

HPE NFV Director

User Guide Release 4.1 Second Edition

Hewlett Packard Enterprise

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Preface

About this guide

This guide is intended to support the NFV Director user during the NFV Director GUI operations.

Audience

This document is targeting all levels of NFV Director users: Domain users, Organization Users, VDC Users, Group Users, and Datacenter users.

For On boarding VNFs please refer to the HPE NFV Director On boarding Guide.

Document history

Table 1: Document history

Edition	Date	Description
1.0	14 October, 2016	First Edition
2.0	2 December 2016	Second edition. Reformatting

Chapter 1 NFV Director Entities and User levels

There are five different entities in NFV-D system and all of them are related. Those entities are the following:

- Domain
- Datacenter
- Organization
- VDC
- VNF Group

The **Domain** is the scope that includes the whole NFV-D system. There is only one Domain and it contains all the other entities. Domain refers to all existing entities in the system.

A **Datacenter** represents a localized physical infrastructure that provides the necessary physical resources for creating virtualized infrastructures. There can be several Datacenters in a Domain, but the use of its resources can be restricted to the rest of the entities.

An **Organization** represents a company or contract that use and manage its own virtualized infrastructures in the Domain. An Organization has to be registered by a Domain User and the Organization entities cannot be shared with another Organization. Two different Organizations can use resources from the same Datacenters, but they can each only use the resources assigned by the Domain based on the quota.

A **VDC** represents a virtual infrastructure where the VNF can be deployed. A VDC can belong to only one Organization (a VDC without an Organization or belonging to more than one is not possible) and it can be registered only by an Organization user.

A **VNF Group** is an entity that contains a set of deployed VNFs inside a VDC. So a VNF belongs to only one VDC. It is intended for management purposes, since a Group User is responsible for managing all VNFs in its VNF Group.

1.1 Domain Level

1.1.1 Domain Entity

A Domain Entity represents all the resources and entities that are available it the scope of an NFV-D implantation. There is only one Domain in an NFVD environment. All NFV-D entities depend on it and all resources are managed by it.

1.1.2 Domain Users

A Domain User can manage the application domain. Their responsibilities include viewing all the domain resources, managing other users, organizations, templates, domain images, organizations quota, and jobs.

It can only be created by another Domain User, and some of the profiles or operations can be revoked.

The profiles and operations available for a Domain User are the following:

Table 2: Domain User Profiles and Operations

Profile	Operations
Administrator	Manage Domain Users
	Manage Organization Users
	Manage VDC Users
	Manage VNF Group Users
	Manage Datacenter Users
Provisioning	Manage Organizations
	Manage Quota Catalog
	Manage Template Catalog
	Manage Images
	Grant/Revoke Images
	View Jobs
	Manage Jobs
Template Designer	Manage VNF Group Templates
	Manage VDC Templates
Monitoring	

1.1.3 Domain Resources

Domain Resources are defined by all the available servers and infrastructure in the Datacenters Domain that can be used for virtualization and VNF deployments.

Domain Resources are all the resources of its Datacenters. Follow these steps as a Domain User to view a global summary of all the resources available in the domain.

1) Click **Summary** in the top menu.

Figure 1: Domain Summary option at the top

2) Select **Global View** in the first drop-down list.



Figure 2: Domain Summary - Global View

You will see a summary of all resources available in the Domain, indicating availability and use. During the first access to the **Summary** without a VIM configured, the **Virtual Load Balancer** and **Virtual Firewalls** tabs could show some resources. In this case the **total** part of **consumed/total** refers to the maximum number of licenses available to be acquired, not to the resources.

Hewlett Packard NFV Director Enterprise					Workspaces - 🌲 nfvd - 🌲 -
L Summary ➢ Administration ▼	🖉 Designer 🛪 🔅 Jobs 🖽 Insta	nces • 🖸 Utilities •			Jobs Monitor + 🛛 C Refresh 🕞
		nfvd.domain Sum	mary		
Global View 🔻					
OpenStack	Virtual Load Balancer	Networking	Virtual Firewalls	Special Ports	Baremetal Devices
		View Type: consumed/total			
		Virtual Cores - Not Dedicated: 6/256 Units		0	
				4	
		Virtual Memory - Page Size 2M: 6144/31936 MB		0	
		External Storage - Kvm-Baremetal-Quality-A: 0,	400000 GB		
		Virtual Disks - Virtual Disks: 6/956 GB			
				٩	
		Virtual Machines - Virtual Machines: 6/20000 U	nits		
				Q	

Figure 3: Domain Summary - OpenStack Resources

The resources can be filtered to show those meeting the Best Effort Quotas filter.

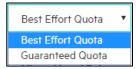


Figure 4: Filter by Best Effort Quotas

Best Effort resources are those which availability is not guaranteed after they have been assigned. It is possible that a resource assigned in **Best Effort mode** cannot be provided.

Following are the resources provided in **Best Effort mode**:

- OpenStack
- Networking
- Virtual Firewalls
- Special Ports
- Baremetal Devices

In contrast, the availability of resources that have been assigned in **Guaranteed mode** is guaranteed. As such, those resources can be assigned to only one entity of the same level (for example, the same guaranteed baremetal server cannot be assigned to two different organizations).

Following are the resources provided in **Guaranteed mode**:

- OpenStack Server Computers
- Baremetal Devices

Clicking on the left icon (magnifying glass) for a resource displays a graph indicating its availability and use by DC and Organization.

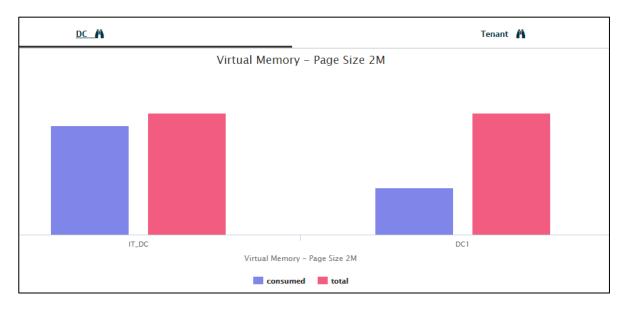


Figure 5: Virtual Memory Page Size 2M resource – availability by Datacenters graph

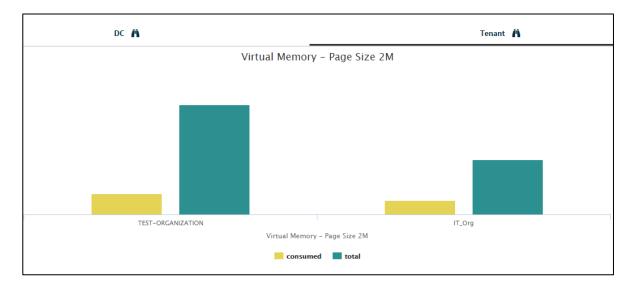


Figure 6: Virtual Memory Page Size 2M resource – availability by Organizations graph

Clicking on **Datacenter View** displays all physical servers in the Domain Datacenters.

Name	✓ Description	~ Country	✓ City	~
DC_2503	Alcobendas Data Cer	nter 2503		
DC_2504	Alcobendas Data Cer	nter 2504 Spain	Alcobendas	
4				k

1) Select the **Datacenter** with the servers.

Figure 7: Datacenter selection

Select the **Datacenter** to display its servers.

Server ~	Model	Usage Mode 🗸	Туре	~
BAR-bare-0-G_B	DL380	guaranteed	baremetal	
NFVCN-dc2-01	DL360	shared	compute	
NFVCN-dc2-02	DL380	shared	compute	
CloudCN-dc2-01	DL380	dedicated	compute	
BASE-CCP-CPX-N0001-NETCL		shared	compute	
CloudCN-dc2-01	DL380	dedicated	compute	
BASE-CCP-CPX-N0001-NETCL		shared	compute	
BAR-bare-0-G_B	DL380	guaranteed	baremetal	
NEV/CN 4-2 02	DI 300	shared	computo	•
	▶ 10 ▼ items per page			1 - 10 of 10 items

Figure 8: Server selection

2) Select a server to list additional details.

DataCenter View	c2-01 Summary
Name	Model 🗸
CloudCN-dc2-01	DL380
Class	Usage Mode
Class_B	dedicated
Туре	Operational Status
compute	UP
Hostname 🗸	Admin Status 🗸
CloudCN-dc2-01	ÚP.

Figure 9: Selected server details

1.1.4 Domain Quota

The Domain is the owner of the resources but it does not have a quota. It manages all available resources in Domain Datacenters.

1.1.5 Domain Catalog

The Domain Catalog is the set of all the available templates in the Domain. The concept of a template is similar to the NFV/NS Descriptor Concept defined in the ETSI MANO standard. It represents the design or modeling of an entity (or a part of an entity).

Currently there is no way of adding templates to a Domain (or removing from it) from the Portal. You have to use the external **Templates Designer**.

However, a user with Domain role is able to set the catalog of an Organization from the Portal using the **VNF Template Catalog** functionality.

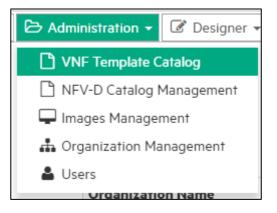


Figure 10: VNF Template Catalog option

The Organization Catalog Management section details how a Domain User can manage the Organization Catalog.

1.1.6 Domain Image Repository

The Domain Image Repository contains all the Operating System Images, which can be deployed in the domain. A Domain User can register and upload an Image from the NFVD Portal and make it either public (accessible to other users) or private.

The NFV Director Images Management chapter details image management.

1.1.7 NFV-D Catalog Management

The Private Catalog is where a Domain User can determine what kinds of quotas can be assigned to the different Organizations.

Follow these steps to manage the Private Catalog of an Organization:

1) Left-click Management and select NFV-D Catalog Management.

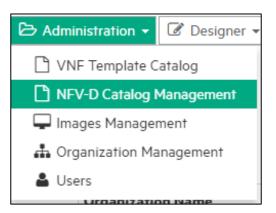


Figure 11: NFV-D Catalog Management option

The following illustration shows all the Organizations in the Domain.

Organization Name $$	Description ~	Contract ID ~	Contact Name 🗸	≡	OpenStack
					Virtual Cores Dedicated
IT_Reseller	IT Reseller Organization			*	
					✓ Virtual Memory Page Size 2M
					✓ Virtual Memory Page Size 1G
					 External Storage Vmware-Quality-A
					✓ External Storage Vmware-Quality-B
					 External Storage Kvm-Baremetal-Quality-A
					🗹 External Storage Kvm-Baremetal-Quality-B
					🗹 External Storage All-vsa-Quality-C
4					
	▶ 10 ▼ items per page		1 - 1 of 1 ite	ims	Virtual Machines Virtual Machines
			Save Rese	·t	VirtualLoadBalancer

Figure 12NFV-D Catalog Management

2) Select an **Organization** to manage its Private Catalog.

The right side of the screen contains a table with all the quota types: Best Effort and Guaranteed.

Selected quotas are allowed to be assigned for the particular organization, while unselected ones are not allowed.

3) Select the quotas to make available for the Organization and unselect the ones not needed.

If a particular type of quota has already been assigned to an Organization, it cannot be unselected for that Organization.

1.1.8 Organization management by Domain user

One of the Domain User's responsibilities is managing the Domain Organizations. The Domain User is responsible for registering new Organizations in the system, assigning Datacenters to them, activating them, managing their Catalogs and Quotas.

1.1.8.1 Registering the Organization

The Domain User can register a new Organization in the system, indicating whether it is contract ID or contact data, with this function.

Follow these steps to register a new Organization as a Domain User.

1) Left-click Management and select Organization Management.

🔁 Management 🔹	🕑 Designer 🔹
🗋 Template Catalog	g Management
🗋 NFV-D Catalog M	lanagement
🖵 Images Managen	nent
📥 Organization Ma	nagement
👗 Users	

Figure 13: Organization Management option

This will display all the Organizations in the Domain.

				Organization M	lanagem	ent				
									Action	15 -
Organization Name	~	Description	~	Contract Id	~	Contact Name	~	Status	~	
TEST_ORG		Organization for testing		321123		Contact Contact		READY TO DEPLOY		*

Figure 14: Organization Management - Organizations table

2) Click Actions and select Create Organization.

	Actions
Create Organiz	zation

Figure 15: Create Organization action

This will display a window where you can enter the Organization data.

		Organizatio	n Creation		3
)rga	nization Name				
ΤE	ST_ORG				~
)esc	ription				
Org	ganization description				~
ont	ract ld				
43	123123				~
ont	act Name				
	act Mail				
.ont	act Mail				
ont	act Phone				
ont	act Phone				
		Description v	Country	City	~
	act Phone DataCenters ~	Description ~	Country ~	Сіту	~
~		Description ~ Alcobendas Data Center 2503	Country ~	City	~
*	DataCenters ~	Alcobendas Data Center 2503	Country ~ Spain	City	~
*	DataCenters ~ DC_2503	Alcobendas Data Center 2503			×
*	DataCenters ~ DC_2503	Alcobendas Data Center 2503			~
*	DataCenters ~ DC_2503	Alcobendas Data Center 2503			· ·
*	DataCenters ~ DC_2503	Alcobendas Data Center 2503			~
*	DataCenters ~ DC_2503	Alcobendas Data Center 2503			~
*	DataCenters ~ DC_2503	Alcobendas Data Center 2503			~
* * *	DataCenters ~ DC_2503 DC_2504	Alcobendas Data Center 2503 Alcobendas Data Center 2504			
* * *	DataCenters ~ DC_2503	Alcobendas Data Center 2503 Alcobendas Data Center 2504			↓ 1-2 of 2 items
* * *	DataCenters ~ DC_2503 DC_2504	Alcobendas Data Center 2503 Alcobendas Data Center 2504		Alcobendas	

Figure 16: Organization Creation form

- 3) Enter the following Organization data:
 - **Organization Name**: It represents the Organization in the Domain. This name has to be unique for all Organizations.
 - **Description**: Text describing the new organization.

- Contract Id
- **Organization Contact information**: The contact name, mailing address, and phone number.
- Organization DataCenters.

1.1.8.2 Activating the Organization

Follow these steps to activate an Organization:

1) Select the Organization to activate, left-click **Actions** and select **Deploy Organization**.

_	Actions -
	Create Organization
	Deploy Organization
	Edit Organization
4	Delete Organization
F	Manage Organization Quota

Figure 17: Deploy Organization action

This will display a confirmation window.

€ Confirm	*
Do you want to deploy this organization?	
	Yes No

Figure 18: Organization Deployment - Confirmation Window

Once the activation has been launched, a message is displayed in the notification area and the corresponding job in the **Jobs Monitor**.

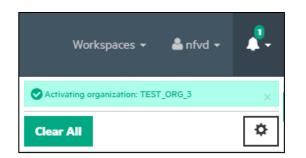


Figure 19: Activating Organization confirmation message in the notification area

	Operation	Name	Start time	End time	
्	deployOrganization	Activating organization: TEST_ORG_3	2016-04-15 01:40:59		,

Figure 20: Activating Organization message in the Jobs Monitor

You can follow the activation job progress in the **Job Tracking Screen** by clicking the **deployOrganization** link in the **Jobs Monitor**.

2) Wait until the activation job is finished and a message is displayed in the notification area.

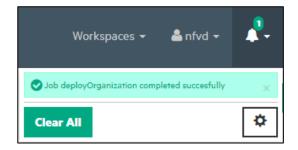


Figure 21: Organization Activation completed message in the notification area

The job status changes to **OK** in the **Jobs Monitor**.

Jobs Monitor 🚺 🗸					
Operation	Name	Start time	End time		
deployOrganization	Activating organization: TEST_ORG_3	2016-04-15 01:40:59	2016-04-15 01:42:24	×	
Clear All					

Figure 22: Organization Activation completed message in the Jobs Monitor

Once the job is completed, the Organization status changes from **INSTANTIATED** to **ACTIVE** after a table refresh.

1.1.8.3 Editing an Organization

Follow these steps to edit an existing Organization:

1) Select the Organization, left-click **Actions** and select **Edit Info Organization**.

Actions 🝷		
Create Organization		
Deploy Organization		
Edit Organization		
Delete Organization		
Manage Organization Quota		

Figure 23: Edit Organization action

2) Edit the Organization data and click **Save**.

	Organization Edition ×			
Orga	anization Name			
TE	EST_ORG_3			✓
Desc	ription			
Or	ganization description			×
Cont	tract Id			
43	123123			×
Cont	tact Name			
со	ntact			×
Cont	tact Mail			
	ntact@contact			✓
	tact Phone			
	3423			•
	DataCenters ~	Description ~	Country ~	City ~
ž	DC_2503 DC_2504	Alcobendas Data Center 2503 Alcobendas Data Center 2504	Spain	Alcobendas
	00,000	Acodendas Bala center 2504	Span	ncoocinata
	4			
		10 + items per page		1 - 2 of 2 items
				Reset Save Cancel

Figure 24: Organization Edit form

Organization Name cannot be changed and you can only attach new Datacenters to the Organization but not detach them.

Ærror	×
Detach DCs from Organization is not allowed.	
	Close

Figure 25: Detaching Organization Datacenters error message

A confirmation window is displayed.

🕑 Do you want to save data?	
Do you want to save data?	
	Yes No

Figure 26: Organization Editing confirmation window

3) Click **Yes** in the confirmation window.

A confirmation message is displayed in the notification area after the Organization has been updated.

Workspaces 👻 💄 nfvd 👻	* -
Organization TEST_ORG_3 edited	×
Clear All	۵

Figure 27: Organization edited confirmation message in notification area

1.1.8.4 Deleting the Organization

Only Organizations without ACTIVE VDC can be deleted. Otherwise, this option will not be available.

Follow these steps to delete an Organization:

1) Select the Organization to delete, left-click Actions and select Delete Organization.

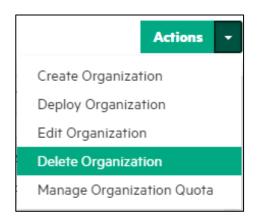


Figure 28: Delete Organization action

A confirmation window is displayed.

Confirm	22
Are you sure you want to delete the selected organization?	
	Yes No

Figure 29: Organization Deleting confirmation window

2) Click **Yes** in the confirmation window.

Once the activation has been launched, a message is displayed in the notification area (the bell icon at top right) and the corresponding job in the **Jobs Monitor**.

Workspaces 👻 🚢 nfvd 👻	* -
Deleting organization: TEST_ORG_3	×
Clear All	۵

Figure 30: Deleting organization message in notification area

			् ।	obs Monitor	1-
	Operation	Name	Start time	End time	
0	undeployOrganization	Deleting organization: TEST_ORG_3	2016-04-15 01:34:58		×
С	lear All				

Figure 31: Deleting organization message in the Jobs Monitor

You can follow the activation job progress in the **Job Tracking Screen** by clicking on the **undeployOrganization** link in the Jobs Monitor.

3) Wait until the delete job completes and a message appears in the notification area.

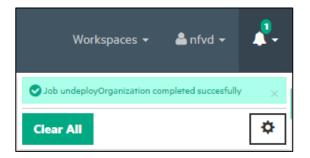


Figure 32: Deleting organization completed message in notification area

The job status changes to **OK** in the **Jobs Monitor**.

			J	obs Monitor (1-
	Operation	Name	Start time	End time	
	undeployOrganization	Deleting organization: TEST_ORG_3	2016-04-15 01:34:58	2016-04-15 01:36:34	×
С	lear All				

Figure 33: Deleting organization completed message in the Jobs Monitor

1.2 Datacenter Level

1.2.1 Datacenter Entity

The Datacenter Entity represents a physical datacenter.

Datacenter is the physical facility used to house computer systems and associated components, such as storage systems and networking infrastructure. It includes the entire physical infrastructure:

- power supplies
- data communications connections
- environmental controls (cooling, fire suppression)
- a number of security items.

Datacenters also include their own management infrastructures.

1.2.2 Datacenter Users

A Datacenter User is intended to manage a specific Datacenter of the domain. It can be registered by a Domain User or another Datacenter User.

Currently a Datacenter User can only manage a datacenter, so Datacenter information must be specified when the user is created from the NFVD Portal.

The following table includes the profiles and operations available for a Domain User:

Table 3: Datacenter User Profiles and Operations

Profile	Operations
Administrator	Manage Datacenter Users

Monitoring	
e.m.e.m.g	

1.2.3 Datacenter Resources

The resources available in a Datacenter are determined by its infrastructure: all available servers and infrastructure that can be used for virtualizing, and will be used for VNF deployments.

A Domain User can view the resources in all Datacenters, but Datacenter User can only view the resources of its own Datacenter.

Follow these steps as a Datacenter User to view your Datacenter servers:

1) Click **Summary** in the top bar.

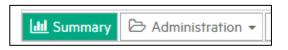


Figure 34: Datacenter Summary option in the top bar

2) Click the drop-down list to display a Server list.

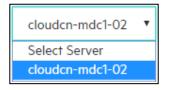


Figure 35: Select Server drop-down list

A window with a list of all the servers in the Datacenter is displayed.

Server 🗸	Model	Usage Mode V	Туре 🗸
BAR-bare-0-G_B	DL380	guaranteed	baremetal
NFVCN-dc2-01	DL360	shared	compute
NFVCN-dc2-02	DL380	shared	compute
CloudCN-dc2-01	DL380	dedicated	compute
BASE-CCP-CPX-N0001-NETCL		shared	compute
CloudCN-dc2-01	DL380	dedicated	compute
BASE-CCP-CPX-N0001-NETCL		shared	compute
BAR-bare-O-G_B	DL380	guaranteed	baremetal
NEVON der 02	007 10	charod	computo >
	▶ 10 ▼ items per page		1 - 10 of 10 item

Figure 36: Select Datacenter Server window

Select the server and left-click **Cancel** to display additional server information.

Clou	udCN-dc2-	01 Summary	
DataCenter View V DC_2504 V CloudCN-dc2-01 V			
Name	~	Model	~
CloudCN-dc2-01		DL380	
Class	×	Usage Mode	~
Class_B		dedicated	
Туре	×	Operational Status	~
compute		UP	
Hostname	×	Admin Status	~
CloudCN-dc2-01		UP	

Figure 37: Datacenter Server Details

1.3 Organization level

1.3.1 Organization Entity

An Organization represents a particular company or contract in the Domain. An Organization Entity includes all the virtual infrastructure in the Domain within the particular Organization.

The organization entity will be registered in the system by a Domain User through "Organization Management" functionality.

1.3.2 Organization Users

An Organization User manages a specific Organization in the Domain. It can be registered by a Domain User or another Organization User.

Currently this user type can only manage an organization, so the organization must be specified when the user is created from the NFVD Portal. Refer to the <u>User Registration</u> section for additional information.

When an Organization User creates another one, it can only assign its own organization.

•
•

Figure 38: Assigning Organization to Organization User

The following table includes all the profiles and operations available for a Domain User.

Profile	Operations
Administrator	Manage Organization Users
	Manage VDC Users
	Manage VNF Group Users
Provisioning	Grant/Revoke VDC Images
	Manage VDC
	Manage VNF Groups
	View Jobs
	Manage Jobs
	Manage Networks
	Manage Organization Catalog
	Manage Organization Images
	Manage Organization Template Catalog
	Manage VDC Template Catalog
	Manage VNF Group Template Catalog
	Check VDCs Quota
	View VDC Manager
	Check VNF Group Quota
	Manage VDC Images
	Grant/Revoke VNF Group Images
	Manage Firewalls
	Manage Load-Balancers
	Manage VNFs
	Manage Monitors
	Manage Storage
	Manage VNF Group Images
Template Designer	Manage VNF Group Templates
	Manage VDC Templates
Monitoring	

Table 4: Organization User Profiles and Operations

1.3.3 Organization Resources

An Organization can only use available resources in its associated Datacenters. An Organization can use resources from one or more Datacenters (depending on the Organization contract). Those Datacenters are assigned to the Organization by a Domain User during registration.

You can assign a new Datacenter to a Group by editing it, but you cannot remove one from it. Refer to the <u>Organization</u> <u>Edition</u> section for additional information.

The guaranteed quotas that can be assigned to an Organization are restricted to resources that are available in its Datacenters.

1.3.4 Organization Quota

The Organization Quota determines the quantity of resources that can be used in that Organization for deploying VNFs. The Domain and Organization Users can manage the Organization Quota.

This functionality lets you assign a Domain Resource quota to the Organization. The Organization Quota will be restricted to those Domain Datacenters that were assigned to the Organization.

The resource types you can assign to an Organization is also restricted to its Private Catalog. Refer to the <u>NFV-D Catalog</u> section for additional information.

1.3.4.1 Organization Quota Management by Domain User

Follow these steps as a Domain User to change the Organization Quota.

1) Left-click Management and select Organization Management.

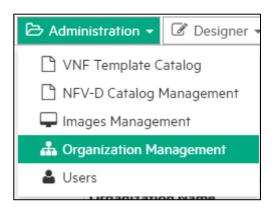


Figure 39: Organization Management option

2) In the window indicating the available Organizations, left-click Actions and select Manage Organization Quota.

Organization Name Description Contract Id Contract Name Sta Create Organization Edit Organization Delete Organization Delete Organization Delete Organization
IT_Reseller Organization DEF Manage Organization

Figure 40: Manage Organization Quotas action

The **Organization Quota Management** screen is displayed where you can assign a quota on Domain resources to that Organization.

				NFV-D Reso	ources			
	Search						×	Q 📜
Effort	Guaranteed Quota							
				OpenSta	ck			
	tual Cores Pedicated	Virtual Not Ded		Virtual M Page Siz		Virtual N Page Si		
Assigned:	0	Assigned:	0	Assigned:	0	Assigned:	0	
itock:	13	Stock:	30	Stock:	192544	Stock:	290848	
Amount:		Amount:		Amount:		Amount:		
	5 Units		5 Units	40	96 MB	4(096 MB	



1.3.4.2 Organization Resource Inventory (Quota Summary)

Organization Users can access a summary of all Organization Quotas filtered by VDC or VNF Group.

Click **Resource Inventory** as an Organization User to access your Organization Quota.

Figure 42: Resource Inventory option

		TEST_ORG	Summary		
Organization View 🔹 💙	Best Effort Quota 🔻				
OpenStack	Virtual Load Balancer	Networking	Virtual Firewalls	Special Ports	Baremetal Devices
	Virtual Co	e: esources VS Total Resources ores - Dedicated: 0/8 Units emory - Page Size 4K: 0/4097	т		

Figure 43: Quota Summary

One of three Quota views can be selected in the drop-down list.



Figure 44: Organization Summary Views

• **Organization View**: It displays all Organization Quota.

Clicking on the left icon (magnifying glass) for a resource displays a graph indicating its availability and the consumption by VDC.

	VDO	: A	
	Virtual Memory	r – Page Size 2M	
VDC_AN_3	VDC_AN_2	VDC_AN	VDC_AJ2
		/ – Page Size 2M	
	consum	ed 📕 total	

Figure 45: Virtual Memory – Page Size 2M graph

• **VDC View**: This displays the Organization Quota by its VDCs.

Select VDC	
VDC Name ~	VDC Description ~
VDC_AN_3	VDC_AN_3
VDC_AN_2	VDC_AN_2
VDC_AN	VDC_AN
VDC_AJ2	VDC_AJ2
• • • • • • • • • • • • • • • • • • • •	⊧ 1 - 4 of 4 items
I I I I I I I I I I I I I I I I I I I	1 - 4 of 4 items
	Cancel

Figure 46: Organization VDC selection

Selecting a VDC displays its Quota Summary:

VDC View	VDC_AN •	VDC_AN S	Summary		
OpenStack	Virtual Load Balancer	Networking	Virtual Firewalls	Special Ports	Baremetal Devices
	View Typ Quota	ve: VS Total Resources	T		
		ores - Dedicated: 18/24 Units	Q		
	Virtual C	ores - Not Dedicated: 10/47 Uni	its Q		

Figure 47: VDC Quota View

Left-click the second drop-down list to select another VDC.

VDC View	>	Select VDC	•
----------	---	------------	---

Figure 48: VDC Section drop-down list

This displays the $\ensuremath{\textbf{VDC}}$ selection window again.

• VNF Group View: This displays the Organization Quota by its VNF Groups.

	 VDC Description 	~
/DC_AN_3	VDC_AN_3	
/DC_AN_2	VDC_AN_2	
/DC_AN	VDC_AN	
/DC_AJ2	VDC_AJ2	

Figure 49: Organization VDC selection

After selecting a VDC, one of its VNF_GROUPs must be selected in the next window:

	 VNF Group Description 	~
EST_VNF_GROUP_2	TEST_VNF_GROUP_2_	
EST_VNF_GROUP	TEST_VNF_GROUP	
		Þ

Figure 50: Organization VNF Group selection

This displays the VNF Group Quota Summary.

>	TEST_VNF_GROUP Su	mmary	
VNF Group View TEST	TENANT V TEST_VNF_GROUP V	> Best Effort Quota	
OpenStack	Networking	Special Ports	Baremetal Devices
	View Type: consumed/total		
	Virtual Cores - Dedicated: 0/8 Units		
	Virtual Memory - Page Size 4K: 0/9 MB		

Figure 51: VNF Group Quota Summary

Click the second drop-down list to open the VDC selection window.

VNF Group View 🔹 💙	TEST_TENANT	•	
--------------------	-------------	---	--

Figure 52: VDC selection drop-down list

Click the third drop-down list to display the VNF_GROUP selection window and select another VNF Group.

Figure 53: VNF Group selection combo box

1.3.4.3 Organization Quota Quick View

If you are logged in as an Organization User, you can click the **Next** icon (always available at the left side of the screen) to display a Quick View of all consumed/assigned Organization Quota:

	>
	-
I	

Figure 54: Organization Quota – Quick View icon

-	OpenStack		C
	Virtual Cores - Not Dedicated	2/4 Units	
	Virtual Memory - Page Size 4K	2048/32015 MB	2
	Virtual Disks - Virtual Disks	2/25 GB	2
	Virtual Machines - Virtual Machines	2/10000 Units	-
•	Virtual Load Balancer		alar
-	Networking		
-	Virtual Firewalls		
•	Special Ports		

Figure 55: Organization Quota - Quick View Navigation

Click the **Refresh** icon to refresh the Quota information:



Figure 56: Organization Quota – Quick View Refresh icon



Figure 57: Organization Quota – Quick View Refreshing

1.3.5 Organization Catalog

The Organization Catalog is the set of all the available templates in the Organization. There are two different types of Organization Templates:

- VDC Templates: Used to create VDCs in the Organization.
- VNF Templates: Assigned to the Organization VDCs to deploy the VNFs.

A Domain User can add templates to an Organization (or remove them from it) if those templates are available in the Domain Catalog.

An Organization User can create its own VNF templates from the Portal using the **VNF Component Designer** and the **VNF Designer**. The VNF Templates created and published from those designers will be available in the Organization Catalog of that user.

1.3.5.1 Organization Catalog Management

Only a Domain User can manage an Organization Catalog.

Two types of templates can be assigned to an organization: VDC and VNF templates.

• A VDC template is a particular template built to represent a resource infrastructure.

• A VNF template represents the design of a VNF and it will be the base piece used to create VNF instances.

Follow these steps to manage an Organization Catalog as a Domain User:

1) Left-click Management and select VNF Template Management to display a table of all Organizations.

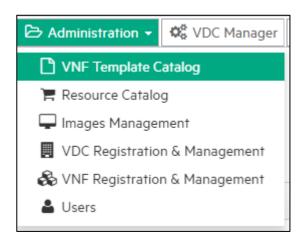


Figure 58: VNF Template Management option

2) Select an organization and left-click **Assign VDC Templates** or **Assign VNF Templates** depending on the type of template you are going to add to or remove from the Organization.

	Template Catalog	
		Actions 🝷
		Assign VDC Templates
Organization Name	Description	Assign VNF Templates
TEST_ORG_3	Organization description	*
TEST_ORG_2	Organization for testing	
TEST_ORG	Organization for testing	
< <tr> I 1 /1 ▶ Io ▼ items per page</tr>		▶ 1 - 3 of 3 items

Figure 59: Assign VDC Templates action

3) Select the Templates to include in the Organization Catalog and click Save.

Template Name 🗸 🗸	Description	~	Published By	~
VAPP_CCB3	VAPP_CCB3			
4				•

Figure 60: Assign Templates to Organization

1.3.6 Organization Image repository

The Organization Image repository contains all the Operative Systems Images, which can be deployed in a specific Organization. An Organization User can register and upload an Image from the **NFVD Portal** and make it public (accessible to other users) or private.

