Dell EMC OpenManage Network Manager Version 6.5

Network Functions Virtualization (NFV)

configuration 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.

Conventions Used

Redcell guides use the following conventions.

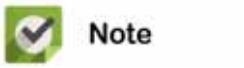
Conventions	Description
Italic	Italic indicates document titles and variables, such as *filename*, in computer input and output.
Bold	Bold identifies important words.
`Courier`	Courier denotes computer input and output.
[abc]	Square brackets enclose optional syntax for computer input.
TAB	Small caps 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 Alt+Y	Ctrl+X means to press and hold the Ctrl key while you press the x key. 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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> 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 Network Functions Virtualization (NFV) administration and configuration, such as defining your OpenStack environment, preparing vendor virtual network function (VNF) images for use, and configuring those images:

- Introduction summarizes this document's content, describes the intended audience, shows where the NFV product fits into the Redcell suite, briefly describes the OpenStack services used, and lists prerequisites and other documents needed.
- Preparing to Configure NFV Infrastructure tells you how to sign in/out from the Redcell application, start/exit the OpenStack dashboard, bring a (VIM) under management, and provides other tasks to complete (such as adding pages and portlets) before you begin using the NFV product.
- Setting Up Cisco CSR100V VNF Package explains the scope, functions, and processes associated with onboarding and instantiating the Cisco VNF.
- Setting Up F5 BIGIP VNF Package explains the scope, functions, and processes associated with onboarding and instantiating the F5 BIGIP VNF.
- Setting Up the Juniper Firefly VNF Package explains the scope, functions, and processes associated with onboarding and instantiating the Juniper Firefly VNF.
- Understanding the Sonus VSBC VNF Package explains the scope, functions, and processes associated with onboarding and instantiating the Sonus VSBC VNF.
- Managing NFVI/VIM Resources provides some basic instructions to manage NFVI/VIM resources.
- Managing Descriptors provides the basic instructions to maintain network service, virtualized network functions (VNFs), and physical network functions (PNFs).
- Automating SMB vCPE Deployment describes the current state, order management, service orchestration, final state, and the NFV catalog using an SMB vCPE service including VPN and internet access as an example.
- NFV User Interface describes the NFV portlets, their usage, and their options.
- Redcell NFV Permissions provides the permissions for the NFV record, descriptors, and operations.
- Notifications lists notifications that Redcell-MANO product publishes to the Redcell event bus.
- Glossary describes the terms used in this document and other related Redcell products.

Intended Audience

This document is intended for system administrators, network administrators, or any one else using the Redcell and OpenStack® infrastructure to design, configure, and administer your network environment.

This document assumes that you are familiar with or have knowledge of:

- Linux distribution that supports OpenStack cloud, SQL databases, and virtualization
- Networking configurations
- Concepts, such as DHCP, Linux bridges, VLANs, iptables

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

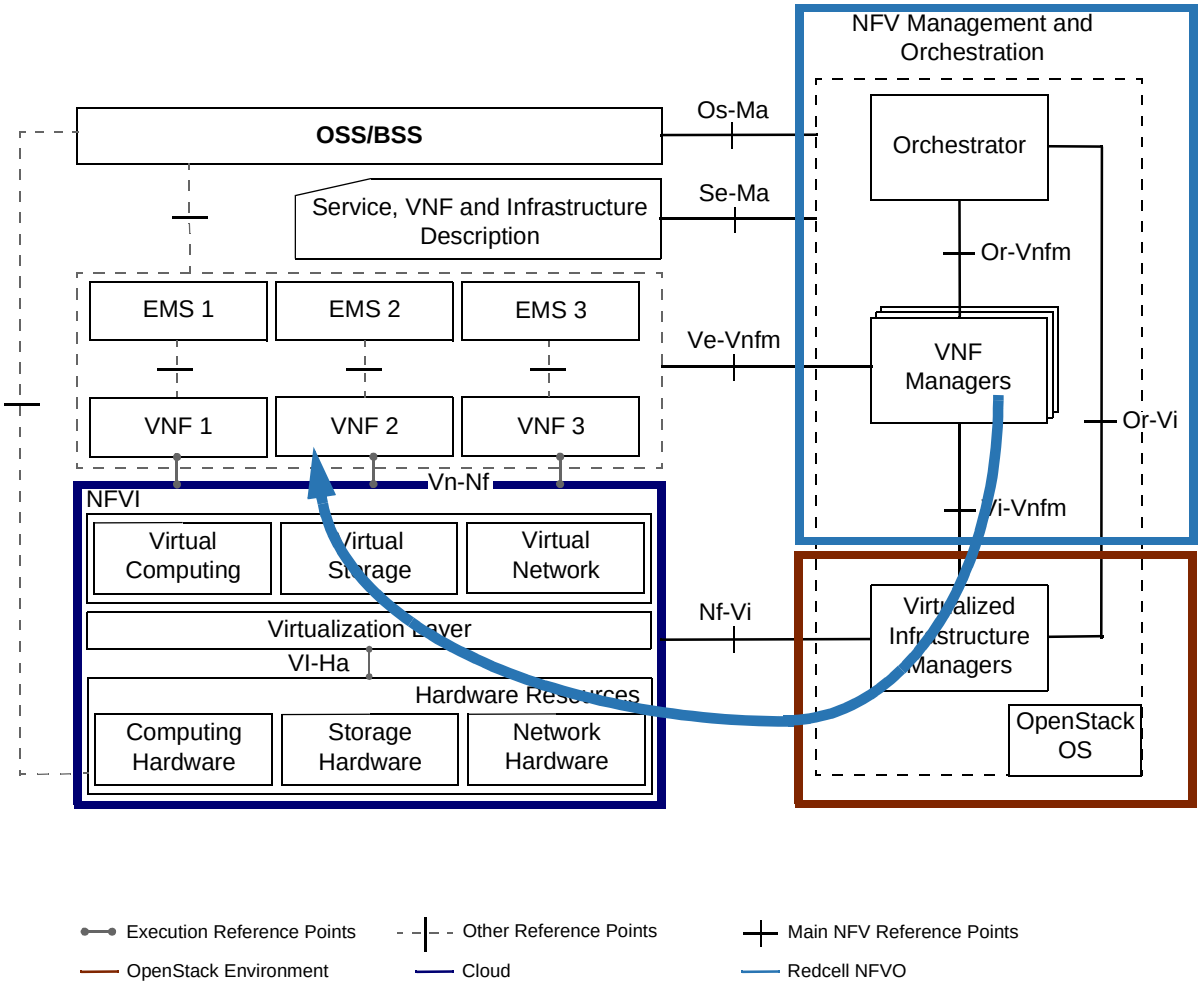


Figure 1-1 Redcell and OpenStack Interaction

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.

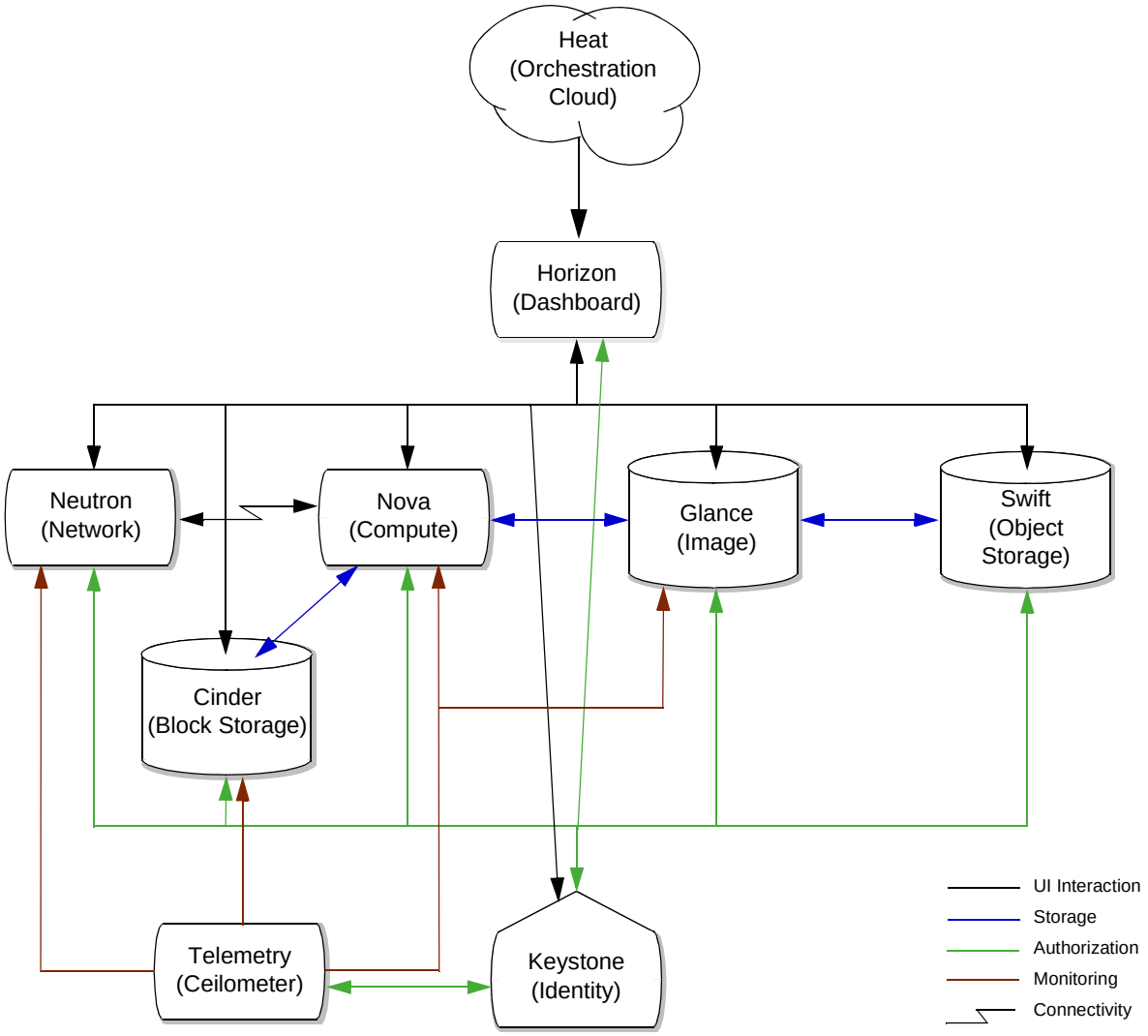


Figure 1-2 OpenStack Services (example)

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. This allows you to easily migrate workloads and run them at scale with predictability, 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). Ideal for storing unstructured data that grows without bounds, such as image files.
Cinder	Block Storage	Provides the ability to virtualize block storage devices 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. 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). 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 you 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 Redcell Application on page 18 if you need instructions.

  Select Add > Applications and then verify that Network Virtualization applications are listed. For a list of NFV applications, see Starting and Exiting OpenStack Dashboard on page 19.

  Refer to the *Redcell Installation Guide* for system requirements and the *Redcell Release Notes* for new features supported, adaptive CLIs, standard change management policies, known issues, and supported devices, switches, and equipment.

- OpenStack operating system (Liberty, Mirantis version 8)

  The OpenStack environment is set up and defined by your system administrator. Obtain login information your system administrator. See Setting Up an OpenStack Project to set up interaction between the Redcell application and the OpenStack operating system.

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

Related Documents

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

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

- *Redcell Release Notes*
- *Redcell Installation 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
- Cisco® CSR 1000V-Series datasheet
- F5® BIG-IP® Virtual Edition (VE) datasheet and OpenStack KVM environment requirements
- Juniper Networks® Firefly SRX documentation and release notes
- Sonus™ Network Session Border Controller (SBC) Software Edition (SWe) documentation and release notes

2

> Preparing to Configure NFV Infrastructure

Covers these topics:

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Starting and Exiting OpenStack Dashboard – 19
Setting Up an OpenStack Project – 20
Bringing a VIM Under Management – 25
Setting Up Redcell Application – 29
Determining What to Do Next – 37

This section provides what you need to prepare for Network Functions Virtualization (NFV) infrastructure configuration and how to start the applications used to do the preparation tasks.

Signing In/Out Redcell Application

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 you are finished with the application.

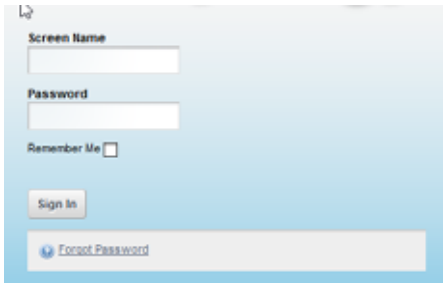
Sign in to your Redcell NFV installation from your Web browser as follows and then sign out when finished.

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.

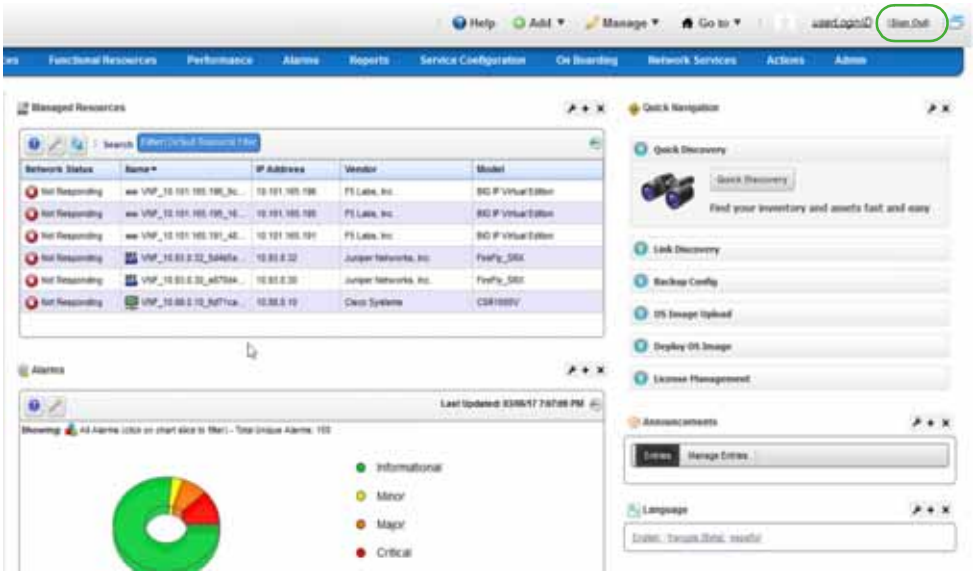
   The sign in request is displayed.



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 you are finished with the application.

   You are returned to the sign in request page.

Starting and Exiting OpenStack Dashboard

Connect to the OpenStack dashboard from your Web browser as follows and then sign out when you are finished.

1. Enter the OpenStack URL.

   `http://serverIP/horizon/auth/login/`

   Replace *serverIP* with your OpenStack server host name or IP address.

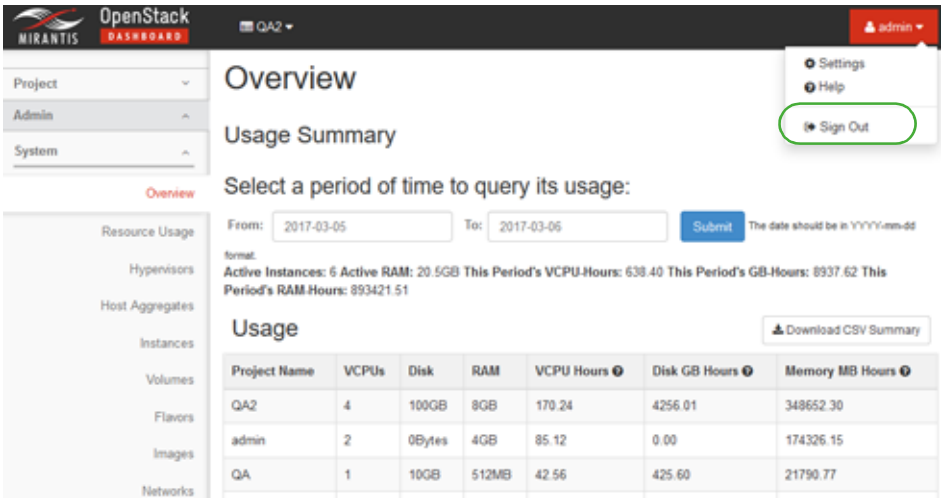
   The OpenStack Dashboard sign in page is displayed.



2. Enter your user name and password.
3. Click Connect.

   The OpenStack dashboard is displayed.

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



4. Select *userName* > Sign Out when finished with the application.

   You are returned to the OpenStack Dashboard sign in page.

Setting Up an OpenStack Project

OpenStack software is the third-party cloud computing software that the Redcell application interacts with to manage NFV packaging of virtual functions and infrastructure resources. Before defining your Virtualized Infrastructure Managers (VIMs), you need to make sure that you have an OpenStack project in which the VIMs will reside and make sure that the project is set up to interact with the Redcell application.

Set up an OpenStack project using one of the following set of instructions:

- Creating a Project if the project does not exist.
- Verify Project Setup for Redcell if the project already exists.

Note

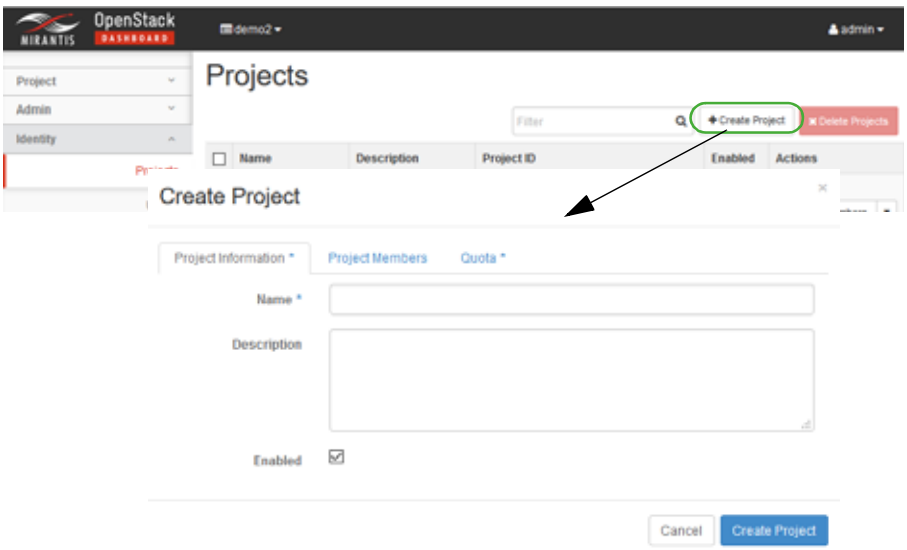
Details of the OpenStack system is out of scope for this document. Refer to the OpenStack documentation if you need more OpenStack details than what is provided in this document.

Creating a Project

Create a project from the OpenStack dashboard as follows.

1. Select Identity > Project.
2. Click Create Project.

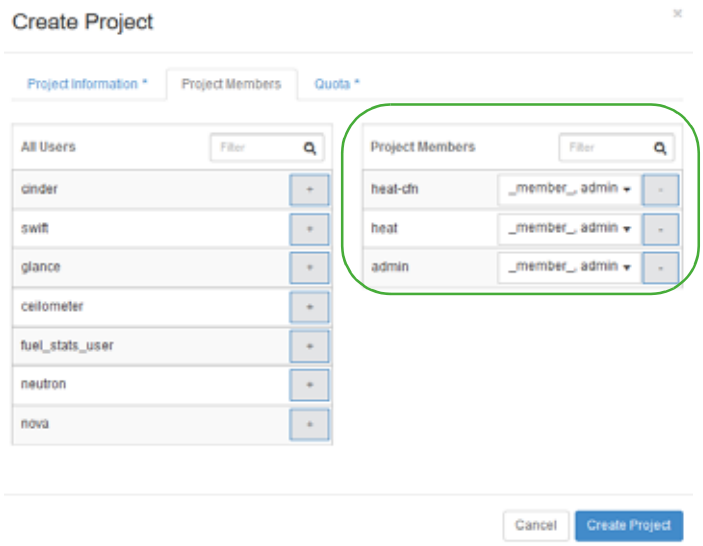
   The Create Project window is displayed.
3. Enter a name and detailed description.



4. Assign users/permissions.
   a. Click Project Members.
   b. Add the following users to the Project Members list.
      - heat-cfn
      - heat
      - admin
   c. Set the member permissions to admin.

5. Click Create Project.

   The new project is saved to the Projects list.

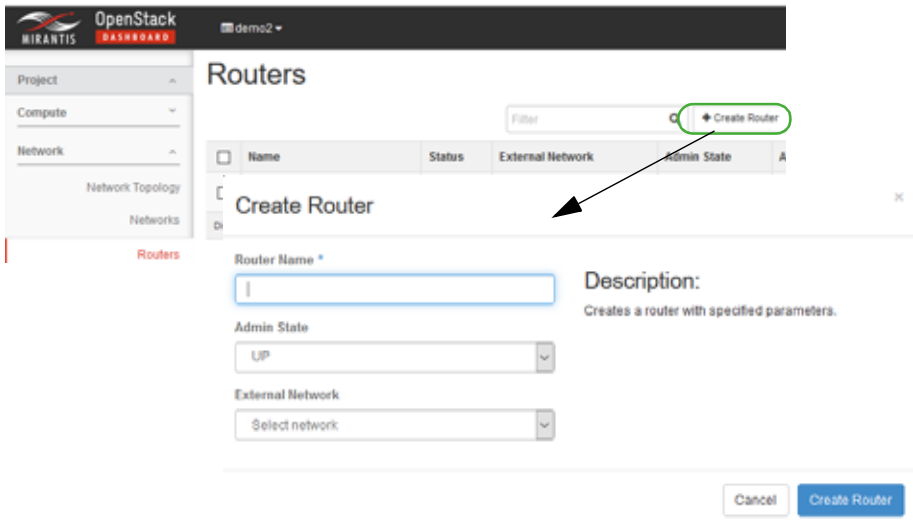


6. Create project networking in an OpenStack VIM (KILO or later release).

   a. Select Project > Network > Routers.

   b. Click Create Router.

      The Create Router window is displayed, where you create a project router with a gateway interface.



   c. Make sure that the router's gateway IP is reachable from the LAN (your Windows system) following project router creation.

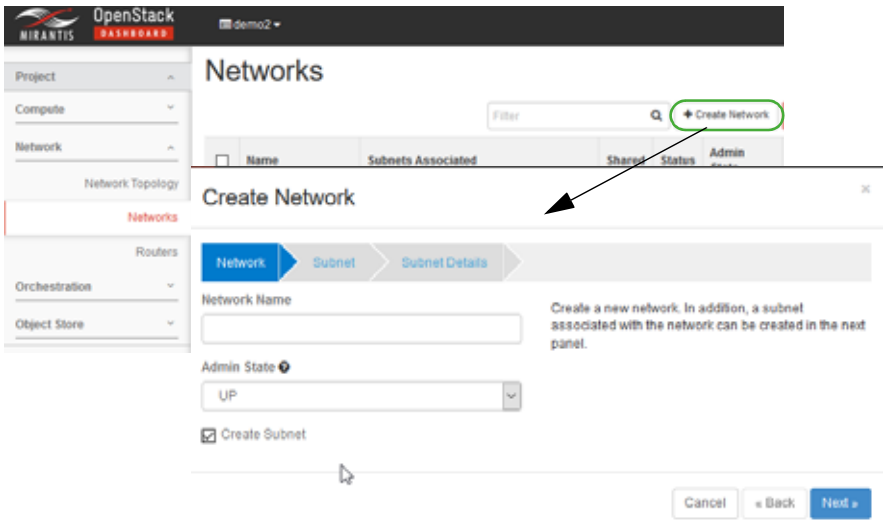
d. Select Project > Network > Networks.

e. Click Create Network.

The Create Network window is displayed.

f. Create and attach the following networks to the project router:

- net-mgmt
- net-data1
- net-data2



Now that your OpenStack project is ready, you can get started by creating a VIM from the Redcell application.

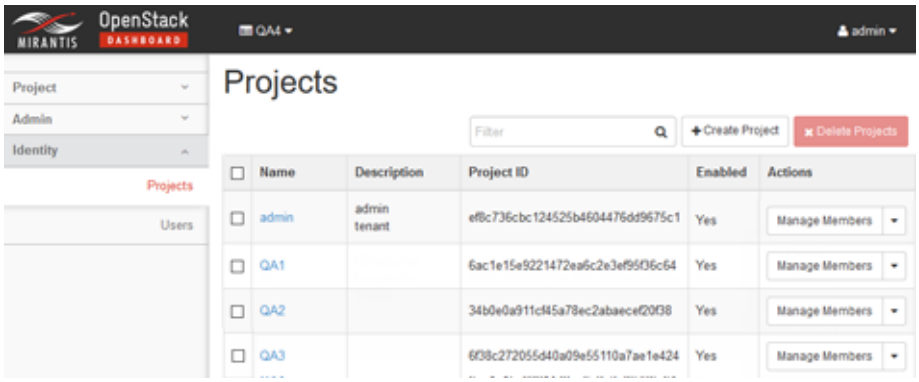
Verify Project Setup for Redcell

Verify that an existing OpenStack project has the proper settings to communicate with the Redcell application and make the appropriate changes as needed.

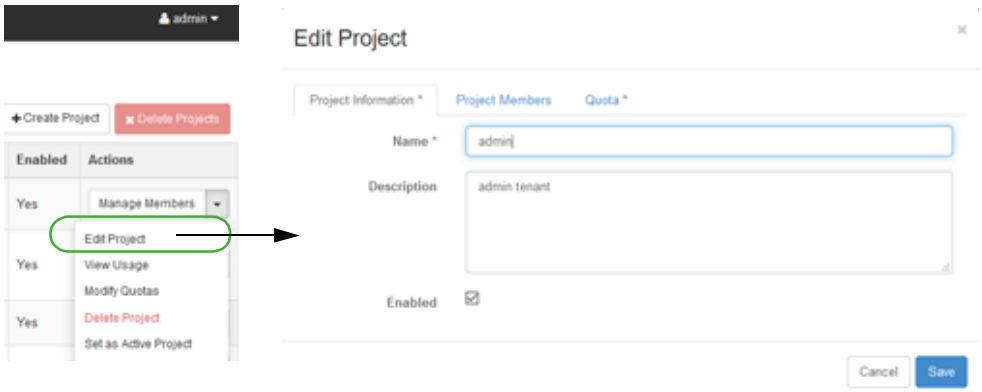
Verify a project's setup from the OpenStack dashboard as follows.

1. Select Identity > Projects.

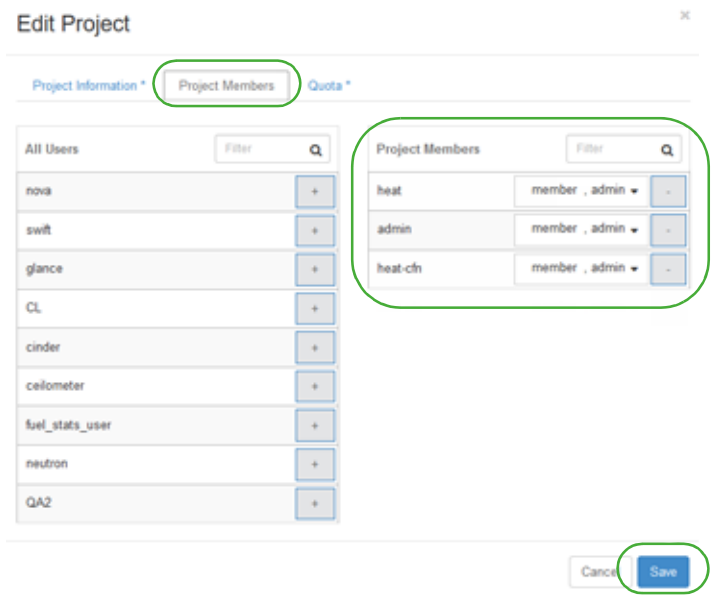
A list of projects is displayed.



2. Select the Edit Project action for the appropriate project.
   The Edit Project window is displayed.



3. Click Project Members.
4. Add the following users to the Project Members list if they do not exist.
   - heat-cfn
   - heat
   - admin
5. Set the member permissions to admin.
6. Save your changes.

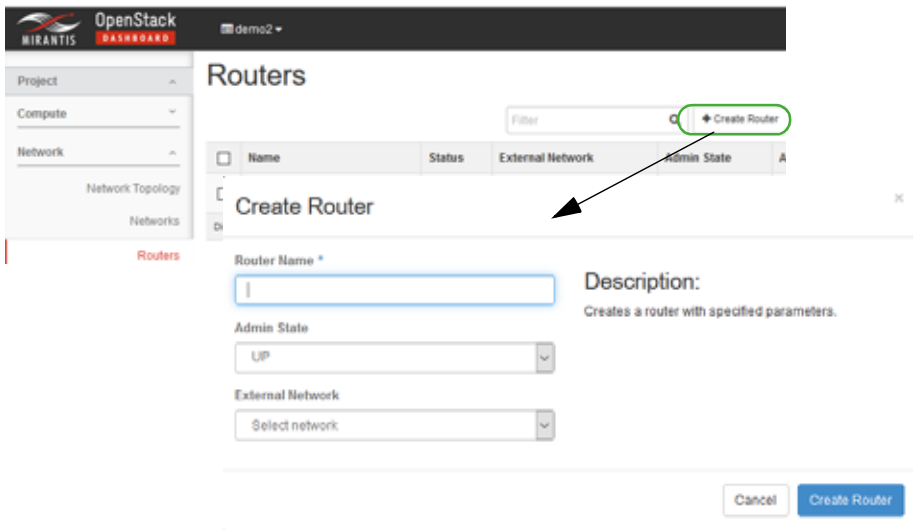


7. Create project networking in an OpenStack VIM (KILO or later release) if it does not already exist.

a. Select Project > Network > Routers.

b. Click Create Router.

The Create Router window is displayed, where you create a project router with a gateway interface.



c. Make sure that the router's gateway IP is reachable from the LAN (your Windows system) following project router creation.

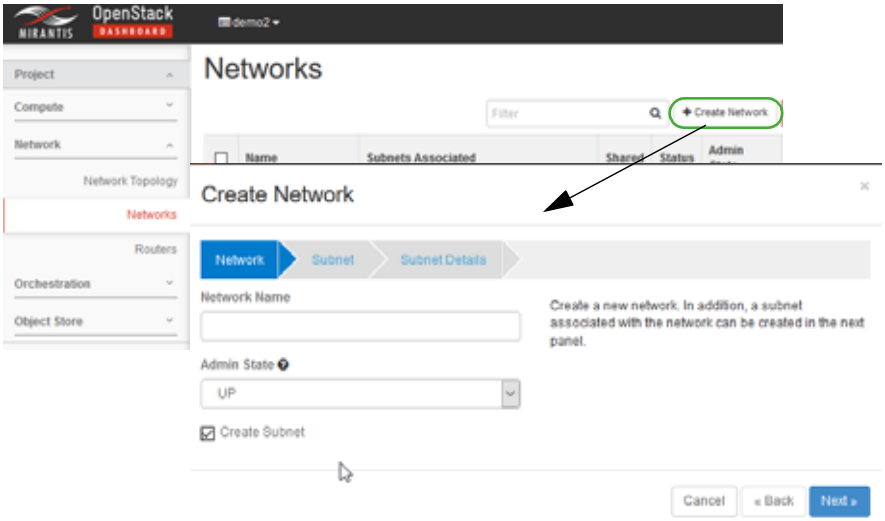
d. Select Project > Network > Networks.

e. Click Create Network.

The Create Network window is displayed.

f. Create and attach the following networks to the project router:

- net-mgmt
- net-data1
- net-data2



Now that your OpenStack project is ready, you can get started by creating a VIM from the Redcell application.

Bringing a VIM Under Management

Before you can deploy network services or virtualized network functions (VNFs), you need to bring under management the Virtualized Infrastructure Manager (VIM) to which you want to deploy the network services or VNFs. Bring VIMs under management by:

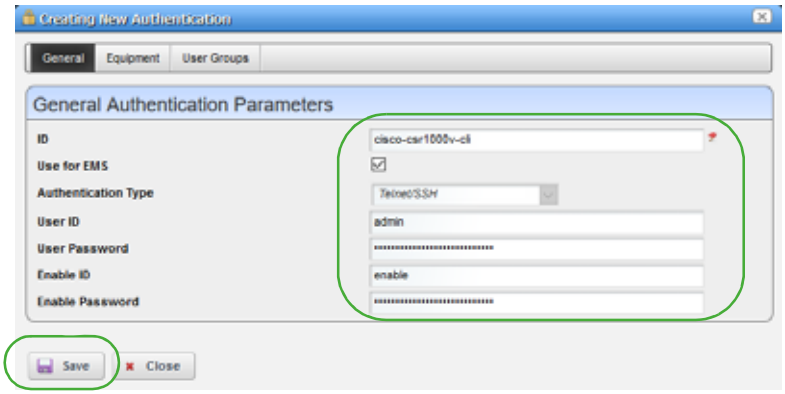
- Setting Up Authentications
- Defining Discovery Profiles
- Adding VIM Resources

Setting Up Authentications

Set up authentications from the Authentication portlet as follows.

1. Right-click > New.

   The Creating New Authentication window is displayed.
2. Enter an authentication ID.
3. Enter the remaining information that applies.
4. Save the authentication profile.
5. Repeat steps 1 through 4 for each new authentication required.



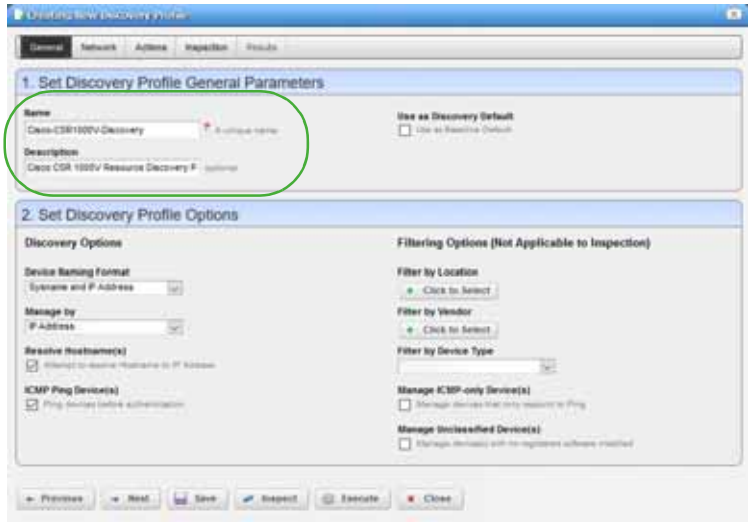
If you need more details than what is provided here, refer to the Authentication portlet description in the *Redcell User Guide*.

Defining Discovery Profiles

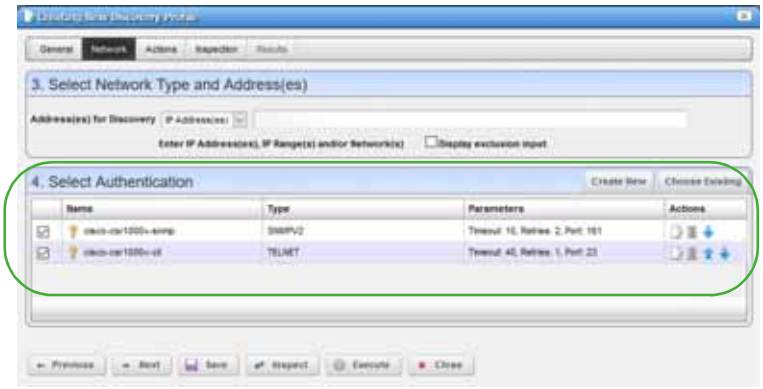
Define discovery profiles from the Discovery Profiles portlet as follows.

1. Right-click > New.

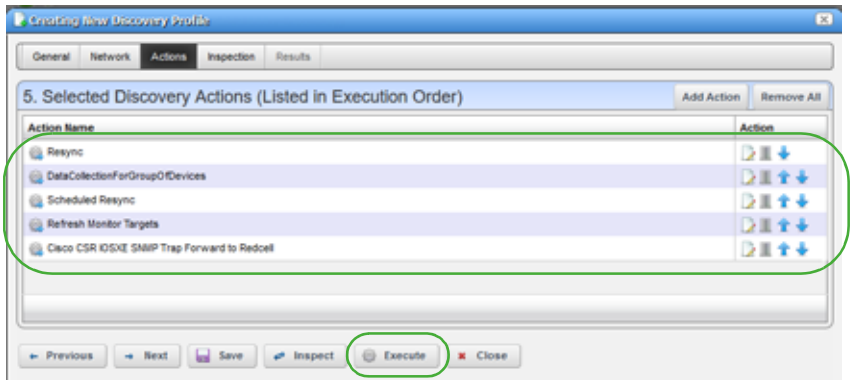
   The Creating New Discovery Profile window is displayed.
2. Enter a name and optional description.



3. Select Network.
4. Create a list of authentications.
5. Select authentications for this profile.



6. Modify the list of actions as needed.
7. Click Execute.



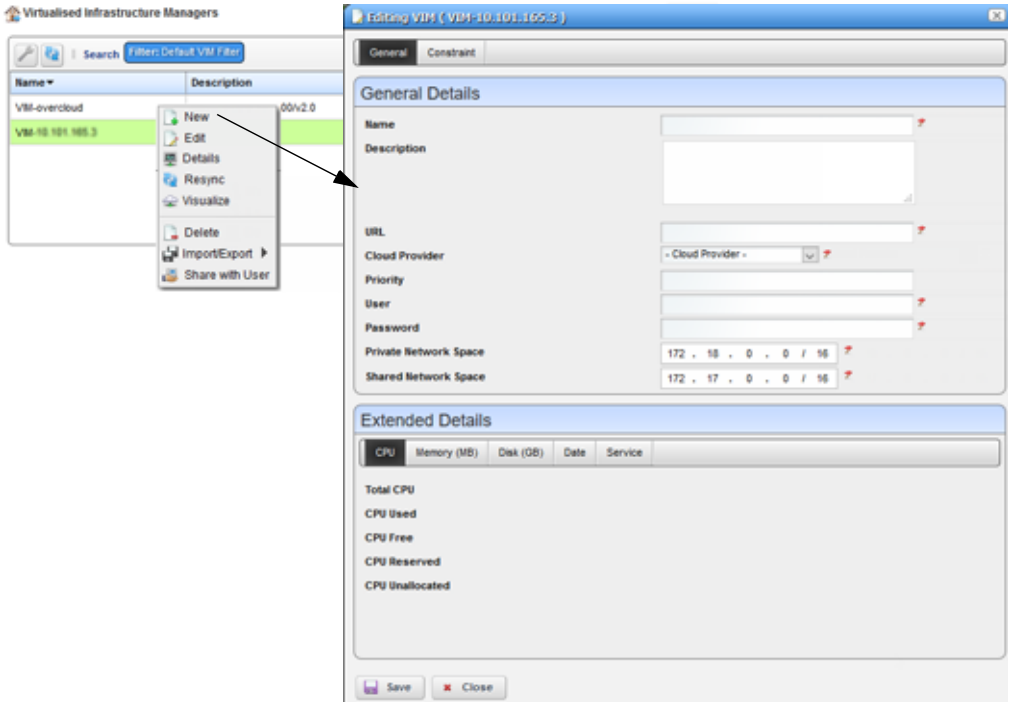
If you need more details than what is provided here, refer to the Discovery Profile portlet description in the *Redcell User Guide*.

Adding VIM Resources

Bring a VIM under management from the Virtualized Infrastructure Manager portlet as follows.

1. Right-click > New.

   The Editing VIM window is displayed.



2. Enter the required information.

   Optionally, provide a more detailed description and a priority.

3. Specify any constraints.

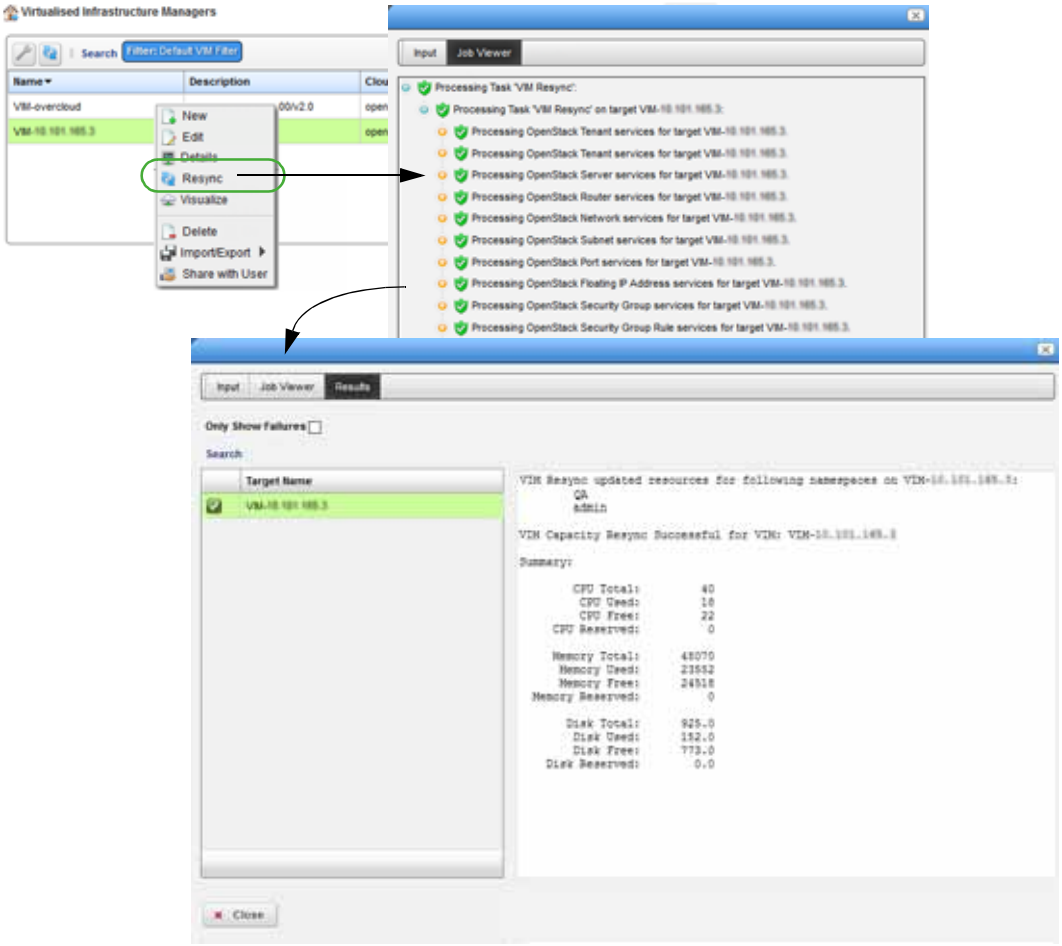
   Constraints specify where to place a network service or VNF if you do not specify a VIM during the staging process.

4. Save the VIM.

   This brings the VIM under management.

5. Right-click > Resync the VIM you created.

   This updates the VIM with the appropriate service models representing the artifacts.



6. View VIM details to see everything related to the VIM, such as:
   - Capacity resources (CPU, memory, disk)
   - Defined constraints
   - Hypervisors
   - VIM Images
   - Reference details (IP addresses, network, port, router, capacity, and so on)
7. Repeat steps 1 through 6 for each new VIM.

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 application.

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

Depending on 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 165. 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
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

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

Portlet	Operator	Administrator	Network Designer
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

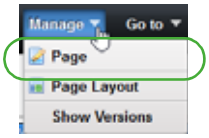
Adding a Page

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.

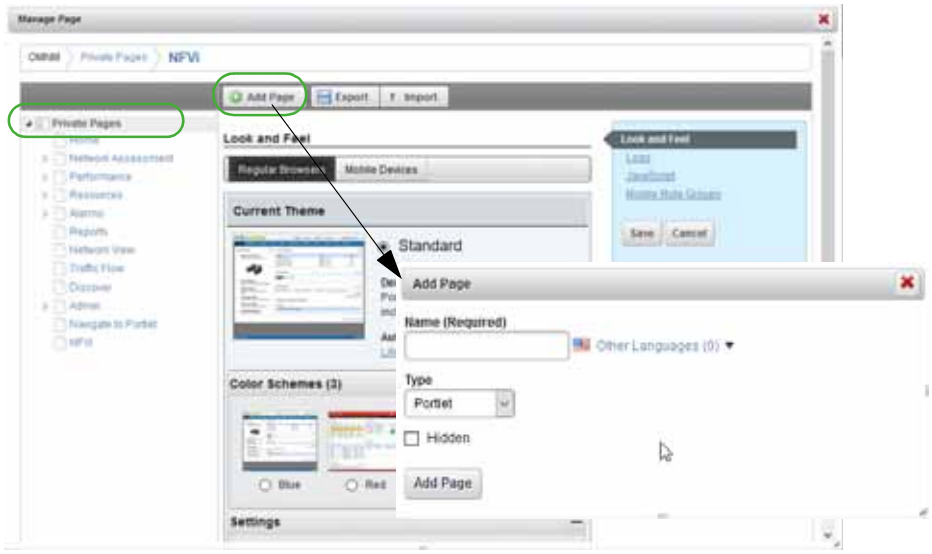
1. Select Manage > Page.

   The Manage Page window is displayed.

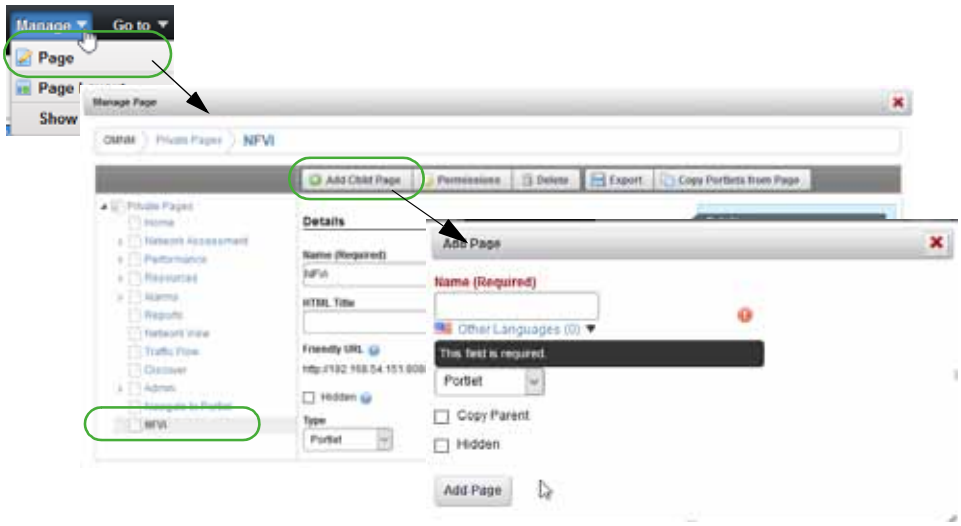


2. Add pages you want to access from the navigation panel.
   a. Select Private Pages.
   b. Specify the look and feel.
   c. Click Add Page.

      The Add Page window is displayed.
   d. Enter page name.
   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 page name.
   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 29 for a brief description of each portlet, or NFV User Interface on page 165 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.

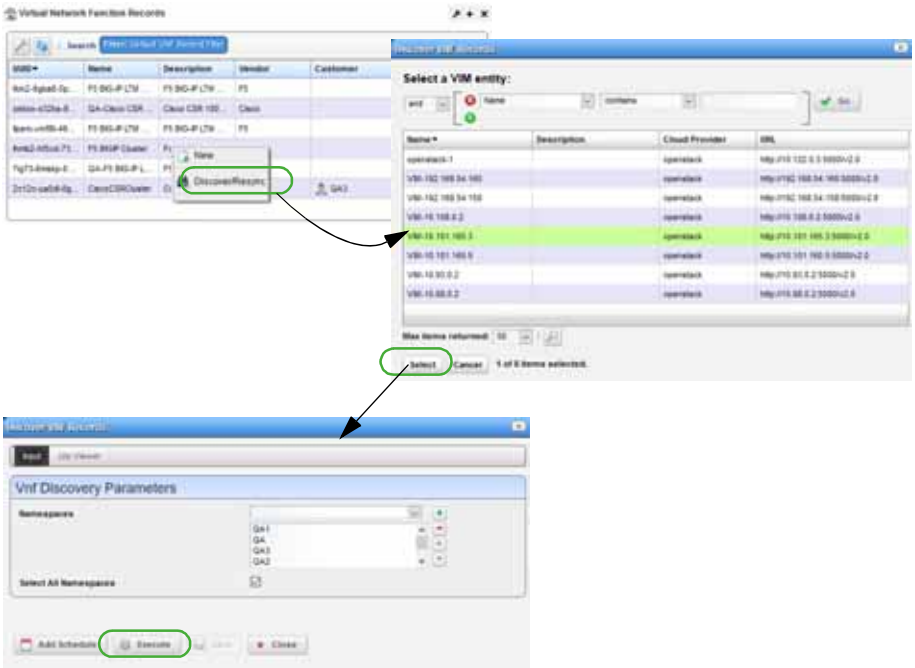
6. Repeat steps 4 and 5 for each portlet you want to add to the selected page.
7. Rearrange the portlets as needed using the drag-and-drop method.
8. Repeat steps 1 through 7 for each page to which you want to add portlets.

Testing Your Redcell Setup

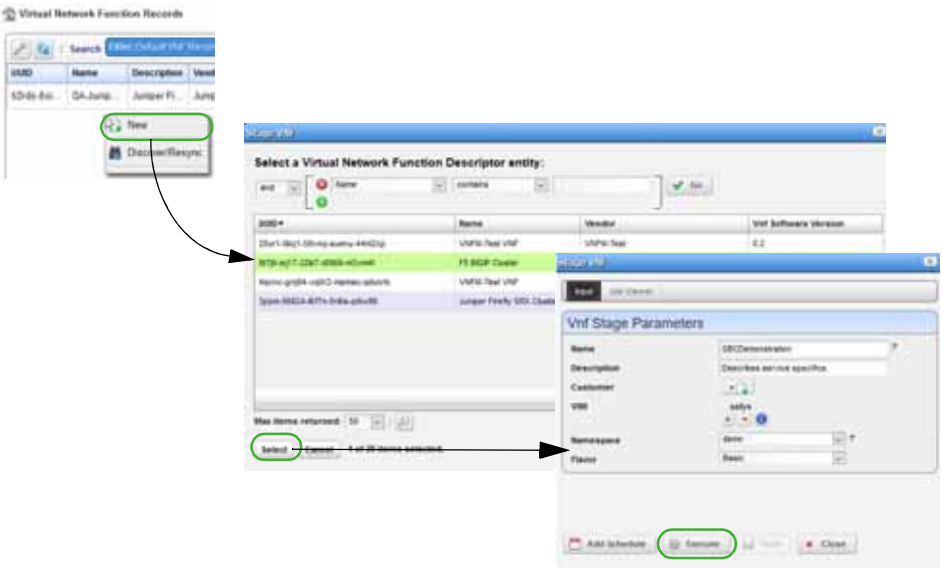
You should run **some** tests to make sure you have what you need and you can perform some basic tasks, such create, edit, view details, delete, and so on.

Test your setup from the Redcell application as follows.

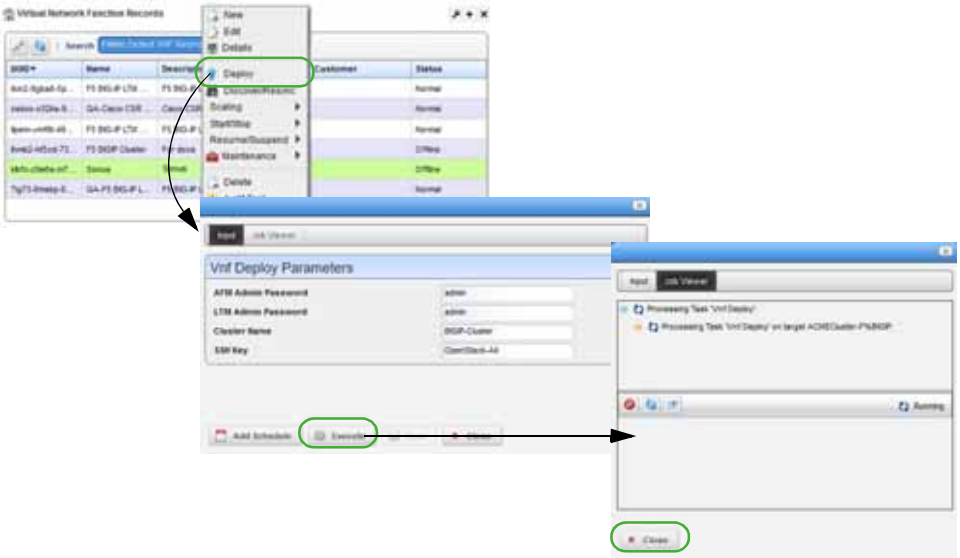
1. Sign out and then sign back in if you are already logged in.
2. Verify that your pages are accessible from the menu bar.
3. Make any necessary changes.
4. Make sure that you can do some basic tasks (add, edit, delete, and view details) from each added portlet, such as these:
   - Network Service Descriptors
   - Physical Network Function Descriptors
   - Software/VIM Images
   - Virtual Network Function Descriptors
   - Virtual Requirements/Reservations
   - Virtualized Infrastructure Managers
5. Navigate to the Virtual Network Function Records portlet.
   a. Verify that you can **discover** VNF records.



