vary depending on the service selected. Selecting a flavor populates the Namespace list. |

Table A-18 Stage NSR Fields/Options (Sheet 2 of 2)

| Field/Option | Description |
|---|---|
| Add Schedule | Set the following schedule parameters used to automatically execute the network service record staging task.<br>• Starting On sets the date and time to execute the task.<br>• Recurrence sets whether the task executes Only Once, Only at Startup, every X minutes (Increment), or Every *X* minutes, hours, days, weekdays, weekend days, weeks, months, years.<br>• Stopping On sets when the task stops executing. Valid values are Never, By Occurrence, or By Date and Time. |
| Execute | Runs the network service stage task. |
| Save | Preserves your staging configuration. |
| Close | Exits the Stage new Network Service window. |

## Editing Network Service Record Window

Use the Editing Network Service Record window (Figure A-14) to view and maintain the service record details, such as record name, description, and monitoring parameters. You can also modify some other details, such as connection points, virtual links, VNF records, and so on.

Access this window by navigating to the Network Service Records portlet, right-clicking a record, and then selecting Edit.

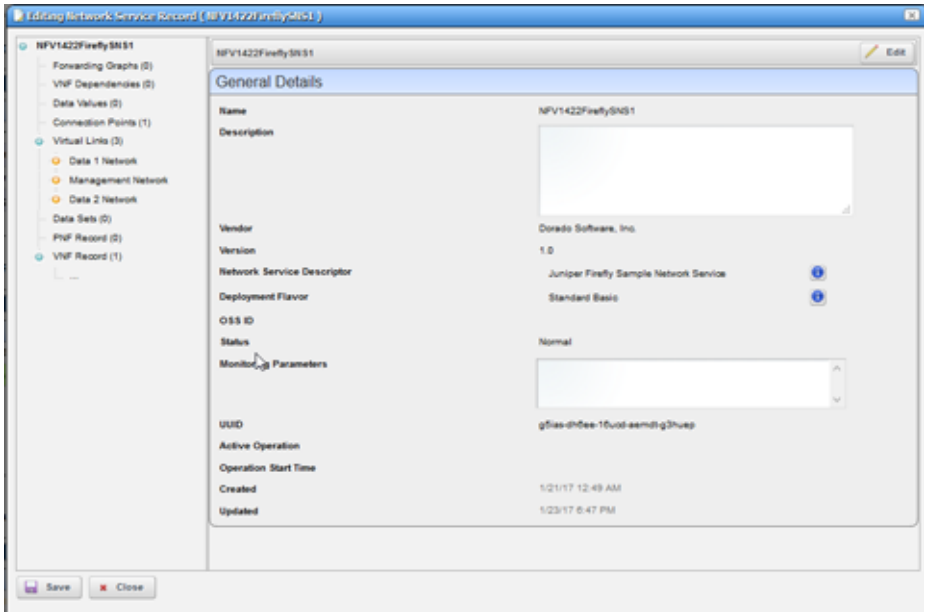



Figure A-14 Editing Network Service Record Window

The Editing Network Service Record window allows you to modify some fields for the following record elements (Table A-19).

Table A-19 Navigation Tree Elements

| Element | Description |
|---|---|
| Service Record | Modify the record name, description, and monitoring parameters by clicking the Edit button. |
| Forwarding Graphs | Modify a forwarding graph name and description by selecting Forwarding Graphs, clicking the Edit this entry icon, making your changes, and then clicking Apply. |
| VNF Dependencies | Modify a VNF dependency name and description by selecting VNF Dependencies, clicking the Edit this entry icon, making your changes, and then clicking Apply. |
| Data Values | Modify a data value name and description by selecting Data Values, clicking the Edit this entry icon, making your changes, and then clicking Apply. |
| Connection Points | Modify a connection point name and description by selecting Connection Points, clicking the Edit this entry icon, making your changes, and then clicking Apply. |
| Virtual Links | Modify a virtual link name, description, and QOS options by selecting Virtual Links, clicking the Edit this entry icon, making your changes, and then clicking Apply. |
| Data Sets | Modify a data set name and description by selecting Data Sets, clicking the Edit this entry icon, making your changes, and then clicking Apply. |
| PFN Record | Cannot modify this record element. |
| VNF Record | Cannot modify this record element. |

## Details Portlets

The Details portlets display the general details for the selected network service descriptor or record. Except where noted, the general details are the same for the network service descriptor and network service record.

You can also view network functions details, connection details, service flavor details (descriptor only), alarms and event details, and history details related to the selected Network Service descriptor or record.

### General Details

Use the Network Service General details (Figure A-15) to view identification and version information, and a reference tree of items related to the selected network service descriptor or record. You can also view:

- Any monitoring parameter definitions and related VNF forwarding graph descriptors for the selected network service descriptor
- Service health for the selected network service record

Access this information by navigating to the appropriate Network Service portlet, right-clicking a row, and then selecting Details.

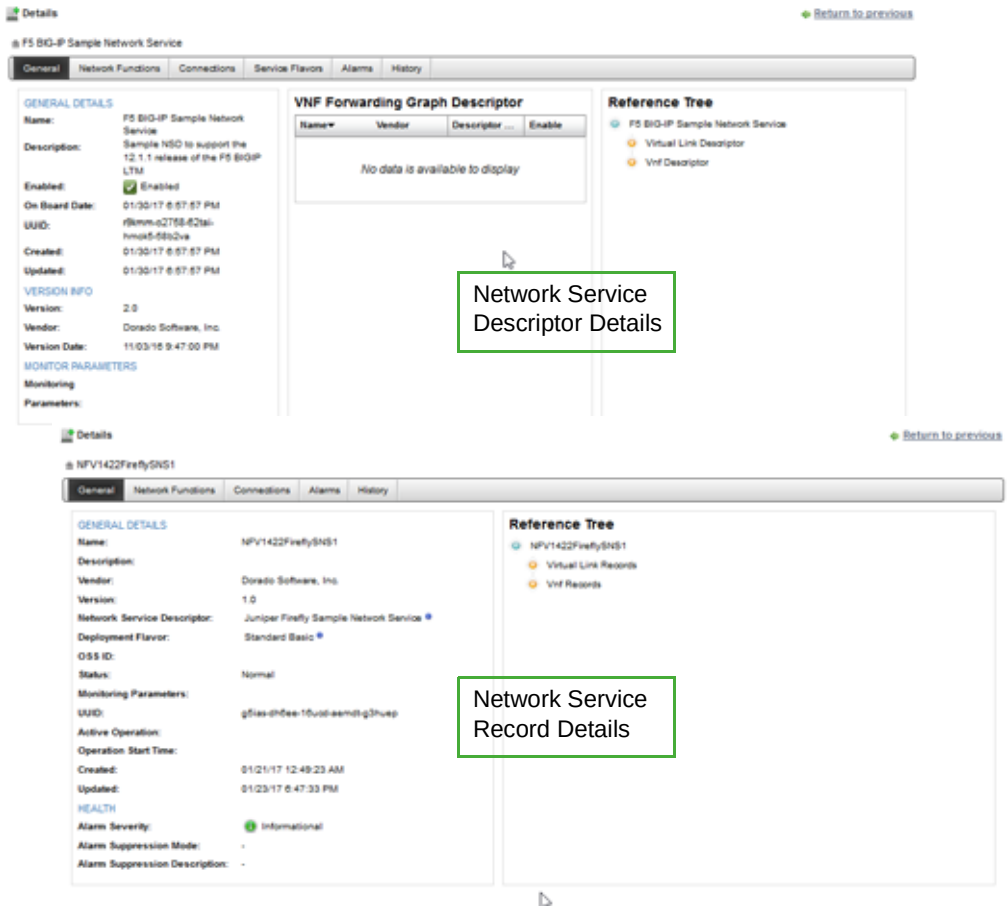



Figure A-15 Network Service General Details Portlet

## Network Functions Details

Use the Network Functions details (Figure A-16) to view the related VNF record, PNF record, and dependency details.

You can perform the same actions as those available from the Virtual Network Function Descriptors Portlet on page 100 (New, edit, Details, Discover Vnfd, Branch, Stage, Delete, Audit Trail, Import/Export, Share with User).

Access this information by navigating to the appropriate Network Service portlet, right-clicking a row, selecting Details, and then clicking the Network Functions tab.

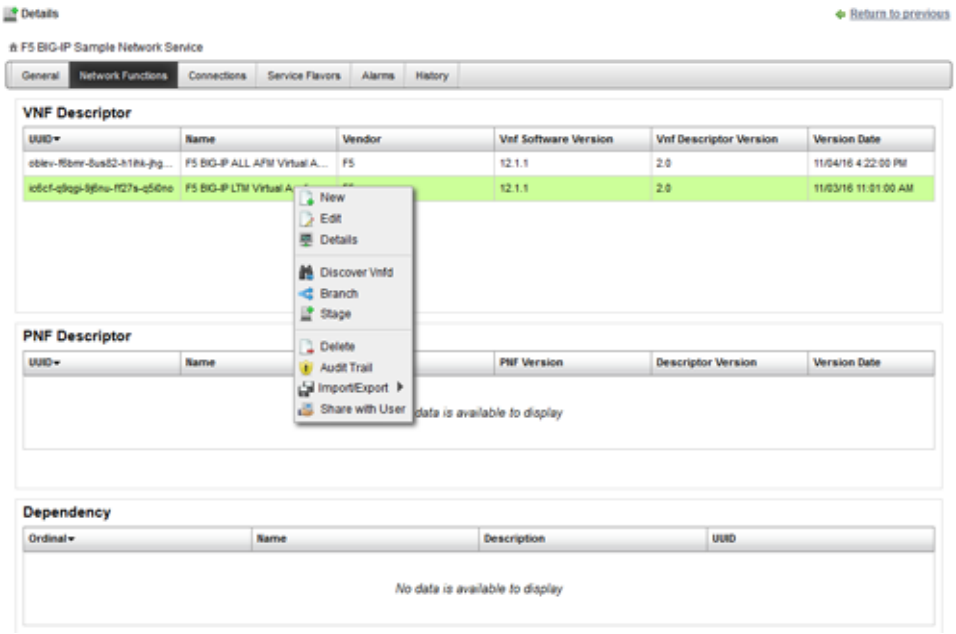



Figure A-16 Network Functions Details

## Connection Details

Use the Network Service Connection details (Figure A-17) to view more granular details about the connection point and virtual link descriptor/record. This information is useful when trying to troubleshoot connectivity issues.

You have the option to drill down to more details or share these details with another user.

If the Connections details are for a selected network service record, you can edit or delete a VL record.

Access this information by navigating to the appropriate Network Service portlet, right-clicking a row, selecting Details, and then clicking the Connections tab.

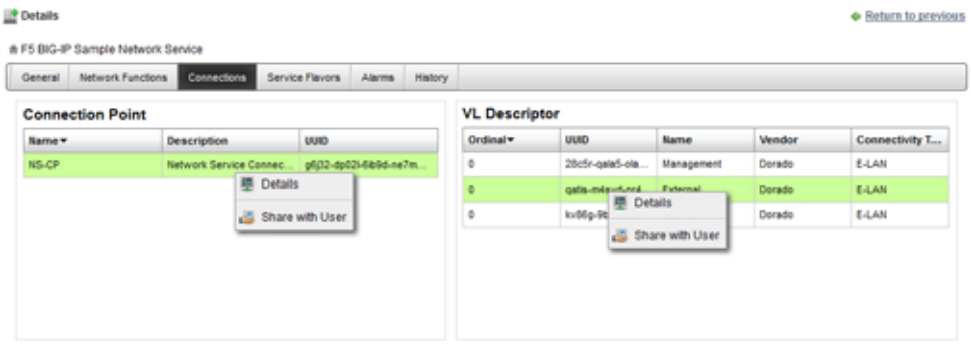



Figure A-17 Network Service Connection Details

## Service Flavor Details

Use the Network Service Flavors details (Figure A-18) to view a list of deployment flavors for the selected network service descriptor. These deployment flavors are useful when there is a need to scale in/out the number of instances to decrease/ increase network service capacity, respectively.

You have the option to share a service flavor with another user on your system.

Access this information by navigating to the Network Service Descriptors portlet, right-clicking a row, selecting Details, and then clicking the Service Flavors tab.

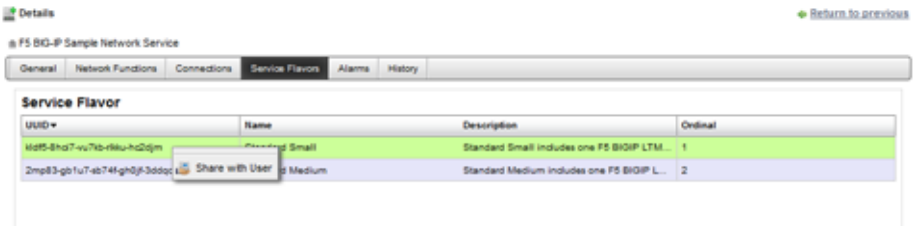



Figure A-18 Network Service Flavors Details

## Alarms and Event Details

Use the Network Service Alarms details (Figure A-19) to monitor and manage alarms and view event history for the selected service.

You can perform the same actions on an alarm or event history from this location as you can from the Alarms and Event History portlets, respectively. Refer to the *Redcell User Guide* for details about the Alarms and Event History portlets.

Access this information by navigating to the appropriate Network Service portlet, right-clicking a row, selecting Details, and then clicking the Alarms tab.

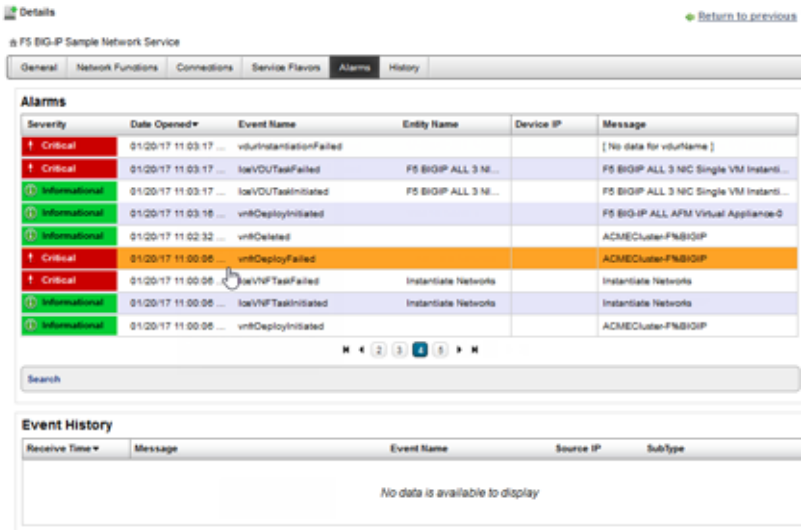



Figure A-19 Network Service Alarms Details

## History Details

Use the Network Service History details (Figure A-20) to view a list of actions (audit trail) performed on the selected service.

Access this information by navigating to the appropriate Network Service portlet, right-clicking a row, selecting Details, and then clicking the History tab.




Figure A-20 Network Service History Details

# Physical Network Function Portlets

This section describes the following Physical Network Function (PNF) portlets:

- Physical Network Function Descriptors Portlet
- Physical Network Function Records Portlet
- Detail Portlets

## Physical Network Function Descriptors Portlet

Use the Physical Network Function Descriptors portlet (Figure A-21) to view, create, and maintain PNF descriptors. The PNF descriptors are used to define network connections between a PNF and other network instances, such as network service, virtualized network functions, virtual links, and so on.

From the Physical Network Functions Descriptors portlet, a system administrator creates and maintains the PNF descriptors, a network designer PNFs, and operators (if they have the proper permissions) view descriptors to gain knowledge.