Refer to the <u>NFV Director Images Management</u> chapter for additional information on Image Management.

1.3.7 Organization VDC Management

One of an Organization User's responsibilities is managing its Organization VDCs:

- registering new VDCs in the system
- activating VDCs
- assigning Datacenters to registered VDCs
- managing VDC Catalog and Quota

1.3.7.1 Registering a VDC

Follow these steps to register a VDC as an Organization User.

 Left-click Management and select VDC Registration & Management to display all the VDCs in the Organization.

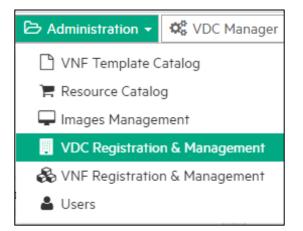


Figure 61: VDC Registration & Management option

2) Left-click Actions and select Create VDC to display all the VDC Templates available in the Organization Catalog.



Figure 62: Create VDC action

VDC Template Name 🛛 🗸	VDC Template Description V
VDC with Management Network (IPv4)	VDC with Management Network (IPv4)
VDC with Management Network (IPv6)	VDC with Management Network (IPv6)
Standard VDC	Standard VDC
4	

Figure 63: VDC Template selection

You have three possibilities:

- **Standard VDC**: This option represents a Virtual DataCenter (or VDC) standard. In this case the VDC will not create a network during the deployment, it only has quotas, users, resource pool, and catalog. This represents the base component of a VDC.
- VDC with Management Network (IPv4): This VDC will create, in addition, an external network and a management network. The IP address of the subnetwork in the management network will be in version 4 (for example, with mask: 10.0.0.0/24). It will be really useful on multisite environments.
- VDC with Management Network (IPv6): This VDC will be similar to VDC with Management Network (IPv4), but subnetwork's IP address will be version 6 (for example, with mask: 2001:0db8:0a0b:12f0:0000:0000:00001/64). It will be really useful on multisite environments.

NOTE: The management networks are deployed with a subnetwork but they are not displayed in the **VDC Manager**, because this network is for internal use and the user must not modify any network properties.

3) Select a VDC Template and click **Continue**.

l≞1

It is not possible to register a new VDC without a Template, so a Template has to be selected from the list. This will display a new modal window for entering VDC data.

- 4) Enter the required VDC data:
 - **VDC Name**: A name that represents the VDC in the system. It has to be unique for all VDCs in the NFVD.
 - **VDC Description**: A description for the new VDC.
 - **VDC Datacenters**: The VDC quota is restricted to the resources available in its associated Datacenters. A VDC cannot use resources from an unassociated Datacenter.

VDC Creation	×
Organization	
TEST_ORG	•
VDC Name	
TEST_VDC	✓
VDC Description	
TEST_VDC	~
✓ Name ✓ City	~
 ✓ DC_2503 ✓ DC_2504 ✓ Alcobendas 	*
	▼
Reset Save	of 2 items

Figure 64: VDC Creation form

A message is displayed in the notification area after the new VDC has been registered.



Figure 65: VDC registered confirmation message in the notification area

An error message is displayed in the notification area if the VDC has not been created due to an error.

A VDC can have two statuses:

- **INSTANTIATED**: This is the status of a VDC after it has been registered and before it has been activated.
- **ACTIVE**: This is the status of an appropriately activated VDC.

1.3.7.2 Activating a VDC

Follow these steps to activate a VDC.

1) Select the VDC to deploy, left-click Actions, and select Deploy VDC.

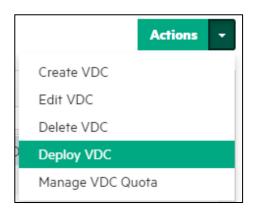


Figure 66: Activate VDC action

A message is displayed in the notification area and in the Jobs Monitor after the activation has been launched.



Figure 67: VDC activation message in the notification area

	🔅 Jobs Monitor 🔳)-
	Operation	Name	Start time	End time	
0	deployVdc	Activating VDC TEST_VDC	2016-04-19 00:38:30		×
С	ear All				

Figure 68: VDC activation message in the Jobs Monitor

You can follow the activation job progress on the **Job Tracking Screen** by clicking the **deployVdc** link in the **Jobs Monitor**.

2) A message is displayed in the notification area and the job status is changed to **OK** in the **Jobs Monitor** after the activation job has completed.

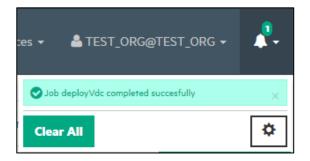


Figure 69: Successful VDC activation message in the notification area

				Jobs Monitor (1 -
	Operation	Name	Start time	End time	
	deployVdc	Activating VDC TEST_VDC	2016-04-19 00:38:30	2016-04-19 00:44:40	×
С	lear All				

Figure 70: Job status in the Jobs Monitor

The VDC status is changed from **INSTANTIATED** to **ACTIVE** after the job has completed. Refresh the table to see the changes.

1.3.7.3 Editing a VDC

Only the **Description** field can be updated in the VDC, **Name** and **Datacenters** cannot be changed.

Follow these steps to edit an existing VDC.

1) Select the VDC, left-click Actions and select Edit VDC.

Actions -
Create VDC
Edit VDC
Delete VDC
Deploy VDC
Manage VDC Quota

Figure 71: Edit VDC action

2) Edit the VDC description and click **Save**.

		VD	Edition	×
Organi	zation			
TEST_	ORG			۲
VDC Na	ame			
TEST	_VDC			<
VDC De	escription			
TEST	_VDC			✓
~	Name		~ City	~
	DC_2503			^
~	DC_2504		Alcobendas	
	4			۱.
ŀ	•	/1 🕨 🕨	10 • items per page	1 - 2 of 2 items
			Reset	Save Cancel

Figure 72: VDC editing form

A confirmation window is displayed.



Figure 73: VDC editing confirmation window

3) Click **Yes** in the confirmation window to display a confirmation message in the notification are after the VDC description has been updated.

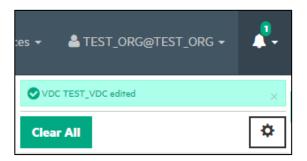


Figure 74: VDC edited confirmation message in the notification area

1.3.7.4 Deleting a VDC

Only VDCs with no VNF Group, Virtual Link, or VNF status can be deleted. Otherwise, this option will not be available.

Follow these steps to delete a VDC.

1) Select the VDC to delete, left-click Actions and Delete VDC.

Actions	•
Create VDC	
Edit VDC	
Delete VDC	
Deploy VDC	
Manage VDC Quota	

Figure 75: Delete VDC option

A confirmation window is displayed.

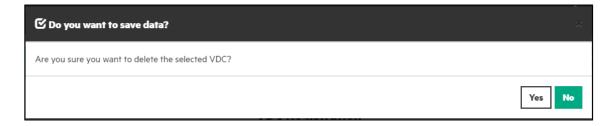


Figure 76: Confirmation window - Delete VDC

2) Click **Yes** in the confirmation window to display a confirmation message in the notification area and in the **Jobs Monitor**.



Figure 77: Delete confirmation VDC message in the notification area

	🤃 Jobs Monitor 🕦			
	Operation	Name	Start time	End time
٢	undeployVdc	Deleting VDC TEST_VDC	2016-04-19 01:19:27	×
C	ear All			

Figure 78: Delete VDC message in the Jobs Monitor

You can follow the activation job progress on the **Job Tracking Screen** by clicking the **undeployVdc** link in the **Jobs Monitor**.

3) A message is displayed in the notification area and the job status is changed to **OK** in the **Jobs Monitor** after the delete job is completed.



Figure 79: VDC delete completed message in the notification area

				Jobs Monitor	
	Operation	Name	Start time	End time	
	undeployVdc	Deleting VDC TEST_VDC	2016-04-19 01:19:27	2016-04-19 01:23:23	×
С	lear All				

Figure 80: VDC delete completed message in the Jobs Monitor

1.4 VDC Level

1.4.1 VDC Entity

A VDC is a virtual infrastructure with several types of virtualized resources. It is where the VNF can be deployed. A VDC belongs to only one Organization (VDCs are not shared between Organizations) and it should be registered and activated by an Organization User using the **VDC Management** functionality.

1.4.2 VDC Users

A VDC User is intended to manage a specific VDC in a Domain Organization. It can be registered by a Domain User, an Organization User, or another VDC User.

Currently this kind of user can manage an only VDC, so specify the VDC is mandatory when the user is created from the NFVD Portal.

When a VDC User creates another one, it can only assign its own VDC. If the VDC User is created by an Organization User, it is only possible to assign it a VDC of the user's organization.

The following table indicates the profiles and operations available for a VDC User.

Table 5: VDC User Profiles and Operations

Profile	Operations
Administrator	Manage VDC Users
	Manage VNF Group Users
Provisioning	Grant/Revoke VNF Group Images
	Manage VNF Groups
	Manage Firewalls
	Manage Jobs
	Manage Load-Balancers
	Manage Networks
	Manage VDC Images
	Manage VDC Template Catalog
	Manage VNFs
	Manage VNF Group Template Catalog
	Check VDCs Quota
	View VDC Manager
	Check VNF Groups Quotas
	View Jobs
	Manage Monitors
	Manage Storage

	Manage VNF Group Images
Template Designer	Manage VNF Group Templates
	Manage VDC Templates
Monitoring	

1.4.3 VDC resources

A VDC can only use the available resources in its Datacenters. The resources will be used to deploy VNFs in that specific VDC.

When a VDC is registered by an Organization User its associated Datacenters have to be indicated. You can assign a new Datacenter to a VNF Group by edition but not remove it.

The guaranteed quotas that can be assigned to a VDC are restricted to those resources that are available in its Datacenters.

1.4.4 VDC Quota

The VDC quota determines the quantity of resources that can be used in that VDC for deploying VNFs. Only an Organization User can manage VDC quota.

Follow these step to manage VDC Quote as an Organization User:

1) Left-click **Administration** and select **VDC Registration & Management** to display all the VDCs in the Organization.

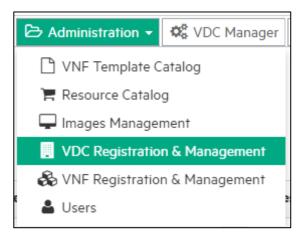


Figure 81: VDC Registration & Management option

2) Select the VDC, left-click Actions and select Manage VDC Quota to display the VDC Quota Assignment screen.

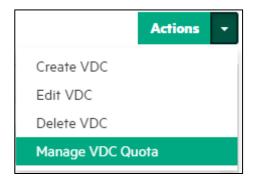


Figure 82: Manage VDC Quota action

	NFV-D Catalog Assignment - TEST_TENANT Search					×	Q 📜	
st Effort	Guaranteed Quota							
OpenStack								
	ual Cores edicated	Virtual Co Not Dedica		Virtual M Page Siz		Virtual M Page Siz		Virtual Memory Page Size 1G
Assigned:	0	Assigned:	0	Assigned:	0	Assigned:	0	
Stock:	5	Stock:	5	Stock:	4096	Stock:	4096	No items in stock
Amount:	0 Units	Amount: 0	Units	Amount:	0 MB	Amount:	0 MB	

Figure 83: VDC Quota Assignment

The quota that an Organization can assign to a VDC is restricted by its own Organization Quota. Refer to *Organization Quota_*for additional information.

1.4.4.1 VDC Resource Inventory (Quota Summary)

VDC Users can access a summary of all of their VDC Quotas, filtering them by VNF Group.

Click on the Resource Inventory option as a VDC User to access your VDC Quota.

Figure 84: Summary option

>	VDC View	Best Effort Quota	TEST_TENAN	T Summary		
_	OpenStack	Virtual Load Balancer	Networking	Virtual Firewalls	Special Ports	Baremetal Devices
			View Type:			
			Quota VS Total Resources	•		
			Virtual Cores - Dedicated: 8/8 Units			
				Q.		
			Virtual Memory - Page Size 4K: 9/9 MB			
				۵,		
			Virtual Memory - Page Size 2M: 11/11 MB	1		
				۹,		

Figure 85: VDC Summary screen

You can access two quota views with the VDC View drop-down list:

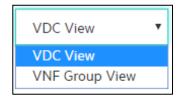


Figure 86: VDC Summary Views

• **VDC View**: Displays all VDC Quota. Click the magnifying glass icon to the left of a resource, displaying its availability and VDC consumption.

VDC 🕅					
Virtual Memory – Page Size 2M					
VDC_AN_3	VDC_AN_2	VDC_AN	VDC_AJ2		
	Virtual Memory – Page Size 2M				
consumed total					

Figure 87: Virtual Memory - Page Size 2M graph

• **VNF Group View**: Displays VDC Quota by VNF Groups. A list of all VDC VNF_GROUPs is displayed after selecting **VNF View** in the drop-down list.

/NF Group Name	~	VNF Group Description	~
EST_VNF_GROUP_2		TEST_VNF_GROUP_2_	
EST_VNF_GROUP		TEST_VNF_GROUP	
			•

Figure 88: Organization VNF Group selection

Selecting a VNF GROUP displays its Quota Summary.

> TEST_VNF_GROUP Summary					
VNF Group View	EST_TENANT V Y TEST_VNF_GROUP V	> Best Effort Quota			
OpenStack	Networking	Special Ports	Baremetal Devices		
View Type: consumed/total					
	Virtual Cores - Dedicated: 0/8 Units				
Virtual Memory - Page Size 4K: 0/9 MB					

Figure 89: VNF GROUP Quota Summary

Use the second drop-down list to select another VNF Group.

Figure 90: VNF Group selection drop-down list

1.4.4.2 VDC Quota Quick View

Click the **Quick View** icon, which is always available at the left side of the screen, as a VDC User to display a quick view of the quota consumption for every quota type.



Figure 91: VDC Quota Quick View icon

•	OpenStack		C
	Virtual Cores - Not Dedicated	3/4 Units !	2
	Virtual Memory - Page Size 4K	3072/32015 MB 🥑	
	Virtual Disks - Virtual Disks	3/25 GB 🥑	
	Virtual Machines - Virtual Machines	3/10000 Units 🥝	
•	Virtual Load Balancer		alan
•	Networking		
•	Virtual Firewalls		
•	Special Ports		

Figure 92: VDC Quota Quick View Navigation

Click the **Refresh** icon to refresh the Quota information.



Figure 93: VDC Quota - Quick View Refresh icon



Figure 94: VDC Quota Quick View refreshing

1.4.5 VDC Catalog

A VDC Catalog is a set of VNF Templates assigned to the VDC. Only an Organization User can manage a VDC Catalog.

Follow these steps to make changes in a VDC Catalog:

1) Left-click **Administration** and select **VNF Template Catalog** to display a list of all VDCs in a User's Organization.

🔁 Administration 👻	📽 VDC Manager				
C VNF Template Catalog					
🏲 Resource Catalog					
🖵 Images Management					
VDC Registration & Management					
🗞 VNF Registration & Management					
🛔 Users					

Figure 95: VNF Template Catalog

2) Select a VDC, left-click **Actions** and select **Assign Templates** to display all the VNF Templates assigned to the User's Organization.

Temp	late Catalog	
		Actions 🔻
VDC Name	 Description 	Assign Templates
TEST_TENANT_2	New description for tenant	*
TEST_VDC TEST_TENANT	TEST_VDC Tenant for testing	
4		+ F
I 1 / 1 I I I I I I I I I I I I I I I I		1 - 3 of 3 items

Figure 96: Assign Templates action

3) Select all the templates to add to the VDC Catalog and unselect the ones to remove.

EST_VNF_TEMPLATE	1 TEST_VNF_	TEMPLATE_1	
ST_VNF_TEMPLATE	2 TEST_VNF_	TEMPLATE_2	

Figure 97: Assign Templates to the VDC

4) Click Save to save changes and refresh the table indicating the VNF Templates of the selected VDC.

Template Name	Description	~	Published By	~
TEST_VNF_TEMPLATE_1	TEST_VNF_TEMPLATE_1			
TEST_VNF_TEMPLATE_2	TEST_VNF_TEMPLATE_2			
<				•
[4] 4] 1 / 1 ► ► 1 10 ▼	items per page			1 - 2 of 2 items

Figure 98: VDC VNF Templates tables

1.4.6 VDC Image repository

The VDC Image repository contains all the Operative System Images that can be deployed in a specific VDC. A VDC User can register and upload an Image from the NFVD Portal and make it either public (accessible to other users) or private.

Refer to the <u>NFV Director Images Management</u> chapter for additional information on Image Management.

1.4.7 VDC VNF Group Management

A VDC User's responsibilities include managing VNF Groups:

- registering new VNF Groups in the system
- assigning and activating Datacenters
- managing the Catalog and its quota

An Organization User can carry out those functions too.

1.4.7.1 Registering a VNF Group

Follow these steps to register a VNF Group.

1) Left-click Administration and select VNF Registration & Management to display the VNF Group Registration screen.

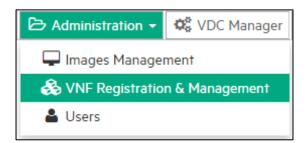


Figure 99: VNF Group Registration & Management option

2) Left-click Actions and select Create VNF Group.

		VNF Group Reg	istration		
Organization		VDC			
TEST_ORG	÷	TEST_TENANT	× -	Act	tions 👻
L				Create VNF Group	
VNF Group Name	✓ Description	VDC	VDC Description	✓ Status	~
TEST_VNF_GROUP_2	TEST_VNF_GROUP_2_	TEST_TENANT	Tenant for testing	INSTANTIATED	*
TEST_VNF_GROUP	TEST_VNF_GROUP	TEST_TENANT	Tenant for testing	ACTIVE	
4					
	I 10 Titems per page			1	1 - 2 of 2 items

Figure 100: Create VNF Group action

A modal window is displayed to enter the new VNF Group information.

rganization		VNF Group Name				
EST_ORG		VNF_GROUP				
elect organization		VNF Group Name	VNF Group Name			
DC		VNF Group Description				
EST_TENANT		•				
elect VDC		VNF Group Description				
Name		~ Country	~ City	~		
✓ DC_2503	Alcobendas Data Center 2503					
✓ DC_2504	Alcobendas Data Center 2504	Spain	Alcobendas			

Figure 101: Create/Edit VNF Group

- 3) Enter the VNF Group information:
 - **VDC**: This is the logged in VDC User. If the logged in user is an Organization User, a VDC of user's Organization can be selected.
 - **VNF Group Name**: This unique name represents the VNF Group in the System.
 - VNF Group Description: This describes the VNF Group.
 - **VNF Group Datacenters**: The VDC Quota is restricted to the resources available in its associated Datacenters.
 - Click Save.

A message is displayed in the notification area indicating the success or failure of VNF Group creation.

ces + 📥 TEST_ORG@TEST_ORG +	^ -
VNF Group TEST_VNF_GROUP registered	×
Clear All	۵

Figure 102: VNF Group creation feedback in the notification area

The VNF Group is registered with **INSTANTIATED** status.

1.4.7.2 Activating a VNF Group

Follow these steps to activate a VNF Group.

1) Select the VNF Group to deploy, left-click Actions and select Deploy VNF Group.



Figure 103: Deploy VNF Group action

After activation is complete, a message is displayed in the notification area and the **Jobs Monitor** indicates the corresponding job.

ces + 🔺 TEST_ORG@TEST_ORG +	* *
Activating VNF Group TEST_VNF_GROUP	×
Clear All	۵

Figure 104: VNF Group activation feedback in the notification area

	Operation	Name	Start time	End time	
¢	deployVnfGroup	Activating VNF Group TEST_VNF_GROUP	2016-04-13 15:15:09		>

Figure 105: VNF Group activation feedback in the Jobs Monitor

Click the **deployVnfGroup** link in the **Jobs Monitor** to follow the activation job progress.

2) After the activation job is completed, a message is displayed in the notification area.

ces + 📥 TEST_ORG@TEST_ORG +	4 -
Sob deployVnfGroup completed succesfully	×
Clear All	۵

Figure 106: VNF Group activation completed message in the notification area

The job status is changed to **OK** in the **Jobs Monitor**.

					Jobs Monitor (1-
		Operation	Name	Start time	End time	
deployVnfGroup Activating VNF Group TEST_VNF_GROUP:OK	•	deployVnfGroup	Activating VNF Group TEST_VNF_GROUP	2016-04-13 15:15:09	2016-04-13 15:17:06	×
	C	lear All				

Figure 107: VNF Group activation completed in the Jobs Monitor

After the job is completed, refresh the table to see that the VNF Group status has changed from **INSTATIATED** to **ACTIVE**.

1.4.7.3 Editing a VNF Group

Only the **Description** field can be updated in a VNF Group. The **Name** and **Datacenters** fields are disabled.

A Error	
You can't uncheck previously added DCs	
	Close

Figure 108: Error removing VNF Group DC message

Follow these steps to edit an existing VNF Group.

- 1) Select the VNF Group and click Edit VNF Group under Actions.
- 2) Change the VNF Group description.
- 3) Click Save.
- 4) Click **Yes** in the confirmation window.

C Do you want to save data?	
Do you want to save data?	
	Yes No

Figure 109: VNF Group Editing confirmation window

After VNF Group editing is completed, a confirmation message is displayed in the notification area.



Figure 110: VNF Group edited message in the notification area

1.4.7.4 Deleting a VNF Group

Only VNF Groups without active VNFs can be deleted. Otherwise, this option will not be available.

Follow these steps to delete a VNF Group.

1) Select the VNF Group to delete, left-click Actions and select Delete VNF Group.

Actions	
Create VNF Group	
Edit VNF Group	
Delete VNF Group	
VNF Group Templates Assignment	
Deploy VNF Group Manage VNF Group Quota	

Figure 111: Delete VNF Group action

A confirmation window is displayed.

C Are you sure you want to delete this item?	
Are you sure you want to delete this item?	
	Yes No

Figure 112: Delete VNF Group confirmation window

2) Click **Yes** in the confirmation window. After activation has been launched, a message is displayed in the notification area.



Figure 113: Deleting VNG Group message in the notification area

The Jobs Monitor displays a feedback.

			្រារ	obs Monitor	1-
	Operation	Name	Start time	End time	
0	undeployVnfgroup	Deleting VNF Group TEST_VNF_GROUP_2	2016-04-13 17:20:31		×
c	lear All				

Figure 114: Delete VNF Group feedback in the Jobs Monitor

Click the **undeployVnfGroup** link in the **Jobs Monitor** to follow the activation job progress.

3) When the delete job is completed, a message is displayed in the notification area.



Figure 115: VNF Group delete completed feedback in the notification area

The job status is changed to **OK** in the **Jobs Monitor**.

					lobs Monitor 🌔]-
		Operation	Name	Start time	End time	
undeployVnfgroup Deleting VNF Group TEST_VNF_GROUP_2:OK		undeployVnfgroup	Deleting VNF Group TEST_VNF_GROUP_2		2016-04-13 17:21:09	×
	c	lear All				

Figure 116: VNF Group delete complete feedback in the Jobs Monitor

After the job is completed, refresh the table to see that the VDC status has changed from **INSTATIATED** to **ACTIVE**.

1.5 VNF Group Level

1.5.1 VNF Group Entity

The VNF Group Entity represents a group of VNFs that are deployed or can be deployed in a VDC. This VNF Group is intended for management purposes.

1.5.2 VNF Group Users

A VNF Group User is intended to manage a specific VNF Group in an Organization VDC. The VNF Group can be registered by a Domain User, an Organization User, a VDC, or another Group User.

Currently this user type can only manage VNF Groups, so the Group must be specified when creating the user in the NFVD Portal.

When a VNF Group User creates another User, they can only assign their own VNF Group. If the Group User is created by a VDC User, its associated VNF Group has to belong to the user's VDC.

The following table indicates the profiles and operations available for a VNF Group User.

Profile	Operations
Administrator	Manage VNF Group Users
Provisioning	Manage Jobs
	Manage Monitors
	Manage Storage
	Manage VNFs
	Manage VNF Group Images
	Manage VNF Group Template Catalog
	View VDC Manager
	Check Quotas VNF Groups
	View Jobs
Template Designer	Manage VNF Group Templates
Monitoring	

Table 6: VNF Group User Profiles and Operations

1.5.3 VNF Group Resources

A Group can only use resources available in its Datacenters. Such resources will be used to deploy VNFs in that VNF Group.

When a Group is registered by an Organization User or a VDC User its associated Datacenters have to be indicated. You can assign a new Datacenter to a Group by editing it, but you cannot remove one.

The Quotas that can be assigned to a Group are restricted to quotas available in its Datacenters.

1.5.4 VNF Group Quota

The VNF Group Quota determines the quantity of resources that can be used in that VDC for deploying VNFs. Organization and VDC Users can manage a VNF Group Quota.

Follow these steps to manage VNF Group Quota.

1) Left-click **Administration** and select **VNF Registration & Management** to display the available VNF Groups screen.

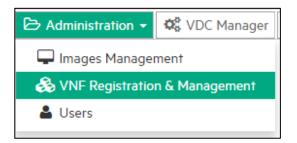


Figure 117: VNF Registration & Management option

2) Select the Group, left-click Actions and select Manage VNF Group Quota.



Figure 118: Manage VNF Group Quota action

This will display the Manage VNF Group Quota screen.

NFV-D Catalog Assignment - TEST_VNF_GROUP						
	Search				×Q	F
Best Effort Guaranteed Quota						
		Op	enStack			
١	/irtual Cores Dedicated	Virtual Cores Not Dedicated	Virtual Men Page Size 4		Virtual M Page Si	
Used:	0		Used:	0	Used:	0
Stock:	5	No items in stock	Stock:	6	Stock:	11
Amoun	t: 3 Units		Amount: उ	¢ MB	Amount:	0 MB

Figure 119: Manage VNF Group Quota

The quota available to a VNF Group is restricted by its VDC Quota. Refer to VDC Quota section for additional information.

1.5.4.1 VNF Group Resource Inventory (Quota Summary)

VNF Group Users can access a summary of their VNF Group.

Click the **Resource Inventory** option as a VNF Group user to access your VNF Group Quota.

Home 🔐 Resource Inventory 🕞 Administration 🕶	🗱 VDC Manager	🔅 Jobs	🖵 KPI Dashboard	Ø Browser
--	---------------	--------	-----------------	-----------

Figure 120: Resource Inventory

TEST_VNF_GROUP Summary					
OpenStack	Networking	Special Ports	Baremetal Devices		
	View Type: consumed/total Virtual Cores - Dedicated: 0/8 Units Virtual Memory - Page Size 4K: 0/9 ME Virtual Memory - Page Size 2M: 0/11 M				

Figure 121: VNF Group Summary screen

1.5.4.2 VNF Group Quota Quick View

Click the **Quick View** icon (always available on the left side of the screen) as a VNF Group User to view your VNF Group Quota Consumption and total for every Quota type.

>

Figure 122: VNF Group Quota - Quick View icon

•	OpenStack			C
	Virtual Cores - Not Dedicated	3/4 Units		
	Virtual Memory - Page Size 4K	3072/32015 MB	9	
	Virtual Disks - Virtual Disks	3/25 GB	9	
	Virtual Machines - Virtual Machines	3/10000 Units	•	
•	Networking			
•	Special Ports			\

Figure 123: VNF Group Quota Quick View Navigation

Click the refresh icon to refresh the Quota information.



Figure 124: VNF Group Quota Quick View Refresh icon



Figure 125: VNF Group Quota Quick View refreshing

1.5.5 VNF Group Catalog

A VNF Group Catalog is a set of VNF Templates assigned to that specific VNF Group. The VNF Group Templates are available to be instantiated in that VNF Group.

A VNF Group Catalog can be managed by an Organization User or a VDC User.

Follow these steps to make changes in a VNF Group Catalog.

1) Left-click Administration and select VNF Registration & Management to display the VNF Group Management screen.

🔁 Administration 🗸	🔅 VDC Manager		
🖵 Images Management			
👶 VNF Registration & Management			
💄 Users			

Figure 126: VNF Registration & Management option

2) Select a Group, left-click Actions and select Template Assignment VNF Group.

			VNF Group Reg	istratio	n		
Organization		,	VDC				
TEST_ORG		~	TEST_TENANT		× -		Actions -
						_	Create VNF Group
VNF Group Name	V Description	Ý	VDC	~	VDC Description	~	Edit VNF Group
							Delete VNF Group VNF Group Templates
TEST_VNF_GROUP_2	TEST_VNF_GROUP_2_		TEST_TENANT		Tenant for testing		Assignment
TEST_VNF_GROUP	TEST_VNF_GROUP		TEST_TENANT		Tenant for testing		Manage VNF Group Quota
TEST_VNF_GROUP	TEST_VNF_GROUP		TEST_TENANT		Tenant for testing		Manage VNF Group Quota
	▶ 10 ▼ items per pa						1 - 2 of 2 ite

Figure 127: VNF Group Templates Assignment action

The new window indicates all the VNF Templates assigned to the user's VNF Group.

rganization Name			
TEST_ORG			~
DC Name			
TEST_TENANT			~
/NF Group Name			
TEST_VNF_GROUP			~
Name	~	Description	~
TEST_VNF_TEMPLATE_1		TEST_VNF_TEMPLATE_1 TEST_VNF_TEMPLATE_2	
			1 - 2 of 2 ite
			1 2012116

Figure 128: VNF Group Template Assignment

3) Select all Templates to add to the VNF Group Catalog, unselect the ones to remove, and click **Save**. A confirmation window will be displayed.

C Do you want to save data?	
Do you want to save data?	
	Yes No

Figure 129: VNF Group Templates Assignment confirmation window

4) Click **Yes** in the confirmation window. This will also refresh the Templates table of the selected VNF Group.

Templates Instances	
Name ~	Description ~
TEST_VNF_TEMPLATE_1	TEST_VNF_TEMPLATE_1
TEST_VNF_TEMPLATE_2	TEST_VNF_TEMPLATE_2
	-
4).
1 /1 > 10 • items pe	r page 1 - 2 of 2 items

Figure 130: VNF Group Templates table

1.5.6 VNF Group Image repository

The VHF Group Image repository contains all the Operative Systems Images that can be deployed in a specific VNF Group. A VNF Group User can register and upload an Image from the NFVD Portal and make it either public (accessible to other users) or private.

Refer to the <u>NFV Director Images Management</u> chapter for additional information on Image Management.

Chapter 2 NFV Director VDC Manager

2.1.1 Introduction

The **VDC Manager** provides a graphical representation of a VDC and allows operations for virtual resources including VNF, VMs, monitors, or storage. In particular, the **VDC Manager** is used to deploy VNFs, perform and monitor day-to-day operations.

The VDC Manager access requires VDC role.

2.1.2 VDC Manager screens

2.1.2.1 Main screen

Once the user has logged in and has selected the **VDC Manager** in the top menu, a screen similar to the following illustration is displayed.

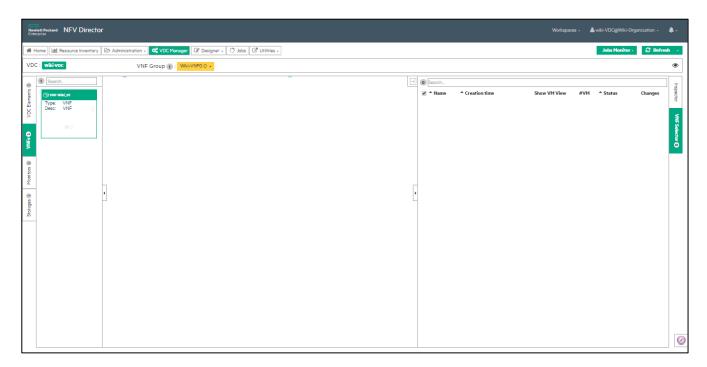


Figure 131: VDC Manager Main screen

Besides the top menu, the **VDC Manager Main screen** is divided into three sections. The leftmost section lists all Templates ready to instantiated, grouped by categories.

- VDC Elements, including networks and firewalls
- VNFs
- Monitors
- External Storage (VLUN)

The **VNFs** section contains the VNF Templates created with the designer, saved and published by the user.