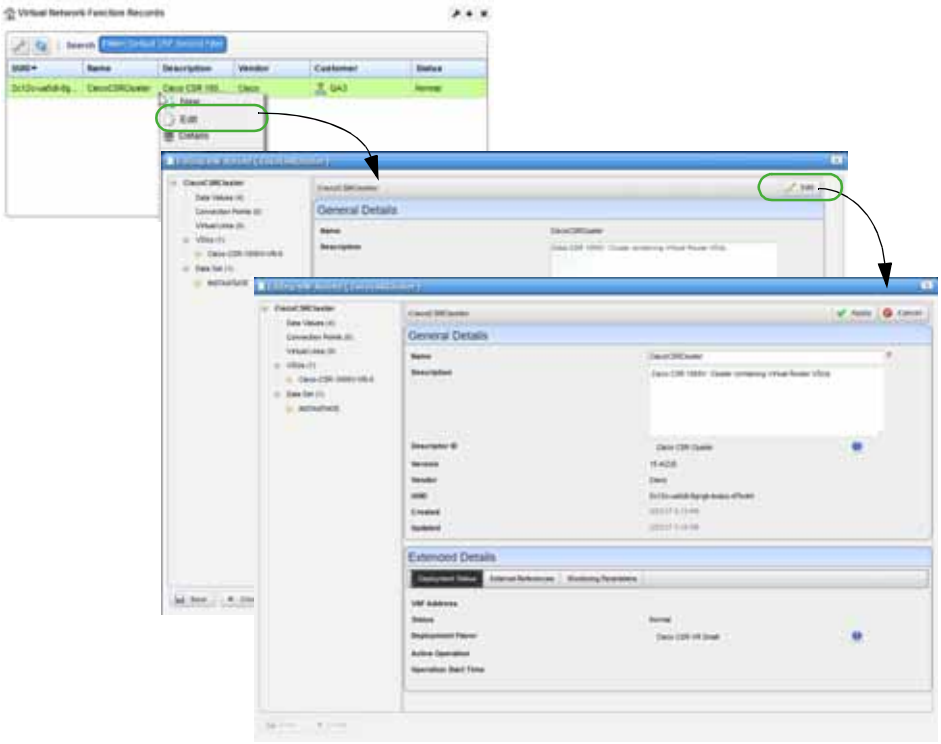
b. Verify that you can **stage** a record.



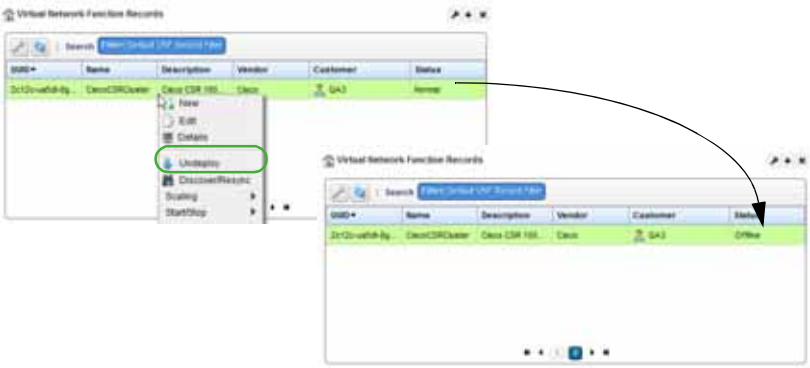
c. Verify that you can **deploy** a staged record staged.



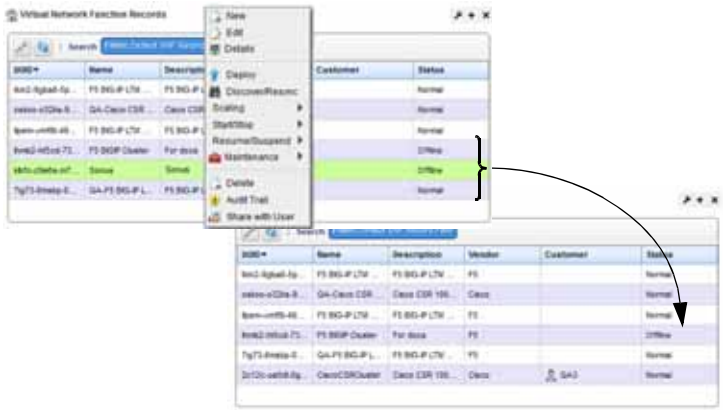
d. Verify that you can **modify** a record.



e. Verify that you can **undeploy** the record deployed in step c.



f. Verify that you can **delete** a record.



Determining What to Do Next

Now that you have prepared your system to configure your NFV infrastructure, you you are ready to get started with the following tasks that apply to your environment (Table 2-3).

Table 2-3 Configuration Tasks

Task	High-Level Steps	Detail Steps
Create Cisco CSR100V VNF descriptor	1. Review VNF package content. 2. Deploy vendor-provided image. 3. Create resource flavors. 4. Create VM snapshots. 5. Create software image descriptor. 6. Modify VIM software image descriptor.	Setting Up Cisco CSR100V VNF Package
Create F5 BIGIP VNF descriptors	1. Review VNF package content. 2. Create a OpenStack project. 3. Deploy vendor-provided image. 4. Modify running VM booted from original image. 5. Create resource flavors. 6. Create VM snapshots. 7. Create software image descriptor. 8. Modify VIM software image descriptor. 9. Apply license.	Setting Up F5 BIGIP VNF Package
Create Juniper Firefly VNF descriptor	1. Review VNF package content. 2. Convert vendor .jva to qcow2 format. 3. Create a project. 4. Deploy vendor-provided image. 5. Create resource flavors. 6. Modify snapshot image changes. 7. Create VM snapshots. 8. Create software image descriptor. 9. Modify VIM software image descriptor.	Setting Up the Juniper Firefly VNF Package
Bring Sonus SBC under management	1. Review VNF package content. 2. Make sure that you understand the VNF configuration methods. **Note:** Sonus VSBC VDUs are automatically brought under Redcell management.	Understanding the Sonus VSBC VNF Package
Manage resources	1. Create, modify, and/or delete VIMs. 2. Resyncing VIMs. 3. Discovering VNF records. 4. Managing software images. 5. Maintaining resource monitors.	Managing NFVI/VIM Resources
Manage descriptors	1. Create or Import descriptors. 2. Modify descriptors as needed. 3. Remove descriptors no longer needed. **Note:** This covers network service, VNF, and PNF descriptors.	Managing Descriptors
Automate deployment	**Note:** Only includes reference information at this time.	Automating SMB vCPE Deployment

3

> Setting Up Cisco CSR100V VNF Package

Covers these topics:

Understanding the Cisco CSR100V VNF Package – 40
Preparing an Image – 45

This section explains the scope, functions, and processes associated with Virtualized Network Functions (VNF) onboarding and instantiation.

Understanding the Cisco CSR100V VNF Package

The Cisco CSR 1000v model is a virtual router that can be deployed in the OpenStack environment. Cloud Services Router (CSR) software images are downloadable and portable between on-premises virtualized data centers, public, and hybrid cloud environments. The CSR allows you to rapidly provision routers as needed across the data center and into the cloud.

The Redcell Cisco CSR100V VNF package provides a sample VNF Descriptor and associated artifacts to deploy the Cisco CSR 1000v virtual router.

Cisco Systems® provides qcow2 images (.qcow2) and licenses that are ready for the OpenStack environment. You need these files to deploy and enable the Cisco CSR 1000v features.

The following list provides the VNF package vendor and validation information:

Vendor and Model Information	
Vendor	Cisco Systems, Inc.
Product Family	CSR
Models	Type 1: 1000v
Operating Systems	IOSXE
Version	15.4(2)S
Validated Environment	
VIM	OpenStack
Version	Liberty
Installer	Mirantis
Version	8
Network Configurations	VXLAN, VLAN Segmentation
Redcell MANO (Management and Operation) Validated Functions	
MANO	NSD, VNFD, NSR, VNFR Link LCEs
VNFM	Generic (MANO Lite) Independent/Specific
NFVO	MANO Lite
Redcell RMO (Resource Management and Operation) Validated Functions	
Inventory	Resource Discovery and Inventory Resource Creation Method (NFV-Model)
Monitoring	SNMP Monitoring CPU & Memory KPIs TFA (flows)
Config	ACLI
NetRestore File Management	NR Backup NR Restore NR Firmware (not validated)

This section covers the:

- Cisco CSR VNF Package Contents
- Redcell VNF Package - Install Component Files
- License Requirements
- Known Issues
- References

Once you have a good understanding of the VNF package, you can get started preparing an image.

Cisco CSR VNF Package Contents

The Cisco CSR (Cloud Services Router) VNF package contains artifacts necessary to install and deploy Virtualized Network Functions (VNFs) for the Cisco CSR 1000v type Virtualization Deployment Unit (VDU).

The sample VNF descriptor created has basic flavors to deploy the VNF VDU as part of a standalone VNF record. The Network Service descriptor is not currently available for the CSR software.

The sample Cisco CSR Cluster VNF descriptor is located in the following file:

`owareapps/nfv-vnfm-cisco/db/vnf.cisco-csr-cluster-v1.xml`

This sample VNF descriptor defines the packaging and behavior of one or more Cisco CSR 1000v VDUs and can be included as part of a network descriptor.

Here are the **Cisco CSR Cluster** descriptor deploy parameters used:

Field Name	Data Type	Description	Default	Valid Values	Required
Cluster Name	String	VNF's Cluster Name	Cisco-Cluster	String	N
DNS IP	IP Address	IP of DNS Server	8.8.8.8	IP Address	N

Here are the **Cisco CSR Cluster** descriptor flavors used:

Flavor Name	VDU Name	VDU Count	CPU	Disk (GB)	Memory (MB)
Cisco CSR VR Small	Cisco-CSR-1000V-VR	1	2	0	4096

View the VNF descriptor's details from the Redcell VNF Descriptor portlet.

Redcell VNF Package - Install Component Files

The following Redcell Virtualized Network Function (VNF) package installation components are required for the Cisco CSR100V product:

VNF (OCP)	nfv-vnfm-cisco.ocp
Device Driver (DDP)	cisco.ddp

The Redcell VNF package descriptors for the **Cisco CSR100V** VNF product includes:

NVF VNF Package			Resource Management		
VIM Software Image Records	VNF Descriptors	Sample NSD	Discovery Authentication Records	Discovery Profiles	Device Driver
Y	Y	N	Y	Y	Y

The VNF package descriptors include:

- Discovery Authentication Profiles
- Discovery Profiles
- NFV VIM Software Image Descriptors

Discovery Authentication Profiles

The Cisco CSR100V Discovery Authentication profiles are located in the following file:

`owareapps/nfv-vnfm-cisco/db/rc.disc-auths-cisco.xml`

This file contains the following discovery authentication profiles:

Authentication Record Name	Description
cisco-csr1000v-cli	Telnet Credentials
cisco-csr1000v-snmp	SNMP v1/v2 Credentials

Discovery Profiles

The Cisco CSR100V Discovery profiles are located in the following file:

`owareapps/nfv-vnfm-cisco/db/rcdisc-profile-cisco.xml`

This file contains the Cisco-CSR1000v-Discovery profile that automatically discovers and populates resource records during VNF record instantiation.

The following tasks are run once the target VM in the OpenStack environment is fully booted and can respond to SNMP and CLI requests from the management system:

1. Resync
2. DataCollectionForGroupOfDevices
3. Scheduled Resync
4. Refresh Monitor Targets
5. Cisco CSR IOSXE SNMP Trap Forwarding to Redcell

NFV VIM Software Image Descriptors

The original Cisco vendor image was used to produce the following workable snapshot image used to create Network Functions Virtualization (NFV) Virtualized Infrastructure Manager (VIM) software image descriptors from the Redcell application. See Preparing an Image on page 45 for detailed instructions.

Name	Scope/Description	Container Format	Disk Format	Min RAM (MB)	MIN Disk (GB)	Resource Discovery Profile
CiscoCSR1000v-snapshot-2-16Ports	Dorado Snapshot of original csr1000v-universalk9 .03.12.00.S.154-2.S-std plus 16 Interfaces per iosxe-cfg-16Ports.txt file	BARE	QCOW2	4096	0	Y

License Requirements

Contact your vendor for licensing requirements.

Known Issues

The OpenStack flavor for the Cisco CSR 1000v VMs must contain a value of 0 for the Root, Ephemeral, and Swap Disk fields. Otherwise, the VM does not complete the bootup process.

References

This section provides references to:

- Vendor Documentation (URLs)
- VNF Configuration Methods

Vendor Documentation (URLs)

Refer to the Cisco website (http://www.cisco.com) for all vendor-specific documentation.

For the Cisco CSR 1000v-Series datasheet, refer to the following Cisco website page:

```
http://www.cisco.com/c/en/us/products/collateral/routers/cloud-services-
   router-1000v-series/datasheet-c78-733443.html
```

VNF Configuration Methods

A combination of image (snapshot) preparation, along with Virtualization Deployment Unit (VDU) Post Instantiate Configuration Lifecycle Events (LCEs), is implemented in this VNF package to ensure the Cisco CSR VDU is automatically brought under Redcell management.

Customized Image Preparation

The Cisco CSR image is provided by Cisco Resource Management applications.

See Preparing an Image on page 45 for a description of how to create an updated image (snapshot) for the Cisco CSR 1000v model series to use to boot up VMs that are managed by the Redcell application. The snapshot produced is used to create Cisco CSRs in the OpenStack environment, so that no manual intervention is required to apply the management system communication settings.

Redcell Resource Configuration Tasks

Once the target VM in the OpenStack environment is fully booted and can respond to SNMP and CLI requests from the management system, post discovery tasks are run.

For more details about the Cisco-CSR1000v-Discovery profile and the tasks that run, see Discovery Profiles on page 42.

Preparing an Image

Before you can discover and manage a Virtualized Network Function (VNF) resource from the Redcell application, you need to:

1. Set up your OpenStack environment by preparing a Cisco CSR image with the necessary configuration.
2. Create a software image record from the Redcell application.

Setting Up Your OpenStack Environment

To set up your OpenStack environment, you need to:

1. Deploy the vendor's base image by uploading the original qcow2 image file received from your Cisco supplier to a target Bare Metal OpenStack controller.
2. Create flavors representing the smallest supported flavor to use. The vendor (Cisco) provides a flavor (Figure 3-1).
3. Create VM snapshots that are used to create and export a VIM software image descriptor within the Redcell application.

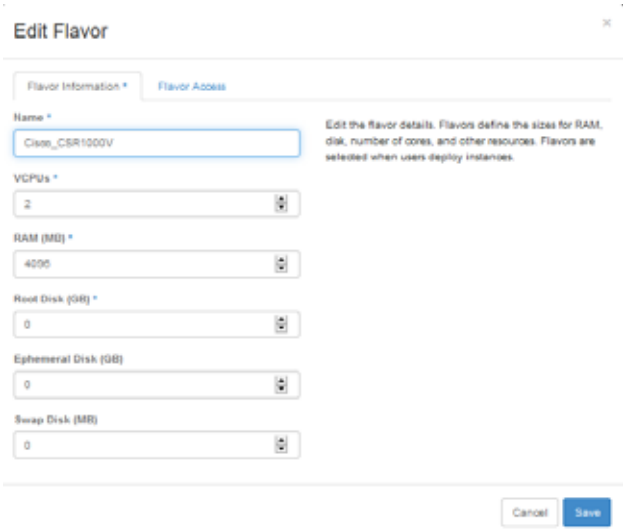


Figure 3-1 Cisco_CSR1000v Flavor

Instantiating a VM From a Vendor Image

Instantiate a VM (virtual machine) in your OpenStack environment from the vendor-provided image as follows.

1. Create a default Cisco IOS-XE configuration file (iosxe_config.txt) with your operational settings for your Cisco CSR 1000v virtual routers.

   Refer to your Cisco product documentation for instructions on how to create and populate a Cisco configuration file for your Cisco CSR VNFs.

   a. Add configuration for the number of interfaces you need to utilize (GigabitEthernet**1** GigabitEthernet***N***).

      The following example shows configuration for four interfaces:

      ```
      interface GigabitEthernet1
       description "Data Port 1"
       ip address dhcp
       no shutdown
      !negotiation auto
      !
      interface GigabitEthernet2
       description "Data Port 2"
       ip address dhcp
       no shutdown
      !negotiation auto
      !
      interface GigabitEthernet3
       description "Data Port 3"
       ip address dhcp
       no shutdown
      !negotiation auto
      !
      interface GigabitEthernet4
       description "Data Port 4"
       ip address dhcp
       no shutdown
      !negotiation auto
      ```

   b. Configure more GigabitEthernet interfaces than are actually attached to the VM when booted later in from the OpenStack system.

      This allows you to use the same image in multiple network topologies that have a varying number of networks to which you will attach the Cisco CSR 1000v virtual rouers.

   c. Name the file iosxe_config.txt.

   d. Upload the iosxe_config.txt file to your target's local disk under the /root directory.

2. Obtain an image from your vendor in qcow2 format.

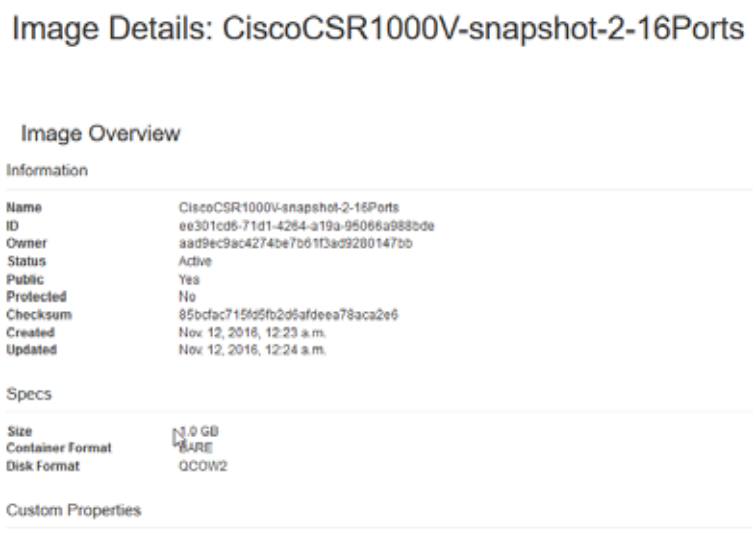
3. Upload the qcow2 image to the OpenStack VIM.

   For example, Cisco provided the following image file for the Cisco CSR 1000v VNF package:

   `csr1000v-universalk9.03.12.00.S.154-2.S-std.qcow2`

4. Name the image record in the OpenStack system as `CiscoCSR1000v`.
5. Double-click the image from the Project > Compute > Images page.

   The image details overview is displayed.



6. Boot up a VM from the OpenStack system using this image.

   Here is an example command syntax:

   `Image file Used:\\192.168.51.11\it\VMs\vnf\vendor\cisco\CSR\`**`csr1000v-universalk9.03.12.00.S.154-2.S-std.qcow2`**

   `Config file used - placed on OpenStack controller 10.101.170.3 (bare metal ICEHOUSE via Fuel) in the root directory:`

   `\\192.168.51.11\it\VMs\vnf\vendor\cisco\CSR\iosxe_config_MgtPlus8DataPorts.txt -> copied to /root/iosxe_config_MgtPlus8DataPorts.txt on the OpenStack Controller.`

7. Log into the OpenStack controller.
8. Boot a new VM using the following nova command line syntax.

   Make sure that you are using the image along with your iosxe_config.txt file and that the instance is operational.

   `nova --os-username admin --os-password <`*`OpenStack admin password`*`> --os-<`*`OpenStack Tenant Name`*`> admin --os-auth-url <`*`OpenStack Auth URL`*`> boot <`*`VM Name`*`> --image <`*`OpenStack Image Name`*`> --flavor <`*`OpenStack Flavor Name`*`>` **`--nic net-id=<`*`OpenStack Network 1 UUID`*`> --nic net-id=<`*`OpenStack Network 2 UUID`*`>`** `--config-drive=true --file iosxe_config.txt=<`*`default config file disk location/file name`*`>`

   This example command has two network connections. You can include additional network connections by adding repetitions of the following:

   `--nic net-id=<`*`value`*`>`

9. Verify that the VM:
   - Booted successfully.
   - Has the proper Cisco configuration file contents applied to its running configuration.
   - Is fully operational.
10. Suspend the VM instance from the OpenStack dashboard.
11. Take a snapshot of the instance.
12. Boot a new VM using the snapshot.
13. Make sure that the VM is operational and has the proper contents from the original configuration file created in step 1 applied to its running configuration.

Create a flavor before creating the VM snapshots.

Creating a Flavor

Cisco provides a flavor. However, VIMs require some additional settings to boot properly.

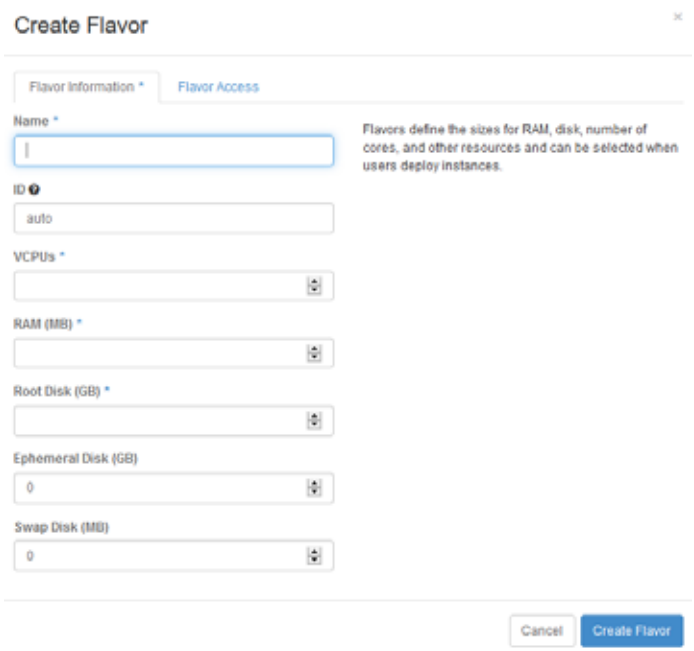
Create a flavor to use from the OpenStack dashboard as follows.

Caution!

It is **critical** that the Root, Ephemeral, and Swap Disk settings are all set to 0. Otherwise, the VMs created later using this flavor and the Cisco CSR 1000v image do not boot properly.

1. Select Admin > System > Flavors.
2. Click Create Flavor.

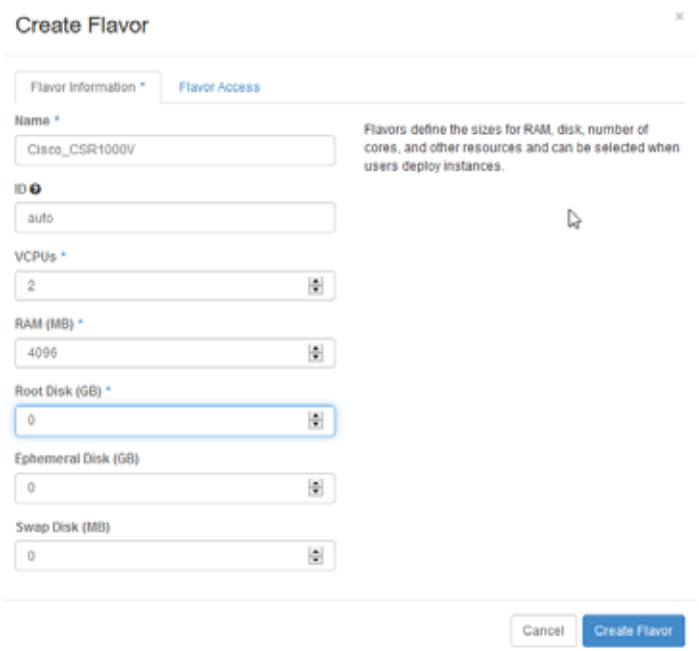
   The Create Flavor window is displayed.



3. Enter a name, such as Cisco_CSR1000v, and the number of VCPUs.
4. Set the memory required to 4096.
5. Set Root, Ephemeral, and Swap Disk values to zero.
6. Specify which projects to apply the flavor.

   If you do not specify a project, the flavor is available to all projects.
7. Click Create Flavor.

   Your flavor is created.



Next you need to create a VM snapshot.

Creating a VM Snapshot

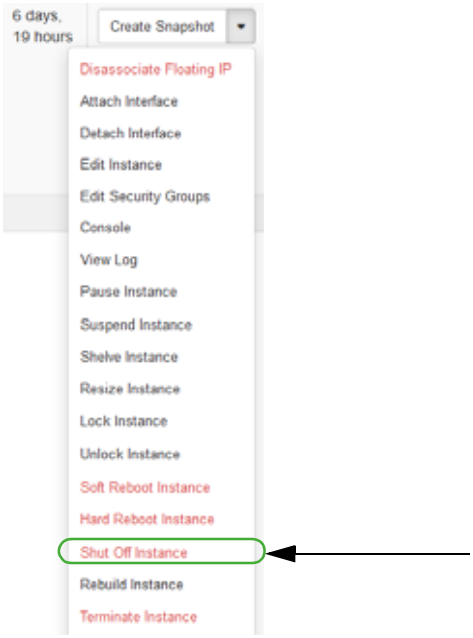
The VM snapshot is used to create and export a VIM software image descriptor from the Redcell application and then the VIM software image descriptor is used to manage, deploy, or migrate images.

Create a VM snapshot from the OpenStack dashboard as follows.

1. Shut off the instance.
   a. Select Project > Compute > Instances.

      A list of instances is displayed.
   b. Select the Shut Off Instance action for the appropriate instance.

      A confirmation message is displayed.
   c. Click Shut Off Instance.



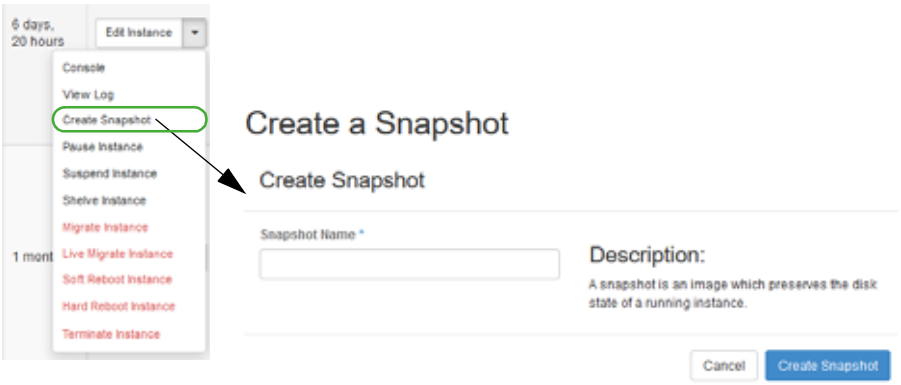
If you prefer to shutdown the Cisco CSR 1000v VM from the Cisco CLI, refer to your Cisco documentation for instructions.

2. Create a snapshot image.
   a. Select Admin > System > Instances.

      A list of instances is displayed.

   b. Select the Create Snapshot action for the instance.

      The Create a Snapshot window is displayed.



   c. Enter a name, such as `CiscoCSR1000v-snapshot` followed by any additional text based on the configuration file you created and applied to the VM (such as Cisco IOS-XE).

   d. Click Create Snapshot.

3. Assign OpenStack image properties to the snapshot image created in step 2.
   a. Select Admin > System > Images.
   b. Select the Edit Image action for the instance.

      The Update Image window is displayed.

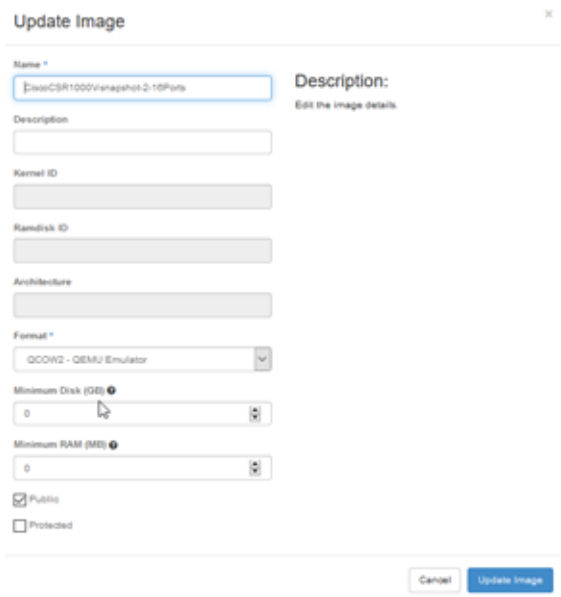
Caution!

It is **critical** that the Root, Ephemeral, and Swap Disk settings are all set to 0. Otherwise, the VMs created later using this flavor and the Cisco CSR 1000v image do not boot properly.

   c. Set the disk and memory requirements to zero (0).
   d. Select Public.

      This is required so that the Redcell system can access and manage the image later on.
   e. Click Update Image.

      Your changes are saved.



Once you create the VM snapshot image in the OpenStack environment, you are ready to create a software image descriptor from the Redcell application.

Creating a Software Image Descriptor

The Redcell Network Functions Virtualization (NFV) feature uses the software image descriptor to manage, deploy, or migrate images. Create a software image descriptor record from the Redcell application by:

1. Creating a Software Image Descriptor for a Snapshot
2. Modifying the VIM Software Image Descriptor

The steps provided in this section assume that you have already created a VIM that houses the snapshot image in the OpenStack environment. If a VIM that houses the snapshot image does not exist, see Setting Up Your OpenStack Environment on page 45 before continuing.

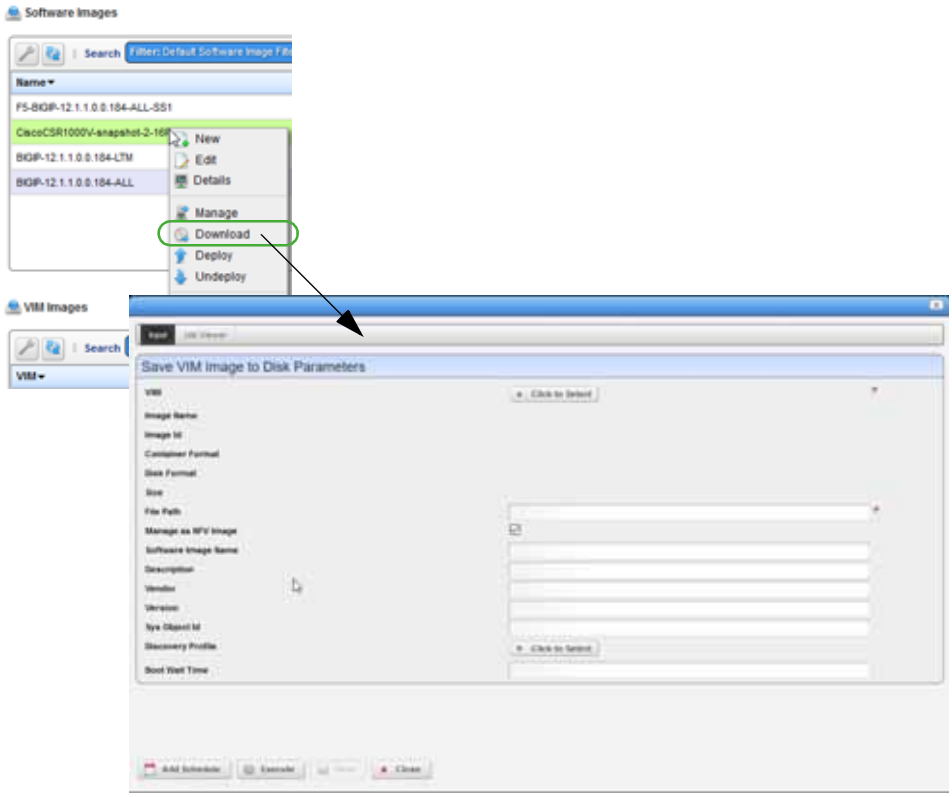
Creating a Software Image Descriptor for a Snapshot

Create a software image descriptor for a snapshot image from the Redcell application as follows.

1. Navigate to the Software Images portlet.

   The portlet's location depends on your company's configuration.
2. Right-click an image.
3. Select Download.

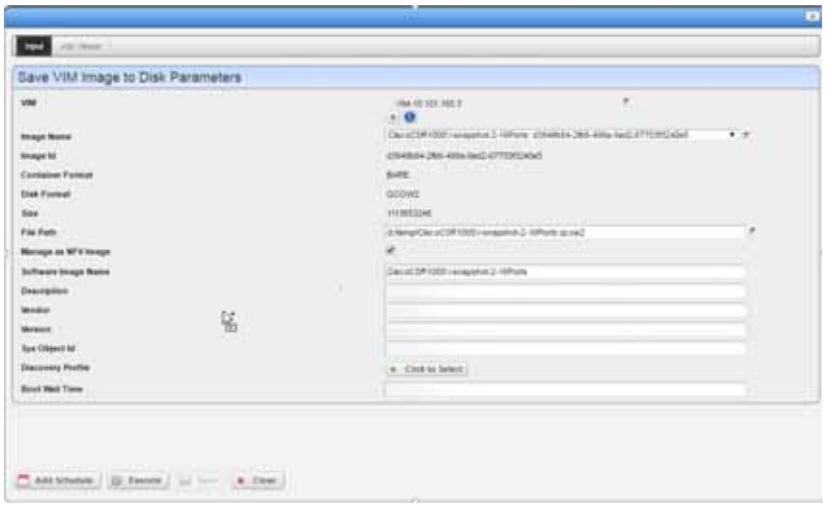
   The Save VIM Image to Disk Parameters input window is displayed.



4. Select the Virtualized Infrastructure Manager (VIM) housing the CiscoCSR1000v-snapshot-2-16Ports image created earlier.
5. Select the snapshot image to download.

   For example: `CiscoCSR1000v-snapshot-2-16Ports.qcow2`

   The fields are populated based on your selection.



6. Click Execute.
7. Copy the image downloaded from your local disk to your company's centralized file server (such as an FTP Server) to redistribute the new snapshot image across additional OpenStack VIMs.

Before the image descriptor is complete and ready to export, you need to modify the image descriptor.

Modifying the VIM Software Image Descriptor

These instructions assume that you have already created a VIM image descriptor. If you have not created the image descriptor, see Creating a Software Image Descriptor for a Snapshot on page 52.

Modify the VIM software image descriptor from the Redcell application as follows.

1. Navigate to the Software Images portlet.

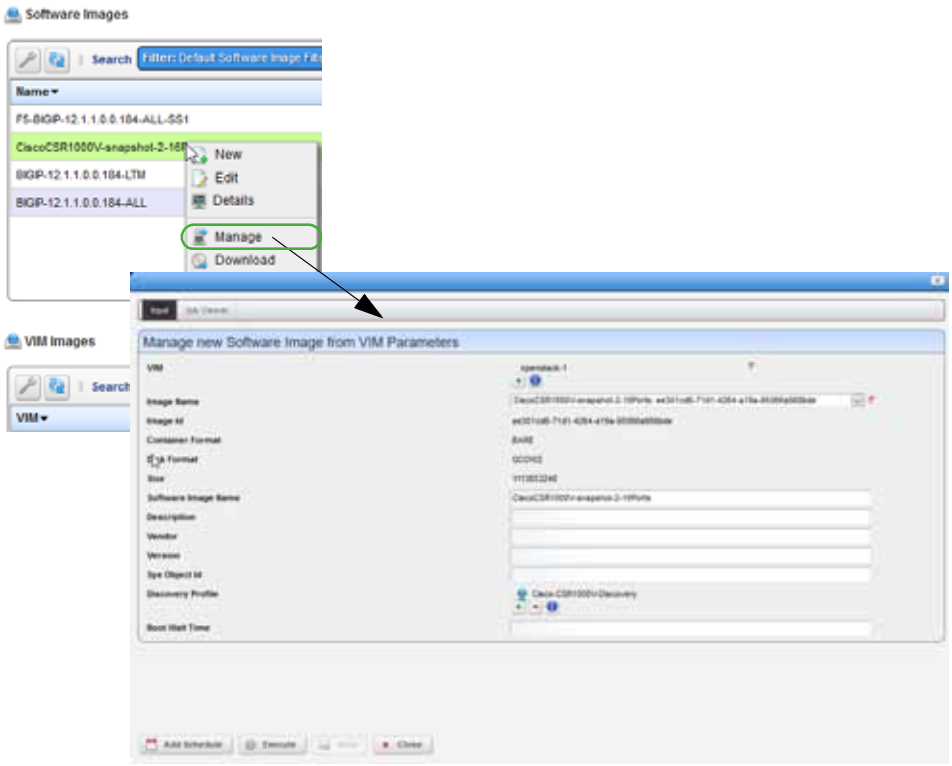
   The portlet's location depends on your company's configuration.
2. Right-click an image.
3. Select Manage.

   The Manage new Software Image from VIM Parameters window is displayed.
4. Select the VIM that houses the snapshot image.
5. Select the snapshot image name.

   For example: `CiscoCSR1000v-snapshot-2-16Ports: uniqueImageID`

   The image ID, container format, disk format, size, and software image name fields are populated.

6. Select a discovery profile.



7. Click Execute.

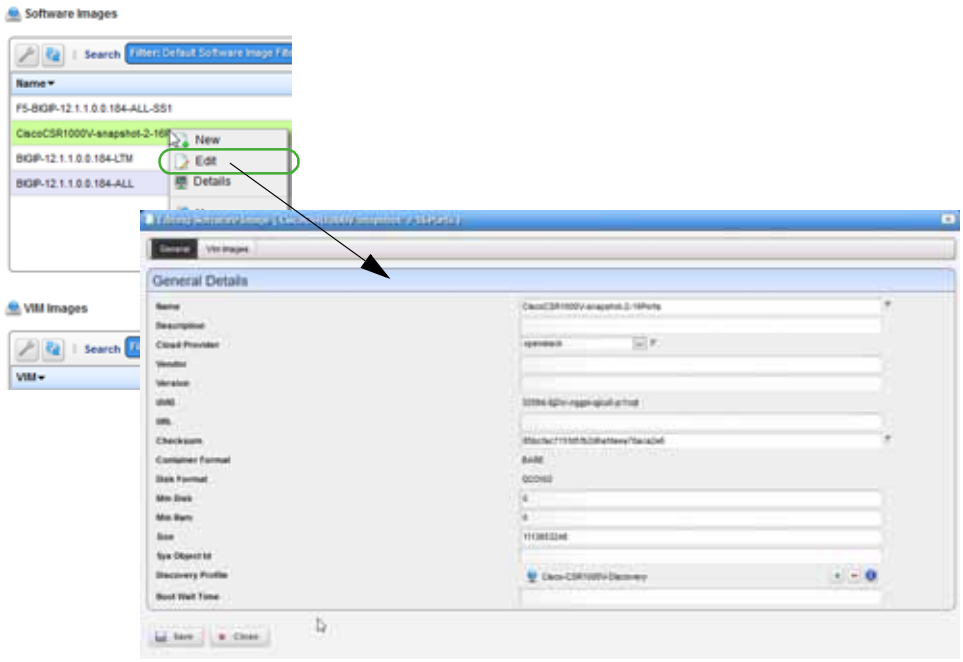
   A new software image record is created matching the image name in your OpenStack environment.

8. Right-click an image.
9. Select Edit.

   The Editing Software Image window is displayed.

10. Select the snapshot image from the Image Name list.

    The Editing Software Image window is displayed.



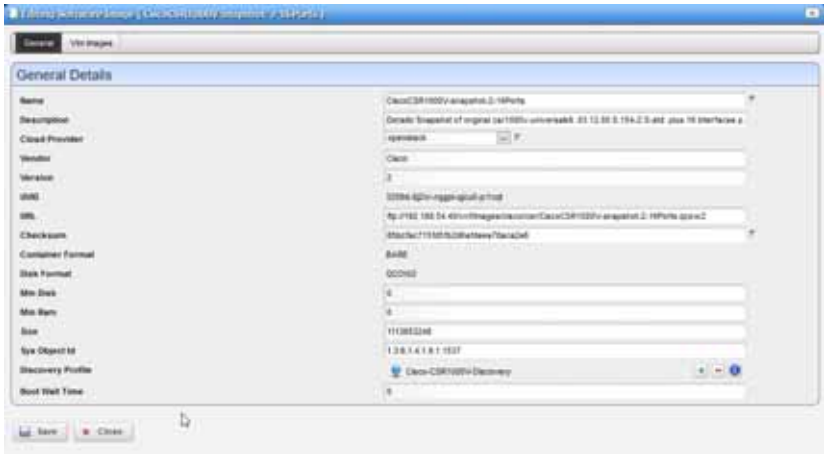
11. Enter the missing information as follows.
    a. Add a meaningful description.
    b. Specify the vendor, such as Cisco.
    c. Add a meaningful version number, such as 2.
    d. Enter a valid URL that points to your local environment's file server or disk location where the qcow2 file is stored and accessible. For example:

       `ftp://caserverIP/cisco/csr/CiscoCSR1000v-snapshot-2-16Ports.qcow2`
    e. Enter the SNMP SysObject ID for the Cisco CSR 1000v model, such as:

       `1.3.6.1.4.1.9.1.1537`
    f. Select the discovery profile containing the required ssh and SNMP authentication objects.

       Discovery profiles are created by your system administrator or someone within your organization with administrative permissions.
    g. Leave the Boot Wait Time field blank.

       The Redcell system assigns a default integer value of 0 after you save the profile.
    h. Review your inputs to ensure accuracy.



12. Save the software image record.
13. Locate and Select the newly created Software Image Record and export it to an archive disk location for backup purposes.

4

> Setting Up F5 BIGIP VNF Package

Covers these topics:

Understanding the F5 BIGIP VNF Package – 58
Preparing an Image – 67
Manually Applying an F5 License – 83

This section explains the scope, functions, and processes associated with Virtualized Network Functions (VNF) onboarding and instantiation.

Understanding the F5 BIGIP VNF Package

The F5 BIG-IP Virtual Edition (VE) is a virtual application delivery controller that is deployable in an OpenStack environment. The BIG-IP VE provides rich features, such as advanced traffic management, acceleration, DNS, firewall, and access management. The BIG-IP VE software images are downloadable and portable between on-premises virtualized data centers, public, and hybrid cloud environments. With BIG-IP virtual editions, you can rapidly provision consistent application services across the data center and into the cloud.

The Redcell F5 BIGIP Virtualized Network Function (VNF) package provides sample VNF descriptors and associated artifacts used to deploy the LTM (Local Traffic Manager, Load Balancer) and AFM (Advanced Firewall Manager) models.

F5 Networks provides qcow2 images (.qcow2) and licenses that are ready for the OpenStack environment. You need these files to deploy and enable the F5 BIGIP VNF features.

The following list provides the VNF package vendor and validation information:

Vendor and Model Information	
Vendor	F5 Networks, Inc.
Product Family	BIGIP VE
Models	Type 1: LTM (Load Balancer) Type 2: AFM (Firewall)
Operating Systems	BIGIP Traffic Management Shell (tmsh)
Version	12.1.1
Validated Environment	
VIM	OpenStack
Version	Liberty
Installer	Mirantis
Version	8
Network Configurations	VXLAN, VLAN Segmentation
Redcell MANO (Management and Operation) Validated Functions	
MANO	NSD, VNFD, NSR, VNFR Link LCEs
VNFM	Generic (MANO Lite) Independent/Specific (N-N/A)
NFVO	MANO Lite
Redcell RMO (Resource Management and Operation) Validated Functions	
Inventory	Resource Discovery and Inventory Resource Creation Method (NFV-Model)
Monitoring	SNMP Monitoring CPU & Memory KPIs TFA (flows)
Config	ACLI
NetRestore File Management	NR Backup NR Restore NR Firmware (not validated)

This section covers the:

- F5 BIGIP VNF Package Contents
- Redcell VNF Package - Install Component Files
- License Requirements
- Known Issues
- References

Once you have a good understanding of the VNF package, you can get started preparing an image.

F5 BIGIP VNF Package Contents

The F5 BIGIP VNF package contains artifacts necessary to install and deploy Virtualized Network Functions (VNFs) for the following Virtualization Deployment Unit (VDU) types the F5 BIG-IP VE product family offers:

- Type 1: BIGIP VE - LTM (Load Balancer)
- Type 2: BIGIP VE - AFM (Firewall)

Multiple sample VNF descriptors were created with basic flavors to deploy the VNF VDUs, either as part of a standalone VNF record, or as part of a higher level, end-to-end Network Service record:

- NFV VNF Descriptors
- Network Service Descriptor

NFV VNF Descriptors

This section describes the following Redcell Network Functions Virtualization (NFV) VNF (virtualized network functions) descriptors:

- F5 BIGIP LTM Virtual Appliance
- F5 BIGIP ALL AFM Virtual Appliance
- F5 BIGIP Cluster

F5 BIGIP LTM Virtual Appliance

The sample F5 BIGIP LTM Virtual Appliance descriptor is located in the following file:

`owareapps/nfv-vnfm-f5/db/vnfd.f5-bigip-ltm-v12.xml`

This sample Virtualized Network Function (VNF) descriptor defines the packaging and behavior of a single F5 BIGIP LTM (Load Balancer) Virtualization Deployment Unit (VDU) and can be included as part of a network descriptor.

Here are the **F5 BIGIP LTM Virtual** descriptor deploy parameters used:

Field Name	Data Type	Description	Default Value	Valid Values	Required
LTM Admin Password	String	VNF's Admin User Password	admin	Valid Linux password format	N

Here are the **F5 BIGIP LTM Virtual** descriptor flavors used:

Flavor Name	VDU Name	VDU Count	CPU	Disk (GB)	Memory (MB)
F5-BIGIP-TTM-Small	BIGIP LTM VA	1	2	50	4096

View the VNF descriptor's composition details from the Redcell VNF Descriptor portlet.

F5 BIGIP ALL AFM Virtual Appliance

The sample F5 BIGIP ALL AFM Virtual Appliance descriptor is located in the following file:

`owareapps/nfv-vnfm-f5/db/vnfd.f5-bigip-all-afm-v12.xml`

This sample Virtualized Network Function (VNF) descriptor defines packaging and behavior of a single F5 BIGIP AFM (Firewall) Virtualization Deployment Unit (VDU) and can be included as part of a Network descriptor.

Here are the **F5 BIGIP ALL AFM Virtual** descriptor deploy parameters:

Field Name	Data Type	Description	Default	Valid Values	Required
AFM Admin Password	String	VNF's Admin User Password	admin	Valid Linux password format	N

Here are the **F5 BIGIP ALL AFM Virtual** descriptor flavors:

Flavor Name	VDU Name	VDU Count	CPU	Disk (GB)	Memory (MB)
F5-BIGIP-AFM-Small	BIGIP AFM VA	1	4	160	8192

View the VNF descriptor's composition details from the Redcell VNF Descriptor portlet.

F5 BIGIP Cluster

The sample F5 BIGIP Cluster descriptor is located in the following file:

`owareapps/nfv-vnfm-f5/db/vnfd.f5-bigip-cluster-v12.xml`

This sample Virtualized Network Function (VNF) descriptor defines a standalone type, which means that no higher-level network service is required to establish the network/virtual links and deploy stage/deploy the VNF.

This sample VNF descriptor includes lifecycle event (LCE) tasks to create the project's router and networks as well as deploy into the project's network a varied composition of F5 BIGIP Virtualization Deployment Units (VDUs), based upon the assigned VNF flavor.

Here are the **F5 BIGIP Cluster** descriptor deploy parameters used:

Field Name	Data Type	Description	Default Value	Valid Values
Cluster Name	String	Name of the Cluster identifying the group of networks and interconnected VDUs	F5-BIGIP-Cluster	String (1-255 characters)
Shared Key	String	SSH Shared Key	OpenStack-All	Name of a valid/existing OpenStack Key Pair Object usable by the selected VIM and project.

Here are the **F5 BIGIP Cluster** descriptor flavors used for the VNF scope. There are no VDU scope deploy parameters:

Flavor Name	VDU Name	VDU Count	CPU	Disk (GB)	Memory (MB)
F5-BIGIP-LTM-Only	F5 BIGIP LTMBIGIP-C-LTM VDU	1	2	50	4096
F5-BIGIP-Small	BIGIP-C-LTM F5 BIGIP LTM VDU	1	2	50	4096
	BIGIP-C-AFM F5 BIGIP ALL (AFM) VDU	1	4	160	8192

View the VNF descriptor's composition details from the Redcell VNF Descriptor portlet.

Network Service Descriptor

The sample Network Service descriptor (NSD) provided shows how to define a network service and utilize any combination of the Virtualized Network Function (VNF) descriptors provided in this package (those that are not standalone), to compose various flavors with different Virtualization Deployment Unit (VDU) composition for a single network service definition.

View the Network Service descriptor contents from the Redcell Network Service Descriptors portlet.



Note

The Network Service Descriptors portlet location is dependant on your company's Redcell NFV installation and configuration. By default, the Network Service Descriptors portlet is located on the On Boarding page and the Network Services page.

This sample NSD is located in the following file:

`owareapps/nfv-vnfm-f5/db/nsd.f5-bigip- v12-sample.xml`

Here are the **VNF Scope** deploy parameters used:

Field Name	Data Type	Description	Default Value	Valid Values	Required
Cluster Name	String	Name of the Cluster identifying the group of networks and interconnected VDUs	F5-BIGIP-Cluster	String (1-255 characters)	Y

Here are the **BIGIP LTM VA VDU Scope** deploy parameters used:

Field Name	Data Type	Description	Default Value	Valid Values	Required
LTM Admin Password	String	VNF's Admin User Password	admin	Valid Linux password format	N

Here are the **BIGIP AFM VA VDU Scope** deploy parameters used:

Field Name	Data Type	Description	Default Value	Valid Values	Required
AFM Admin Password	String	VNF's Admin User Password	admin	Valid Linux password format	N

Here are the **Network Service** descriptor flavors used:

NS Flavor Name	VNF Flavor Names	VDU Name	VDU Count	CPU	Disk (GB)	Memory (MB)
Standard-Small	F5 BIGIP LTM Small	F5 BIGIP LTM Virtual Appliance 1 x BIGIP LTM VA VDU	1	2	50	4096
Standard-Medium	F5 BIGIP LTM VA Small	BIGIP LTM VA VDU 1 x BIGIP LTM VDU	1	2	50	4096
	F5 BIGIP AFM VA Small	F5 BIGIP LTM Virtual Appliance 1 x BIGIP AFM VA VDU	1	2	160	8192

Redcell VNF Package - Install Component Files

The following Redcell Virtualized Network Function (VNF) package installation components are required for the F5 BIGIP product:

VNF (OCP)	nfv-vnfm-f5.ocp
Device Driver (DDP)	f5bigip.ddp

The Redcell VNF package descriptors for the **F5 BIGIP** VNF product include:

NVF VNF Package			Resource Management		
VIM Software Image Records	VNF Descriptors	Sample NSD	Discovery Authentication Records	Discovery Profiles	Device Driver
Y	Y	Y	Y	Y	Y

The VNF package descriptors include:

- Discovery Authentication Profiles
- Discovery Profiles
- NFV VIM Software Image Descriptors

Discovery Authentication Profiles

The F5 BIGIP Discovery Authentication profiles are located in the following file:

`owareapps/nfv-vnfm-f5/db/rc.disc-auths-f5-bigip.xml`

This file contains the following discovery authentication profiles:

Authentication Record Name	Description
f5bigip-cli	SSH v2 Credentials
f5bigip-snmp	SNMP v1/v2 Credentials
f5bitip-https	HTTPS Credentials

Discovery Profiles

The F5 BIGIP Discovery profiles are located in the following file:

`Fowareapps/nfv-vnfm-f5/db/rcdisc-profile-f5-bigip.xml`

This file contains the F5 BIGIP Discovery profile that automatically discovers and populates resource records during Virtualized Network Functionality (VNF) record instantiation. The discovery profile name is F5-BIGIP-VE-Discovery_v12x.

The following tasks are run once the target VM in the OpenStack environment is fully booted and can respond to SNMP and CLI requests from the management system:

1. Resync
2. DataCollectionForGroupOfDevices
3. Scheduled Resync
4. Refresh Monitor Targets
5. F5 BIGIP SNMP Trap Forwarding to Redcell

NFV VIM Software Image Descriptors

The F5-BIGIP-12.1.1.0.0.184-LTM-SS1 and F5-BIGIP-12.1.1.0.0.184-ALL-SS1 snapshot records were used to create and test the Network Functions Virtualization (NFV) descriptors in this package. See Preparing an Image on page 67 for image customization required to produce and use these snapshots.

The original F5 vendor images covered by the BIGIP-12.1.1.0.0.184-LTM and BIGIP-12.1.1.0.0.184-ALL descriptors were used to produce the workable snapshot images.