The Physical Network Function Descriptors portlet also provides a maximized view that includes additional filtering and the ability to export the table to a portable document format (PDF), Excel format, or CSV format.

Both views have the same pop-up menu options and by default the same columns. See Maximized Portlet on page 61 for a description of its standard options provided.

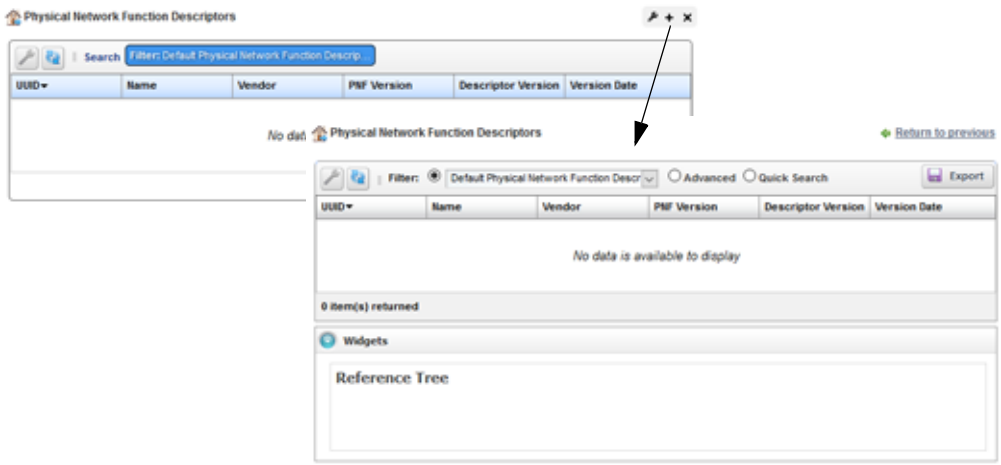



Figure A-21 Physical Network Function Descriptors Portlet

### Pop-Up Menu

The Physical Network Function Descriptors portlet provides access to the following pop-up menu options. Right-click a row to access these options (Table A-20).

Table A-20 Physical Network Function Descriptors Pop-Up Menu Options (Sheet 1 of 2)

| Option | Description |
|---|---|
| New | Opens the Editing Physical Network Function Descriptor window, where you create a physical network function descriptor. |
| Edit | Opens the Editing Physical Network Function Descriptor window, where you modify a physical network function descriptor. |

Table A-20 Physical Network Function Descriptors Pop-Up Menu Options (Sheet 2 of 2)

| Option | Description |
|---|---|
| Details | Displays the general details, such as identification information, version information, connection points, and a reference tree.<br>You can also view alarms and event details and history details by selecting the appropriate tab. |
| Delete | Removes the selected PNF descriptor from the system. A confirmation message is displayed giving you a chance to change your mind. |
| Audit Trail | Opens the Audit Trail Viewer window, which displays a list of actions that occurred for the selected PNF. Select an audit record and the job record displays its status and any other job-related information. |
| Import/Export | Provides the following actions when available for the selected image:<br>• Import retrieves a file containing XML PNF descriptions. Some imports can come from a URL.<br>• Export Selection exports the selected PNF description to an XML file.<br>• Export All exports all PNF descriptions to an XML file.<br>Click Download Export File to specify where to save the file.<br>The Import/Export option is useful as a backup or to share descriptors with other projects. |
| Share with User | Opens the Share with User window, where you select a user to which you want to share the selected asset and then enter a message. You can share with colleagues existing on your system.<br>**Note:** Sharing only handles one item so it uses the first one in the selection. |

## Columns

Other than the general navigation and configuration options, the Physical Network Function Descriptors portlet includes the following columns (Table A-21).

You can view the value for most of the hidden columns by right-clicking a row and selecting Details. The other option is to add the column by clicking the Settings tool, selecting the Columns tab, clicking Show for the appropriate column, and the applying the change.

Table A-21 Physical Network Function Descriptors Columns (Sheet 1 of 2)

| Column | Description |
|---|---|
| UUID | A unique 128-bit, system generated value assigned to each PNF descriptor created. |
| Name | The text that identifies each PNF descriptor. |
| Vendor | The vendor generating this PNF descriptor. |
| Pnf Version | The version for the PNF that this PNF descriptor is describing. Provided by the network service engineer creating the descriptor. |
| Descriptor Version | The version of the PNF descriptor. |
| Version Date | The timestamp for the PNF descriptor. |
| Created | The system-generated timestamp in which the PNF descriptor was created. By default, this field is not shown. |
| Description | A detailed description of the PNF's purpose. By default, this field is not shown. |
| Enabled | An indicator that shows whether the PNF descriptor is available (checkmark) or not (X). By default, this field is not shown. |
| On Board Date | The user-specified timestamp in which to instantiate the PNF descriptor. By default, this field is not shown. |

Table A-21 Physical Network Function Descriptors Columns (Sheet 2 of 2)

| Column | Description |
|---|---|
| Update | The system-generated timestamp that the PNF descriptor was last modified. By default, this field is not shown. |

## Editing Physical Network Function Descriptor Window

Use the Editing Physical Network Function Descriptor window (Figure A-22) to create and modify PNF descriptors. This is where you define network connections between a PNF and other network instances, such as network service, virtualized network functions, virtual links, and so on.

Access this window by navigating to the Physical Network Function Descriptors portlet, right-clicking a row, and then selecting Edit.

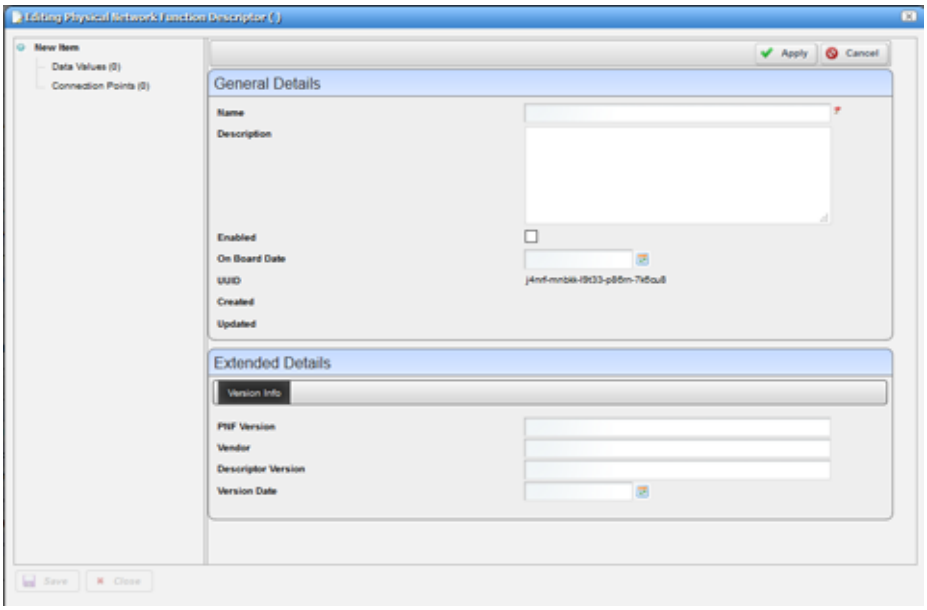



Figure A-22 Editing Physical Network Function Descriptor Window

The Editing Physical Network Function Descriptor window has the following input fields and options (Table A-22). The fields not listed are system-generated fields, such UUID, Created, and Updated.

Table A-22 Editing Physical Network Function Descriptor Fields/Options (Sheet 1 of 2)

| Field/Option | Description |
|---|---|
| Name | Enter a name for the PNF descriptor you are creating. If you are modifying the PNF descriptor, you can change the name.<br>This field is required. |
| Description | Enter an optional description that provides more details about the PNF. |
| Enable | Indicates whether the device is available for use.<br>If you select this option during PNF descriptor creation, you must define connection points. Otherwise, an error is displayed when save the descriptor. |
| On Board Date | Enter the date and time that you want to instantiate the PNF descriptor. |
| Vendor Info | Enter the PNF version, vendor, descriptor version, and the version date. |

Table A-22 Editing Physical Network Function Descriptor Fields/Options (Sheet 2 of 2)

| Field/Option | Description |
|---|---|
| Data Values | Define one or more data value records. Enter a name, description, data type, and value. The name and data type are required fields. The system generates the UUID, Created, and Updated information.<br>Data values are typically captured at deploy time. They are either entered directly by the user or extracted from the resulting deployed VDU. The types of values is completely dependent upon the network service. For example:<br>• A VNF may need to know what the gateway IP address is for the service so that it can properly configure the service.<br>• A value is extracted from the OpenStack system is the heat stack ID, that ID is then used at a later date when undeploying the service. |
| Connection Points | Define one or more connection points between the PNF and other network instances, such as network service, virtualized network functions, virtual links, *etc*.<br>The name and connection type are required. Valid connection types are EthernetPort, IPVPN, OTHER, PNIC, PPORT, VNIC (virtual network interface controller), VPORT, VPORTLAN, VPORTWAN. |

## Physical Network Function Records Portlet

Use the Physical Network Function Records portlet (Figure A-23) to view, create, and maintain PNF records.

From the Physical Network Function Records portlet, operators creates PNF records that specify network connectivity between a physical device and virtual network instances. An administrator or network designer would use this portlet to test a new or modified descriptor or test an implemented PNF.

The Physical Network Function Records portlet also provides a maximized view that includes additional filtering and the ability to export the table to a portable document format (PDF), Excel format, or CSV format.

Both views have the same pop-up menu options and by default the same columns. See Maximized Portlet on page 61 for a description of its standard options provided.

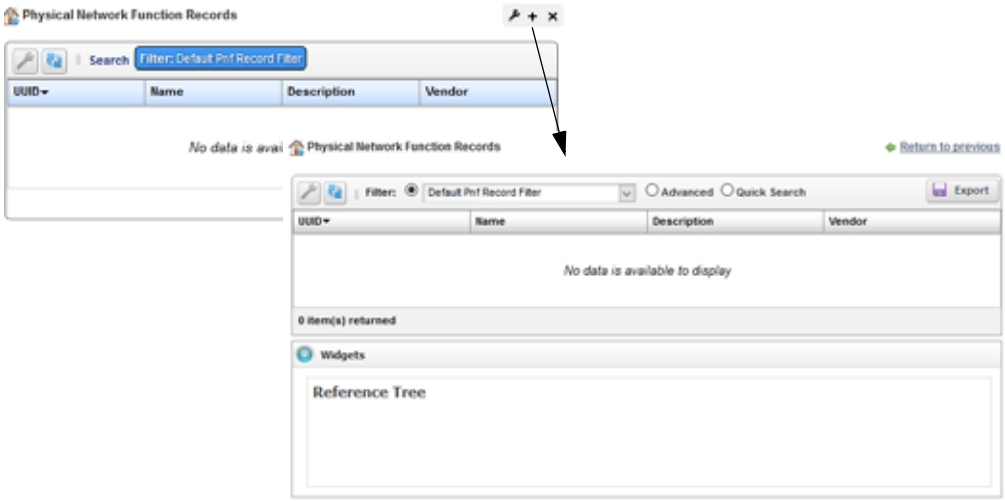



Figure A-23 Physical Network Function Records Portlet

## Pop-Up Menu

The Physical Network Function Records portlet provides access to the following pop-up menu options. Right-click a row to access these options (Table A-23).

Table A-23 Physical Network Function Records Pop-Up Menu Options

| Option | Description |
|---|---|
| New | Opens the Editing Pnf Record window, where you create a PNF record. |
| Edit | Opens the Editing Pnf Record window, where you modify a PNF record name or description. |
| Details | Displays the general details, such as identification information, version information, connection points, and a reference tree.<br>You can also view alarms and event details and history details by selecting the appropriate tab. |
| Delete | Removes the selected PNF descriptor from the system. |
| Share with User | Opens the Share with User window, where you select a user to which you want to share the selected asset and then enter a message. You can share with colleagues existing on your system.<br>**Note:** Sharing only handles one item so it uses the first one in the selection |

## Columns

Other than the general navigation and configuration options, the Physical Network Function Records portlet includes the following columns (Table A-24).

You can view the value for most of the hidden columns by right-clicking a row and selecting Details. The other option is to add the column by clicking the Settings tool, selecting the Columns tab, clicking Show for the appropriate column, and the applying the change.

Table A-24 Physical Network Function Records Columns (Sheet 1 of 2)

| Column | Description |
|---|---|
| UUID | A unique 128-bit, system generated value assigned to each PNF record created. |
| Name | The text that identifies the PNF record. |
| Description | Details that provide more information about the PNF record, such as it function and purpose. |
| Vendor | The vendor that generated this PNF descriptor. |
| Alarm Severity | The alarm severity for each record, such as Critical, Major, Minor, Informational, Normal, Warning. By default, this field is not shown. |
| Alarm Suppression Description | A text description of alarm suppression. By default, this field is not shown. |
| Alarm Suppression Mode | An indicator that shows whether alarm suppression is on or off. By default, this field is not shown. |
| Created | The timestamp that the PNF record was created. By default, this field is not shown. |
| DescriptionId | The identifier for the PNF descriptor from which the PNF record was created. By default, this field is not shown. |
| Equipment | A reference to the physical resource that the network service is using. By default, this field is not shown. |
| IP Address | The resource (equipment) IP address. By default, this field is not shown. |
| Network Service | The reference to the network service record in which the PNF is participating. By default, this field is not shown. |
| OAM Reference | This is not currently implemented. By default, this field is not shown. |

Table A-24 Physical Network Function Records Columns (Sheet 2 of 2)

| Column | Description |
|---|---|
| Updated | The timestamp for the latest PNF record changes. By default, this field is not shown. |
| Version | The PNF descriptor version from which the PNF record was created. By default, this field is not shown. |

## Editing Pnf Record Window

Use the Editing Pnf Record window (Figure A-24) to create and modify PNF records. This is where you define network connections between a physical device and other virtual network instances, such as network service, virtualized network functions, virtual links, and so on.

Access this window by navigating to the Physical Network Function Records portlet, right-clicking a row, and then selecting New or Edit.

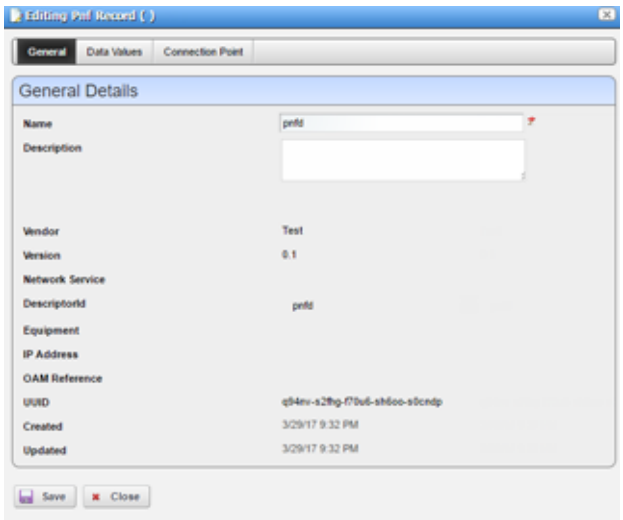



Figure A-24 Editing Pnf Record Window

The Editing Physical Network Function Descriptor window has the following input fields and options (Table A-22). The fields not listed are system-generated fields, such UUID, Created, and Updated.