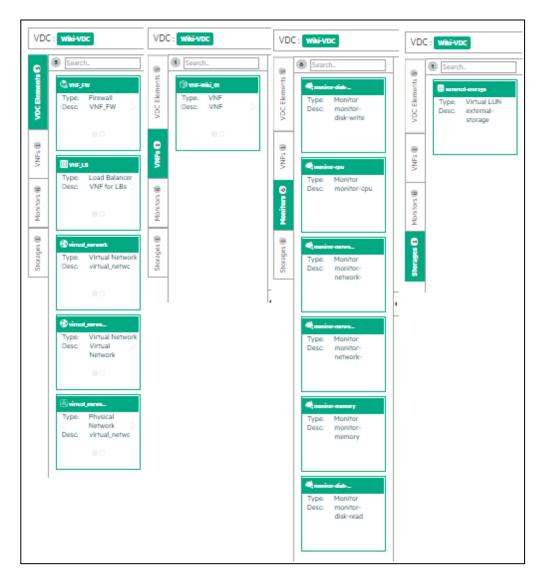


Figure 132: Available VDC Manager elements

The central section of the **VDC Manager** represents the workspace or VDC drawing area. This is where the user will drag all the necessary components to connect, edit, and operate on the elements. Depending on the operations, the components will change their status. These include component color change in the work space or the shape of the line that represents the connection between components. Each change in the workspace is designed to be intuitively detectable.

The third section, the right side, of the **VDC Manager Main screen** is where the **VNF Inspector** and the **VNF Selector** are located.

The **VNF Inspector** is used to display and edit each element's attributes. The **Inspector** pops up automatically when an element is selected in the workspace.

The **VNF Selector** lists the VNF instances currently deployed in the VDC. The **VNF Inspector** can be accessed by clicking on one element in the **VNF Selector**.

The VNF Inspector and the VNF Selector will be described in more details later in this guide.

VDC : wiki-vdc VNF Group 1 : Wiki-VNFG () •

Figure 133: VDC Manager top menu

The VDC Manager top menu has three elements from left to right:

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- VDC indicates the user currently logged in and using the VDC Manager. In the previous illustration, it is Wiki-VDC.
- VNF Group indicates the number (circled) of VNFs available from the VDC to be used in the VDC Manager.
- Enabled/Disabled icon (or •) indicates the Firewall status.
 - o Enabled: the workspace displays the VNF:FW.
 - o Disabled: the workspace displays only the virtual networks present.

One of the most important elements of the **VDC Manager Main screen** is the compass symbol in the bottom right corner of the window. When the user left-clicks this element, a small window indicating a miniature view of the workspace is displayed in the same corner of the **VDC Manager**. Depending on the number of connected entities, the workspace view could be difficult to manage. This zoomed out view lets you easily browse through the VDC. The following illustration shows the workspace with three Virtual Networks instantiated and the zoomed out view.

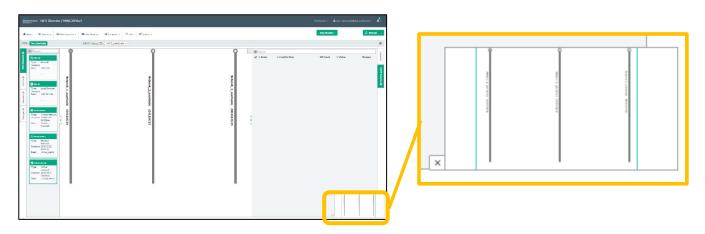


Figure 134: VDC Manager workspace with zoomed-out view

The blue lines indicate the borders of the screen visible at one time. Up to three networks can be viewed comfortably on the screen, but as more components are introduced in the workspace, the mini-map feature become very useful.

2.1.2.2 VDC Manager Inspector

The **VDC Manager Inspector** allows the editing and checking component's attribute. The **FW_UserGuide** component is displayed in the following illustration. This component is in a primary status, meaning that the element was recently instantiated and remains inactive. When selecting the element, the **Inspector** will display the structure inside the component.

Hewlett Packard NFV Director Enterprise			Workspaces 🗸 📥 wiki-VDC@Wiki-Organization 👻 🌲 👻
Home	Administration + 😻 VDC Manager 🕼 Designer + 💭 Jobs	Utilities *	Jobs Monitor - 🗘 Refresh -
VDC : Wiki-VDC	VNF Group 1 : Wiki-VNFG 0 •		۲
C Sectored Secto	Viki-VNF Tread		<pre>v End Point : endpoint Subnetwork : Service_Subnet v Wir Component : WN_COMPONE u V Wir Mould_FW Virtual Port : FW GUI Core Virtual Port : GUI_SERVICE v Wir WI_PAN_FW Virtual Port : PAN_SERVICE v Virtual Port : PAN_SERVICE v Virtual Port : PAN_SERVICE</pre>

Figure 135: VDC Manager Inspector

Selecting the network in the left side of the work space will display the information about the specific component.

Hewl	Rett Packard NFV Director						Workspaces 👻 🔺 wiki-VDC@Wiki-C	Organization 🗸 🌲 🗕	·
А Н	ome	🗁 Admi	nistration - 🗣 VDC Manager 🖉 Designer - 🔅 Jobs 🗹 Utilities -				Jobs Monitor	- 🤁 Refresh	-
VDC	: Wiki-VDC		VNF Group 1: Wiki-VNFG 0 •					۲	
VNFs (1) VDC Elements (5)	Search. Search. Critical storage Type: Virtual LUN Desc: external- storage	Wiki-	finanal	E		Virtual Network: Wiki-Network_01 Virtual Network: Wiki-Netw Type Virtual Network Name Wiki-Network_01 Description	Virtual Network : Wiki-Netw Network : Wiki-Network_01 Subnetwork : Wiki-Network_01	Actions	spector VNE Selector
Storages () Monitors ()	-	Wiki-Network	WHE-NEWYORK, CU		_	Wiki Net Status ACTIVE			
									Ø

Figure 136: VDC Manager Inspector

A useful feature of the Inspector provides the user direct access to the Virtual Machines present in the component, and vice versa. This feature is represented by a scope sym \clubsuit () displayed near the accessible elements.

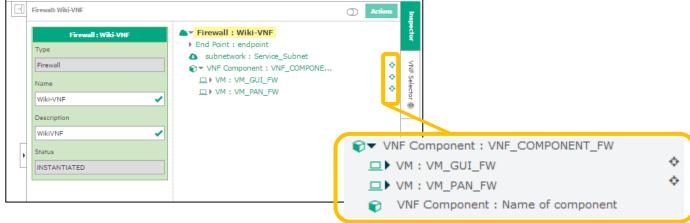


Figure 137: The scope symbol

The primary elements suitable for scoping are Virtual Machines. Left-clicking the scope symbol will display the Virtual Machine owned by the element with the scope feature, and will navigate to the corresponding VM Inspector. In order to return to the Virtual Machine parent element, left-click the dark green scope symbol in the top right corner of the attribute inspector window.

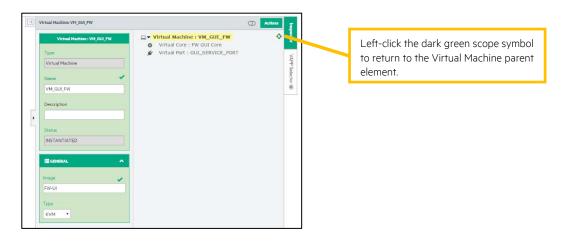


Figure 138: Return from scoping

The **Actions** switch in the **Inspector** title bar hides or displays all attributes of an instance, regardless of their visibility. This is useful for debugging. The **show all** mode displays all of the, mostly read-only, attributes.

Prevail 17 U. UA - Filterwith 12 HY, UAG View - Market is Schular Market is Schular - Market is Schular View - Market is Schular Pielus - Market i	Firewall: FW_UsG	D Action	* z	Virtual Network: Network_Unerfailde	C Actions
	Type Freeval Name PRJ, Und Decorption TW User Guide Stetus	End Point : endpoint A Network : Service subnetwork : Service_Subnet	Nabe Nabelane ®	Terr Inter Interest Inter Interest Recent On the Sam Date Recent On the Sam Date Interest O	Monitar : manitar-network Monitar : manitar-subnetwork Network : Network_UserGuide subnetwork : Network_UserGuide
			\bigcirc		

Figure 139: Enable/disable attributes window

The other element present in the top menu is the **Actions** button. Clicking this button displays a pop-up menu with all the operations available for the specific component. The actions' availability depends on the role of the user currently logged in.

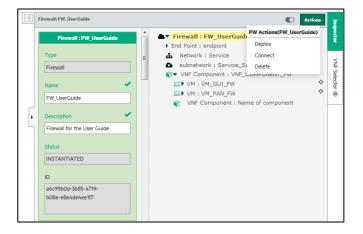


Figure 140: The Actions button

2.1.2.3 VDC Manager VNF Selector

The VDC Manager's **VNF selector** lists the selected VNF Group's VNF instances. These VNFs can be instantiated or deployed.

→ 1 Sear	rch				
A 1	Name	Creation time	VM Count	▲ Status	Changes
	F_User	2016-04-07 18:48:34	2	INSTANTIATED	
F					

Figure 141: VDC Manager VNF Selector

As you can see in the previous illustration, the selector lists the **VNF_User** component, which was created from the designer. This component displays the number of Virtual Machines, along with the actual status of the component, and the creation timestamp. Clicking an item in the **VNF Selector** opens the **VNF Inspector**.

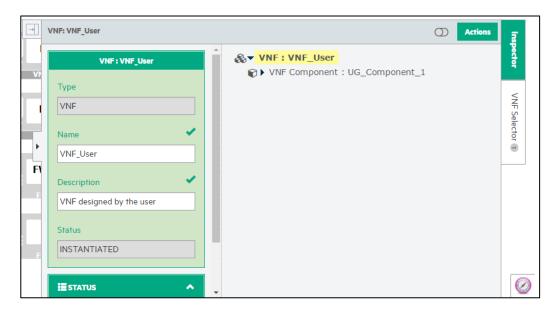


Figure 142: VNF Inspector

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2.1.2.4 Updating VDC Manager attributes

Attributes of non-deployed instances can be modified. Once a VNF is deployed, instances become read-only. After modifying attributes from an Inspector, changes have to be finalized with the **Update** operation. The result of the **Update** operation is global in the **VDC Manager**, meaning that all the modified attributes are stored regardless of element definition. This means that all modifications can be saved with a single **Update**.

There are two ways to initiate an Update:

- Left-click Actions and select Update.
- Right-click in the element previously selected in the workspace. The **VDC Manager** will display a list of actions available for the element.

NOTE: The workspace represents the VDC itself so it is enough to right-click in the empty region of the workspace to display the list of operations available for the element.

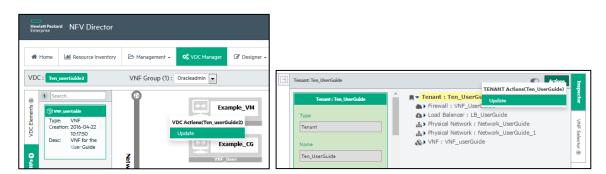


Figure 143: Updating VDC attributes

Left-click **Update** in the menu to execute a VDC workspace update. A window similar to the one in the following illustration will be displayed.

Update Instance:					×
Warning: Unchecked modifications will b Modified Attributes (2):	e lost after upda	te!			
Element	Attribute	Category	Old Value	New Value	
subnetwork : Network_UserGuide_1	Starting IP	VNF_DESIGNER.IPV4	10.0.0.0	14.0.0.0	
Firewall : VNF_UserGuide	Name		VNF_UserGuide	VNF_UserGuide_Mod	
				Update Ca	ncel

Figure 144: Update confirmation window

This window displays the modifications to be saved. In this case the IP address of a subnetwork owned by one of the virtual networks in the workspace was edited, as well as the **VNF_UserGuide** name. Click **Update** to start the update process. If the update was successful, a message similar to the one in the following illustration is displayed and the job is registered in the **Jobs Monitor**.

Click the **Symbol** to view the message.

VNF instance: updated successfully.

Figure 145: Instance update confirmation message

2.1.2.5 VDC Manager and the Management Network

There are two types of main VDCs that can be managed by the solution:

• Standard VDC, or

╘╘

• Management VDC with network type IPv4 or IPv6

This means we really have three types of VDCs. The difference between them is that the last one is associated with a **management_network**. This network is responsible for the communication between various entities needed by the VDC for correct operation. **The Management Network is hidden from the users** because the user will not need to modify any feature or attribute of the Management Network directly. This is also a security measure, because the Management Network carries out certain sensitive VDC management processes.

Also, the **Management Network** will allow communication between Datacenters in a multi-datacenter environment, where the **Management Network**, as stated previously, will remain hidden from the users.

The presence of the Management Network is also critical when the Datacenter/Resource Pool is going to be used with a DCN environment (SVN Platform, besides the OpenStack Platform). If the Datacenter was designed to be used with both platforms, apart from the DCN structure that has to be implemented in the datacenter, the VDC must be **Management** type, in order to have a management network properly configured for the future operations.

This type of VDC and network is also crucial for a specific VNF, the Firewall. Without a management VDC and a Datacenter specifically designed for both platforms, the **VNF Firewall** activation will fail.

NOTE: The **Management Network** is not the external network. The external network will only be visible in the **VDC Manager** when a **Management VDC** is used, and the external network will develop the communication between the machines and networks not managed by the solution or the OpenStack platform.

2.1.3 Virtual Network operations

Left-click **VDC Elements** to operate with networks in the **VDC Manager**. There are three types of suitable Virtual Networks detailed in the following sections.

2.1.3.1 Virtual Network attributes

The majority of all Virtual Networks' attributes and categories are similar with small additions or configurations. This section details the specific attributes of the Virtual Networks.

Virtual Network: Network_UserGuide Virtual Network : Network_UserGuide Type Virtual Network Name Name Network_UserGuide Description Network for the User Guide Status	 ✓ Virtual Network : Network_UserGuide ▲ Network : Network_UserGuide ▲ subnetwork : Network_UserGuide 	Inspector VNF Selector (1)
Status INSTANTIATED		

Figure 146: Virtual Network attributes

The previous illustration indicates the general attributes of the Virtual Networks. In this case the **Type** and **Status** attributes are disabled. Left-click in the **Name** and **Description** fields to edit their values.

These attributes are common to all Virtual Networks, as the elements that conforms the element, a VN always is going to have at least a Network and a Subnetwork.

The unique primary difference between the standard Virtual Network and the rest are small changes. The **Monitored Virtual Network** has two monitors already set to use, just as the **Physical Virtual Network**. The attributes of the Networks and Subnetworks are the same in both.

\rightarrow	Virtual Network: Network_UserGuide	\bigcirc	Actions	Ţ
	Network: Network_UserGuide Image: Second			Inspector
	Image: Second secon			VNF Selector (0)
Þ	segmentation_id			
	Access_level VIRTUAL_LINK VIRTUAL_LINK VIRTUAL_LINK			

2.1.3.1.1 The attributes of a Virtual Network's network

Figure 147: Virtual Network SDN category

The previous illustration indicates the selected Network, and the category and attributes of the Network part of the Virtual Network. These are minor components when working with the **VDC Manager**, so the only editable attribute of the Network is **SDN.Access_level**. This attribute can take only two possible values, **ANY** or **VIRTUAL_LINK**, so the Network is only going to gain access through the Virtual_Link.

If SDN Access level is set to **VIRTUAL_LINK**, then the Virtual Machines connected over that Virtual Link will only have access to that specific Virtual Link Subnetwork. Otherwise, if it is set to **ANY**, the Virtual Machines will be able to reach other ranges, either Internet or Virtual Links with access level set to **ANY**.

For example:

- If we create 3 Virtual Links
 - o NET1 with subnet range 10.0.0/24 and Access level ANY
 - o NET2 with subnet range 20.0.0/24 and Access level ANY
 - o NET3 with subnet range 30.0.0/24 and Access level VIRTUAL_LINK
- Then
 - o VM in NET1 will be able to ping (with appropriate routes) VMs on NET1 and NET2
 - o VM in NET1 will NOT be able to ping VMs on NET3 unless there is a FW or LB in between NET1 and NET3
 - VM in NET2 will NOT be able to ping VMs on NET3 unless there is a FW or LB in between NET2 and NET3
 - o VM In NET3 will be ONLY able to ping VMs on NET3

		TEST_VM VM Standrd VM	20.0.0.4) (3
	10.0.0.6	Carrier gr		
				Standrd M Standrd M Standrd M Standrd M Standrd Stand
				Carrier gr ∨∺ DHCP
NET1	DHCP	FW Firewall	DHCP	DHCPDHCP

Figure 148: Possible connections for various Virtual Networks

-+	Virtual Network: Network_UserGuide		Actions	ਡ
	Name Network_UserGuide	 Virtual Network : Network Network : Network subnetwork : Network 		Inspector
				VNF Selector (0)
	.= I ^p · · ·			ector
	Address Unit			0
	200.0.0.0 🗸 IPADDRESS			
	Mask Unit			
	/24 V IPMASK			
	Version			
	4 *			
	ipv6_address_mode			
	DEFAULT			
	ipvó_ra_mode			
	DEFAULT			
	INSTANTIATE A			
	Gateway_ip			
	NO_GATEWAY *			
		*		0
200 Maia 724 4 4 6 5 90 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	4 IPMASK sion 6_address_mode EFAULT EFAULT http://www.stateful http://wwwww.stateful ht			
dł	ncpvó-stateful			
	ncpvó-stateless aac			
Gat	tewaγ_ip			
N	O_GATEWAY *			
	EFAULT D_GATEWAY			
TNU.	o_GATESTAT			

2.1.3.1.2 The attributes of a Virtual Network's subnetwork

Figure 149: Attributes of a subnetwork

The previous illustrations indicate (with the subnetwork selected) the categories and attributes of the subnetwork that is part of the Virtual Network. There are two categories that the user is allowed to edit.

The first one, **IP**, has five editable attributes:

• Address: The IP address in the illustration is set to **200.0.0.** Choose the IP address for the subnetwork with care, make sure it is unique. This address can be for IPv4 or IPv6, but you must specify a valid IP. Note: Must be consistent with the field "Version".



NOTE: This value must be consistent with the **Version** field.

If the range selected on the subnetwork **overlaps** with another range you **may** receive an error during deployment. If you are using a multi-site solution the IPAM plugin used in the background (at VIM level) will enforce that ranges **do not** repeat.

If you are in mono-site mode without the IPAM plugin, you can repeat the ranges with the same limitations as OpenStack.

• Mask: It defines the network mask number and its value depends on the IP version. In case of IPv4 valid values are between /1 and /30. In IPv6 valid values are between /1 and /126.

NOTE: It is necessary to put the / character before the mask value.

- Version: This value is either 4 or 6, corresponding to IPv4 and IPv6.
- **ipv6_address_mode**: This value controls how OpenStack handles addressing. There are a number of different ways that guest instances can obtain an IPv6 address, and this attribute indicates these choices to the Networking API users.
- **ipv6_ra_mode**: This value controls router advertisements for a subnet.

The IPv6 Protocol uses Internet Control Message Protocol packets (ICMPv6) as a way to distribute networking information. ICMPv6 packets with the type flag set to 134 are called **Router Advertisement** packets, which broadcast information about the router and the route that can be used by guest instances to send network traffic.

The **ipv6_ra_mode** attribute specifies if the Networking service should transmit ICMPv6 packets for a subnet.

IPv6 supports three different addressing schemes for address configuration and for providing optional network information.

- Stateless Address Auto Configuration (SLAAC): Address configuration using Router Advertisement (RA).
- **DHCPv6-stateless**: Address configuration using RA and optional information using DHCPv6.
- **DHCPv6-stateful**: Address configuration and optional information using DHCPv6.

You can choose any of these values or **DEFAULT**. If you are using IPv4, you must choose the **DEFAULT** value.

There are many combinations of these two attributes, but only some of them are valid. The following table explains these combinations.

Table 7: SLAAC combinations

ipv6_ra_mode	ipv6_address_mode	Result
Not specified	SLAAC	Addresses are assigned using EUI-64 and external router will be used
		for routing.
SLAAC	SLAAC	Addresses are assigned using EUI-64 and OpenStack networking
		provides routing.

Table 8: Stateful-stateless combinations

ipv6_ra_mode	ipv6_address_mode	Result
DHCPv6-stateless	DHCPv6-stateless	Address and optional information using neutron router and DHCP implementation respectively.
DHCPv6-stateful	DHCPv6-stateful	Addresses and optional information are assigned using DHCPv6.

Based on OpenStack capabilities, addressing configuration modes are only available using IPv6 and there is no mandatory configuration parameter. Accordingly, **NFV Director** operates as follows.

- IPv4: It always takes the **DEFAULT** value, regardless of the value selected by the user because modes cannot be applied to IPv4 networks.
- **IPv6**: It can take the values mentioned in the chain or **DEFAULT**. as Ruben correctly says. The **DEFAULT** value does not provide any value for an OpenStack request, so default Neutron configuration is provided to the network. In terms of functionality, the behavior is the same as **DHCPv6-stateful**.
- **Default value**: The default value has been provided for full compatibility between IPv4 and IPv6.

The second category for the subnetwork is **INSTANTIATE** with the **Gateway_ip** attribute that can only take two values, **DEFAULT** (use default gateway) and **NO_GATEWAY** (do not use any gateway).

If **NO_GATEWAY** is selected then the Virtual Machine will **not** get any default route via DHCP options during boot. Depending on your VM needs, this will be in effect until proper routes are set with the VM console.

If you select **DEFAULT** and connect a Virtual Machine to **two** networks both set with **DEFAULT** options, then your VM will get **two** default routes via DHCP options.

2.1.3.2 Virtual Network types

There are three types of virtual networks:

- **VIRTUAL NETWORK GENERIC**: This represents the basic virtual network with one network and one subnetwork.
- VIRTUAL NETWORK EXTERNAL: This represents a network that will come from the outside and use floating IPs, primarily for multi-site environments.
- VIRTUAL NETWORK MANAGEMENT: This represents a network for internal management. This network will create the needed connections automatically with other components and will manage the infrastructure of the application. When this virtual network is activated, it will configure the correct ports and connections to offer the correct services. This virtual network will not be visible to the user.

2.1.3.3 Standard Virtual Network operations

In order to operate with networks in the **VDC Manager**, left-click in the **VDC Elements** to select the tag. Once the list of elements is loaded, select a Virtual network to be created in the workspace. There are three types of Virtual Networks suitable for operation. The following section will detail Standard Virtual Network operations.

2.1.3.3.1 Creating a Standard VN

There are two ways to create (instantiate) a Virtual Network.

- a. Select the template from the list and drag it to the workspace.
- b. Select the element from the list, left-click Actions and select Create from the displayed list.

When a Virtual Network is selected from the list of components, the component's border color will turn green. The system will also generate the timestamp for the component. These changes are indicated in the following illustration.

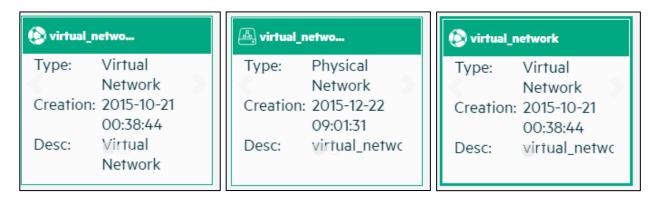


Figure 150: Three types of Virtual Networks

Regardless of the method used to create the instance, the same window will be displayed.

Virtual Network Instance Name:	-
Network_UserGuide_1	
Description:	1
Virtual Network for the User Guide	
VDC:	
Ten_UserGuide	
VAPP Group Name:	
VNFG_UserGuide	

Figure 151: Create Virtual Network window

For this Virtual Network example we set the name of the network to **Network_UserGuide_1** and the Description to **Virtual network for the User Guide**. The **VDC** and **VAPP Group Name** fields are disabled. Left-click **Create** to create the Virtual Network or left-click **Cancel** to discard the changes. Once the element is created, a new Virtual Network will be displayed in the manager's workspace.

2.1.3.3.2 Deploying a Standard VN

Select the Virtual Network in the workspace to deploy it. To select an element, left-click inside it in the workspace until its border has changed to a dashed pattern of a color different from gray. Once selected, there are two ways to initiate deployment:

- Left-click Actions and select Deploy.
- Right-click in the previously selected element and select **Deploy** from the list that is displayed.

Virtual Network Actions(Network_UserGuide_1) Deploy Delete		
Delete	Virtual Network : Network_UserGuide_1	Actions intual Network Actions(Network_UserGuide_1) Deploy Delete

Figure 152: Two ways to launch a Deploy a Standard VN

After the required action has been selected, the VDC Manager will display the following window.

Deploy Virtual Network Network_UserGuide_1	×
Do you really want to deploy this instance?	
	Deploy Cancel

Figure 153: Deploy Virtual Network confirmation window

Left-click **Deploy** to deploy the element. If the deployment process started correctly, the system will display a confirmation message and register in the **Jobs Monitor** similar to the following illustrations.

Click the **button** to access these messages.

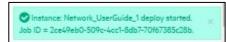


Figure 154: Deploy Virtual Network confirmation message

 *

Figure 155: Deploy Virtual Network job registration

If the deployment process ended properly, the color of the element will change to green, indicating **ACTIVE** status. If the color of the element changes to red, it indicates **ERROR** status.

2.1.3.3.3 Deleting a Standard VN

Select a **Virtual Network** in the workspace and left-click inside an element to change its border to a dashed line that is any color but gray. There are two ways to initiate deleting.

- Left-click Actions and select Delete.
- Right-click inside the previously selected element and select **Delete** from the displayed list.

After the required action has been selected, the VDC Manager will display the following window.

Delete :	×
Do you really want to delete instance: ?	
	Delete Cancel

Figure 156: Delete Virtual Network confirmation window

Left-click **Delete** to delete the element. If the deleting process started correctly, the system will display a confirmation message similar to the following illustration.

Click the button to access these messages.

Instance: Network_UserGuide_1 deleted successfully. ID = d21dc416-def7-46ed-bf1d- 3f8d8b798fe0.	×
---	---

Figure 157: Delete Virtual Network confirmation message

2.1.3.3.4 Un-deploying a Standard VN

The **Un-deploy** operation is only available in the **VDC Manager** is for the selected Virtual Network to have active undeployed status. Active Virtual Network status is indicated by any color other than gray and red.

There are two ways to initiate un-deployment.

- Right-click the Virtual Network and select **Un-Deploy** from the displayed list.
- Select the Virtual Network, left-click Actions at the right side of the VDC Manager, and select Un-Deploy.

Hewle	ett Packard NFV prise	Director /	/ MWC201	6v3		
# ⊦	Home	ary 🕞 M	1anagement 🔻	Ö <mark>9</mark> Tenant Manager	🕑 Designer 🔻	iou (*)
Tena	ant : Ten_UserGuid	e		VNF Group (1):	VNFG_UserGuide •	
Storages (1) Monitors (8) VNFs (1) Terrant Elements (0)	Search. Search. Yuff, FW Type: Desc: VNF, FI Type: Load B Creation: Desc: VNF fo Stratal_netwon Type: Virtual_netwon Oreation: Desc: virtual_netwon Type: Virtual_netwon Type: Virtual_netwon Ovaital_netwon Ovaital_netwon Ovaital_netwon Ovaital_netwon Desc: Virtual_netwon Ovaital_netwon	N alancer r LBs Network k network -21 -4	<u><u> </u></u>	ual Network Actions(Netw n-Deploy	ork_UserGuide_1)	
	etwork: Network, al Network : Network, U	lserGuide_1		Virtual Network	Actions(Network_U	serGuide_1)
Name	al Network			letwork : Network_usersu ubnetwork : Network_Use	lide_1	
Descri Netwo Status ACTIN	ork for the User Guide					

Figure 158: Two ways to initiate un-deployment

After the **Un-deploy** operation has been selected, the following confirmation window will be displayed.

Undeploy Virtual Network For Network_UserGuide_1	×
Do you really want to undeploy this instance?	
	Undeploy Cancel

Figure 159: Un-deploy operation confirmation window

If the Virtual Network still has elements connected, the following window will be displayed.

Undeploy Virtual Network For Network_UserGuide_1				
Do y	you really want to undeploy this instance?			
!	Warning!: Virtual Network "Network_UserGuide_1" This network still has some connections. Please remove them before undeploy			
	Undeploy Can	cel		

Figure 160: Un-deploy operation connections warning window

In this case all the connections related to the Virtual Network need to be removed before proceeding with undeployment. Left-click **Un-deploy** to un-deploy the selected Virtual Network or left-click **Cancel** to discard the undeployment process. If the un-deployment process is executed correctly, the element will be removed from the workspace.

2.1.3.4 Physical Network operations

In order to operate with networks in the **VDC Manager**, left-click in the **VDC Elements** to select the tag. Once the list of elements is loaded, a Virtual Network can be selected to be created in the workspace. There are three types of Virtual Networks suitable for operation. This section will discuss Physical Network operations.

2.1.3.4.1 Creating a Physical VN

The difference between a Standard VM and a Physical VM is that the physical have elements in the real world. The **VDC Manager** treats both the same. There are two ways to create (instantiate) a Physical Virtual Network.

- Select the template from the list and drag it to the workspace.
- Select the element from the list, left-click Actions and select Create from the displayed list.

When a Virtual Network is selected from the list of components, the component's border color will turn green. The system will also generate the timestamp for the component. These changes are indicated in the following illustration.

🚯 virtual_	netwo	💩 virtual_n	etwo	🚱 virtual_	network
Type:	Virtual Network	Type:	Physical Network	Type:	Virtual Network
	: 2015-10-21 00:38:44	Creation:	2015-12-22 09:01:31	Creation	n: 2015-10-21 00:38:44
Desc:	Virtual Network	Desc:	virtual_netwc	Desc:	virtual_netwc

Figure 161: Three types of Virtual Networks

Regardless of the method used to create the instance, the same window will be displayed.

Create Network: virtual_network_physical	×
Virtual Network Instance Name:	-
Physical_Network_userGuide_1	
Description:	-
Physical Netwok for the UserGuide	
VDC:	
Ten_UserGuide	
VAPP Group Name:	
VNFG_UserGuide	
Create	Cancel

Figure 162: Create Physical VN window

For this Virtual Network example we set the name of the network to **Physical_Network_userGuide_1** and the **Description** field to **Physical Network for the user Guide**. The **VDC** and **VNF Group Name** fields are disabled. Left-click **Create** to create the Physical Network or left-click **Cancel** to discard the changes. Once the element is created, a new Physical Network will be displayed in the manager's workspace.

Creating a Physical Network creates 2 networks with subnetworks.

When using a multi-site solution with SDN and IPAM plugin, make sure that the ranges and mask are the same. If the IPAM is to manage them as a single network, make sure that either **vxlan** or **vlan** subnet IP address does not collide.

One site will be **vxlan** based and will appear at SDN level (if SDN is present). The other site will be **vlan** based and so it will **not** appear in SDN (if SDN is present).

2.1.3.4.2 Deploying a Physical VN

Select the Virtual Network in the workspace to deploy a Physical Virtual Network Standard. To select an element in the workspace, left-click inside it in the workspace until its border has changed to a dashed line any color but gray. Once selected, there are two ways to initiate deployment:

- Left-click Actions and select Deploy.
- Right-click in the previously selected element and select **Deploy** from the list that is displayed.

Physical_Network_userGuide_1_10.0.0.0/24	Virtual Network Actions(Physical_Network) Deploy Delete	Type Physical Network Name Physical_Network_userGuide_1 Description	Virtual Network Actions(Physical Network)	Inspector VAPP Selector (0)
.0.0.0/24		Description Physical Netwok for the UserGuide Status INSTANTIATED		

Figure 163: Two ways to launch a Deploy a Physical VN

After the required action has been selected, the VDC Manager will display the following window.

Deploy Virtual Network Physical_Network_userGuide_1	×
Do you really want to deploy this instance?	
Deploy	ancel

Figure 164: Deploy Physical VN confirmation window

Left-click **Deploy** to deploy the element. If the deployment process started correctly, the system will display a confirmation message and register in the **Jobs Monitor** similar to the following illustrations.

Click the button to access these messages.

Sinstance: Physical_Network_userGuide_1 deploy started. Job ID = 5d6b65ce-339e-4bc0-a97b- 4f2548dedc5a.	×
---	---

Figure 165: Deploy a Physical VN confirmation message

	Operation	Name	Start time	End time	
0	deployVirtualLink	Physical_Network_userGuide_1	2016-04-07 12:55:11		×
d	lear All				

Figure 166: Deploy a Physical VN job registration

If the deployment process ended properly, the color of the element will change to green, indicating **ACTIVE** status. If the color of the element changes to red, it indicates **ERROR** status.