Name	Scope/Description	Container Format	Disk Format	Min RAM (MB)	MIN Disk (GB)	Resource Discovery Profile
F5-BIGIP-12.1.1.0.0.184-LTM-SS1	F5 BIGIP LTM - snapshot created from F5 original image BIGIP-12.1.1.0.0.184-LTM	BARE	QCOW2	4096	50	Y
F5-BIGIP-12.1.1.0.0.184-ALL-SS1	F5 Big IP Firewall - snapshot created from F5 original image BIGIP-12.1.1.0.0.184-ALL	BARE	QCOW2	8192	160	Y
BIGIP-12.1.1.0.0.184-LTM	F5 BIGIP VE LTM (Load Balancer) Image - Original **Note:** No RC Discovery/ Management Enabled	BARE	QCOW2	4096	50	Y

Name	Scope/Description	Container Format	Disk Format	Min RAM (MB)	MIN Disk (GB)	Resource Discovery Profile
BIGIP-12.1.1.0.0.184-ALL	F5 BIGIP VE ALL Image (Use for AFM-Firewall) F5 BIGIP VE LTM (Load Balancer) Image - Original **Note:** No RC Discovery/ Management Enabled	BARE	QCOW2	8192	160	Y

License Requirements

To enable either the LTM (Load Balancer) or AFM (Firewall) feature set, you must manually apply a license to each F5 BIGIP VM.

Manually apply the license after creating the Virtualized Network Function (VNF) record and successfully deploying the Virtualization Deployment Units (VDUs) to the OpenStack environment.

You can register and apply a license directly to an F5 BIG-IP VE VM who's status is Online (Active) by logging into the VNF's Web interface and following the instructions F5 provides.

See Manually Applying an F5 License on page 83 regarding an example process for obtaining/applying the license provided by F5 using the manual license registration process. Contact F5 directly for further assistance.

Known Issues

The following issues are known:

- F5 BIGIP VE license registration and activation requires manual steps.

  License activation is not automatically assigned or applied by Redcell NFV-MANO. License activation requires some manual steps. After instantiating a VNF/ VDU, you must perform the manual steps every time you instantiate a VM that represents an F5 BIGIP VE instance in the OpenStack environment.

  See Manually Applying an F5 License on page 83 for detailed instructions.

- Management Traffic using SNMP is blocked by default.

  By default, the F5 BIGIP VE is configured to block SNMP traffic.

  Redcell Resource Discovery and Resource Monitoring activities require that SNMP access is turned on and enabled on the running F5 BIGIP VEs, in order to discover and manage the VEs.

  Dorado Software applications **require** a setting before creating the bootable snapshot that enables SNMP access.

  See Preparing an Image on page 67 for details on creating an updated F5 BIGIP VE snapshot image.

- Pagination preference for F5's TMSH CLI is only available globally.

  The F5 BIGIP TMSH command line interface (CLI) Pagination preference setting is not available on a per CLI session or per user account basis. Because the setting is global and it is required to be set to false for Redcell to issue scripts to the F5

BIGIP VM via the TMSH CLI without errors in an automated fashion, the global pagination setting must be reset to `false` (off).

Turn off the pagination setting before creating the bootable snapshot that contains other settings.

See Preparing an Image on page 67 for details on creating the updated F5 BIGIP VE snapshot image.

- The nfv-vnfm-f5 package is a codeless VNFM implementation and therefore **does not support** NFV VNF record and NFV Network Service record Discovery/Resync.

References

This section provides references to:

- Vendor Documentation (URLs)
- VNF Configuration Methods

Vendor Documentation (URLs)

Refer to the following vendor-specific websites for assistance, downloads, documentation, product datasheet, and so on:

- F5 Vendor website:

  `http://www.f5.com`

  `http://ask.f5.com`

  `http://devcentral.f5.com`

- Product Description:

  `https://www.f5.com/pdf/products/BIGIP-virtual-editions-datasheet.pdf`

- OpenStack KVM Environment Requirements:

  `https://support.f5.com/kb/en-us/products/BIGIP_ltm/manuals/product/bigip-ve-setup-linux-kvm-12-0-0.html`

VNF Configuration Methods

A combination of image (snapshot) preparation, along with Virtualization Deployment Unit (VDU) Post Instantiate Configuration Lifecycle Events (LCEs), is implemented in this VNF package to ensure that the F5 BIGIP LTM and AFM VNF VDUs are automatically brought under Redcell management.

Customized Image Preparation

The base BIGIP model family images provided by F5 requires additional manual configuration before producing VMs in the OpenStack environment that can be discovered and managed using the Redcell Resource Management applications.

See Preparing an Image on page 67 for a description of how to create an updated image (snapshot) for the F5 BIGIP LTM and AFM model series to use to boot up VMs that the Redcell application manages. Use the snapshot produced to create F5 BIGIP VEs in the OpenStack environment, so that no manual intervention is required to apply the management system communication settings.

Redcell Resource Configuration Tasks

Once the target VM in the OpenStack environment is fully booted and can respond to SNMP and CLI requests from the management system, post discovery tasks are run.

For more details about the F5-BIGIP-VE-Discover_v12x profile and the tasks that run, see Discovery Profiles on page 63.

Preparing an Image

Before you can discover and manage a Virtualized Network Function (VNF) resource from the Redcell application, you need to:

1. Set up your OpenStack environment by preparing BIGIP VE VIM images with the necessary configuration.
2. Create a software image record from the Redcell application.

A snapshot is taken to capture the following settings, so that the Redcell system automatically discovers the resources using SNMP and SSH (tmsh CLI) access when a new BIGIP VE VM is created/booted in the OpenStack environment.

To enable Redcell Resource Management for the BIGIP VE VNF VDUs (VMs), use these management settings:

- SNMP Access Enabled
- Pagination Turned Off
- Mgmt (eth0) Port MTU - Set to recommended value of 1400 instead of 1500 (default)

Setting Up Your OpenStack Environment

To set up your OpenStack environment, you need to:

1. Create a project.
2. Deploy the vendor's base image by uploading the original qcow2 image file received from the F5 vendor to a target Bare Metal OpenStack controller.
3. Make configuration changes to the running VM booted from the F5 vendor's original image.
4. Create flavors representing the smallest supported flavor to use. The F5 vendor provides the following flavors (Figure 3-1).

F5 LTM v12.1.1 For LTM Models	Flavor Name: f5.medium	CPU – 2, Memory – 4 GB (4096 MB), Disk - 50 GB
F5 BIGIP ALL v12.1.1 For AFM (Firewall) Models	Flavor Name: f5.xxlarge	CPU – 4, Memory – 8 GB (8192 MB), Disk – 160 GB

5. Create VM snapshots that are used to create and export a VIM software image descriptor within the Redcell application.

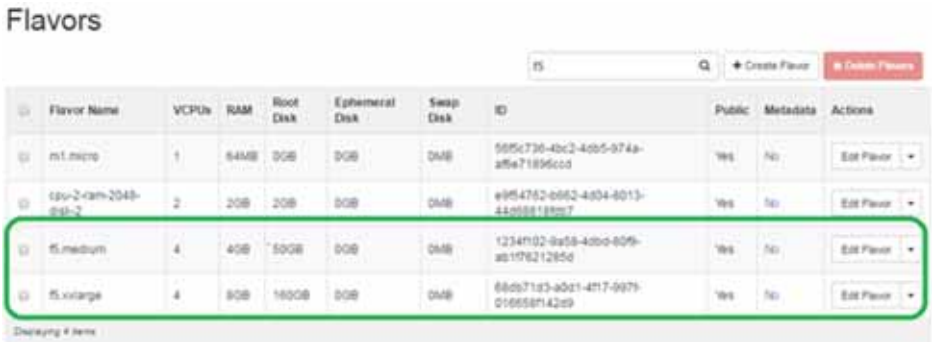


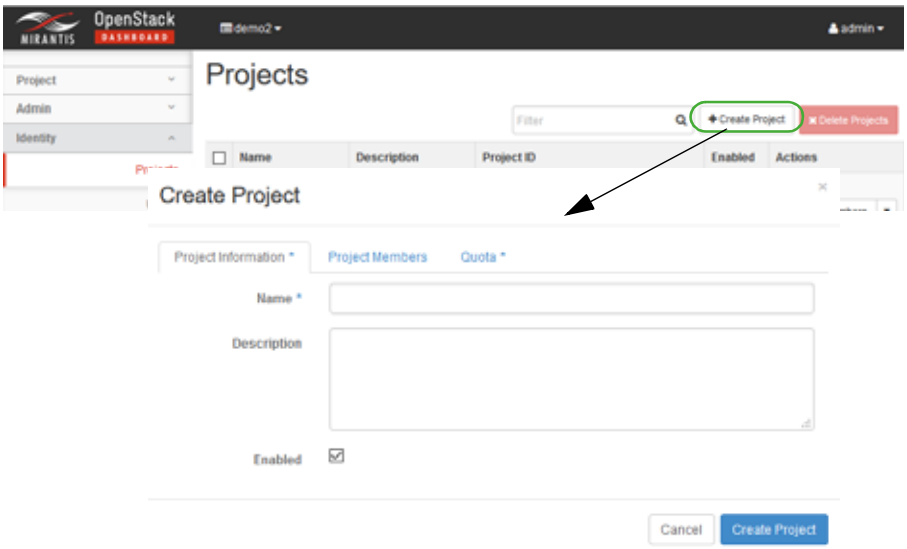
Figure 4-1 F5 BIGIP Flavors Example

Creating a Project

Create a project in an OpenStack VIM (Virtualized Infrastructure Manager) as follows.

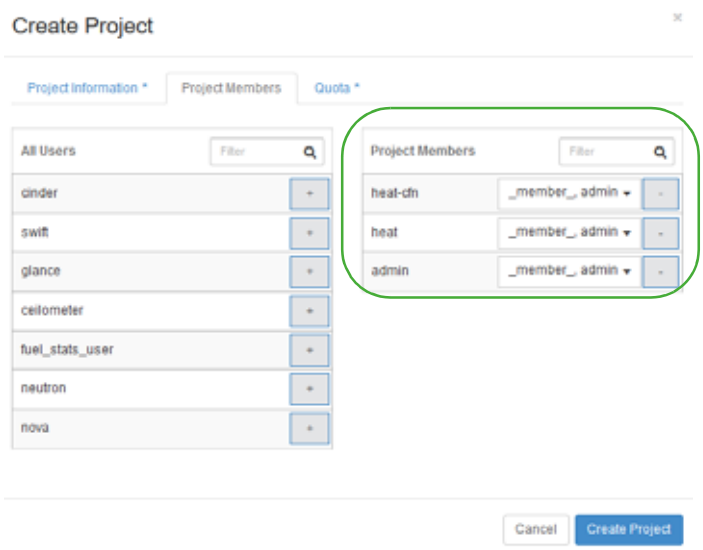
1. Select Identity > Project.
2. Click Create Project.

   The Create Project window is displayed.
3. Enter a name and detailed descriptions.

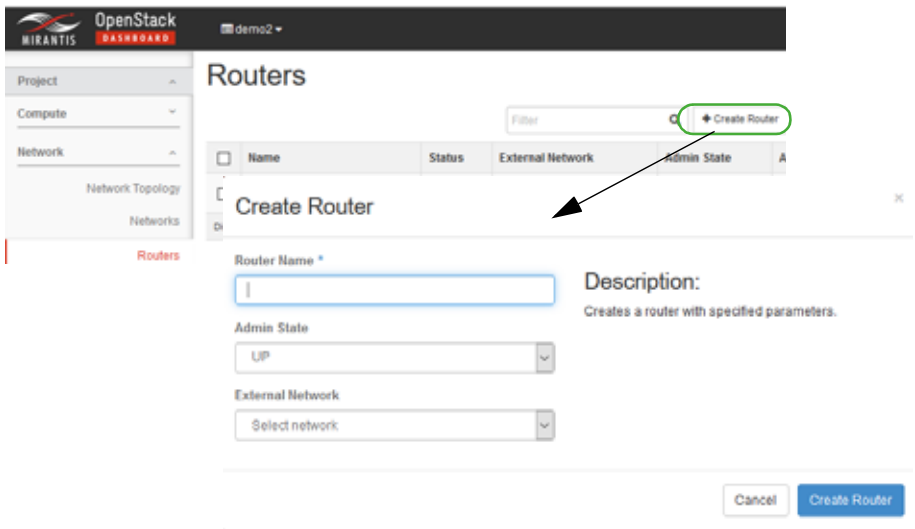


4. Assign users/permissions.
   a. Click Project Members.
   b. Add the following users to the Project Members list.
      - heat-cfn
      - heat
      - admin
   c. Set the member permissions to admin.
5. Click Create Project.

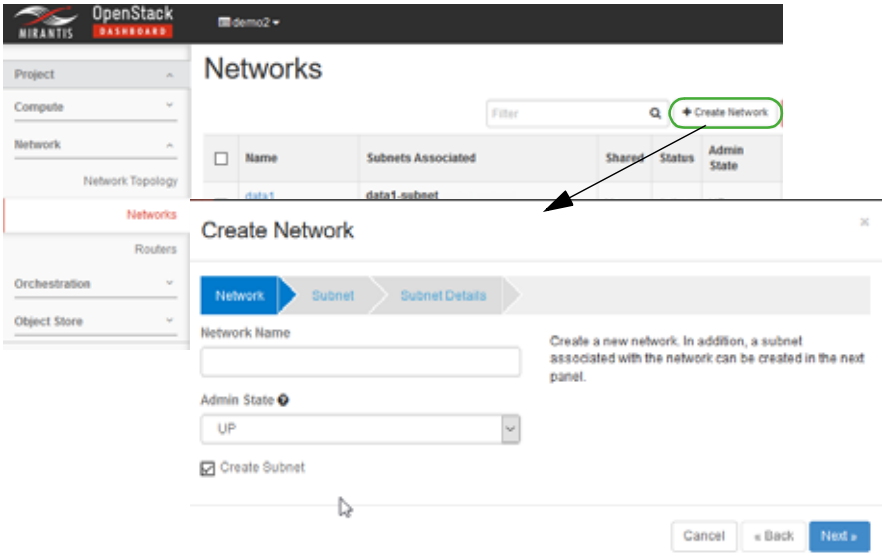
   The new project is saved to the Projects list.



6. Create project networking in an OpenStack VIM (KILO or later release).
   a. Create a project router with a gateway interface.



   b. Make sure that the router's gateway IP is reachable from the LAN (your PC) following project router creation.
   c. Create and attach the following networks to the project router:
      - net-mgmt
      - net-data1
      - net-data2



7. Create the F5 BIGIP security group in the project.

   The new security group allows utilization of the F5 BIGIP VE VMs created during Image Preparation and other manual activities for the F5 BIGIP VE performed in the OpenStack environment.

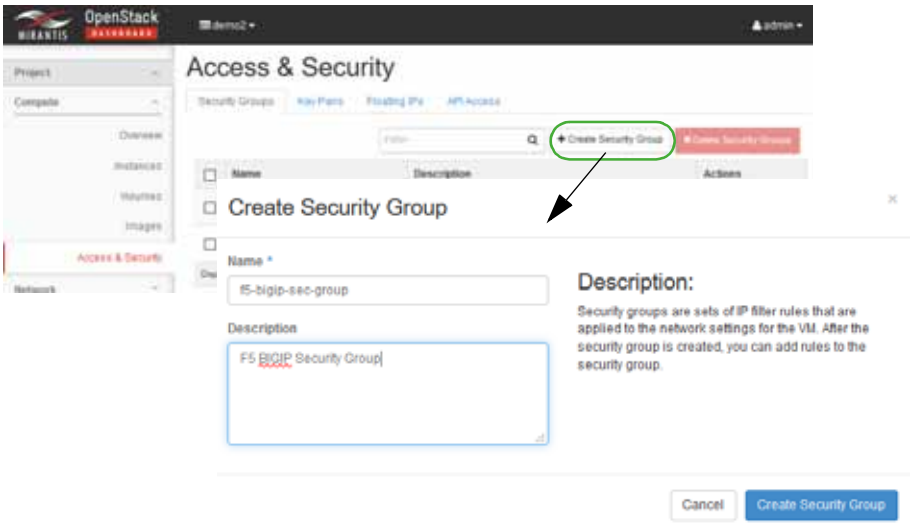
   a. Navigate to the project, for example the F5Dev project.

   b. Select Project > Compute > Access & Security.

      The Access & Security options are displayed.

   c. Click Create Security Group.

      The Create Security Group window is displayed.



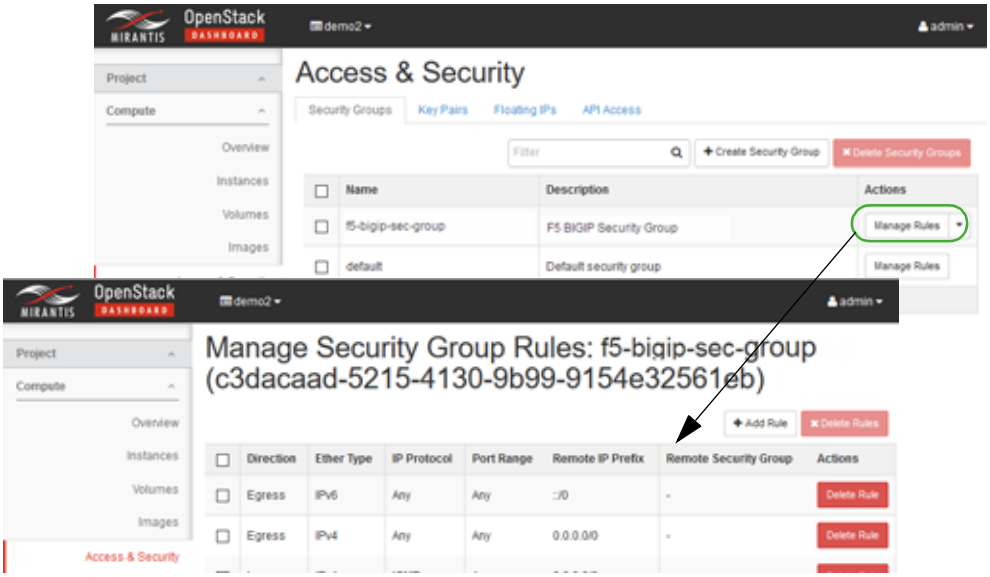
   d. Enter the security group name and description.

   e. Click Create Security Group.

      The new security group object is saved in the OpenStack environment.

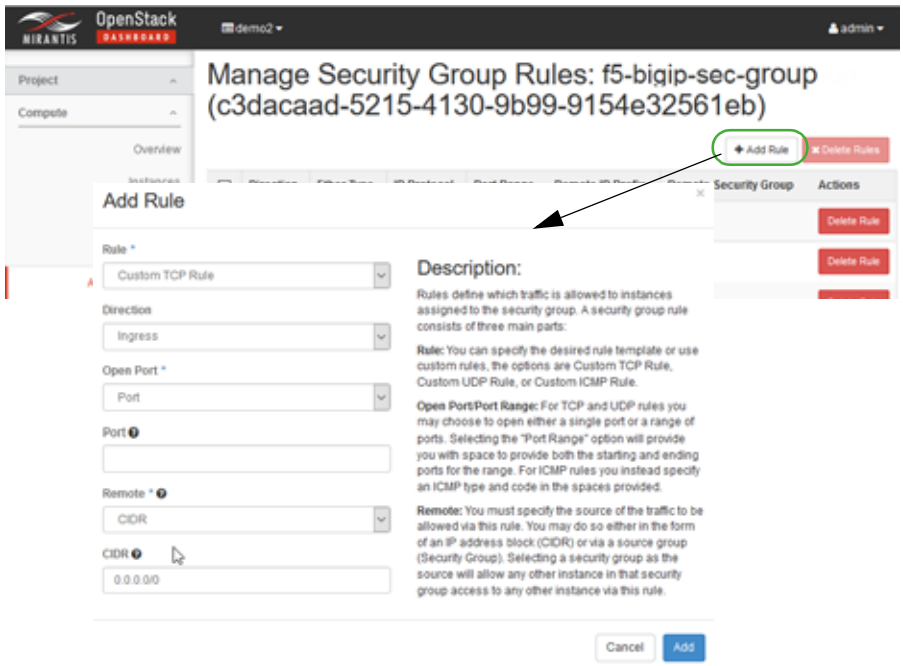
f. Select the Manage Rules action for the new security group.

The two default rules added by the OpenStack environment are listed.



g. Click Add Rule.

The Add Rule window is displayed.



h. Add the following rules to enable all ICMP, TCP, and UDP traffic:

Direction	Either Type	IP Protocol	Port Range	Remote IP Prefix	Remote Security
Ingress	IPv4	ICMP	Any	0.0.0.0/0	-
Egress	IPv4	ICMP	Any	0.0.0.0/0	-
Ingress	IPv4	TCP	1-65535	0.0.0.0/0	-
Egress	IPv4	TCP	1-65535	0.0.0.0/0	-
Ingress	IPv4	UDP	1-65535	0.0.0.0/0	-
Egress	IPv4	UDP	1-65535	0.0.0.0/0	-

When done, the resulting rule set for the f5-bigip-sec-group security group should contain the two default rules added by the OpenStack environment and the traffic rules you added, as in:

Direction	Either Type	IP Protocol	Port Range	Remote IP Prefix	Remote Security
Egress	IPv4	Any	Any	0.0.0.0/0	-
Egress	IPv6	Any	Any	::/0	-
Ingress	IPv4	ICMP	Any	0.0.0.0/0	-
Egress	IPv4	ICMP	Any	0.0.0.0/0	-
Ingress	IPv4	TCP	1-65535	0.0.0.0/0	-
Egress	IPv4	TCP	1-65535	0.0.0.0/0	-
Ingress	IPv4	UDP	1-65535	0.0.0.0/0	-
Egress	IPv4	UDP	1-65535	0.0.0.0/0	-

Now it is time to instantiate a VM from a vendor image.

Instantiating a VM from a Vendor Image

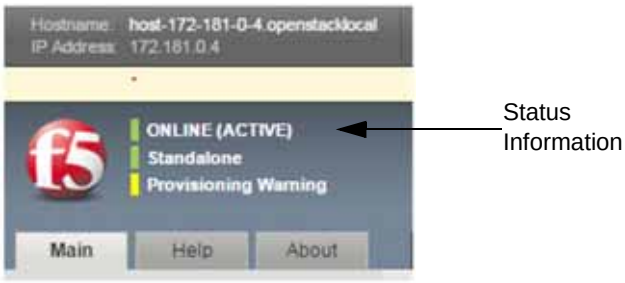
Instantiate a VM (virtual machine) in the new OpenStack project from the F5 vendor-provided image as follows.

1. Boot up the F5 BIGIP LTM or F5 BIGIP ALL (AFM) image with the following network connections.

Linux interface name	F5 Interface Name	Network
eth0	mgmt	net-mgmt
<None> *	1.1	net-data-1
<None> *	1.2	net-data-2
* The <None> interface names require CLI configuration along with a proper license before the interface can be configured/enabled and pass traffic. This is done as post-bootup and post device discovery configuration applied by the Redcell system (not part of the base image snapshot).		

2. Assign a floating IP Address to the eth0/mgmt connection.
3. Log into the new VMs Web interface using the floating IP address.

   For example: `https://10.122.0.244`
4. Verify that the status changes to ONLINE (ACTIVE) and the proceeding status bar is green.



Now you are ready to make VM configurations changes.

Manually Making Configuration Changes

To enable automated resource management, the Redcell application requires additional configuration to the VM post bootup and this configuration captured in the new shapshot.

Manually make the required configuration changes to the running VM booted from the F5 vendor's original image as follows.

Note

Dorado Software provides an executable script in the F5 BIGIP Device Driver component that automates the following configuration additions.

1. Go to a command line prompt.

   On a Windows system, enter Cygwin Linux shell.

2. Run the following bash script to apply the management configuration.

   `$OWARE_USER_ROOT/oware/bin/oware.cmd`

3. Run the f5vmconfig.sh script, which logs into the target VM using the F5 vendor's default ssh v2 user credentials and applies the following commands to the VM as well as saves the running configuration to be permanent.

   `f5vmconfig.sh -i <Management IP Address> [-m <MTU>]`

   Where:

   - **-i** is the target F5 BIGIP device management IP address (required)
   - **-m** is the MTU integer value (optional)

     The Dorado Software LAN environment requires that MTU value of 1400 be assigned to the mgmt (eth0) port. Omit or change to a different valid MTU value based upon your specific network environment requirements.
   - **-h** is the help message

   For example: `f5vmconfig.sh -i 10.122.15.44 -m 1400`

4. Reboot the VM for the MTU change to take affect by logging into the Linux shell using the `ssh` command and issuing the `reboot` command.

   The ssh connectivity is lost, until the VM reboots and completely starts up again.

5. Manually log into the VM using the `ssh` command.

6. Verify that the MTU setting was applied or retained properly:

```
# ifconfig eth0
config eth0 Link encap:Ethernet HWaddr FA:16:3E:9E:E7:4D
    inet addr:172.85.0.5 Bcast:172.85.0.255 Mask:255.255.255.0
    inet6 addr: fe80::f816:3eff:fe9e:e74d/64 Scope:Link
    UP BROADCAST RUNNING ALLMULTI MULTICAST MTU:1400 Metric:1
    RX packets:817 errors:0 dropped:0 overruns:0 frame:0
    TX packets:843 errors:0 dropped:0 overruns:0 carrier:0
    collisions:0 txqueuelen:1000
    RX bytes:167119 (163.2 KiB) TX bytes:148788 (145.3 KiB)
```

7. Verify that the **mtu** setting of **1400** for the **eth0** interface command was appended to the /config/startup file by running the following command.

```
config # cat /config/startup
#
# NOTE:
# This file will be installed in /config/startup and it will
# be called by /etc/rc.local.
#
# - /config/startup is for customer config additions and
# will be saved in UCS and synced by tmsh run sys sync-sys-files
#
# - /etc/rc.local should *not* be used by customers and
# can/will be changed by F5
#
ifconfig eth0 mtu 1400
```

8. Make sure that the SNMP allowed-addresses tmsh cli setting of **ALL** was persisted after reboot:

```
config # tmsh list sys snmp allowed-addresses
sys snmp {
    allowed-addresses { ALL }
}
```

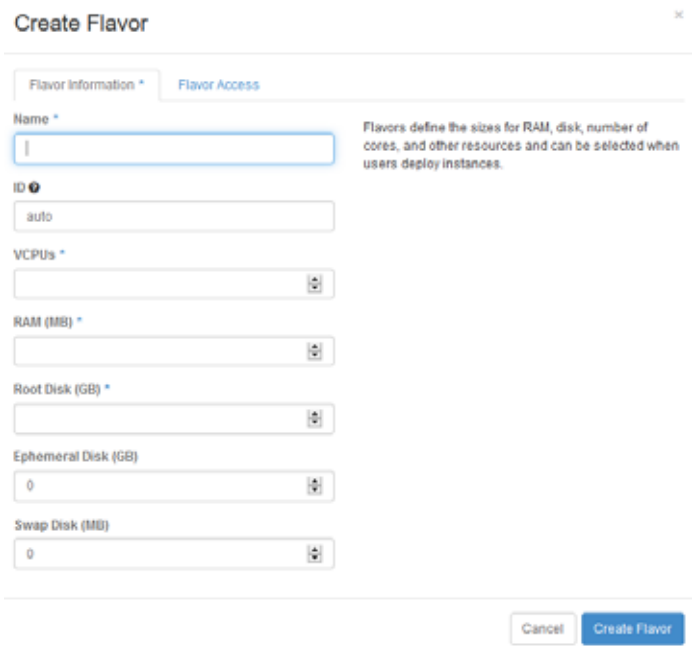
Create flavors before creating the VM snapshots.

Creating Flavors

Create the following F5 flavors from the OpenStack dashboard.

F5 LTM v12.1.1 For LTM Models	Flavor Name: f5.medium	CPU – 2, Memory – 4 GB (4096 MB), Disk - 50 GB
F5 BIGIP ALL v12.1.1 For AFM (Firewall) Models	Flavor Name: f5.xxlarge	CPU – 4, Memory – 8 GB (8192 MB), Disk – 160 GB

1. Select Admin > System > Flavors.
2. Click Create Flavor.
   The Create Flavor window is displayed.



3. Enter a name, such as f5.medium.
4. Set VCPUs, memory, and disk values.
5. Specify which projects to apply the flavor.
   If you do not specify a project, the flavor is available to all projects.
6. Click Create Flavor.
   Your flavor is created.
7. Repeat step 2 through step 6 for the f5.xxlarge flavor.

Next you need to create a VM snapshot.

Creating a VM Snapshot

The VM snapshot is used to create and export a Virtualized Infrastructure Manager (VIM) software image descriptor from the Redcell application and then the VIM software image descriptor is used to manage, deploy, or migrate images.

This section uses the F5 BIGIP VE LTM image as an example. The same process applies for creating a snapshot for the F5 BIGIP VE ALL image (for the AFM model).

Gracefully shutdown the VM manually in the OpenStack environment and then take a snapshot produced as a qcow2 image file.

Create a VM snapshot from the OpenStack dashboard as follows.

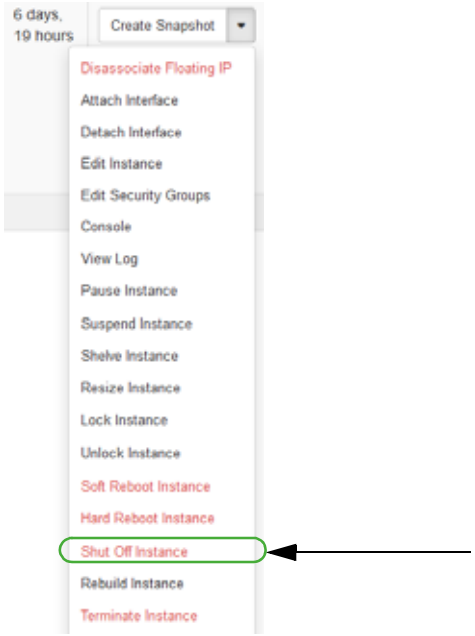
1. Shut off the instance.
   a. Select Project > Compute > Instances.

      A list of instances is displayed.

   b. Select the Shut Off Instance action for the appropriate instance.

      A confirmation message is displayed.

   c. Click shut Off Instance.



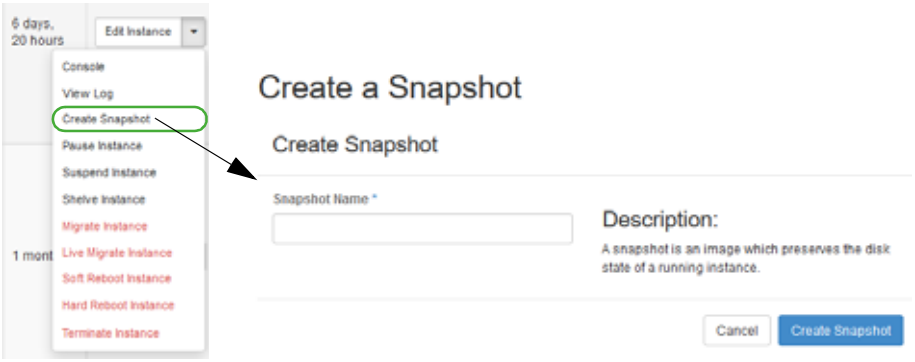
If you prefer to shutdown F5 BIGIP VM processes from the Linux shell, log in as root and enter `shutdown now`. Refer to your F5 BIG-IP documentation for more details.

2. Create a snapshot image.
   a. Select Admin > System > Instances.

      A list of instances is displayed.

   b. Select the Create Snapshot action for the instance.

      The Create a Snapshot window is displayed.



   c. Enter a name, such as the original image name with the `F5-` vendor prefix and a suffix of `-SS1`.

   d. Click Create Snapshot.

3. Assign OpenStack image properties to the snapshot image created in step 2.
   a. Select Admin > System > Images.

   b. Select the Edit Image action for the instance.

      The Update Image properties are displayed.

   c. Set the disk and memory requirements to match the smallest flavor that the image supports.

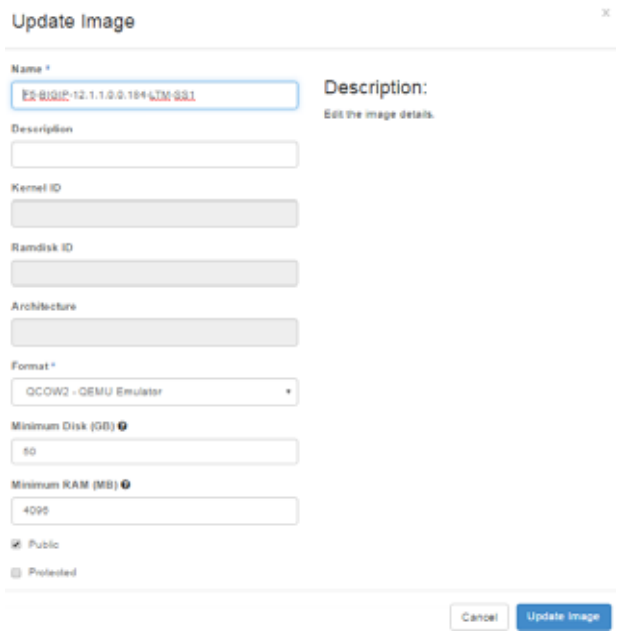
      See Creating Flavors on page 75 for BIGIP-VE Version 12.x.x flavors.

   d. Select Public.

      This is required so that the Redcell system can access and manage the image later on.

   e. Click Update Image

      Your changes are saved.



Once you create the VM snapshot image in the OpenStack environment, you are ready to create a software image record from the Redcell application.

Creating a Software Image Descriptor

The Redcell Network Functions Virtualization (NFV) feature uses the software image descriptor to manage, deploy, or migrate images. Create a software image descriptor record from the Redcell application by:

1. Creating a Software Image Descriptor for Snapshot Image
2. Modifying the VIM Software Image Descriptor

The steps provided in this section assume that you have already created a VIM that houses the snapshot image in the OpenStack environment. If a VIM that houses the snapshot image does not exist, see Setting Up Your OpenStack Environment on page 67 before continuing.

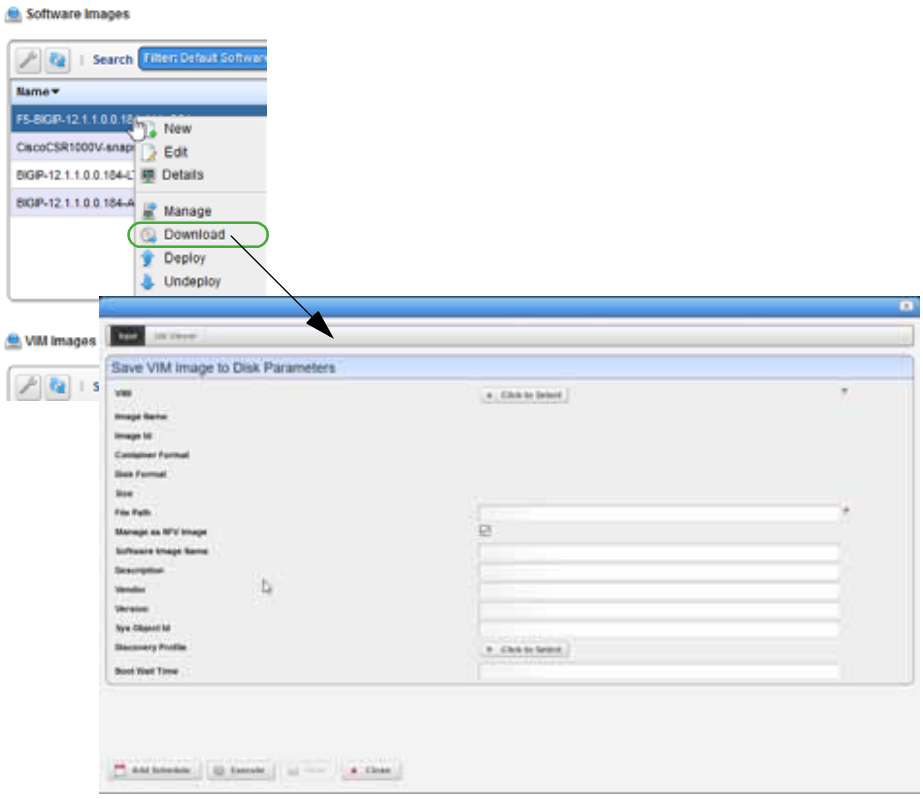
Creating a Software Image Descriptor for Snapshot Image

Create a software image descriptor for a snapshot image from the Redcell application as follows.

1. Navigate to the Software Images portlet.

   The portlet's location depends on your company's configuration.
2. Right-click an image.
3. Select Download.

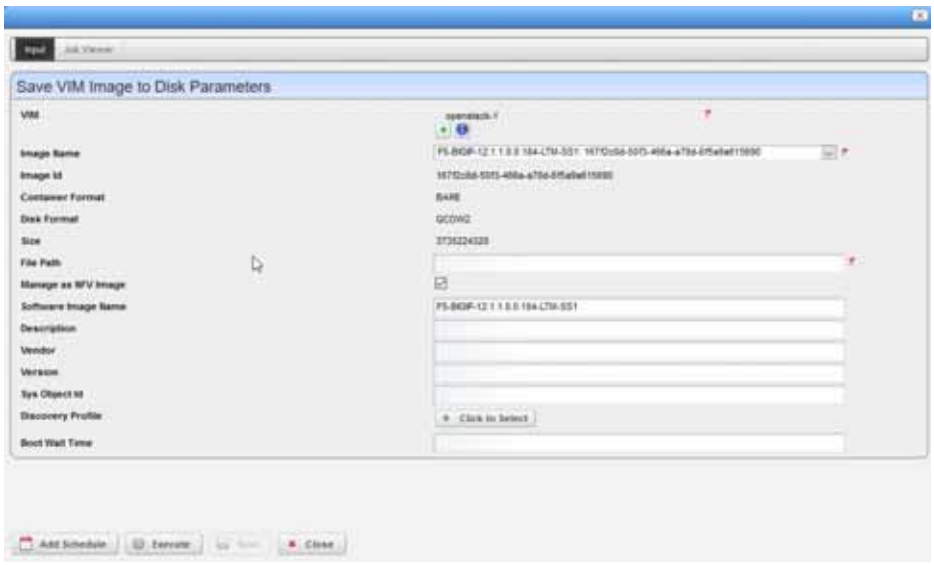
   The Save VIM Image to Disk Parameters input window is displayed.



4. Select the Virtualized Infrastructure Manager (VIM) housing the snapshot qcow2 image created earlier.
5. Select the snapshot image to download.

   For example: `F5-BIGIP-12.1.1.0.0.184-LTM-SS1.qcow2`

   The fields are populated based on your selection.



6. Click Execute.

7. Copy the image downloaded from your local disk to your company's centralized file server (such as an FTP Server) to redistribute the new snapshot image across additional OpenStack VIMs.

Before the image descriptor record is complete and ready to export, you need to edit the image descriptor.

Modifying the VIM Software Image Descriptor

These instructions assume that you have already created a Virtualized Infrastructure Manager (VIM) image descriptor. If you have not created the image descriptor, see Creating a Software Image Descriptor for Snapshot Image on page 78 before continuing.

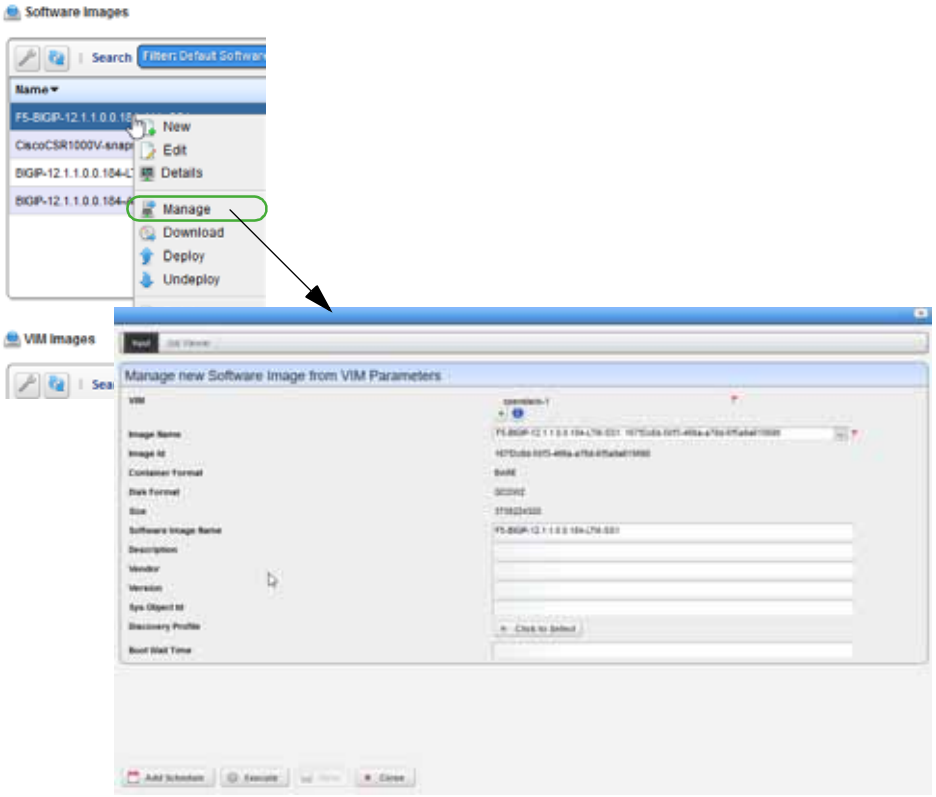
Modify the VIM software image descriptor from the Redcell application as follows.

1. Navigate to the Software Images portlet.

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

2. Right-click an image.
3. Select Manage.

   The Manage new Software Image from VIM Parameters window is displayed.



4. Select the VIM that houses the snapshot image.
5. Select the snapshot image name.

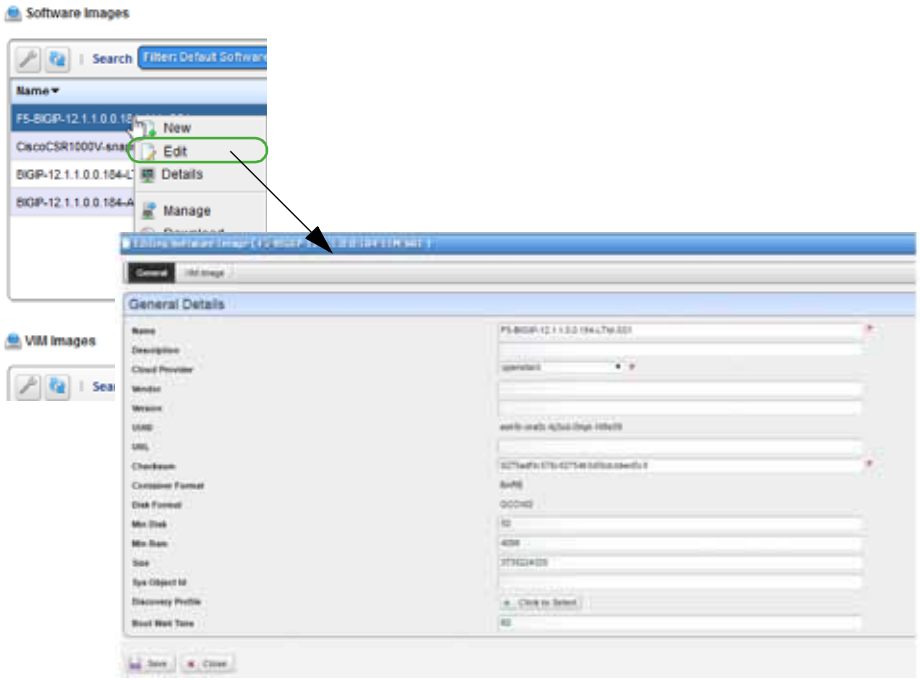
   For example: `F5-BIGIP-12.1.1.0.0.184-LTM-SS1: uniqueImageID`

   The image ID, container format, disk format, size, and software image name fields are populated.
6. Select a discovery profile.
7. Click Execute.

   A new software image record is created matching the image name in your OpenStack environment.
8. Right-click an image.
9. Select Edit.

   The Editing Software Image window is displayed.
10. Select the snapshot image from the Image Name list.

    The Editing Software Image window is displayed.



11. Enter the missing information as follows.
    a. Add a meaningful description.
    b. Specify the vendor, such as F5.
    c. Add a meaningful version number, such as 12.1.1.
    d. Enter a valid URL that points to your local environment's file server or disk location where the qcow2 file is stored and accessible. For example:

       `ftp://serverIP/bigipveltm/F5-BIGIP-12.1.1.0.0.184-LTM-SS1.qcow2`
    e. Enter the SNMP SysObject ID for the F5 VE instances (for LTM, AFM and other VE models), which is:

       `1.3.6.1.4.1.3375.2.1.3.4.43`

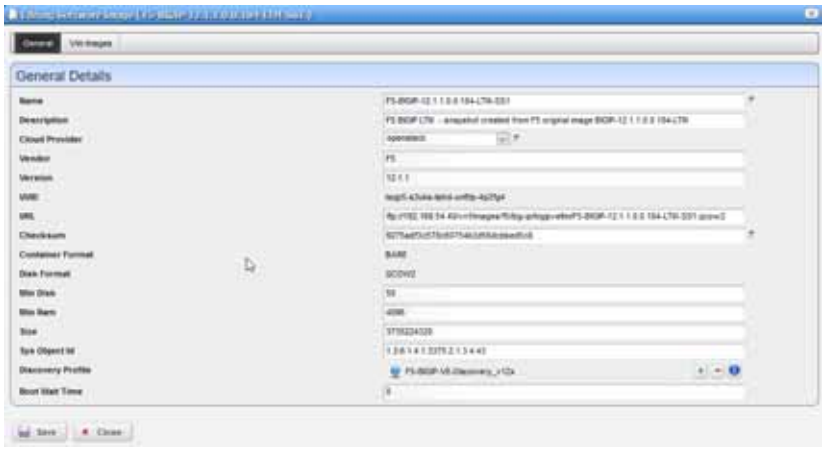
f. Select the discovery profile containing the required ssh and SNMP authentication objects.

   Discovery profiles are created by your system administrator or someone within your organization with administrative permissions.

g. Leave the Boot Wait Time field blank.

   The Redcell system assigns a default integer value of 0 after you save the profile.

h. Review your inputs to ensure accuracy.



12. Save the software image record.
13. Locate and Select the newly created Software Image Record and export it to an archive disk location for backup purposes.

Manually Applying an F5 License

Due to license requirements and logistics for the F5 BIGIP VE instances, you need to work directly with F5 to obtain and apply a license. This section provides an example on how to apply a license obtained from F5. The example covers applying the AFM (Firewall product feature set) license after you successfully booted a VM from the F5-BIGIP-12.1.1.0.0.184-ALL-SS1 snapshot created in Creating a VM Snapshot on page 76.

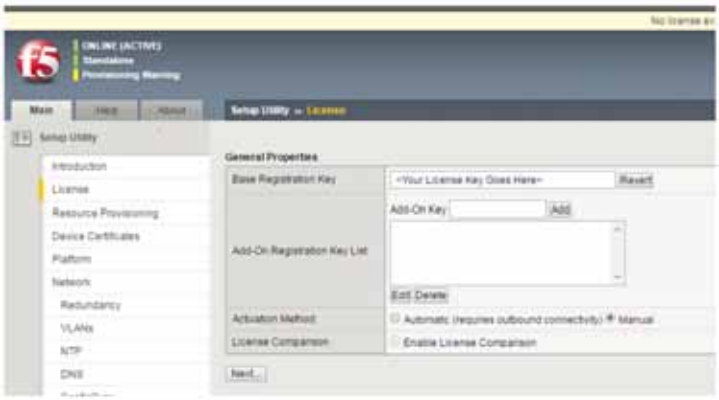
Consult the F5 Networks product documentation or contact the F5 Support team directly for further instructions on configuring the BIGIP VE VM following license activation.

Manually apply an F5 AFM (Firewall) features license from the OpenStack system as follows.

1. Login using the admin user account to the running VM housed in the OpenStack system to be licensed using https.
2. Navigate to the Main Tab.

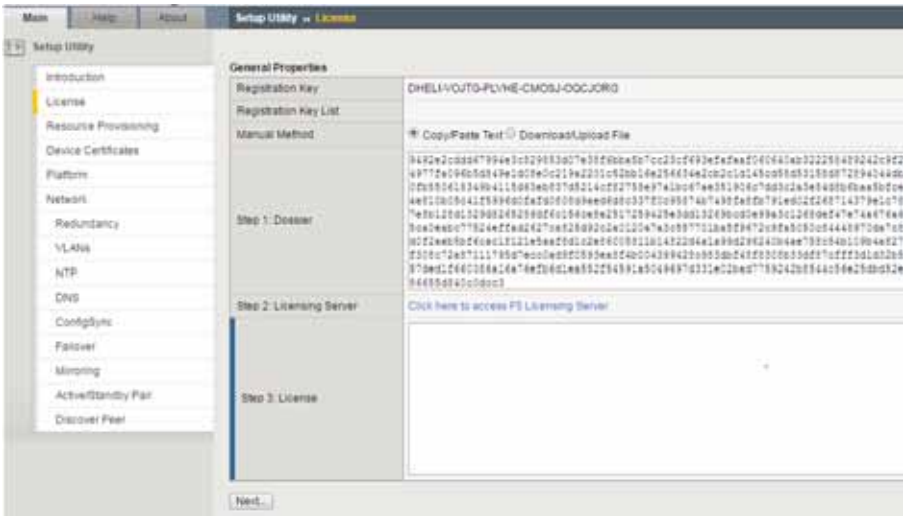
   A Setup Utility wizard is displayed.
3. Click Next.

   The Setup > Utility > License information is displayed.
4. Click Activate.
5. Locate the registration key value from the text provided by F5.
6. Enter the license properties.
   a. Enter the base registration key provided by F5.
   b. Select Manual activation method.



   c. Click Next.

      The General Properties, Dossier is populated.



d. Select the Download/Upload File option.

e. Select “Click Here to Download Dossier File.”

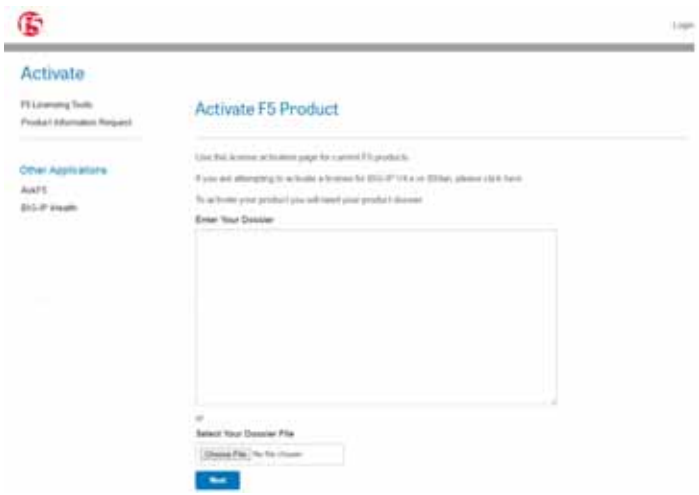


f. Save the file to an accessible/writable disk location.

7. Specify the licensing server.

a. Select “Click here to access F5 Licensing Server.”

The Activate F5 Product webpage is displayed.



b. Click Choose File > Next.

The license agreement is displayed.

c. Select the option to accept and agree to the license terms.

d. Click Next.

A file activation page is displayed.

e. Click Download license.



f. Save the file as License.txt to a writable disk location.

8. Go back to the F5 Setup Utility >> License General Properties page.

9. Continue with the License setup.

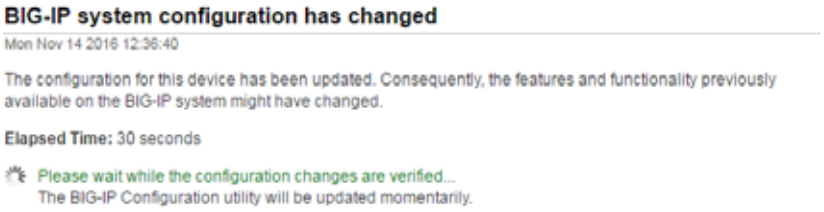
a. Click Choose File.

b. Select the License.txt file saved in step 7.

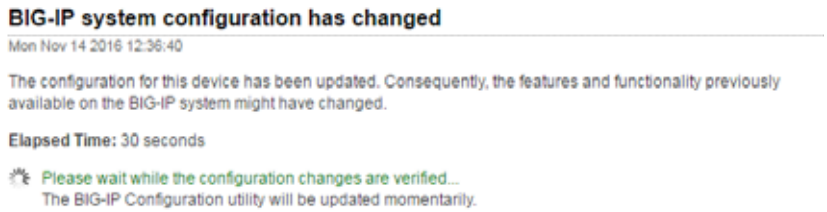


c. Click Next.

A status message is displayed indicating that the configuration data is loading followed by a message that the license configuration changes are in progress.