Table A-25 Editing Physical Network Function Descriptor Fields/Options (Sheet 1 of 2)

| Field/Option | Description |
|---|---|
| Name | Enter a name for the PNF record you are creating. If you are modifying the PNF descriptor, you can change the name.<br>This field is required. |
| Description | Enter an optional description that provides more details about the PNF. |
| Vendor | Enter the vendor that generated this PNF descriptor. |
| Version | Enter the PNF descriptor version from which the PNF record was created. |
| Network Service | Enter a reference to the network service record in which the PNF is participating. |
| DescriptorId | Enter an identifier for the PNF descriptor from which the PNF record was created. |
| Equipment | Enter a reference to the physical resource that the network service is using. |
| IP Address | Enter the resource (equipment) IP address. |
| OAM Reference | This is not currently implemented. |

Table A-25 Editing Physical Network Function Descriptor Fields/Options (Sheet 2 of 2)

| Field/Option | Description |
|---|---|
| Data Values | Define one or more data value records. Enter a name, description, data type, and value. The name and data type are required fields. The system generates the UUID, Created, and Updated information.<br>Data values are typically captured at deploy time. They are either entered directly by the user or extracted from the resulting deployed VDU. The types of values is completely dependent upon the network service. For example:<br>• A VNF may need to know what the gateway IP address is for the service so that it can properly configure the service.<br>• A value is extracted from the OpenStack system is the heat stack ID, that ID is then used at a later date when undeploying the service. |
| Connection Points | Define one or more connection points between the PNF and other network instances, such as network service, virtualized network functions, virtual links, *etc*.<br>The name and connection type are required. Valid connection types are EthernetPort, IPVPN, OTHER, PNIC, PPORT, VNIC (virtual network interface controller), VPORT, VPORTLAN, VPORTWAN. |

## Detail Portlets

The Details portlets display the general details for the selected network descriptor or record. Except where noted, the general details are the same for the network service descriptor and network service record.

You can also view alarms and event details and history details related to the selected Physical Network Function descriptor or record.

### General Details

Use the Physical Network Function (PNF) General details (Figure A-25) to view identification and version information, connection points, and a reference tree of items related to the selected physical network function descriptor or record.

Access this information by navigating to the appropriate PNF portlet, right-clicking a row, and then selecting Details.

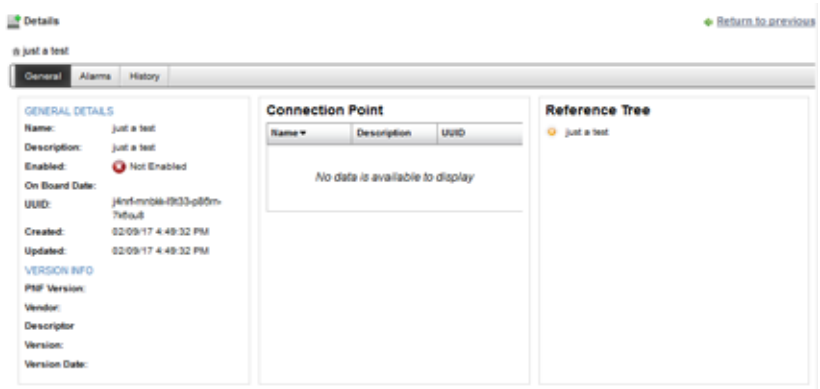



Figure A-25 Physical Network Function General Details

### Alarms and Event Details

Use the Physical Network Function (PNF) Alarms details (Figure A-26) to monitor and manage alarms and view event history for the selected PNF descriptor or record.

You can perform the same actions on an alarm or event history from this location as you can from the Alarms and Event History portlets, respectively. Refer to the *Redcell User Guide* for details about the Alarms and Event History portlets.

Access this information by navigating to the appropriate PNF portlet, right-clicking a row, selecting Details, and then clicking the Alarms tab.

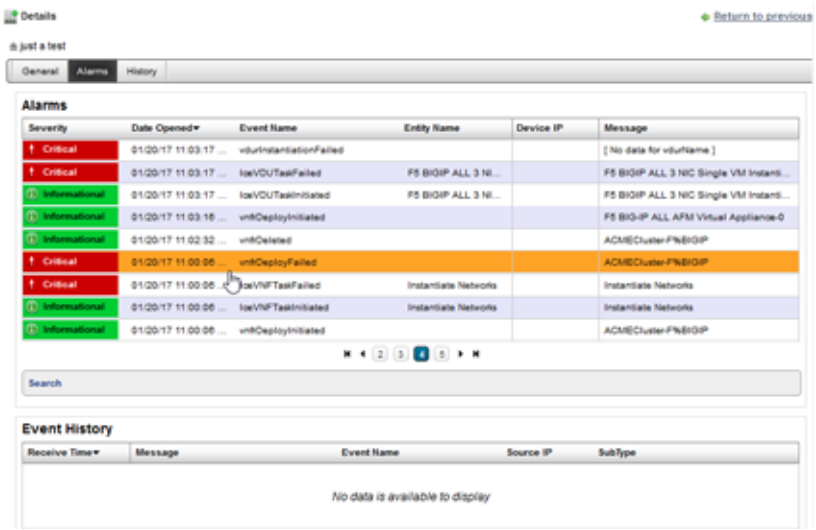



Figure A-26 Physical Network Function Alarms Details Portlet

## History Details

Use the Physical Network Function (PNF) History details (Figure A-27) to view a list of actions (audit trail) performed on the selected PNF descriptor or record.

For the selected action, you can view the job, aging policy, delete the action, view as a portable document format (PDF), or share this action with other users on your system.

Access this information by navigating to the appropriate Physical Network Function portlet, right-clicking a row, selecting Details, and then clicking the History tab.

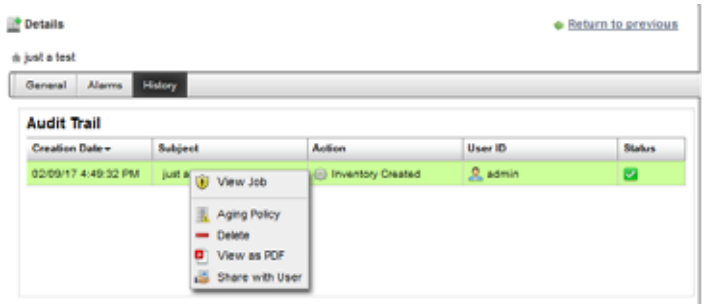



Figure A-27 Physical Network Function History Portlet

# Virtualized Network Function Portlets

This section describes the following Virtualized Network Function (VNF) portlets:

- Virtual Network Function Descriptors Portlet
- Virtual Network Function Records Portlet
- Details Portlets

## Virtual Network Function Descriptors Portlet

Use the Virtual Network Function Descriptors portlet (Figure A-28) to maintain a list of virtualized network function (VNF) descriptors. These descriptors are templates used to create VNF records.

From the Virtual Network Function Descriptors portlet, a system administrator creates and maintains the descriptors, a network designer implements VNFs, and operators (if they have the proper permissions) view descriptors to gain knowledge.

The Virtual Network Function Descriptors portlet also provides a maximized view that includes additional filtering and the ability to export the table to a portable document format (PDF), Excel format, or CSV format.

Both views have the same pop-up menu options and by default the same columns. See Maximized Portlet on page 61 for a description of its standard options provided.

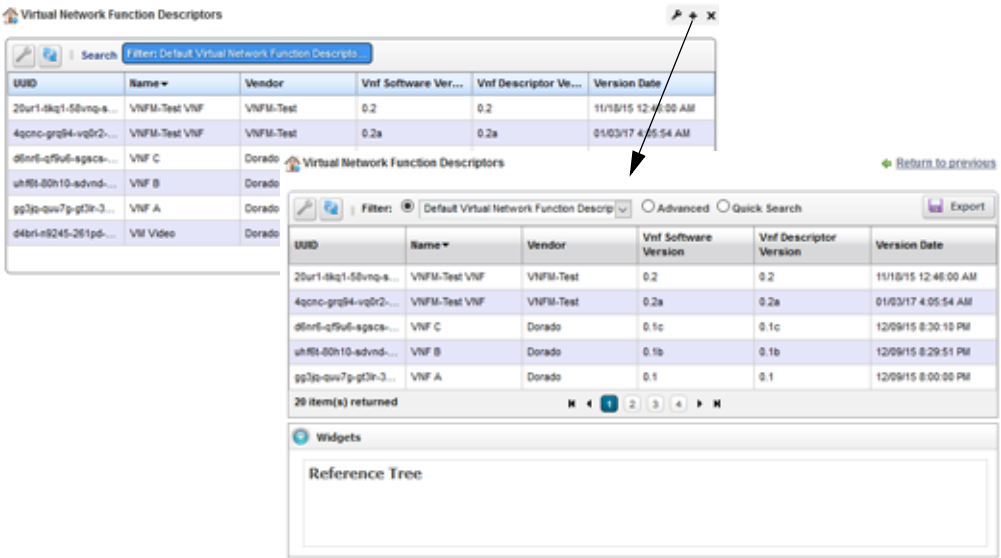



Figure A-28 Virtual Network Function Descriptors Portlet

## Pop-Up Menu

The Virtual Network Function Descriptors portlet provides access to the following pop-up menu options. Right-click a row to access these options (Table A-26).

Table A-26 Virtual Network Function Descriptors Pop-Up Menu Options

| Option | Description |
|---|---|
| New | Opens the Editing Virtual Network Function Descriptor window, where you define a VNF descriptor and any related data values, lifecycle events, deployment flavors, connection points, VDU dependencies, virtual links, and VDUs. |
| Edit | Opens the Editing Virtual Network Function Descriptor window, where you modify a VNF descriptor and any related data values, lifecycle events, deployment flavors, connection points, VDU dependencies, virtual links, and VDUs. |
| Details | Displays the general details, such as identification information, version information, monitor parameters, and a reference tree.<br>You can also view VDU information, deployment flavor details, connections details, alarms and event details, and history details by selecting the appropriate tab. |
| Discover Vnfd | Opens the Discover VNF Descriptor window, where you select a target VIM on which to create the VNF descriptor, create the VNF descriptor from OpenStack artifacts parameters, and then execute the Create Vnf Descriptor from OpenStack Artifacts task. |
| Branch | Opens the Branch VNF Descriptor window, where you execute the Vnf Descriptor Branch to new version task or schedule the task to run at a later time.<br>Executing this task ensures that you have the latest descriptor. |
| Stage | Opens the Stage new VNF Record window, where you set staging parameters and then run the VNF stage tasks or schedule them to run at a later time. If the staging tasks run successfully, you can then deploy the VNF. |
| Delete | Removes the selected VNF descriptor from the system. |
| Audit Trail | Opens the Audit Trail Viewer window, which displays a list of actions that occurred for the selected VNF. Select an audit record and the job record displays its status and any other job-related information. |
| Import/Export | Provides the following actions when available for the selected image:<br>• Import retrieves a file containing XML VNF descriptions. Some imports can come from a URL.<br>• Export Selection exports the selected VNF description to an XML file.<br>• Export All exports all VNF descriptions to an XML file.<br>Click Download Export File to specify where to save the file.<br>The Import/Export option is useful as a backup or to share descriptors with other projects. |
| Share with User | Opens the Share with User window, where you select a user to which you want to share the selected asset and then enter a message. You can share with colleagues existing on your system.<br>**Note:** Sharing only handles one item so it uses the first one in the selection. |

## Columns

Other than the general navigation and configuration options, the Virtual Network Function Descriptors portlet includes the following columns (Table A-27).

You can view the value for most of the hidden columns by right-clicking a row and selecting Details. The other option is to add the column by clicking the Settings tool, selecting the Columns tab, clicking Show for the appropriate column, and the applying the change.

Table A-27 Virtual Network Function Descriptors Columns

| Column | Description |
|---|---|
| UUID | A unique 128-bit, system generated value assigned to each VNF descriptor created. |
| Name | The user-entered name that identifies the VNF descriptor. |
| Vendor | The vendor VNF used to generate this VNF descriptor, such as F5, Cisco, *etc.* |
| Vnf Software Version | The version of VNF software used to generate this VNF. |
| Vnf Descriptor Version | The VNF descriptor version. |
| Version Date | The VNF descriptor timestamp. |
| Auto-configure | An indicator that shows whether configuration tasks are queued (checkmark) once the instantiation completes or not (X). By default, this field not shown. |
| Created | The system-generated timestamp for the description creation. By default, this field is not shown. |
| Description | The optional detailed description provided during descriptor creation. By default, this field is not shown. |
| Enabled | An indicator that shows whether the VNF descriptor is available (checkmark) or not (X). By default, this field is not shown. |
| On Board Date | The timestamp for the descriptor onboarding. By default, this field is not shown. |
| Parent Version | The name of the descriptor from which the new descriptor was branched. By default, this field is not shown. |
| Stand-alone | A indicator that shows whether the VNF descriptor deploys without (checkmark) or with (X) a network service. By default, this field is not shown. |
| Updated | The system-generated timestamp for the latest descriptor changes. By default, this field is not shown. |

## Editing Virtual Network Function Descriptor Window

Use the Editing Virtual Network Function (VNF) Descriptor window (Figure A-29) to view, define, or modify a VNF descriptor and any of the following related items listed in the navigation tree:

- Data Values lists any defined data values.
- Lifecycle Events provides access to any defined list of events for the Heal, Shutdown, Configure, Scale in, Instantiate, Terminate, Scale out, and Diagnostics lifecycle events.
- Deployment Flavors lists the default or defined deployment flavors.

  There are deployment flavors available by default. However, your system administrator can create and maintain the deployment flavors available.
- Connection Points lists any defined connection points.
- VDU (virtualization deployment unit) Dependencies lists any defined VDU dependencies.
- Virtual Links lists any defined virtual links.
- VDUs lists any defined VDU descriptors.

Select an item from the navigation tree and the available definitions are displayed in the general or extended details. If you have administrative permissions, you can add, modify, or delete definitions.

Access this window by navigating to the Virtual Network Function Descriptors portlet, right-clicking a descriptor or the portlet, and the selecting New or Edit.

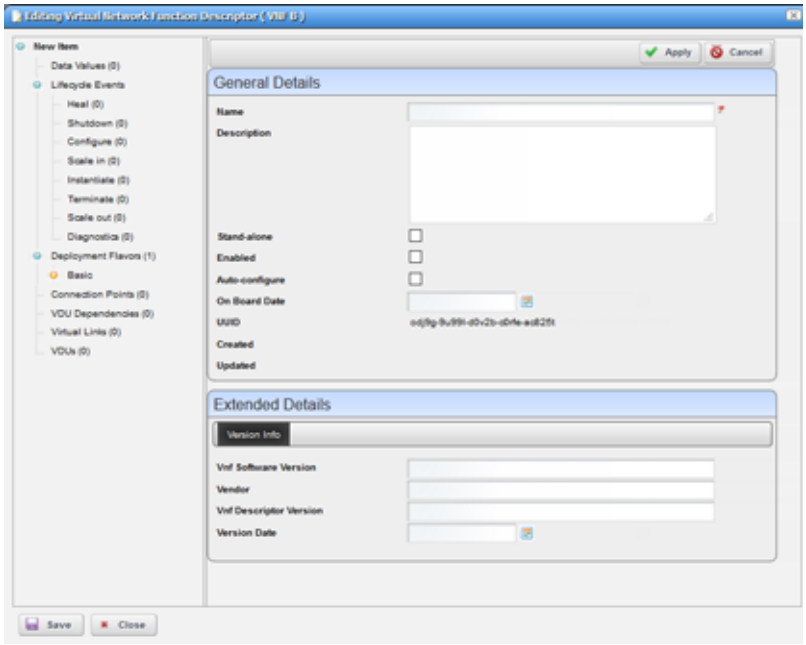



Figure A-29 Editing Virtual Network Function Descriptor Window

The Editing Virtual Network Function Descriptors window has the following editable fields and options (Table A-28). The fields not listed are system-generated fields, such UUID, Created, and Updated.