2.1.3.4.3 Deleting a Physical VN

Select the **Virtual Network** in the workspace and left-click inside an element to change its border to a dashed line that is any color but gray. There are two ways to initiate deleting:

- Left-click Actions and select Delete.
- Right-click inside the previously selected element and select **Delete** from the displayed list.

After the required action has been selected, the VDC Manager will display the following window.

Delete :		×
Do you really want to delete instance: ?		
	Delete	Cancel

Figure 167: Delete Physical VN confirmation window

Left-click **Delete** to delete the element. If the deleting process started correctly, the system will display a confirmation message <u>similar</u> to the following illustration.

Click the 📩 button to access these messages.

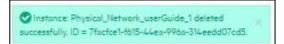


Figure 168: Delete Physical VN confirmation message

2.1.3.4.4 Un-deploying a Physical VN

The **Un-deploy** operation is only available in the **VDC Manager**. The selected Physical Virtual Network has to have active un-deployed status. Active Physical Virtual Network status is indicated by any color other than gray and red.

There are two ways to initiate un-deployment.

- Right-click the Physical Virtual Network and select **Un-Deploy** from the displayed list.
- Select the Physical Virtual Network, left-click Actions at the right side of the VDC Manager and select Un-Deploy.

Hewlett Packard NFV Direct Enterprise	ctor / MWC2016v3		
Home Summary	B Management • 05 Tenant Manager 2 Designer • VNF Group (1) : VNFG_UserGuide		
Contraction Creation: Creation: Desc: Virge: Firewall Creation: Desc: Virge: Contraction: Desc: Virge: Contraction: Desc: Virge: Contraction: Desc: Virge: Contraction: Desc: Virge: Physical Network Creation: Desc: Virge: Physical Network Creation: Desc: Virge: Physical Network	City Un-Deploy	Physical Network: Network. Physical Network: Physical User G Type Physical Network: Name Network_Physical_UserGuide Description Physical Virtual Network for the User C Status ACTIVE	Virtual Network Actions(Network Physical) Physical Un-Osploy Network : Network_Physical_UserGuide_1 Subnetwork : Network_Physical_UserGuide_1 U_endpoint : Name V_endpoint : Name

Figure 169: Two ways to initiate un-deployment

After the **Un-deploy** operation has been selected, the following confirmation window will be displayed.

Undeploy Virtual Network For Network_Physical_UserGuide	×
Do you really want to undeploy this instance?	
	Undeploy Cancel

Figure 170: Physical VN un-deploy operation confirmation window

If the Virtual Network still has elements connected, the following window will be displayed.

Un	Undeploy Virtual Network For Network_UserGuide_1		
Do y	iou really want to undeploy this instance?		
!	Warningt. Virtual Network "Network_UserGuide_1" This network still has some connections. Please remove them before undeploy		
	Undeploy Can	cel	

Figure 171: Un-deploy operation connections warning window

In this case all the connections related to the Virtual Network need to be removed before proceeding with undeployment. Left-click **Un-deploy** to un-deploy the selected Virtual Network or left-click **Cancel** to discard the undeployment process. If the un-deployment process is executed correctly, the element will be removed from the workspace.

2.1.3.5 Monitored Virtual Network operations

In order to operate with networks in the **VDC Manager**, left-click in the **VDC Elements** to select the tag. Once the list of elements is loaded, a Virtual Network can be selected to be created in the workspace. There are three types of Virtual Networks suitable for operation. This section will discuss Monitored Virtual Network operations.

A Monitored Virtual Network has two previously configured monitors: one for the network itself and another for the subnetwork related to the network, as indicated in the following illustration.

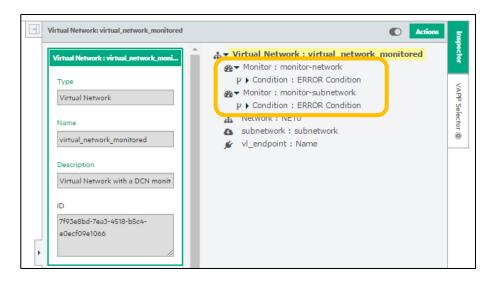


Figure 172: Monitored VN structure

2.1.3.5.1 Creating a Monitored VN

There are two ways to create (instantiate) a Monitored Virtual Network.

- Select the element from the list and drag it to the workspace.
- Select the element from the list, left-click Actions, and select Create from the displayed list.

When a Monitored Virtual network is selected from the list of components, the component's border color will turn green. The system will also generate the timestamp for the component. These changes are indicated in the following illustration.

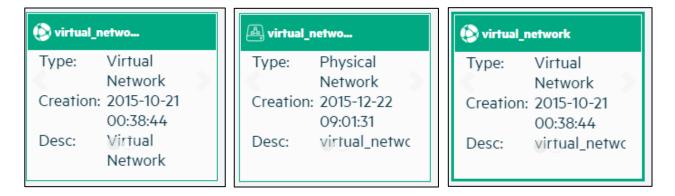


Figure 173: Three types of Virtual Networks

Regardless of the method used to create the instance, the same window will be displayed.

Create Network: virtual_network_monitored	×
Virtual Network Instance Name:	-
Monitored_Network_userGuide_1	
Description:	-
Monitored Network for the userGuide	
VDC:	
Ten_UserGuide	
VAPP Group Name:	
VNFG_UserGuide	
Create	Cancel

Figure 174: Create Monitored VN window

For this Virtual Network example we set the name of the network to **Monitored_Network_userGuide_1** and the **Description** field to **Monitored Network for the userGuide**. The **VDC** and **VNF Group Name** are disabled. Left-click **Create** to create the Physical Network or left-click **Cancel** to discard the changes. Once the element is created, a new Physical Network will be displayed in the manager's workspace.

2.1.3.5.2 Deploying a Monitored VN

Select the Virtual Network in the workspace to deploy a Monitored Virtual Network. To select an element in the workspace, left-click inside it in the workspace until its border has changed to a dashed line that is any color but gray. Once selected, there are two ways to initiate a deployment:

- Left-click **Actions** and select **Deploy**.
- Right-click in the previously selected element and select **Deploy** from the list that is displayed.

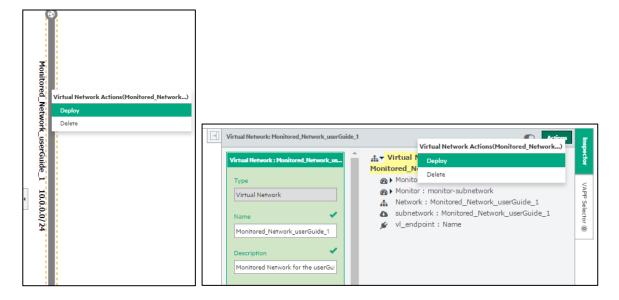


Figure 175: Two ways to launch a Deploy a Monitored VN

After the required action has been selected, the VDC Manager will display the following window.

Deploy Virtual Network Monitored_Network_userGuide_1	×
Do you really want to deploy this instance?	
Deploy C	ancel

Figure 176: Monitored VN deployment confirmation window

Left-click **Deploy** to deploy the element. If the deployment process started correctly, the system will display a confirmation message and register in the **Jobs Monitor** similar to the following illustrations.

Click the further to access these messages.

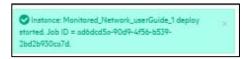


Figure 177: Monitored VN deployment confirmation message

	Operation	Name	Start time	End time	
Q	deployVirtualLink	Monitored_Network_userGuide_1	2016-04-07 13:31:08		×
C	lear All				

Figure 178: Monitored VN deployment job registration

If the deployment process ended properly, the color of the element will change to green, indicating **ACTIVE** status. If the color of the element changes to red, it indicates **ERROR** status.

2.1.3.5.3 Deleting a Monitored VN

Select the **Virtual Network** in the workspace and left-click inside an element to change its border to a dashed line that is any color but gray. There are two ways to initiate deleting:

- Left-click Actions and select Delete.
- Right-click inside the previously selected element and select **Delete** from the displayed list.

After the required action has been selected, the VDC Manager will display the following window.

Delete :	×
Do you really want to delete instance: ?	
	Delete Cancel

Figure 179: Delete Monitored VN confirmation window

Left-click **Delete** to delete the element. If the deleting process started correctly, the system will display a confirmation message <u>similar</u> to the following illustration.

Click the button to access these messages.

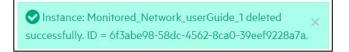


Figure 180: Delete Monitored VN confirmation message

2.1.3.5.4 Un-deploying a Monitored VN

The **Un-deploy** operation is only available in the **VDC Manager**. The selected Monitored Virtual Network needs to have active un-deployed status. Active Monitored Virtual Network status is indicated by any color other than gray and red.

There are two ways to initiate un-deployment.

- Right-click the Monitored Virtual Network and select **Un-Deploy** from the displayed list.
- Select the Monitored Virtual Network, left-click **Actions** at the right side of the **VDC Manager**, and select **Un-Deploy**.

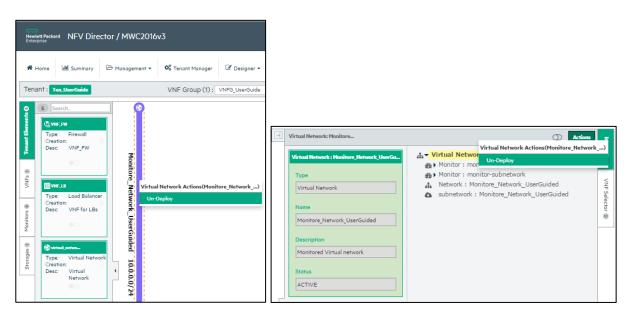


Figure 181: Two ways to initiate un-deployment

After the Un-deploy operation has been selected, the following confirmation window will be displayed.

Undeploy Virtual Network For Monitore_Network_UserGuided	×
Do you really want to undeploy this instance?	
	Undeploy Cancel

Figure 182: Monitored VN un-deploy operation confirmation window

If the Virtual Network still has elements connected, the following window will be displayed.

Un	deploy Virtual Network For Network_UserGuide_1	×
Do you really want to undeploy this instance?		
ł	Warning: Virtual Network "Network_UserGuide_1" This network still has some connections. Please remove them before undeploy.	
	Undeploy	:el

Figure 183: Un-deploy operation connections warning window

In this case all the connections related to the Virtual Network need to be removed before proceeding with undeployment. Left-click **Un-deploy** to un-deploy the selected Virtual Network or left-click **Cancel** to discard the undeployment process. If the un-deployment process is executed correctly, the element will be removed from the workspace.

2.1.4 VNF operations

In order to operate with VNFs in the **VDC Manager**, left-click in the **VDC Elements**. Once the list of elements is loaded, a VNF can be selected to be created in the workspace. This is a special type of artifact that develop a complex task in the system. The following sections discuss **VDC Manager** operations with the different types of VNFs available.

Due to the nature of these components, a distinction needs to be made for when the component is in a state other than **ACTIVE**, and when the component has been activated.

2.1.4.1 VNF attributes

The majority of all VNF attributes and categories are similar with small additions or configurations. This section details the specific attributes of the Virtual Networks.

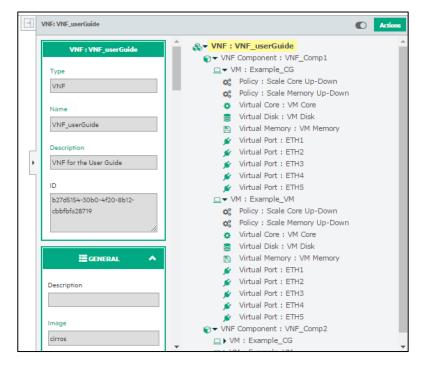


Figure 184: VNF components and attributes

The previous illustration indicates the general attributes of the **VNF_userGuide**. In this case the **Type** and **Status** attributes cannot be edited. The **ID** field, for obvious reasons, is also disabled. The values for the **Name** and **Description** fields are **VNF_userGuide** and **VNF designed by the user**. Left-click in these fields to edit their values.

These attributes are common to all VNFs. A VNF can have a wide range of components and configurations. In order to provide appropriate editing support, the following sections will explain a significant sample of the possibilities.

There are special, more complex VNFs. An example is the **VNF Firewall** with a specific function. This element has attributes besides the ones that are common to all the VNFs.

2.1.4.1.1 VNF Firewall attributes

The **VNF Firewall** is a special type of VNF with a number of requirements. The most important requirement is that the **VNF Firewall** can only be deployed in a Datacenter/Scenario that can operate in a DCN platform. This means that the entire structure required for this platform should be present in the Datacenter to be used. Also, the **VNF Firewall** will use a Service Network to carry out its tasks. This Service Network is neither the External Network, nor the Management Network. These three networks must not be misinterpreted.



IMPORTANT: The VNF Firewall must be deployed in a Datacenter/Scenario where DCN is configured.

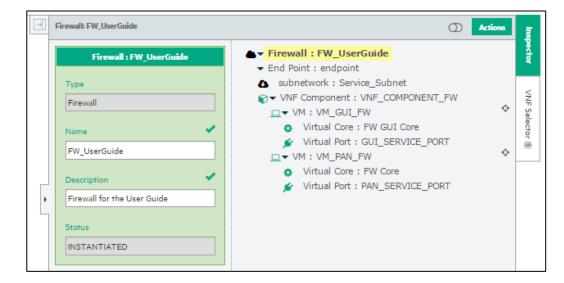


Figure 185: VNF Firewall attributes

The previous illustration indicates, with the **VNF Firewall** selected, all the components that make up the VNF. As indicated, the Firewall has one **Network**, one **Subnetwork**, and an **EndPoint**. It also has a **VNF_Component** that includes two **Virtual Machines**. The **Network** and **Subnetwork** artifacts and possible Virtual Network configurations were explained in previous chapters.

The **EndPoints** are elements of connection between entities. They represent the component point of access when an element or component in the workspace (VDC) tries to communicate with a specific component. This communication will take place through the **EndPoint**, so the **EndPoints** will be connected to the entities required during activation. This refers to communication, not network traffic.

The **Virtual Machine** component attributes will be explained in the *Virtual Machine operations* section. The VNF attributes are the attributes of its components, but only some of them are user-editable.

As indicated on the previous illustration, the **VNF Firewall** has two **Virtual Machines**, the **VM_GUI_FW** and the **VM_PAN_FW**. All Virtual Machines have four user-configurable elements:

- a virtual core
- virtual disk
- virtual memory
- virtual port

The most relevant **VNF Firewall** configuration at this level is the image to be used with the **Virtual Machines**.

Left-click the **Virtual Machine** (PAN or GUI) in the components menu to configure its attributes. Select the **GENERAL** category and assign the correct values to the **Image** and **Type** fields. The **Image** attribute validates the Name. The most often used **Image** value is **cirros**. If **cirros** is selected, **Type** will be **KVM**. Depending on the version, **KVM** images are associated with .qcow or .qcow2 files. Before deployment, a **VNF Firewall** will always check the component image file configuration. Deployment will fail if the image or extension file is not configured correctly.

2.1.4.2 Non-active VNF Firewall operations

The following non-active VNF:FW operations are available from the VDC Manager:

- creating
- deploying
- deleting

After the component has been activated, the VDC Manger allows the following additional operations:

- scaling
- un-deploying

2.1.4.2.1 Creating a VNF Firewall

There are two ways to create (instantiate) a VNF Firewall.

- a. Select the element in the list and drag it to the workspace.
- b. Select the element in the list, left-click Actions, and select Create in the displayed list.

When **VNF:FW** is selected from the list of components, the component's border color will turn green. The system will also generate the timestamp for the component. These changes are indicated in the following illustration.

🔮 VNF_FW	
Type: Firewall	l
Creation: 2015-10-02	l
13:16:09	
Desc: VNF_FW	l
	l
	l

Figure 186: Firewall element in the VDC menu

Regardless of the method used to create the instance, the same window will be displayed.

Create Firewall: VNF_FW	×
Instance Name:	-
Firewall_userGuide	
Description:	
Firewall for the User Guide	
VDC:	
Ten_userGuide2	
VNF Group Name:	
Oracleadmin	
Create	Cancel

Figure 187: Creating a VNF Firewall

For this VNF:FW we set the name of the firewall to Firewall_userGuide and the Description field to Firewall for the User Guide. The VDC and VNFG Group Name fields are disabled. Left-click Create to create the VNF:FW or left-click Cancel to discard the changes. Once the element is created, a new VNF:FW will be displayed in the manager's workspace.

A **Firewall** is a specific implementation of VNF that contains a service network. When using a multi-site solution with IPAM plugin, make sure that the **SERVICE** subnetwork range does not overlap with existing ones.

If the creating process was successful, the system will display a confirmation message similar to the following illustration.

Click the button to access these messages.



Figure 188: Successful VNF Firewall creation confirmation window

2.1.4.2.2 Deploying a VNF Firewall

Select **VNF:FW** in the workspace to deploy a VNF Firewall. To select an element in the workspace, left-click it in the workspace until its border has changed to a dashed line that is any color but grey. Once selected, there are two ways to initiate deployment:

- Left-click Actions and select Deploy.
- Right-click in the previously selected element and select **Deploy** from the list that is displayed.

A successful Firewall deployment requires connection to at least two active Virtual Networks. The Firewall could be connected to more than two networks, but two are used for simplicity.

There are two ways to connect the VNF:FW to the Virtual Networks.

- Select and right-click the VNF:FW in the workspace, and left-click Connect from the menu.
- Left-click Actions and select Connect.

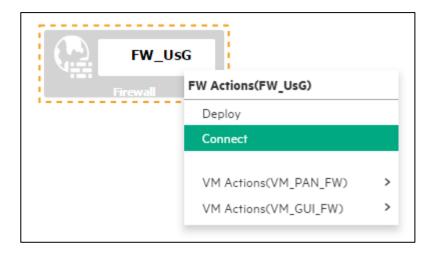


Figure 189: VNF Firewall connect menu

A window similar to the one in the following illustration will be displayed.

Connect Firewall: FW_UserGuide	×
VDC:	
Ten_userGuide2	
VNF Group Name:	
Oracleadmin	
Network Connection: endpoint	
Network:	
(Deplayed) Network_UserGuide	
Deployed) Network_UserGuide_1	
Connect	Cancel

Figure 190: VNF Firewall connection to Virtual Networks form

In order to connect the **VNF:FW** to the Virtual Networks, left-click the checkboxes for the deployed Virtual Networks. Once both **Network_UserGuide** and **Network_UserGuide_1** active Virtual Networks are connected, two lines between each network and the **VNF:FW** will indicate the connections. The lines should be dashed to indicate that the connection exists but it is still in an instantiated status. If the workspace is similar to the one in the following illustration, then the **VNF:FW** will be ready for deployment.

Hewlett Packard NF ¹ Enterprise	V Director								Workspaces 🕶	Å UserGuide	_1@Org_UserGuide2 +	* *
# Home	source Inventory	🗁 Management 🔹	📽 VDC Manager	🖉 Designer 🔻	🔿 Jobs	🖉 Utilities 🕶			Jobs	Monitor +	2 Refre	sh 👻
VDC : Ten_userGuide	2	VNF Group (1): Oracleadmin 🔹									۲
Search. Search. Search. Search. Creation: Desc: VNF	for the r Guide	Network_UserGuide 200.0.0.0/24	(<u>)</u> FW_	UserGuide	DHCP/24-	Network_UserGuide_1 200.0.0/24	I Dearch.	Creation time	VM Count	▲ Status	Changes	Inspector VNE Selector O

Figure 191: Virtual Networks in the VDC

IMPORTANT: The VNF Firewall must be deployed in a Datacenter/Scenario where DCN is configured.

There are two ways to select deployment and display the following illustration:

- Right-click the component in the workspace and select **Deploy**.
- Left-click **Actions** and select **Deploy**.

Deploy Firewall For: FW_UserGuide	×
Name:	
FW_UserGuide	
Tenant:	
Ten_UserGuide	
Deploy Mode:	
Default	•
Resource Pool: ★	
O VDC: Ten_UserGuide	
 ODC: DC_UserGuide 	
 VIM: H12_HOUSTON 	
 Region: sacramento 	
O Zone:	
Region: regionone	
O Zone:	
	Deploy Cancel

Figure 192: Deploy VNF Firewall confirmation window

The only deployment mode available for **VNF:FW** is **Default**, which executes the actions for each step of the deployment operation without ensuring or simulating the result. The results depend on the **VNF:FW** configuration and the scenario.

After selecting the mode, select the Firewall deployment destination. There is no level restriction for VNF deployment in the selected resource pool. It is enough to select one of the elements in the resource pool list. **Region: regionone >Zone:** is selected for this particular firewall.

Left-click **Deploy** to deploy the element. If the deployment process started correctly, the system will display a confirmation message and register in the **Jobs Monitor** similar to the following illustrations.

Click the button to access these messages.



Figure 193: Firewall deployment confirmation message

Operation	Name	Start time	End time	
🔅 deployFw	FW_UserGuide	2016-04-08 10:36:52		×
Clear All				

Figure 194: Firewall deployment job registration

If the deployment process ended properly, the color of the element will change to green, indicating **ACTIVE** status. If the color of the element changes to red, it indicates **ERROR** status. If the deployment process was not able to activate the element, the components in the workspace at the end of the process should be in the same state as prior to deployment.

NOTE: If there is a VDC with Management, the VNF will automatically connect to the management network after deployment of the VNF.

2.1.4.2.3 Deleting a VNF Firewall

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Select the **VNF Firewall** in the workspace and left-click inside an element to change its border to a dashed line that is any color but gray. There are two ways to initiate deleting.

- Left-click Actions and select Delete.
- Right-click inside the previously selected element and select Delete from the displayed list.

After the required action has been selected, the VDC Manager will display the following window:

Delete : FW_UserGuide	×
Do you really want to delete instance: FW_UserGuide?	
	Delete Cancel

Figure 195: Delete VNF Firewall confirmation window

Left-click **Delete** to delete the element. If the deleting process started correctly, the system will display a confirmation message.

Click the **button** to access these messages.

2.1.4.3 Activated VNF Firewall operations

The following VNF Firewall operations are available:

- Scale Up
- Scale Down

- Scale In
- Scale Out
- Un-Deploy
- Apply changes
- Connect
- Delete
- Launch Firewall Console

The **Scale** operations can only have one element as target. Each element requires a policy, meaning the VNF Components and the VNF each require a Scale policy in order to escalate. If a policy needs to elevate more than one element, it will only scale one, leaving the others unaltered.

2.1.4.3.1 Un-deploying a VNF Firewall

The **Un-deploy** operation is only available if the specific **VNF Firewall** has **ACTIVE** status. There are two ways to initiate un-deployment.

- Right-click the element and select **Un-Deploy** from the displayed list.
- Select the element in the workspace, left-click Actions, and select Un-Deploy.

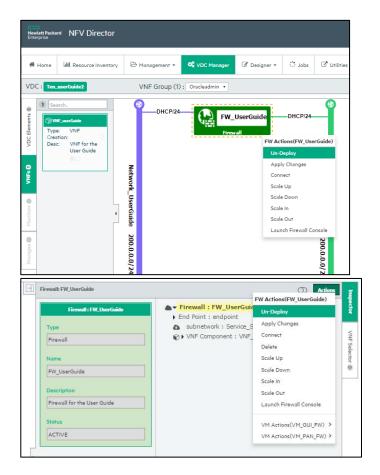


Figure 196: Two ways to initiate un-deployment

After the **Un-deploy** operation has been selected, the following confirmation window will be displayed.

Undeploy Firewall For FW_UserGuide	×
Do you really want to undeploy this instance?	
Undeploy	Cancel

Figure 197: Un-deploy operation confirmation window

For this component the user need to select which is going to be the mode of the deployment process, in this case the user has chosen "Default", the other mode available is "Guaranteed",

Left-click **Un-deploy** to un-deploy the selected VNF Firewall or left-click **Cancel** to discard the un-deployment process. If the un-deployment process is executed correctly, the element will be removed from the workspace.

2.1.4.3.2 Scale Up a VNF Firewall

If execution requires a **Scale Up** operation, it can be selected from the list of operations. There are two ways to launch a **Scale Up** operation from the component.

- Right-click in the VNF Firewall in the workspace and select Scale Up.
- Left-click Actions and select Scale Up.

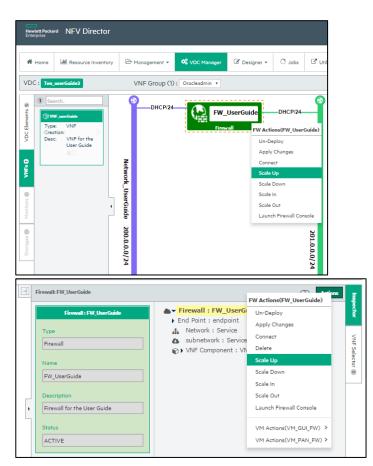


Figure 198: Two ways to Scale Up an activated VNF Firewall

After the operation has been selected, the following confirmation window will be displayed.

Scale Up FW_UserGuide	×
Do you really want to scale this instance?	
	Scale Cancel

Figure 199: Scale Up an activated VNF Firewall confirmation window

Left-click **Scale** to start the escalation process, or left-click **Cancel** to discard the process. If the escalation is executed correctly, the element will be removed from the workspace.



NOTE: Escalation policies operate along with **Entity Scale Policies**, so when initiating this type of process, check which of the policies developed by the user is going to be executed.

2.1.4.3.3 Scale Down a VNF Firewall

If execution requires a **Scale Down** operation, it can be selected from the list operations. There are two ways to launch a **Scale Down** operation from the component.

- Right-click in the VNF Firewall in the workspace and select Scale Down.
- Left-click Actions and select Scale Down.

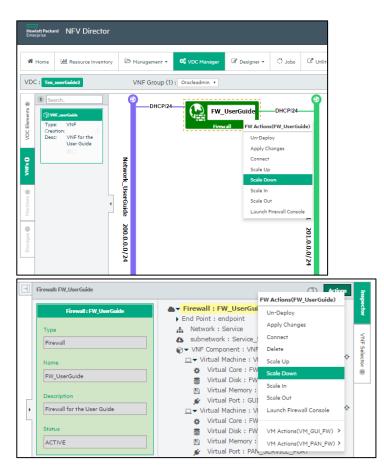


Figure 200: Two ways to Scale Down an activated VNF Firewall

After the operation has been selected, the following confirmation window will be displayed.

Scale Down FW_UserGuide	×
Do you really want to scale this instance?	
	Scale Cancel

Figure 201: Scale Down an activated VNF Firewall confirmation window

Left-click **Scale** to start the escalation process, or left-click **Cancel** to discard the process. If the escalation is executed correctly, the element will be removed from the workspace.

NOTE: Escalation policies operate along with **Entity Scale Policies**, so when initiating this type of process, check which of the policies developed by the user is going to be executed.

2.1.4.3.4 Scale In a VNF Firewall

If execution requires a **Scale In** operation, it can be selected from the list of operations. There are two ways to launch a **Scale In** operation from the component.

- Right-click in the VNF Firewall in the workspace and select Scale In.
- Left-click Actions and select Scale In.

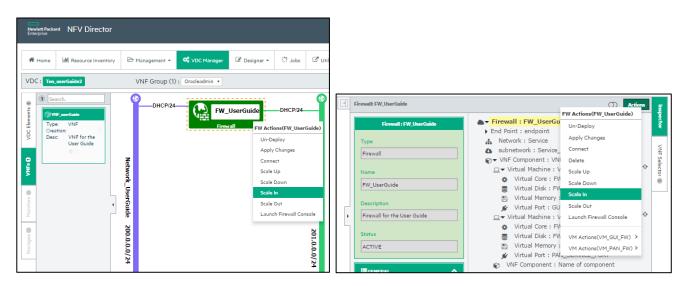


Figure 202: Two ways to Scale In an activated VNF Firewall

After the operation has been selected, the following confirmation window will be displayed.

Scale In FW_UserGuide	×
Do you really want to scale this instance?	
	Scale Cancel

Figure 203: Scale In an activated VNF Firewall confirmation window

Left-click **Scale** to start the escalation process, or left-click **Cancel** to discard the process. If the escalation is executed correctly, the element will be removed from the workspace.

NOTE: Escalation policies operate along with **Entity Scale Policies**, so when initiating this type of process, check which of the policies developed by the user is going to be executed.

2.1.4.3.5 Scale Out a VNF Firewall

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If execution requires a **Scale Out** operation, it can be selected from the list of operations. There are two ways to launch a **Scale Out** operation from the component.

- Right-click in the VNF Firewall in the workspace and select Scale Out.
- Left-click **Actions** and select **Scale Out**.

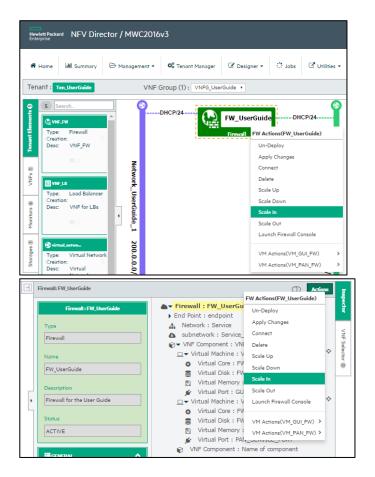


Figure 204: Two ways to Scale Out an activated VNF Firewall

After the operation has been selected, the following confirmation window will be displayed.

Scale Out FW_UserGuide	×
Do you really want to scale this instance?	
	Scale Cancel

Figure 205: Scale Out an activated VNF Firewall confirmation window

Left-click **Scale** to start the escalation process, or left-click **Cancel** to discard the process. If the escalation is executed correctly, the element will be removed from the workspace.



NOTE: Escalation policies operate along with **Entity Scale Policies**, so when initiating this type of process, check which of the policies developed by the user is going to be executed.

2.1.4.3.6 Launch Firewall console

Select the Launch Firewall Console if execution requires the Firewall Console. There are two ways to launch a Firewall Console from the component.

- Right-click in the VNF Firewall present in the workspace, and select Launch Firewall Console.
- Left-click Actions and select Launch Firewall Console.

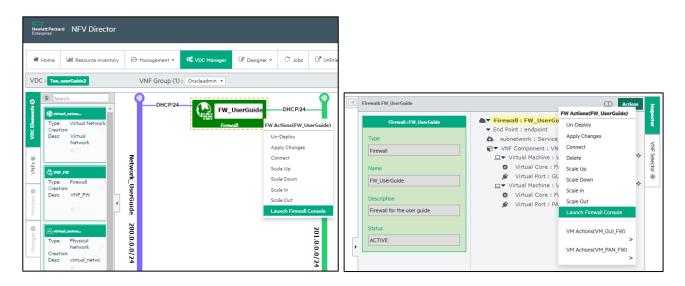


Figure 206: Two ways to launch the Firewall Console

If the console started correctly, the system will display a message to confirm the start of deleting. Click the button to access these messages. The console will be displayed in a new web page and should be similar to the following illustration.

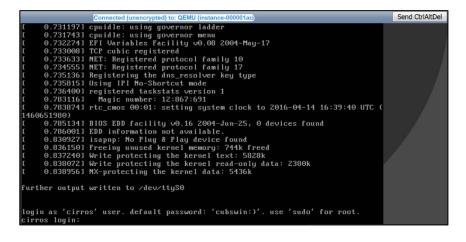


Figure 207: VNF Firewall Console

2.1.4.1 User-created VNF operations

The following non-active user-created VNF operations are available from the VDC Manager.

- creating
- deploying
- deleting

After the component has been activated, the **VDC Manager** allows the following additional operations:

• scaling

• un-deploying

also all the operations derivate of each component member of the VNF.