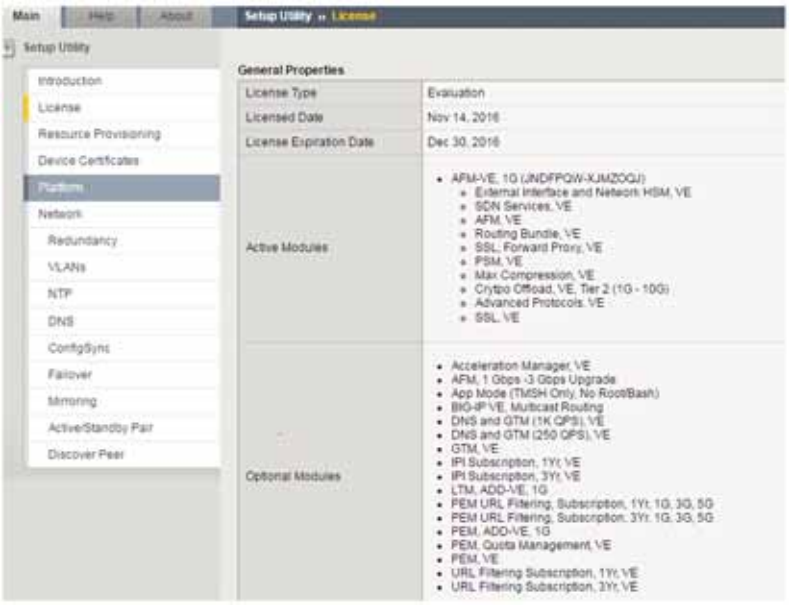


d. Wait until a process completed message is displayed.



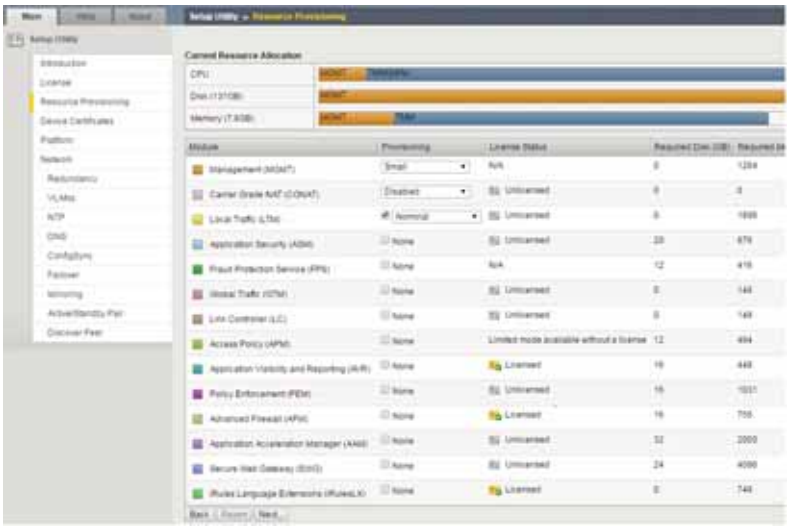
10. Verify the activated license by selecting the Setup Utility, License tab on the F5 BIGIP page.

    For example: Applying an Evaluation AFM (Firewall) license.



11. Continue on through the rest of the Setup Wizard.

    The Resource Provisioning page should show which modules are now licensed, such as an AFM (Firewall) evaluation license.



    Consult F5's product documentation or contact F5 Support team directly for further instructions on configuring the BIGIP VE VM following license activation.

5

> Setting Up the Juniper Firefly VNF Package

Covers these topics:

Understanding the Firefly VNF Package – 88
Preparing an Image – 94

This section explains the scope, functions, and processes associated with the Virtualized Network Function (VNF) onboarding and instantiation.

Understanding the Firefly VNF Package

The Juniper Networks Firefly SRX model is a virtual appliance that provides security and networking services at the edge in a virtualized private or public cloud environment. This appliance runs on a virtual machine (VM) on a server.

The Redcell Firefly Virtualized Network Function (VNF) package provides sample VNF descriptors and associated artifacts used to deploy the Juniper Firefly SRX model described in this section.

Juniper Networks provides images and licenses needed to deploy and enable the Juniper Firefly SRX features.

The following list provides the VNF package vendor and validation information:

Vendor and Model Information	
Vendor	Juniper Networks
Product Family	Firefly
Models	SRX
Operating Systems	Junos® OS
Version	12.1
Validated Environment	
VIM	OpenStack
Version	Liberty
Installer	Mirantis
Version	8
Network Configurations	VXLAN, VLAN Segmentation
Redcell MANO (Management and Operation) Validated Functions	
MANO	NSD, VNFD, NSR, VNFR Link LCEs
VNFM	Generic (MANO Lite) Independent/Specific
NFVO	MANO Lite
Redcell RMO (Resource Management and Operation) Validated Functions	
Inventory	Resource Discovery and Inventory Resource Creation Method (NFV-Model)
Monitoring	SNMP Monitoring CPU & Memory KPIs TFA (flows)
Config	ACLI
NetRestore File Management	NR Backup NR Restore NR Firmware (not validated)

This section covers the:

- Firefly VNF Package Contents
- Redcell VNF Package - Install Component Files
- License Requirements
- Known Issues
- References

Once you have a good understanding of the VNF package, you can get started preparing an image.

Firefly VNF Package Contents

The Redcell Firefly VNF package contains artifacts necessary to install and deploy Virtualized Network Functions (VNFs) for the SRX Virtualization Deployment Unit (VDU) offered as part of the Juniper Firefly product family.

Multiple sample VNF descriptors were created with basic flavors to deploy the VNF VDUs, either as part of a standalone VNF record, or as part of a higher level, end-to-end Network Service record:

- NFV VNF Descriptors
- Network Service Descriptor

NFV VNF Descriptors

This section describes the following Redcell Network Functions Virtualization (NFV) VNF (virtualized network functions) descriptors:

- Juniper Firefly SRX Cluster
- Juniper Firefly Virtual Appliance

Juniper Firefly SRX Cluster

The sample Juniper Firefly SRX cluster descriptor is located in the following file:

`owareapps/nfv-vnfm-firefly/db/vnfd.juniper-firefly-cluster.xml`

This Virtualized Network Function (VNF) descriptor defines a standalone network as a varied composition of Juniper Firefly Virtualization Deployment Units (VDUs), based on the assigned VNF favor.

Here are the **Juniper Firefly SRX** descriptor deploy parameters used:

Field Name	Data Type	Description	Default Value	Valid Values	Required Values
Management-Network	IP Address	Address of the Management Network to be created on the OpenStack system	172.191.0.0/24	Valid CIDR Address	Y
LAN1 - Network	IP Address	Address of the LAN1 Network to be created on the OpenStack system	172.191.1.0/24	Valid CIDR Address	Y
LAN2 – Network	IP Address	Address of the LAN2 Network to be created on the OpenStack system	172.191.2.0/24	Valid CIDR Address	Y
Cluster-Name	String	Name of the Cluster identifying the group of networks and interconnected VDUs	None	Alpha-numeric String	Y

Here are the **Juniper Firefly SRX** descriptor flavors used:

Flavor Name	VDU Name	VDU Count	CPU	Disk (GB)	Memory (MB)
Basic	Firefly-SRX	1	2	2	2048

View the VNF descriptor's composition details from the Redcell Onboarding page > VNF Descriptor portlet.

Juniper Firefly Virtual Appliance

The sample Juniper Firefly Virtual Appliance descriptor is located in the following file:

`owareapps/nfv-vnfm-firefly/db/vnfd.juniper-firefly-virtual-appliance.xml`

This sample Virtualized Network Function (VNF) descriptor defines packaging and behavior of one or more Firefly SRX Virtualization Deployment Units (VDUs) and can be included as part of a Network Descriptor.

Here are the **Juniper Firefly Virtual Appliance** descriptor flavors:

Flavor Name	VDU Name	VDU Count	CPU	Disk (GB)	Memory (MB)
Firefly Basic	Firefly Virtual Appliance	1	2	2	2048

View the VNF descriptor's composition details from the Redcell Onboarding page > VNF Descriptor portlet.

Network Service Descriptor

The sample Network Service descriptor (NSD) provided shows how to define a Network Service and utilize any combination of the Virtualized Network Function (VNF) descriptors provided in this package.

View the Network Service descriptor contents from the Redcell Network Service Descriptors portlet.



Note

The Network Service Descriptors portlet location is dependant on your company's Redcell NFV installation and configuration. By default, the Network Service Descriptors portlet is located on the On Boarding page and the Network Services page.

This sample NSD is located in the following file:

`owareapps/nfv-vnfm-firefly/db/ns.juniper-firefly-sample.xml`

Here are the **Network Service** descriptor flavors used:

NS Flavor Name	VNF Flavor Names	VDU Name	VDU Count	CPU	Disk (GB)	Memory (MB)
Standard-Basic	Firefly Basic	Firefly Virtual Appliance	1	2	2	2048

Redcell VNF Package - Install Component Files

The following Redcell Virtualized Network Function (VNF) package installation components are required for the Juniper Firefly product:

VNF (OCP)	nfv-vnfm-firefly.ocp
Device Driver (DDP)	juniper.ddp

The Redcell VNF package descriptors for the Juniper Firefly product include:

NVF VNF Package			Resource Management		
VIM Software Image Records	VNF Descriptors	Sample NSD	Discovery Authentication Records	Discovery Profiles	Device Driver
Y	Y	Y	Y	Y	Y

The VNF package descriptors include:

- Discovery Authentication Profiles
- Discovery Profiles
- NFV VIM Software Image Descriptors

Discovery Authentication Profiles

The Juniper Firefly Discovery Authentication profiles are located in the following file:

`owareapps/nfv-vnfm-firefly/db/rc.disc-auths-firefly.xml`

This file contains the following discovery authentication profiles:

Authentication Record Name	Description
Juniper Firefly SNMP	SNMP v2 Credentials
Juniper Firefly CLI	SSH v2 Credentials

Discovery Profiles

The Juniper Firefly Discovery profiles are located in the following file:

`owareapps/nfv-vnfm-firefly/db/rcdisc-profile-firefly.xml`

This file contains the Juniper Firefly Discovery profile that automatically discovers and populates resource records during Virtualized Network Functionality (VNF) record instantiation. The discovery profile name is JuniperFirefly_Discovery.

The following tasks run once the target VM in the OpenStack environment is fully booted and can respond to SNMP and CLI requests from the management system:

1. Resync
2. DataCollectionForGroupOfDevices
3. Discovery Links for a Group of Devices
4. Refresh Monitor Targets
5. Juniper JUNOS SNMP Trap Forward to Redcell

NFV VIM Software Image Descriptors

See Preparing an Image for image customization required to produce and use this snapshot.

Name	Scope/Description	Container Format	Disk Format	Min RAM (MB)	MIN Disk (GB)	Resource Discovery Profile
Juniper-Firefly-snapshot-2	Juniper Firefly Snapshot 2 - Customized for Redcell Resource Management - created from original Juniper image junos-vsrx-12.1X46-D25.7-domestic.jva	BARE	QCOW2	2048	2	Y

License Requirements

Contact Juniper Networks regarding pricing and logistics for obtaining and installing license for the Juniper Firefly (SRX).

Known Issues

There are no known issues at this time.

References

This section provides references to:

- Vendor Documentation (URLs)
- VNF Configuration Methods

Vendor Documentation (URLs)

Refer to the Juniper Networks website (http://www.juniper.net) for all vendor-specific documentation.

For the Juniper Networks documentation and release notes, refer to the following Juniper websites page:

`http://www.juniper.net/support/downloads/?p=vsrx#docs`

`http://www.juniper.net/support/downloads/?p=firefly`

VNF Configuration Methods

A combination of image (snapshot) preparation, along with Virtualization Deployment Unit (VDU) Post Instantiate Configuration Lifecycle Events (LCEs), is implemented in this VNF Package to ensure that the Juniper Firefly VDUs are automatically brought under Redcell management.

Customized Image Preparation

The base Firefly SRX model family images provided by Juniper requires additional manual configuration before producing VMs in the OpenStack environment that can be discovered and managed using the Redcell Resource Management applications.

See Preparing an Image on page 94 for a description of how to create an updated image (snapshot) for the Firefly SRX model series to use to boot up VMs that the Redcell application manages. Use the snapshot produced to create Firefly VMs in the OpenStack environment, so that no manual intervention is required to apply the management system communication settings.

Redcell Resource Configuration Tasks

Once the target VM in the OpenStack environment is fully booted and can respond to SNMP and CLI requests from the management system, post discovery tasks are run.

For more details about the JuniperFirefly_Discovery profile and the tasks that run, see Discovery Profiles on page 91.

Preparing an Image

Before you can discover and manage a Virtualized Network Functionality (VNF) resource from the Redcell application, you need to:

1. Set up your OpenStack environment by preparing the Firefly VIM image with the necessary configuration.
2. Create a software image record from the Redcell application.

The junos-vsrx-12.1X46-D25.7-domestic.jva file provided by Juniper Networks must be converted to a qcow2 format before configuration can be performed.

Setting Up Your OpenStack Environment

To set up your OpenStack environment, you need to:

1. Convert the Firefly self-extracting package file (.jva) to a qcow2 file format.
2. Create a project.
3. Deploy the vendor's base image junos-vsrx-domestic.jva file by uploading it to a target Bare Metal OpenStack controller and then converting it to a qcow2 format.
4. Create a flavor representing the smallest supported flavor to use (Figure 5-1). The Juniper vendor provides the following JUNOS VSRX Version 12.x.x flavor:

Juniper-Firefly-snapshot-2	Flavor Name: cpu-2-ram-2048-disk-2	CPU – 2, Memory – 2 GB (2048 MB), Disk – 2 GB

5. Make configuration changes to the snapshot image.
6. Create a VM snapshot that is used to create and export a Virtualized Infrastructure Manager (VIM) software image descriptor within the Redcell application.

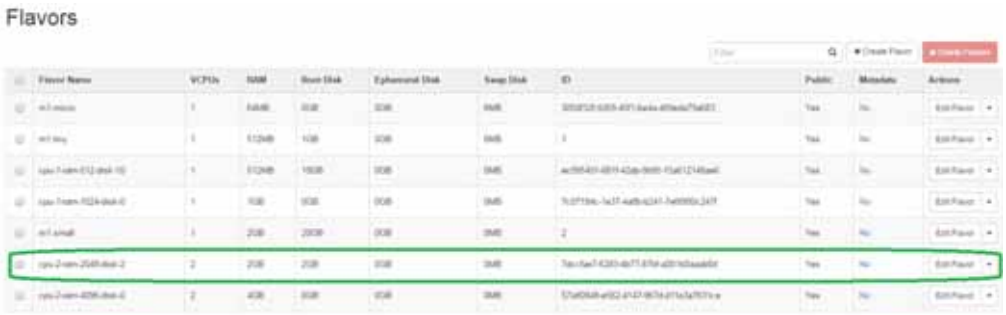


Figure 5-1 Juniper Firefly Flavors Example

Converting JVA to QCOW2

Convert the Firefly self-extracting package file (.jva) to a qcow2 file format from the command line as follows.

1. Upload junos-vsrx-domestic.jva file you received from Juniper to a target Bare Metal OpenStack controller.
2. Access the OpenStack controller using the ssh command.
3. Navigate to the var/tmp directory.
4. Verify that the .jva file is located in the junos-vsrx-domestic-NUMBER directory.
5. Enter the following command:

   ```
   glance image-create --name "Juniper-Firefly-InitialConversion" --disk-
      format qcow2 --container-format bare --is-public True --file junos-
      vsrx-domestic.img
   ```

   This creates the qcow2 file.
6. Verify that the qcow2 image was created by entering `glance image-list`.

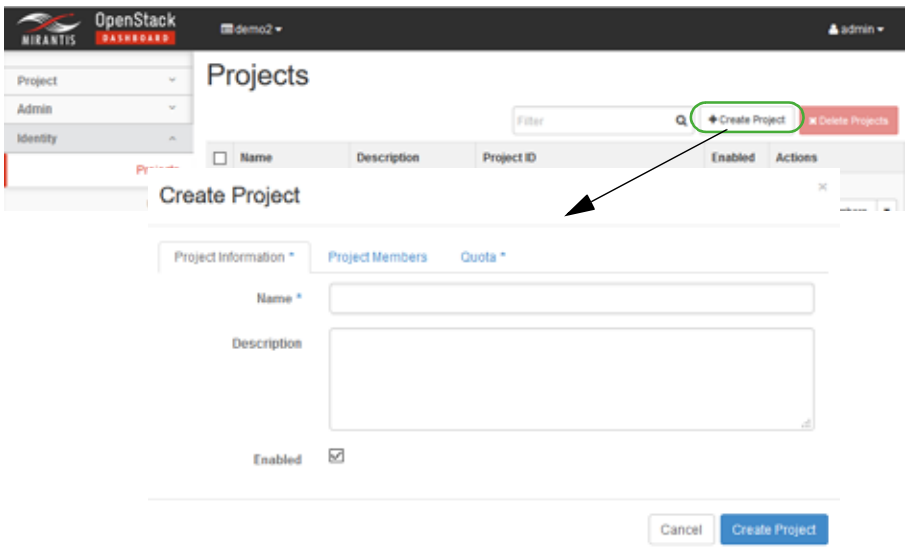
Now that you have converted the .jva file to a qcow2 format, you are ready to create a project.

Creating a Project

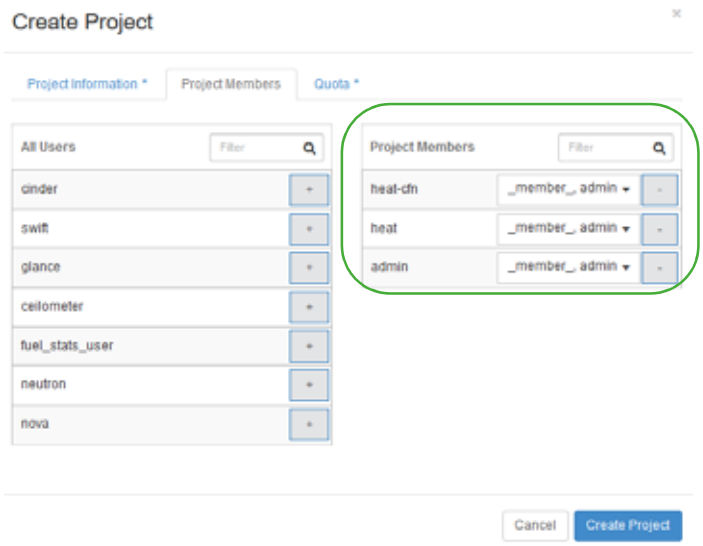
Create a project in an OpenStack VIM (Virtualized Infrastructure Manager) as follows.

1. Select Identity > Project.
2. Click Create Project.

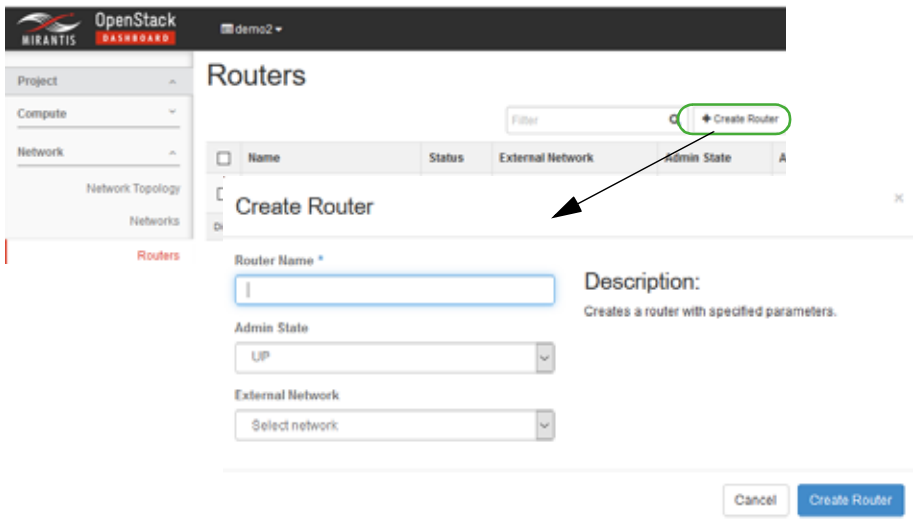
   The Create Project window is displayed.
3. Enter a name and detailed descriptions.



4. Assign users/permissions.
   a. Click Project Members.
   b. Add the following users to the Project Members list.
      - heat-cfn
      - heat
      - admin
   c. Set the member permissions to admin.
5. Click Create Project.
   The new project is saved to the Projects list.



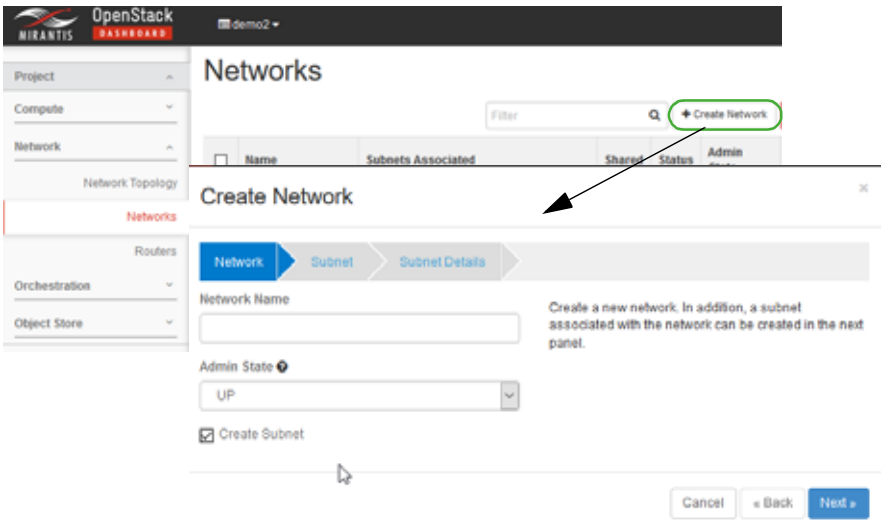
6. Create project networking in an OpenStack VIM (KILO or later release).
   a. Create a project router with a gateway interface.



b. Make sure that the router's gateway IP is reachable from the LAN (your PC) following project router creation.

c. Create and attach the following networks to the project router:

- net-mgmt
- net-data1
- net-data2



Now you can instantiate a VM from the vendor-created image.

Instantiating a VM from a Vender-Converted Image

Instantiate a VM (virtual machine in the new OpenStack project from the Juniper-Firefly-snapshot-2 image created in the Creating a VM Snapshot section as follows.

1. Boot up the Juniper-Firefly-snapshot-2 image with the following network connections.

Linux interface name	Firefly Interface Name	Network
eth0	mgmt	net-mgmt
<None> *	1.1	net-data-1
<None> *	1.2	net-data-2
* The <None> interface names require CLI configuration along with a proper license before the interface can be configured/enabled and pass traffic. This is done as post-bootup and post device discovery configuration applied by the Redcell system (not part of the base image snapshot).		

2. Assign a floating IP address to the eth0/mgmt connection.
3. Go to the OpenStack dashboard.
4. Select Project > Compute > Instances.

   The instances list is displayed.
5. Verify that the deployed instance is listed.

Create flavors before creating the VM snapshots.

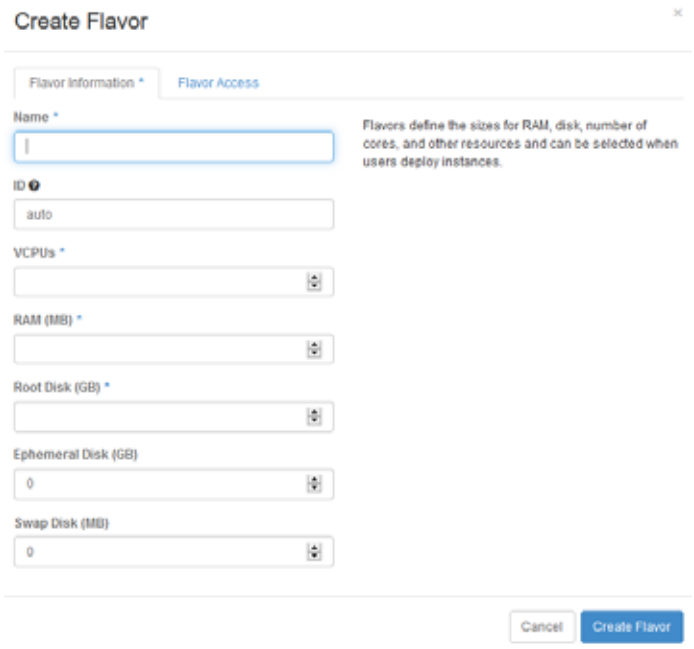
Creating a Flavor

Create the following Firefly flavor from the OpenStack dashboard.

Juniper-Firefly-snapshot-2	Flavor Name: cpu-2-ram-2048-disk-2	CPU – 2, Memory – 2 GB (2048 MB), Disk – 2 GB

1. Select Admin > System > Flavors.
2. Click Create Flavor.

   The Create Flavor window is displayed.



3. Enter a name, such as cpu-2-ram-2048-disk-2.
4. Set VCPUs, memory, and disk values.
5. Specify which projects to apply the flavor.

   If you do not specify a project, the flavor is available to all projects.
6. Click Create Flavor.

   Your flavor is created.

Now it is time to manually configure the converted image.

Manually Configuring the Snapshot

The Juniper-Firefly-Initial conversion image must now be deployed and configured manually to create a snapshot that functions with the Redcell application.

Manually configure the snapshot from the OpenStack dashboard as follows.

1. Select Admin > System > Images.
2. Launch a Juniper-Firefly-InitialConversion instance from Images.
3. Make sure that you select the correct flavor (cpu-2-ram-2048-disk-2) and the created networks are included.
4. Wait until instantiation completes.

5. Enter the instance overview.
6. Navigate to the instance console.
7. Login as root.
8. Configure the admin user (admin/D0rado!!) as follows:

```
logout

Amnesiac (ttyv0)

Login: root

--- JUNOS 12.1X16-D25.7 built 2012-09-06 01:40:34 UTC
root@% cli
root> edit private
warning: uncommitted changes will be discarded on exit
Entering configuration mode

[edit]
root# edit system

[edit system]
root# set root-authentication plain-text-password
New password:
Retype new password:

root# edit login user admin

[edit system login user admin]
root# set uid 2001

[edit system login user admin]
root# set class super-user

[edit system login user admin]
root# set pl
syntax error.
root# set authentication plain-text-password
New password:
Retype new password:

[edit system login user admin]
root# top

[edit]
root# commit
commit complete

[edit]
root#
```

9. Login as the admin user.

10. Configure the interfaces for each network connection as follows:

    ge-0/0/0: net-mgmt network port

    ge-0/0/1: net-data-1 network port

    ge-0/0/2: net-data-2 network port

    For example, configure the ge-0/0/0 port (repeat this process for ge-0/0/1 and ge-0/0/2) “set unit 0 family inet dhcp” as follows:

```
[edit]
admin@vSRX1# show interfaces ge-0/0/0
unit 0 {
    family inet {
        dhcp;
    }
}
```

11. Configure security zones.

    a. Delete ge-0/0/0 interface from security-zone untrust (default settings).

    b. Add the ge-0/0/0 interface to security-zone trust and add host-inbound-traffic settings as follows:

```
[edit]
admin@vSRX1# show security zones
security-zone trust {
                    tcp-rst;
                    interfaces {
                        ge-0/0/0.0 {
                            host-inbound-traffic {
                                system-services {
                                    all;
                                }
                                protocols {
                                    all;
                                }
                            }
                        }
                    }
}
security-zone untrust {
                    screen untrust-screen;
}

[edit]
admin@vSRX1#
```

Next you need to create a VM snapshot.

Creating a VM Snapshot

The VM snapshot is used to create and export a Virtualized Infrastructure Manager (VIM) software image descriptor from the Redcell application and then the VIM software image descriptor is used to manage, deploy, or migrate images.

Gracefully shutdown the VM manually in the OpenStack environment and then take a snapshot produced as a qcow2 image file.

Create a VM snapshot from the OpenStack dashboard as follows.

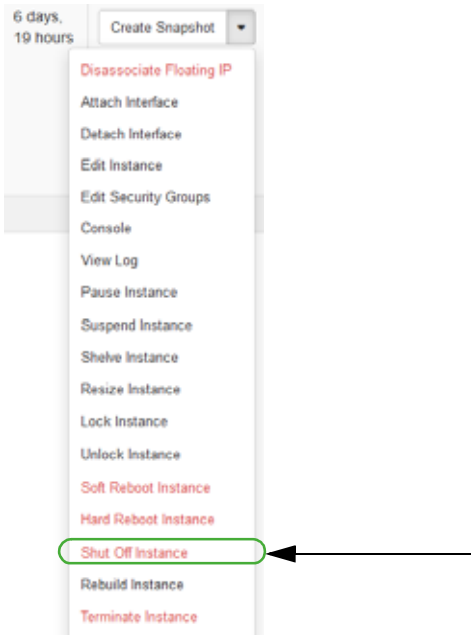
1. Shut off the instance from.
   a. Select Project > Compute > Instances.

      A list of instances is displayed.

   b. Select the Shut Off Instance action for the appropriate instance.

      A confirmation message is displayed.

   c. Click shut Off Instance.



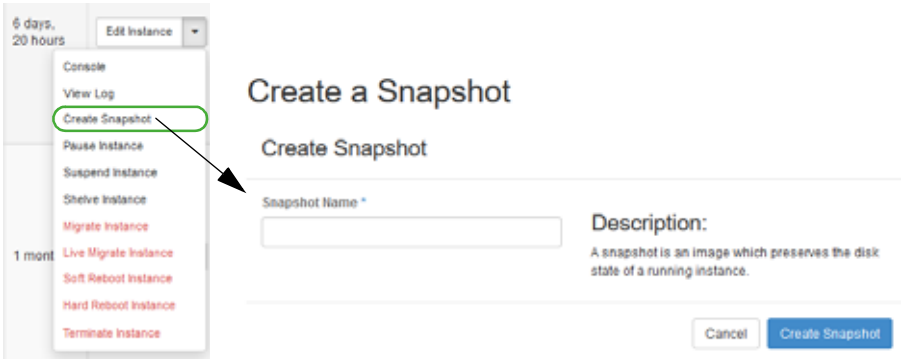
   If you prefer to shutdown Firefly VM processes from the Firefly SRX command-line interface (CLI) shell, use the `request system power-off` command or the `request system halt` command. Refer to your Juniper firefly documentation for more details.

2. Create a snapshot image.
   a. Select Admin > System > Instances.

      A list of instances is displayed.

   b. Select the Create Snapshot action for the instance.

      The Create a Snapshot window is displayed.



c. Enter a name, such as Juniper-Firefly-Snapshot-2.

d. Click Create Snapshot.

3. Assign OpenStack image properties to the snapshot image created in step 2.

a. Select Admin > System > Images.

b. Select the Edit Image action for the instance.

The Update Image properties are displayed.

c. Set the Disk to 2 and the Memory requirements to 2048.

d. Select Public.

This is required so that the Redcell system can access and manage the image later on.

e. Click Update Image

Your changes are saved.



Now you are ready to create a software image descriptor from the Redcell application.

Creating a Software Image Descriptor

The Redcell Network Functions Virtualization (NFV) feature uses the software image descriptor to manage, deploy, or migrate images. Create a software image descriptor record from the Redcell application by:

1. Creating a Software Image Descriptor for Snapshot Image
2. Modifying the VIM Software Image Descriptor

The steps provided in this section assume that you have already created a VIM that houses the snapshot image in the OpenStack environment. If a VIM that houses the snapshot image does not exist, see Setting Up Your OpenStack Environment on page 94 before continuing.

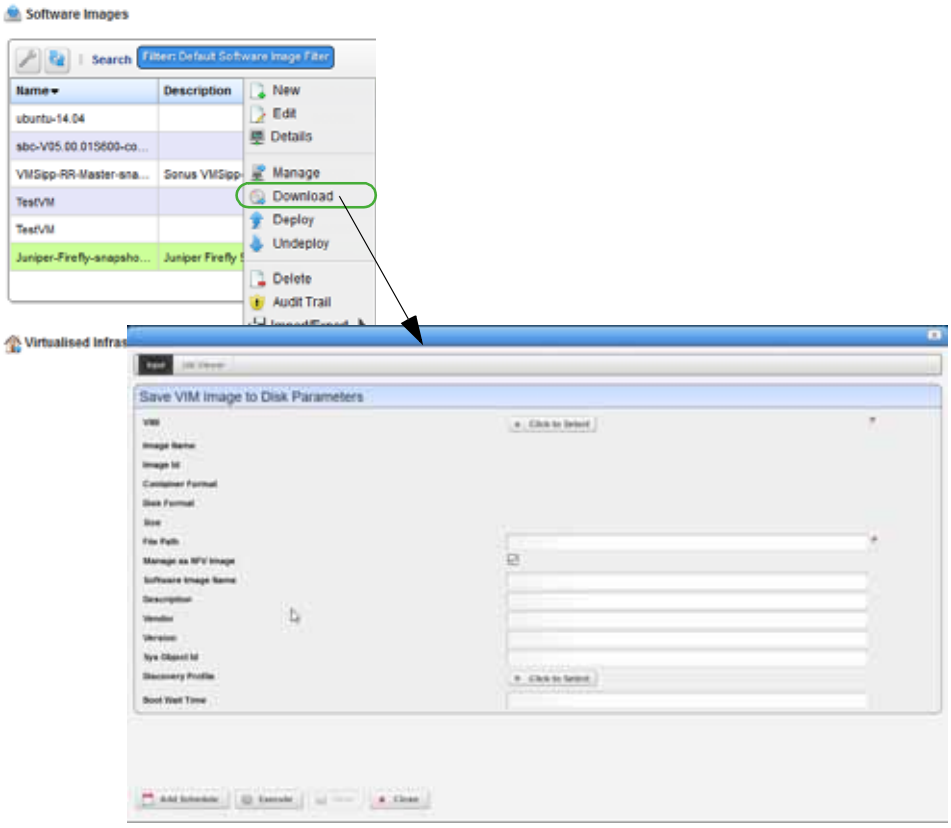
Creating a Software Image Descriptor for Snapshot Image

Create a software image descriptor for a snapshot image from the Redcell application as follows.

1. Navigate to the Software Images portlet.

   The portlet's location depends on your company's configuration.
2. Right-click an image.
3. Select Download.

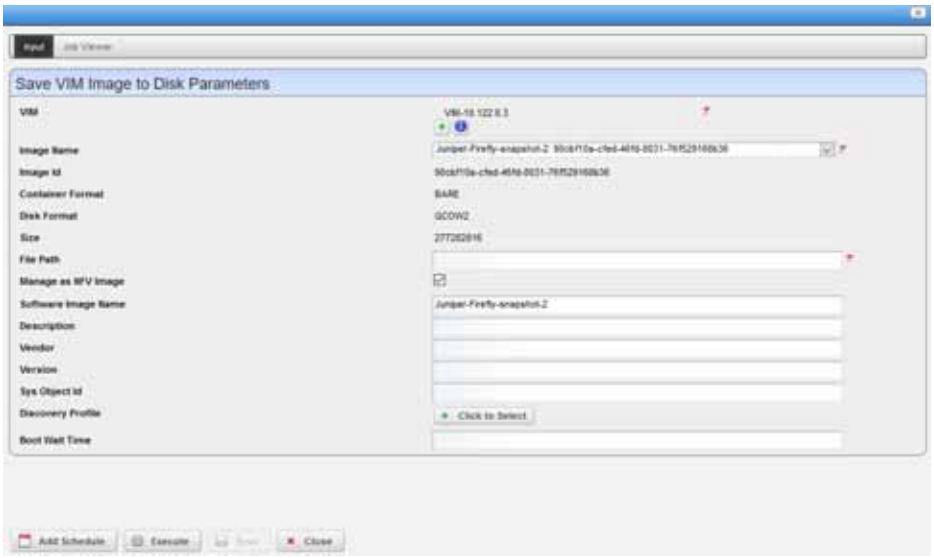
   The Save VIM Image to Disk Parameters input window is displayed.



4. Select the Virtualized Infrastructure Manager (VIM) housing the snapshot qcow2 image created earlier.
5. Select the snapshot image to download.

   For example: `Juniper-Firefly-snapshot-2.qcow2`

   The fields are populated based on your selection.



6. Click Execute.
7. Copy the image downloaded from your local disk to your company's centralized file server (such as an FTP Server) to redistribute the new snapshot image across additional OpenStack VIMs.

Before the image descriptor record is complete and ready to export, you need to edit the image descriptor.

Modifying the VIM Software Image Descriptor

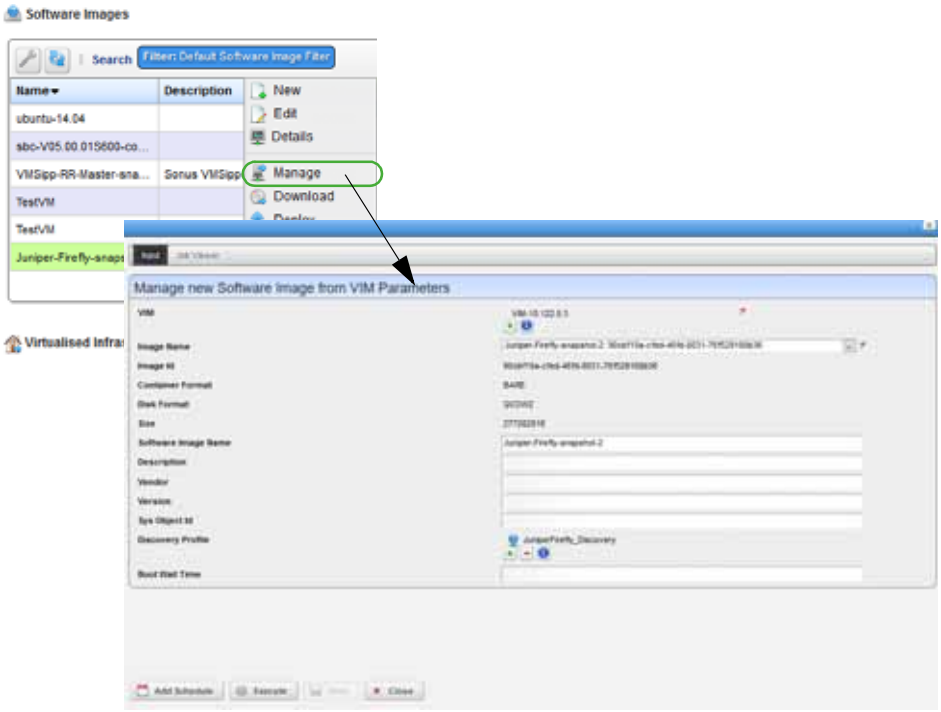
These instructions assume that you have already created a Virtualized Infrastructure Manager (VIM) image descriptor. If you have not created the image descriptor, see Creating a Software Image Descriptor for Snapshot Image on page 103 before continuing.

Modify the VIM software image descriptor from the Redcell application as follows.

1. Navigate to the Software Images portlet.

   The portlet's location depends on your company's configuration.
2. Right-click an image.
3. Select Manage.

   The Manage new Software Image from VIM Parameters window is displayed.



4. Select the VIM that houses the snapshot image.
5. Select the snapshot image name.

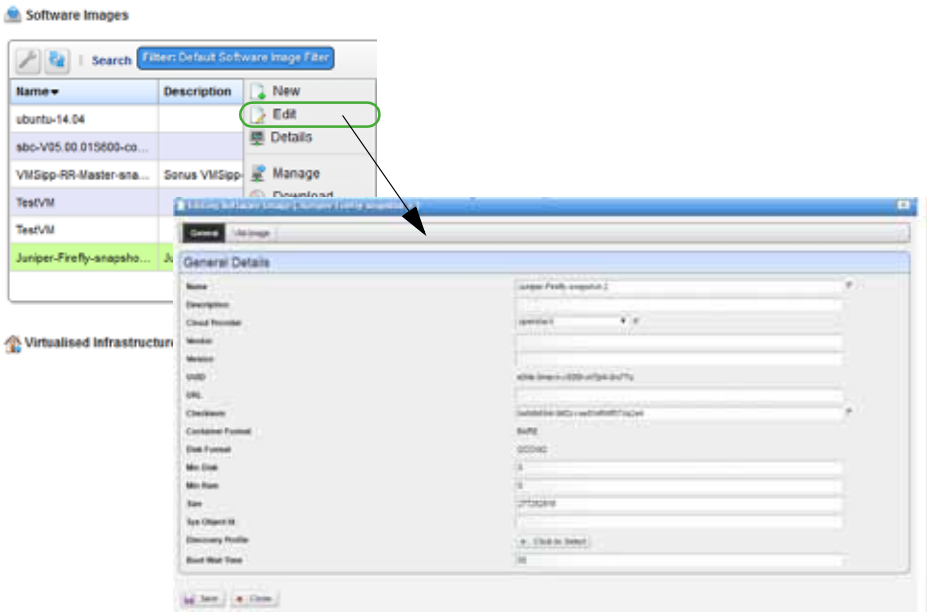
   For example: `Juniper-Firefly-snapshot-2: uniqueImageID`

   The image ID, container format, disk format, size, and software image name fields are populated.
6. Select a discovery profile.
7. Click Execute.

   A new software image record is created matching the image name in your OpenStack environment.
8. Right-click an image.
9. Select Edit.

   The Editing Software Image window is displayed.
10. Select the snapshot image from the Image Name list.

    The Editing Software Image window is displayed.



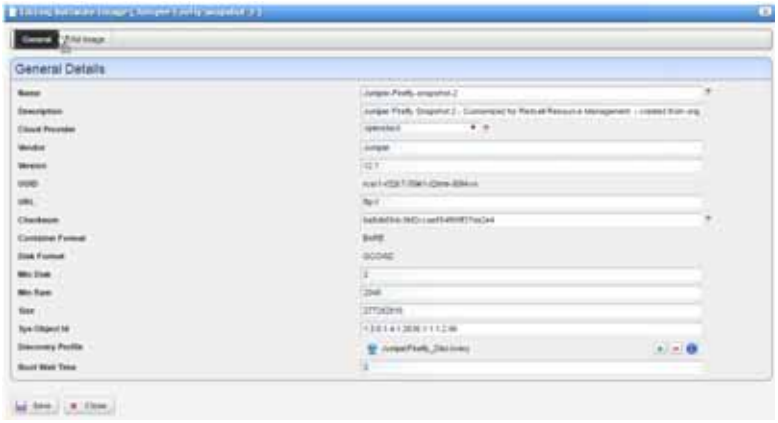
11. Enter the missing information as follows.
    a. Add a meaningful description.
    b. Specify the vendor, such as Juniper.
    c. Add a meaningful version number, such as 12.1.
    d. Enter a valid URL that points to your local environment's file server or disk location where the qcow2 file is stored and accessible. For example:

       `ftp://serverIP/firefly/Juniper-Firefly-snapshot-2.qcow2`
    e. Enter the SNMP SysObject ID for the Juniper Firefly SRX instances, which is:

       `1.3.6.1.4.1.2636.1.1.1.2.96`
    f. Select the discovery profile containing the required ssh and SNMP authentication objects.

       Discovery profiles are created by your system administrator or someone within your organization with administrative permissions.
    g. Leave the Boot Wait Time field blank.

       The Redcell system assigns a default integer value of 0 after you save the profile.
    h. Review your inputs to ensure accuracy.



12. Save the software image record.
13. Locate and Select the newly created Software Image Record and export it to an archive disk location for backup purposes.

6

> Understanding the Sonus VSBC VNF Package

Covers these topics:

Sonus SBC VNF Package – 110
Sonus SBC VNF Package Contents – 111
Redcell VNF Package - Install Component Files – 114
License Requirements – 116
Known Issues – 116
References – 116

This section explains the scope, functions, and processes associated with the Virtualized Network Functionality (VNF) onboarding and instantiation.

Sonus SBC VNF Package

The Sonus Network Session Border Controller (SBC) Software Edition (SWe) product is virtualized and fits into a service provider's or enterprise's Network Functions Virtualization (NFV) strategy – optimizing resource utilization based on their specific needs.

The SBC SWe product, also referred to as VSBC, utilizes the same code base and firmware as the Sonus SBC 5000 and 7000 series and provides the same carrier-class redundancy to ensure service continuity.

A popular use of the SBC SWe as a Virtualized Network Function (VNF) is in support of voice communications, including the use of SIP, H.323, and over 80 signaling variants providing Call Admission Control (CAC).

The Redcell VNF package provides sample VNF descriptors and associated artifacts to deploy the SBC SWe (VSBC) as a VNF in the OpenStack environment. This VNF package also includes:

- A sample standalone Sonus VSBC Cluster VNF – to demonstrate an SIP communication deployment scenario with scaling operations (elasticity) based upon call volume
- A simpler Sonus VSBC Virtual Appliance VNF descriptor for SBC SWe standalone usage – or for insertion into the Network Service record, alongside other VNFs, that can be defined and customized based on your specific network topology and intended use

Sonus Networks provides qcow2 images and licenses that are ready for the OpenStack environment. You need these files to deploy and enable the VSBC VNF features.

The following list provides the VNF package vendor and validation information:

Vendor and Model Information	
Vendor	Sonus Networks
Product Family	SBC
Models	VSBC (Virtual SBC)
Operating Systems	SBC SWe (Software Edition)
Version	5.01
Validated Environment	
VIM	OpenStack
Version	Liberty
Installer	Mirantis
Version	8
Network Configurations	VXLAN, VLAN Segmentation
Redcell MANO (Management and Operation) Validated Functions	
MANO	NSD, VNFD, NSR, VNFR Link LCEs
VNFM	Generic (MANO Lite) Independent/Specific (N-N/A)
NFVO	MANO Lite

Redcell RMO (Resource Management and Operation) Validated Functions	
Inventory	Resource Discovery and Inventory Resource Creation Method (NFV-Model)
Monitoring	SNMP Monitoring
Config	ACLI

Sonus SBC VNF Package Contents

The Sonus SBC VNF package contains artifacts necessary to install and deploy Virtualized Network Functions (VNFs) for Sonus VSBC Virtualization Deployment Units (VDUs) offered.

The following sample VNF descriptors were created with basic flavors to deploy the VNF VDUs, either as part of a standalone VNF record, or as part of a higher level, end-to-end Network Service record.

- Sonus VSBC Virtual Appliance
- Sonus VSBC Cluster

Sonus VSBC Virtual Appliance

The sample Sonus VSBC Virtual Appliance descriptor is located in the following file:

`owareapps/nfv-vnfm-sonus/db/vnfd.sonus-virtual-appliance.xml`

This is a standalone Sonus VSBC that you can deploy without a Network Service.

You can copy (branch) this basic Virtualized Network Function (VNF) housing a single VSBC SWe Virtualization Deployment Units (VDU) using the Redcell VNFD portlet, Branch action and easily convert it to a non-standalone VNF to incorporate as a VNF member of a higher-level Network Service descriptor.

The Sonus VSBC Virtual Appliance VNF descriptor defines a standalone VNF that deploys a single VSBC VDU along with the required project networks and security groups in the OpenStack environment.

The Sonus VSBC Virtual Appliance VNF creates the following artifacts during deployment:

- Tenant Router — OpenStack Neutron Router
- Private Tenant Networks required for the VSBC to connect with to function:

Network Name	Description
MGT0	Management Network with Public (Floating) IP Address Assignment
HA	High Availability Network for Internal SBC VM Communication
PKT0	Internal Packet Network
PKT1	External Packet Network

- Security Groups controlling TCP, UDP, and ICMP port access to/from the VSBC's network ports.

Here are the **Sonus VSBC Virtual Appliance** descriptor deploy parameters used:

Field Name	Data Type	Description	Default Value	Valid Values	Require Values
Cluster Name	String	Cluster Name	ExampleCluster	Any String	N

Here are the **Sonus VSBC Virtual Appliance** descriptor flavors used:

Flavor Name	VDU Name	VDU Count	CPU	Disk (GB)	Memory (MB)
Basic	VSBC VA	1	2	65	10240

View the VNF descriptor's composition details from the Redcell Onboarding page > VNF Descriptor portlet.

Sonus VSBC Cluster

The sample Sonus VSBC Cluster descriptor is located in the following file:

`owareapps/nfv-vnfm-sonus/db/vnfd.sonus-vsbc-cluster-v1.xml`

The Sonus VSBC Cluster Virtualized Network Function (VNF) descriptor defines a standalone VNF that fully automates the deployment and monitoring of multiple types of Servers/VMs alongside of one or two VSBC Virtualization Deployment Units (VDUs). This VNF is deployed as a cluster of VDUs and is isolated to an OpenStack project.

The Sonus VSBC Cluster VNF creates the following artifacts during deployment:

- Tenant Router — OpenStack Neutron Router
- Private Tenant Networks interconnecting the VSBC with a central Dynamic Name Service (DNS) in addition to an SIP client and server VM:

Network Name	Description
MGT0	Management Network with Public (Floating) IP Address Assignment
HA	High Availability Network for Internal SBC VM Communication
PKT0	Internal Packet Network
PKT1	External Packet Network

- Security Groups controlling TCP, UDP, and ICMP port access to/from each VSBC's network ports.
- The following VDU types that get instantiated as VMs in the target OpenStack project:

VDU Type	Description
DNS	Used to perform load balancing across multiple VSBC VDU instances.
VSBC	Performs SIP Call Admission and Control for this scenario.
SIP Client	Used to originate SIP calls with the SIP Server VDU and utilized to test and demonstrate SIP call connectivity and generate call volume using the VSBCs.
SIP Server	Used to establish SIP calls with the SIP Client and utilized to test and demonstrate SIP call connectivity and generate call volume using the VSBCs.

Here are the **Sonus VSBC Cluster** descriptor deploy parameters used:

Field Name	Data Type	Description	Default Value	Valid Values	Required Values
Cluster Name	String	Cluster Name	ExampleCluster	Any String	N
DNS IP	String	IP address of DNS Server	8.8.8.8	Valid IP Address	N
DNS Zone	String	DNS zone	example.com	Any String	N
VSBC DNS Host Name	String	Host Name in the Domain to use for the Updated DNS Entry	vsbc	Any String	N

Here are the **Sonus VSBC Cluster** descriptor flavors used:

Flavor Name	VDU Name	VDU Count	CPU	Disk (GB)	Memory (MB)
Basic	C-VSBC	1	2	65	10240
	Ubuntu DNS	1	1	10	512
	SIPP Server	1	1	20	2048
	SIPP Client	1	1	20	2048
Advanced	C-VSBC	2	4	130	20480
	Ubuntu DNS	1	1	10	512
	SIPP Server	1	1	20	2048
	SIPP Client	1	1	20	2048

View the VNF descriptor's composition details from the Redcell Onboarding page > VNF Descriptor portlet.

Redcell VNF Package - Install Component Files

The following Redcell installation components are required for the Sonus VSBC product:

VNF (OCP)	nfv-vnfm-sonus.ocp
Device Driver (DDP)	ddsonus.ddp

The Redcell VNF package descriptors for the **Sonus VSBC** VNF product include:

NVF VNF Package			Resource Management		
VIM Software Image Records	VNF Descriptors	Sample NSD	Discovery Authentication Records	Discovery Profiles	Device Driver
Y	Y	N	Y	Y	Y

The VNF package descriptors include:

- Discovery Authentication Profiles
- Discovery Profiles
- NFV VIM Software Image Descriptors

Discovery Authentication Profiles

The Sonus VSBC Discovery Authentication profiles are located in the following file:

`owareapps/nfv-vnfm-sonus/db/rc.disc-auths-vsbc.xml`

This file contains the following discovery authentication profiles:

Authentication Record Name	Description
sonus-cli	SSH v2 Credentials
snmp-sonus-vsbc	SNMP v2 Credentials

Discovery Profiles

The Sonus VSBC Discovery profiles are located in the following file:

`owareapps/nfv-vnfm-sonus/db/rc.disc-profile-vsbc-v50x.xml`

This file contains the Sonus VSBC Discovery profile (Sonus_VSBC_v5.0.x) that automatically discovers and populates resource records during Virtualized Network Function (VNF) record instantiation.

The following tasks are run once the target VM in the OpenStack environment is fully booted and can respond to SNMP and command-line interface (CLI) requests from the management system:

1. Sonus SBC Reset CLI Password
2. Resync
3. Refresh Monitor Targets
4. Sonus VSBC Set Account Max Session
5. Sonus vSBC SNMP Trap Forwarding to Redcell

NFV VIM Software Image Descriptors

Here is a list of the Network Functions Virtualization (NFV) Virtualized Infrastructure Manager (VIM) software image descriptors.

Name	Scope/Description	Container Format	Disk Format	Min RAM (MB)	Min Disk (GB)	Resource Discovery Profile
sbc-V05.00.01S600-connexip-os_03.00.02-S600_amd64-GA	Base image for the SBC SWe (VSBC) - version 5.0.1 GA Release. This is the original qcow2 file supplied by Sonus.	BARE	QCOW2	10240	65	Y
ubuntu-14.04	Open Source version of the Ubuntu OS utilized to create the DNS VDU in the Sonus VSBC Cluster VNF.	BARE	QCOW2	0	0	N
VMSipp-RR-Master-snapshot-1	Open Linux Image with cloud-in it and SIP testing software installed. Utilized for the SIP Client and Server VDUs in the Sonus VSBC Cluster VNF.	BARE	QCOW2	0	20	N

License Requirements

Sonus Networks does require and provide licenses to operate a SBC SWe (VSBC) as a fully functional Virtual Machine in the OpenStack environment.

Contact the Sonus Networks support team regarding license requirements and logistics.

Known Issues

The Sonus VSBC instances require that the CLI user account's password change during the initial login session. A task was implemented in the Sonus Device Driver so that it applies a password change via CLI communication with the VSBC during the initial SSH session established to a newly deployed VSBC Virtualized Network Function's (VNF's) Virtualization Deployment Unit (VDU).

Contact the Sonus Networks support team for further details regarding known issues or caveats utilizing the SBC SWe VNF.