Table A-28 Editing Virtual Network Function Descriptor Fields/Options

| Field/Option | Description |
|---|---|
| Name | Enter a VNF descriptor name that identifies its purpose. |
| Description | Enter more details that describe the VNF's purpose, version, *etc.* |
| Stand-alone | Select to deploy the VNF descriptor deploys without a network service. The default is to deploy with a network service (not selected). |
| Enabled | Select to make the VNF descriptor is available. By default, the VNF descriptor is not available (not selected.) |
| Auto-configure | Select to automatically queue configuration tasks once the VNF descriptor instantiation completes. By default, configuration tasks are not automatically queued (not selected). |
| On Board Date | Select a date and time instantiate the VNF descriptor. Once instantiated, this timestamp changes to the instantiation date/time. |
| Extended Details | Enter the appropriate information for the VNF descriptor or the selected element, during creation:<br>• For the VNF descriptor, enter Vendor Info (Vnf Software Version, Vendor name, Vnf Descriptor Version, Version Date) and Monitor Parameters (monitor attributes).<br>• For Virtual Links, enter Properties (connectivity type, root bandwidth, leaf bandwidth, test access), VNFC Connection Points, and Qos options<br>• For a VDU, enter Image Requirements (VIM image, CPU, memory, disk, bandwidth, resource model, system object ID), Image Properties (HA, min/max instances), and Monitoring Parameters |

## Discover VNF Descriptor Window

Use the Discover VNF Descriptor window (Figure A-30) to create a VNF descriptor from OpenStack artifacts on a target VIM.

Access this window by navigating to the Virtual Network Function Descriptors portlet, right-clicking a descriptor, and then selecting Discover Vnfd.

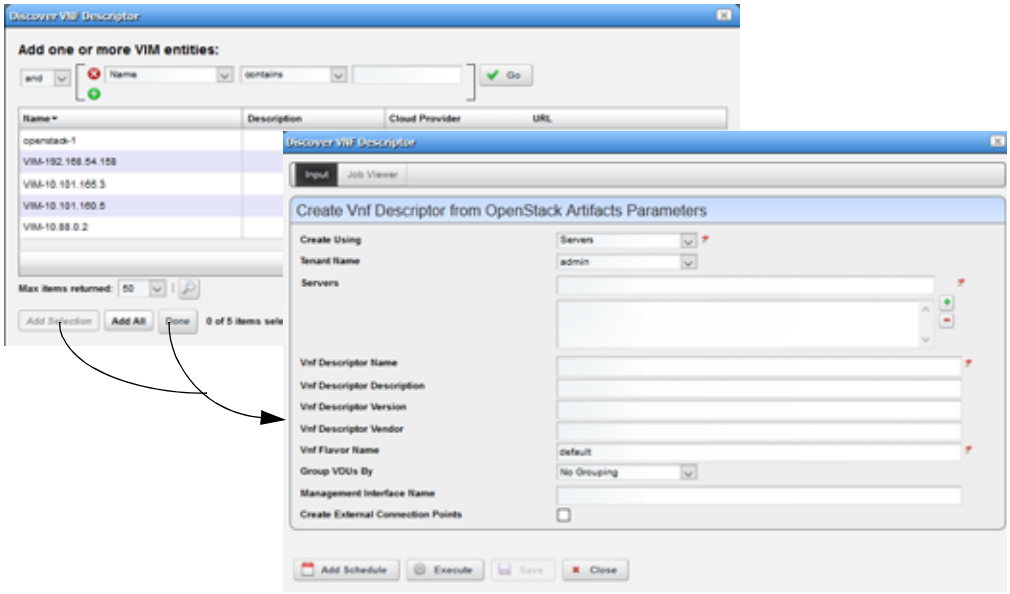



Figure A-30 Discover VNF Descriptor Window

The Discover VNF Descriptor window has the following fields and options (Table A-29).

Table A-29 Discover VNF Descriptor Fields/Options (Sheet 1 of 2)

| Field/Option | Description |
|---|---|
| Conditional Search Parameters | Define conditional search criteria to find the appropriate VIM. |
| Available VIM List | Select a VIM on which to create a VNF descriptor and then click Add Selection > Done. The Create Vnf Descriptor from OpenStack Artifacts Parameters input fields are displayed. |
| Create Using | Select whether to use Servers or Stacks to discover a VNF descriptor. |
| Tenant Name | Select the target project. When you select a project, the Servers/Stacks field populates with available choices. |
| Servers/Stacks | Select which servers/stacks to use. This field name and available choices vary depending on your Create Using and Tenant Name selection. |
| Vnf Descriptor Name | Enter a name identifier for the new VNF descriptor. |
| Vnf Descriptor Description | Enter a detailed description for the new VNF descriptor. |
| Vnf Descriptor Version | Enter a version for the new VNF descriptor. |
| Vnf Descriptor Vendor | Enter the vendor VNF used to generate this descriptor. |
| Vnf Flavor Name | Enter a VNF deployment flavor name or leave the value as default. |
| Group VDUs By | Select whether to group VDUs by Flavor, Image, Name Pattern, or No Grouping. The default is No Grouping. |
| Management Interface Name | Enter the port through which the VDU is managed. |
| Create External Connection Points | Select whether to create external connection points. The default is not to create external connection points (not selected). |

Table A-29 Discover VNF Descriptor Fields/Options (Sheet 2 of 2)

| Field/Option | Description |
|---|---|
| Add Schedule | Set the following schedule parameters used to automatically execute the Create VNF Descriptor from OpenStack Artifacts task on the specified target VIM.<br>• Starting On sets the date and time to execute the task.<br>• Recurrence sets whether the task executes Only Once, Only at Startup, every X minutes (Increment), or Every *X* minutes, hours, days, weekdays, weekend days, weeks, months, years.<br>• Stopping On sets when the task stops executing. Valid values are Never, By Occurrence, or By Date and Time. |
| Execute | Runs the Create VNF Descriptor from OpenStack Artifacts task to create the selected descriptor on the target VIM. |
| Save | Preserves your create VNF descriptor configuration. |
| Close | Exits the Discover VNF Descriptor window. |

## Branch VNF Descriptor Window

Use the Branch VNF Descriptor window (Figure A-31) to create a descriptor with the latest/improved version.

Access this window by navigating to the Virtual Network Function Descriptors portlet, right-clicking a descriptor, and then selecting Branch.

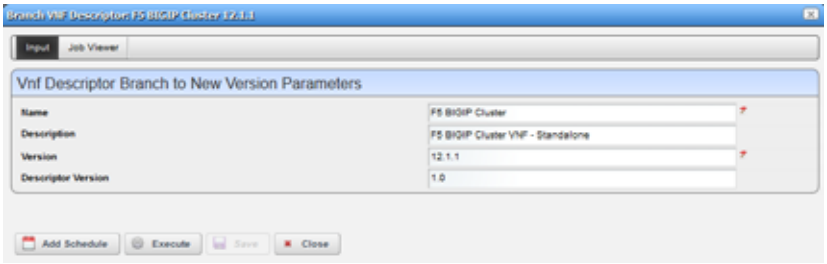



Figure A-31 Branch VNF Descriptor Window

The Branch VNF Descriptor window has the following fields and options (Table A-30).

Table A-30 Branch VNF Descriptor Fields/Options (Sheet 1 of 2)

| Field/Option | Description |
|---|---|
| Name | Modify the displayed VNF identifier as needed. |
| Description | Modify the displayed VNF detailed description as needed. |
| Version | Modify the displayed VNF software version as needed. |
| Descriptor Version | Modify the displayed VNF descriptor version as needed. |
| Add Schedule | Set the following schedule parameters used to automatically execute the branch VNF descriptor to new version task.<br>• Starting On sets the date and time to execute the task.<br>• Recurrence sets whether the task executes Only Once, Only at Startup, every X minutes (Increment), or Every *X* minutes, hours, days, weekdays, weekend days, weeks, months, years.<br>• Stopping On sets when the task stops executing. Valid values are Never, By Occurrence, or By Date and Time. |
| Execute | Runs the branch VNF descriptor to new version task. |

Table A-30 Branch VNF Descriptor Fields/Options (Sheet 2 of 2)

| Field/Option | Description |
|---|---|
| Save | Preserves your branching configuration. |
| Close | Exits the Branch VNF Descriptor window. |

## Stage new VNF Record Window

Use the Stage new VNF Record window (Figure A-32) to stage a VNF and then deploy the successfully staged VNF record.

Access this window by navigating to the Virtual Network Function Descriptor portlet, right-clicking a descriptor, and then selecting Stage.

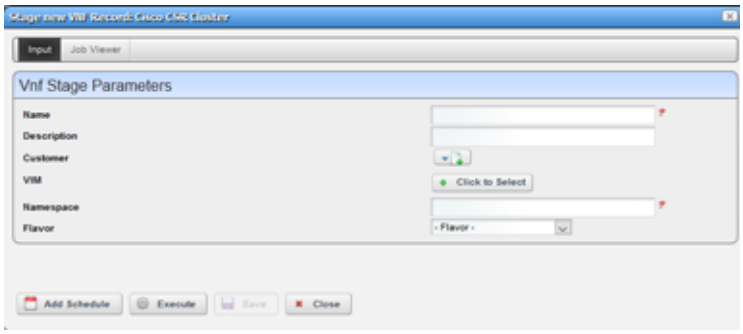



Figure A-32 Stage new VNF Record Window

The Stage new VNF Record window has the following fields and options (Table A-31).

Table A-31 Stage new VNF Record Fields/Options

| Field/Option | Description |
|---|---|
| Name | Enter a name that identifies the VNF you want to stage. |
| Description | Enter a more detailed description of the VNF you want to stage. |
| Customer | Select the person, group, or organization that requested the VNF. If the customer is not listed, create it. |
| VIM | Select the Virtualized Infrastructure Manager to which you to instantiate the VNF. Selecting a VIM populates the Namespace list. |
| Namespace | Select the name for the project that houses the VIM. This list is populated when you select a deployment VIM. |
| Flavor | Select a target deployment model (flavor). Valid values vary depending on the VNF selected. |
| Add Schedule | Set the following schedule parameters used to automatically execute the VNF staging task.<br>• Starting On sets the date and time to execute the task.<br>• Recurrence sets whether the task executes Only Once, Only at Startup, every X minutes (Increment), or Every *X* minutes, hours, days, weekdays, weekend days, weeks, months, years.<br>• Stopping On sets when the task stops executing. Valid values are Never, By Occurrence, or By Date and Time. |
| Execute | Runs the VNF record stage task. |
| Save | Preserves your staging configuration. |
| Close | Exits the Stage new VNF Record window. |

## Virtual Network Function Records Portlet

Use the Virtual Network Function Records portlet (Figure A-33) to maintain a list of virtualized network function (VNF) records.

From the Virtual Network Function Records portlet, operators stage, deploy, and undeploy network services. A network designer would use this portlet to test a new or modified descriptor.

The Virtual Network Function Records portlet also provides a maximized view that includes additional filtering and the ability to export the table to a portable document format (PDF), Excel format, or CSV format.

Both views have the same pop-up menu options and by default the same columns. See Maximized Portlet on page 61 for a description of its standard options provided.

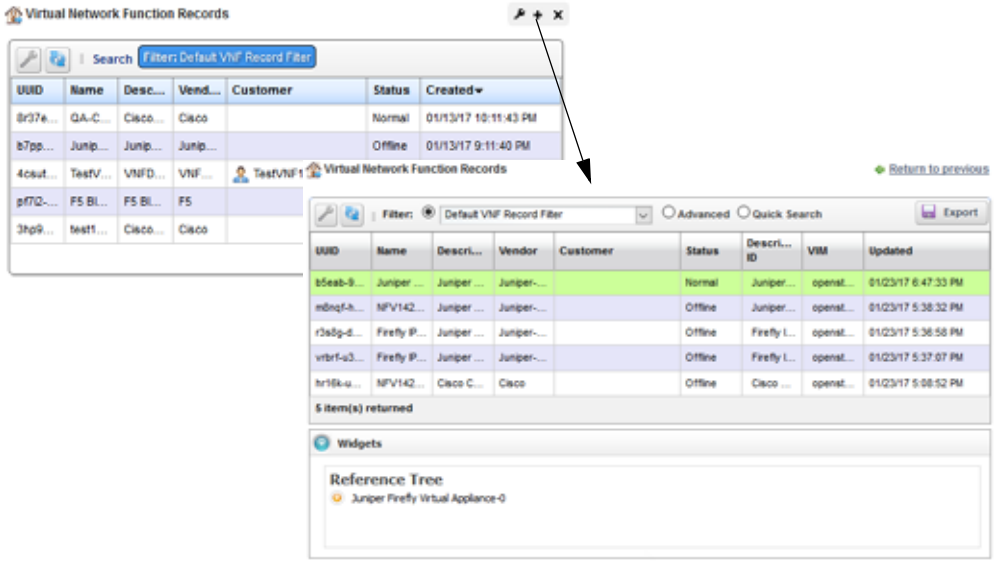



Figure A-33 Virtual Network Function Records Portlet

### Pop-Up Menu

The Virtual Network Function Records portlet provides access to the following pop-up menu options. Right-click a row to access these options (Table A-32).

Table A-32 Virtual Network Function Records Pop-Up Menu Options (Sheet 1 of 3)

| Option | Description |
|---|---|
| New | Opens the Stage VNF window, were you define a new VNF to stage and then deploy. |
| Edit | Opens the Editing VNF Record window, where |
| Details | Displays the general details, such as identification information, version information, deployment status, external references monitor parameters, health, connection points, and a reference tree.<br>You can also view VDU information, alarms and event details, and history details by selecting the appropriate tab. |

Table A-32 Virtual Network Function Records Pop-Up Menu Options (Sheet 2 of 3)

| Option | Description |
|---|---|
| Deploy | Adds the VNF to the specified VIM by running the VNF Deploy task on the specified target, which includes processing the VNF Instantiate event for the VNF.<br>You can also execute the Vnf Deploy action from the Actions portlet.<br>Once deployment successfully completes, the record status shows as Instantiating. When instantiation completes, the status changes to Normal. |
| Undeploy | Removes the VNF from the specified VIM by running the VNF Undeploy task on the specified target, which includes processing the Terminate event for the VNF. You can also execute the Vnf Undeploy action from the Actions portlet.<br>This action changes the record status to Offline. |
| Discover/Resync | Executes the Vnf Discovery task on the target VIM to identify VNF changes and performs a resync action to ensure VNFs are up to date. |
| Scaling | Provides access to the following scaling options:<br>• **Scale In** executes the Scale-in event to reduce the VNF capacity.<br>• **Scale Out** executes the Scale-out event to increase the VNF capacity.<br>You can also execute the Vnf Scale In and Vnf Scale Out actions from the Actions portlet. |
| Start/Stop | Toggles between the ability to start or stop a VNF record depending on its current state.<br>If you **stop** the record, a confirmation message is displayed. Click Stop to continue. This updates the record status to Stopped and any transactions after this point are lost.<br>When you **start** activity, the record status returns to Normal.<br>You can also execute the Vnf Stop and Vnf Start actions from the Actions portlet. |
| Resume/Suspend | Toggles between the ability to suspend a VNF's record activity or resume a suspended VNF's record activity.<br>If you **suspend** the record, a confirmation message is displayed. Click Suspend to continue. This updates the record status to Suspended. Activity continues to collect and is passed through once you resume activity.<br>When you **resume** activity, the record status returns to Normal.<br>You can also execute the Vnf Suspend and Vnf Resume actions from the Actions portlet. |
| Maintenance | Executes the following tasks on the selected VNF record:<br>• **Diagnostics** runs the Diagnostics event. The user defines these events.<br>• **Heal** runs the Heal event.<br>• **Upgrade** runs the Upgrade event to ensure that the latest descriptor is used.<br>• **Disaster Recovery** runs the Disaster Recovery event. The user defines these events.<br>You can also execute the Vnf Diagnostics, Vnf Heal, Vnf Upgrade, and Vnf Disaster Recovery actions from the Actions portlet. |
| Delete | Removes the selected VNF record from the system. You can also execute the Vnf Delete action from the Actions portlet. |
| Shutdown | Gracefully shuts down VNF/VDUs, allowing any current processes to complete. A confirmation message is displayed. Click Shutdown to continue. The status remains the same.<br>You can also execute the Vnf Shutdown action from the Actions portlet. |
| Audit Trail | Opens the Audit Trail Viewer window, which displays a list of actions that occurred for the selected VNF record. Select an audit record and the job record displays its status and any other job-related information. |

Table A-32 Virtual Network Function Records Pop-Up Menu Options (Sheet 3 of 3)

| Option | Description |
|---|---|
| Share with User | Opens the Share with User window, where you select a user to which you want to share the selected asset and then enter a message. You can share with colleagues existing on your system.<br>**Note:** Sharing only handles one item so it uses the first one in the selection |

## Columns

Other than the general navigation and configuration options, the Virtual Network Function Records portlet includes the following columns (Table A-33).