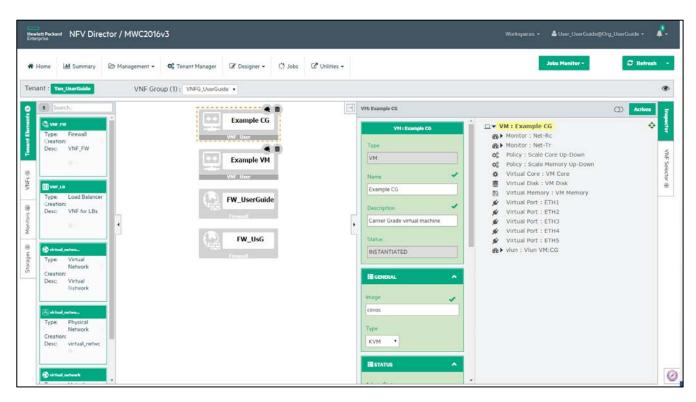


Figure 208: VDC Manager workspace with the three types of VNF

As indicated in the previous illustration, in case of user-created VNF, the workspace displays not only the VNF, but the VNF's Virtual Machine member as well. In this case the selected Virtual Machine is **Example CG**. All elements of this Virtual Machine are displayed and editable by selecting them from the list of components at the right side of the **VDC Manager**.

As indicated in the following illustration, the operations available for this component are the same as those available for the rest of the VNF.

Home Lat Summary 🕑	Management - OS Tenant	Manager 🕼 Designer 🔹 🔅	Jobs 🕑 Utilities •		Jobs Monitor +	C Refresh
ant: Ten_UserGuide	VNF Group (1): VN	FG_UserGuide		VH: Example CG		Actions
Vier J.V Type: Firewall Creation: Desc: VNF_FW Desc: VNF_FW Desc: VNF for LBs Orthud_internet Type: Virtual Network Creation: Desc: Virtual Network Creation: Desc: Virtual Network Creation: Desc: Virtual Network Creation: Desc: Virtual		Konstanting Konstanti	tions(Example C6) Monitor ove Monitor Storage ove Storage Actions itor Actions(Net-Rc) itor Actions(Net-Tr) age Actions(Viun VM:CG)	VH: Example CC D a V D a V D a Connect Delote Connect Delote V Connect Delote V Connect D	 WM: Example CG Monitor: Net-RC Monitor: Net-RC Monitor: Net-Tr Policy: Scale Core Up-Down Policy: Scale Memory Up-Down Virtual Core : VM Core Virtual Core : VM Oisk Virtual Port : ETH1 Virtual Port : ETH3 Virtual Port : ETH3 Virtual Port : ETH3 Virtual Port : ETH3 Virtual Port : ETH5 Virtual Port : VM:CG 	\$

Figure 209: Available user-created VNF actions

There are two ways to access the list of available actions.

- Left-click Actions.
- Right-click the previously selected element in the workspace.

The **VDC Manager** will display a list of available actions. The available actions are the same as those explained earlier in this chapter, including actions for the specific element, such as monitor or VLun actions.

2.1.4.1.1 Non-active VNF operations

This section includes all the available non-active VNF operations in the **VDC Manager**.

2.1.4.1.1.1 Creating a VNF

There are two ways to create (instantiate) a VNF.

- Select the element from the list and drag it to the workspace.
- Select the element from the list, left-click Actions, and select Create.

When a VNF is selected from the list of components, the component's border color will turn green. The system will also generate the timestamp for the component. These changes are indicated in the following illustration.

A Home 📶 Resource In	ventory 🕒 .	Home 🛄 Resource Inventory
VDC : VNFLB-VDC	VNF VNF	VDC: VNFLB-VDC VN
CE CERTIFICATION CONTRIBUTION CONTRIBUTICON CONTR		I Search I Search

Figure 210: Creating a VNF

Regardless of the method used to create the instance, the same window will be displayed.

Create VNF: VNF_UserGuide	×
Instance Name: VNF_UserGuide	*
VNF designed by the user VDC: VNFLB-VDC	
VNF Group Name: VNFLB-VNFG	
2	Create Cancel
	Instance Names VNF_UserGuide Description: VNF designed by the user VDC: VNFLB-VDC VNFLB-VNFG

Figure 211: Create VNF window

For this VNF we set the name for the firewall to **VNF_UserGuide** and the Description to **VNF desgined by the user**. The **VDC** and **VNF Group Name** fields are disabled. Left-click **Create** to create the VNF or left-click **Cancel** to discard the changes. Once the element is created, a new VNF will be displayed in the manager's work space. The VNF's grey color indicates that the element is not active.

VNF_UserGu	
VNF	

Figure 212: Inactive element

If the deployment process started correctly, the system will display a confirmation message similar to the following

illustration. Click the **button** to access these messages.



Figure 213: Successfully created VNF confirmation message

2.1.4.1.1.2 Deploying a VNF

Select the VNF created in the previous section. Left-click the element until its border has changed to a dashed pattern of a color different from grey. Once selected, there are two ways to initiate deployment:

- Left-click Actions and select Deploy.
- Right-click in the previously selected element and select **Deploy** from the list that is displayed.

A successful VNF deployment requires connection to a previously activated Virtual Network. Select the VNF in the workspace and right-click in the element to display a list of available actions.

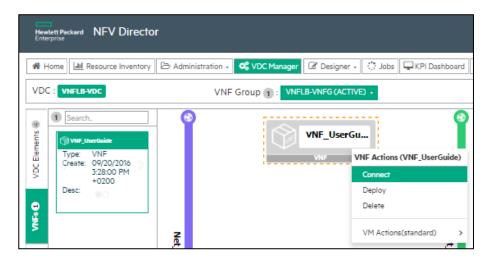


Figure 214: Connecting a VNF to Virtual Networks

Left-click **Connect**, or left-click **Actions**, and select **Connect** to display a window similar to the one in the following illustration.

NETS ETHO V NETS					de	onnect VNF: VNF_UserG						de	Connect VNF: VNF_UserGuid
VNF Group Name: VNF Group Name: VNF Group Name: VNF Group Name: Interver Connection Information Interver Management is group in the sector in t						G							VDC:
VNELS-VNFG Machines # of GWs ETHO connected ETHO has GW Management is ETHO Imagement is ETHO						NFLB-VDC							VNFLB-VDC
Intervent						F Group Name:							VNF Group Name:
Hachines # of GWs ETH0 connected ETH0 has GW Management is ETH0 # of GWs # of GWs ETH0 connected ETH0 standard 0 0 NO NO VES Itandard 1 0 NO						NFLB-VNFG							VNFLB-VNFG
NETS ETHO NETS NETS <th< td=""><td></td><td></td><td></td><td></td><td></td><td>Network Connection Information</td><td></td><td></td><td></td><td></td><td></td><td></td><td>Network Connection Information</td></th<>						Network Connection Information							Network Connection Information
Network Connection: Endpoint Network Connection: Endpoint Network Network: Please choose an option Please choose an option Offline Net_O1	ETH0 has GW Management is ETH0	ETH0 has GW	ETH0 connected	# of GWs		achines	\Box		ETH0 has GW	ETH0 connected	# of GWs		Machines
Network: Network: Please choose an option • Please choose an option • Offline •	NO YES	NO	NO	0	1	tandard		YES	NO	NO	0	0	standard
Please choose an optionPlease choose an option Offline						letwork Connection: Endpoint							Network Connection: Endpoint
Please choose an option Offline Offline						work:							Network:
Offline						t_01							Please choose an option
Deployed	Connect Cance												
Net_01							_						Net_01
Net_02	A												Net_02

Figure 215: Configuration form for connecting VNF endpoints

Due to the nature of the VNF, at least one endpoint must be selected. The VNF could have more than one, depending on the number of VNF Components and Virtual machines of each component. These endpoints are directly related to the Virtual Networks present in the workspace, so the **Network** field will list all the available networks.

NOTE: An operational VNF connection requires that one network take the role of **Network Connection Endpoint**.

The following illustration indicates the VDC status just prior to starting the deployment.

Hewlett Packard NFV Direct	pr	Workspaces 🗸	📥 VNFLB-VDC@VNFLB-Orga	nization 👻 🔺 🗸
Home 🔐 Resource Inventory	🗁 Administration 🔹 🛠 VDC Manager 🕼 Designer 🔹 🔅 Jobs 🔲 KPI Dashboard 🚱 Browser		Jobs Monitor +	🕄 Refresh 🕞
VDC : VNFLB-VDC	VNF Group 1 : VNFLB-VNFG (ACTIVE) V			۲
€ 50000 1 Search 3 VNF_UserGuide Type: VNF Create: 09/20/2016 3.28:00 PM +0200 Desc: 9	VNF_UserGu			® Net_03

Figure 216: VDC elements

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Once the VNF is connected to both activated Virtual Networks, Net_01 and Net_02, a line will be displayed between them and the VNF indicating the connection. The line should be dashed, indicating an inactive connection. If the workspace is similar to the following illustration, then the VNF is ready to be deployed.

There are two ways to start the deployment process.

- Right-click the component in the workspace.
- Left-click Actions and select Deploy.

Hewlett Packard NFV Director			Workspaces 👻	🛓 VNFLB-VDC@VNFLB-Organization 👻 📕 🗸
🗰 Home 🔠 Resource Inventory 🗁 Administration 🔹 📽 VDC Manager 🖉 Desi	gner 👻 🔅 Jobs 🖵 KPI Dashboard 🕻			Jobs Monitor - 🧭 Refresh -
VDC : VNFLB-VDC VNF Group 1: VNFLB-VNFG (ACT	VE) •			۲
Search. Image: Constraint of the search of the	Connect	VVIE: VVIE_UberGuide VVIF_VVIE VVIF VVIF Name VVIF_UberGuide Description VVIF designed by the optimized of		Connect ¥ ScaleInOu Deploy

Figure 217: Two ways to launch a Deploy a VNF

After selecting **Deploy**, the following window will be displayed.

Deploy VNF For: VNF_UserGuide	×
Name:	
VNF_UserGuide	
VDC:	
VNFLB-VDC	
Deploy Mode:	
Default	•
Resource Pool: ★	
 VDC: VNFLB-VDC 	
OC: GRE-DS_Kilo-156	
 VIM: kilo_2 	
 Region: RegionOne 	
• Zone: nova	
Deploy	Cancel

Figure 218: VNF Deployment configuration

The only deployment mode available for the VNF is **Default**, which executes the actions for each step of the deployment operation without ensuring or simulating the result. The results depend on the VNF configuration and scenario.

After selecting the mode, select the VNF deployment destination. There is no level restriction for VNF deployment in the Datacenter. It is enough to select one of the elements in the resource pool list. **Region: regionone –> Zone:nova** is selected for this particular VNF.

Left-click **Deploy** to deploy the element. If the deployment process started correctly, the system will display a confirmation message and register in the **Jobs Monitor** similar to the following illustrations.

Click the button to access these messages.

Instance: 'VNF_UserGuide' created successfully. ID = b0fe3cd2-1085-4ae9-9260-4ff98678f228. click 'refresh'	×		Operation	Name	Start time	End time	
button to show the instance.		0	deploy∨nf	VNF_UserGuide	09/20/2016 4:12:28 PM +0200		×
Instance: VNF_UserGuide connected successfully.	\sim						
Instance: VNF_UserGuide deploy started. Job ID = c26d5b0e-94e1-4fff-8f98-1fcae47e4528.	×		lear All				

Figure 219: VNF deployment confirmation message and job registration

If the deployment process ended properly, the color of the element will change to green, indicating **ACTIVE** status. If the color of the element changes to red, it indicates **ERROR** status. If the deployment process was not able to activate the element, the components in the workspace at the end of the process should be in the same state as prior to deployment. The element displayed after successful deployment is similar to the following illustration.



Figure 220: Successful deployment

During the deployment of the VNF, its components will retain the **INSTANTIATED** status. This is because the VNF component is a member of the Virtual Machines group, and the rest of the elements that are part of the VNF, including policies, monitors, or Virtual Luns, are treated as the container in this version. A component status change is not required to perform any operation.



NOTE:

If there is a VDC with Management, the VNF will connect to the Management Network during deployment.

Select **Apply Changes** for the VNF instance after successful deployment to deploy a VNF with one or more monitors.

2.1.4.1.1.3 Deleting a VNF

Select the **VNF** in the workspace and left-click inside and element to change its border to a dashed line that is any color but grey. There are two ways to initiate deleting.

- Left-click Actions and select Delete.
- Right-click inside the previously selected element and select **Delete** from the displayed list.

t .
· · · · · ·
tions(standard)
ct

Figure 221: Delete VNF action

After the required action has been selected, the **VDC Manager** will display the following window:

Delete : VNF_UserGuide	×
Do you really want to delete instance: VNF_UserGuide?	
De	lete Cancel

Figure 222: Delete VNF confirmation window

Left-click **Delete** to delete the element. If the deleting process started correctly, the system will display a confirmation message.

Click the button to access these messages.

2.1.4.1.2 Activated VNF operations

This section lists the actions available for an activated generic VNF. The following operations are available from the **VDC Manager**:

- creating
- deploying
- deleting

After the component has been activated, the **VDC Manger** allows the following additional operations:

- scaling
- un-deploying

Activating the VNF enables additional operations:

- Scale Up
- Scale Down
- Scale In
- Scale Out
- Un-Deploy
- Apply changes
- Connect
- Heal
- Deploy All KPIs

The **Scale** operations can only have one element as target. Each element requires a policy, meaning the VNF Components and the VNF each require a Scale policy in order to escalate. If a policy needs to elevate more than one element, it will only scale one, leaving the others unaltered.

2.1.4.1.2.1 Updating a VNF field

After making changes to any of the attributes of the elements in the **VDC Manager** workspace or attributes displayed in the **Inspector**, such changes must be saved. There are two ways to save changes:

- Left-click Actions and select Update.
- Right-click any blank space in the VDC Manager and select Update.

Hevelet Packard NFV Director	🛓 VNFLB-VDC@VNFLB-Organization 👻 🔺
# Home Image: Image	Joba Monitor - 🗘 Refresh 🔹
Image: Search. Image:	VDC:VNFLB-VDC Actions VDC:VNFLB-VDC VHF Group Actions (VNFLB-VNFC) Type A > Virtual Network : Update VDC VhF Group Actions (VNFLB-VNFC) Name Virtual Network : Net_02 VNFLB-VDC > Virtual Network : Net_03 VNFLB-VDC VNF Is VNF_UserGuide I VNFLB-NEVDDirector Tenant Status ACTIVE ACTIVE

Figure 223: Update action in the VDC Manager

Selecting **Update** displays a new form indicating all the fields that have been modified. Left-click **Update** to apply the changes and modify the image used to activate the VM.

Update Instance:					×
Warning: Unchecked modifications will Modified Attributes (1): Element Virtual Machine : standard	l be lost after update !				
Element	Attribute	Category	Old Value	New Value	
Virtual Machine : standard	Image	GENERAL		Image_UserGuide	
				Update	Cancel

Figure 224: Update fields confirmation window

The following illustration indicates the message in the notification area after the update has been applied.

VNF instance: " updated successfully.	×
Clear All	۵

Figure 225: Update successful message in the notification area

2.1.4.1.2.2 Applying VNF changes

Changes to any of the components in the **VDC Manager** workspace, for example adding a new monitor or Lun to some entity, must be saved. There are two ways to save these changes.

- Left-click Actions and select Apply Changes.
- Right-click any blank space in the VDC Manager and select Apply Changes.

Heriden Rackard NFV Director			Workspaces 👻 🚢 VNF	LB-VDC@VNFLB-Organization +
Image: The second se	-]		Jobs Monitor - 🏾 🕄 Refresh
	VMF Actions (VNF_UserGuide) Un-Deploy Apply Changes Connect Heal Scale Up Scale Up Scale Down Scale In Scale In Display All KPIs	✓ W#: VHF_UserGuide VHF: VHF_UserGuide Type VNF Name VNF_UserGuide Description VNF designed by the user Status ACTIVE	VNF : VNF UserGuide → End Point : Endpoint E > Scale Policy : ScaleInO → VNF Component : VNF	

Figure 226: Apply Changes action in the VDC Manager

Selecting **Apply Changes** will display a new form. Select **Default** in the **Apply Changes Mode** field and left-click **OK** to execute the action.

Apply Changes For VNF_UserGuide	×
VDC:	
VNFLB-VDC VNF Group Name:	
VNF Group Name: VNFLB-VNFG	
Apply Change Modes	
Default	•
1 1 LYNA designed by the User	OK Cancel

Figure 227: Apply Changes to the VNF

Clicking **OK** will display a new confirmation message in the notification area and a new message in the **Jobs Monitor**.

2.1.4.1.2.3 Un-deploying a VNF

The **Un-deploy** operation is only available if the specific **VNF** has **ACTIVE** status. There are two ways to initiate undeployment.

- Right-click the element and select **Un-Deploy** from the displayed list.
- Select the element in the workspace, left-click **Actions** and select **Un-Deploy**.

Figure 228: Un-deploy VNF action

After the **Un-deploy** operation has been selected, the following confirmation window will be displayed.

Undeploy VNF For VNF_UserGuide	×
Do you really want to undeploy this instance?	
Undeploy	Cancel
VINE + INFE LICARGOUND	.R 1

Figure 229: Un-deploy operation confirmation window

Left-click **Un-deploy** to un-deploy the selected VNF or left-click **Cancel** to discard the un-deployment process. If the un-deployment process is executed correctly, the element will be removed from the workspace.

2.1.4.1.2.4 Scale Up a VNF

If execution requires a **Scale Up** operation, it can be selected from the list of operations. There are two ways to launch a **Scale Up** operation from the component.

- Right-click in the VNF in the workspace and select Scale Up.
- Left-click Actions and select Scale Up from the displayed list.

Howlett Packard NFV Director				Workspäces 🗸 🔺 🔺 VN	FLB-VDC@VNFLB-Organization 、	-	4 -
🐐 Home 🔟 Resource Inventory 🗁 Ad	ministration 👻 🗱 VDC Manager 🕼 Designer 🗸	🔅 Jobs 🖵 KPI Dashboard			Jobs Monitor - 🥃 Re	efresh	•
VDC : VNFLB-VDC	VNF Group 1: VNFLB-VNFG (ACTIVE) •						۲
Net 01 200.0.0.0/24	Ur Aş Ca Hı Sa Sa Sa Sa Sa Sa Sa Sa	• ¥	VNIS VNE_UserGuide VNIS VNE_UserGuide Type VNE Name VNE_UserGuide Description VNE designed by the user Status ACTIVE	Image: State Point - State	VNF Actions (VNF_UserGuide) Un-Deploy Apply Changes	•	Inspector VNF Selector (1)

Figure 230: Two ways to Scale Up a VNF

After the operation has been selected, the following confirmation window will be displayed.

Scale Up VNF_UserGuide	×
Do you really want to scale this instance?	
	Scale Cancel

Figure 231: Scale Up a VNF confirmation window

P

Left-click **Scale** to start the escalation process, or left-click **Cancel** to discard the process. If the escalation is executed correctly, the element will be removed from the workspace.

NOTE: Escalation policies operate along with **Entity Scale Policies**, so when initiating this type of process, check which of the policies developed by the user is going to be executed.

2.1.4.1.2.5 Scale Down a VNF

If execution requires a Scale Down operation, it can be selected from the list operations. There are two ways to launch a Scale Down operation from the component.

- Right-click in the VNF in the workspace and select **Scale Down**. •
- Left-click Actions and select Scale Down from the displayed list. •

Hewlett Packard NFV Director Enterprise			Workspaces 👻 📥 VNF	LB-VDC@VNFLB-Organization +	4 -
👫 Home 🔟 Resource Inventory 🗁 Adminis	istration 👻 🧐 VDC Manager 🖉 Designer 👻 🔅 Jobs 🖵 KPI Dashboard			Jobs Monitor - 2 Refres	h +
VDC : VNFLB-VDC	VNF Group 1: VNFLB-VNFG (ACTIVE) •				۲
Search. Search. Search. Over VNF Desc: Vec 01 200.0.0.02	DHCP/24 VNF_UserGU VNF Actions (VNF_UserGuide) Un-Deploy Apply Changes Connect Heal Scale Up Scale Up Scale Down Scale In Scale Out Display All KPIs VM Actions(standard) >	VNF: VNF_UserGuide VNF=VNF_UserGuide Type VNF Name VNF_UserGuide Description VNF designed by the user Status ACTIVE	VNF : VNF_UserGuide Image: Scale Policy : ScaleInC Image: Scale Policy : ScaleInC Image: VNF Component : VNF	Actions VHF_LiserGuide) Un-Deploy Apply Changes Connect Heal Scale Up Scale Up Scale In Scale In Scale Our Display All KPIs VM Actions(standard)	Inspector V/NF Selector 1

Figure 232: Two ways to Scale Down a VNF

After the operation has been selected, the following confirmation window will be displayed.

Scale Down VNF_UserGuide	×
Do you really want to scale this instance?	
	Scale Cancel
	VNE VNE HearGuida

Figure 233: Scale Down a VNF confirmation window

Left-click Scale to start the escalation process, or left-click Cancel to discard the process. If the escalation is executed correctly, the element will be removed from the workspace.



NOTE: Escalation policies operate along with Entity Scale Policies, so when initiating this type of process, check which of the policies developed by the user is going to be executed.

2.1.4.1.2.6 Scale In a VNF

If execution requires a **Scale In** operation, it can be selected from the list of operations. There are two ways to launch a **Scale In** operation from the component.

- Right-click in the VNF in the workspace and select Scale In.
- Left-click Actions and select Scale In from the displayed list.

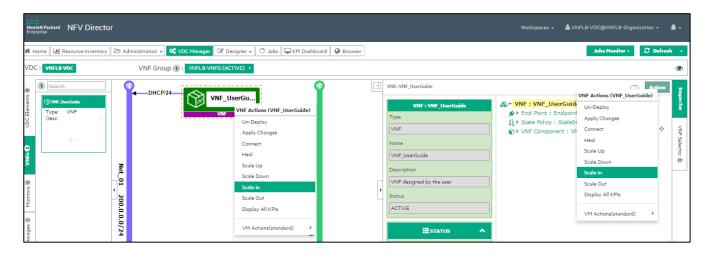


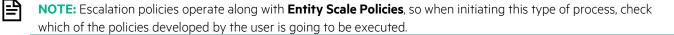
Figure 234: Two ways to Scale In a VNF

After the operation has been selected, the following confirmation window will be displayed.

Scale In VNF_UserGuide	×
Do you really want to scale this instance?	
	Scale Cancel
	VNF : VNF UserGuide

Figure 235: Scale In a VNF confirmation window

Left-click **Scale** to start the escalation process, or left-click **Cancel** to discard the process. If the escalation is executed correctly, the element will be removed from the workspace.



2.1.4.1.2.7 Scale Out a VNF

If execution requires a **Scale Out** operation, it can be selected from the list of operations. There are two ways to launch a **Scale Out** operation from the component.

- Right-click in the VNF in the workspace and select **Scale Out**.
- Left-click Actions and select Scale Out from the displayed list.

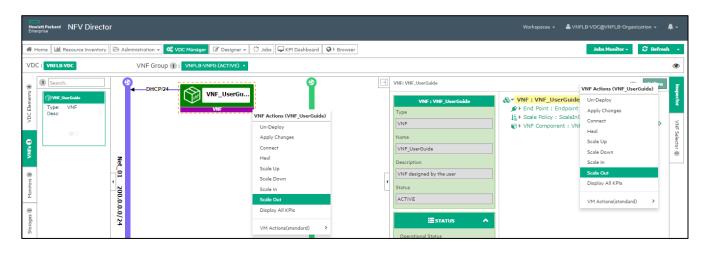


Figure 236: Two ways to Scale Out a VNF

After the operation has been selected, the following confirmation window will be displayed.

Scale Out VNF_UserGuide	×
Do you really want to scale this instance?	
	Scale Cancel
	VNF : VNF UserGuide

Figure 237: Scale Out a VNF confirmation window

Left-click **Scale** to start the escalation process, or left-click **Cancel** to discard the process. If the escalation is executed correctly, the element will be removed from the workspace.



NOTE: Escalation policies operate along with **Entity Scale Policies**, so when initiating this type of process, check which of the policies developed by the user is going to be executed.

2.1.4.1.2.8 Healing a VNF

A **Heal Policy** indicates a **Heal** cause and the workflow that will be executed in the NVFD when the user triggers the **Heal** operation for a VNF or a VNF component. This type of policy will perform its configured action even if the operation that has triggered the policy is still in execution.

At least one **Heal** policy needs to be configured in the VNF in order to execute be able to execute it. Refer to the *Error! Reference source not found.* and *Error! Reference source not found.* chapters on how to configure these policies. There are two ways to execute the policy.

- Left-click Actions and select Heal.
- Right-click the VNF and select Heal.

Enterprise NFV Director	Workspaces + 🎄 VNFLB-VDC@VNFLB-Organization + 🧍 +
🏶 Home 🔠 Resource Inventory 🗁 Administration 🔹 🥰 VDC Manager 🕼 Designer 🔹 🔅 Jobs 🖙 KPI Dashboard 🖉 Br	Jobs Monitor - 🛛 Refresh 🕞
VDC : VNFLB-VDC VNF Group 1 : VNFLB-VNFG (ACTIVE) •	•
Bearch. Image: Constraint of the const	VHF: VHF_UserGuide_Heal Charles VHF Actions (VHF UserGuide_Heal) Charles VHF Actions (VHF UserGuide_Heal) VNF VNF VNF Connect Charles Charles VNF VNF Connect Charles Charles Charles VNF VNF Connect Charles Charles Charles Charles VNF VNF Connect Charles Charles

Figure 238: Two ways to execute a Heal policy

Selecting the **Heal** action will display a new window indicating the causes of the **Heal** configured during the creation of the policy. Set the **Heal** causes when designing the VNF Components and the VNF (*Error! Reference source not found.* and *Error! Reference source not found.* chapters). There are two causes set up in the illustration, **Cause A** and **Cause B**. Select either one and left-click **Heal** to launch the policy for the VNF.

Heal VNF	×
Cause:	
Please choose an option	•
Please choose an option	
Cause_B	-
Cause_A	
	riear Cancer

Figure 239: Select Heal cause

A new message will be displayed in the notification are, indicating the result of the **Heal** policy.

2.1.4.1.2.9 Displaying all KPIs of the VNF instance

This operation browses all the KPIs collected by all the monitors in the VNF/VMs. The latest KPI values are listed in the dialog box and clicking **Refresh** will update them.

vnf1	
VNF Actions (vnf1)	
 Un-Deploy	
Apply Changes	
Connect	
V Scale Up	
Scale Down	
Scale In	
Scale Out	
Display All KPIs	
VM Actions(standard)	>

Figure 240: Displaying all KPIs of the VNF instance

2.1.5 Virtual Machine operations

Operating with Virtual Machines in the **VDC Manager** requires a VNF with an activated VM. This is usually a VNF created by the user in the **VNF Designer**. The following section describes the operations available in the **VDC Manager** with an activated VM.

NOTE:

말

The Virtual Machine will be activated when the VNF that hosts these elements go through an activation process.

The Virtual Machines and the VNF operations menu are available through the VDC Manager.

He Ent	weitt Packard NFV Director			
*	Home	Management - OS VDC Manager C Desig	iner - 🗘 Jobs 🖉 Utilities -	
VD	DC : Ten_userGuide2	VNF Group (1) : Oracleadmin 🔹		
VDC Elements (\$)	1 Search. WHE userClaide Type: VNF Creation: Desc: VNF for the User Guide	B Example_VM VHF UserGuide	VM Actions(Example_VM)	
tions (I) VNFs (I)		DHCP/24 FW_UserGuid	Connect Delete	
-	VM: Example_VM		VM Actions(Example_VM)	Inspector
	VM : Example	A Mon	ple_VM VNF Actions	ector
	Type VM	🔅 Polic Virtu De	innect Down elete	VNF Select

Virtual Memory : VM Memory

Virtual Port : ETH1

Figure 241: Two ways to access VNF Actions in a user-created VNF

B

2.1.5.1 Stopping a Virtual Machine

There are two ways to stop the Virtual Machine.

Example_VM

- Right-click in the VNF that hosts the VM and select **Stop**.
- Left-click Actions and select Stop.

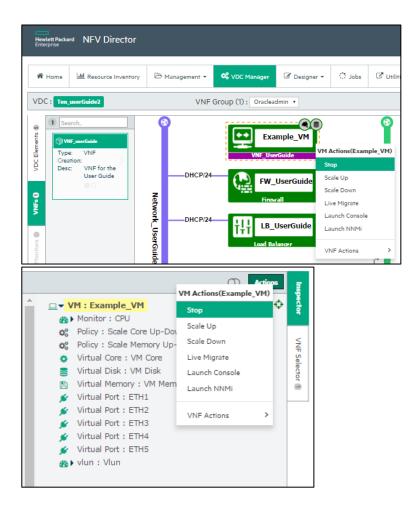


Figure 242: Two ways to stop a Virtual Machine

After the operation has been selected, the following confirmation window will be displayed.

Stop VM: Example_VM	×
Do you really want to stop this VM?	
	Stop Cancel

Figure 243: Stop a Virtual Machine confirmation window

Left-click **Stop** to stop the Virtual Machine. If the Virtual Machine was stopped correctly, the system will display a confirmation message and register the job in the **Jobs Monitor**.

Click the **button to access these messages**.

2.1.5.2 Launching the Virtual Machine Console

here are two ways to launch the Virtual Machine Console.

- Right-click in the VNF's Virtual Machine and select Launch Console.
- Left-click Actions and select Launch Console.

Hewlett Packard NFV Director	
Home	C Management • C VDC Manager
VDC : Ten_userGuide2	VNF Group (1): Oracleadmin •
Search. VIE.secf.idde Type: VNF Creation: Desc: VNF for the User Guide	Image: State of the state o
VM: Example_VM	
VH : Example_VH Type VM Name Example_VM Description	VH Actions(Example_VH) VH Actions(Example_VH) VH Example_VM Sop Policy : Scale Core Up-Dc Scale Dp Scale Down Virtual Core : VM Core Virtual Core : VM Disk Uve Migrare Virtual Port : ETH1 Virtual Port : ETH1 Virtual Port : ETH2 Virtual Port : ETH3 VHF Actions VIrtual Port : ETH5 VIrtua

Figure 244: Two ways to launch the Virtual Machine Console

After the required action has been selected, the VDC Manager will display the following window:

Launch VM Console: Example_CG	×
Open VM console for: Example_CG in another tab?	
Launch	Cancel

Figure 245: Launch Virtual Machine Console confirmation window

Left-click **Launch** to launch the element's console. If the console started correctly, the system will display a confirmation message <u>and</u> the console will load in a new web page similar to the following illustration.

Click the button to access these messages.

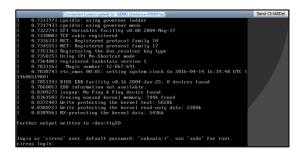


Figure 246: Virtual Machine Console

2.1.5.3 Launching NNMi of a Virtual Machine

There are two ways to launch a Virtual Machine Console.

- Right-click in the VNF's Virtual Machine and select Launch Console.
- Left-click Actions and select Launch Console.

After selecting the Launch Console action, the VDC Manager will open the login page of the HPE Network Node Manager i web page. Enter the required credentials to access Node Manager.

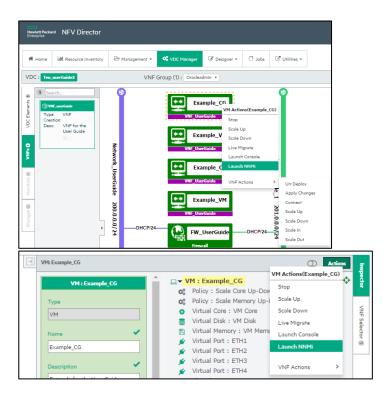


Figure 247: Two ways to launch NNMi from a Virtual Machine

2.1.5.4 Connecting the VNF

If changes are required to an attribute or configuration of the networks associated with the VNF, the VNF needs to connect to the network. There are two ways to connect.

- Left-click the element's VNF Actions and select Connect.
- Left-click Actions and select VNF Actions -> Connect.

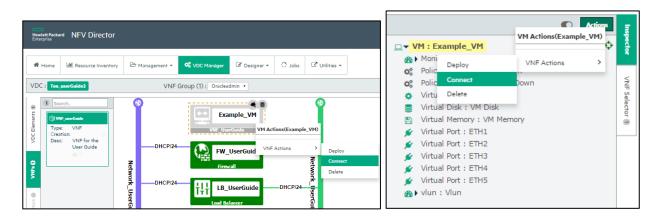


Figure 248: Two ways to connect a Virtual Machine

After the required action has been selected, the following window will be displayed to edit certain element attributes.