References

This section provides references to:

- Vendor Documentation (URLs)
- VNF Configuration Methods

Vendor Documentation (URLs)

Refer to the Sonus Networks website (http://www.sonus.net) for all vendor-specific documentation.

For the Sonus VSBC documentation and release notes, refer to the following Sonus Networks websites page:

`http://www.sonus.net/products/session-border-controllers/sbc-swe`

VNF Configuration Methods

A combination of image (snapshot) preparation, along with Virtualization Deployment Unit (VDU) Post Instantiate Configuration Lifecycle Events (LCEs), is implemented in this Virtualized Network Function (VNF) package to ensure that the Sonus VSBC VDUs are automatically brought under Redcell management.

Customized Image Preparation

For the VSBC VDUs:

- The original qcow2 image was used to create this VNF package, without a need to customize or take a snapshot for the Sonus VSBC VNF VDUs.
- Configuration changes are applied automatically through discovery actions to the VSBC running in the OpenStack system post boot-up in order to have Redcell monitor, configure and manage the VSBC.

For the SIP Client and Server VDUs:

- Cloud-init was added by first using the original image, VMSipp-RR-Master, and then installing cloud-init on a running instance booted from the original image. A snapshot image was created with cloud-init included.
- The SIP Client and Server VDUs are then configured with instance specific IP address information using the OpenStack HEAT Server Resource metadata facility in conjunction with cloud-init during execution of the VNF VDU's instantiate lifecycle task.

For the DNS VDU:

- A cloud enabled Ubuntu version 14.04 image is used that has cloud-init included in the original image.
- The DNS service is installed and configured using the OpenStack HEAT Server Resource metadata facility in conjunction with cloud-init during execution of the VNF VDU's instantiate Lifecycle task.

Redcell Resource Configuration Tasks

A specialized action, Sonus SBC Rest CLI Password, is specified as one of the execution actions in the sample Redcell Resource Discovery profile included in this VNF package. This action is required to perform the initial password reset required by the SBC when logging in the very first time to a new VSBC VM instance using the CLI user account.

The password reset action is automatically executed, prior to performing resource discovery/resync and post configuration tasks.

Once the target VM in the OpenStack environment is fully booted and can respond to SNMP and CLI requests from the management system, post discovery tasks are run. For more details about the Sonus VSBC profile and the tasks that run, see Discovery Profiles on page 114.

7

> Managing NFVI/VIM Resources

Covers these topics:

Managing VIMs – 120
Discovering VNF Records – 125
Managing Software Images – 127
Maintaining Resource Monitors – 129

The management of Network Functions Virtualization infrastructure (NFVI) or virtualized infrastructure manager (VIM) resources from the Redcell application is no different from managing physical devices you discovered or created on your network. This section provides some basic instructions to manage NFVI/VIM resources. For a detailed description of the user interface, instructions, and other resource management options available, refer to the *Redcell User Guide*.

Monitor VIM details, alarms, and history to determine what actions are required, such as VNF discovery, VIM resync, VIM delete, and so on.

Managing VIMs

A Virtualized Infrastructure Managers portlet is where you deploy network services, physical network functions (PNFs) and virtualized network functions (VNFs).

This section provides example instructions for:

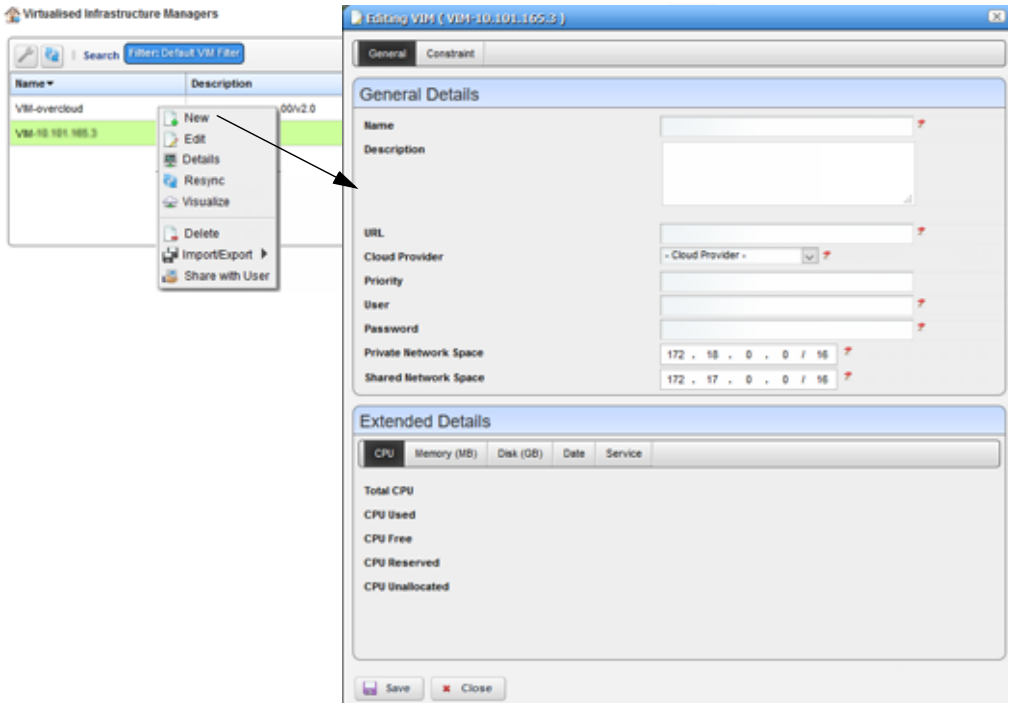
- Creating VIMs
- Modify a VIM
- Deleting a VIM
- Resyncing a VIM

Creating VIMs

Create VIMs from the Virtualized Infrastructure Manager portlet as follows.

1. Right-click > New.

   The Editing VIM window is displayed.



2. Enter the required information.

   Optionally, provide a more detailed description and a priority.

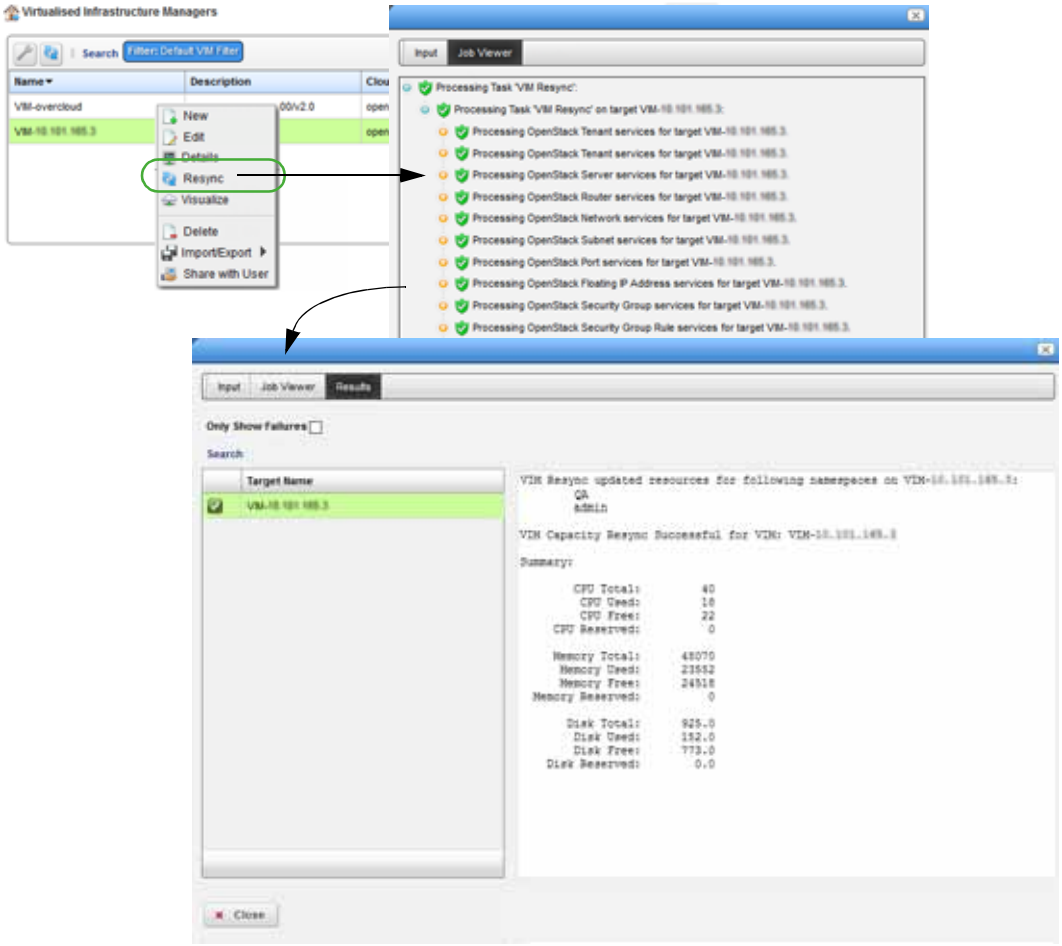
3. Specify any constraints.

   Constraints specify where to place a network service or VNF if you do not specify a VIM during the staging process.

4. Save the VIM.

   This brings the VIM under management.

Once you create the VIM, it is a good idea to do a resync to ensure that the VIM has the latest capacity information.



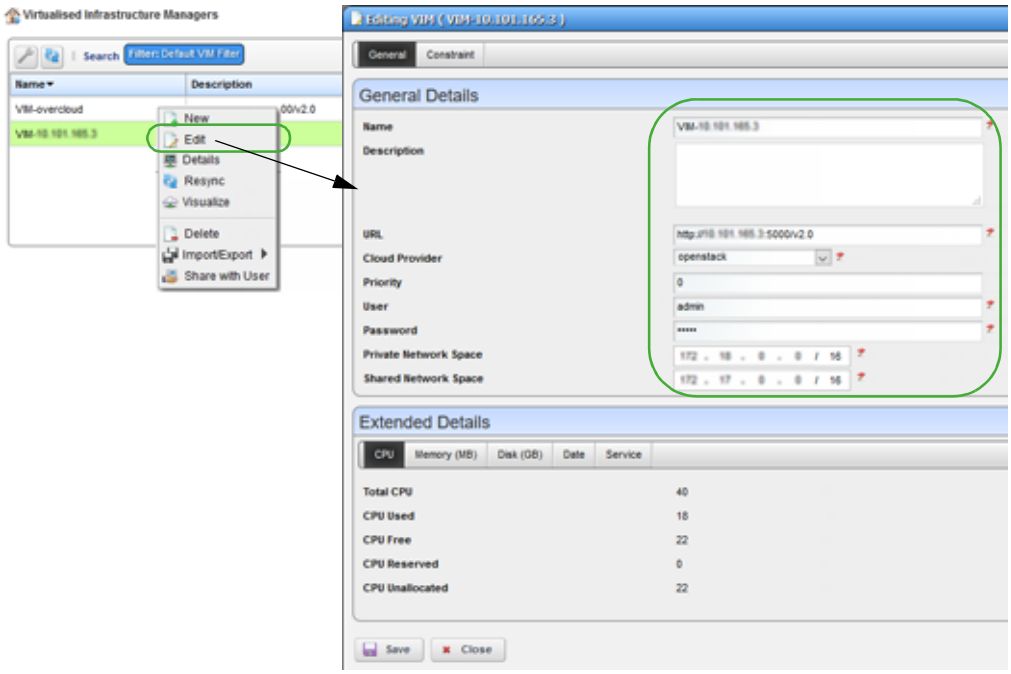
5. View VIM details to see everything related to the VIM, such as:
   - Capacity resources (CPU, memory, disk)
   - Defined constraints
   - Hypervisors
   - VIM Images
   - Reference details (IP addresses, network, port, router, capacity, and so on)
6. Repeat steps 1 through 5 for each new VIM.

Modify a VIM

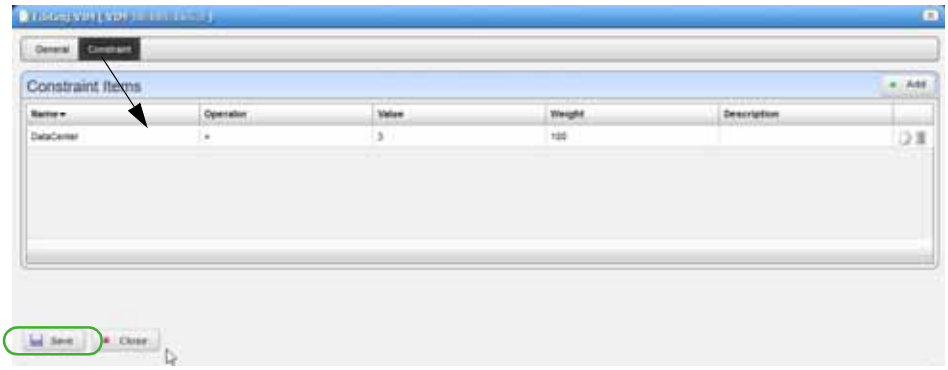
Modify a VIM from the Virtualized Infrastructure Manager portlet as follows.

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

   The Editing VIM window is displayed.



3. Modify the general information as needed.
4. Modify the constraints as needed.
5. Save your changes.

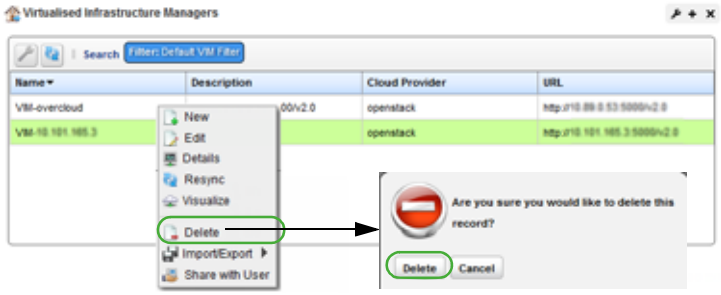


Deleting a VIM

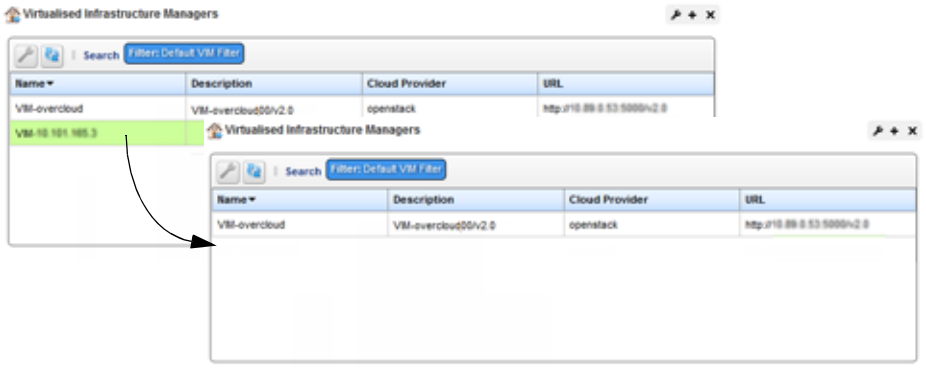
Delete a VIM from the Virtualized Infrastructure Manager portlet as follows.

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

   A confirmation message is displayed.
3. Click Delete.



4. Verify that the VIM no longer exists.



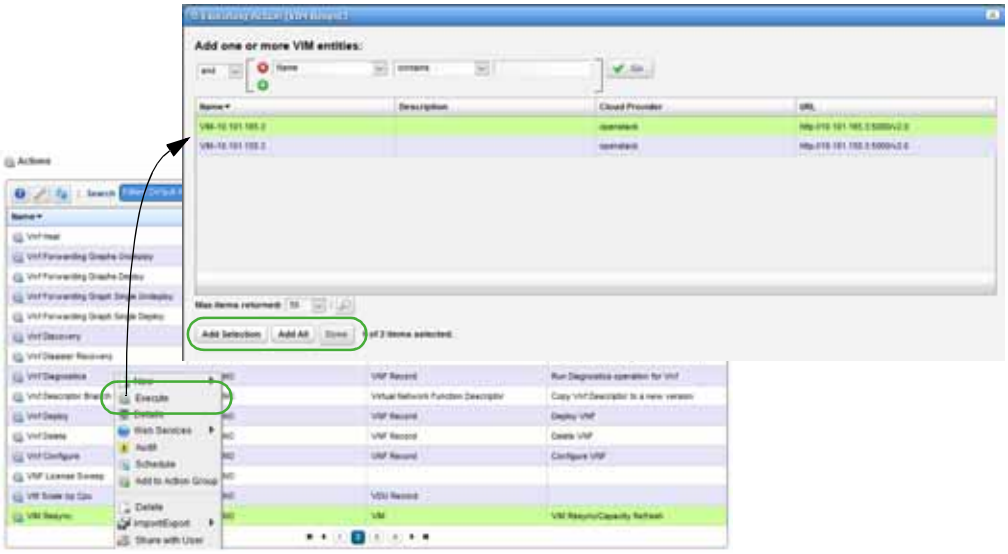
Resyncing a VIM

The resync action refreshes the selected virtualized infrastructure manager (VIM) with the latest capacity information.

Resync a VIM from the Virtualized Infrastructure Manager portlet by right-clicking a VIM and then selecting Resync, or from the Actions portlet as follows.

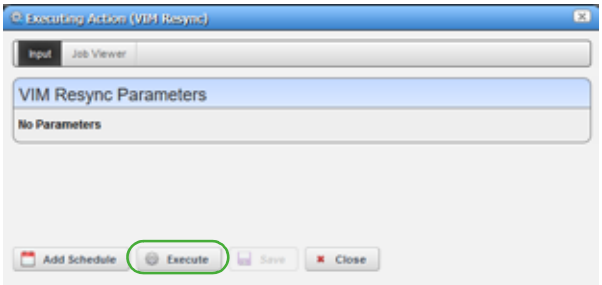
1. Navigate to the VIM Resync action.
2. Right-click VIM Resync > Execute.

   The Executing Action (VIM Resync) window displays a list of VIM entities.



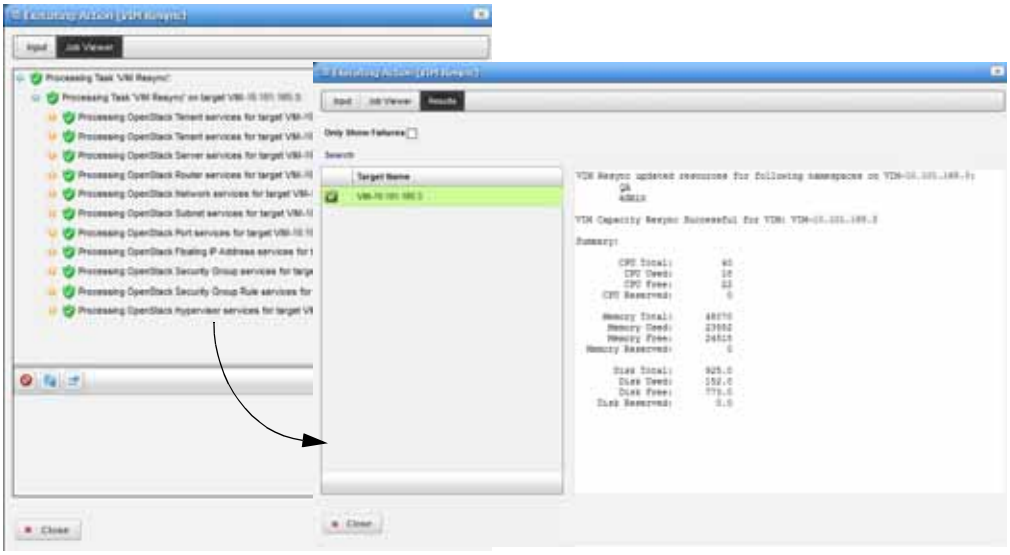
3. Select a VIM.
4. Click Add Selection and then Done.

   The Executing Action (VIM Resync) Info window is displayed.



5. Click Execute.

   The Executing Action (VIM Resync) Job Viewer displays the progress and upon completion, the results are displayed.



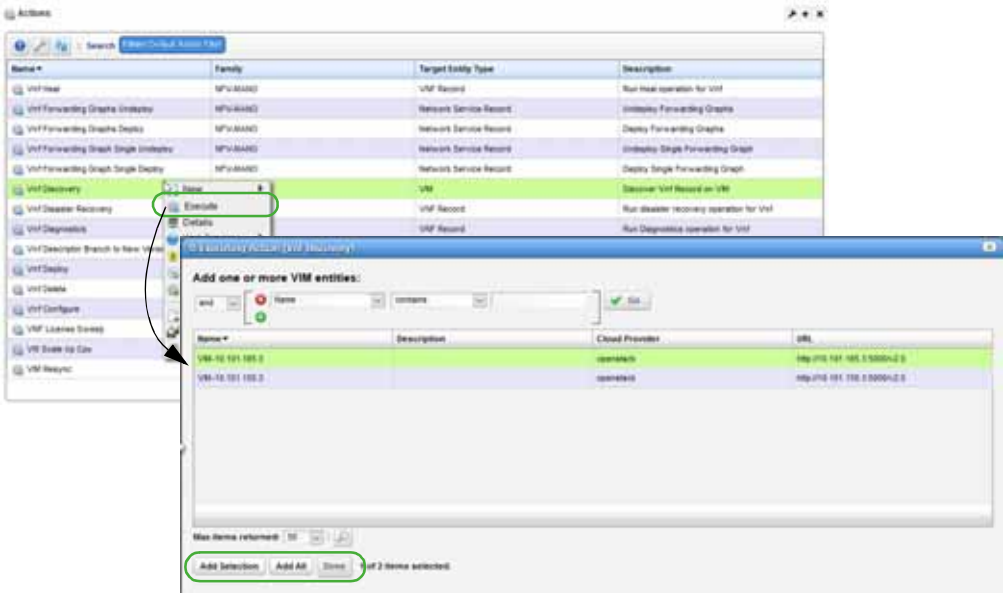
Discovering VNF Records

The discovery VNF action finds VNF records existing on the specified VIM. You can discover VNF records from the Virtual Network Function Records portlet or the Actions portlet. The instructions provided in this section show how to discover VNFs from the Actions portlet.

Discover VNF records from the Actions portlet as follows.

1. Navigate to the Vnf Discovery action.
2. Right-click Vnf Discovery > Execute.

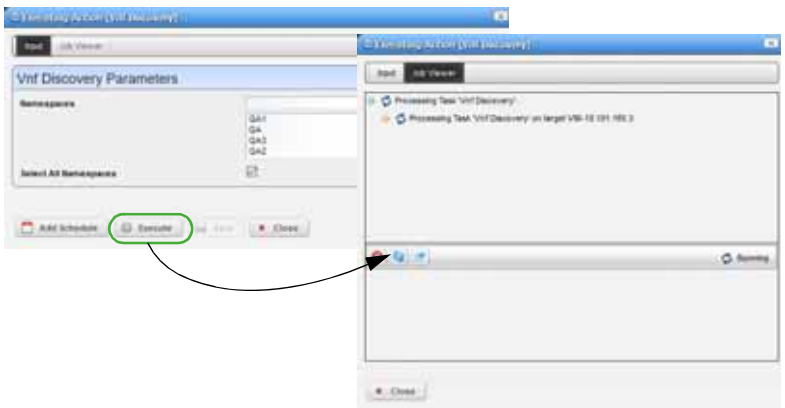
   The VIM entities list is displayed.



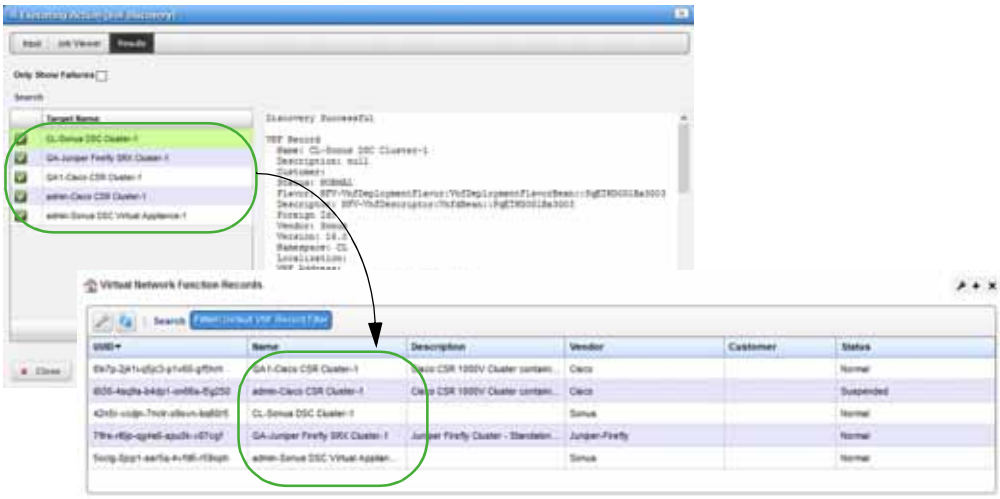
3. Select a VIM
4. Click Add Selection and the Done.

   The Vnf Discovery Parameters are displayed.
5. Specify the namespaces.
6. Click Execute.

   The Executing Action (Vnf Discovery) Job Viewer displays the progress and upon completion, the results are displayed.



7. Verify that the target names listed are found in the Virtual Network Function Records portlet.



Managing Software Images

A software image represents an image that can be deployed to a virtualized infrastructure manager (VIM) and then turned up (activated and provisioned) for a specific virtualization deployment unit (VDU) within a virtualized network function (VNF). Once a software image exists, you can modify, deploy, undeploy, view details, and so on.

This section provides example instructions for:

- Creating a Software Image
- Deploying a Software Image

Creating a Software Image

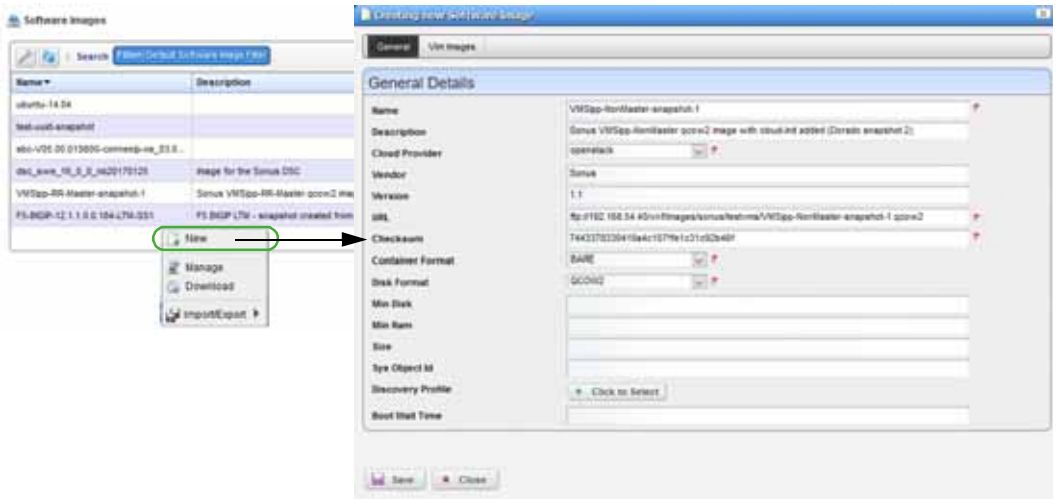
You have the option to create a software image from the Software Images portlet using either the New or Manage options. For simplicity, the example provided here uses the New option.

Create a software image from the Software Images portlet as follows.

1. Right-click > New.

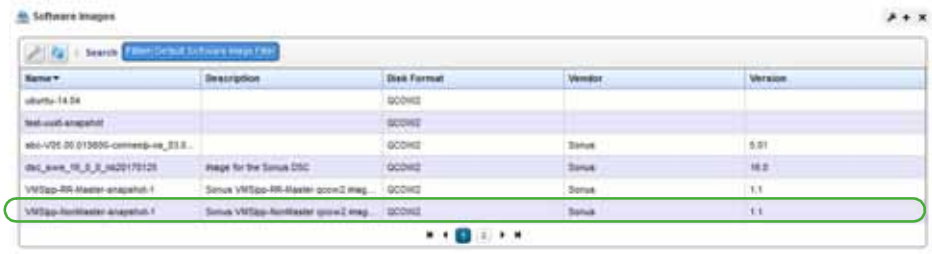
   The Creating new Software Image window is displayed.

2. Enter the required information and any other optional information.



3. Click Save.

   The Audit Trail Viewer shows that an inventory item was created for the image and the Software Images portlet displays the new image.



Before the image is available for use, you need to deploy it to one or more VIMs.

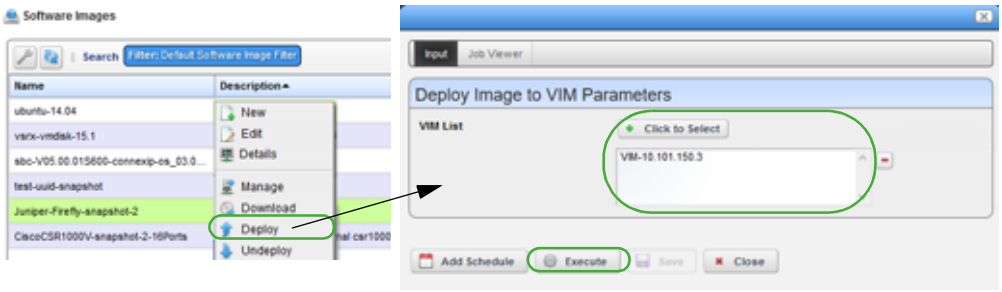
Deploying a Software Image

Successfully deploying a software image makes the image available from the selected virtualized infrastructure managers (VIMs), which allows you to activate and provision specific virtualization deployment unit (VDU) within a virtualized network function (VNF). Deployed images are added to the VIM Images list.

Deploy a software image from the Software Images portlet as follows.

1. Select an image.
2. Right-click > Deploy.

   The Deploy Image to VIM Parameters are displayed.
3. Select the VIMs to which you want to deploy the image.

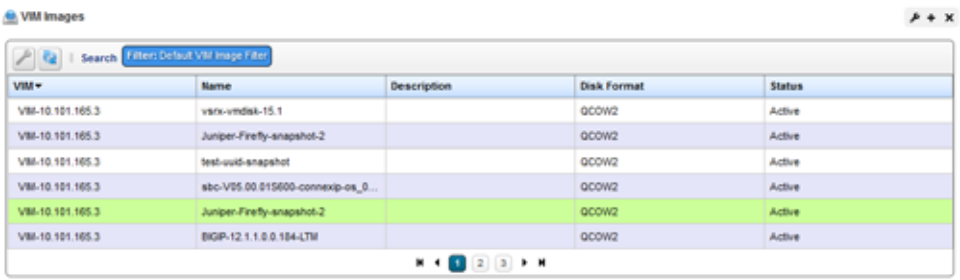


4. Click Execute.

   The Job Viewer displays the processing progress.
5. Wait until the deploy process successfully completed.



6. Verify that the image was added to the VIM Images list.



Maintaining Resource Monitors

The options available and the steps you take to create a resource monitor varies depending on the type of monitor you choose to create. The example steps provided here are for creating, modifying, and deleting a key metrics monitor.

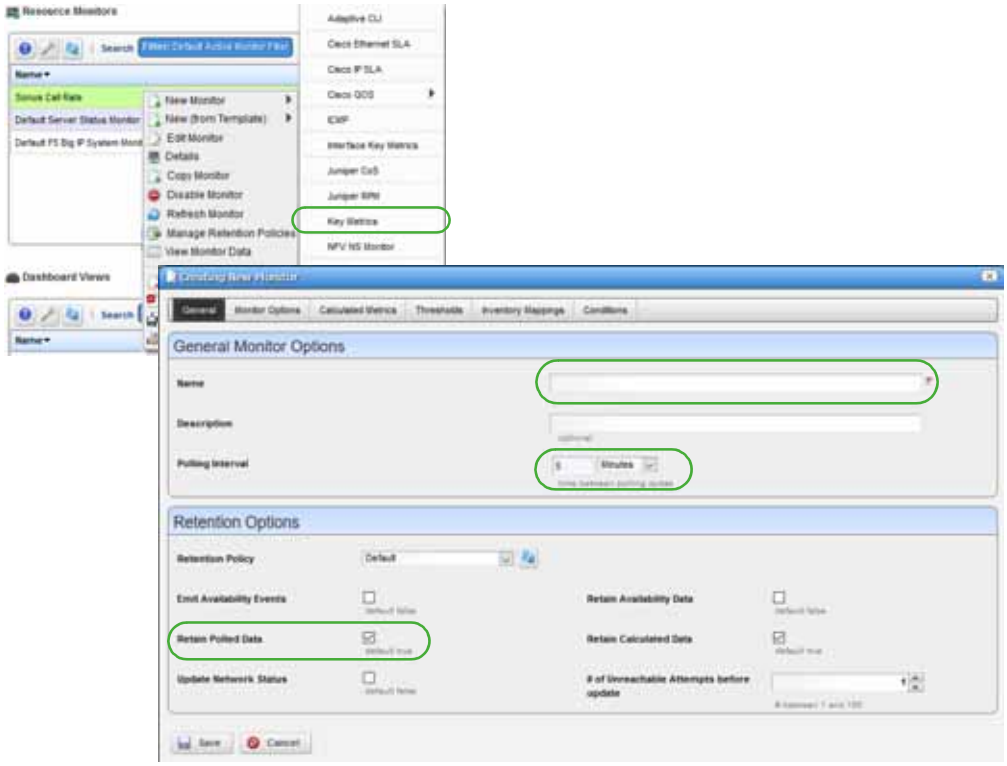
In addition to these basic steps, there are many other settings to set up for monitoring, such as calculated metrics, thresholds, inventory mappings, and conditions. Refer to the *Redcell* User Guide for a detailed description of the Resource Monitors portlet, feature, and options.

Creating a Monitor

Create a Key Metrics Monitor from the Resource Monitors portlet as follows.

1. Right-click > New Monitor > Key Metrics.

   The Creating New Monitor window displays the General parameters.



2. Enter a name.

   For example, enter Test Key Metrics Monitor.

3. Select a polling interval.

   The default is 5 minutes.

4. Make sure that Retain Polled Data is selected.

5. Accept all other default retention options.

6. Set monitor options.

   a. Select Monitor Options.

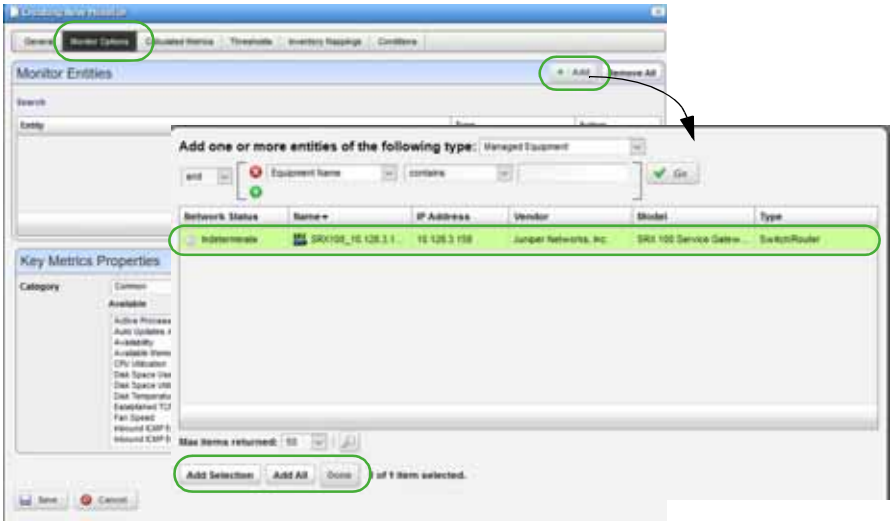
   b. Click Add for Monitor Entities.

      An entities list is displayed.

c. Select devices on which you want to apply key metrics.

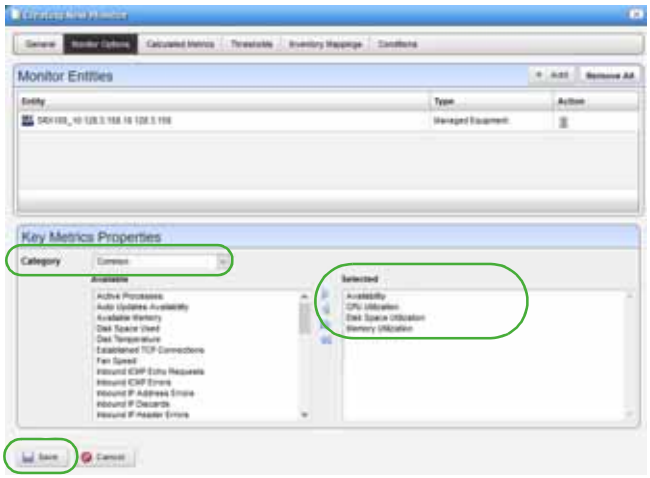
d. Click Add Selection.

e. Click Done.



f. Select key metrics Category.

g. Move the appropriate available metrics to the Selected list.

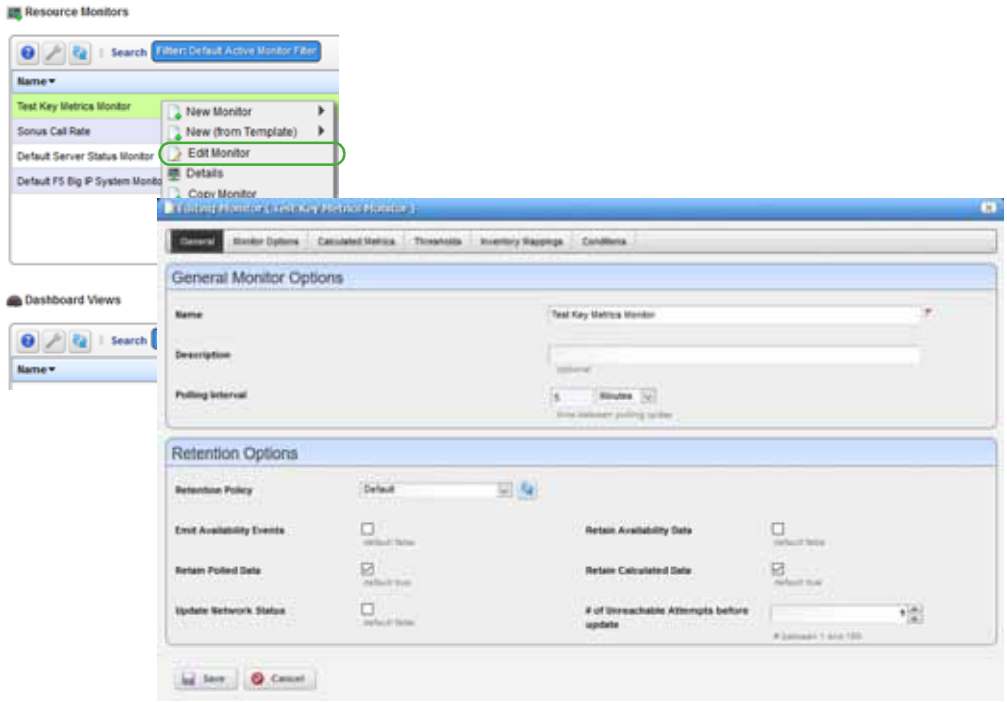


7. Save your new monitor.
8. Verify that the Resource Monitors portlet lists your new monitor.



Modifying a Monitor

1. Select the resource monitor you want to modify.
   For example, the Test Key Metrics Monitor created earlier.
2. Right-click > Edit Monitor.
   The Editor Monitor window displays the General parameters.

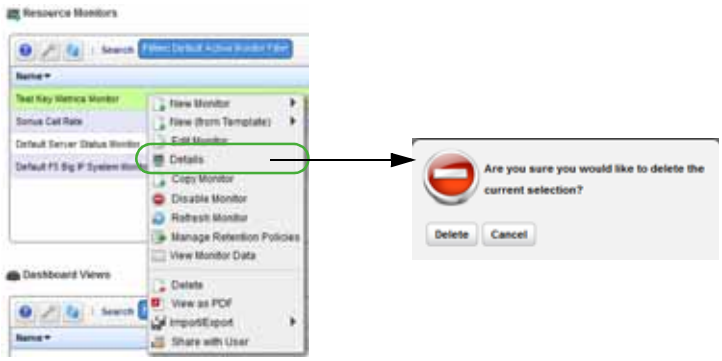


3. Make any needed changes to:
   - Polling Interval or Retention Options
   - Monitor Options
   - Calculated Metrics
   - Thresholds
   - Inventory Mapping
   - Conditions
4. Save your changes.

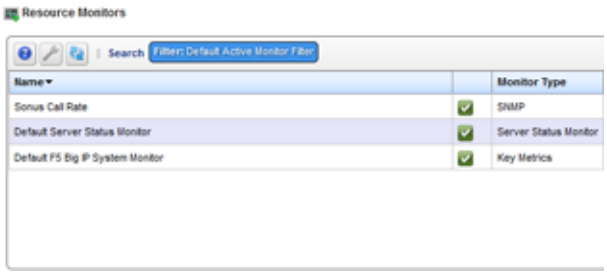
Deleting a Monitor

Delete a resource monitor from the Resource Monitors portlet as follows.

1. Select the resource monitor you want to delete.
   For example, the Test Key Metrics Monitor created earlier.
2. Right-click > Delete.
   A confirmation message is displayed.
3. Click Delete.



4. Verify that the Resource Monitors portlet no longer lists the deleted monitor.
   Notice that the Test Key Metrics Monitor created earlier no longer exists.



8

> Managing Descriptors

Covers these topics:

Maintaining Network Service Descriptors – 134
Maintaining VNF Descriptors – 146
Maintaining PNF Descriptors – 156

Network function virtualization (NFV) descriptor management is done by users with administrative permissions, such as administrators, network designers, or engineers. This section covers the basic create, import, modify, and delete descriptor tasks. For a description of all the available options to monitor and maintain descriptors, see NFV User Interface on page 165.

Maintaining Network Service Descriptors

This section covers the following basic network service descriptor maintenance tasks:

- Creating a Network Service Descriptor
- Importing a Network Service Descriptor
- Modifying a Network Service Descriptor
- Deleting a Network Service Descriptor

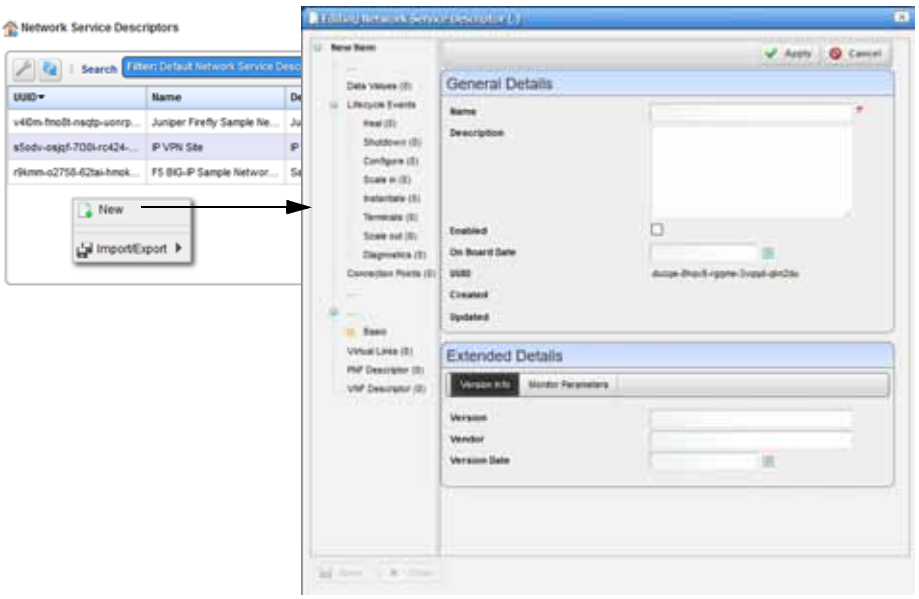
For a description of all the available options to monitor and maintain descriptors, see Network Service Portlets on page 182.

Creating a Network Service Descriptor

Create a network service (NS) descriptor from the Network Service Descriptors portlet as follows.

1. Right-click > New.

   The Editing Network Service Descriptor window is displayed.



2. Enter a name and optional description.

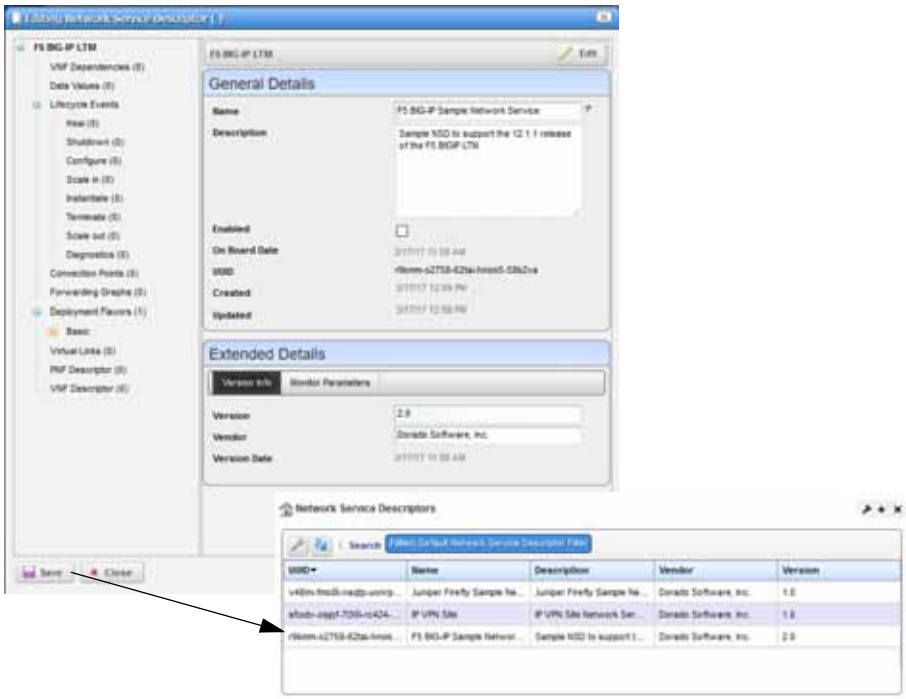
   For example, information for an F5 BIG-IP network service.

3. Enter an on-board date and the version information.
4. Click Apply.

   The Editing Network Service Descriptor window is updated based on the information provided so far.

5. Save the record.
6. Verify that the NS descriptors list displays the new descriptor.

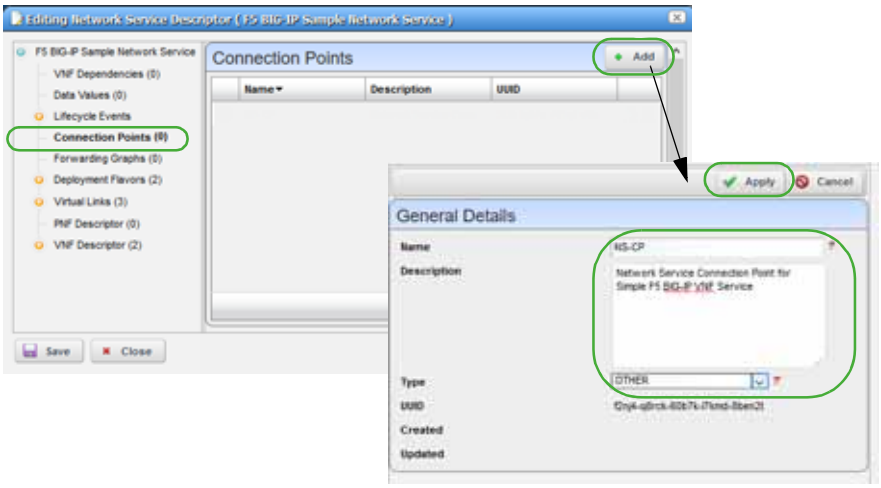
   Depending on the descriptor, you may need to define dependencies, data values, lifecycle events connection points, and so on. The remaining steps are only for connection points, deployment flavors, virtual links, and VNF descriptors.



7. Define connection points, such as a NS connection point for an F5 BIG-IP VNF service.
   a. Right-click *descriptor* > Edit.
   b. Click Connection Points.

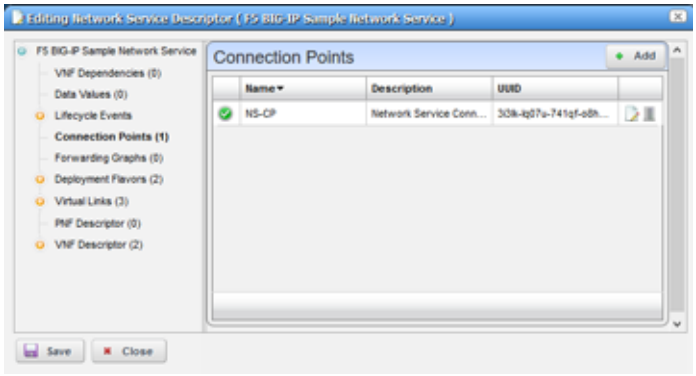
      Notice that there are no connection points listed.
   c. Click Add.

      The general parameters are displayed.

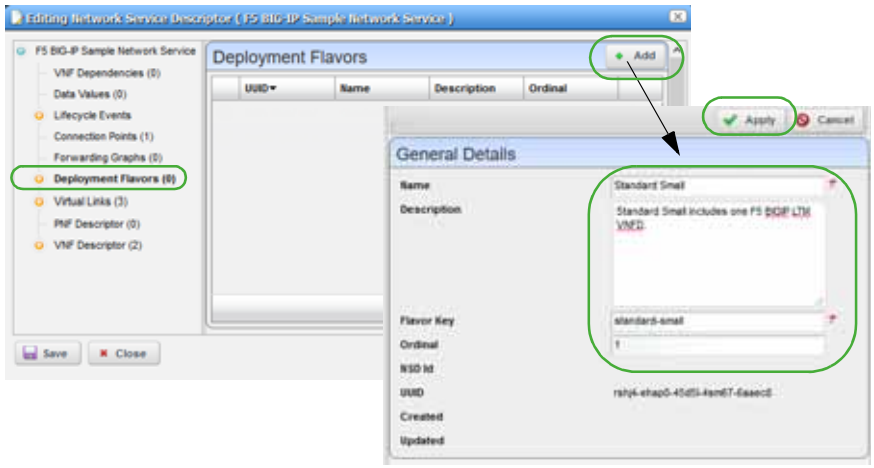


   d. Enter the required information.
   e. Click Apply.

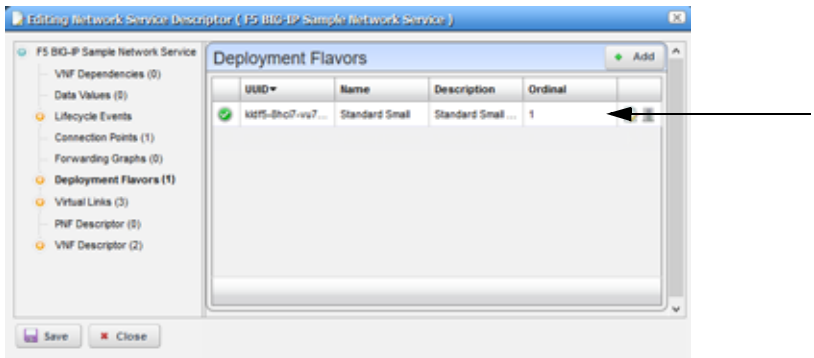
      The new connection point definition is listed.



8. Define NS deployment flavors, such as standard-small and standard-medium.
   a. Click Deployment Flavors.
      Notice that there are no deployment flavors listed.
   b. Click Add.
   c. Enter information for a small flavor.



   d. Click Apply.
      The flavor definition is added to the list.

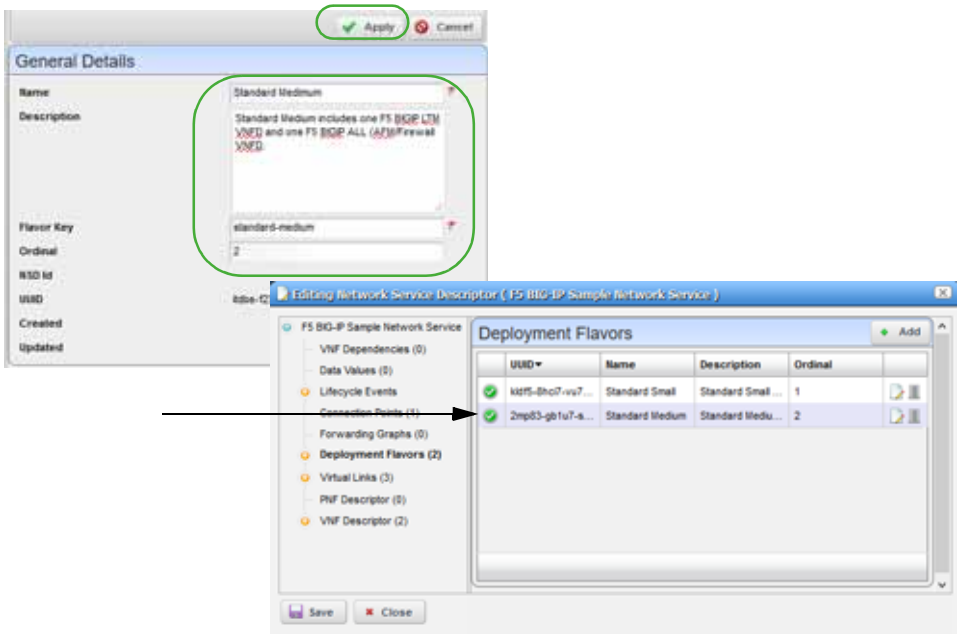


e. Click Add.

f. Enter information for a medium flavor.

g. Click Apply.