You can view the value for most of the hidden columns by right-clicking a row and selecting Details. The other option is to add the column by clicking the Settings tool, selecting the Columns tab, clicking Show for the appropriate column, and the applying the change.

Table A-33 Virtual Network Function Records Columns

| Column | Description |
|---|---|
| UUID | A unique 128-bit, system generated value assigned to each VNF record created. |
| Name | A text that identifies the VNF record and its purpose. |
| Description | Details that describe the VNF's purpose, version, *etc.* |
| Vendor | The vendor VNF (such as F5, Cisco, *etc.*) used to generate the VNF descriptor. |
| Customer | The person, group, or organization that requested the VNF. |
| Status | The current record status, such as Normal, Offline, Stopped, Instantiating, *etc.* |
| Active Operation | The current operation being performed on the VNF. Because VNF operations are long running, this lets you know when the VNF is ready to receive another operation. By default, this field is not shown. |
| Alarm Severity | The alarm severity for each record, such as Critical, Major, Minor, Informational, Normal, Warning. By default, this field is not shown. |
| Alarm Suppression Description | A text description of alarm suppression. By default, this field is not shown. |
| Alarm Suppression Mode | An indicator that shows whether alarm suppression is on or off. By default, this field is not shown. |
| Created | The system-generated timestamp for the record creation. By default, this field is not shown. |
| Deployment Flavor | A usage deployment model. Valid values vary depending on the VNF selected. By default, this field is not shown. |
| Descriptor ID | The name of the descriptor from which the record was created.<br>By default, shows only on the maximized view. |
| Foreign ID | A identifier of a VNF managed by an external VNFM. The foreign ID is useful when OMNM needs to do something to the VNF managed by the external VNFM. By default, this field is not shown. |
| Localization | This feature is not currently implemented. By default, this field is not shown. |
| Namespace | The name for the project that houses the VIM. This list is populated when you select a deployment VIM. By default, this field is not shown. |
| Operation Start Time | The time the active operation started. By default, this field is not shown. |
| Updated | The system-generated timestamp for the latest record changes. By default, this field is not shown. |
| VIM | The Virtualized Infrastructure Manager on which to deploy the VNF record. By default, shows only on the maximized view. |
| VNF Address | The primary IP address associated with the VNF. By default, this field is not shown. |
| VNFM ID | The VNF manager name or identifier. By default, this field is not shown. |
| Version | The vendor VNF (such as F5, Cisco, *etc.*) version used to generate the VNF descriptor. |

## Stage VNF Window

Use the Stage VNF window (Figure A-34) to define a new VNF to stage and then deploy.

Access this window by navigating to the Virtual Network Function Records portlet, right-clicking a record, and then selecting New.

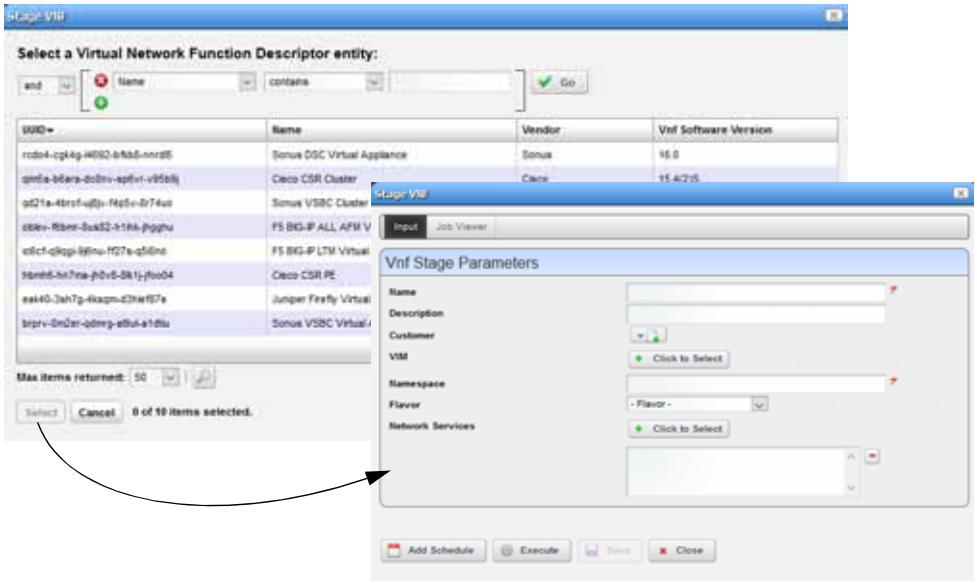



Figure A-34 Stage VNF Window

The Stage VNF window has the following fields and option (Table A-34).

Table A-34 Stage VNF Fields/Options (Sheet 1 of 2)

| Field/Option | Description |
|---|---|
| Conditional Search Parameters | Define conditional search criteria to find the appropriate VNF descriptor entity. |
| Available VNF List | Select a VNF descriptor from which to stage a VNF record and then click Select. The Vnf Stage Parameters input fields are displayed. |
| Name | Enter a VNF descriptor name that identifies its purpose. |
| Description | Enter more details that describe the VNF's purpose, version, *etc.* |
| Customer | Select the person, group, or organization that requested the VNF. If the customer is not listed, create it. |
| VIM | Select a VIM. Selecting a VIM populates the namespace list. |
| Namespace | Select the project in which to deploy the VNF |
| Flavor | Select a deployment flavor. |
| Network Service | Select the network service required to stage or deploy the VNF. This field shows only when a network service is required to stage or deploy the VNF. |

Table A-34 Stage VNF Fields/Options (Sheet 2 of 2)

| Field/Option | Description |
|---|---|
| Add Schedule | Set the following schedule parameters used to automatically execute the VNF Stage task on the specified target.<br>• Starting On sets the date and time to execute the task.<br>• Recurrence sets whether the task executes Only Once, Only at Startup, every X minutes (Increment), or Every *X* minutes, hours, days, weekdays, weekend days, weeks, months, years.<br>• Stopping On sets when the task stops executing. Valid values are Never, By Occurrence, or By Date and Time. |
| Execute | Runs the VNF Stage task on the specified target and reserves resources. |
| Save | Preserves your stage VNF configuration. |
| Close | Exits the Stage VNF window. |

## Editing VNF Record Window

Use the Editing VNF Record window (Figure A-35) to modify the following VNF record information:

- General VNF details name, description, and monitoring parameters
- Data Values description
- Connection Points name and description
- Virtual Links name, description and QOS options
- VDUs name and description
- Data Set description

Access this window by navigating to the Virtual Network Function Records portlet, right-clicking a record, and then selecting Edit.

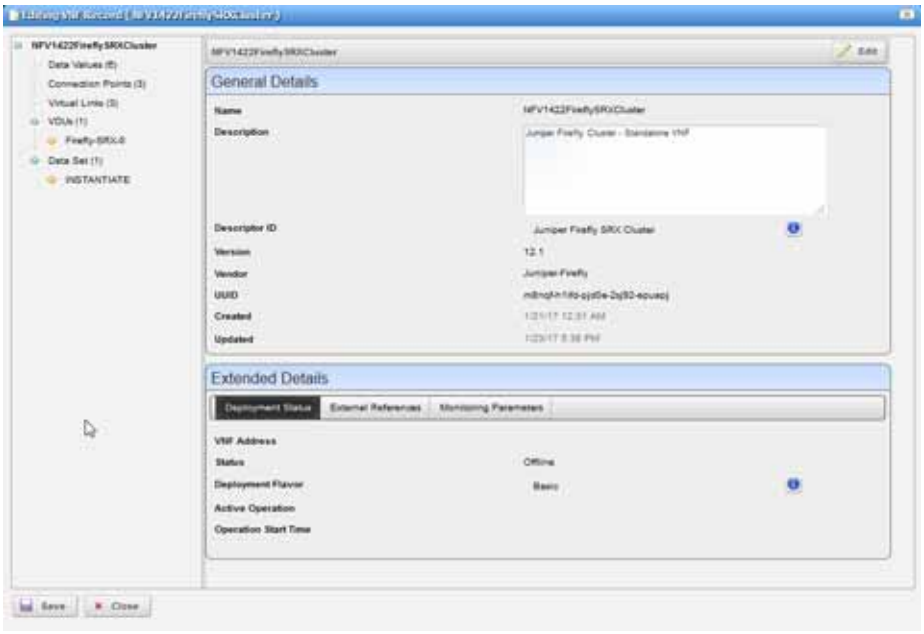



Figure A-35 Editing VNF Record Window

## Details Portlets

The Details portlets display the general details for the selected Virtualized Network Function (VNF) descriptor or record. Except where noted, the general details are the same for the VNF descriptor and VNF record.

You can also view VDU information details, descriptor deployment flavor details, connections details, alarms and event details, and history details related to the selected VNF descriptor or record.

### General Details

Use the Virtualized Network Function (VNF) General details (Figure A-36) to view identification and version information, any monitoring parameter definitions, and a reference tree of items related to the selected VNF descriptor or record. You can also view VNF deployment status, external references, health, and connection points for the selected VNF record. For VNF descriptor connection portlets, see Connections Details on page 116.

Access this information by navigating to the appropriate VNF portlet, right-clicking a row, and then selecting Details.

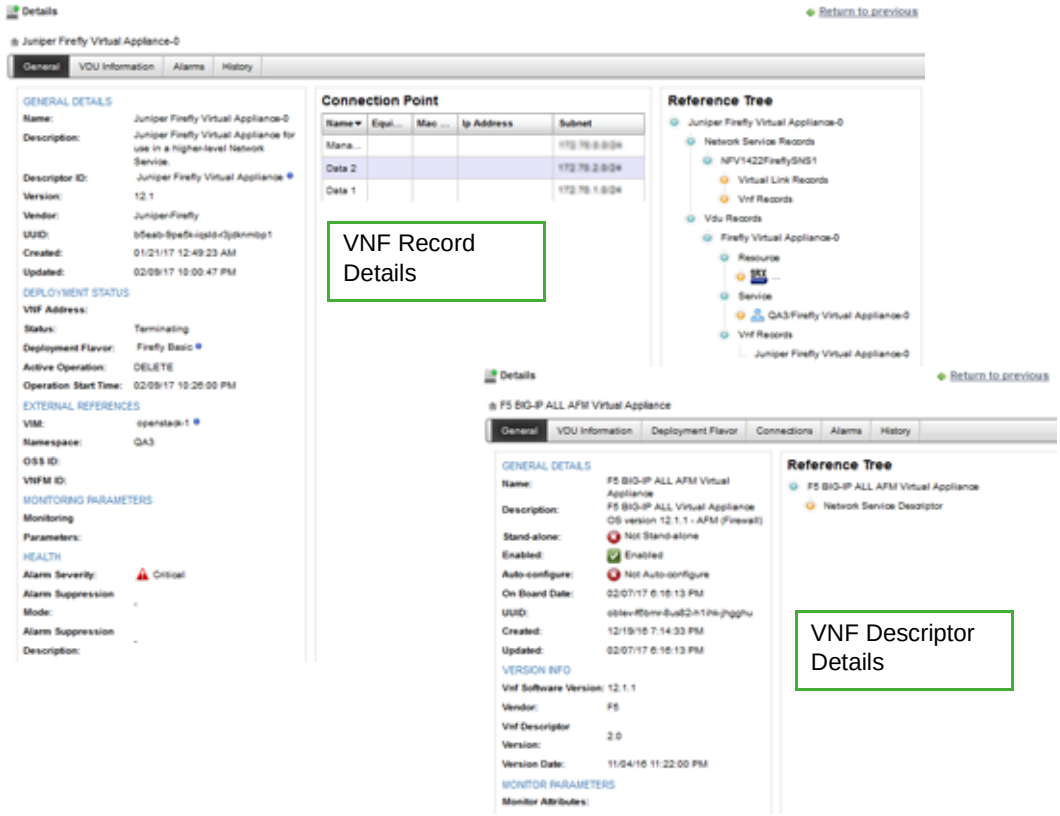



Figure A-36 VNF General Details Portlets

## VDU Information Details

Use the Virtualized Network Function (VNF) VDU Information details (Figure A-37) to view the following information:

- For a Descriptor, Virtualization Deployment Unit (VDU) information (required CPU, memory, and disk) and any defined dependencies
- For a Record, VDU status and VNF virtual link information

You have the option to view more details or share selected details with another user on your system.

Access this information by navigating to the appropriate VNF portlet, right-clicking a row, selecting Details, and then clicking the VDU Information tab.

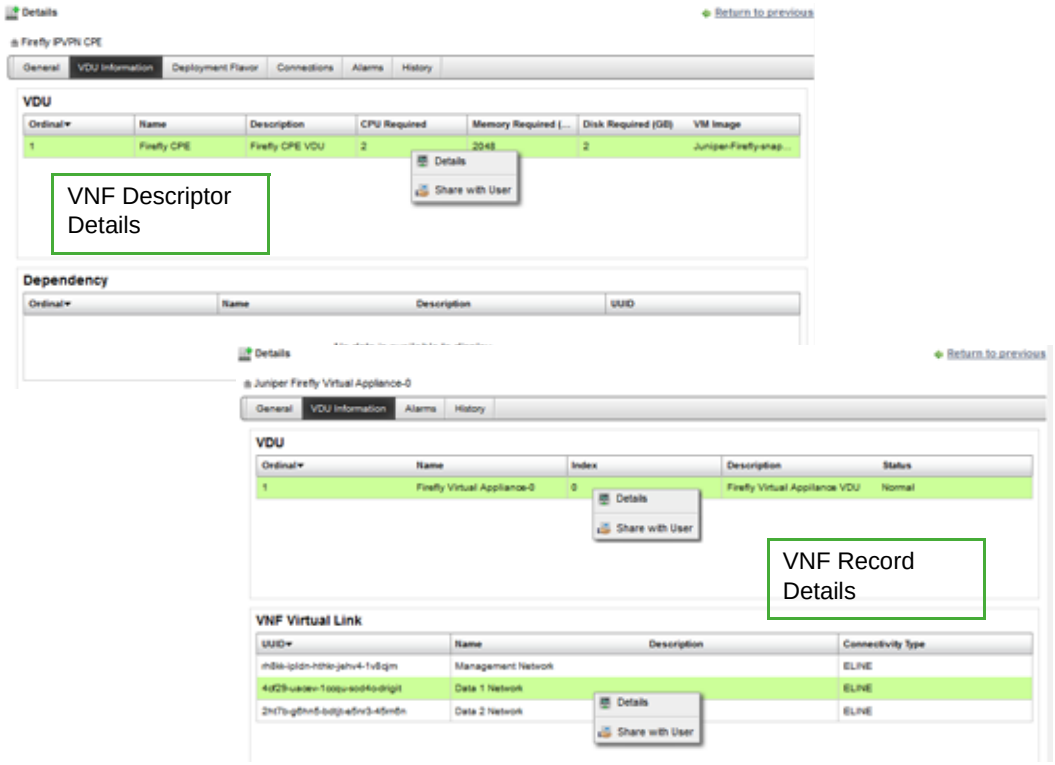



Figure A-37 VNF VDU Information Details Portlets

## Deployment Flavor Details

Use the Virtualized Network Function (VNF) Deployment Flavor details (Figure A-38) to view a list of deployment flavors for the selected VNF descriptor. These deployment flavors are useful when there is a need to scale in/out the number of instances to decrease/increase VNF capacity, respectively.