Connect VNF: VNF_Use	rGuide				×
/DC:					
Ten_userGuide2					
/NF Group Name:					
Oracleadmin					
Network Connection Information					
Network Connection Information	# of	# of GWs	ETH0 connected	ETH0 has GW	Management is
	# of NETS	# of GWs	ETH0 connected	ETH0 has GW	Management is ETH0

Figure 249: Virtual Machine connection configuration window

Left-click **Connect** to connect the Virtual Machine to the listed networks. If the connection was successful, the system will display a <u>confirmation</u> message in the notification area.

Click the **button to access these messages**.

1=1

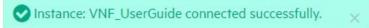


Figure 250: Virtual Machine successful connection confirmation message

2.1.5.5 Attaching a Floating IP to a Virtual Machine

A **Floating IP** is a publicly-accessible static IP address that can be assigned to one entity.

NOTE: The entity owner of the Floating IP still keeps its original public IP address, which will remain unchanged. Instead, a Floating IP will provide an additional static IP address that can be used to access the entity.

When using Floating IPs, the user should identify two parts beside the Floating IP itself.

- Active server: This receives user traffic forwarded from the Floating IP.
- Passive server: This is a standby server usually configured identical to the active server. It will receive traffic only during a failover event.

The Floating IP address points to one of the servers. A Floating IP can also be reused in another port of another VM, but can only be used by one port at a time.

If execution requires assigning a Floating IP address to the Virtual Machine, there are two ways to do this.

- Right-click the Virtual Machine in the workspace and select Attach Floating IP.
- Left-click Actions and select Attach Floating IP.

After the required action has been selected, the **VDC Manager** will display a confirmation window. Left-click **Attach** to start assigning the Floating IP address. If the process started correctly, the system will display a confirmation message.

Click the **button** to access these messages.

2.1.5.6 Deleting a Floating IP from a Virtual Machine

Select the Virtual Machine with the Floating IP in the workspace. To select an element, left-click inside it in the workspace until its border has changed to a dashed line that is any color but gray. Once selected, there are two ways to initiate deleting:

- Left-click Actions and select Delete Floating IP.
- Right-click in the previously selected element and select **Delete Floating IP** from the list that is displayed.

After the required action has been selected, the VDC Manager will display the following window.

Delete :	×
Do you really want to delete instance: ?	
Delete	ancel

Figure 251: Delete Floating IP confirmation window

Left-click **Delete** to delete the Floating IP. If the deleting process started correctly, the system will display a confirmation message.

Click the	button to access these messages.
-----------	----------------------------------

2.1.5.7 Deleting a Virtual Machine

Select a Virtual Machine in the workspace with **INSTANTIATED** status. To select an element, left-click inside it in the workspace until its border has changed to a dashed line that is any color but gray. Once selected, there are two ways to initiate deleting:

- Left-click Actions and select Delete.
- Right-click in the previously selected element and select **Delete** form the list that is displayed.

① Action	
VM Actions(Example_CG	۵
\$ Policy · Scale Core Un-Dow \$ Policy Deploy VNF Actions >	
Virtu Connect Virtu Delete	VNF Sele
Virtue nerrory , vir nerrory	ctor
 Virtual Port : ETH1 Virtual Port : ETH2 	

Figure 252: Two ways to delete a Virtual Machine

Deleting a Virtual Machine will delete the VNF that hosts the specific Virtual Machine. After the required action has been selected, the **VDC Manager** will display the following window.

Delete : VNF_userGuide	×
Do you really want to delete instance: VNF_userGuide?	
De	lete Cancel

Figure 253: Deleting a Virtual Machine confirmation window

Left-click **Delete** to delete the Virtual Machine. If deleting started correctly, the system will display a confirmation message <u>similar</u> to the following illustration.

Click the state button to access these messages.

✓ Instance: deleted successfully. ID = dddee9c3-f27a-4484-9d0f-ab3f59f528dd.

Figure 254: Deleting a Virtual Machine confirmation message

2.1.6 Monitor operations

This section describes how to edit Monitors in the VNF Designer if the Monitor menu is not disabled.

All **Monitor** operations in the **VDC Manager** are focused on creating and activating Monitors over Virtual Machines, the unique element that Monitors can take as target.

The following Monitor types may be deployed over Virtual Machines:

- **Monitor Disk Write**: Monitors writing operations over the Virtual Disk associated with the Virtual Machine Server.
- **Monitor Disk Read**: Monitors reading operations over the Virtual Disk associated with the Virtual Machine Server.
- Monitor CPU: Monitors operations over the Virtual CPU associated with the Virtual Machine Server.
- **Monitor Network Transmitted**: Monitors transmission operations over the Virtual Network related to the Virtual Machine.
- **Monitor Network Received**: Monitors the messages received through the Virtual Network related to the Virtual Machine.
- Monitor Memory: Monitors operations over the Virtual Memory associated with the Virtual Machine Server.

There are two ways to create a Monitor.

- Drag the element to the workspace.
- Right-click the previously selected element and select Create Instance.

The VDC Manager will display the following window.

Create Monitor: monitor-disk-write	×
Instance Name:	-
Disk_Wr_monitor	
Description:	-
Monitor for Disk Wirting	
Tenant:	15
Ten_UserGuide	
VNF Group Name:	
VNFG_UserGuide	
Monitor Template:	
monitor-disk-write	
VM: ★ Search_ = VDC: Ten_UserGuide = VAPP: VNF_User = VAPP COMPONENT: UG_Component_1 ■ VM: Example VM © VM: Example CG	
Cre	Cancel

Figure 255: Monitor creation configuration

The **Instance Name** and **Description** fields were completed with the **Disk_Wr_monitor** and **Monitor for Disk Writing** values respectively for this example. Besides these attributes, the attribute referring to the monitor target needs to be completed. In this case the target is one of the user-created Virtual Machines in the VNF, **Example VM**. Left-click **Create** to create the Monitor or left-click **Cancel** to discard the changes.

All **Monitors** are created identically and all have the same editable attributes at this level. A Monitor has an error condition and error action that should be configured before operating with the monitor, else the Monitor will be a dummy. Refer to the *Error! Reference source not found*. chapter (*Error! Reference source not found*. and *Error! Reference source not found*. and *Error! Reference source not found*.

The following illustration indicates how the **Monitor** has been integrated in the Virtual Machine members.

Management NEV Director	د - + Geleicheell رونگول, eleicheell هـ - + arsochter
● Home Idd Resource Inventory 日本 Nanagement - CC VCCC Management - C Designer + O Jobs C Unitines -	Julia Manihar - 🕄 Stationals
VDC : Tex see Guide2 VNF Group (1) : Oradaudmin *	
Vermonia Vermonia Vermonia Deser Verficiente Deser Verficiente Des	VMM Romple,VM VM Strongle,VM VM

Figure 256: New Monitor in the Virtual Machine

2.1.7 Storage operations

This section describes how to configure and edit **VLuns** in the **VNF Designer** if the **VLun** menu is not disabled.

A **VLun** is a storage component. A **LUN** is a unique identifier for a physical storage allocation that can reference an entire RAID set, a single hard disk or partition, or multiple disks or partitions. The **VLun** does not map to a specific device or allocation of storage space but a virtual space that can be created in excess of the actual physical space available.

Follow these steps to create a VLun from the VDC Manager.

- 1. Position the cursor in the left region of the **VDC Manager**.
- 2. Left-click **Storage** in the vertical list.

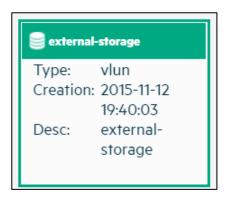


Figure 257: VLun element

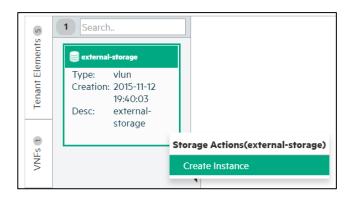


Figure 258: VLun Create Instance action

There are two ways to create a VLun.

- Drag the element to the workspace.
- Right-click the previously selected element and select Create Instance.

Create Virtual LUN: external-storage	Create Virtual LUN: external-storage
Instance Namer	Instance Name: *
vlun_UserGuide	
Descriptions 🗸	Description:
Storage for the User Guide	
Tenanti	Tenant:
Ten_UserGuide	Ten_UserGuide
VNF Group Name:	VNF Group Name:
VNFG_UserGuide	VNFG_UserGuide
Storage Template:	Storage Template:
external-storage	external-storage
VH: ★ [sarch.] - VIC: Text: Used wide - VID: VAL_Use - VID: VAL_Use <	VM: * Example • VDC: Tect_ber:Guide • VW: VVC:Some:Trive • VW: VVC:Some:Trive • VW: Example: CG

Figure 259: VLun creation configuration

The Instance Name and Description fields were completed with the vlan_UserGuide and Storage for the User Guide values respectively. Besides these attributes, the attribute referring to the monitor target needs to be completed. As indicated in the previous left-side illustration, the application will not allow selecting anything other than the Virtual Machine. In this case the target is one of the user-created Virtual Machines in the VNF, Example VM. Left-click Create to create the VLun or left-click Cancel to discard the changes.

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IMPORTANT: In case of a Helion Carrier Grade (HCG) environment there must be at least one VLun with the following attributes set:

- STORAGE.Bootable attribute set to true, making the VLun bootable
- INFO.Amount attribute set to 0

If these values are not set accordingly, the HCG environment will develop an internal conflict. Proper operation requires storage to be configured. Machines deployed in an HCG environment without properly configured VLuns will not operate as expected.

2.1.8 Heal operation

Sometimes a VNF or some VMs of a VNF do not operate properly or could be damaged. NFVD has a special **Heal** operation, which allows the execution of a specific workflow to heal the VNF.

The **Heal** operation can be triggered from two different levels:

- VNF level
- VNF component level

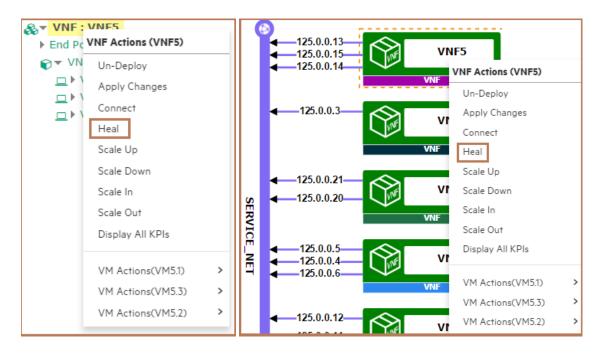


Figure 260: Heal operation at the VNF level



Figure 261: Heal operation at the VNF component level

The prerequisite for the **Heal** operation:

- VNF or vnf_component is deployed.
- VNF or vnf_component is created with Heal polices.

200.00.3	VAR VAR	(1) Anima
deployed vnf	head pedicy : bead pedicy Type head pedicy Name head pedicy Description head pedicy Status NSTANTIATED	• VMF : VMF3 • End Point : EP3 • VMF Component : VMF_CH • Ineal_policy: Ineal_policy • VMF: VM1 • Ineal_policy • VMF: VM1 • Ineal_policy
	HestCause	

Figure 262: Deployed VNF

When selecting the **Heal** action, the cause needs to be selected. Possible values depend on the Heal policy attached to the VNF.

Heal VNFC		×
Cause:		
Please choose an option		•
Please choose an option		
- Network		-
	Heal	Cancel

Figure 263: Selecting the Heal cause

The system displays a confirmation message after the **Heal** operation has completed successfully.

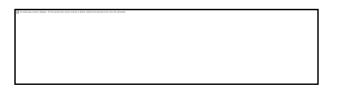


Figure 264: Heal operation confirmation message

The system will display the following message if there is no available **Heal** cause.

Heal VNF	×
Cause: Please choose an option	۲
Warning!: "KVM1" :This vnf instance doesn't contain any heal policy, don't allow to do heal operation.	Heal Cancel

Figure 265: Missing Heal cause error message

Chapter 3 NFV Director Online Designer

3.1 VNF Component Designer

3.1.1 Introduction

The VNF component designer is an online designer implemented in our NFV Director platform. It allows us to design and modify the attributes and specifications of the VNF components that are going to be used later. To access the designer, go to the top menu of the NFV Director Web, and right-click **Designer**. From a list of two elements, select **VNF Component Designer**.

To use all the functionalities of the Designers at our disposal, we are accessing the NFV Director platform with a VDC level User.

3.1.2 Screens of the designer

3.1.2.1 Template chooser

After entering the valid credentials and selecting **Component Designer** in the top menu, you are going to see the following screen:

Herwiett Packard NFV Director		Workspaces - 📥 VNFLB-VDC@VNFLB-Or	rganization - 🗳
Home M Resource Inventory Administration - Choose a VNF Component:	nager 🕜 Designer - 🔅 Jobs 🖵 KPI Dashboard 🛛 🏵 Browser	Jobs Monitor	C Refresh -
Name	Description	Action	
VNF Component base	VNF Component base	Clone	
VNFC_Userguide	No description	Clone Cont Contract C	Delete

Figure 266: First window of the Component Designer.

The **Download** button allows us to get the file of the component of our selection. The design is exported to an .xml file. To download the design, click **Download** next to the component chosen. A new window appears, allowing to choose between the two types of files. It also allows the user to change the name of the design.

Download	×
File Name: VNF_userGuide	
	Yes No

To execute the download, click **Yes**. In the case of the above image, once we click in the button, an xml file will be downloaded with the name **VNFC_UserGuide.xml**.

In this version, we can upload an already designed and functional VNF, have stored locally. To upload a new element to be edited with the designer, click **Upload**. A new window appears:

Upload	×
Import Only support xml file.	
	Yes No

The upload only accepts xml files. After clicking **Import** a new file explorer window appears. Choose the file to upload. After selecting it, click Ok in the file explorer window. After that, click **Yes** in the upload window. Once the new element is uploaded, it will be listed in the **VNF Designer** list of VNFs available.

To continue, we need a template for our future component. To have a standardized starting point for all future components, first we need to clone the **VNF** Component Base. This element has the logical structure needed to build our VNF. To perform the cloning, right-click **Clone** in the right side of the page.

After right-clicking Clone, the designer is going to appear with all its sections.

In this screen, we have a list of all the possible component base for the creation of a VNF component. In this user guide, we are taking the easier way to make the tool easier to understand.

3.1.2.2 Main Screen of the Component Designer

The main screen of the Component Designer has five main zones. We are going to explain the different parts from the top to the bottom of the page.

Henders Redard NFV Director	Workspaces 👻	🚢 wiki-VDC@Wiki-Organization 👻 🌲 +
👫 Home 🔚 Resource Inventory 🕒 Administration 🔹 📽 VDC Manager 🕜 Designer 🖌 🔅 Jobs 🗭 Utilities 🗸		Jobs Monitor + 🛛 🕄 Refresh 🕞
VNF Component Designer /		Save Save As Publish Cancel
Search • Consecutive ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	⊡ VH: VH-2 Type ∨H VH Name 处灶-2 Description Image	▼ VH: VH-2 ▼ GENERAL
Publice Monitors Viuns		
Atfinity Policies Anti-Atfinity Policies Scale Policies Heal Policies Processing Policies		
Search O Add Affinity •		

Figure 267: Main window of the Component Designer

Just under the top Menu of the NFV Director Web, we can see the beginning of the Component Designer. The first element on the top includes the name of the tool in use on the left, in this case, VNF Component Designer". This element contains usual options to save/cancel/publish our design on the right. The **Publish** option refers to the action of making the designed component usable for the creation of a VNF element. To publish an element, save it in advance.

VNF Component D	ner /	Save	Save As	Publish	Cancel	

Figure 268: Top menu of the Component Designer.

The center part of the page harbors three of the five parts of the Component Designer. The parts are described from the top to the bottom. The Component list and the Search tool on the left side of the Component Designer, we can execute searches for other components that are listed. In this case, we only have listed two possible components: a "standard" Virtual Machine, and a "carrier_grade" VM. If our NFV Director platform detects more components suitable to be used in a VNF, they are listed in this section.

The middle of the web page is the work place of the designer. If we select a component of the list and drag it to the center of the web page, the component will be created and will appear in this space. This way, it is possible to edit and customize the component. When all the elements are created, and we want to see all the components listed, it will be enough to select the work space to see the list on the right side of the designer. To select work space, click in an empty zone of the work space.

The fourth part of the Component Designer is located on the right side of the web page. This is where we can edit our components, by changing the different values of the attributes in each category. Some of these attributes are not editable, because they were set at the creation of the component to make sure that the value of the field is adequate, and to avoid future problems. Another possibility is that the values will be editable in another phase of the component. Notice the

element in the top right corner of the field: IIII This button permits to edit and consult all the elements of the component that have been created, or the component that is just about to be created.

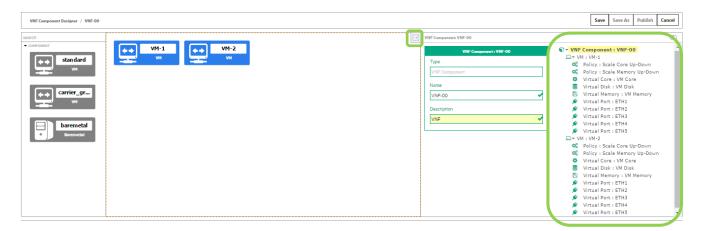


Figure 269: Attributes list in the Component Designer

The fifth part allows us to add and modify and include policies, monitors and VLuns. Creating and assigning each element will be explained later in the document.

Policies Mo	itors Vluns
Affinity Policies	Anti-Affinity Policies Scale Policies Heal Policies Processing Policies
Search	Add Affinity •

Figure 270: Secondary elements menu in the Component Designer

3.1.3 Creation of elements for the component

To create new components for our future VNFs, open the designer and select the component to create or edit from the second part of the designer (as explained before). In this part, we have the list of possible components suitable to become a part of our VNF.

For example, to create a component Virtual Machine standard, select the component in the left side of the NFV Director Web Component Designer, and drag the future component to the work space in the center of the web page. The results should look like the below:

Mention Processor NFV Director		Workspaces - 🛔 wiki-VDC@Wiki-Organization - 🍂
🕷 Home 🕍 Resource Inventory 🗈 Administration - 📽 VOC Manager		Jobs Monitor - 📿 Refresh -
VNF Component Designer / VNF-00		Save Save As Publish Cancel
search	VM:	۵ 🕲
sandard v carrier_gr v barenetal Barenetal	V** Type VH Secured Description Type Vertex	C - VM : C Policy : Scale Core Up-Down C Policy : Scale Memory Up-Down Virtual Core : VM Core Virtual Disk : VM Disk Virtual Disk : VM Disk Virtual Port : ETH1 Virtual Port : ETH3 Virtual Port : ETH3 Virtual Port : ETH4 Virtual Port : ETH5
Publice Monitors Viuns		
Affinity Policies Anti-Affinity Policies Scale Policies Head Policies Processing Policies		
Search. Add Affinity •		

Figure 271: Creation of elements in the Component Designer, first stage

Notice that the elements active in the work space are colored in blue. Also, notice that in the fifth part of the Designer. in the bottom of the page, we can see two news sections, **Monitors** and **Vluns**. **Monitors** allows for the creation of different types of monitors, **Vluns** fulfills the storage needs of the component.

When selecting an element in the design area, the associated "inspector" is opened on the right of the page. It lists all the visible attributes of the elements. These attributes can be modified before the template is saved.

Some fields in the inspector are mandatory parameters that must be filled before the component is saved and published.

If we scroll down in the inspector of the component Designer, we can see the rest of the editable attributes of the element selected, in this case, a VM. We should at least fill the attribute Name with a correct value to continue with the publishing of the element.

VM : undefined		~
Type VM	Image	
Name	cirros	✓
*	Туре	
Description	KVM	•



These are examples of how the designer allows for the editing of the different categories of the element. In this case, the categories are **GENERAL**, **CREDENTIALS** and the one inherent most the elements that reflect **Name**, **Type** and **Description**. The fields that are marked with a reflect with a values for the attribute, and can also be edited depending on the needs of the user. The values in a field with the same symbol, but with transparent text are non-editable attributes. The attributes that are not in red, and do not have any symbol associated are free to edit. This means that they are going to be needed in some processes, but not in all the possible processes (like mandatory parameters).

To change any of the editable fields of any of the element's attributes, select the element, and change the value of the attribute. To make this changes effective, save the element. To enable the use of the saved element by other components, publish the element.

The next step in the creation of a component is assigning the policies, monitors and storage. All these actions take place in the fifth section of the Component Designer. When we open the Designer, we can see the **Policies** element at the bottom of the designer. This element is used to create three kinds of policies, Affinity, Anti-Affinity and Scale. These policies should be added as per the needs of the user. Not all the policies are always necessary, and it is possible that the policies have different values in their attributes.

If a component is being edited, in the section mentioned above, we are going to have at least two more sections: **Monitors** and **VLuns**. The monitors were introduced previously, and the Vluns are elements associated with the storage space needs of the component.

To summarize it: To create a component, drag the component from the list of components to the space of work in the center of the Designer. Once it is there, edit it if necessary by changing the attributes of each element in the component. Once done with editing the attributes, add Policies, Monitors and Vluns, if needed.

To delete some element of the designer, select the component and hit **Del** on your keyboard. If we use the **Cancel** button in the first section of the Designer, we are going to delete the component that we are working with. It can be a huge mistake if you are working with a complex component.

3.1.3.1 Creating a "standard" Virtual Machine

The creation of a standard "Virtual Machine" component begins with the selection of the component from the list of possible elements in the second part of the Designer. This is the list on the left side of the web page. As explained before, this list contains the valid elements to be integrated in the future component.



After selecting the element, drag it to the work space and wait for its creation.

Figure 273: Creating a Standard Virtual Machine

As you can see in the images above, we selected the element standard Virtual Machine, we dragged the element to the work space, so the element has been created and has been colored in blue. As you can see, all the attributes and internal elements of the component are in the list on the right of the designer. Also, you can see how the designer requires the field Name to be filled, as it is a mandatory field. It will be filled with the value Example VM.

In the above image, on the right side of the designer, we can choose and change the value of some of the attributes present in the elements listed. Inside our Virtual Machine, we have policies, Virtual Ports, Virtual Core, and so on. All these elements are editable within certain constraints. If you select one of these attributes, you will see how the component window changes, and it displays the attributes of the element selected.

VH	0 😂	VM:	00
Netry: Scale Care Up Down Control Up Down Scale Care Up Down Control Up	VH: CF Delify: Scale Core Up-Down Policy: Scale Kore Up-Down Virtual Core : VM Core Virtual Memory: VM Memory Virtual Memory: VM Memory Virtual Memory: VM Memory Virtual Memory: VM Memory Virtual Memor: ETH4 Virtual Pert: ETH4 Virtual Pert: ETH5	Virtual Memory: VM Memory Image: INFO Amount Unit 1024 MB Virtual Ore: VM Disk Virtual Disk: VM Disk Virtual Port: ETH1 ✓ Virtual Port: ETH2 ✓ Virtual Port: ETH3 ✓ Virtual Port: ETH3 ✓ Virtual Port: ETH4	

Figure 274: Editing the attributes of a standard Virtual machine

As you can see, the window that allows to edit the attributes will change with the element selected in the list. Once we finish the creation and the modifications needed by the component, we will proceed to assigning policies, monitors and storage. This part of the creation is common to all the elements, so it will be covered in another section.

Once we have created the element, we can edit the attributes and components of the element. We are going to introduce a new name for our Virtual Machine. To do that, we select the element in the work space by clicking it, and then we click in the field "Name" on the right side of the work space. After that, we type the new name for the VM, in this case **Example VM**.



Figure 265: Introducing a new name for our standard Virtual Machine

To properly configure our Virtual Machine, that is, to make it behave correctly during the future execution, we need to fill all the attributes in all the categories until the green tick appears on the right side of the box.

VM : Example_VM	
Type VM	CREDENTIALS
Name Example_VM	AdminPassword
Vm Example	AdminUser
	🔚 KEYPAIR 🔥
Order	Pubkey_Data
Type KVM • KVM • VMWARE •	

Figure 275: Editing the attributes of a standard Virtual machine

In this example, we have filled the attributes Name and Description with the values Example Vm and Vm Example, respectively.

To change the values of the attributes, click the attribute and edit the field.

In the GENERAL category, the attribute Image is filled with the value cirros. This can be changed if the user wants to aim to another image. The attribute Type can only take two values. KVM and VMWARE refer to the type of the image given in the previous field.

The Order attribute will designate the activation order of the machine. If more than one machine exists in the component, this attribute will be used during deploy, undeploy and scale operations, and every process that the solution can develop.

The CREDENTIALS category contains the attributes AdminPassword and AdminUser. These fields contain the access information for the Virtual Machine that we are configuring. AdminPassword and AdminUser are the values of the fields necessary to access the VM once activated. They are not mandatory.

The **KEYPAIR** category contains data needed to connect with the Virtual Machine that was recently activated by SSH. If the user fills the Name and PubKey_Data fields, they will be set in the current KEYPAIR as new values for the attributes.

The Default attributes of a Standard Virtual Machine are:

- Virtual Machine type: "KVM".
- 5 Virtual Ports of type "virtio" to be used at disposition.
- 1 Virtual Port of type "virtio" and "NetworkType" : "MANAGEMENT", to be used by the Management Network.
- 1 Virtual Disk, with "Controller type": "SCSI", and an "Amount" of 1 Gb.
- 1 Virtual Core:
 - O CORE_ARCHITECTURE :
 - o NUMA_ID:
 - o SHARED_VCPU:
- "shared" empty.

empty.

- 1 Virtual Memory:
- o Amount : 1024. O PAGE_SIZE : 2048.

Depending on the conditions of the operation over the Virtual Machine, we should configure the attributes above to have a correct execution. We may encounter platforms that will not accept an activation of a Virtual Machine with a CORE_ARCHITECTURE other than "shared". To have a successful execution, we should configure our VM in line with the platform and scenario that we are going to use. Generally, we need to focus on the attributes

CORE_ARCHITECTURE, NUMA_ID and SHARED_VCPU. It is also necessary keep in mind that the attributes mentioned above could have validations, where the three of them will have specific values.

Note that a component may have more than one element in the list on the left side of the web page. This way, we have the possibility to create components with more than one Virtual Machine.

3.1.3.2 Creating a "carrier_grade" Virtual Machine

The creation of a component "Virtual Machine carrier_grade" begins with the selection of the component from the list of possible elements in the second part of the Designer. This is the list present in the left side of the web page, as explained before, this list contains the valid elements that can be integrated in the future components.

After selecting the element, drag the element to the work space and wait for the creation.

Search		
COMPONENT Standard VM VM Carrier_gr VM VM	VII VIII Type CC Policy: Scale Core Up-Down Visi Visi Name Visial Policy: Scale Memory Up-Down Visi Visial Policy: Scale Memory Up-Down Visi Visial Policy: Scale Memory Up-Down Visial Policy: Scale Memory Up-Down Visial Policy: Scale Memory Up-Down Visial Policy: Scale Memory Up-Down Visial Policy: Scale Memory Up-Down Visial Policy: Scale Memory Up-Down Visial Policy: Scale Memory Up-Down Visial Policy: Scale Policy: Scale Memory Up-Down Visial Policy: Scale Memory Up-Down Visial Policy: Scale Policy: Scale Memory Up-Down Visial Policy: Scale Memory Up-Down Visial Policy: Scale Policy:	
<u> </u>		

Figure 276: Creation of a Carrier Grade Virtual Machine

As you can see in the images above, we selected the element (standard Virtual Machine), and dragged the element to the work space. The element has been created and has been colored in blue. As you can see, all the attributes and internal elements of the component are in the list at the right of the designer. Also, you can see how the designer requires the field Name to be filled, as it is a mandatory field.

After creating the element, we can edit the attributes and the element's components. We are going to introduce a new name for our Virtual Machine carrier grade. To do that, we select the element in the work space by clicking it and then click in the field Name on the right side of the work space. After that, type the new name for the VM. In this case, it is **Example CG VM**.

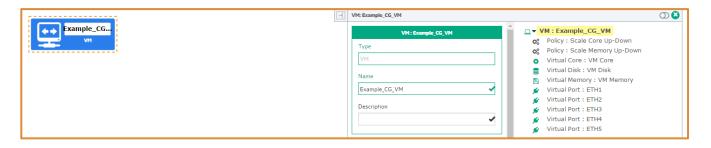


Figure 277: The attributes of a CG Virtual Machine

In the above image, on the right side of the designer, we can choose and change the value of some of the attributes present in the elements listed. Inside our Virtual Machine, we have policies, Virtual Ports, Virtual Core, and so on. All these elements are editable within certain constraints. If you select one of these attributes, you will see how the component window changes, and it displays the attributes of the element selected.

Ξ	VM: Example_VM	00	Ī	0	VM: Example_VM				00
	Virtual Homory i Will Homory Image: State Care Up-Down Amount Unit 1024 Image: State Care Up-Down Name Virtual Care : VM Care VM Memory Virtual Care : VM Care VM Memory Virtual Care : UP-Down PAGE_SIZE Unit Valuel Port : ETH1 Virtual Port : ETH2 Virtual Port : ETH4 Virtual Port : ETH5				IP Address InterfaceOrder 5 Add new item to Name ETH5	Verwal Peer : ETHS	 - + × 	 VM : Example_VM Policy : Scale Core Up-Down Policy : Scale Memory Up-Down Virtual Core : VM Core Virtual Core : VM Core Virtual Memory : VM Memory Virtual Port : ETH1 Virtual Port : ETH3 Virtual Port : ETH3 Virtual Port : ETH4 Virtual Port : ETH5 	

Figure 278: Edition of the attributes of a CG Virtual machine

As you can see, the window that allow us to edit the attributes will change with the element selected in the list, once we carry out the creation and modifications needed by the component, we will proceed to the assignation of policies, monitors and storage, this part of the creation it is common to all the elements so it is going to be relegate to another section.

The Virtual Machine Carrier Grade has some peculiarities over the "standard" VM. This is because the VM CG are components set up to be deployed in a specific **REGION:OPENSTACK**. A VM Carrier Grade needs to be related to a VIM carrier grade, or it will result in an error or incompatibility with the VM. The rest of characteristics come from the attributes, in a VM CG, the category INFO is going to have the **PAGE_SIZE** attribute present, responsible for setting the memory size in the machine. Also, the Virtual Core associated to the VM is going to have two more attributes in its **INFO** category: **CORE_ARCHITECTURE** and **NUMA_ID**. These attributes can only take two values. The possible values of

CORE_ARCHITECTURE are "shared" or "dedicated". By default, the value of the architecture is "shared". The possible values of NUMA_ID are "0" or "1". Both attributes will be validated during the assigning process. The combination of the values will determine how the assigning will take place.

The Default attributes of a Virtual Machine Carrier-Grade are:

- Virtual Machine type: "KVM".
- 5 Virtual Ports of type "virtio" to be used at disposition.
- 1 Virtual Port of type "virtio" and "NetworkType" : "MANAGEMENT", to be used by the Management Network.
- 1 Virtual Disk, with "Controller type": "SCSI", and an "Amount" of 1 Gb.
- 1 Virtual Core:
 - o CORE_ARCHITECTURE : "shared" o NUMA_ID: "0". o SHARED_VCPU: empty.
- 1 Virtual Memory:
 - o Amount : 1024.
 - O PAGE_SIZE : 2048.

Depending on the conditions of the operation over the Virtual Machine, we should configure the attributes above to have a correct execution. We may encounter platforms that will not accept an activation of a Virtual Machine with a CORE_ARCHITECTURE other than "dedicated". To successfully execute a specific operation over a VM, we must make be sure that is properly configured, and it is not going to trigger an error. The main attributes to consider are CORE_ARCHITECTURE, NUMA_ID and SHARED_VCPU.

VM : Example, CG_VM Type VM Name Example_CG_VM Description ID 644e6892-f292-4edc-86b9-3a90e0357bb7 Image cirros ImageOSName ImageOSName ImageOSName ImageOSName Type	
VM Name Example_CG_VM Description ID b44e6892-7292-4edc-8bb9-3a9be0357bb7 ID bescription Image cirros ImageOSName ImageOSName	
AdminPassword AdminUser AdminUser AdminUser Control Contro	
ample_CG_VM icription AdminUser AdminUser AdminUser Exception Pubkey_Data Pubkey_Data Pubkey_Path Type	
AdminUser AdminUser AdminUser KEYPAIR Pubkey_Data Pubkey_Path Type	1
92-7292-4edc-86b9-3a96e0357bb7 Image: Constraint of the system	125.2
Image: Seneral Image: Seneral Pubkey_Data Pubkey_Data Pubkey_Path Image: Type	
i≣ GENERAL ▲ Pubkey_Data Pubkey_Path Type	~
Pubkey_Data Pubkey_Data Pubkey_Path CSName Type	
Pubkey_Path	^
lame Type	
Name Type	-
Name Type	
Туре	
1	
VARE	

Figure 279: Editing the attributes of a CG Virtual machine

In this example, we have filled the Name and Description attributes with the values Example CG and VM CG, respectively. To change the values of the attributes, click the attribute and edit the field.