The flavor definition is added to the list.



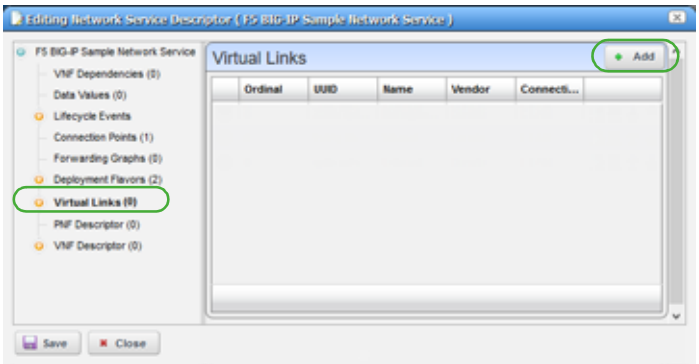
9. Define NS virtual links, such as a management, internal, and external link.

a. Click Virtual Links.

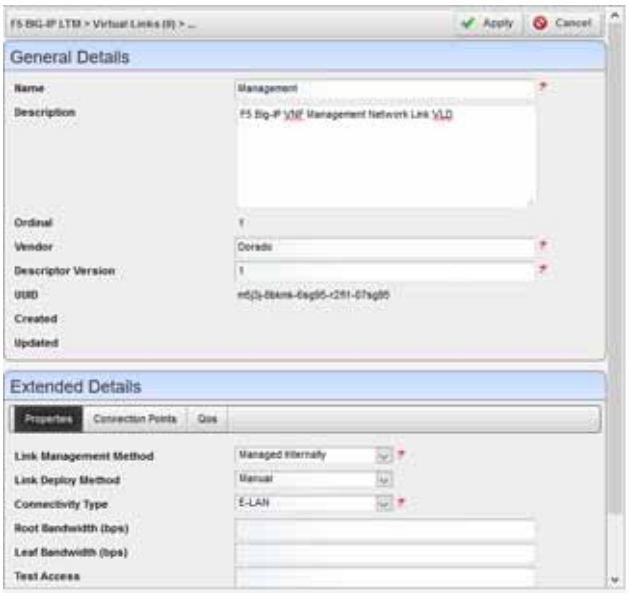
Notice that there are no virtual links listed.

b. Click Add.

The general and extended parameters are displayed.

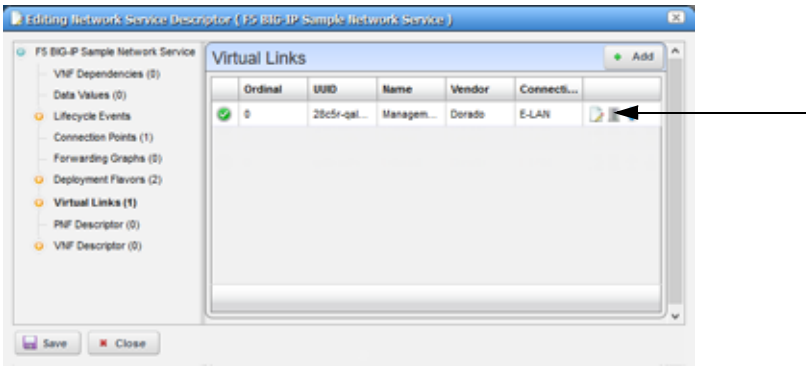


c. Enter the required information, such as name, vendor information, link management method, and connectivity type for a manager link.



d. Click Apply.

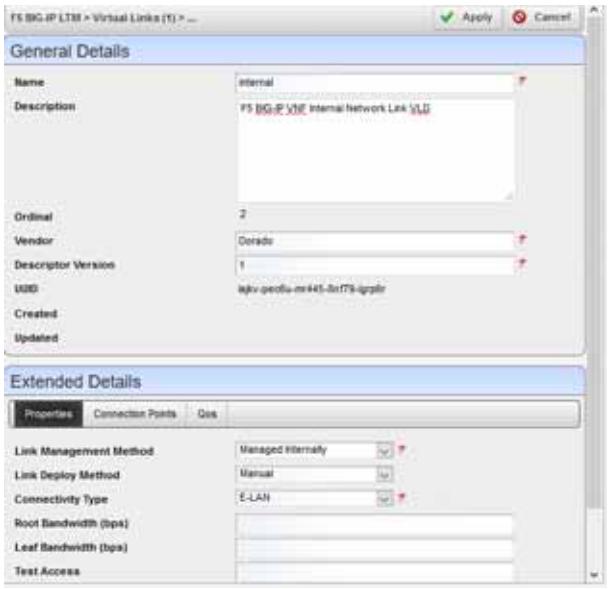
The new link is listed.



e. Click Add.

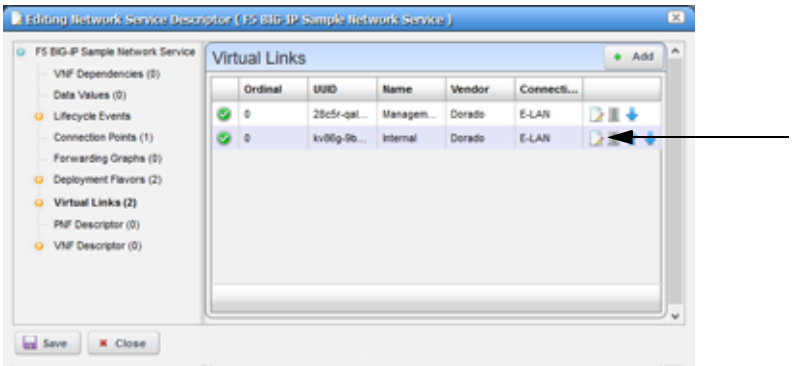
The general and extended parameters are displayed.

f. Enter the required information, such as name, vendor information, link management method, and connectivity type for an internal link.



g. Click Apply.

The new link is listed.



h. Click Add.

The general and extended parameters are displayed.

i. Enter the required information, such as name, vendor information, link management method, and connectivity type for an external link.



j. Click Apply.

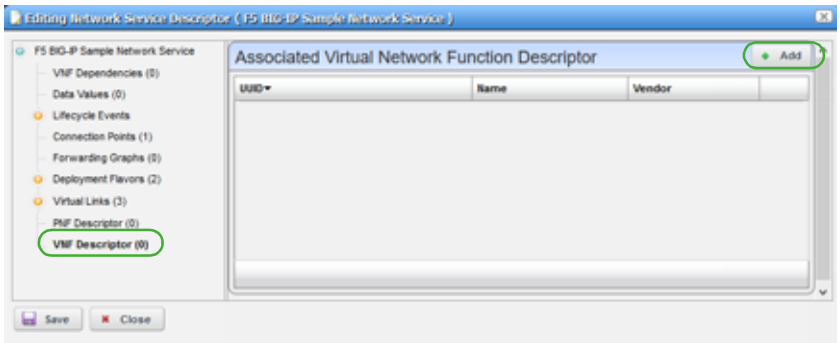
The new link is listed.



10. Define VNF descriptors, such as F5 BIG-IP LTM and F5 BIG-IP ALL AFM virtual appliances.

a. Click VNF Descriptor.

Notice that there are no VNF descriptors listed.



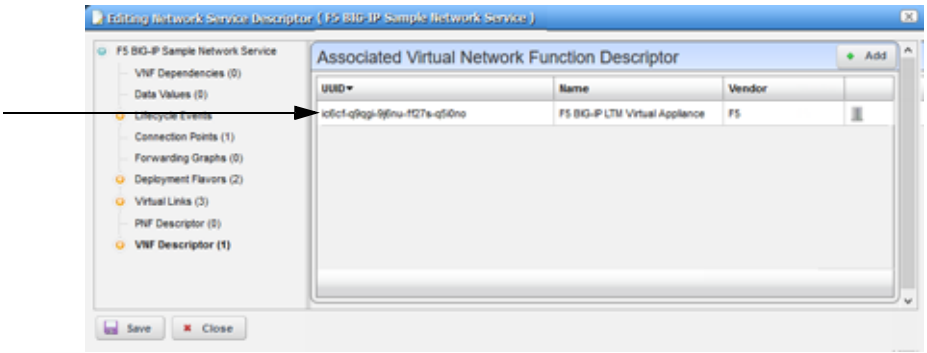
b. Click Add.

A list of descriptor entities are displayed.

c. Select a descriptor from which to create a VNF.
For example, F5 BIG-IP LTM Virtual Appliance.



d. Click Select.
The selected descriptor is added to the associated VNF descriptor list.

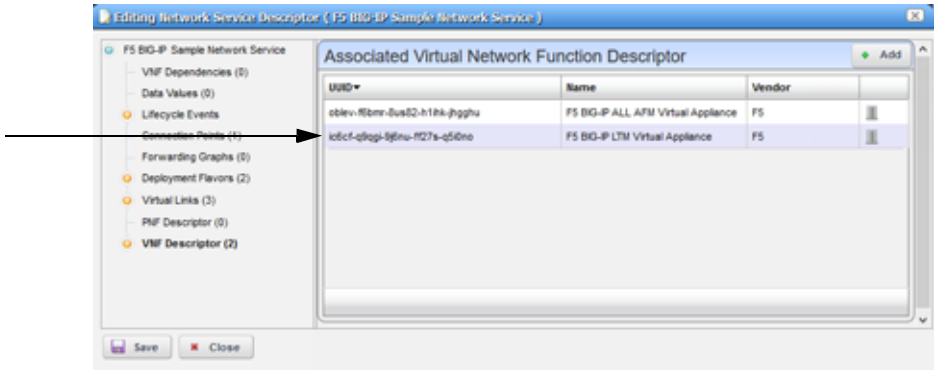


e. Click Add.
A list of descriptor entities are displayed.

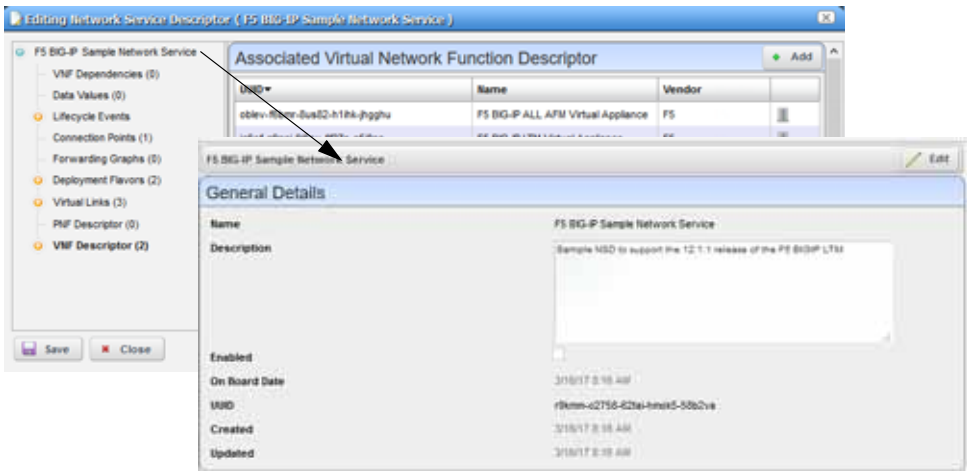


f. Select a descriptor from which to create a VNF.
For example, F5 BIG-IP All AFM Virtual Appliance.

g. Click Select.
The selected descriptor is added to the associated VNF descriptor list.



11. Make this descriptor available.
    a. Click the descriptor name, such as F5 BIG-IP Sample Network Service. The general details are displayed.



    b. Click Edit.
    c. Select Enable.



12. Save the NS descriptor.

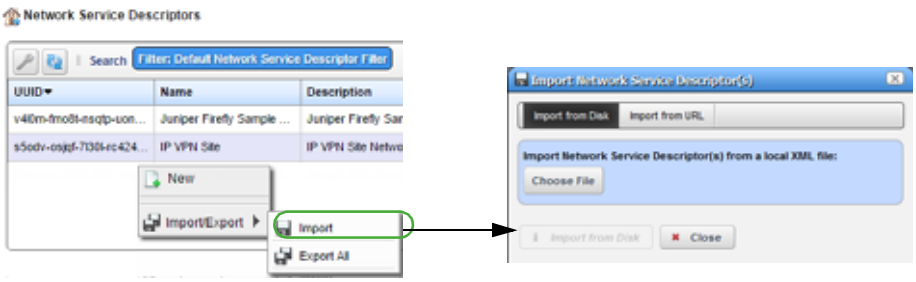
Importing a Network Service Descriptor

You can import a network service (NS) descriptor from another system or from a backup that was exported to a XML file or you can import a descriptor from a URL. The example provided here imports a descriptor from an XML file.

Import an NS descriptor from the Network Service Descriptors portlet as follows.

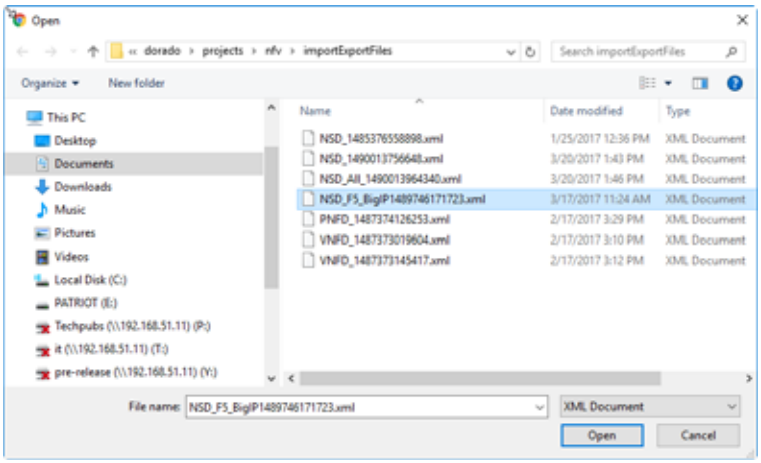
1. Right-click > Import/Export. > Import.

   The Import Network Services Descriptor(s) window is displayed.



2. Click Choose File.

   The navigation window is displayed.

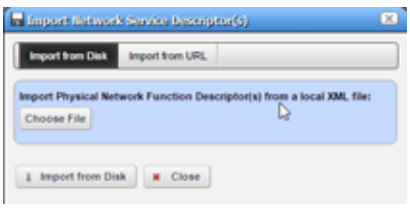


3. Navigate to the XML file.
4. Select the file to import.

   For example: `NSD_F5_BigIP1485376558898.xml`

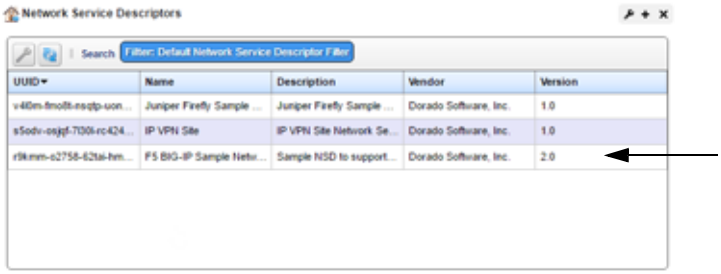
5. Click Open.

   The Import Network Service Descriptor(s) Import from Disk button is activated.



6. Click Import from Disk.

   The selected descriptor is added to the PNF list.

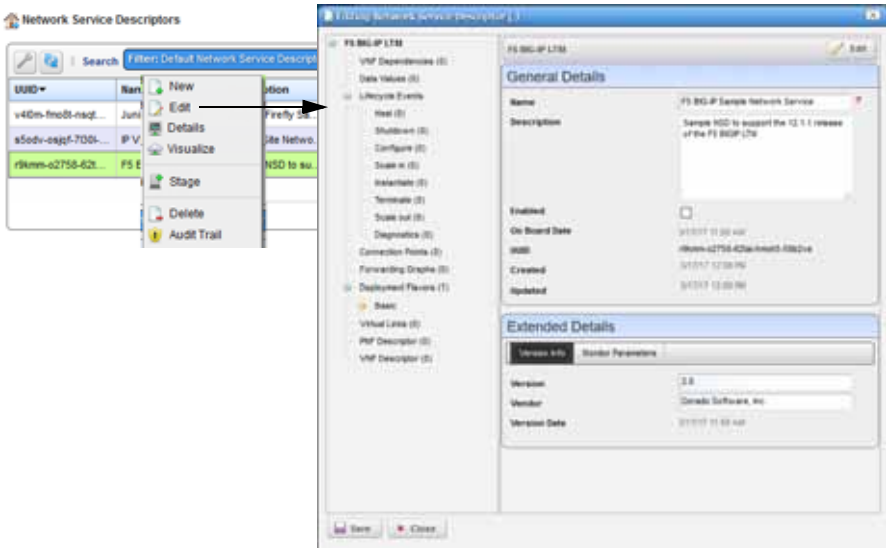


Modifying a Network Service Descriptor

Modify a network service (NS) descriptor from the Network Service Descriptors portlet as follows.

1. Right-click > Edit.

   The Editing Network Service Descriptor window is displayed.



2. Click Edit to modify the general or extended details.
3. Modify any of the following needing changes:
   - VNF Dependencies
   - Data Values
   - Lifecycle Events
   - Connection Points
   - Forwarding Graphic
   - Deployment Flavors
   - Virtual Links
   - PNF Descriptor
   - VNF Descriptor
4. Save your changes.

Deleting a Network Service Descriptor

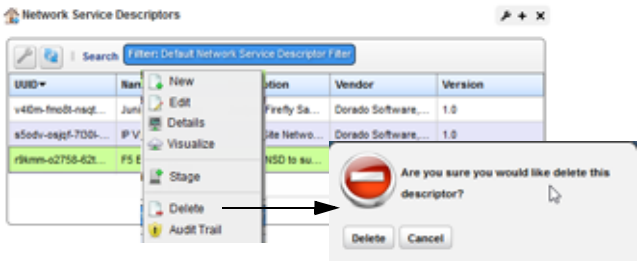
Delete a network service (NS) descriptor from the Network Service Descriptors portlet as follows.

1. Right-click > Delete.

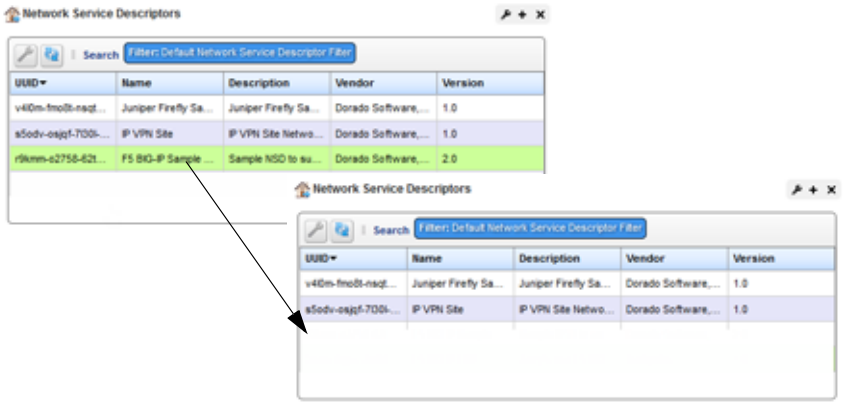
   A confirmation message is displayed.

2. Click Delete.

   The descriptor is removed.



3. Verify that the descriptor is no longer listed.



Maintaining VNF Descriptors

This section covers the following basic virtualized network function (VNF) descriptor maintenance tasks:

- Creating a VNF Descriptor
- Importing a VNF Descriptor
- Modifying a VNF Descriptor
- Deleting a VNF Descriptor

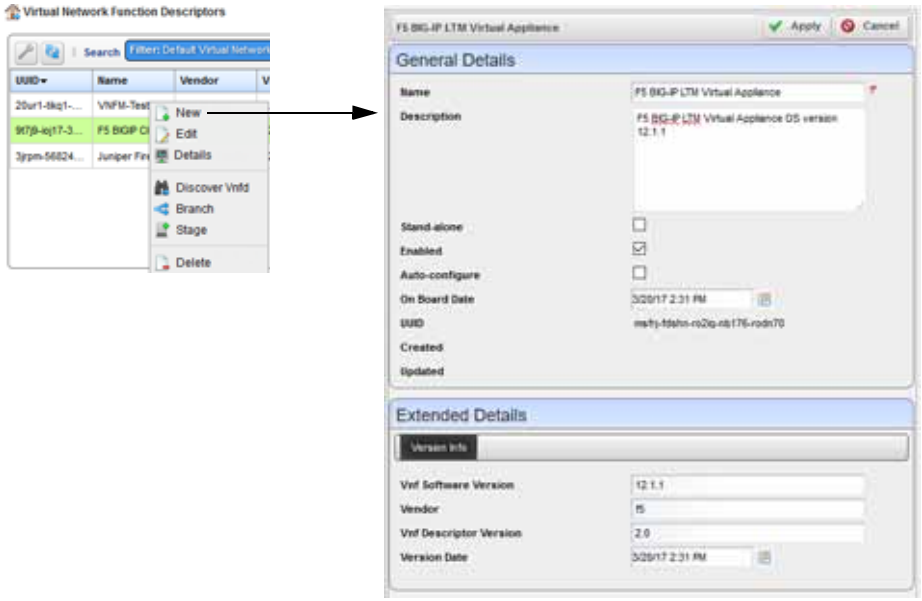
For a description of all the available options to monitor and maintain descriptors, see Network Service Descriptors Portlet on page 182.

Creating a VNF Descriptor

Create a virtualized network function (VNF) from the Virtual Network Function portlet as follows.

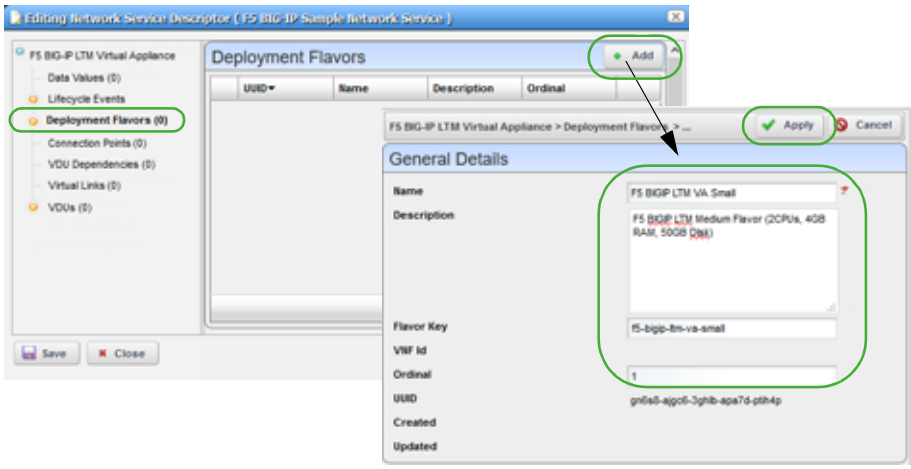
1. Right-click > New.

   The general and extended details are displayed.



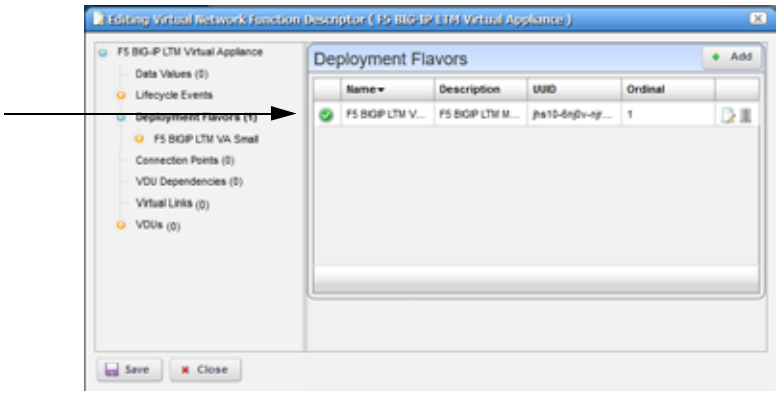
2. Enter the general and extended details, such as information for an F5 BIG-IP LTM Virtual Appliance VNF descriptor.
3. Click Apply.

   The entered information is applied to the descriptor.
4. Define VNF deployment flavors, such as F5 BIGIP LTM VA Small.
   a. Click Deployment Flavors.
   b. Click Add.
   c. Enter information for a small flavor.



d. Click Apply.

The flavor definition is added to the list.

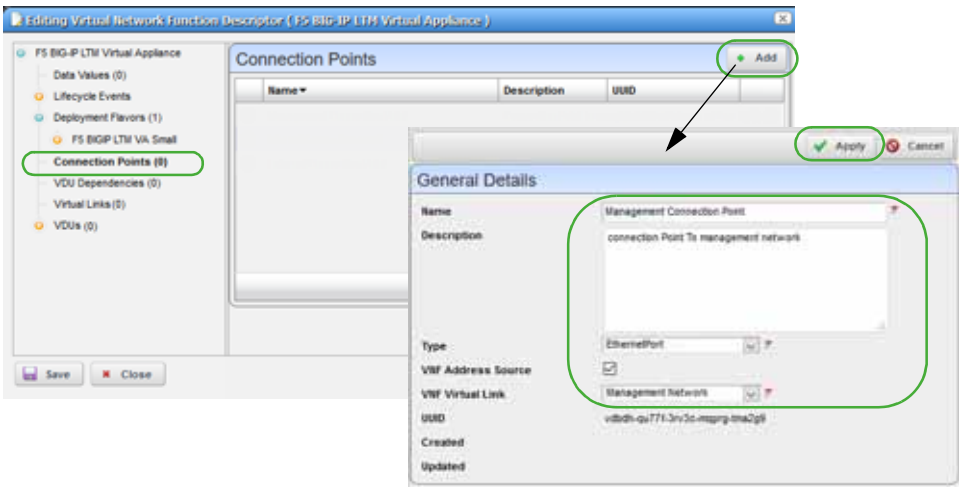


5. Define connection points, such as management, internal, and external.
   a. Click Connection Points.

      The Connection Points list is displayed.

   b. Click Add.

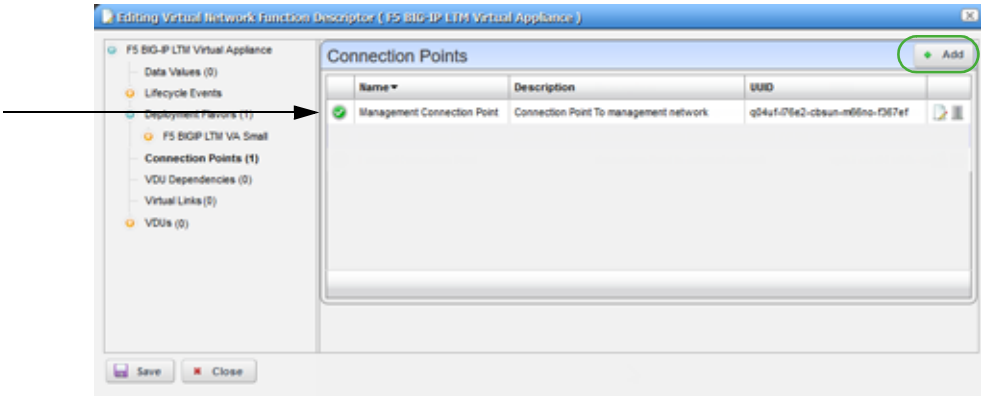
      The general details are displayed.



c. Enter the required information, such as information for a management connection point.

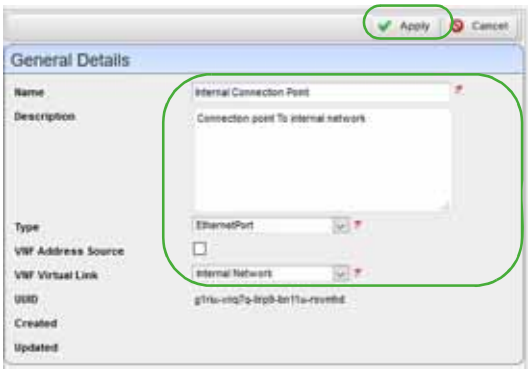
d. Click Apply.

The new connection definition is listed.



e. Click Add.

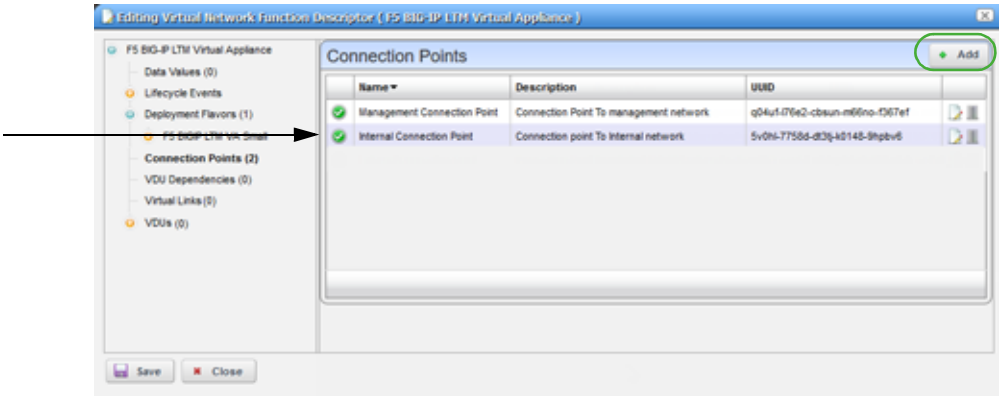
The general details are displayed.



f. Enter the required information, such as information for an internal connection point.

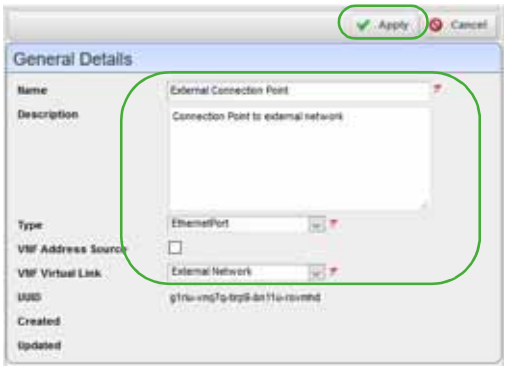
g. Click Apply.

The new connection definition is listed.



h. Click Add.

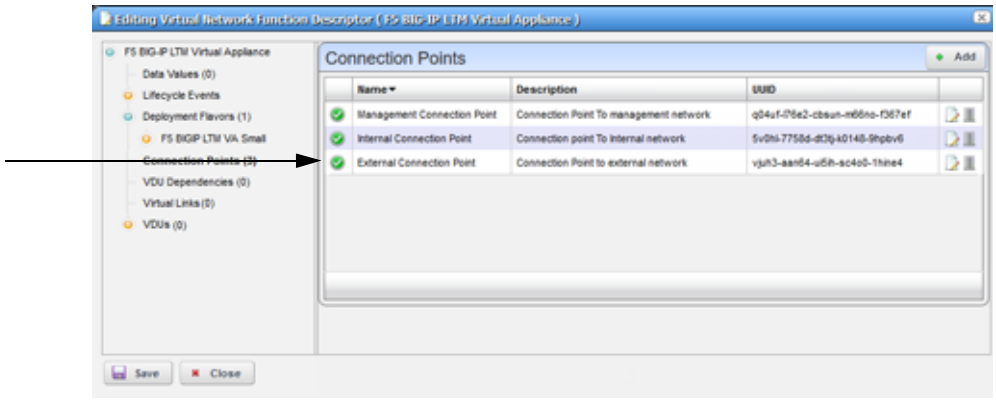
The general details are displayed.



i. Enter the required information, such as information for an external connection point.

j. Click Apply.

The new connection definition is listed.



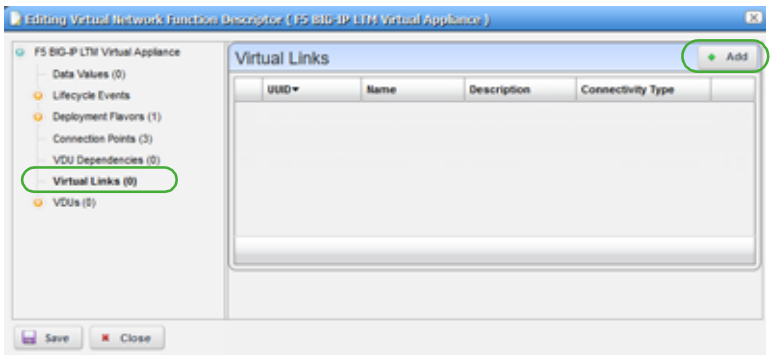
6. Define virtual links, such as management, internal, and external.

a. Click Virtual Links.

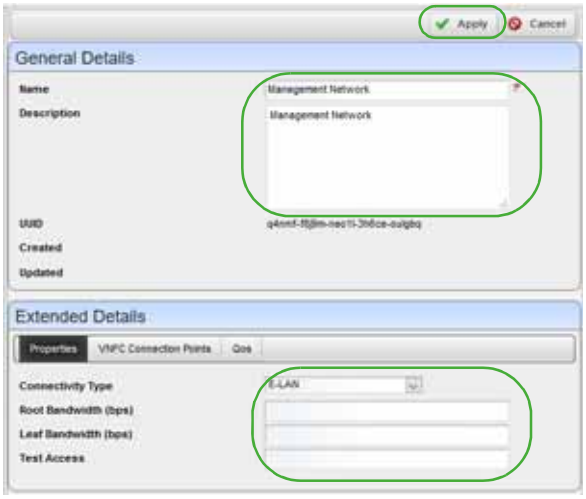
Notice no links are listed.

b. Click Add.

The general and extended parameters are displayed.

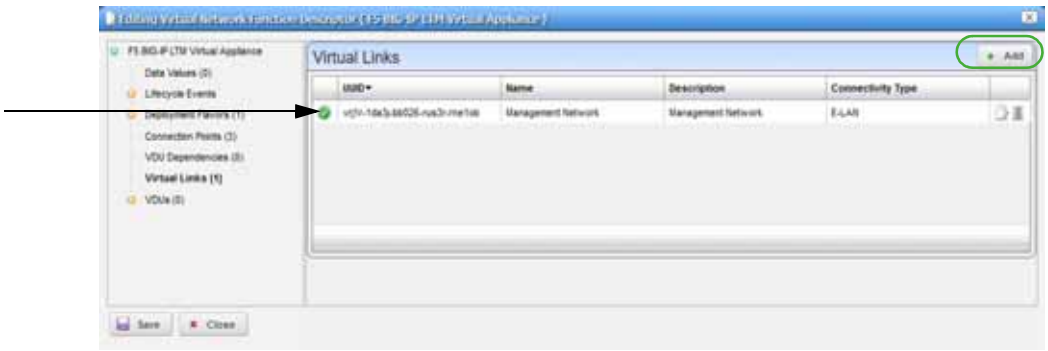


c. Enter the required information, such as name, vendor information, link management method, and connectivity type for a manager link.



d. Click Apply.

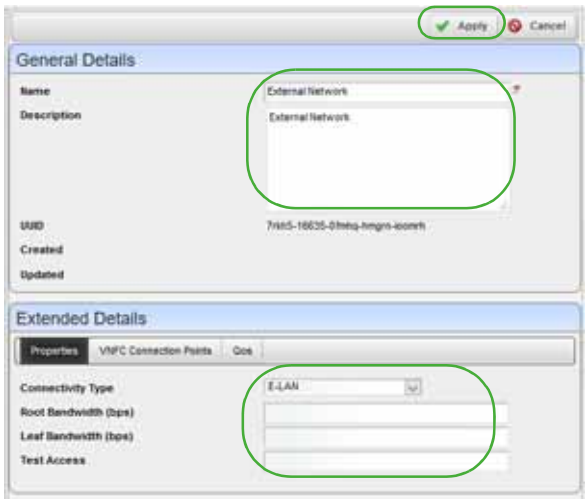
The new link is listed.



e. Click Add.

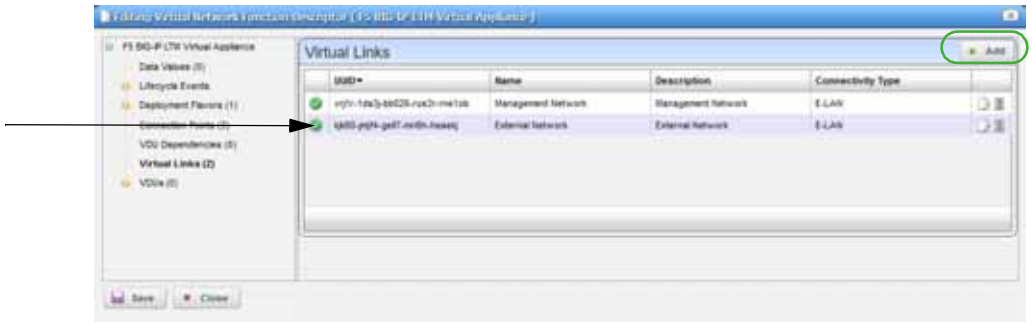
The general and extended parameters are displayed.

f. Enter the required information, such as name, vendor information, link management method, and connectivity type for an external link.



g. Click Apply.

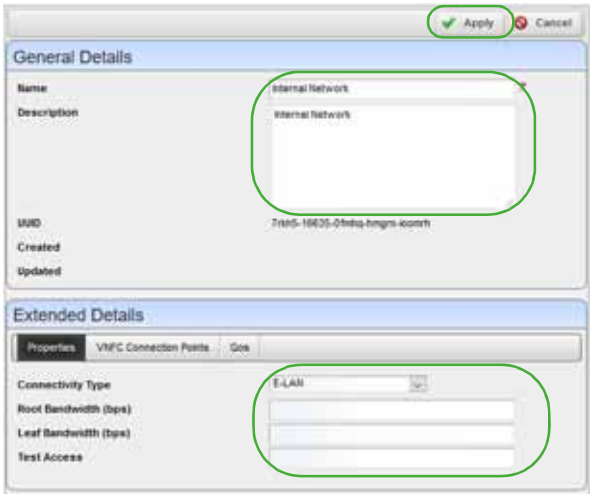
The new link is listed.



h. Click Add.

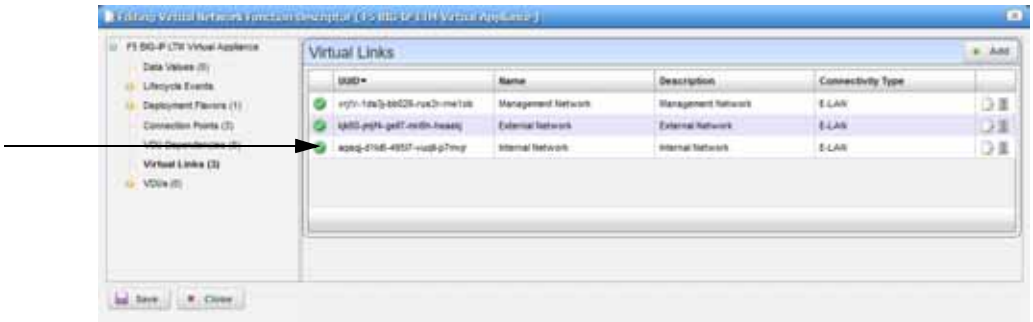
The general and extended parameters are displayed.

i. Enter the required information, such as name, vendor information, link management method, and connectivity type for an internal link.

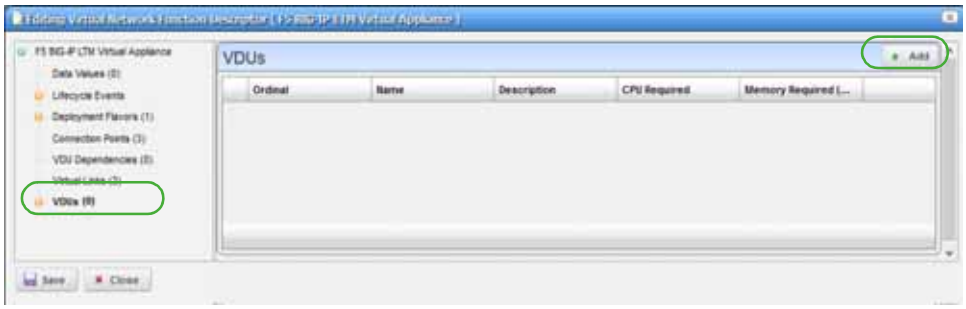


j. Click Apply.

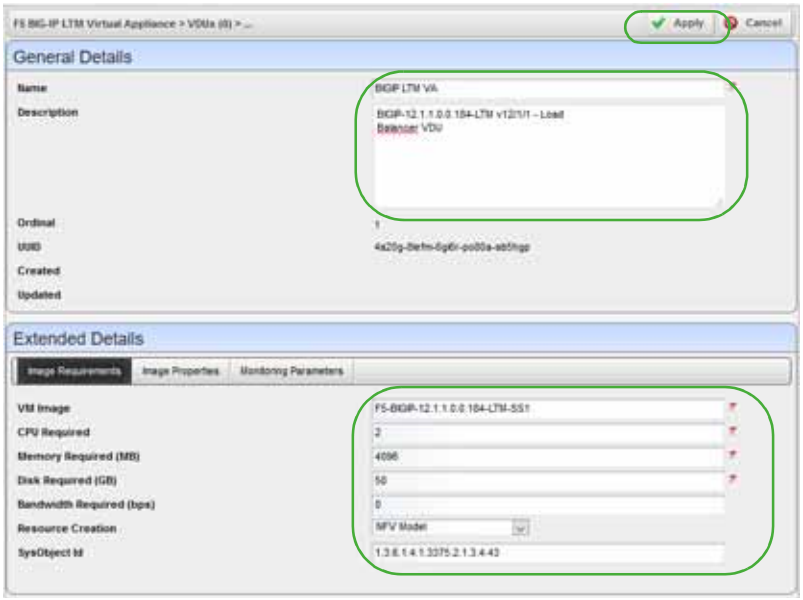
The new link is listed.



7. Specify VDUs, such as BIGIP LTM VA.
   a. Click VDUs.
      Notice that no VDUs are listed.



   b. Click Add.
      The general and extended parameters are displayed.



   c. Enter the required information, such as name and image requirements for F5 BIG-IP LTM.
   d. Click Apply.
      The new VDU is listed.



8. Save your new VNF.

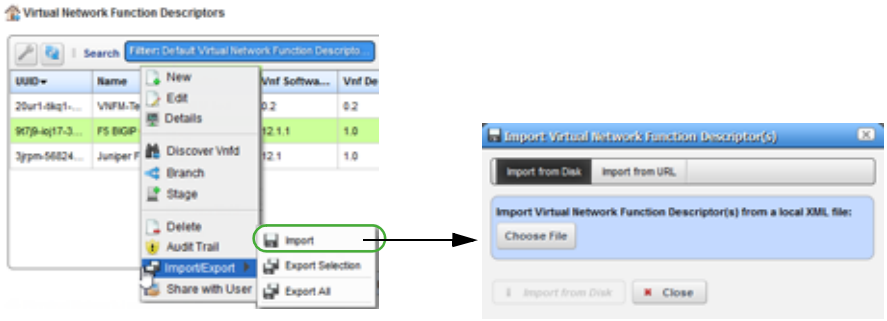
Importing a VNF Descriptor

You can import a virtualized network function (VNF) descriptor from another system or from a backup that was exported to a XML file or you can import a descriptor from a URL. The example provided here imports a descriptor from an XML file.

Import a virtualized network function from the Virtual Network Function portlet as follows.

1. Right-click > Import/Export. > Import.

   The Import Virtualized Network Function Descriptor(s) window is displayed.



2. Click Choose File.
3. Navigate to the XML file.
4. Select the file to import.

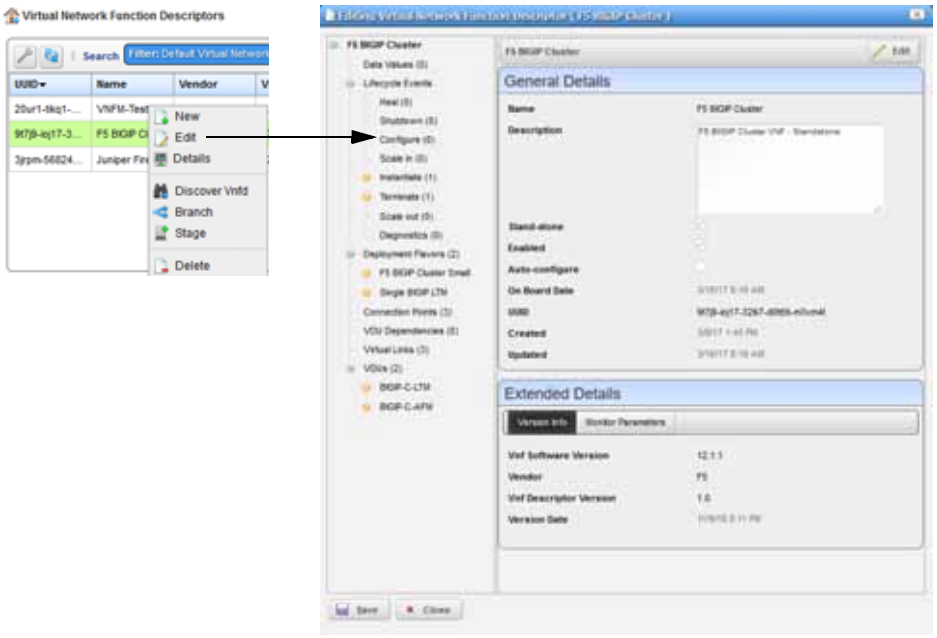
   For example: `VNFD_1487373019604.xml`
5. Verify that the descriptor was added to the VNF descriptors list.

Modifying a VNF Descriptor

Modify a virtualized network function (VNF) from the Virtual Network Function portlet as follows.

1. Right-click > Edit.

   The Editing Network Service Descriptor window is displayed.



2. Click Edit to modify the general or extended details.
3. Modify any of the following needing changes:
   - Data Values
   - Lifecycle Events
   - Deployment Flavors
   - Connection Points
   - VDU Dependencies
   - Virtual Links
   - VDUs
4. Save your changes.

Deleting a VNF Descriptor

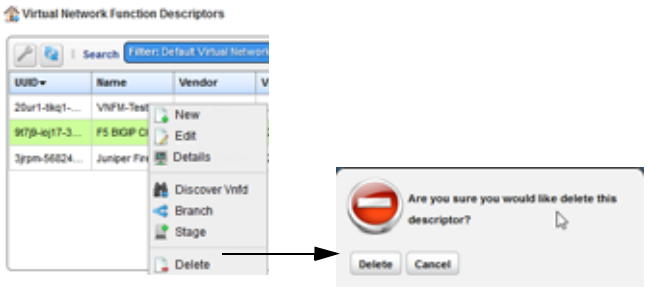
Delete a virtualized network function (VNF) from the Virtual Network Function portlet as follows.

1. Right-click > Delete.

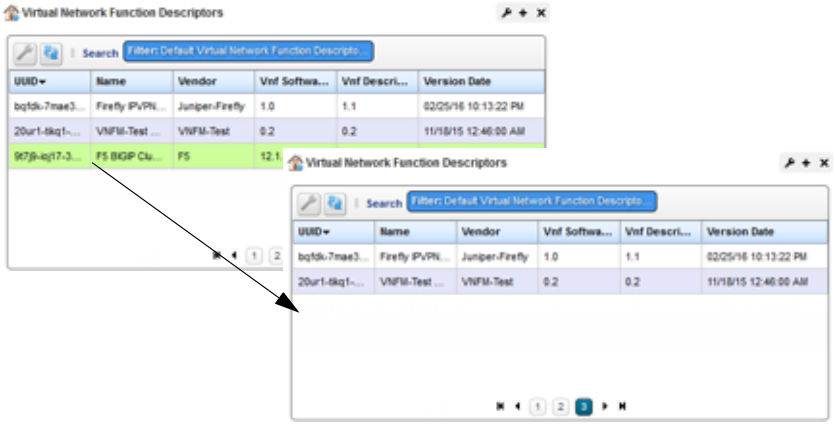
   A confirmation message is displayed.

2. Click Delete.

   The descriptor is removed.



3. Verify that the descriptor is no longer listed.



Maintaining PNF Descriptors

This section covers the following basic physical network function (PNF) descriptor maintenance tasks:

- Creating a PNF Descriptor
- Importing a PNF Descriptor
- Modifying a PNF Descriptor
- Deleting a PNF Descriptor

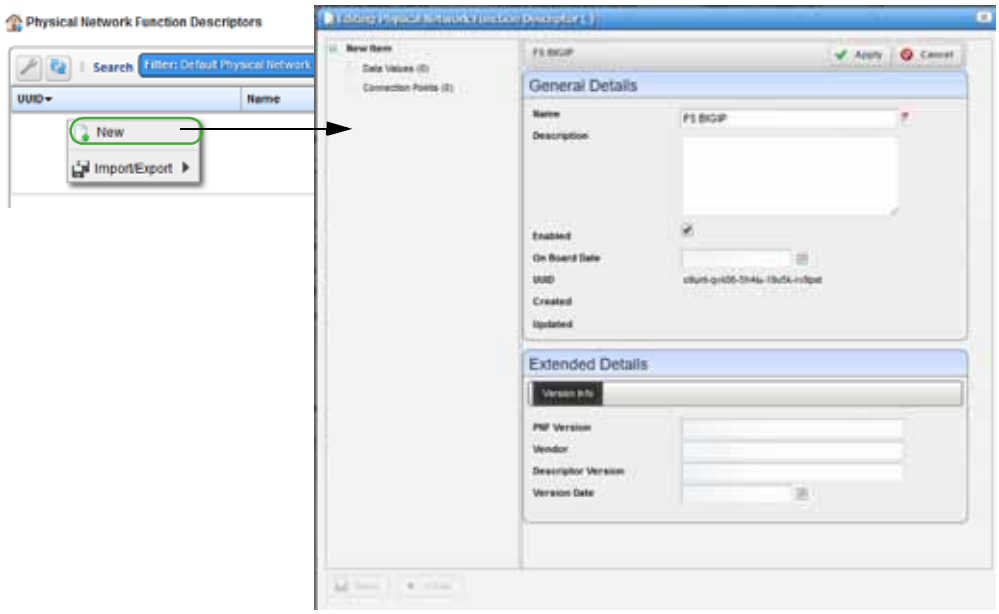
For a description of all the available options to monitor and maintain descriptors, see Physical Network Function Descriptors Portlet on page 197.

Creating a PNF Descriptor

Create a physical network function (PNF) from the Physical Network Function portlet as follows.

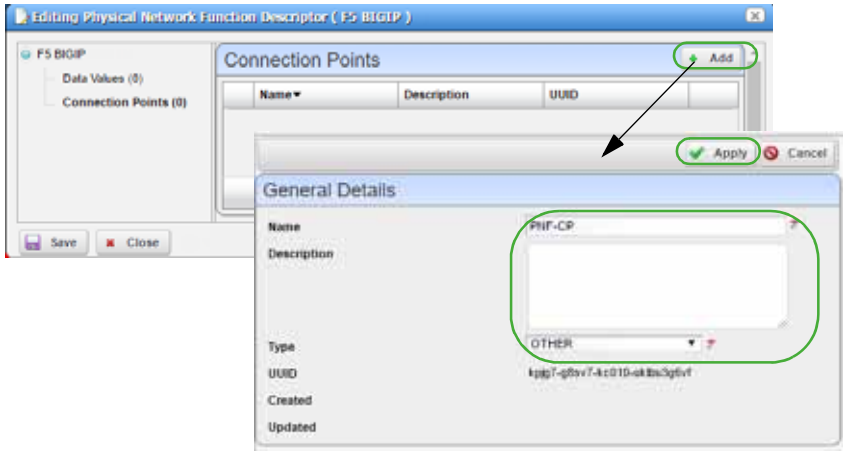
1. Right-click > New.

   The Editing Physical Network Function Descriptor window is displayed.
2. Enter a name.
3. Select Enabled.
4. Click Apply.



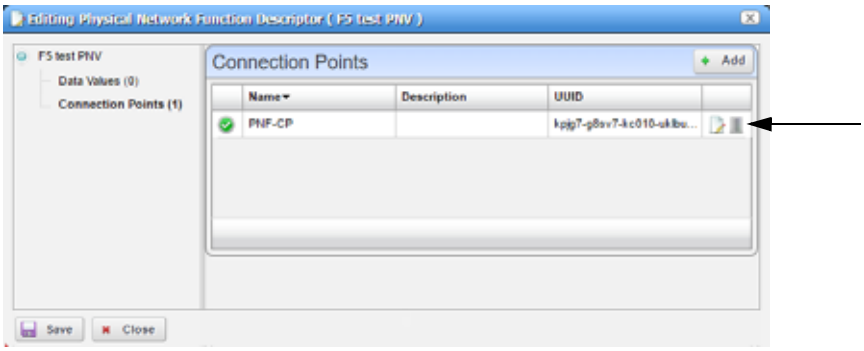
5. Click Connection Points.

   Notice that no items are listed.
6. Click Add.



7. Enter a name and a type.
8. Click Apply.

   The connection point is added to the list.