You have the option to view more deployment flavor details or share a deployment flavor with another user on your system.

Access this information by navigating to the Virtual Network Function Descriptors portlet, right-clicking a row, selecting Details, and then clicking the Deployment Flavor tab.

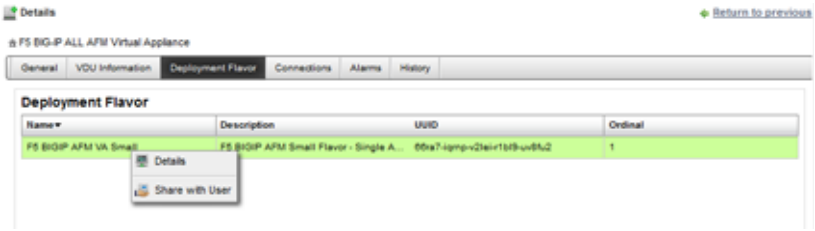



Figure A-38 VNF Descriptor Deployment Flavor Details Portlet

## Connections Details

Use the Virtualized Network Function (VNF) descriptor Connection details (Figure A-39) to view more granular details about the descriptor virtual link and connection point. This information is useful when trying to troubleshoot connectivity issues.

You have the option to drill down to more details or share these details with another user.

Access this information by navigating to the Virtual Network Function Descriptor portlet, right-clicking a row, selecting Details, and then clicking the Connections tab.

For VNF record connection details, see General Details on page 114. For VNF record virtual link details, see VDU Information Details on page 115.

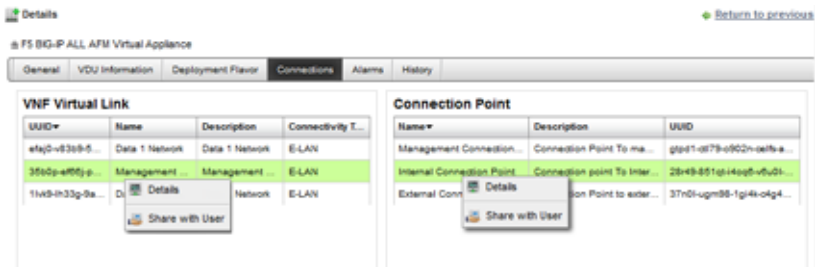



Figure A-39 VNF Descriptor Connections Portlets

## Alarms and Event Details

Use the Virtualized Network Function (VNF) Alarms details (Figure A-40) to monitor and manage alarms and view event history for the selected device.

You can perform the same actions on an alarm or event history from this location as you can from the Alarms and Event History portlets, respectively. Refer to the *Redcell User Guide* for details about the Alarms and Event History portlets.

Access this information by navigating to the appropriate VNF portlet, right-clicking a row, selecting Details, and then clicking the Alarms tab.

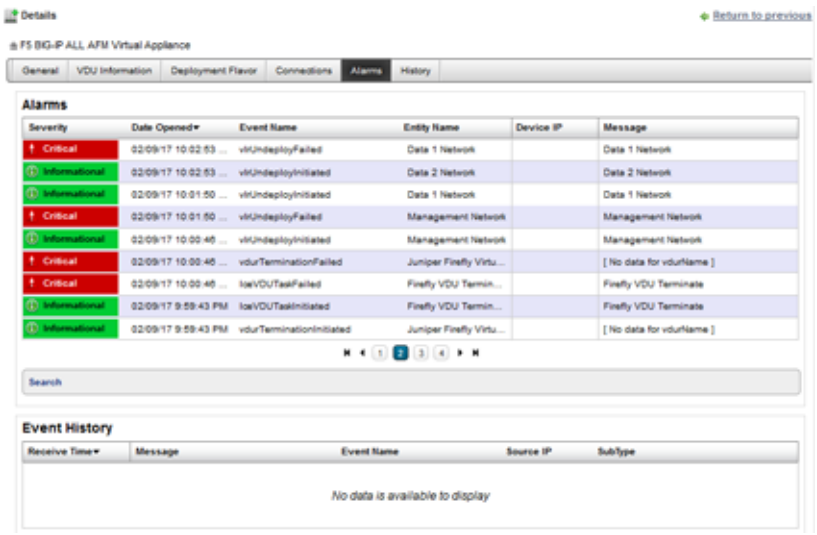



Figure A-40 VNF Alarms and Events Details Portlets

## History Details

Use the Virtualized Network Function (VNF) History details (Figure A-41) to view a list of actions (audit trail) performed on the selected VNF descriptor or record.

For a selected action, you can view the job, aging policy, delete the action, view as a portable document format (PDF), or share this information with other users on your system.

Access this information by navigating to the appropriate VNF portlet, right-clicking a row, selecting Details, and then clicking the History tab.

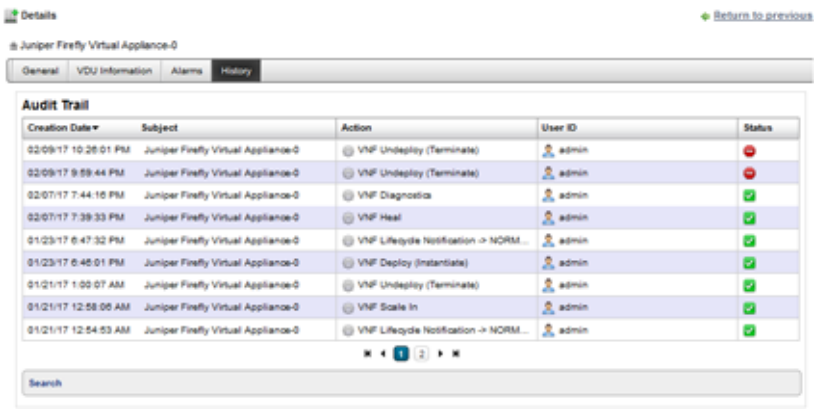



Figure A-41 VNF History Details

# Virtual Requirements Portlet

Use the Virtual Requirements portlet (Figure A-42) to view the virtual domain resource requirements and usage (such as memory, CPU, and disk). You also have the option to modify a domain's description.

The Virtual Requirements portlet also provides a maximized view that includes additional filtering and the ability to export the table to a portable document format (PDF), Excel format, or CSV format.

Both views have the same pop-up menu options and by default the same columns. See Maximized Portlet on page 61 for a description of its standard options provided.

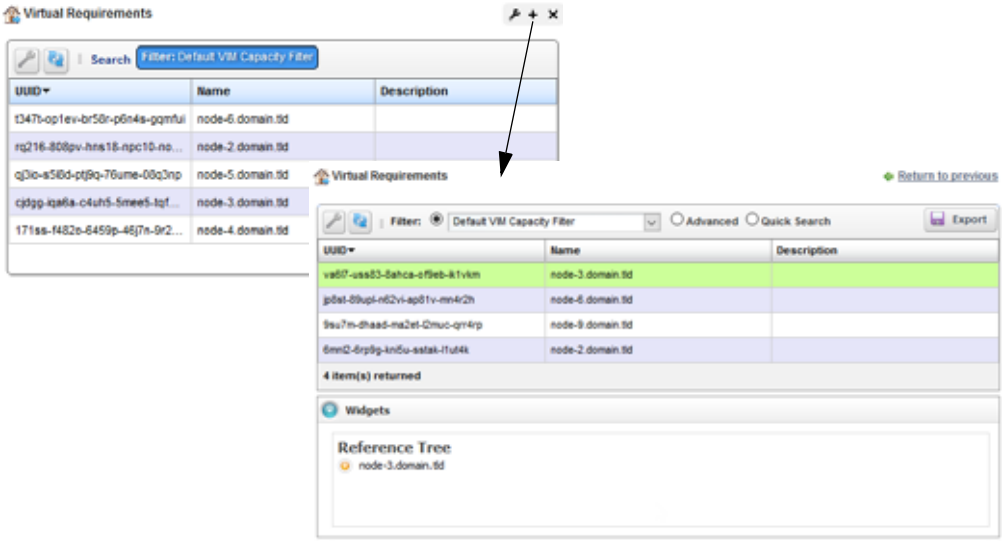



Figure A-42 Virtual Requirements Portlet

## Pop-Up Menu

The Virtual Requirements portlet provides access to the following pop-up menu options. Right-click a row to access these options (Table A-35).

Table A-35 Virtual Requirements Pop-Up Menu Options

| Option | Description |
|---|---|
| Edit | Opens the Edit VIM Capacity window, where you view virtual requirements information and make any needed modifications to the description. |
| Details | Opens the Details portlets, where you view the general details, VDU reservations, reference tree, and activities history (audit-trail).<br>You can also modify a selected VDU's name or description, view VDU details, or share a VDU with another user on your system. |
| Share with User | Opens the Share with User window, where you select a user to which you want to share the selected asset and then enter a message. You can share with colleagues existing on your system.<br>**Note:** Sharing only handles one item so it uses the first one in the selection. |

## Columns

Other than the general navigation and configuration options, the Virtual Requirements portlet includes the following columns (Table A-36).

You can view the value for most of the hidden columns by right-clicking a row and selecting Details. The other option is to add the column by clicking the Settings tool, selecting the Columns tab, clicking Show for the appropriate column, and the applying the change.

Table A-36 Virtual Requirements Columns

| Column | Description |
|---|---|
| UUID | The unique 128-bit, system generated value assigned to each virtual requirements record created. By default, this field is not shown. |
| Name | The text that identifies the VIM domain. |
| Description | The hypervisor description. |
| CPU Free | The number of CPUs available. By default, this field is not shown. |
| CPU Reserved | The number of CPUs reserved. By default, this field is not shown. |
| CPU Unallocated | The number of CPUs not allocated. By default, this field is not shown. |
| CPU Used | The number of CPUs used. By default, this field is not shown. |
| Cloud Id | The text that identifies the VIM. By default, this field is not shown. |
| Created | The system-generated timestamp for the virtual requirements creation. By default, this field is not shown. |
| Disk Free | The disk space available in gigabytes. By default, this field is not shown. |
| Disk Reserved | The disk space reserved in gigabytes. By default, this field is not shown. |
| Disk Unallocated | The disk space not allocated in gigabytes. By default, this field is not shown. |
| Disk Used | The disk space used in gigabytes. By default, this field is not shown. |
| Host Id | The OpenStack identifier. By default, this field is not shown. |
| IP Address | The address where the VIM is located. By default, this field is not shown. |
| Last Synchronization | The most recent VIM synchronization timestamp. By default, this field is not shown. |
| Memory Free | The memory available in megabytes. By default, this field is not shown. |
| Memory Reserved | The memory reserved in megabytes. By default, this field is not shown. |
| Memory Unallocated | The memory not allocated in megabytes. By default, this field is not shown. |
| Memory Used | The memory used in megabytes. By default, this field is not shown. |
| Total CPU | The total number of CPUs (used, free, reserved, and unallocated). By default, this field is not shown. |
| Total Disk | The total gigabytes of disk space (used, free, reserved, and unallocated). By default, this field is not shown. |
| Total Memory | The total megabytes of memory (used, free, reserved, and unallocated). By default, this field is not shown. |
| Type | Information from the OpenStack system describing the type of hypervisor. By default, this field is not shown. |
| Updated | The system-generated timestamp for the latest virtual requirements changes. By default, this field is not shown. |

# Virtual Reservations Portlet

Use the Virtual Reservations portlet (Figure A-43) to verify that a VDU's resources were reserved after you stage a VNF record.

From the Virtual Reservation portlet, a system administrator maintains the reservations, a network designer implements reservations, and operators (if they the the proper permissions) view to verify resources were reserved after VNF staging.

The Virtual Reservations portlet also provides a maximized view that includes additional filtering and the ability to export the table to a PDF, Excel, or CSV format.

Both views have the same pop-up menu options and by default the same columns. See Maximized Portlet on page 61 for a description of its standard options provided.

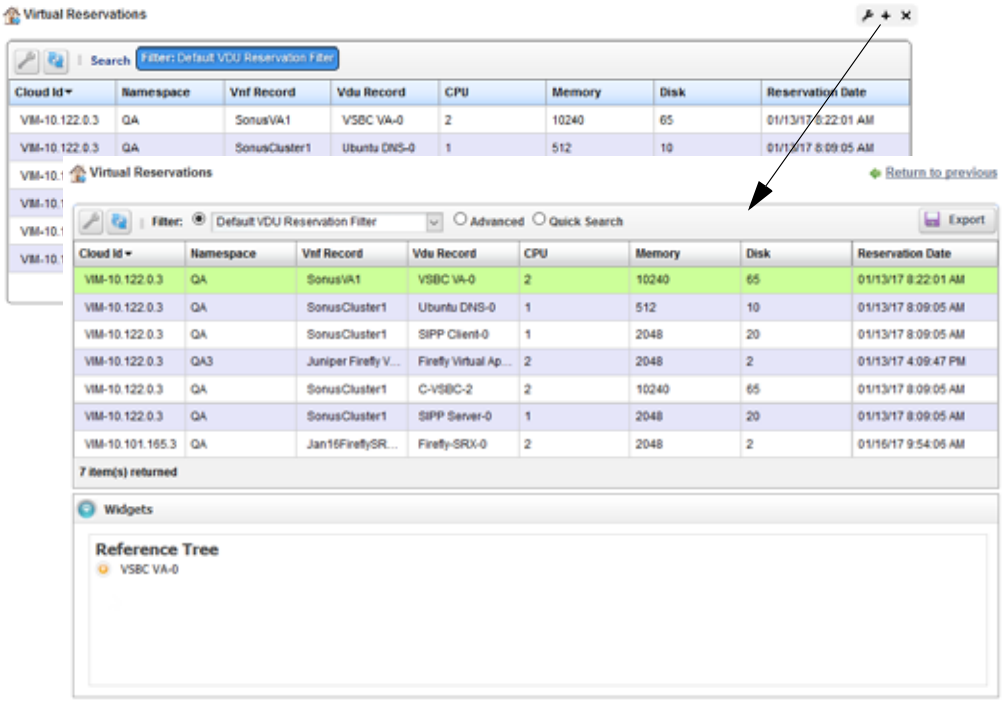



Figure A-43 Virtual Reservations Portlet

## Pop-Up Menu

The Virtual Reservations portlet provides access to the following pop-up menu options. Right-click a row to access these options (Table A-37).

Table A-37 Virtual Reservations Pop-Up Menu Options

| Option | Description |
|---|---|
| Edit | Opens the Editing VDU Reservation window, where you can change the VDU name and description for the selected reservation. |
| Details | Displays the general VDU reservation details, such as identification information, CPU, memory, disk, date, *etc*. for the selected reservation. |
| Share with User | Opens the Share with User window, where you select a user to which you want to share the selected asset and then enter a message. You can share with colleagues existing on your system.<br>**Note:** Sharing only handles one item so it uses the first one in the selection. |

## Columns

Other than the general navigation and configuration options, the Virtual Reservations portlet includes the following columns (Table A-38).

You can view the value for most of the hidden columns by right-clicking a row and selecting Details. The other option is to add the column by clicking the Settings tool, selecting the Columns tab, clicking Show for the appropriate column, and the applying the change.