In the **GENERAL** category, the attribute **Image** is filled with the value **cirros**. This can be changed if the user wants to aim to another image. The attribute **Type** can only take two values, **KVM** and **VMWARE**, which refer to the type of the image given in the previous field.

The **CREDENTIALS** category contains the attributes **AdminPassword** and **AdminUser**. These fields contain the access information for the Virtual Machine that we are configuring. **AdminPassword** and **AdminUser** are the values of the fields necessary to access the VM once activated. In this case, the values are both **root**. This is set in the VM CG by error.

The **KEYPAIR** category contains data needed to connect with the Virtual Machine that was recently activated by SSH. If the user fills the **Name** and **PubKey_Data** fields, they will be set in the current **KEYPAIR** as new values for the attributes.

To make the element eligible to be part of a VNF, save it first. To do that, click **Save** in the first section of the designer. Note that before saving, the **Save As** and **Publish** options are not accessible. After saving the element, click **Publish** to make the element available for the VNFs.

3.1.3.3 Other attributes of a VM component

3.1.3.3.1 General.Order

The General.Order attribute allows the user to determine a specific order of activation for the VM when the deployment operation is being executed by NFVD. Additionally, the General.Order attribute allows the user to perform a specific order on the deployment and start tasks for monitors. When the deployment is being executed by NFVD, the General.Order attribute will be used with all the operations available in the solution, Scales, Deploys and Undeploy.

The following picture shows the user the attribute General.Order for VM and Monitor component

Figure 280: Editing the attribute General.Order.

General.Order works like an optional attribute. It means that the user can fill in the attribute or leave it empty on the UI. It depends on the behavior that the user wants to get from activation/deployment task in NFVD. Here we explain the behavior that the user can get from NFVD if they fill in the attribute, or if they leave the attribute empty. The following examples are related to a VM where the task affected is VM activation. If the user works with a monitor, the behavior of NFVD will be the same, in terms of order, but the task affected will be deploy and start monitor tasks.

- All VMs with General. Order attribute empty. The VMs will be activated in parallel.
- All VMs with General.Order attribute filled. The VMs will be activated step by step ordering the activation with the order given on each VM. NFVD supports serial and parallel activation.
 - o Serial activation: imagine a deployment with three VMs where VM1 has order 1; VM2 has order 2 and VM3 has order 3. The activation of the second VM starts after VM1 is finished and so on
 - Parallel activation: imagine a deployment with four VMs where VM1 has order 1; VM2 and VM3 have order 2 and VM4 has order 3. The activation of the second and third VM is executed in parallel and starts after VM1 is finished. The activation of the fourth VM will start after VM2 and VM3 is finished.

- Some VMs with General.Order attribute filled and other VMs with the attribute empty. NFV Director will start with the activation of the VMs which have the attribute filled (following the rules given previously) and after that, it will continue with the parallel activation of the rest of the VMs.

Numeric or alphabetic order is supported by NFVD. It means that General.Order can be filled with numbers or words and NFVD will order the activation properly. The order of non-consecutive values is also supported, for example VM1 with order 2 and VM2 with order 8.

Also, the user should keep in mind that the **General.Order** will be taken into consideration also when the operations will be of type Scale, or during the Undeploy operation, not only in the deployments. During an undeployment operation, the logic that has been explained previously will act in reverse. The first VM to be undeployed will be VM2, followed by VM1.

The attribute General.Order can be filled or modified on VNF Component Designer, on VNF Designer, and also on VDC manager when the VNF template has been instantiated.

As the user knows, a VNF template can be built for different VNF components. In this situation, NFVD will be able to manage the VM ordering properly.

3.1.4 Adding policies to the component

We relegate this to another section due to the peculiarities of this elements and its assigning process. When we need to create a policy to be attached or connected to an element, we should have the element properly created and with all its attributes correctly filled. Also, we should know well which policies our element needs. Once we know and have what is needed, we can start the process of creation.

Policies Monitors Vluns Policies Mor	nitors Vluns	Policies Monitors Vluns
Affinity Policies Anti-Affinity Policies Scale P Affinity Policies	Anti-Affinity Policies Scale Policies	Affinity Policies Anti-Affinity Policies Scale Policies
Search Search	◆ Add Anti affinity policy ▼	Search Scale In/Out Policy
	ti af inity Policy	Scale I Scale Policy
Policies Monitors Vluns	Policies Monitors Vluns	
Affinity Policies Anti-Affinity Policies Scale Policies Heal Policies	Affinity Policies Anti-Affinity Policies	Scale Policies Heal Policies Processing Policies
Search	Search O Add 🗸	postpre_policy v
heal_po Heal Policy	postpre Processing Policy	

Figure 281: Types of policies available in the Component Designer

The designer allows us to create three types of policies, Affinity, Anti-affinity and Scales polices. Each one of them have some rules to take into consideration. These rules will be described in the following sections.

A Scale policy will only act over ONE element: a Scale Policy only develops its function over one element, a VNF component or a VNF for the Scale In/Out, and a Memory or a Core in case of the Scale Up/Down. It does not work for more than one element, a Scale policy applied over more than one element will develop its function only over one of the elements, the rest of the elements will remain unaltered.

The Affinity policies are elements that enclose the possible operation targets. This means the performing of operations in one AVAILABILITY_ZONE or another, and the SERVER's receive the same treatment.

3.1.4.1 Adding Affinity Policies

An Affinity Policy allows us to indicate where and over what artifact the assigning of resources is going to take place. When we create an Affinity policy of type MUST, and it is going to act on the Server's level, it is going to assign to the SERVER: GENERIC all the resources that will be needed for a correct behavior of the element.

Policies Monitors Vluns	Policies Monitors Viuns
Affinity Policies Anti-Affinity Policies Scale Policies	Affinity Policies Anti-Affinity Policies Scale Policies
Search Add Anti affinity policy V	Search O Add Anti affinity policy
	Anti-Affinity Policy

Figure 282: Adding an Affinity policy to a component

To create a new "Affinity Policy", we need to click the tag **Policies**, and then click **Anti-Affinities Policies** in the bottom left side of the web UI. After selecting these two tags, we will see a window similar to the image above on the left, depending on the theme on the platform. To create the policy, click **C** Add. The policy will be created with the editable fields empty, as in the image above on the right.

Affinity Policy : Affinity	
Type Affinity Policy Name Affinity	Affinity Level Unit SERVER:GEI AVAILAVILITY_ZONE SERVER:GENERIC Select a policy target :
	VM :Example_VM
Type MUST T MUST T SHOULD	

For this policy, we set the Name with the value Affinity Policies, and the field Description with the value Policy Affinity. All the fields must be filled until the green tick is present in the right side of the box.

The difference between selecting MUST or SHOULD as the value for the GENERAL. Type is that in case we have selected MUST, if the system is close to running out of resources during the assigning, the application will throw an error message. If the value is SHOULD, the application will throw a warning message, and continue with the execution without stopping. In

this case, the value of the Type attribute is MUST, so if the resources available are close to be depleted in the moment of the assigning, the application will throw an error. In other case, the execution will continue.

Once we have chosen the Type of the policy, we should choose the Affinity Level. The affinity level only has two possible values: **SERVER:GENERIC** or **AVAILABILITY_ZONE**. These limitations respond to a control of the resources. If our policy is going to be used at Server level, this policy will be applied to that Server and only to that Server. If we choose the other option, our recently configured policy will be applied to all the servers below the Availability Zone chosen.

The last part of the creation of the Affinity policies is selecting the target of the policy. In this example, we only have one Virtual Machine to choose. Remember that we have only created a VM Example. If, in the previous section, we had created more than one VMs, we could select more than one VMs. We will select the unique Virtual Machine present in the list. Once we have configured the policy, we can continue creating the rest of the policies needed.

3.1.4.2 Adding Anti-Affinity Policies

An Anti-Affinity Policy allows us to indicate where and over what artifact the assigning of resources should not take place. When we create an Anti-Affinity policy of type MUST, that is going to act on the Availability Zone's level, it is going to avoid the assigning of resources in that Zone.

Policies Monitors Vluns	Policies Monitors Vluns
Affinity Policies Anti-Affinity Policies Scale Policies	Affinity Policies Anti-Affinity Policies Scale Policies
Search Add Anti affinity policy V	Search O Add Anti affinity policy •
	Anti-Affinity Policy



To create a new Affinity Policy, click **Policies**, and then click **Affinities Policies**, in the bottom left side of the web. After selecting these two tags, we will see a window like the image above on the left, depending on the theme on the platform. To create the policy, click • Add . The policy will be created with the editable field empty, as in image above on the right.

Anti-Affinity Policy : Anti affinity policy	
Type Anti-Affinity Policy	
Name Anti affinity policy Description	Affinity Level Unit ARTIFACT_TYPE AVAILAVILITY_ZONE:OPENSTACK SERVER:GENERIC Select a policy target :
	VM :Example_VM
Type MUST - MUST SHOULD	

For this policy, we set the Name with the value Affinity Policies, and the field Description with the value Policies AntiAffinity. All the fields must be filled until the green tick is present in the right side of the box.

The difference between selecting MUST or SHOULD as the value for the GENERAL. Type is that in case we have selected MUST, if the system is close to running out of resources during the assigning, the application will throw an error message. If the value is SHOULD, the application will throw a warning message, and continue with the execution without stopping. In this case, the value of the Type attribute is MUST, so if the resources available are close to be depleted in the moment of the assigning, the application will throw an error. In other case, the execution will continue.

Once we have chosen the Type of the policy, we should choose the Affinity Level. The affinity level only has two possible values: **SERVER:GENERIC** or **AVAILABILITY_ZONE**. These limitations respond to a control of the resources. If our policy is going to be used at Server level, this policy will be applied to that Server and only to that Server. If we choose the other option, our recently configured policy will be applied to all the servers below the Availability Zone chosen.

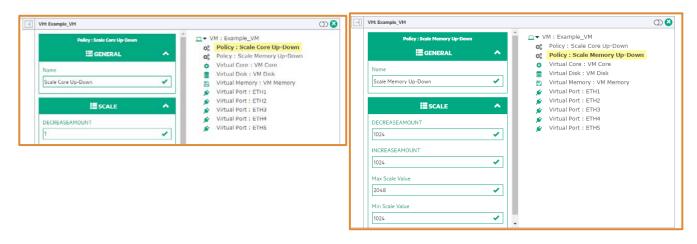
The last part of the creation of the Affinity policies is selecting the target of the policy. In this example, we only have one Virtual Machine to choose. Remember that we have only created a VM Example. If, in the previous section, we had created more than one VMs, we could select more than one VMs. We will select the unique Virtual Machine present in the list. Once we have configured the policy, we can continue creating the rest of the policies needed.

3.1.4.3 Adding Scale Policies

The Scale policies are a set of orders and presets that conduct and manage the escalation processes over the different elements of the system. To clarify what types of policies we use and which ones are the best options to be applied depending on the needs of the process, we will go over the scaling policies nature.

Scale Up:	Acts when a specific category's attribute of an artifact need to be dimensioned to an upper value, so this policy is going to act over elements as CPU or Memory.
Scale Down	Acts when a specific category's attribute of an artifact need to be dimensioned to a lower value, so this policy is going to act over elements as CPU or Memory.
Scale In:	Acts when an artifact needs to be eradicated in all its conditions and states. This type of policies permits the deletion of a number of elements, all of them equal to the artifact that acts as target of the policy.
Scale Out	Acts when an artifact needs to be cloned in all its conditions and states. This type of policies permits the creation of a number of elements, all of them equal to the artifact that acts as target of the policy.

When we create a Virtual Machine, in the moment of the creation, the element has two scale policies already created and related to the new VM. These policies are Policy:Scale Core Up-Down and Policy:Scale Memory Up-Down.



3.1.4.3.1 The Scale Up and Scale Down policies

Policy: Scale Core Up-Down is responsible for resizing the number the Virtual Machine's cores. If, for some reason, during the execution the Virtual Machine needs more Cores, the policy UP will start creating Cores until the number of cores reaches the Max Scale Value. Of course, if the VM needs less Cores, the policy DOWN will start. It is pretty much what happens with the same kind of policy, but applied to the Memory management. If needed, the policy Scale Memory Up will start, increasing the amount of Memory until the size of the memory reaches the value of the attribute Max Scale Value. The same dynamic but in opposite direction for the Scale Memory Down policy is, in this case, decreasing the size of the memory until it reaches the value of the attribute Min Scale Value.

SCALE	A 1
DECREASEAMOUNT	
1024	1
DESTINY	
INFO,Amount	
DOSCALE	
Туре	
INCREASEAMOUNT	
1024	1
Max Scale Value	
Max Scale Value	
Max Scale Value 2048	-
	1

DECREASEAMOUNT: The amount of unities that are going to be eliminated. For this policy, it will be erased of the memory. In this case, 1024 Mb. **DESTINY:** The category and attribute that is going to be modified by the policy. In this case the "Amount" of memory in Mb, reflected in the category "INFO".

DOSCALE: Not editable by the user.

INCREASEAMOUNT: The amount of unities that are going to be enhanced. For this policy, it will be created for the memory. In this case, 1024 Mb. Max Scale Value: The maximum amount of the specific resource that can be reached through a scale operation, in this case, 2048 Mb. Min Scale Value: The minimum amount of the specific resource that can

Min Scale Value: The minimum amount of the specific resource that can be reached through a scale operation, in this case, 1024 Mb.

Note that the Scale Up/Down policies are implemented by defect in the base components. Another important thing to have in mind before starting a Scale Up/Down operation is that the policy is going to act without knowing if the situation on the OpenStack platform can afford what is expected by the policy. This means that, to guarantee the escalation, the user should be sure that the resources present in the OpenStack platform are enough to carry out the escalation, the limitation of the resources in the OpenStack platform must be checked by the user.

3.1.4.3.2 The Scale Out and Scale In policies

The Scale Out/In policies are responsible for the creation or deletion of components. At this level, for a VNF Component, the scale Out/In policies are the ones that will create or destroy the Virtual Machines that conform the VNF Components. These policies can be set in two levels, between the VNF and the VNF Component, and, in our case, between a VNF Component and its Virtual Machines.

To create a new escalation policy over a Virtual Machine, first we should have a VM artifact in our work space (Third section of the Designer), with all its attributes and elements correctly filled. Once we have our VM, we need to go to the bottom of the web page, click **Policies**, and we will be able to see the below screen:

Policies	Monitors	Vluns			
Affinity Polic	ies Anti-Affir	ity Policies	Scale Policies	Heal Policies	Processing Policies
Search	C	Add Sca	le In/Out Policy 🔻]	
	Scale I Scale Policy				

Figure 285: The creation of a Scale Policy

Once we see this screen, we can create the policy by clicking Once we see this screen, we can create the policy by clicking and setting the target and name for the policy.

We should keep in mind that **the escalation policies should be set at the proper level to get the desired effect**. We have two options to create the escalation policies: Creating the escalation policy at component level, and creating the policy at VNF level:

Component level. When we set a Scale Out/In policy at this level, the escalation operation will be applied to the elements that conform the component. This means that the escalation is going to take place over the Virtual Machines of the component, only over these machines, and only over the original template of the Component. The modifications over the instances will not be reflected in the escalated elements.

For example, if we have a Component with One VM, and a Scale policy with an Incremental Value of 1:

- The user starts an escalation operation, the VNF Component will create another Virtual Machine cloning the one that already exists.
- At the end of the first escalation operation, the user will have two VMs over the same component.
- Later, this VNF Component needs to grow again and the user starts another escalation operation.
- When the process has finished, the user has three Virtual Machines, due to the escalation process is performed over the original design of the VNF Component, not over the result of the first escalation process.

VNF Level. When we set a Scale Out/In policy at this level, the escalation will be applied over all the components of the VNF. So, if we configured an **Increment Value** of **1**, each component of the VNF will be duplicated by cloning one time. Basically, we will reproduce our VNF structure one time, including the Scale policies present in the VNF Components. These policies are going to be executed, too, when we trigger the escalation operation.

Notice that an escalation is never going to take place if the Decrement Value, Increment Value and the Min Scale Value are in conflict. The following cases clarify what we mean by conflict:

A Scale Out operation at VNFC level, because we will use number of Virtual Machines: if our policy was set at VNF level, we would talk about number of VNF Components, but the behavior of the policy would be the same.

Number of VM	Decrement	Increment	Min	Max	Conflict
1	1	1	1	1	Min and Max has the same value, no Scale Out will be performed due the number of VM already suits the Max value.
2	1	1	2	3	Max value is not enough to settle the amount of VM that the operation will create with and increment of one. Four VMs will be created, with a Max value of 3. No Scale out will be performed.
3	1	1	3	6	The Scale Out will be performed only one time. With this configuration, the Scale Out can only be executed once in a row.

We will implement our escalation policies for our VNF Component at the level that shown in the image below. It will only act over the VM:standard, which is part of the component.

& ▼ VNF :

L Scale Policy	: Scale In/Out Policy				
♥▼ VNF Component : VNFC_01					
1 Scale Pol	Scale Policy : Scale In/Out Policy				
□ ▼ VM : standard					
	RANGE 🔨				
	Decrement Value				
	1				
	Increment Value				
Scale Policy : Scale In/Out Policy	1				
Туре	Max Scale Value				
Scale Policy	10 🗸				
Name	Min Scale Value				
Scale In/Out Policy	1 –				
Description	Add new item to the list				
✓	Scale Mandatory Type				
	MUST • -				
	MUST				
	SHOULD				
	Select a policy target :				
	VM :Example_VM				

Figure 286: Editing the attributes of a Scale policy

For this policy, the fields Name and Description in the category GENERAL have been filled with the values Scale Policy and Policy to scale VM respectively. And in the category RANGE, we are going to construe the value in each field.

The Decrement Value and Increment Value are related to the number of VMs that are going to be duplicated or erased. If we have a value of 1 as decrement value, it means that in case of a Scale IN, the number of VMs that are going to be erased is only one. In case of increment, the logic to apply it is the same. For a value of 2, if we have one VM, we will end up having three VMs. In case of having two VMs, we will finish with six VMs.

The difference between selecting MUST or SHOULD as the value for the GENERAL. Type is that in case we have selected MUST, if the system is close to running out of resources during the assigning, the application will throw an error message. If the value is SHOULD, the application will throw a warning message, and continue with the execution without stopping. In this case, the value of the Type attribute is MUST, so if the resources available are close to be depleted in the moment of the assigning, the application will throw an error. In other case, the execution will continue.

As target, we have selected the unique VM in the list, remember that if your component has more than one VMs, they are going to be listed there. To select other VM, it is enough to tick the box at the left of the artifact's name in the list.

3.1.4.4 Adding Heal Policies

A Heal Policy allows us to indicate a Heal cause, and to determine what workflow will be executed in NVFD when the user triggers the Heal operation over a VNF or a VNF component.

Heal policies can be used during the execution of the operations. These policies will take care of the heal cause, using the workflow that has been set in the policy while the operation is still working.

Policies Monitors Vluns	Policies Monitors Viuns
Affinity Policies Anti-Affinity Policies Scale Policies Heal Policies Processing Policies	Affinity Policies Anti-Affinity Policies Scale Policies Heal Policies
Search Add heal_policy •	Search O Add heal_policy •
	heal_po
	C Heal Policy

Figure 287: Adding a Heal policy to a component.

To create a new Heal Policy, click **Policies**, and then click **Heal Policies**, in the bottom left side of the web. To create the policy, click **C** Add . The policy will be created with the editable field empty.

heal_policy : heal_policy	♥▼ VNF Component :
Туре	heal_policy : heal_policy
Туре	□ ▼ VM : standard
heal_policy	🚓 🛛 Policy : Scale Core Up-Down
	🚓 🛛 Policy : Scale Memory Up-Down
Name	Virtual Core : VM Core
heal_policy 🗸	🛢 🛛 Virtual Disk : VM Disk
	🖺 🛛 Virtual Memory : VM Memory
Description	💉 🛛 Virtual Port : ETH1
✓	💉 🛛 Virtual Port : ETH2
	💉 🛛 Virtual Port : ETH3
	💉 🛛 Virtual Port : ETH4
PROCESSING_JOB	💉 🛛 Virtual Port : ETH5
HealCause	
-	
Add new item to the list	
Workflow	
Workflow 🗸	

Figure 288: Editing the attributes of a Heal policy.

For this policy, we set the Name with the value Heal_Policy, the field Description with the value Policies Heal, the field HealCause, which is a list of values that allows the user to add new items, and the field Workflow with the name of the workflow that will be executed when NFVD triggers a heal operation.

3.1.4.5 Adding Pre/Post-Processing policies

Post-processing and Pre-processing policies allow us to execute a specific action before the operation starts (Pre-Processing policies) or after the execution of the operation is finished (Post-Processing policies). Such actions that should take place in a specific moment should be carried out by a Workflow. This workflow should contain all the logic needed for the action to achieve its goal. These actions could be closing a connection before the shutdown of a machine, or assuring a set of prerequisites before the launch of an operation. Basically, these policies modify the preceding and following scenario for our VNFs.

Policies Monitors Vluns	Policies Monitors Viuns
Affinity Policies Anti-Affinity Policies Scale Policies Heal Policies Processing Policies	Affinity Policies Anti-Affinity Policies Scale Policies Heal Policies Processing Policies
Search Oostpre_policy *	Search postpre_policy *
	postpre Processing Policy



The image above shows how the Pre/Post processing policies are created. All the editable attributes are wrapped in the category **PROCESSING_JOB**. A Pre/Post-processing policy must have a workflow to be processed, and it should have an operation as target for the triggering of the policy. For these policies, it is also possible to identify an order of execution. A complex task could have more than one Workflow or process involved. We are going to explain what each attribute of the category **PROCESSING_JOB** is and how these attributes should be filled to have a successful use of the policy.

- **Type:** The type only can take two values: **PRE** or **POST**, corresponding with one of the two types of actions that will take place when the policy will be executed.
- WorkFlow: The policy needs an element that contains all the logic of the process that is going to be executed. This mandatory element is implemented through a Workflow that is customized for the specific operation. This means that a Pre-processing policy can have more than one workflow prepared to be executed. Each workflow will have a Pre/Post-processing policy assigned to be executed, so the same entity could have several Pre-Post policies related, but entities cannot share their processing policies with each other.
- Operation: The Operation attribute represents the operation from which the policy will be triggered. These operations are Deploy, Undeploy, Scale Up, Scale Down, Scale In and Scale Out, basically the core operations of the solution.
- OrderBy: This is a numerical attribute. We can introduce the order of execution that should be followed during the execution of the operation. If we have more than one policies related to the same operation, we can sort the execution introducing a number in this attribute. This way, if we introduce the number 2, our policy will wait for the first policy to be executed, and only after that will out policy start its execution.

3.1.5 Addition of monitors to the component

Monitors are elements that permit the user configure an observer for the element monitored. This means, that depending on how we configure our monitor, it will receive different information about the behavior and changes of the component monitored. This monitoring has the objective to react when the system is in need of some kind of resources, mainly solving this lack with the launching of escalation actions.

A Monitor must be connected and related to a Virtual Machine, If the user does not have a Virtual Machine already instantiated in the work Space (third part of the Designer), the **Monitors** tag it will not be shown as Active, so we are not going to be able to create a Monitor.

Policies Monitors	Vluns	
VM :Example_VM		
Search	• Add	monitor-network-transmitted 🔻
		monitor-network-transmitted
		monitor-network-received
		monitor-disk-write
		monitor-cpu
		monitor-memory
_		monitor-disk-read

Figure 290: Types of Monitors available

If the user has properly created a Virtual Machine element in the work space, the user will be able to create a Monitor of the type listed in the image above. As you can see in the image, the Monitor (regardless the kind) will be created under the influence of the VI:Example_VM Virtual Machine. In the figure, we can see all possible types of Monitors that the application allows us to create. To create one type of monitor, select the type and click Add. This action will add a Monitor of the selected type to the Virtual Machine, and it will pair that monitor to the element determined by the Monitor's type. A monitor of type CPU will be matched with the CPU related to the Server used with the Virtual Machine in use.

3.1.5.1 Types of Monitors

All the attributes of a Monitor, from our point of view, are reduced to the **Name** and **Description** of the element. This is because we have already chosen the type and the element that is going to be monitored. The attributes that remain empty are those two previously mentioned. The other two important categories to configure are **Action** and **Condition**. The way to treat these categories is covered later in this chapter.

The types of Monitor we can deploy over our Virtual Machines are:

Monitor Disk Write:	Monitors writing operations over the Virtual Disk associated to the Server related to the Virtual Machine.
Monitor Disk Read:	Monitors reading operations over the Virtual Disk associated to the Server related to the Virtual Machine.
Monitor CPU:	Monitors operations over the Virtual CPU associated to the Server related to the Virtual Machine.
Monitor Network Transmitted:	Monitors transmission operations over the Virtual Network related to the Virtual Machine.
Monitor Network Received:	Monitors the messages received through the Virtual Network related to the Virtual Machine.

Monitor Memory:

Monitors operations over the Virtual Memory associated to the Server related to the Virtual Machine.

A Virtual Machine can have one type of Monitor per each kind of artifact related to it.

Policies	Monitors V	luns	
VM:			
Search	• A	dd monitor-network-transmitted 🔻	
	D-Write NetworkTx	Memory NetworkTx NetworkTx	

Figure 291: Multiple monitors assigned to a Component.

In the image above, we can see a Virtual Machine named VM: Example VM, with four different Monitors configured.

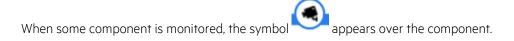




Figure 292: A monitored component

3.1.5.2 Configuring error Actions for Monitors

Monitors need to be configured to start their activity in case some attribute of the monitored element reaches a certain state, or some of its attributes exceed a quantity or surpass a number of communications. To achieve this behavior, the monitor has a Condition and an Action attribute that need to be filled. Unlike the general attributes of the monitor, Condition:ErrorCondition and Action:ErrorConditionAction work together as a trigger. When the condition is met, the action will take place.

-+	Monitor: CPU			08
	Monitor : CPU Type Monitor Name CPU Description		 Monitor : CPU P Condition : ErrorCondition 	
	Frequency Unit Seconds	^		
	Type AUTO AUTO HYPERVISOR VIM	•		

Figure 293: Configuring the error Condition and Action of a Monitor

As you can see in the image above, the monitor has the typical attributes Name and Description, and the attribute Type is not editable, as usual. To change the value of the previous fields, click in the field's box and introduce a valid name and description for the monitor.

The **GENERAL**. Frequency attribute refers to time gap between each capture by the monitor. It is set in milliseconds. In this case, the value automatically set is 600. To change the value of the attribute, proceed as explained in the previous chapter.

The **DEPLOYMENT.Type** attribute refers to the element that is going to be monitored. In the image, the artifact selected is the **Hypervisor**. You can see the other two possible options. If the user selects **VIM**, the monitor will target this element for monitoring. If the user selects **AUTO**, the system will decide which element is going to be monitored.

Monitor: CPU	D	Action : ErrorConditionAction
Action : ErrorConditionAction		
GENERAL	Action : ErrorConditionAction	Name
Name		ErrorConditionAction
ErrorConditionAction	Action : ErrorConditionAction	
Operation_Mode	E GENERAL A	Operation_Mode
CLOSED_LOOP	• Name	CLOSED_LOOP
Туре	ErrorConditionAction	Туре
SCALE_UP	Operation_Mode	SCALE_UP
Choose an action target :	CLOSED_LOOP *	EMAIL
	CLOSED LOOP	NONE [Add to Event]
 VNF Component :VNF_00 VM :Example_VM 	OPEN_LOOP	SCALE_DOWN
○ VM :Example_VM	SCALE_UP *	SCALE_IN
		SCALE_OUT
	Choose an action target :	SCALE_OUT_AND_CONNECT
	Choose an action larger.	SCALE_UP
	 VNF Component :VNF_00 	SCRIPT
	VM :Example_VM	

Figure 294: Editing the attributes of an error Condition Action for a Monitor

In the image above, we can see the different attributes of the Action: ErrorConditionAction. As always, we can see the field Name filled with the value ErrorConditionAction. After the Name, two attributes are present: GENERAL.Operation_Mode and GENERAL.Type.

GENERAL.Operation_Mode, can only take two values, CLOSED_LOOP and OPEN_LOOP. This means that if the value chosen was CLOSED_LOOP, the action to take is not going to wait for the user's operations to end. For example, if the monitor is configured to launch a SCALE_IN, the monitor will launch the scaling process without respect the running processes of the user. If the user chooses OPEN_LOOP, the monitor will wait to launch the Action until the user's operations are finished.

The "GENERAL. Type it refers to the type of the operation that the monitor it is going to throw if the condition is met. We should take into consideration that the user can configure a monitor that will never be used. For example, the user creates a monitor that has – as target – a Virtual Machine with a SCALE_OUT value in the field GENERAL. Type, It implies that the Virtual Machine is the owner of an Entity Scale (which is an error, as a Virtual Machine has no child suitable to be the child of the Entity Scale policy associated to the VM. So, the Scale Out has no element to be escalated, there is no child for the Entity Scale policy), and it also implies that that this policy has an element acting as child that can be the target of the policy. This is a condition that can never take place. The Scale_Out operations are launched at least over a VNF component level. This way we always have a child element to be escalated.

As you can see, a monitor can be used over a wide number of operations, mainly scale operations. These operations were explained in the chapter *Adding Scale Policies*. The operations that were not explained in a previous section are:

Refers to the case when, for a specific Condition, the monitor must launch a Script and not start an operation.

NONE [add to Event]:

Refers to situations when CPU use breaches threshold or the disk is about to run out of space. In such cases, an alarm will be raised, then we will handle this alarm and will perform associated ACTIONs like SCALE UP/DOWN/SCRIPT.

• EMAIL: Refers to the case when the occurrence of an event must be notified to an entity or subject.

In the section **Choose an action target**, the designer allows us to choose which element is going to be monitored. In this case, the user can choose from three elements, the VNF that it is being designed, the VNF Component that is part of the VNF, and the Virtual Machine that is member of this VNF component. Note that if during the design we have more than one VNF components, or these components has more than one Virtual Machines, they will be listed in this section.

[•] SCRIPT:

3.1.5.3 Configuring Error Conditions for Monitors

The monitors need to have configured a condition that will act as trigger for the action of the monitor. Such conditions are configured by an expression that includes some attributes, referenced by their exact name and the value of the attribute referenced. Also, it should reflect how the condition is going to treat the changes in the attribute, for example, when the attribute's value becomes greater than the value reflected in the monitor.

Condition : ErrorCondition	~	Monitor : CPU P ▼ Condition : ErrorCondition Condition : ErrorConditionAction Condition : ErrorConditionAction ConditionAction Condition ConditionAction ConditionAction Condition Co
Expression		
network_bytes_transmitted >90	//	
Name		
ErrorCondition	✓	

Figure 295: Configuring Error Condition for a Monitor

For the condition present in the Monitor Net-Rc, (image above) the attribute GENERAL.Name has a value of ErrorCondition and the GENERAL.Expression attribute has a value of network_bytes_transmitted >90, so, when the monitored element reaches 90 bytes transmitted through the network, the monitor will launch the operation present in the Action (in this case a SCALE_UP, see previous subchapter) GENERAL.Type.

To modify the value of the attributes, click in the box of the attribute and type a valid new value.

3.1.6 Adding VLuns to the component

A VLun is a storage component. A LUN is a unique identifier for a physical storage allocation. A LUN could reference an entire RAID set, a single hard disk or partition, or multiple disks or partitions. The VLUN does not map to a specific device or allocation of storage space but to a virtualized space that can be created in excess of the actual physical space available.