9. Save your new descriptor.

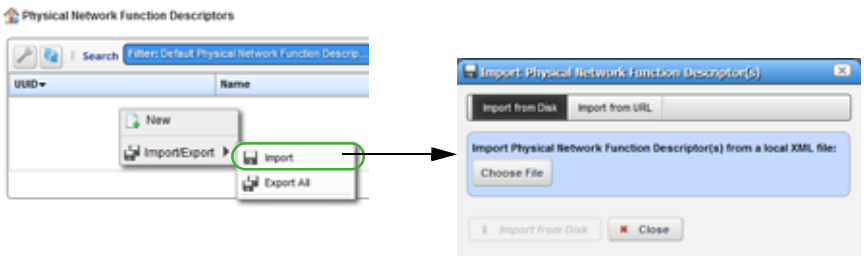
Importing a PNF Descriptor

You can import a physical network function (PNF) descriptor from another system or from a backup that was exported to a XML file or you can import a descriptor from a URL. The example provided here imports a descriptor from an XML file.

Import a physical network function (PNF) from the Physical Network Function portlet as follows.

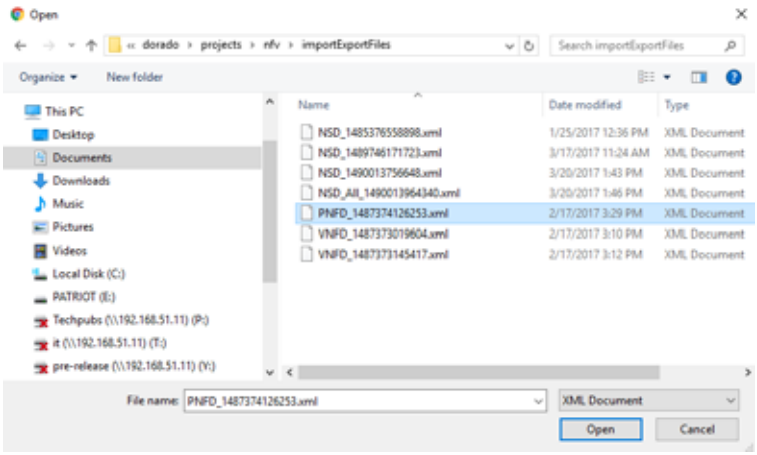
1. Right-click > Import/Export. > Import.

   The Import Physical Network Descriptor(s) window is displayed.



2. Click Choose File.

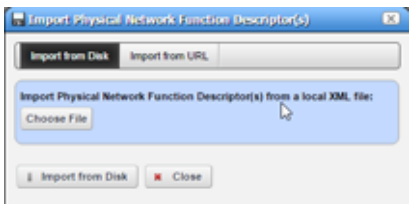
The navigation window is displayed.



3. Navigate to the XML file.
4. Select the file to import.

   For example: `PNFD_1487374126253.xml`
5. Click Open.

   The Import Physical Network Function Descriptor(s) Import from Disk button is activated.



6. Click Import from Disk.

   The selected descriptor is added to the PNF list.



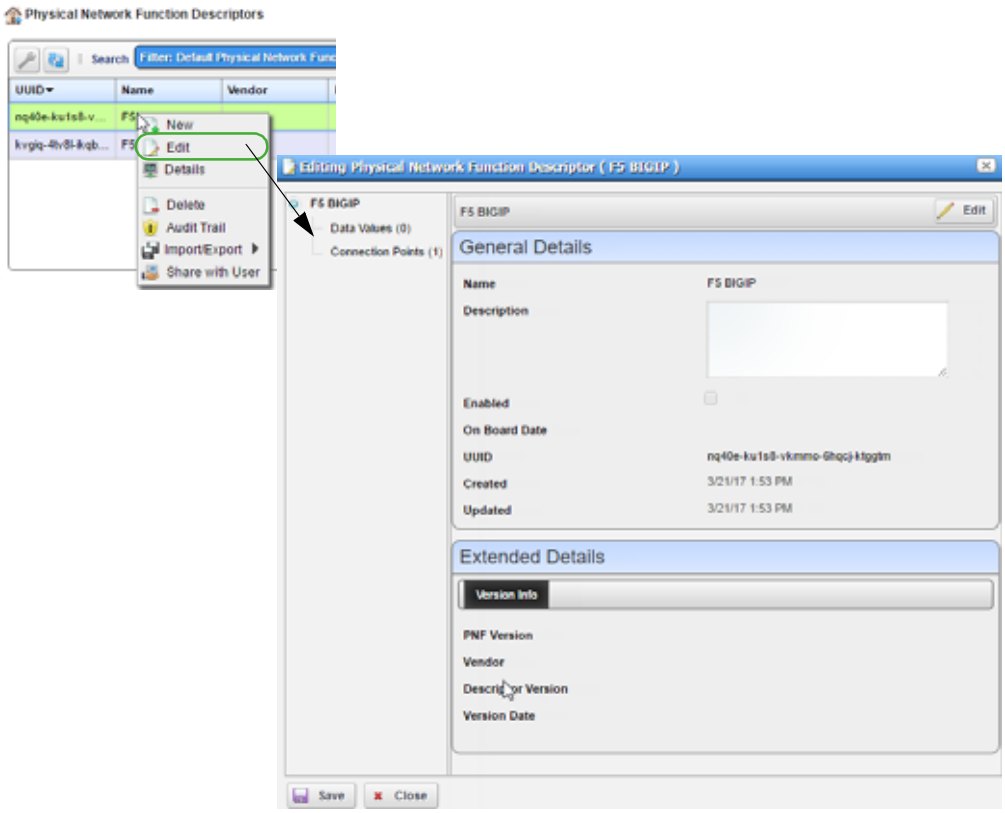
Modifying a PNF Descriptor

Modify a physical network function (PNF) from the Physical Network Function portlet as follows.

1. Right-click *descriptor* > Edit.

   The Editing Physical Network Descriptor window is displayed.

2. Click Edit.
3. Make any necessary changes.
4. Save your modifications.



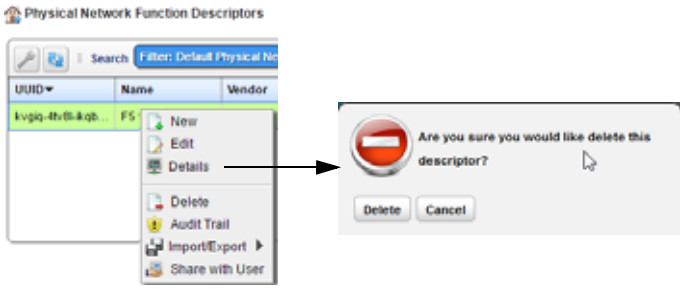
Deleting a PNF Descriptor

Delete a physical network function (PNF) from the Physical Network Function portlet as follows.

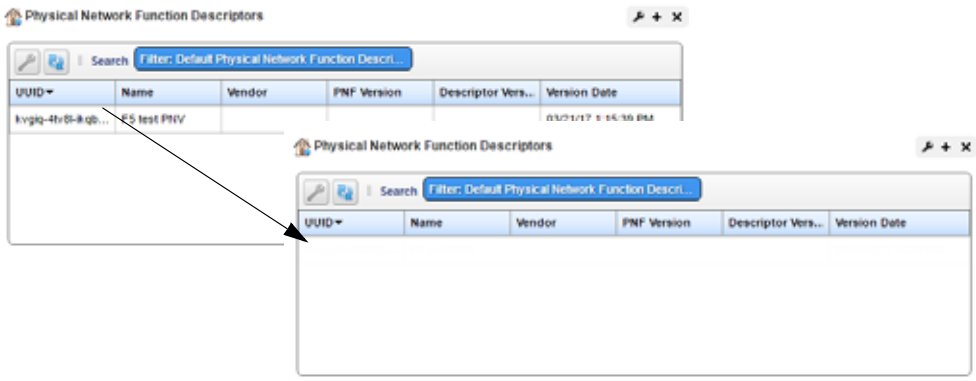
1. Right-click *descriptor* > Delete.

   A confirmation message is displayed.

2. Click Delete.



3. Verify that the descriptor is no longer listed.



9

> Automating SMB vCPE Deployment

Covers these topics:

Current State – 162
Order Management – 162
Service Orchestration – 162
Final State – 163
NFV Catalogs – 163

Full deployment automation of an SMB vCPE service including VPN and internet access. For this example, the provider's order management (OM) system manages the customer catalog service and coordinates with the Dorado Software Redcell Network Functions Virtualization Orchestration/Virtualized Network Function Manager (NFVO/VNFM) for full automated instantiation of the virtualized network functions.

Current State

The current Network Functions Virtualization Infrastructure (NFVI) Point of Presence (POP) is configured and has one multi-vendor Virtualized Network Function (VNF) deployed.

The system provides a wide array of ongoing management tools to access the health and configuration of the network function and environment, such as:

- Topology
- Resource Management
- Performance Monitoring
- Infrastructure Capacity

These portals indicate the current NFVI POP state where the virtual customer premise equipment (vCPE) is to be deployed.

Order Management

Your order management system and the Dorado Software Redcell Management and Orchestration (MANO) product use a REST interface to provide a seamless service deployment.

Catalogs defined in both systems provide the platform for top-to-bottom automated order management.

Key elements include:

- Product Catalogs
- Service Templates
- Network Service Descriptors
- Virtualized Network Function Descriptors
- Current Network Capability (VNFR)

Service Orchestration

Create and deploy a customer vCPE service. Track a service from initial order entry through final function configuration.

Key tasks include:

- Create a Customer Record
- Select a Service
- Complete Service Order
- Submit the Order
- Instantiate virtual components
- Configure customer attachment
- Configure virtual functions
- Monitor Progress

Final State

Upon completion of vCPE instantiation, the Redcell management tools reflect the deployed VNFs.

The topology reflects the positioning of the new vCPE and VNF instances.

Resource Management indicates the additional VNFs under management.

Infrastructure capacity reflects the resources utilized for the scaled capability.

NFV Catalogs

The NFV catalogs contain the building blocks (Figure 9-1) that the orchestrators use to manage services, functions, and infrastructure for virtual network ecosystems.

Managed elements include:

- VNF Descriptor
- NS Descriptor
- VNF Images
- VIM Images
- VIM Capacity
- NS Records

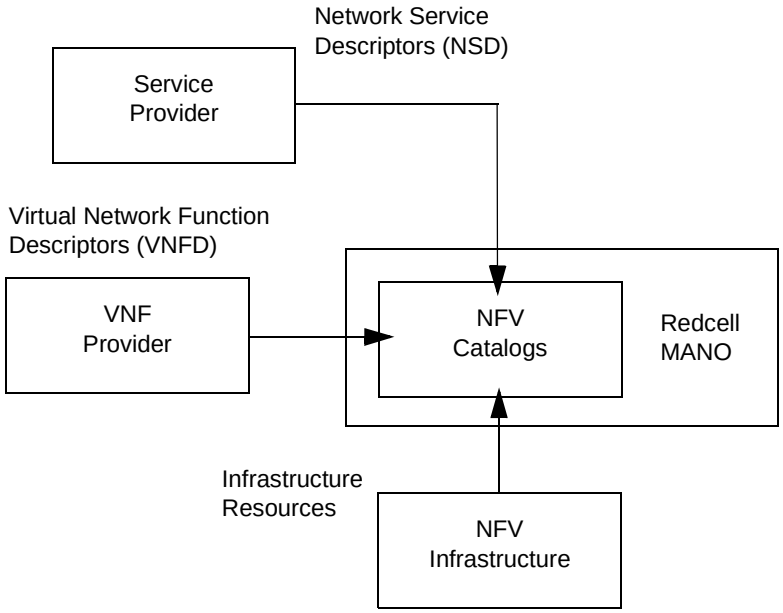


Figure 9-1 Orchestration Building Blocks

Managing Network Services (NS) and Virtualized Network Function (VNF) descriptors effectively as the Network Functions Virtualization (NFV) standards, functions, and processes mature is essential to allow both service and network function providers to recognize benefits.

F5 LTM Onboarding	Review the full process of instantiation of a VNF from onboarding through function turnup.
VIM Management	The Redcell application manages each VIM as a resource. This allows all the Redcell core management processes to be applied to the VIM resources. Additionally NFV functions are supported, such as reservation.
Image Management	The Redcell NFV functions provide image management capabilities to support both the demand of production and lab environments.
REST API	The Redcell application provides REST access to both its NFV capabilities and its entire suite of service management features.

A

> NFV User Interface

Covers these topics:

General Information – 166
Image Portlets – 171
Network Service Portlets – 182
Physical Network Function Portlets – 197
Virtualized Network Function Portlets – 206
Virtual Requirements Portlet – 224
Virtual Reservations Portlet – 226
Virtualized Infrastructure Managers Portlet – 228

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: • **Look and Feel**, where you configure the portlet text styles, background, border, margin and padding, advanced, and WAP styles. • **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. 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. **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.

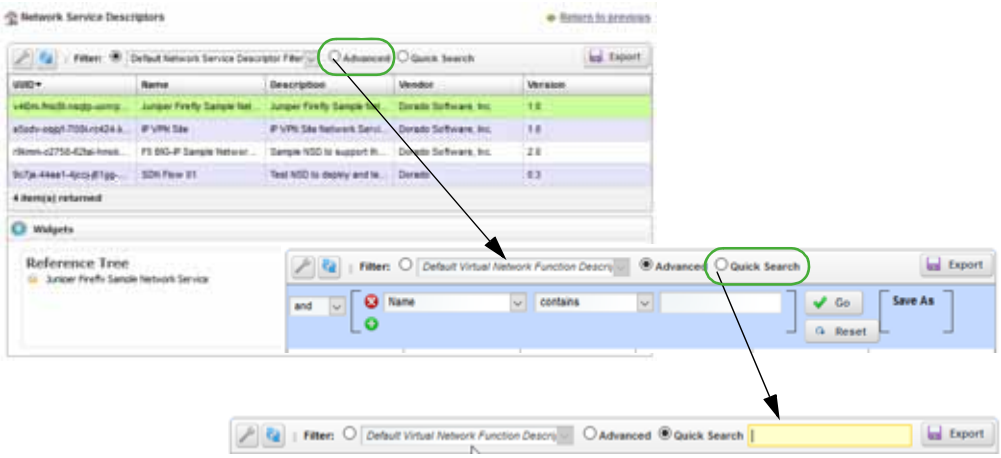


Figure A-1 Maximized Portlet (example)

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. **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.

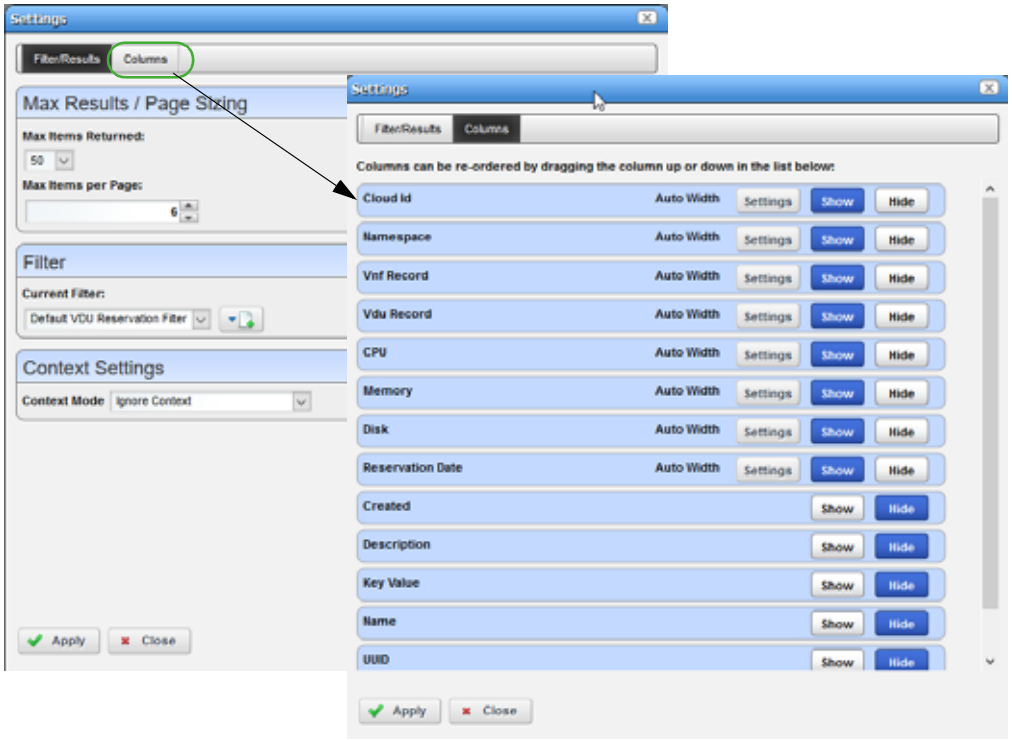


Figure A-2 Settings Window

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. 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: • Listen for Context • Ignore Context (default) • Broadcast Context • Broadcast and Listen for Context **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. 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. Click the Settings button to specify whether the width is automatically set or specify a specific pixel width. 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 167 for a description of its standard options provided.

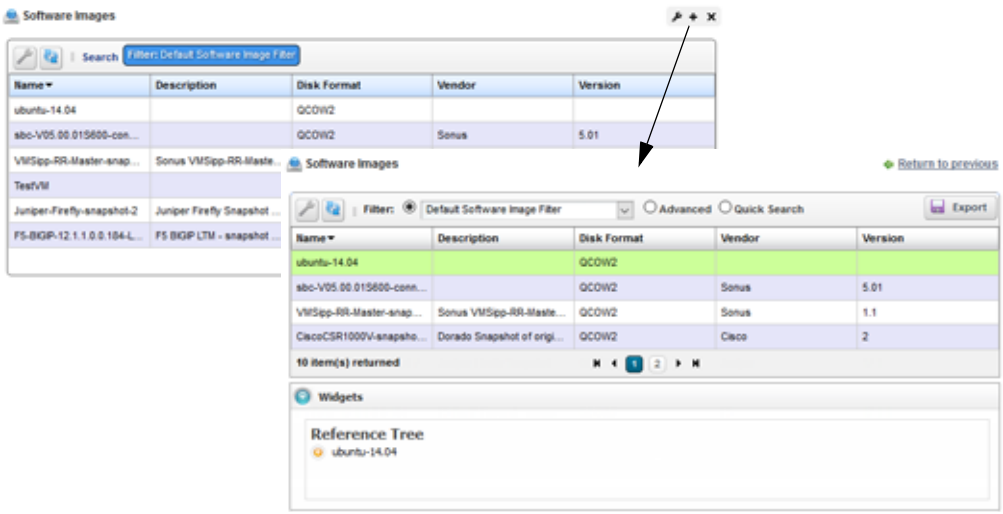


Figure A-3 Software Images Portlet

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. 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. **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. **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: • Import retrieves a file containing XML image descriptions. Some imports can come from a URL. • Export Selection exports the selected image description to an XML file. • Export All exports all image descriptions to an XML file. Click Download Export File to specify where to save the file. 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. **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. 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: `1.3.6.1.4.1.3375.2.1.3.4.43` 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: `ftp://caserverIP/vnf/images/juniper/firefly/Juniper-Firefly-shapshot-2.qcow2` 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.

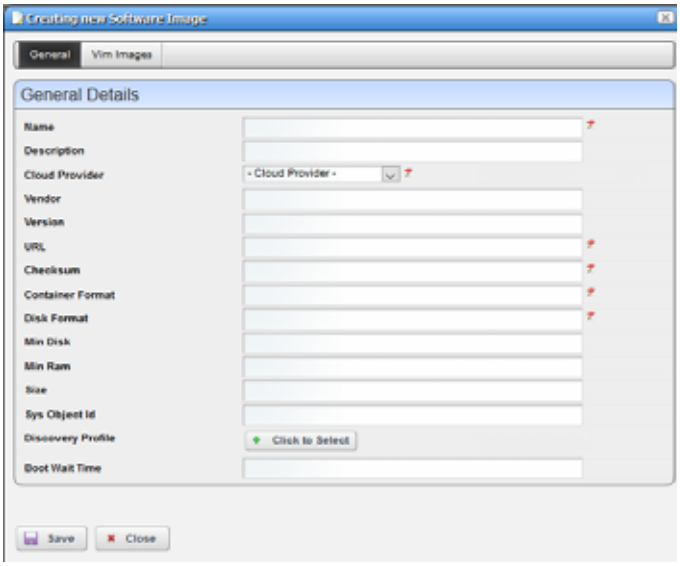


Figure A-4 Creating new Software Image Window

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. 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: `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: `9275adf3c578c60754b3d56dcbbed5c8` 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. 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. 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: `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.

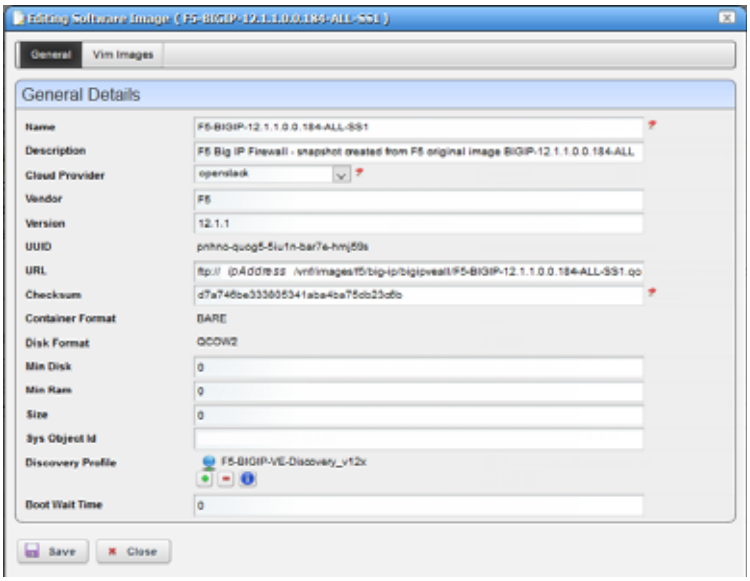


Figure A-5 Editing Software Image Window

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. 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: `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: `9275adf3c578c60754b3d56dcbbed5c8` 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. 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. 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: `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.

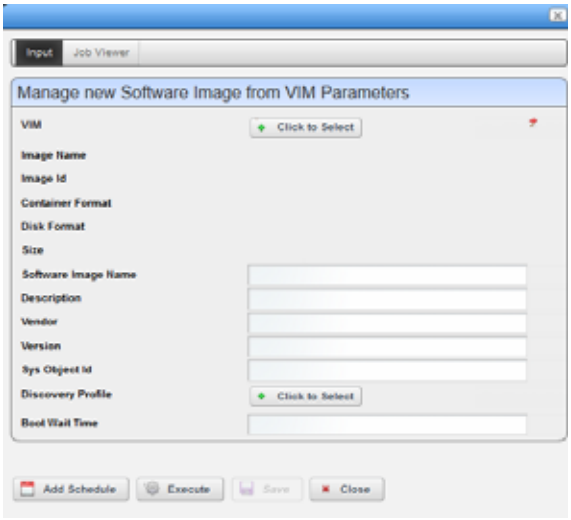


Figure A-6 Manage new Software Image VIM Parameters Window

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: • **Image Id** is the system-generated identifier. • **Container Format** is the target format specified during image creation. • **Disk Format** is the format in which the image was saved. • **Size** is a value in gigabytes. • **Software Image Name** is an editable field to specify a name identifier.
Description	Enter more details about the software image. 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: `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. • Starting On sets the date and time to execute the task. • 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. • 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.

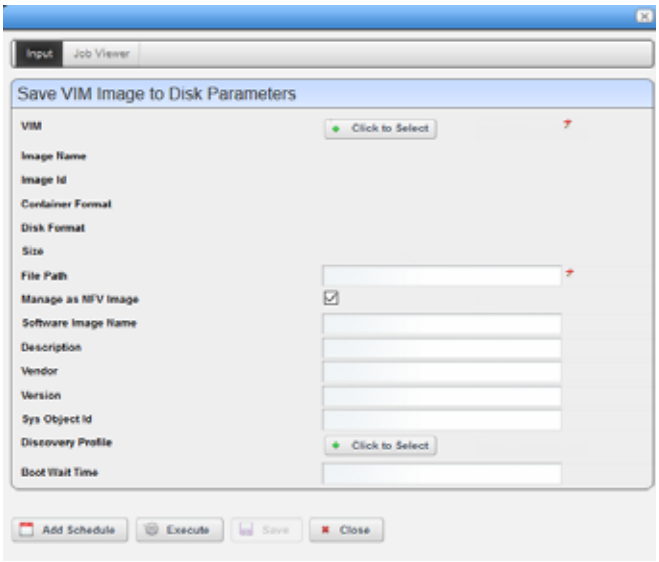


Figure A-7 Save VIM Image to Disk Parameters Window

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: • **Image Id** is a system-generated identifier. • **Container Format** is the target format specified during image creation. • **Disk Format** is the format in which the image was saved. • **Size** is a value in gigabytes. • **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. 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: `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. • Starting On sets the date and time to execute the task. • 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. • 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 167 for a description of its standard options provided.

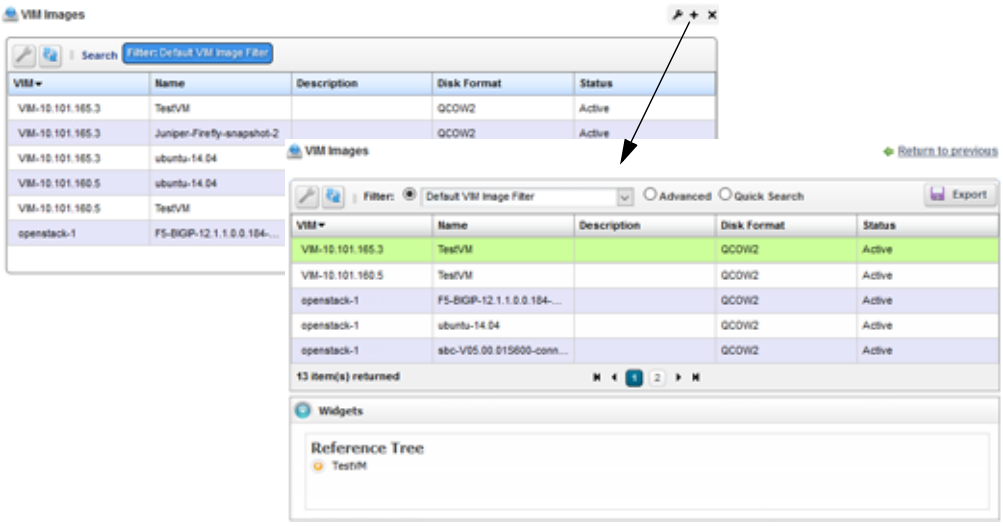


Figure A-8 VIM Images Portlet

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. **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. 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: `ftp://caserverIP/vnf/images/juniper/firefly/Juniper-Firefly-shapshot-2.qcow2` 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: `http://ipAddress:5000/v2.0` 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 167 for a description of its standard options provided.

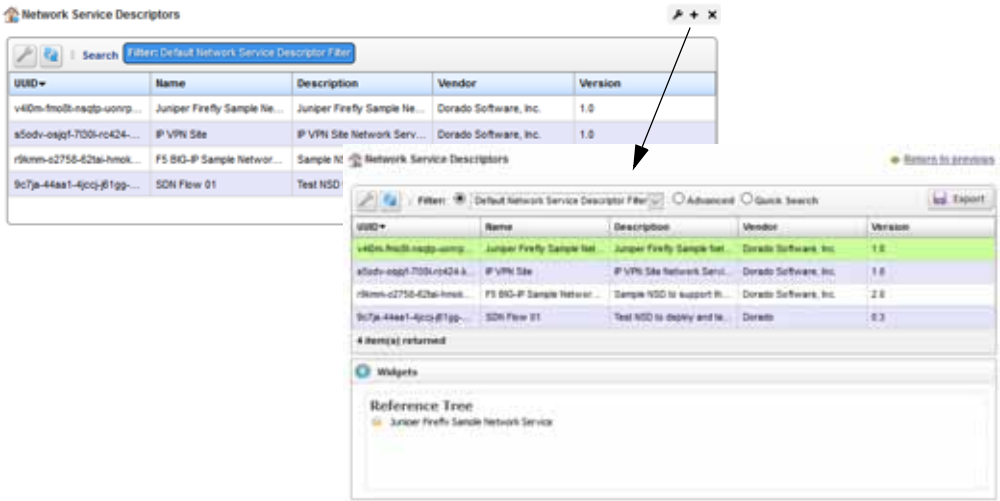


Figure A-9 Network Service Descriptors Portlets

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. 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: • Import retrieves a file containing XML network service descriptions. Some imports can come from a URL. • Export Selection exports the selected network service description to an XML file. • Export All exports all network service descriptions to an XML file. Click Download Export File to specify where to save the file. 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. **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.

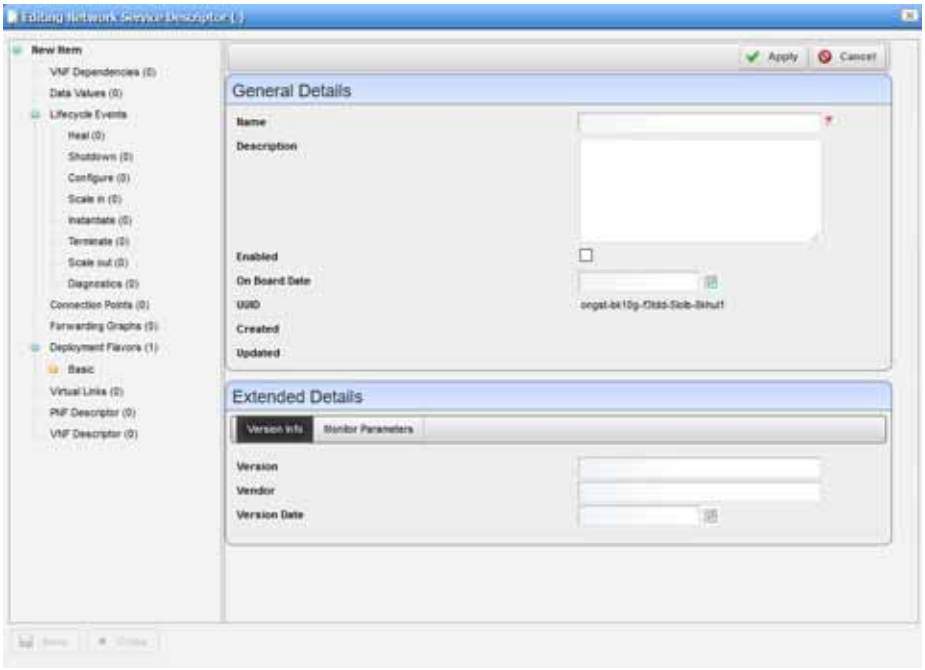


Figure A-10 Editing Network Service Descriptor Window

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.

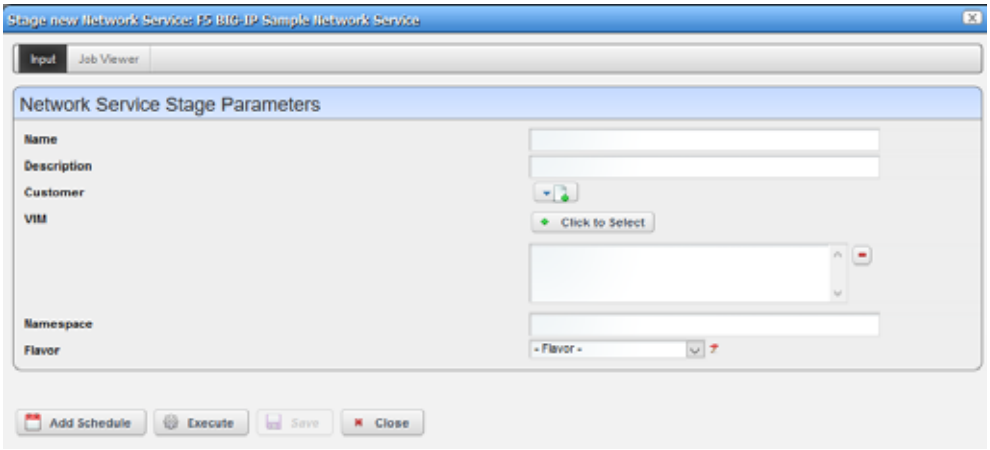


Figure A-11 Stage new Network Service Parameters Window

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. • Starting On sets the date and time to execute the task. • 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. • 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 167 for a description of its standard options provided.

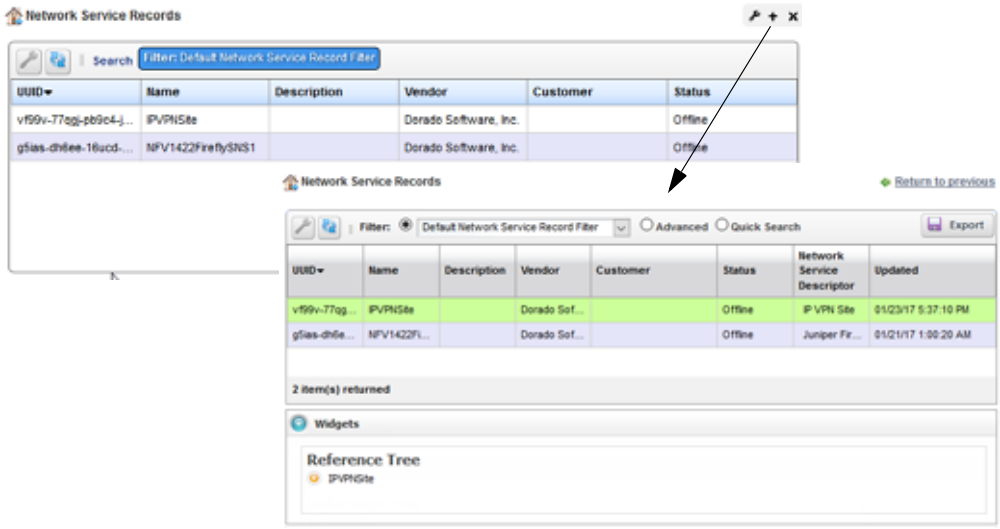


Figure A-12 Network Service Records Portlets

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: • Record name, description, or monitoring parameters • Connection point name or description • 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. 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: • **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. • **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: • **Diagnostics** runs the Diagnostics event for the selected service and the VNF. The user defines these events. • **Heal** runs the Heal event for the network service and the VNF. • **Upgrade** runs the Upgrade event for the selected service and the VNF to ensure that the latest descriptor is used. • **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. **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.

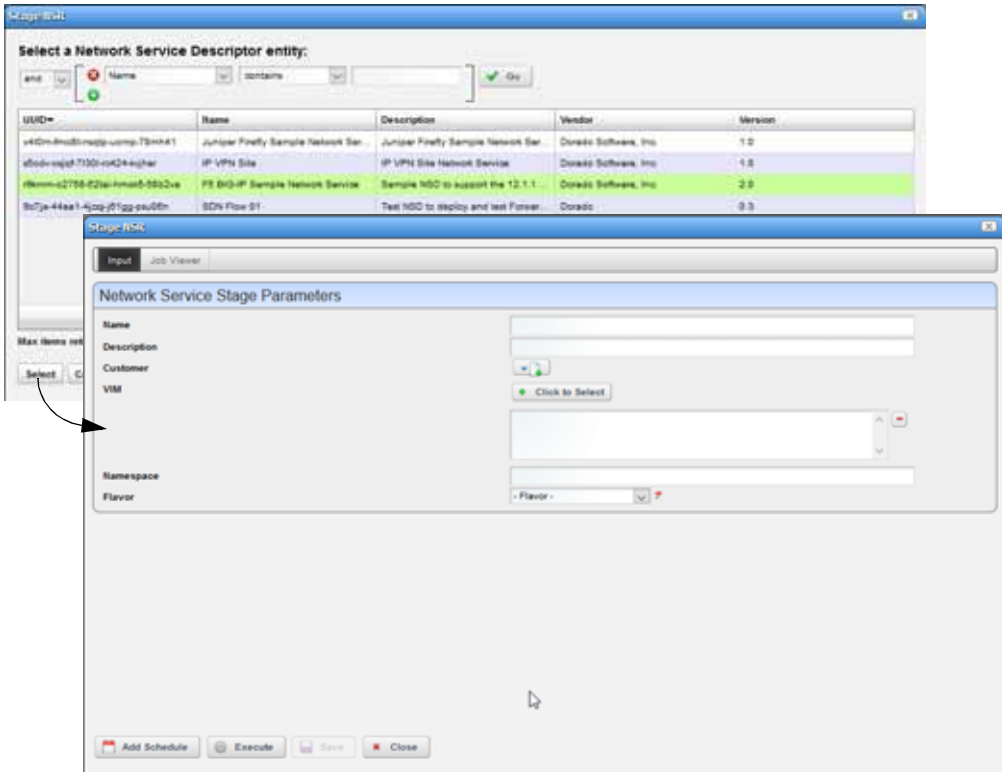


Figure A-13 Stage NSR Window

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. • Starting On sets the date and time to execute the task. • 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. • 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.

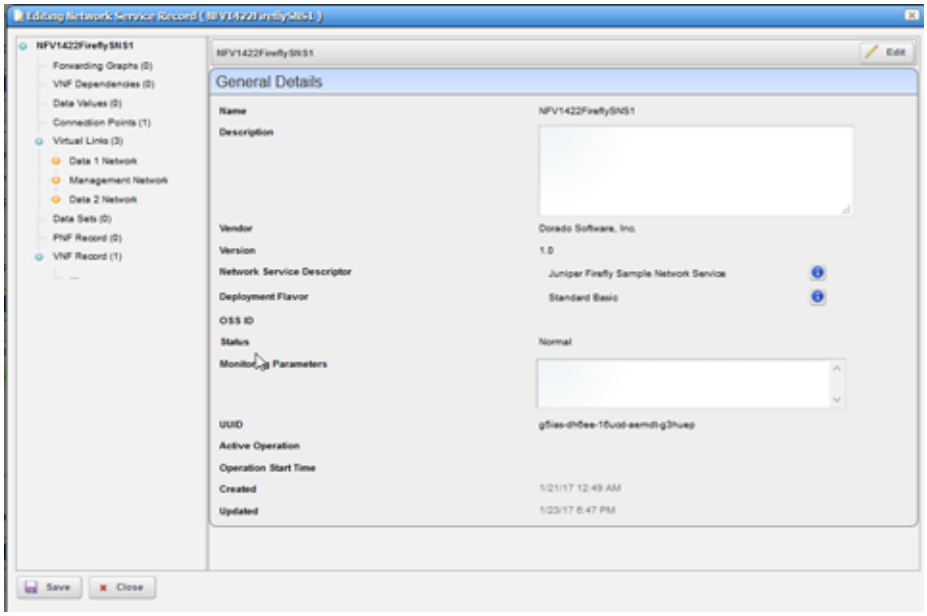


Figure A-14 Editing Network Service Record Window

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.

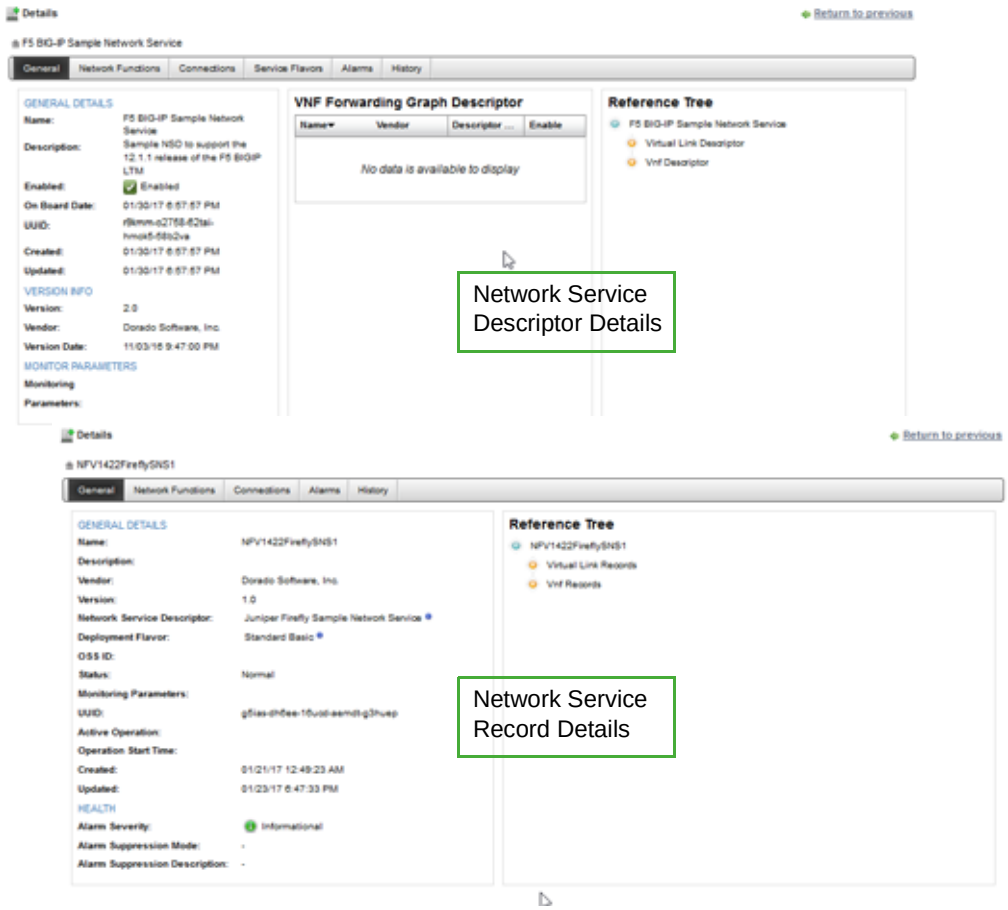


Figure A-15 Network Service General Details Portlet

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 206 (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.

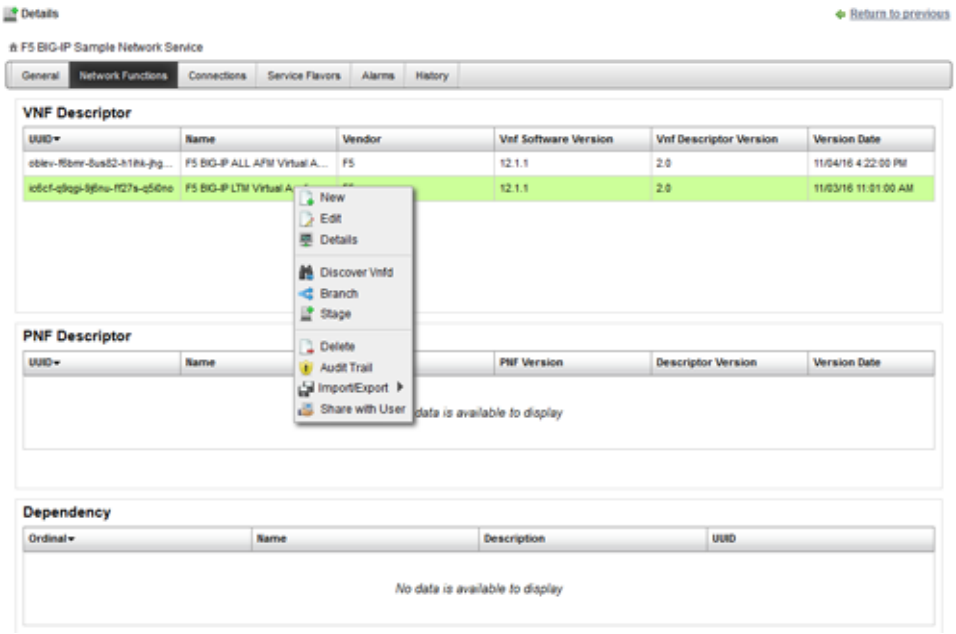


Figure A-16 Network Functions Details

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.

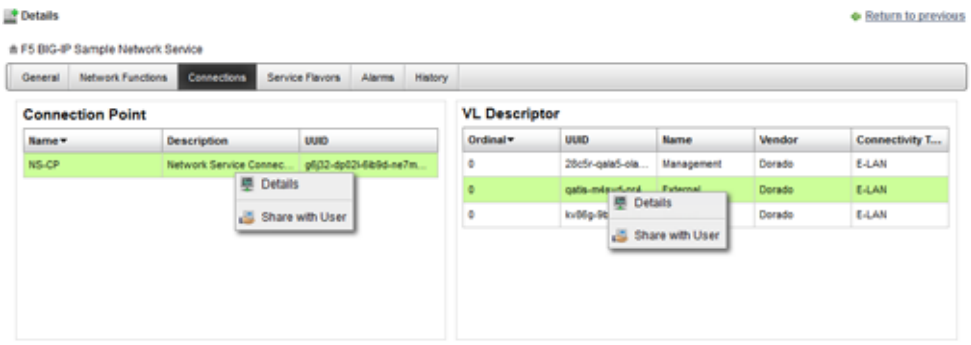


Figure A-17 Network Service Connection Details

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.

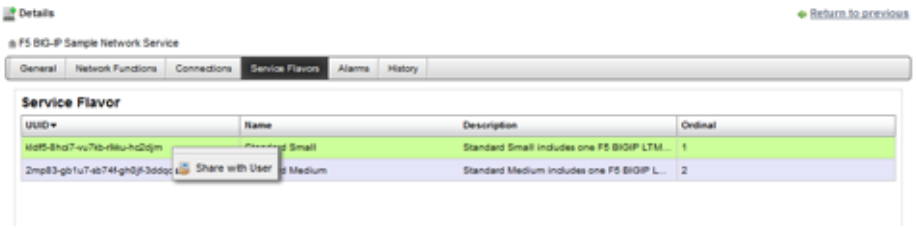


Figure A-18 Network Service Flavors Details

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.

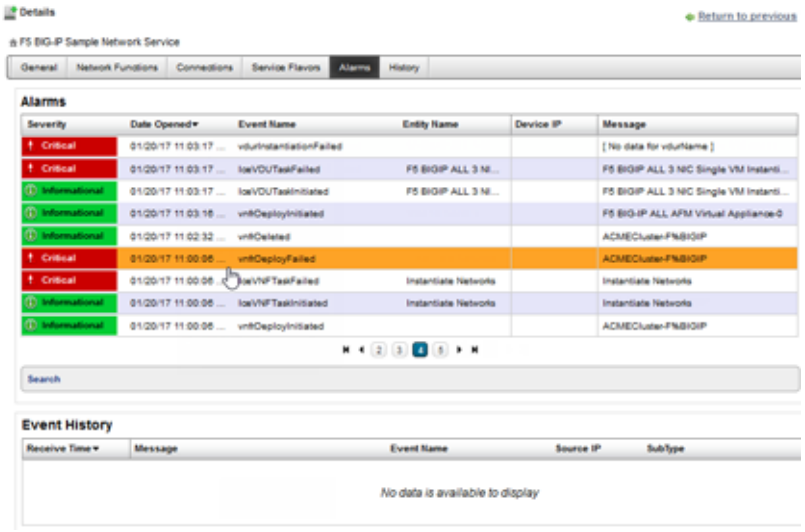


Figure A-19 Network Service Alarms Details

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.

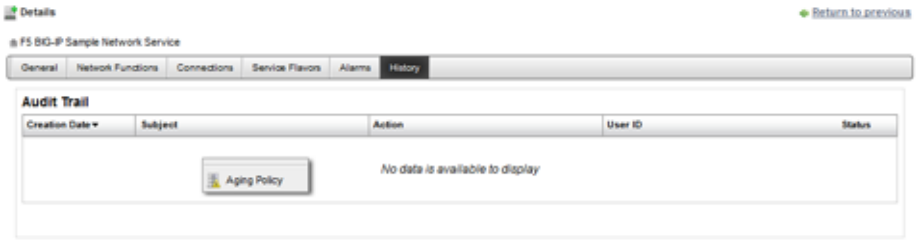


Figure A-20 Network Service History Details

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 167 for a description of its standard options provided.

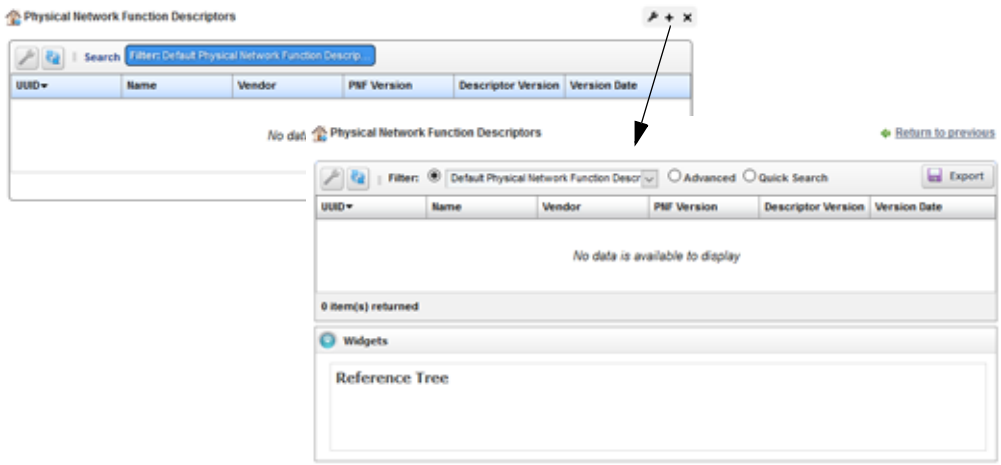


Figure A-21 Physical Network Function Descriptors Portlet

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. 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: • Import retrieves a file containing XML PNF descriptions. Some imports can come from a URL. • Export Selection exports the selected PNF description to an XML file. • Export All exports all PNF descriptions to an XML file. Click Download Export File to specify where to save the file. 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. **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.

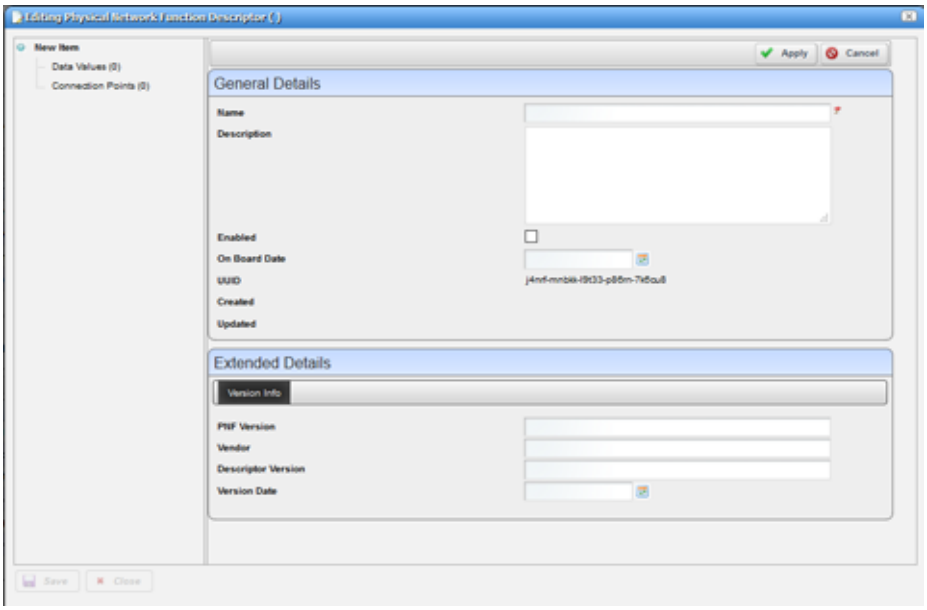


Figure A-22 Editing Physical Network Function Descriptor Window

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. 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. 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. 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: • A VNF may need to know what the gateway IP address is for the service so that it can properly configure the service. • 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*. 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 167 for a description of its standard options provided.

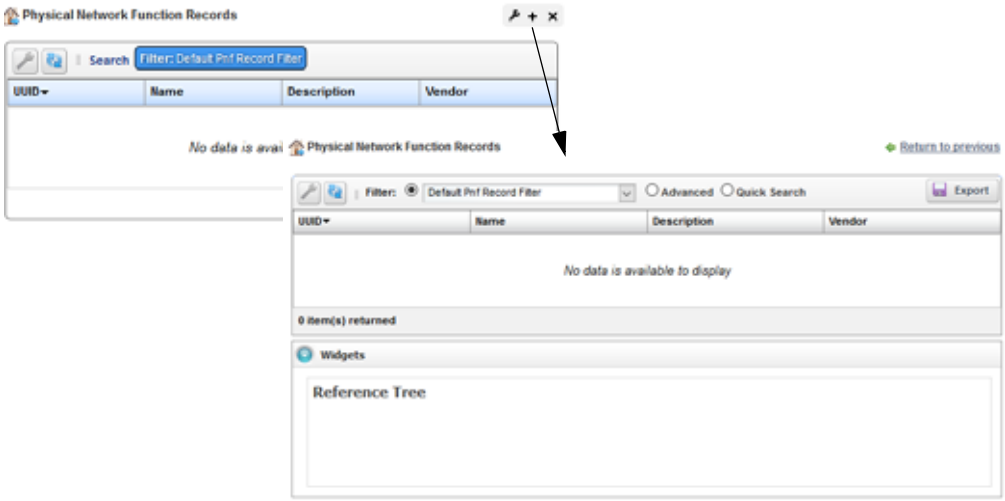


Figure A-23 Physical Network Function Records Portlet

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. 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. **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.