Table A-38 Virtual Reservations Columns

| Column | Description |
|---|---|
| Cloud Id | The Virtualized Infrastructure Manager (VIM) name. |
| Namespace | The name for the project that houses the VIM. |
| Vnf Record | The VNF record name. |
| Vdu Record | The VDU record name. |
| CPU | The number of CPUs reserved for the selected VDU. |
| Memory | Displays how much memory is reserved for the selected VDU. |
| Disk | Displays how much disk space is reserved for the selected VDU. |
| Reservation Date | The date the resources were reserved. |
| Created | The timestamp when the reservation record was created. By default, this field is not shown. |
| Description | Details about the reserved VDU, such as function, version, purpose, *etc.* By default, this field is not shown. |
| Name | The text that identifies the reserved VDU. By default, this field is not shown. |
| UUID | The unique 128-bit, system generated value assigned to each virtual reservation record created. By default, this field is not shown. |
| Updated | The timestamp for the latest reservation record changes. By default, this field is not shown. |

# Virtualized Infrastructure Managers Portlet

Use the Virtualized Infrastructure Managers portlet (Figure A-44) to maintain a list of virtualized infrastructure managers (VIMs) to which you deploy network services, physical network functions (PNFs) and virtualized network functions (VNFs).

From the Virtualized Infrastructure Managers portlet, a system administrator creates and maintains VIMs and operators (if they have the proper permissions) view VIM resources as part of their network monitoring process.

The Virtualized Infrastructure Managers portlet also provides a maximized view that includes additional filtering and the ability to export the table to a portable document format (PDF), Excel format, or CSV format.

Both views have the same pop-up menu options and by default the same columns. See Maximized Portlet on page 61 for a description of its standard options provided.

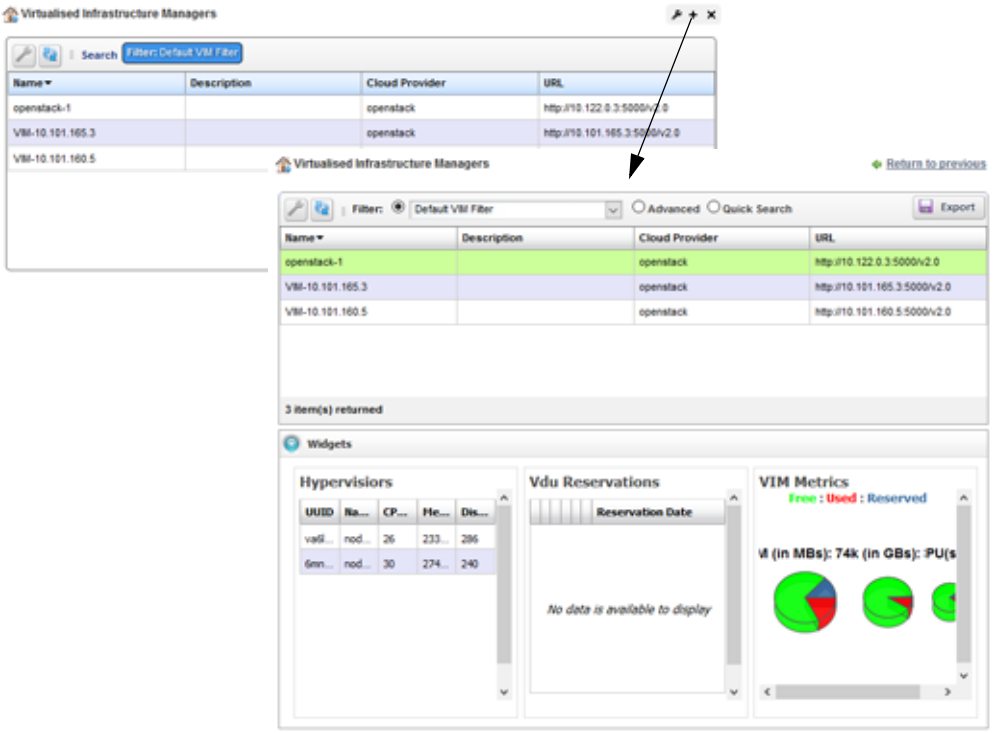



Figure A-44 Virtualized Infrastructure Managers Portlet

## Pop-Up Menu

The Virtualized Infrastructure Managers portlet provides access to the following pop-up menu options. Right-click a row to access these options (Table A-39).

Table A-39 Virtualized Infrastructure Managers Pop-Up Menu Options

| Option | Description |
|---|---|
| New | Opens the Editing VIM window, where you create a VIM. |
| Edit | Opens the Editing VIM window, where you modify the selected VIM's description. |
| Details | Displays the general details, such as identification information, version information, deployment status, external references monitor parameters, health, connection points, and a reference tree.<br>You can also view alarms and event details and history details selecting the appropriate tab. |
| Resync | Runs the VIM Resync task on the target VIM to update capacity information. You can also execute the VIM Resync action from the Actions portlet. |
| Visualize | Opens the Visualize portlet, where you define a multi-layered, customizable topology view of your network to help track network devices state. Refer to the *Redcell User Guide* for the Visualize portlet configuration details. |
| Delete | Removes the selected VIM from the system. You can also execute the VIM Delete action from the Actions portlet. |
| Import/Export | Provides the following actions when available for the selected image:<br>• Import retrieves a file containing XML VIM descriptions. Some imports can come from a URL.<br>• Export Selection exports the selected VIM description to an XML file.<br>• Export All exports all VIM descriptions to an XML file.<br>Click Download Export File to specify where to save the file.<br>The Import/Export option is useful as a backup or to share descriptors with other projects. |
| Share with User | Opens the Share with User window, where you select a user to which you want to share the selected asset and then enter a message. You can share with colleagues existing on your system.<br>**Note:** Sharing only handles one item so it uses the first one in the selection. |

## Columns

Other than the general navigation and configuration options, the Virtualized Infrastructure Managers portlet includes the following columns (Table A-40).

You can view the value for most of the hidden columns by right-clicking a row and selecting Details. The other option is to add the column by clicking the Settings tool, selecting the Columns tab, clicking Show for the appropriate column, and the applying the change.

Table A-40 Virtualized Infrastructure Managers Columns (Sheet 1 of 2)

| Column | Description |
|---|---|
| Name | The text that identifies the VIM. |
| Description | The optional details provided about the VIM, such as its purpose. |
| Cloud Provided | The cloud environment where the VIM resides. |
| URL | The address used to access the VIM. For example:<br>`http://ipAddress:5000/v2.0` |
| Alarm Severity | The severity of alarms against the VIM. By default, this field is not shown. |

Table A-40 Virtualized Infrastructure Managers Columns (Sheet 2 of 2)

| Column | Description |
|---|---|
| Alarm Suppression Mode | An indicator that shows whether alarms are suppressed. By default, this field is not shown. |
| CPU Free | The number of CPUs available. By default, this field is not shown. |
| CPU Reserved | The number of CPUs reserved. By default, this field is not shown. |
| CPU Unallocated | The number of CPUs not allocated. By default, this field is not shown. |
| CPU Used | The number of CPUs used. By default, this field is not shown. |
| Created | The VIM creation timestamp. By default, this field is not shown. |
| Disk Free | The disk space available in gigabytes. By default, this field is not shown. |
| Disk Reserved | The disk space reserved in gigabytes. By default, this field is not shown. |
| Disk Unallocated | The disk space not allocated in gigabytes. By default, this field is not shown. |
| Disk Used | The disk space used in gigabytes. By default, this field is not shown. |
| Last Synchronization | The most recent VIM synchronization timestamp. By default, this field is not shown. |
| Memory Free | The memory available in megabytes. By default, this field is not shown. |
| Memory Reserved | The memory reserved in megabytes. By default, this field is not shown. |
| Memory Unallocated | The memory not allocated in megabytes. By default, this field is not shown. |
| Memory Used | The memory used in megabytes. By default, this field is not shown. |
| Priority | A relative number indicating which VIM should be chosen over another, where multiple VIMs support a VNF deployment. By default, this field is not shown. |
| Private Network Space | The private network space identifier in the following format:<br>`123.17.0.0/16`<br>This is the overall address space used to create smaller subnet private networks. By default, this field is not shown. |
| Shared Network Space | The shared network space identifier in the following format:<br>`123.18.0.0/16`<br>This is the overall address space used to create smaller subnet shared networks. By default, this field is not shown. |
| Total CPU | The total number of CPUs (used, free, reserved, and unallocated). By default, this field is not shown. |
| Total Disk | The total gigabytes of disk space (used, free, reserved, and unallocated). By default, this field is not shown. |
| Total Memory | The total megabytes of memory (used, free, reserved, and unallocated). By default, this field is not shown. |
| UUID | A unique 128-bit, system generated value assigned to each VIM created. By default, this field is not shown. |
| Updated | The latest VIM changes timestamp. By default, this field is not shown. |

## Editing VIM Window

Use the Editing VIM window (Figure A-45) to create and maintain Virtualized Infrastructure Managers (VIMs).

Access this window by navigating to the Virtualized Infrastructure Managers portlet, right-clicking a VIM or the portlet, and then selecting Edit or New. You can also access this window from the details reference tree, by right-clicking a VIM, and then selecting Edit.

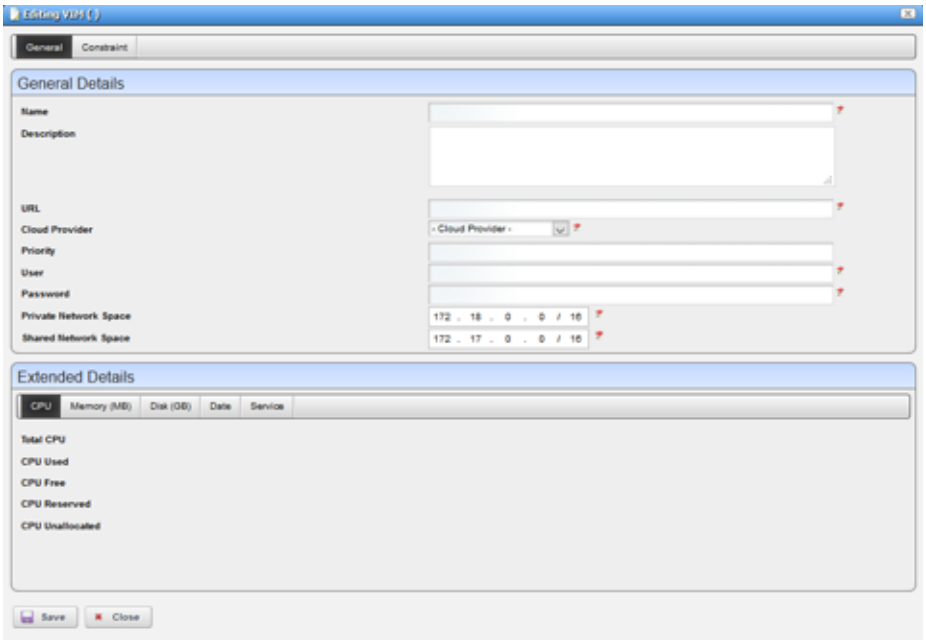



Figure A-45 Editing VIM Window

The Editing VIM window has the following fields and option (Table A-41).

Table A-41 Editing VIM Fields/Options (Sheet 1 of 2)

| Field/Option | Description |
|---|---|
| Name | Enter required text that identifies the VIM. |
| Description | Enter an optional description that provides more information about the VIM, such as its purpose. |
| URL | Enter the address used to access the VIM. For example:<br>`https://ipAddress:5000/v2.0` |
| Cloud Provider | Select the provider where the VIM resides. |
| Priority | Enter a relative number indicating which VIM should be chosen over another, where multiple VIMs support a VNF deployment. By default, this field is not shown. |
| User | Enter the user account ID that is used to access the VIM (OpenStack). |
| Password | Enter the password assigned the provided user ID. |
| Private Network Space | Modify appropriately. This field is automatically populated in the following format when you select the New menu option:<br>`123.17.0.0/16`<br>This is the overall address space used to create smaller subnet private networks. |

Table A-41 Editing VIM Fields/Options (Sheet 2 of 2)

| Field/Option | Description |
|---|---|
| Shared Network Space | Modify appropriately. This field is automatically populated in the following format when you select the New menu option:<br>`123.18.0.0/16`<br>This is the overall address space used to create smaller subnet shared networks. By default, this field is not shown. |
| Extended Details | Displays details about the VIM, such as CPU, memory, and disk information as well as the synchronized, created, and updated dates, and service UUID. |
| Constraints | Displays the list of defined constraints, which determine where to place network services or VNFs if the VIM is not specified during network service or VNF descriptor staging process. Modify the list as needed by adding, deleting, or modifying constraints. |

## Details Portlets

The Details portlets display the general details for the selected Virtualized Infrastructure Manager (VIM).

You can also view alarms and event details and history details related to the selected VIM.

Access the details portlets by navigating to the Virtualized Infrastructure Managers portlet, right-clicking a VIM, and then selecting Details.

### General Details

Use the Virtualized Infrastructure Manager (VIM) General details (Figure A-46) to view identification and version information, CPU, memory (MB), disk (GMB), activity dates, service information, health, constraints, hypervisors, and a reference tree of items related to the selected VIM.

From the Hypervisor details, you have the following menu options:

- **Edit** to view VIM capacity or change the VIM's description from the Editing VIM Capacity window
- **Details** allows you to view more details about a selected hypervisor and any audit trail history
- **Share with User** allows you to share the selected asset with colleagues on your system

From the Vim Images details, you have the following menu options:

- **Details** allows you to view details and the reference tree for the selected image
- **Share with User** allows you to share the selected asset with other users on your system

From the Reference Tree, you have the following menu options:

- **Edit** when you right-click a capacity element, opens the Editing VIM Capacity window, where you view VIM capacity or change the VIM's description

  **Edit** when you right-click a VIM, opens the Editing VIM window, where you modify the selected VIM's description
- **Details** allows you to view more details about a selected hypervisor and any audit trail history
- **Share with User** allows you to share the selected asset with colleagues on your system

Access this information by navigating to the Virtualized Infrastructure Managers portlet, right-clicking a row, and then selecting Details.

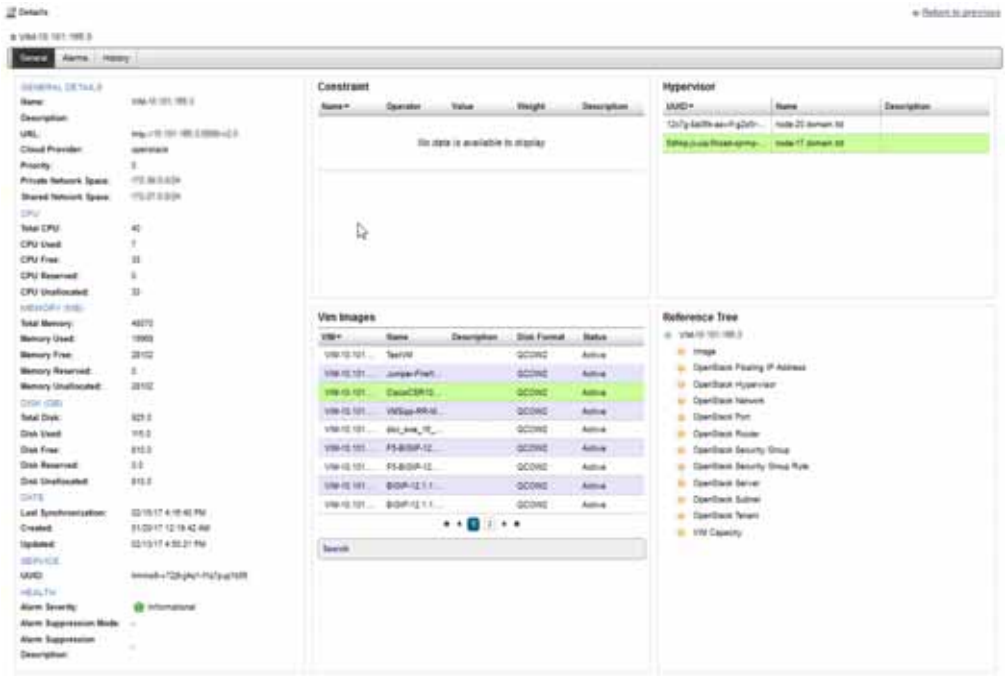



Figure A-46 VIM General Details Portlets

## Alarms and Event Details

Use the Virtualized Infrastructure Manager (VIM) Alarms details (Figure A-47) to monitor and manage alarms and view event history for the selected VIM.