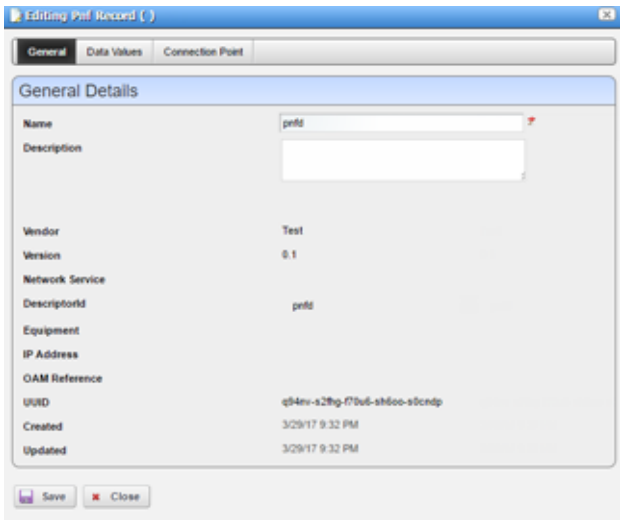


Figure A-24 Editing Pnf Record Window

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. 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. 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: • A VNF may need to know what the gateway IP address is for the service so that it can properly configure the service. • 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*. 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.

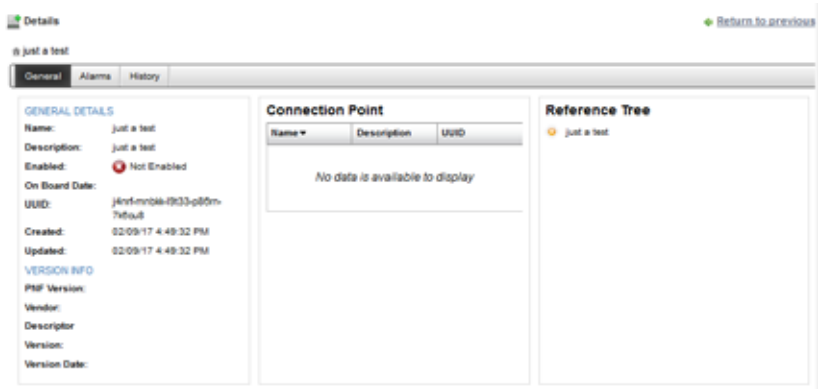


Figure A-25 Physical Network Function General Details

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.

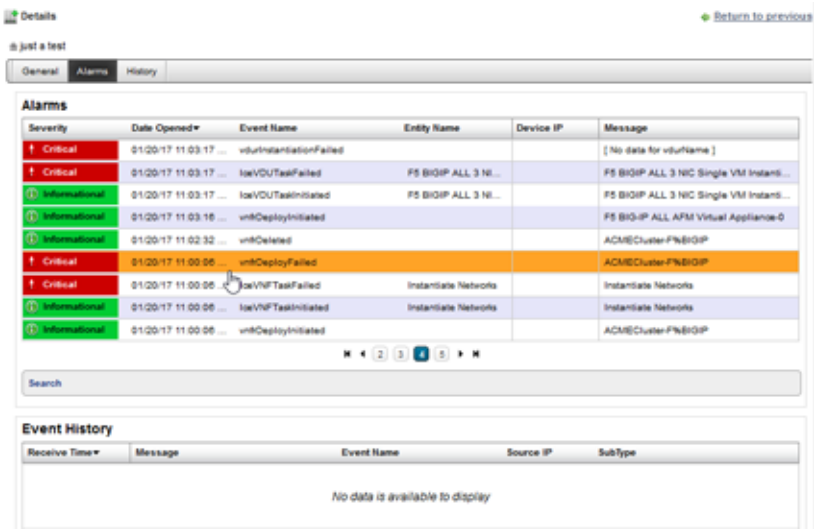


Figure A-26 Physical Network Function Alarms Details Portlet

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.

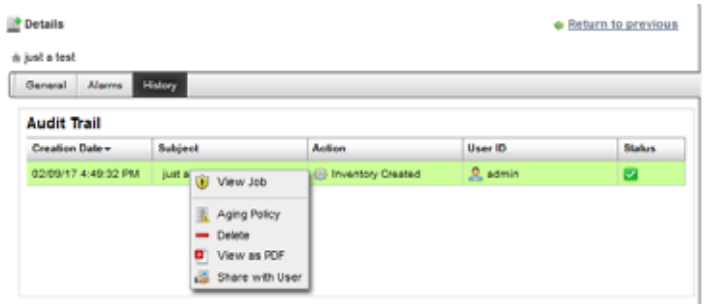


Figure A-27 Physical Network Function History Portlet

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 167 for a description of its standard options provided.

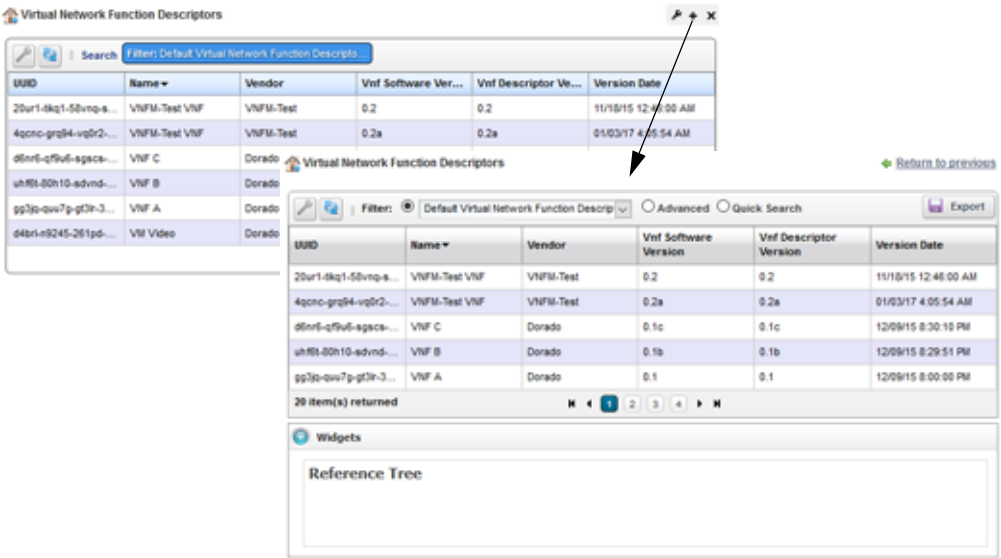


Figure A-28 Virtual Network Function Descriptors Portlet

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. 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. 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: • Import retrieves a file containing XML VNF descriptions. Some imports can come from a URL. • Export Selection exports the selected VNF description to an XML file. • Export All exports all VNF descriptions to an XML file. Click Download Export File to specify where to save the file. 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. **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.

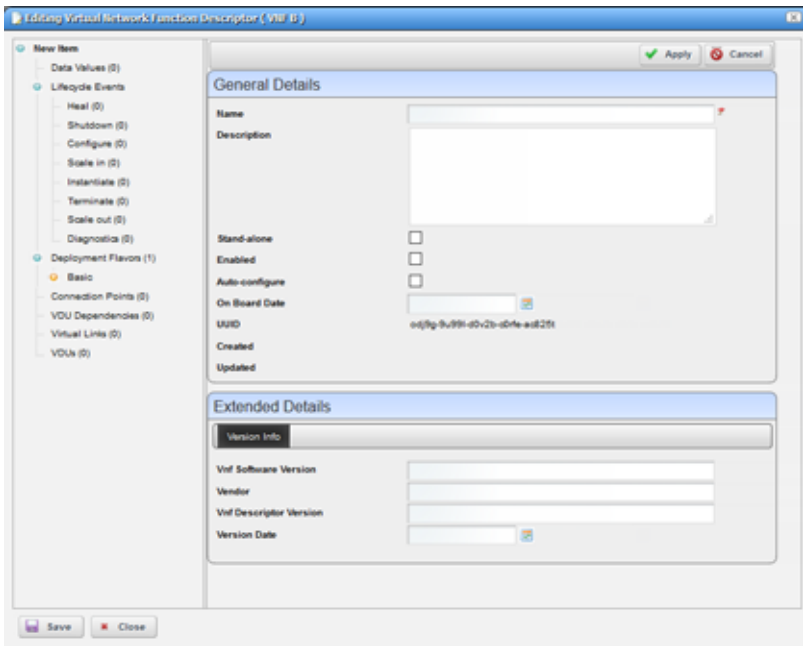


Figure A-29 Editing Virtual Network Function Descriptor Window

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: • For the VNF descriptor, enter Vendor Info (Vnf Software Version, Vendor name, Vnf Descriptor Version, Version Date) and Monitor Parameters (monitor attributes). • For Virtual Links, enter Properties (connectivity type, root bandwidth, leaf bandwidth, test access), VNFC Connection Points, and Qos options • 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.

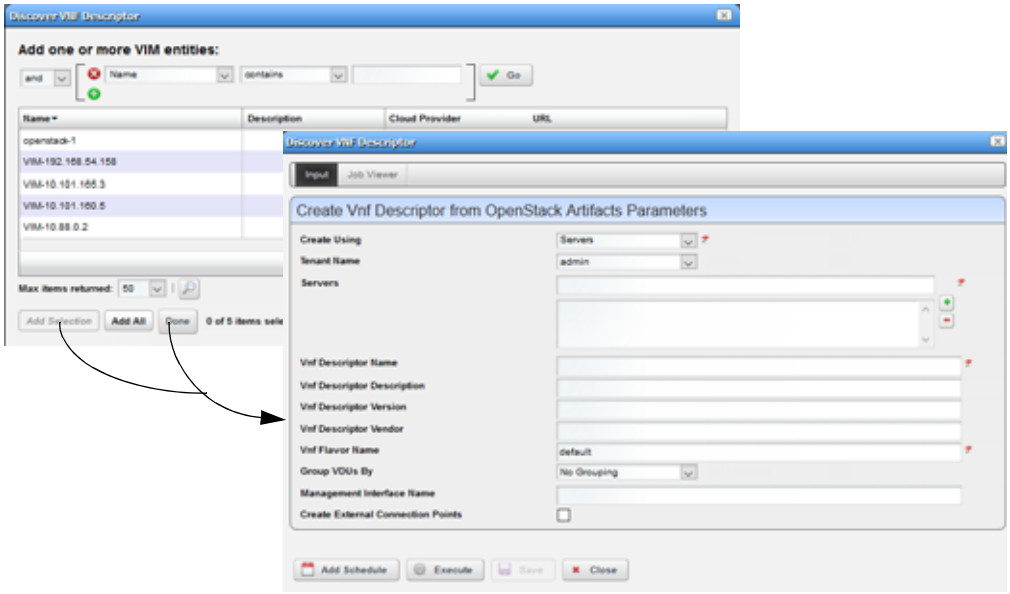


Figure A-30 Discover VNF Descriptor Window

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. • Starting On sets the date and time to execute the task. • 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. • 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.

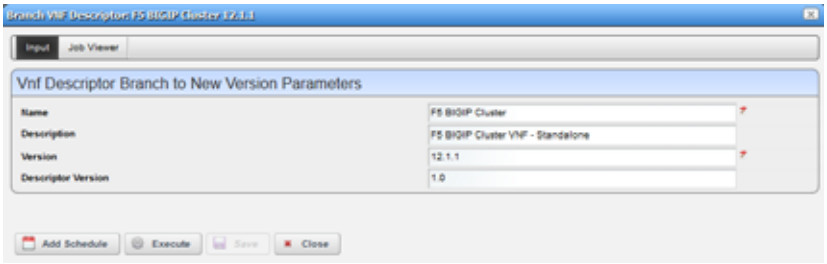


Figure A-31 Branch VNF Descriptor Window

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. • Starting On sets the date and time to execute the task. • 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. • 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.

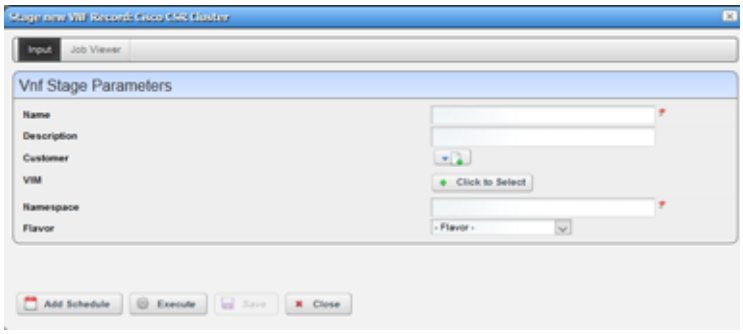


Figure A-32 Stage new VNF Record Window

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. • Starting On sets the date and time to execute the task. • 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. • 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 167 for a description of its standard options provided.

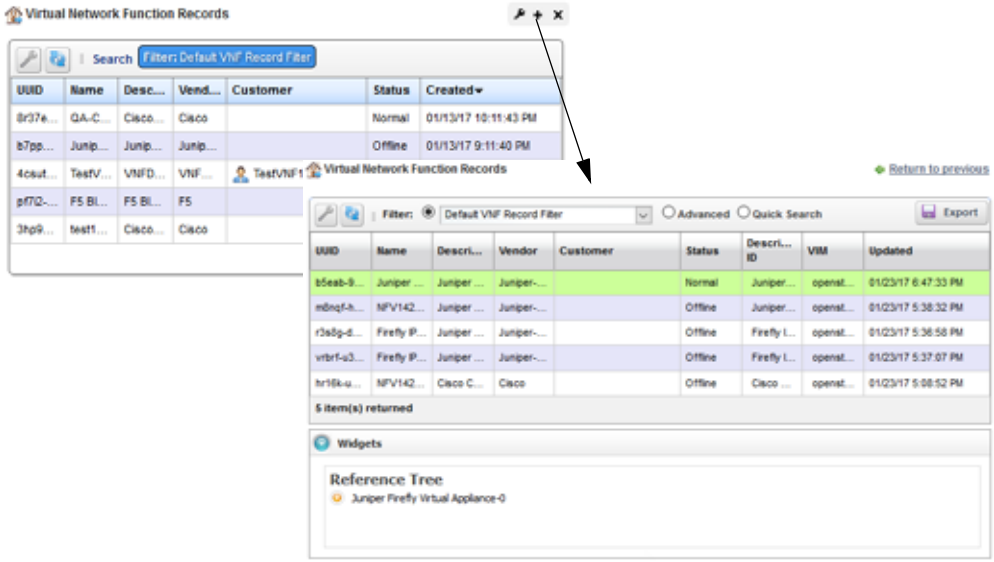


Figure A-33 Virtual Network Function Records Portlet

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. 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. You can also execute the Vnf Deploy action from the Actions portlet. 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. 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: • **Scale In** executes the Scale-in event to reduce the VNF capacity. • **Scale Out** executes the Scale-out event to increase the VNF capacity. 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. 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. When you **start** activity, the record status returns to Normal. 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. 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. When you **resume** activity, the record status returns to Normal. 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: • **Diagnostics** runs the Diagnostics event. The user defines these events. • **Heal** runs the Heal event. • **Upgrade** runs the Upgrade event to ensure that the latest descriptor is used. • **Disaster Recovery** runs the Disaster Recovery event. The user defines these events. 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. 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. **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. 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.

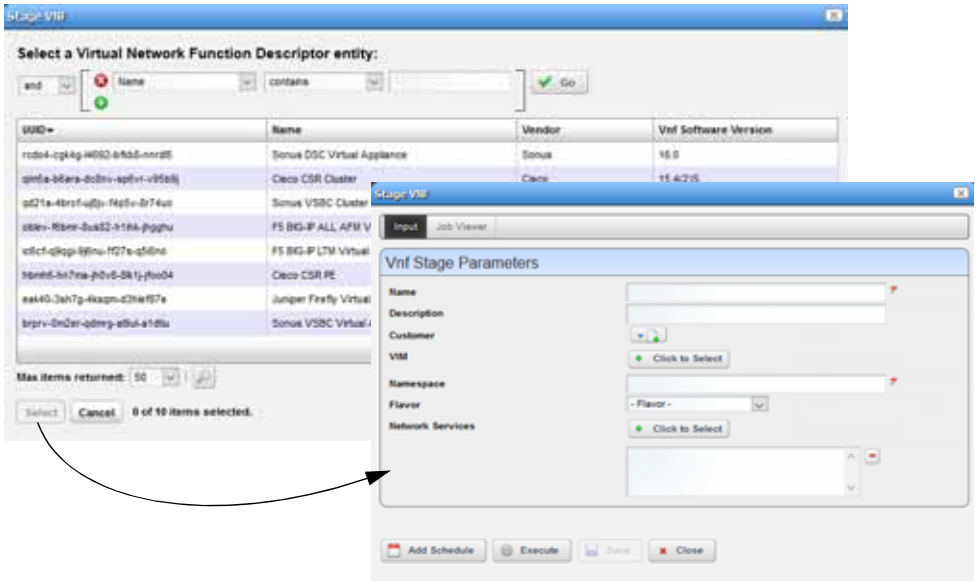


Figure A-34 Stage VNF Window

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. • Starting On sets the date and time to execute the task. • 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. • 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.

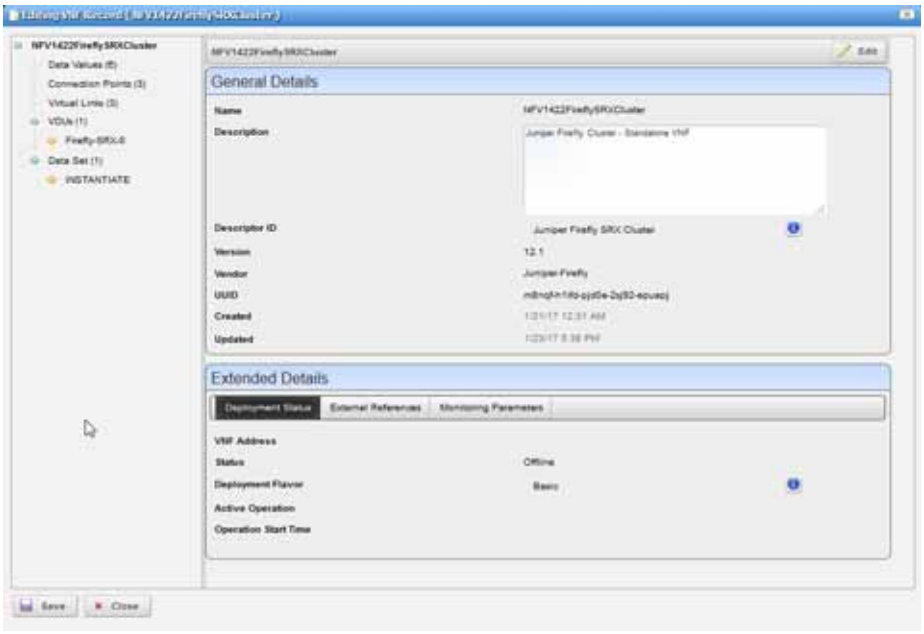


Figure A-35 Editing VNF Record Window

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 222.

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

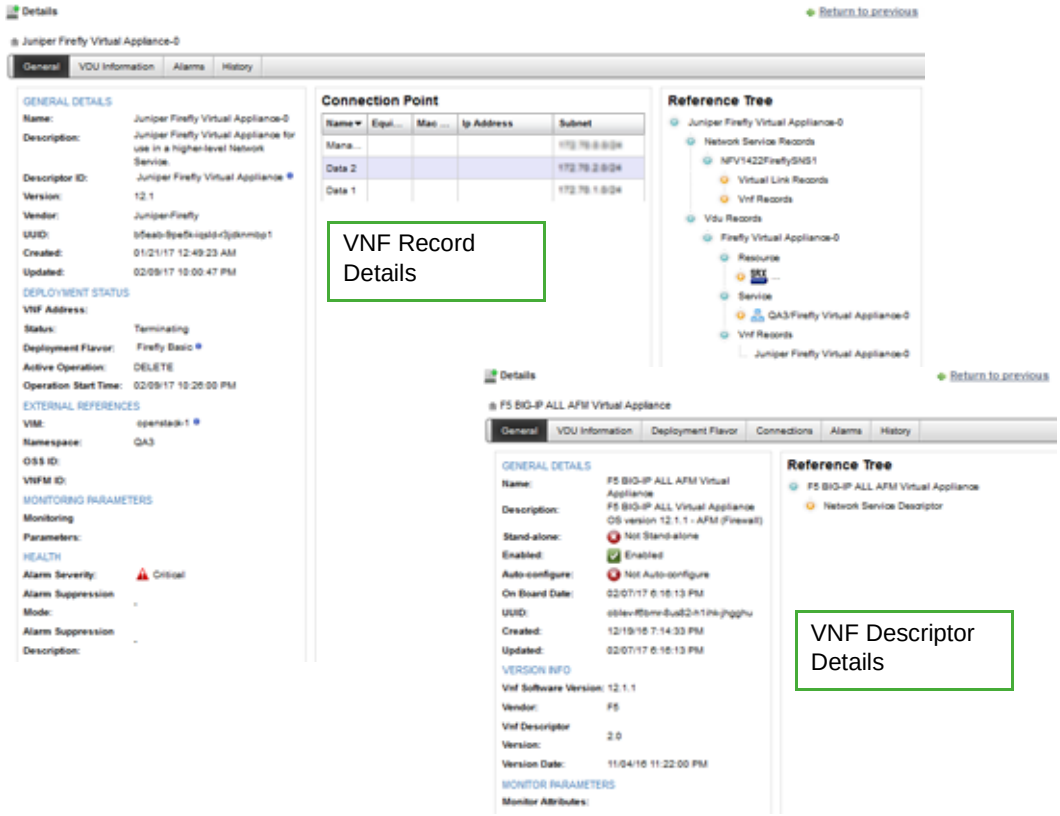


Figure A-36 VNF General Details Portlets

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.

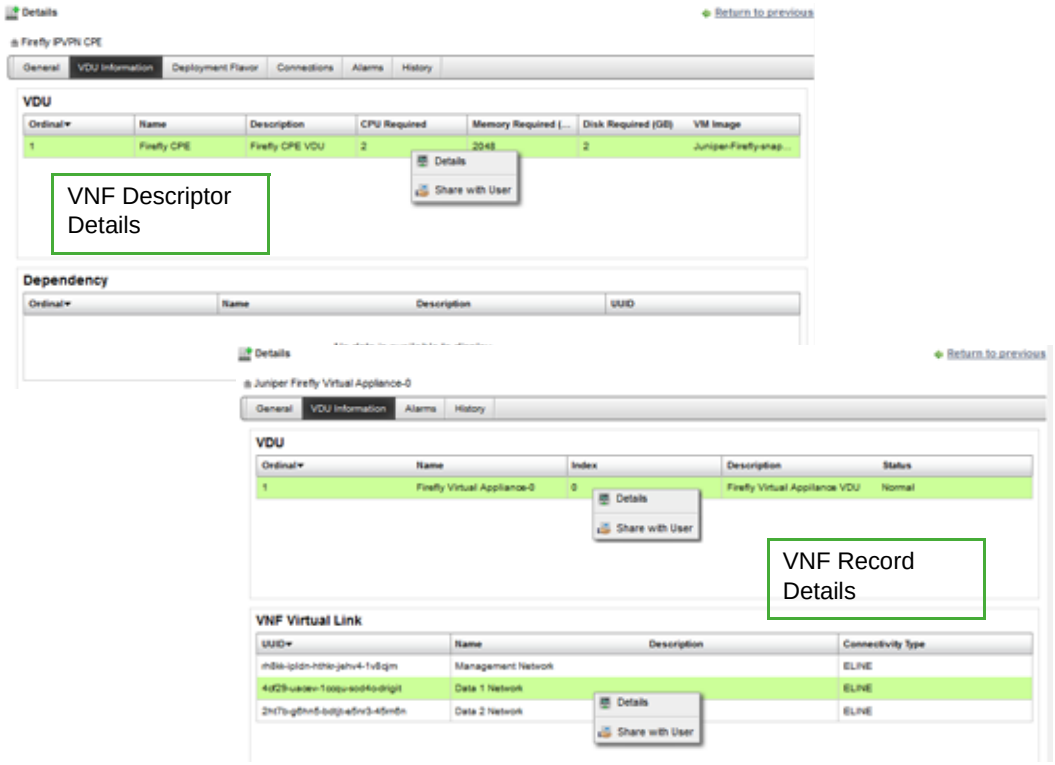


Figure A-37 VNF VDU Information Details Portlets

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.

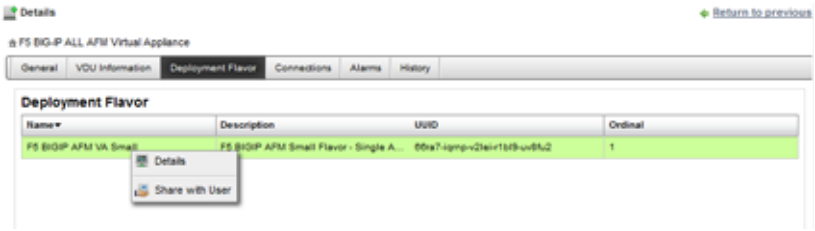


Figure A-38 VNF Descriptor Deployment Flavor Details Portlet

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 220. For VNF record virtual link details, see VDU Information Details on page 221.

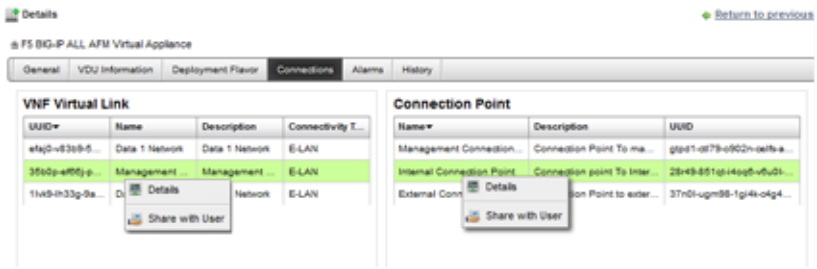


Figure A-39 VNF Descriptor Connections Portlets

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.

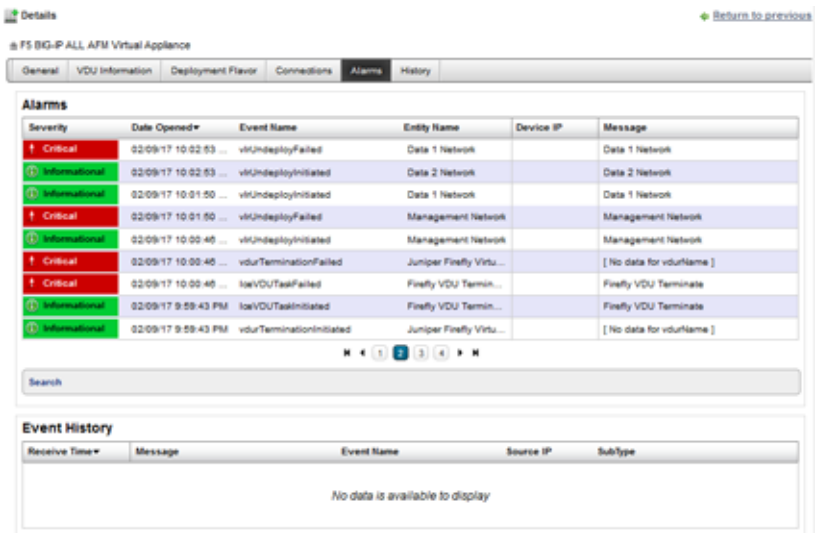


Figure A-40 VNF Alarms and Events Details Portlets

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.

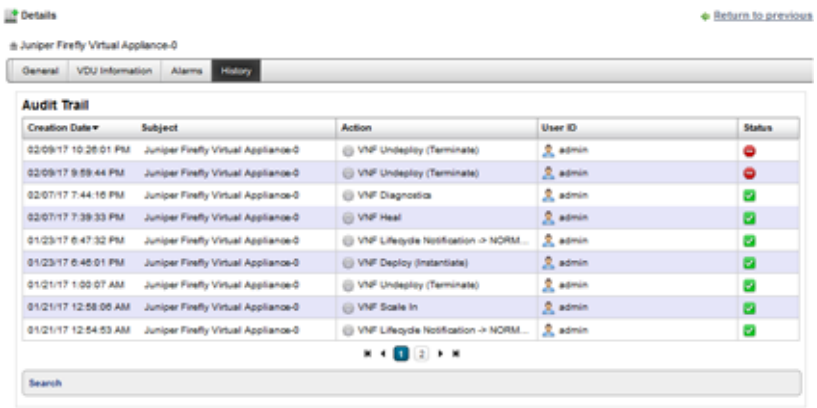


Figure A-41 VNF History Details

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 167 for a description of its standard options provided.

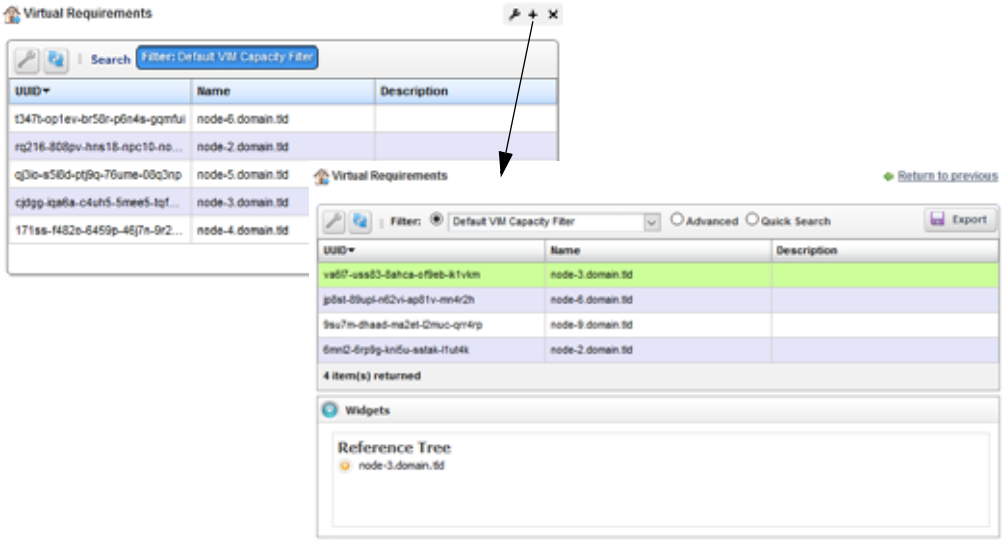


Figure A-42 Virtual Requirements Portlet

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). 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. **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 167 for a description of its standard options provided.

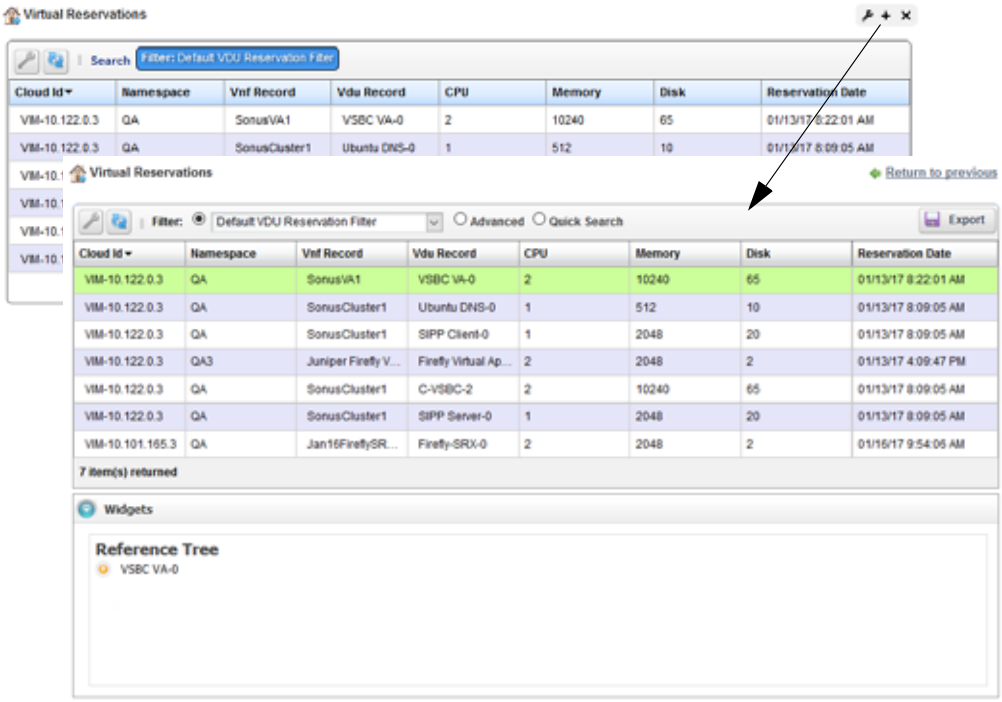


Figure A-43 Virtual Reservations Portlet

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. **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 167 for a description of its standard options provided.

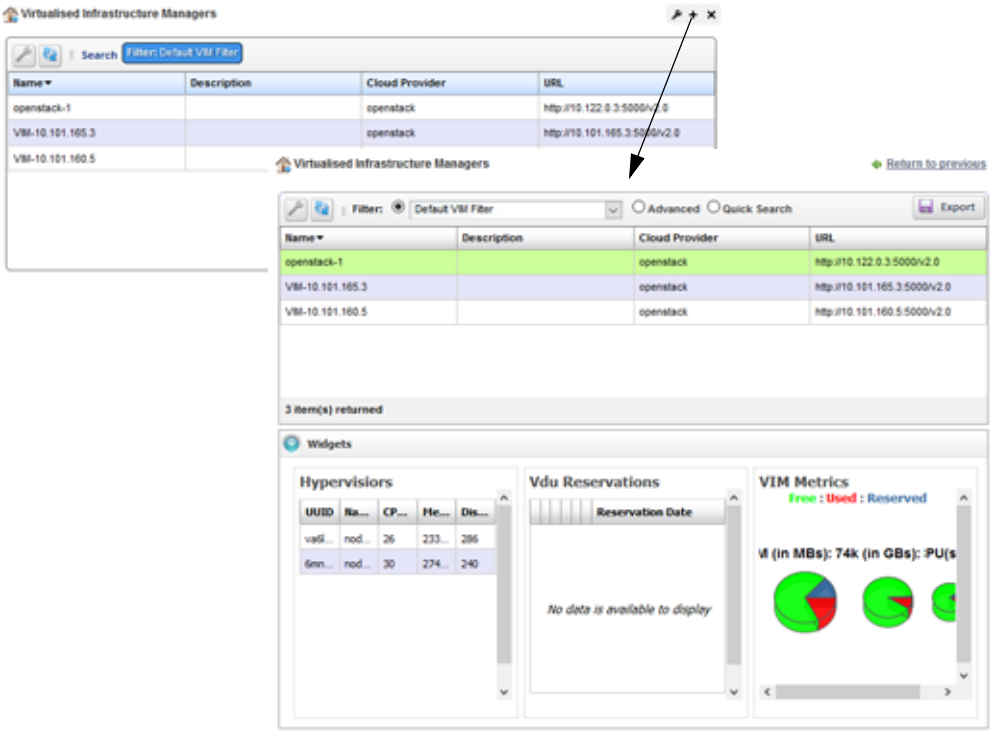


Figure A-44 Virtualized Infrastructure Managers Portlet

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. 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: • Import retrieves a file containing XML VIM descriptions. Some imports can come from a URL. • Export Selection exports the selected VIM description to an XML file. • Export All exports all VIM descriptions to an XML file. Click Download Export File to specify where to save the file. 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. **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: `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: `123.17.0.0/16` 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: `123.18.0.0/16` 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.

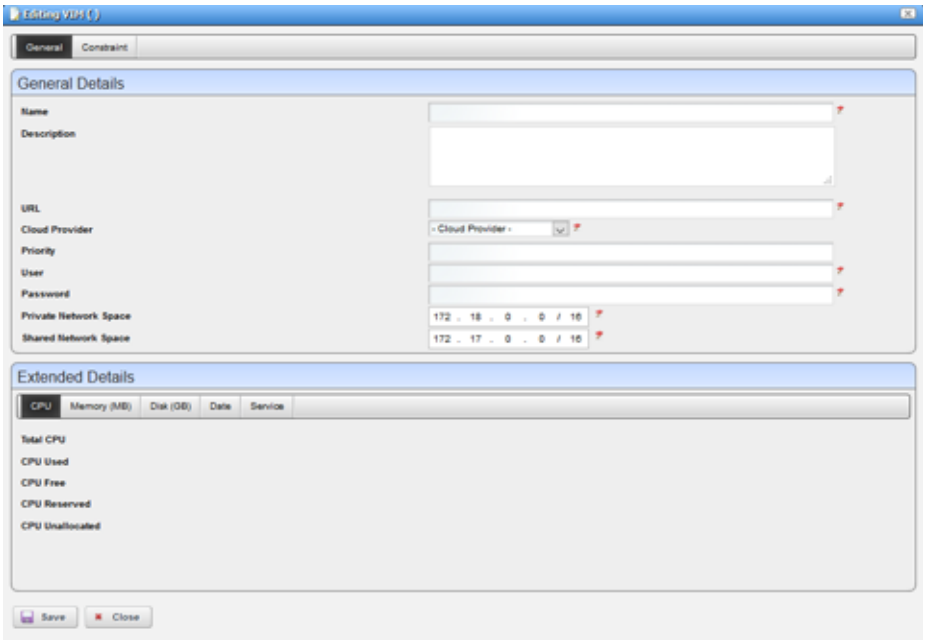


Figure A-45 Editing VIM Window

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: `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: `123.17.0.0/16` 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: `123.18.0.0/16` 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.

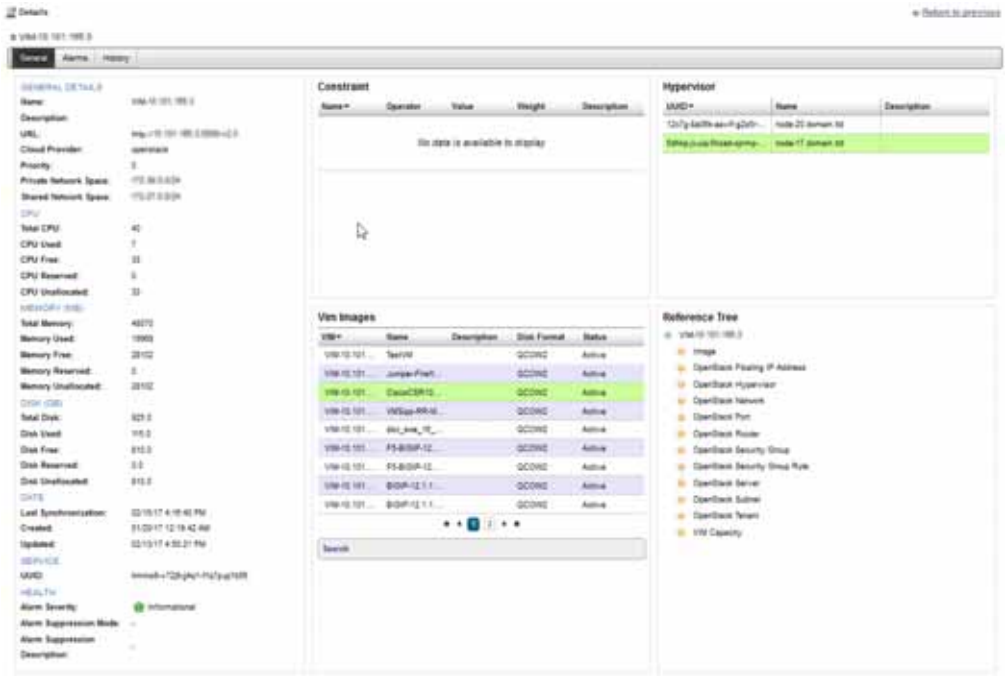


Figure A-46 VIM General Details Portlets

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.

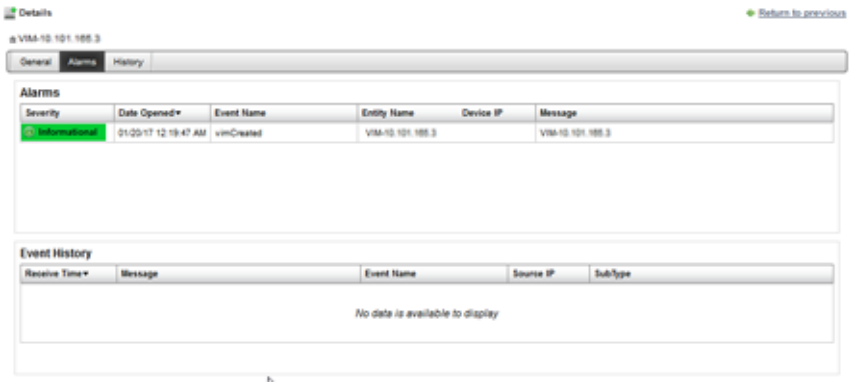


Figure A-47 Alarms and Event History Portlets

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.

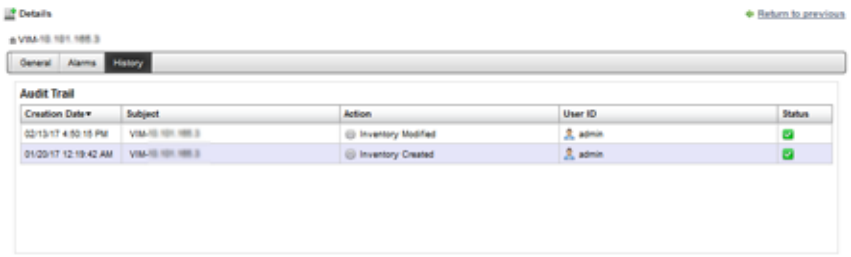


Figure A-48 VIM History Details Portlet

B

> Redcell NFV Permissions

Covers these topics:

NFV Records – 236
NFV Descriptors – 237
NFV Operations – 238

This section describes the permissions for NFV records, descriptors, and operations. Each list includes a description of its type or function, valid actions, and portlet from which each action is performed.

NFV Records

Record types (Table B-1) are object-scoped, where READ, WRITE, ADD, DELETE, and EXECUTE are against objects of the specified type.



Note

By default, all users have permission to create and maintain these NFV records.

Table B-1 Record Types

Type	Description	Actions
Software Image	A catalog of VDU/VM images. Maintain and deploy/undeploy these records from the Software Images Portlet portlet.	Read, Write, Add, Delete, Execute
Vim Instance	Virtual Information Manager OpenStack deployments under management. Maintain these records from the Virtualized Infrastructure Managers Portlet.	R,W,A,D,E
Network Service	Provisioned virtual network functions and physical functions used to produce connectivity. Maintain these records from the Network Service Records Portlet portlet.	R,W,A,D,E
Vnf	At least one VDU/VM, such as a router. Maintain these records from the Virtual Network Function Records Portlet portlet.	R,W,A,D,E
Pnf	Physical device to which you connect a virtual device. Maintain these records from the Physical Network Function Records Portlet portlet.	R,W,A,D,E
Vdu Reservation	Virtualization Deployment Unit (VDU) reserved within a staged VNF. View VDU reservation records from the Virtual Reservations Portlet portlet.	R,W,A,D,E

NFV Descriptors

Descriptor types (Table B-2) are object-scoped, where READ, WRITE, ADD, DELETE, and EXECUTE are against objects of the specified type.



Note

By default, only users with administrative permissions (such as system administrators, network service designers or engineers, and so on) can add and maintain the NFV descriptors.

Table B-2 Descriptor Types

Type	Description	Actions
Network Service	The template used to create network service records that provision virtual network functions and physical functions used to produce connectivity. Maintain these descriptors from the Network Service Descriptors Portlet portlet.	Read, Write, Add, Delete, Execute
Vnf	The template used to create VDU/VM records, such as a router. Maintain these descriptors from the Virtual Network Function Descriptors Portlet portlet.	R,W,A,D,E
Pnf	The template used to create records for physical device to which you connect a virtual device. Maintain these descriptors from the Physical Network Function Descriptors Portlet portlet.	R,W,A,D,E

NFV Operations

Operation functions (Table B-3) for which there is only an EXECUTE action defined. The listed functions are performed from the Redcell application portlets.

Note

By default, all users have permission to execute all these functions except for the Vnf Discovery function. Only users with administrative permissions (such as system administrators, network service designers or engineers, and so on) can execute the Vnfd Discovery function.

Table B-3 Operation Functions (Sheet 1 of 3)

Function	Description	Actions
Vim Capacity Resync	Refreshes namespace resources and capacity for the selected VIM or OpenStack capacity. Performed from the Virtualized Infrastructure Managers Portlet.	Execute
Image Download	Creates a software image descriptor (such as F5 Firefly) for a snapshot image and saves it to disk in the specified location. Performed from the Software Images Portlet portlet. Right-click and software image and then select Download.	Execute
Image Deploy	Implements the selected software image (such as F5 Firefly) in the specified VIM. Performed from the Software Images Portlet portlet. Right-click an software image and then select Deploy.	Execute
Image Undeploy	Removes the selected software image setup from the VIM. Performed from the Software Images Portlet portlet. Right-click an software image and then select Undeploy.	Execute
Network Service Deploy	Implements a network service in the specified VIM by establishing network connectivity, processing the VNF instantiate event, and resyncing VIM resources. Performed from the Network Service Records Portlet portlet. Right-click a network service record and then select Deploy.	Execute
Network Service Undeploy	Removes the network service from the specified VIM by processing the VNF terminate event and resyncing VIM resources. Performed from the Network Service Records Portlet portlet. Right-click a network service record and then select Undeploy.	Execute
Network Service Discovery	Brings existing Network Services under management by interrogating the virtualization platform and matching the instance properties to a descriptor. Performed from the Network Service Records Portlet portlet. Right-click a network service record and then select Discovery/Resync.	Execute
Network Service Scale-In	Runs the Scale-in event to reduce the service scope. To successfully run, this option requires a scale-in event with a lower scale value. Performed from the Network Service Records Portlet portlet. Right-click a network service record and then select Scaling > Scale In.	Execute
Network Service Scale-Out	Runs the Scale-out event to increase the service scope. To successfully run, this option requires a scale-out event with a higher scale value. Performed from the Network Service Records Portlet portlet. Right-click a network service record and then select Scaling > Scale Out.	Execute

Table B-3 Operation Functions (Sheet 2 of 3)

Function	Description	Actions
Network Service Diagnostics	Runs the Diagnostics event for the selected service. The user defines this event. Performed from the Network Service Records Portlet portlet. Right-click a network service record and then select Maintenance > Diagnostics.	Execute
Network Service Upgrade	Runs the Upgrade event for the selected service to ensure that the latest descriptor is used. Performed from the Network Service Records Portlet portlet. Right-click a network service record and then select Maintenance > Upgrade.	Execute
Network Service Recovery	Runs the Disaster Recovery event for the selected service. The user defines this event. Performed from the Network Service Records Portlet portlet. Right-click a network service record and then select Maintenance > Disaster Recover.	Execute
Network Service Shutdown	Gracefully shuts down the selected network service. Performed from the Network Service Records Portlet portlet. Right-click a network service record and then select Shutdown.	Execute
Network Service Link Deploy	Deploys link configuration actions that define the end points to pass traffic. Performed from the Network Service Records Portlet portlet. Right-click a network service record and then select Deploy Virtual Links.	Execute
Vnfd Discovery	Creates a base descriptor record from an existing VNF deployment. Performed from the Virtual Network Function Descriptors Portlet. Right-click a VNF descriptor and then select Discover Vnfd. **Note:** Only users with administrative permissions (such as system administrators, network service designers or engineers, and so on) can execute this function.	Execute
Vnf Discovery	Brings existing VNF instances under management by matching the configuration properties with those of a descriptor in inventory. Performed from the Virtual Network Function Records Portlet portlet. Right-click a VNF and then select Discover/Resync.	Execute
Vnf Deploy	Implements a VNF instance in the specified VIM. Performed from the Virtual Network Function Records Portlet portlet. Right-click a VNF and then select Deploy.	Execute
Vnf Undeploy	Runs the VNF terminate event. Performed from the Virtual Network Function Records Portlet portlet. Right-click a VNF and then select Undeploy.	Execute
Vnf Start	Resumes running the selected VNF instance in a non-frozen state. Performed from the Virtual Network Function Records Portlet portlet. Right-click a VNF and then select Start/Stop > Start. Can also use the OpenStack Unpause command.	Execute
Vnf Stop	Pauses the selected VNF instance, stores the VM state in RAM, and the instance continues to run in a frozen state. Performed from the Virtual Network Function Records Portlet portlet. Right-click a VNF and then select Start/Stop > Stop. Can also use the OpenStack Pause command.	Execute

Table B-3 Operation Functions (Sheet 3 of 3)

Function	Description	Actions
Vnf Resume	Continues with the selected VNF instance maintenance state. Performed from the Virtual Network Function Records Portlet portlet. Right-click a VNF and then select Resume/Suspend > Resume.	Execute
Vnf Suspend	Pauses the selected VNF instance maintenance state. Performed from the Virtual Network Function Records Portlet portlet. Right-click a VNF and then select Resume/Suspend > Suspend.	Execute
Vnf Shutdown	Gracefully shuts down the selected VNF instance. Part of the lifecycle event. Performed from the Virtual Network Function Records Portlet portlet. Right-click a VNF and then select Shutdown. Can also use the OpenStack Shut Off Instance action.	Execute
Vnf Migrate	Move the VNF from one host to another. Performed from the Virtual Network Function Records Portlet portlet. Right-click a VNF and then select Maintenance > Migrate.	Execute
Vnf Scale-In	Runs the Scale-in event to reduce the VNF scope. To successfully run, this option requires a scale-in event with a lower scale value. Performed from the Virtual Network Function Records Portlet portlet. Right-click a VNF and then select Scaling > Scale In.	Execute
Vnf Scale-Out	Runs the Scale-out event to increases the VNF scope. To successfully run, this option requires a scale-out event with a higher scale value. Performed from the Virtual Network Function Records Portlet portlet. Right-click a VNF and then select Scaling > Scale Out.	Execute
Vnf Diagnostics	Runs the Diagnostics event for the selected VNF. The user defines this event. Performed from the Virtual Network Function Records Portlet portlet. Right-click a VNF and then select Maintenance > Diagnostics.	Execute
Vnf Heal	Runs the Heal event for the selected VNF. Part of the lifecycle event. Performed from the Virtual Network Function Records Portlet portlet. Right-click a VNF and then select Maintenance > Heal.	Execute
Vnf Upgrade	Runs the Upgrade event for the selected VNF to ensure that the latest descriptor is used. Performed from the Virtual Network Function Records Portlet portlet. Right-click a VNF and then select Maintenance > Upgrade.	Execute
Vnf Recovery	Runs the Disaster Recovery event for the selected VNF. The user defines this event. Performed from the Virtual Network Function Records Portlet portlet. Right-click a VNF and then select Maintenance > Disaster Recovery.	Execute
Vnf Configure	Lays the down base configuration necessary for VNF to operate, once the VNF is instantiated.	Execute

C

> Notifications

Covers these topics:

Provides a list of notifications (Table C-1) that the Redcell application publishes to the Redcell event bus. Refer to the *Redcell Event Management User Guide* to understand what you can do with the notification's w/r/t forwarding, suppressing, running actions, correlation, and so on.

Table C-1 Notifications (Sheet 1 of 3)

Notification	OID
Network Service Descriptors	
Network Service Descriptor Created	1.3.6.1.4.1.3477.36.2.2
Network Service Descriptor Branched	1.3.6.1.4.1.3477.36.2.3
Network Service Descriptor Updated	1.3.6.1.4.1.3477.36.2.4
Network Service Descriptor Deleted	1.3.6.1.4.1.3477.36.2.5
Network Service Records	
Network Service Record Staged	1.3.6.1.4.1.3477.36.4.2
Network Service Record Deploy Initiated	1.3.6.1.4.1.3477.36.4.3
Network Service Record Deploy Completed	1.3.6.1.4.1.3477.36.4.4
Network Service Record Deploy Failed	1.3.6.1.4.1.3477.36.4.5
Network Service Record Undeploy Initiated	1.3.6.1.4.1.3477.36.4.6
Network Service Record Undeploy Completed	1.3.6.1.4.1.3477.36.4.7
Network Service Record Undeploy Failed	1.3.6.1.4.1.3477.36.4.8
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Vdu Record Migrated	1.3.6.1.4.1.3477.36.10.17
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Lifecycle Vnf Record Task Initiated	1.3.6.1.4.1.3477.36.12.5
Lifecycle Vnf Record Task Complete	1.3.6.1.4.1.3477.36.12.6
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Virtual Link Record Undeploy Initiated	1.3.6.1.4.1.3477.36.14.5
Virtual Link Record Undeploy Complete	1.3.6.1.4.1.3477.36.14.6
Virtual Link Record Undeploy Failed	1.3.6.1.4.1.3477.36.14.7

Table C-1 Notifications (Sheet 3 of 3)

Notification	OID
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VIM Instance Created	1.3.6.1.4.1.3477.36.16.2
VIM Instance Deleted	1.3.6.1.4.1.3477.36.16.3
Software Images	
Software Image Deployed	1.3.6.1.4.1.3477.36.18.2
Software Image Undeployed	1.3.6.1.4.1.3477.36.18.3
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VNF License Threshold Cleared	1.3.6.1.4.1.3477.36.20.3

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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