You can perform the same actions on an alarm or event history from this location as you can from the Alarms and Event History portlets, respectively. Refer to the *Redcell User Guide* for details about the Alarms and Event History portlets.

Access this information by navigating to the Virtualized Infrastructure Managers portlet, right-clicking a row, selecting Details, and then clicking Alarms.

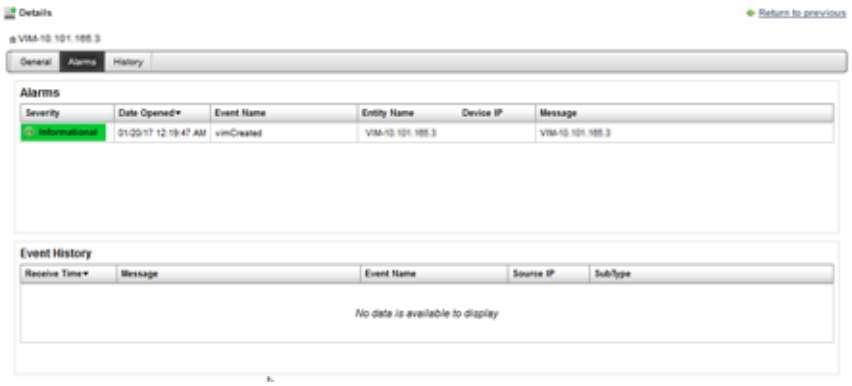



Figure A-47 Alarms and Event History Portlets

## History Details

Use the Virtualized Infrastructure Manager (VIM) History details (Figure A-48) to view a list of actions (audit trail) performed on the selected VIM.

For a selected action, you can view the job, aging policy, delete the action, view as a portable document format (PDF), or share this information with other users on your system.

Access this information by navigating to the Virtualized Infrastructure Managers portlet, right-clicking a row, selecting Details, and then clicking History.

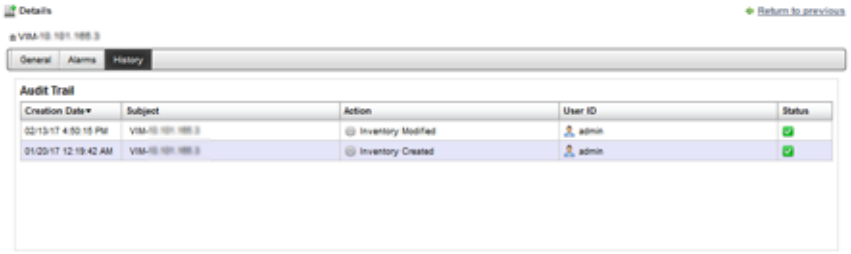



Figure A-48 VIM History Details Portlet

# Glossary

**Advanced Firewall Manager (AFM)** An F5 Networks BIG-IP Web application firewall that uses both positive and negative security models to identify, isolate, and block sophisticated attacks without impacting legitimate application transactions. AFM is a high-performance, stateful, full-proxy network security solution designed to guard data centers against incoming threats that enter the network on the most widely deployed protocols.

**Agent Mapper** The Mediation Agent handles SNMP requests, SNMP traps, and ASCII grammars through the Agent Mapper. You must configure the Agent Mapper with each Mediation Agent location.

**Alarm** A signal alerting the user to an error or fault. Events produce alarms. Alarms produce a message that displays in the Alarm window or Alarms portlet.

**API** Application Programing Interface — A set of routines used by the application to direct the performance of procedures by the computer's operating system.

**Applet** A small application that performs a single task and runs within a widget engine or larger program, often as a plug-in.

**Application Server** A component frameworks container. For example, Enterprise JavaBeans, that includes fundamental services for access and intra-system communication. Both Redcell and Oware run in the Application Server.

**ASCII** American Standard Code for Information Interchange protocol.

**ATM** Asynchronous Transfer Mode. ATM is a high bandwidth, low-delay, connection-oriented, packet-like switching and multiplexing technique.

**Bare Metal** A computer system or network in which a virtual machine is installed directly on hardware rather than within the host operating system (OS). Bare metal refers to a hard disk where the OS is installed.

**Blade** See Solution Blade.

**BOM** Business Object Manager; responsible for managing all defined objects. Includes object database. Handles all scheduling, notification, caching and modification services for objects.

**Business Class** A category of objects. A business class contains a name that defines the class, properties, and attributes that define the individual data within the business class. For example, you can have a business class named Employee that has a persisted property and a Name attribute.

**Note:** A business class is not the same as a Java class. Business class is concept that is unique to Oware.

**Business Object** One specific instance in a class. For example, the Employee business class would include the John Smith object.

**Ceilometer** A metering function that collects, normalizes, and transforms data produced by OpenStack services. The information collected allows you to track and manage resources.

**Center** One of three integrated Oware parts; each part has its own function within Oware. The three parts are:

- Oware Creation Center (OCC) — for creating and rendering solution blades
- Oware Execution Center (OEC) — for powering solution blades
- Oware Management Center (OMC) — for deploying and managing solution blades

**Class** See Business Class.

**CORBA** Common Object Request Broker Architecture — An architecture that enables pieces of programs, called objects, to communicate with one another regardless of what programming language they were written in or what operating system they're running on.

**CoS** Class of Service — Describes the level of service provided to a user. Also provides a way of managing traffic in a network by grouping similar types of traffic.

**Creation Center, (OCC)** This Oware center is where you create and render solution blades.

**Database** An organized collection of Oware objects.

**Deployment** The distribution of solution blades throughout a domain.

**Descriptor** A file that describes the VNF attributes and network services specifications.

A VNF descriptor describes the virtual functions behavior. A network services descriptor describes the deployment requirements, operational behavior, and policies required.

These descriptors are templates from which you build network service records and VNF records.

**Domain** A goal-oriented environment that can include an industry, company, or department. You can use the Oware product to create solutions within your particular domain.

**EJB** Enterprise JavaBean — An application designed to extend the JavaBean component model to a cross-platform, server-side application.

**Element** A type of data that defines and organizes Oware data for easy references. There are six types of elements: business class, event, form, grammar, graphic, and rule.

**Event** Notification received from the NMS (Network Management System). Notifications may originate from the traps of network devices or may indicate an occurrence such as the closing of a form. Events have the potential of becoming alarms.

**Event Definition** Parameters that define what an event does. For example, you can tell the Oware application that the event waits for incoming data from a remote database, then the Oware application performs a certain action after it receives the data.

**Event Instance** A notification sent between two Oware components. An event instance is the action the event performs per the event definition.

**Event Template** Defines how an event is handled.

**Event Threshold** Number of events within a given time frame that must occur before an alarm is raised.

**Execution Center (OEC)** This Oware center renders solutions by executing solution blades. It does this by completing the application. It loads classes into the classes database, it and reads and creates objects in the database.

**Exporting** Saving business objects, packages, or solution blades to a file for others to import.

**FCAPS** Fault Configuration Accounting Performance Security

**Flavors** Redcell deployment configurations that specify the number of network services, virtualized network functions, *etc.* The deployment flavors are useful when there is a need to scale in/out the number of instances to decrease/increase capacity, respectively.

In an OpenStack configuration, flavors define resources, such as CPU, memory, and disk space.

**Form** An interface that lets users interact with a solution blade. Users can use forms to enter data, view data and/or events, and trigger rules and/or events in a solution blade.

**Grammar** Translates ASCII text communications between the solution blade and the external systems via patterns built into the OCC Grammar Composer.

**GUI** Graphical User Interface

**Hypervisor** Software that partitions the underlying physical resources and creates Virtual Machines (VMs), and isolates the VMs from each other.

A hypervisor runs one or more virtual machines on a host machine, and each virtual machine is called a guest machine. This allows multiple guest VMs to effectively share the system's physical resources, such as CPU cycles, memory space, network bandwidth, and so on.

**IDE** Integrated Development Environment. A programing environment integrated into an application.

**IIOP** Internet Inter-ORB Protocol. A protocol used to implement CORBA solutions over the World Wide Web

**Image** A blueprint from which new VMs are deployed. An image captures the operating system, applications, and their configuration settings. The image does not contain any sensitive data (such as private keys and passwords).

**Importing** Loading business objects, packages, or solution blades into the OCC for you to edit.

**Instantiate** The process of creating an object of a specific class.

**LCE** A Lifecycle Event (LCE) that identifies a specific behavior as defined within the Redcell Management and Orchestration NFV specification.

**Managed Object** A network device managed by the system.

**Management Center, Oware (OMC)** This Oware center deploys and manages solution blades.

**Mbeans** Management Beans. These objects specify the protocol of the device with which they are communicating.

**Mediation** Communication between Oware and external systems or devices, for example, telephone switches, security systems, or remote database. Mediation services let Oware treat external systems and/or devices as objects.

**Mediation Agent** Any communication to and from managed objects is handled by the Mediation Agent. This communication includes SNMP requests, ASCII requests, and unsolicited ASCII messages. In addition, the Mediation Agent receives and translates emitted SNMP traps and converts them into events.

**Metadata** Attributes that describe Oware database objects; data about data (for example, title, size, author, or subject).

**Metadatabase** An organized collection of Oware attributes (also called meta-data). For example, the ZIP Code attribute in the meta-database can describe all database business objects with five digits (such as, 94101).

**MIB** Management Information Base. A database (repository) of managed objects containing object characteristics and parameters that can be monitored by the network management system.

**Multi-Threading** Concurrent processing of more than one message by an application.

**Network Functions Virtualization Infrastructure (NFVI)** **All** hardware and software components used to create the environment in which you deploy virtualized network functions (VNFs).

**Note:** The NFV infrastructure can span across several locations (such as different data center operations) and provides the connectivity between these locations.

NFVI and VNF are the are the main entities of network function virtualization.

**OCC** See Creation Center, (OCC).

**OEC** See Execution Center (OEC).

**OID** Object ID.

**OMC** See Management Center, Oware (OMC).

**Onboarding** A process used to implement network services.

**OpenStack** An open-source cloud operating system that controls large pools of compute, storage, and networking resources. The OpenStack system is often deployed as an infrastructure-as-a-service (IaaS).

**Orchestration** The automated arrangement, coordination, and management of computer systems, middleware, and services.

**Oware** Oware is an Internet infrastructure software product that delivers advanced user, content and network aware Internet Commerce Systems. Oware allows users to quickly render Internet Commerce Systems that have inherent knowledge of user profiles, content, and network resources, enabling a class-of-service based Internet.

**Package** The container for Oware elements.

**Parameter Event** An event with rule parameters.

**Persistent Data** Data stored in the database for future use. (As opposed to transient data).

**Pessimistic Locking** A pessimistic locking scheme denies all access (create, read, write, update) to database items already being read by other users.

**Policy** A rule made up of conditions and actions and associated with a profile. Policy objects contain business rules for performing configuration changes in the network for controlling Quality of Service and Access to network resources. Policy can be extended to perform other configuration functions, including routing behavior, VLAN membership, and VPN security.

**Policy routing** Routing scheme that forwards packets to specific interfaces based on user-configured policies. Such policies might specify that traffic sent from a particular network should be routed through interface, while all other traffic should be routed through another interface.

**Profile** A profile is an abstract collection of configuration data that is utilized as a template to specify configuration parameters to be applied to a device as a result of a policy condition being true.

**Pseudo-optimistic locking** Oware provides pseudo-optimistic locking. The first caller to attempt to get an object for update is granted an “update” lock. Subsequent callers can still read the object, but Oware denies any attempt to obtain an update lock until the initial caller ends the session.

**QoS** Quality of Service. In digital circuits, it is a measure of specific error conditions as compared with a standard. The establishment of QoS levels means that transmission rates, error rates, and other characteristics can be measured, improved, and, to some extent, guaranteed in advance. Often related to Class of Service (CoS).

**Redcell** A suite of programs providing provisioning, personalization, monitoring, and management of next-generation networks.

**Rendering/Render** The process of generating OMG metadata, compiling and saving application components within the context of Oware. Also called solution rendering.

**RMI** Remote Method Invocation — A set of protocols (Sun's JavaSoft) that enables Java objects to communicate remotely with other Java objects. It works only with Java objects.

**RMO** Resource Management and Operation (RMO) is the Redcell core resource management, configuration, backup, and image management feature.

**RMON** **R**emote **Mon**itoring; a monitoring set of SNMP-based MIBS used to manage networks remotely. Nine diagnostic groups are defined. Of these, Redcell software supports Events and Alarms.

**Rule** Defines what a solution blade does in a particular situation — for example, how the solution blade responds to an event. An event, another rule, or program code can trigger a rule.

**Scale In** An event used to decrease an instance's capacity by selecting the appropriate deployment flavors.

**Scale Out** An event used to increase an instance's capacity by selecting the appropriate deployment flavors.

**Servlet** A small Java program that runs on a server, noted for quickness. (See also: Applet.).

**SMTP** Simple Mail Transfer Protocol.

**SNMP** Simple Network Management Protocol. Network management protocol used almost exclusively in TCP/IP networks. SNMP provides the means to monitor and control network devices, and to manage configurations, statistics collection, performance, and security.

**Solution Blade** The properties specified in the OCC that describe the application to be rendered. Also called a meta application or a blade.

**Solution Rendering** The integration of all Oware elements and components into an executable application and a set of instructions (metadata) for creating the application.

**Spanning Tree Protocol (STP)** The inactivation of links between networks so that information packets are channeled along one route and will not search endlessly for a destination.

**Telemetry** An automated communications process used to collect measurements and other data from remote or inaccessible points and transmit it to receiving equipment for monitoring.

**Transaction** An atomic unit of work that modifies data. A transaction encloses one or more program statements, all of which either complete or roll back. Transactions enable multiple users to access the same data concurrently.

**Transaction Context** The scope of a transaction; defined by a transaction context shared by the participating objects.

**Transaction Service** This defines interfaces that allow multiple, distributed objects to cooperate. These interfaces enable the objects to either commit all changes together or to rollback all changes together, even in the presence of failure. The Transaction Service typically places no constraints on the number of objects involved, the topology of the application or the way in which the application is distributed across a network.

**Transient Data** Temporary data that exists only while being used by a solution blade.

**Trap (SNMP Trap)** A notification from a network element or device of its status, such as a server startup. This notification is sent by an SNMP agent to a Network Management System (NMS) where it is translated into an event by the Mediation Agent.

**Trap Forwarding** The process of re-emitting trap events as traps to another management system, such as the NMS (Network Management System).

**UUID (Universally Unique ID)** A unique 128-bit, system generated value assigned to each network service, virtual network function, and physical function descriptor.

**Virtualized Infrastructure Manager (VIM)** A functional block that controls and manages Network Functions Virtualization Infrastructure (NFVI) resources (compute, storage, and network) within an operator's infrastructure domain.

**Virtual Rule Machine (VRM)** A rule engine encapsulated by a ubiquitous meta schema that manages logic, processes requests, and associates behaviors required by a solution blade.

**Virtual Solution Machine (VSM)** A complete, integrated set of technologies used to create, execute, and manage Internet commerce business systems. All of the components, services and technology in a single product, already integrated and ready to use.

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**Note:** To find other instances of these terms (or any others), use the Acrobat or online help search feature.

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