VM :Example_VM Search Search	VM :Example_VM
Search	
	Search O Add external-storage 🔻
	Vlun

Figure 296: Adding VLuns to a component

To create a VLun from the web page, we need to position the cursor in the bottom left region the **Component Designer**, once there, click in the tag **Vluns** in the menu. The only option to choose for the type is **external-storage**. As

explained already, to finally create the VLun, click • Add . The VLun will be created under the influence of the VM Example_VM

Viun ı VLun_Example	INF0	~	STORAGE	~
Type Virtual LUN	Amount Unit		Bootable	
Name	1 🖌 GB		false	· -
VLun_Example	Volume_Type		Add new item to the list	+
Description	All-vsa-Ouality-C	· -	IMAGEREF	
VLUN Example	Add new item to the list	+		~

Figure 297: Attributes of a VLun

In this example, we have filled the Name and the Description attributes with the values VLun_Example and VLUN Example, respectively. To change the values of the attributes, click the attribute and edit the field.

In the **INFO** category, the user will set the size of the virtual storage in Gb. In this case, the size of the virtual storage is 1 Gb. The attribute **Volume_Type** allows the user to choose what kind of storage is going to be created for its use, the possible types of volumes are:

INFO		^
Amount 1 Volume_Type	Unit GB	
All-vsa-Quality-C		
All-vsa-Ouality-C Vmware-Ouality-A Vmware-Ouality-B		+

Figure 298: Type of Volumes for storage available

The types of VLUN have been configured on the OpenStack platform. From the solution, we are only able to choose the ones that were configured previously. In our case, All-vsa-Quality-C was selected.

The **STORAGE** category refers to the configuration of the virtual storage device. In this case, the **Bootable** attribute, allows or denies the possibility of booting from the volume. Notice that this volume could be part of a SAN (Storage Area Network). If this is the case, we will talk about booting from a SAN, not only from a LUN.

The **IMAGEREF** attribute refers to the file that will be used to create the VLUN. If we configured a bootable VLUN, it should be filled with the name of an image configured in the solution. This means that we need to use an image that is managed by the NFV Director. So, we will use one of the images that we have created for our VMs, the image that we will use with our VLUN must not necessarily be the one that we will use with our VMs. If the types and attributes have correct values, it will allow the user to create a bootable volume from the image specified.

Note that a component can have more than one elements from the list on the left side of the web page. This way, we have the possibility to create components with more than one Virtual Machines.

In the case of a Helion Carrier Grade environments, we must have at least one VLUN, with its attributes STORAGE.Bootable set as true, making the VLUN bootable, and its INFO.Amount set to a value of 0. A HCG environment will develop an internal conflict otherwise. We need to have storage configured to get the expected behavior. The machines deployed in a HCG environment without VLUNs configured will not behave as expected.

When a component has a VLun added, the symbol is shown above the element in the workspace.



Figure 299: A component with storage configured

3.1.7 Deleting elements in the designer

There are various ways to delete a component in the designer. The user should not misunderstand the concept of delete and cancel in the designer. If the user's intention is to eliminate one component of the design, the user will erase unitarily the component selected. If the user's intention is to dismiss the design of the main component, the user will use the option **Cancel** of the top menu of the designer to delete all the design with all the components inside.

The first way to delete a component is by using the button 😢 present at the end of the top of the attributes menu:

Received Darkand NFV Director	Workspaces • 💧 wiki-VDC@Wiki-Organization • 📫
🕷 Home 📓 Resource Inventory 🖻 Administration - 📽 VDC Manager 🧭 Designer - 🔅 Jobs 🕼 Utilities -	Jobs Menitor - 🖉 Refresh -
VNF Component Designer / VNF-00	Save Save As Publish Cancel
• composition • composition	Scale Policy : Scale In/Out Policy

Figure 300: One way to delete elements from the Component Designer

This icon is only available if the user has selected a component in the workspace. It would be highly unproductive if the users were able to erase the component they are working on before it has been created.

To finally perform the deletion, click 😢 The following window will be displayed:

Are you sure?	
You will delete this item. Are you sure?	
	Yes Cancel

Figure 301: Confirmation window for deleting a component

To delete the component, click Yes. The component element selected will be deleted, and no message or jobs are generated by this action.

3.1.8 The list of the component's elements

As we said before, the list of elements of the component permits the user to change the attributes of the element selected. In the images below, the user has selected different elements/artifacts. These artifacts have their own attributes, but they have common categories. This implies that some elements need to be fulfilled or configured before saving the component.

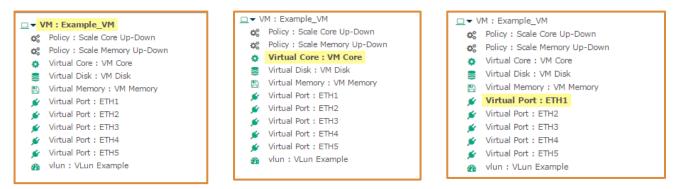


Figure 302: Elements that conform different components of some entities

When explaining how to create policies of various types, we discussed how to change the values of the attributes of these elements. Below these lines are the attributes that are shown suitable to be edited after selecting the artifact in the list.

VH : Example_VH	
Туре	
MH .	
Name	
Example_VM	1
Description	
Vm Example	1
	^
Image	>
Order	1
Type KVM Add new thim to the list	• - +
CREDENTIALS	*
AdminPassword	*
AdminUser	1
≣ KEYPAIR	*
Pubkey_Data	1
	-

^
\$
•
~
-

	Virtual Port : ETH1	
	INFO	^
InterfaceOrder		
1		
Name		
ETH1		 Image: A second s
Туре		
virtio		

If you run into any problems filling some attributes during the creation of the component, or if the component is not accessible from this list, it is not necessary to edit the component.

3.1.9 Publishing your component

Once we have finished designing our new component, in order to make it usable, we must save it before we can include it in a VNF.

First, we should properly fill the **Name** attribute of our future component. To do this we should select our work space that represents the VNF component that is being configured.

Hennet Postant NFV Director		Workspäces • 🛔 with VDCgWile-Crysinization • 🤹
💰 Home 🕍 Resource Internet (🕀 Administration + 🖉 🕫 VDC Manager 🕼 Disigner + 🔿 John 🗍 CP Unified +		John Meniher + 💭 Befresh -
VMC Composent Designer / VME-00		Save Save Au Publish Cancel
	VIE Component VIE-0 VIE Component VIE-0 Tops Inter Viel-Component VIE-0 Viel-Component VIE-0 Viel-Compon	VMP Companded LVM-00 *** Ministry Policy : Ministry C Policy : Mi
Pulicie Honitor Ven VH-Exempte VM VH-Exempte D		
Data energinger		

Figure 304: Publishing your components

As we can see in the image above, the user gave as value for the attribute "Name", "VNF_00", this name is what will be shown in the "VNF Designer" when the user look for the component to be used, If we have completely finished fulfilling the different attributes for our specific purpose in each element, and we are pretty sure that we have all the elements needed correctly configured we will proceed to save the component.

To save the component, click **save** at the top-right side of the web UI. The application is going to create the user's component. After saving it, the component must be published to become eligible to be part of a "VNF Designer". The component is published by clicking **Publish** in the previously mentioned menu.

If the publishing was successful, when the user opens the "VNF Designer" and selects the **VNF_Base** element, the component that has been published will be available as an element to be included in the design of the "VNF".

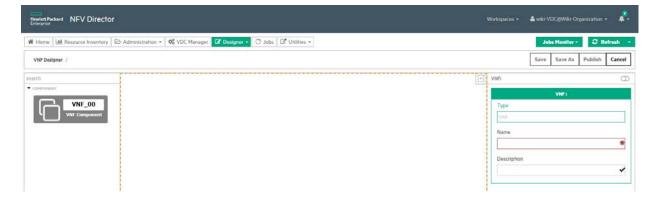


Figure 305: Component designed available to be used

3.1.10 Making the designed components visible

To make our VNF components visible for the VDC Manager, we should assign them to a VNF Group. Otherwise, it would be impossible for the VDC Manager to use these components.

To make these elements visible, the user must go to the **Management** section of the web platform's top menu, and select the section **Section**. Then the user will see a list like in the image below.

VDC Actions VINE-Organisation VDC VINE-Organisation VDC VINE-Organisation VDC VINE-Organisation VDC VINE-VDC Create VNF Group Edit VNF Group Edit VNF Group Wise-VNFG VNFG for CR Wise-VDC Wise-NFVDirector Anage VNF Group Quota	ne III Resource In	wentory 😂 Administration - 0	& VDC Manager @ Designer -	🗘 Jobs 🔀 Utilities +			Jobs Monitor - 3 Refre
Organization VDC Wiki-Opganization Wiki-VDC VNF Group Name Description VDC VDC Description Vector Create VNF Group Description VDC Wiki-VNFG VNFG for CR Wiki-VDC Wiki-NFVDirector							
Wilk-Porganisarities Wilk-VDC Actions VNF Group Name Description VDC VDC Description Edit VNF Group Wilk-VNFG VNFG for CR Wilk-VDC Wilk-NFVDirector VNFG Group Templates				VNF Group Reg	jistration		
VNF Group Name Description VDC VDC VDC Description Wiki-VNFG VNFG for CR Wiki-VDC Wiki-NFVDirector VNFG for CR		Organization		VDC			
VNF Group Name Description VDC VDC Description Edit VNF Group Wiki-VNFG VNFG for CR Wiki-VDC Wiki-NFVDirector VNFG for QR		Wiki-Deganizatio	án l	+ Wild-VDC		Actions	
Delete VNF Group Wiki-VNFG VNFG for CR Wiki-VDC Wiki-NFVDirector VNF Group Templates Assignment						Create VNF Group	
Wike-VNFG VNFG for CR Wike-VDC Wike-NFVDirector Assignment		VNF Group Name	~ Description	~ VDC	VDC Description		
Wite-VN-6- VN-6-bit C.M. Wite-VDC Wite-NI-VUlrector Assignment							
Manage VNF Group Ouota		Wiki-VNFG	VNFG for CR	Wiki-VDC	Wiki-NFVDirector		*
						Assignment	
							-1
							-
							-
		*				Manage VNF Group Guota	
F B T T T T T T T T T T T T T T T T T T		r. 14 4 5 /1	H 10 T Items per pag	ę		Manage VNF Group Guota	> 1 items
* * * * * * * * * * * * * * * * * * *		* 441/1	Items per pag	e		Manage VNF Group Guota	× 1 items
I d d 1 /1 > PI 10 T Items per page 1-1of1 items Templates Instances				R		Manage VNF Group Guota	y 1 Berns
		Templates Instance			riotian	Manage VNF Group Guota	

Figure 306: Make visible the components designed for the rest of users

In the list, the user must select **VNF Group Template Assignment** by clicking the element. Once selected, the user will see the following window:

Organization Name		
Wild-Organization		
/DC Name		
Wad-VDC		
/NF Group Name		
Wild-VNFG		
Name	✓ Description	v
VNF-Wiki_01	VNF	
Wiki-VNF	VNF for the Wiki.	
VNF-Wiki	Wiki	
Wiki-VNF-02	VNF for the NFV-Director Wiki.	
VNF-Wiki	Wiki	
d d 1 /1 P Pl 10 V items per page		1 - 4 of 4

Figure 307: Assigning the elements to the adequate VNF Group

In the lower half of this window, the user can see the name of the VNF components and VNFs designed with the "VNF Designer" or with the "VNF Component Designer". To make such elements usable by the VDC Manager, select the two of them. If the user has more elements of the two types in the list, tick or untick the box at the left of the name of the components to select or unselect them.

After selecting the items, to make the changes effective, the user should click **Save** at the right bottom corner.

🕑 Do you want to save data?	×
Do you want to save data?	
	Yes No

Figure 308: Confirmation window for the assigning of components

If the assigning was successful, the user will see the below message:

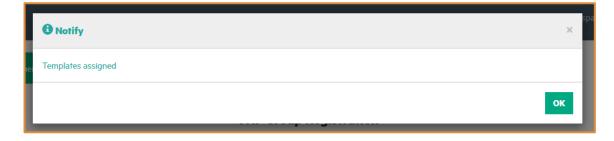


Figure 309: Confirmation message of the assignation.

The VNFs should be always associated with at least one VNF Group. If the user being used is of VDC level, it is recommended associate all the VNFs.

3.2 VNF Designer

3.2.1 Introduction

The VNF Designer is an online designer implemented in our NFV Director platform. It allows us to design and modify the attributes and specifications of the VNFs that we are going to use later. To access to the designer, go to the top menu of the NFV Director Web. The third element in the menu is **Designer**. Right-click on the menu element to obtain a list with two elements. Select the one named **VNF Designer**. Note that the user only has access to this designer with the right user level. The most recommended level is "VDC".

3.2.2 Screens of the designer

3.2.2.1 First Screen of the Designer

After selecting **Designer** in the top menu, you are going to see a screen like the below:

Hewlett Packard NFV Director		Workspaces - 🛔 VNFLB-VDC@VNFLB-Organization - 🍂
Home 🔟 Resource Inventory 🗁 Administration • 📽 VDC Mana	ager 🔽 Designer • 🔅 Jobs 🖵 KPI Dashboard 🛛 😵 Browser	Jobs Monitor - 2 Refresh - Search
Name	Description	Action
🗞 VNF base	VNF base	Clone
🗞 VNF_CR2693	No description	Clone
🗞 VNF_CR2685	No description	Clone Z Edit & Download
& CR2491_VNF	No description	Clone

Figure 310: First window of the designer

The **Download** button allows us to get the file of the component that we choose. The design will be exported to an xml file. To download the design, click **Download** next to the component selected. A new window will appear, giving us the option to choose between the two file types. It will also allow us to change the name of the design.

Download	×
File Name: VNF_userGuide	
	Yes No

To execute the download, click **Yes**. In the case of the image above, after clicking **Yes**, an xml file will be downloaded with the name **VNFC_UserGuide.xml**.

There is another feature implemented in this version, the "Upload" and search of the entities for our designer:

🖝 Home 🔟 Resource Inventory 🗁 Administration 🔹 📽 VDC Manager 🧭 Designer 🔹 🔅 Jobs 🖵 KPI Dashboard 🚱 Browser		
	Jobs Monitor - 🤁 Refres	sh -
Choose a VNF: 🕜 Search	🔔 Upload	

In this version, we can upload an already designed and functional VNF that we have stored locally. To upload a new element to be edited with the designer, click **Upload** and a new window will appear:

Upload	×
Import Only support xml file.	
	Yes No

The upload only accepts XML files. After clicking **Import**, a new file explorer window will appear. Choose the file to upload. After selecting it, click **OK** in the file explorer window. Click **Yes** in the upload window. When the upload is done, the new element will be listed in the "VNF Designer" list of VNFs available.

Next we need a template for our future components. To have a standardized starting point for all the future components, the first thing to do is cloning the "VNF base". This element has the logical structure needed to build above our VNF. To execute the cloning, click **Clone** on the right side of the page.

After clicking **Clone**, the next page that is going to appear is the designer with all its sections.

In this screen, we will see (at least) the components that we created, saved and published in the "VNF Component Designer". In this case, the user will see (at least) the component VNF_00, previously created in Chapter 3.

Hewlett Packard NFV Director		🐣 wiki-VDC@Wik	-Organization	- 4-
🕷 Home 🔟 Resource Inventory 🗁 Administration 🔹 📽 VDC Manager 🕼 Designer 🔹 🗇 Jobs 🕼 Utilities 🔹		Jobs Monit	or - 🕄 R	efresh -
VNF Designer /		Save Save	s Publish	Cancel
search I	VNF:			\bigcirc
COMPONENT		VNF:		i I
VNF_00 VNF Component	Type VNF			
	Name			
				*
	Description			_
				*
Policies Network Connections Monitors				
Attinity Policies Anti-Attinity Policies Scale Policies Heal Policies Processing Policies				
Search				

Figure 311: Inside the VNF Designer

3.2.2.2 Main Screen of the Designer

The main screen of the Component Designer has five main zones. We are going to explain the different parts from the top to the bottom of the page.

Hewlett Packard NFV Director			å wiki-V	DC@Wiki-Or	ganization	. 🔏.
🕷 Home 🔟 Resource Inventory 🗁 Administration 🔹 📽 VDC Manager 🕼 Designer 🔹 🔅 Jobs 🕼 Utilities 🗸			Jol	bs Monitor -	C R	efresh 🕞
VNF Designer /			Save	Save As	Publish	Cancel
search	V	/NF:				D
VNF_00 VNF_00				VNF:		Î
VINF Component		Type VNF				
		Name				
						*
		Description				-
						•
Policies Network Connections Monitors						
Affinity Policies Anti-Affinity Policies Scale Policies Heal Policies Processing Policies						
Search_ • Add •						

Figure 312: Creating a VNF Component for the VNF

Just under the top Menu of the NFV Director Web, we can see the beginning of the Component Designer. The first element on the top includes the name of the tool in use on the left, in this case, VNF Designer". This element contains usual options to save/cancel/publish our design on the right. The **Publish** option refers to the action of making the designed component usable for the creation of a VNF element. To publish an element, save it in advance.

🖝 Home 🔟 Resource Inventory 🖻 Administration 🔹 📽 VDC Manager 🕼 Designer 🔹 👶 Jobs 🕼 Utilities -	Jol	bs Monitor -	₿ R	efresh -
VNF Designer /	Save	Save As	Publish	Cancel

Figure 313: Top Menu of the VNF Designer.

The center part of the page harbors three of the five parts of the Designer, it will be described from the top to the bottom.

Using the Component list and the Search tool on the left side of the Component Designer, we can search for other components that are listed. In this case, we only have one possible component listed, a VNF Component named VNF_00. To know more about creating components for our VNFs, go to section 3.1. If our NFV Director platform detects more components suitable to be used as elements in a VNF, they are listed in this section.

Henders Packand NFV Director	Workspaces - 🛔 wilk VDC@Wilk- Organization -
Home 🕍 Resource Inventory 🖄 Administration - 📽 VDC Manager 🖉 Designer - 🗇 Jobs 🗭 Utilities -	Jobs Monitor - 🛛 Refres
VNF Designer /	Save Save As Publish Ca
rch	VVIP Component: Ex, Component
RECHEDIT	VNF Component : Ex_Component : Ex_Component : Ex_Component :
VNF_00	Type Affinity Policy : Affinity
VW Component	Anti-Affinity Policy : Anti-Affinity policy
	VNE Companient Is Scale Policy : Scale In/Out Policy
	Name @ VM : Example_CG @ Monitor : monitor-disk-write
	Ex.Component
	Action : ErrorConditionAction
	Description of Policy : Scale Core Up-Down
	Of Policy : Scale Memory Up-Down
	Virtual Core : VM Core
	S Virtual Disk : VM Disk
	Virtual LUN ; external-storage Virtual Memory : VM Memory
	Virtual Memory VM Memory
	Virtual Port : ETH2
	Virtual Port : ETH3
	💉 Virtual Port : ETH4
	💋 Virtual Port : ETHS
	□ VM : Example_VM
	👸 🔻 Monitor : monitor-disk-write
	🎾 🖛 Condition : ErrorCondition
1	😪 Action : ErrorConditionAction

Figure 314: The central part of the Designer

The middle of the web page is the work place of the designer. If we select a component of the list and drag it to the center of the web page, the component will be created and will appear in this space. This way, it is possible to edit and customize the component. When all the elements are created, and we want to see all the components listed, it will be enough to select the work space to see the list on the right side of the designer. To select work space, click in an empty zone of the work space.

The fourth part of the Component Designer is located on the right side of the web page. This is where we can edit our components, by changing the different values of the attributes in each category. Some of these attributes are not editable (such as the Type of some components, or some critical attributes), because they were set at the creation of the component to make sure that the value of the field is adequate, and to avoid future problems. Another possibility is that the values will

be editable in another phase of the component. Notice the element in the top right corner of the field: permits to edit and consult all the elements of the component that have been created, or the component that is just about to be created.

NEV Director Interpret		Workspaces - 🔺 wiki-VDC@Wiki-Organization - 🦧
Image: With Designer / Image: With Designer / Image: With Designer /		Jobs Honitor - 2 Refresh -
Verscher Concenter VVF_00 V	NF Component: Ex. Component VHF Component Ex. Component Type VYHF Component Ex. Component Ex. Component Description	 VINE Component : Ex. Component VINE Component : Ex. Component Anti-Affinity Policy : Affinity Anti-Affinity Policy : Affinity Scale Policy : Scale In/Out Policy Scale Policy : Scale In/Out Policy Condition : EmorCondition Action : EmorCondition Circuit (VIN Example_CG Worked Texts : VM Disk Virtual Totk : VM Disk Virtual Totk : VM Disk Virtual INE : VM Disk Virtual INE : VM Disk Virtual INE : VM Nemory Virtual Port : ETH1 Virtual Port : ETH3 Virtual Port : ETH4 Virtual Port : ETH4 Virtual Port : ETH4 Virtual Port : ETH4 Virtual Port : ETH5 VM : Example_VM Memory : EmorCondition Condition : EmorCondition

Figure 315: The attribute's window in the VNF Designer

The fifth part allow us to add and modify policies, network connections and monitors.

Policies	etwork Connections Monitors
Affinity Polici	Anti-Affinity Policies Scale Policies Heal Policies Processing Policies
Search	O Add ▼

Figure 316: Bottom Menu of the VNF Designer

3.2.3 Creation of elements for the VNF.

To create new components for our VNF, open the designer and select the component to create from the second part of the designer (as explained before). In this part, we have the list of possible components suitable to become a part of our VNF.

For example, to create a VNF_00 component, select the component on the left side of the NFV Director web UI "VNF Designer" and drag the future component to the work space in the center of the web page. It results in the following:

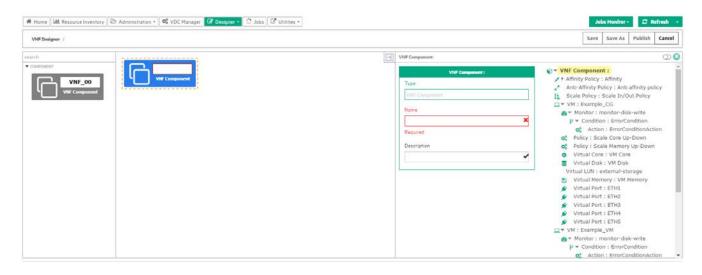


Figure 317: Creating a new VNF Component for the VNF

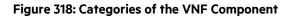
Notice that the active elements in the work space are colored in blue. Also, notice that in the fifth part of the Designer, in the bottom of the page, we can see two news sections, **Network Connections** and **Monitors**. **Network Connections** is responsible for the creation the End-Point necessary to connect the different elements and entities related to the VNF designed by the user. **Monitors** refers to the creation of different types of associated monitors to monitor the behavior of the component.

Also, in the right side of the web page you can see a field colored in red. These fields are mandatory parameters that must be filled before the publishing of the component, otherwise, publishing will not be permitted. This time the field Name of the VNF is the one that must be filled to continue.

The list of attributes present on the right side of the web page is the list for the edition of each element in the list. This means that when we select an element from the list, it will be marked as active element, and it will be loaded in the attributes editor on the left. The field in red is displayed because the element selected in the list is the VNF itself.

If we scroll down in the attribute editor of the Designer, we will see the rest of the editable attributes of the selected element, in this case, a VNF. At least we should fill the **Name** attribute with a correct value to continue with the publishing of the element.

	Virtual Port : ETH2			
VNF Component:	VM : Example_CG	III INFO 🔷		
VNF Component : undefined	Туре	IP Address		
Туре	VM			
VNF Component	Name			
Name	Example_CG	InterfaceOrder		
*		2		
Description	Description	Add new item to the list		
✓	✓	Name		
		ETH2		
		Туре		
		virtio 🔻 🗕		
		Add new item to the list		



3.2.3.1 Creating a VNF Component for a VNF

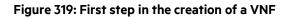
The creation of a VNF Component begins with the selection of the component in the list of possible elements in the second part of the Designer. This is the list present on the left side of the web page. As we explained before, this list contains the valid elements to be integrated in the future components.

This list is filled with all the possible elements suitable to be part of a new VNF. The creation of these elements takes place in the "VNF Component Designer". The steps that the user should follow to create such of components is described in Chapter 3.

Once the user understands that these elements are not trivial, and are conformed of other elements previously configured with the help of another (very similar) designer, the user can continue with the designing of a new VNF.

After selecting the element, drag it to the work space and wait for its creation.

Sharch	search Q	VNF Component:	C) 🖸
COMPONENT VINE_00 VAPP Component		Will Composed address Type Vitif Composed Vitif Composed Unite Decomption	 VHC Component: undefined ✓ VHC Component: undefined ✓ Arti-Affiny Policy: Harti-Affinity Policies ✓ Arti-Affiny Policy: Harti-Affinity Policies ✓ Gale Policy: Scale Row Policy ✓ WH: Domping_CC ✓ Whith Brown Condition ✓ Active: Affinity Policy: Scale Core Up-Down ✓ Vistal Dist: VM Obiek ✓ Vistal Dist: VM Obiek ✓ Vistal Port: EPIN



As you can see in the images above, we selected the element VNF_00, and we dragged it to the work space. The element has been created and is colored in blue. As you can see, all the attributes and internal elements of the component are in the list right of the designer. Also, see how the designer requires the Name field to be filled, as that is a mandatory field. It is filled with the value VNF_Comp1.

In the above image, on the right side of the designer, we can choose and change the values of some of the attributes present in the elements listed. Inside our VNF_00, we have policies, Virtual Ports, Virtual Core, Monitors, and so on. All these elements are editable within certain constraints. If you select one of these attributes, you will see how the component window changes, showing the attributes of the element selected.

 VNF Component: Ex_Component	0 😆	VNF Component: Ex_Component	00
VHF Component: Ex, Component Verifier : monitor-disk-write Type Verifier : monitor-disk-write Description Excends Coder Coder Type AUTO Type AUTO Coder Coder Coder Coder Coder Coder Coder Coder Coder Coder Coder Coder Coder Coder Coder	 ✓ VNF Component : Ex_Component ✓ Affinity Policy : Affinity ✓ Anti-Affinity Policy : Anti affinity policy [i] Scale Policy : Scale In/Out Policy [i] Scale Policy : Scale In/Out Policy [i] VH : Example_CG ✓ VM : Example_CG ✓ Conditon : ErrorCondition C Policy : Scale Core Up-Down C Policy : Scale Core Up-Down Virtual Dik : VM Disk Virtual Dik : VM Disk Virtual IDK : ETH1 ✓ Virtual Port : ETH1 ✓ Virtual Port : ETH2 ✓ Virtual Port : ETH3 ✓ Virtual Port : ETH4 	Vertexempokent: Ety_compokent Vertexe Pert : ETHC: EINFO IP Address InterfaceOnder 2 • • Add raws them to the fast Verto	 VNF Component : Ex_Component Affraity Policy : Affinity Anti-Afficity Policy : Anti Affinity policy Scale Policy : Scale In/Out Policy Scale Policy : Scale NerroCondition Condition : ErrorConditionAction Policy : Scale Nerror Up-Down Policy : Scale NerroCondition Policy : Scale NerroCondition Virtual Dirk : VM Disk Virtual Dirk : VM Disk Virtual Dirk : VM Disk Virtual Dirk : TH1 Virtual Port : ETH1 Virtual Port : ETH3 Virtual Port : ETH4
	Virtual LUN : external-storage Virtual Memory : VM Memory Virtual Port : ETH1 Virtual Port : ETH1 Virtual Port : ETH2		
	🗩 virtual Port : ETH2		



As you can see, the window that allows us to edit the attributes will change with the element selected in the list. Once we carry out the creation and modifications required by the component, we will proceed to the assigning of policies, network connections and monitors. This part of the creation is common to all the elements, so it is going to be discussed in another section.

Once we have created the element, we can edit the attributes and the components of the element. We are going to introduce a new name for our Virtual Machine. To do that, select the element in the work space by clicking it, then click in the Name field on the right side of the work space. Type the new name for the VM, in this case, it is VNF_Comp1.

	VNF Component: VNF_Comp1	C 🖸
VNF_Component VNF Component	VHF Component : VHF_Comp1 Type VNF Component Name VNF_Comp1 Description ID Ba6e99ea-5720-4036-90fb-0bf7ec79999a IE GENERAL Description Description	 VNF Component: VNF_Comp1 Affinity Policy : Affinity Policy Anti-Affinity Policy : Anti-Affinity Policies Scale Policy : Scale Policy VM : Example_CG Monitor : ErrorCondition Condition : ErrorConditionAction Policy : Scale Memory Up-Down Virtual Core : VM Core Virtual Core : VM Core Virtual Poti : ETH1 Virtual Pott : ETH1 Virtual Pott : ETH4 Virtual Pott : ETH4 Virtual Pott : ETH4 Virtual Pott : ETH4 Virtual Pott : ETH5 wun : Storage1

Figure 321: Editing the VNF's name.

To configure our Virtual Machine to behave correctly during the future execution, we need to fill all the attributes in all the categories until the green tick appears at right side of the box.

VNF Component : VNF_Comp1	VNF Component : VNF_Comp1
-	💉 🕨 Affinity Policy : Affinity Policy
Туре	🥒 Anti-Affinity Policy : Anti-Affinitty Policie
VNF Component	Scale Policy : Scale Policy
	_ ▼ VM : Example_CG
Name	→ Monitor : Monitor CPU
VNF_Comp1	🛿 🔻 Condition : ErrorCondition
	Action : ErrorConditionAction
Description	😋 Policy : Scale Core Up-Down
✓	😋 Policy : Scale Memory Up-Down
	Virtual Core : VM Core
ID	Virtual Disk : VM Disk
8a6e99ea-5720-4036-90fb-0bf7ec79999a	Virtual Memory : VM Memory
	💉 Virtual Port : ETH1
	💉 Virtual Port : ETH2
GENERAL 🔨	💉 Virtual Port : ETH3
	💅 Virtual Port : ETH4
Descripton	🖌 Virtual Port : ETH5

Figure 322: Editing the rest of the attributes of the VNF

In this example, we have filled the attributes Name and Description with the values VNF_Compl and Component 1, respectively. The other editable attribute of the VNF_Compl Component is the GENERAL.Name, which is an autogenerated value, in this case, VNF Comp. The user can edit this field at his will. Note that we can create two VNF Components from the same element. This means that it is possible to duplicate VNF components when we are creating a VNF with the designer. Keep in mind that we are referring now to the final VNF, the one that is going to be used as a whole, and the objects that can be duplicated are the components of this final VNF, not the elements that are parts of this VNF's components. Those can be duplicated if necessary, to meet the needs of the user. This is explained in Chapter 3.

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NUME VALUES VALUES	Viel Compile Viel Compile		C Writeward Wited C Writeward Wited C Writeward Wited Res Res C Writeward C W		2Core_KVM_any_ Policy : vCare2Cor Policy : 2Core_KVM_dedi Policy : 2Core_KVM_dedi Policy : 2Core_KVM_shar	V Poley pobluka sCNC.any, andJobbi edJobbi edJobbi edJobi ed.	лна 4

Figure 323: A VNF with more than one VNF Components

3.2.4 Adding policies to the component

We are going to discuss this in another section due to the peculiarities of this elements and the assigning process. If we need to create a policy to be attached or connected to an element, we should have the element properly created, with all its attributes correctly filled. Also, we must know clearly what policies our element needs. Once we know and have what is needed we can start the process of creation.

Policies Network Connectio	ons Monitors
Affinity Policies Anti-Affinity I	Policies Scale Policies Heal Policies Processing Policies
Search 🗲 Ad	d Scale In/Out Policy *
Scale I Scale Policy	

Figure 324: Adding Scale policies to the VNF

The designer allows us to create one type of policy over a VNF, a Scale policy. The rules to create this type of policy will be described in the following sections. The Affinity and Anti-Affinity policies are already included in the VNF. These policies can be edited, although they were created with the component.

3.2.4.1 Modifying Affinity Policies

An Affinity Policy allows us to indicate where and over what artifact the assigning of resources is going to take place. At this level, the Affinity policies are limited to the ones that were created in the components previously.

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14 Jone 14 Resource Inventory 20 Administration • 05 VOC Hanger 27 Deby 12 Unline • O Jobe 12 Unline • O Jobe 12 Unline •					
VHF Dealgenr /	Save Save As Publish Cancel				
VHF_Comp2 VHF_Comp3 VHF_Comp3 VHF_Comp3 VHF_Comp3 VHF_Comp3 VHF_Comp3 VHF_Comp3	Atteining Kulkey, Atteining Tripis Atteining Kulkey, Atteining Tripis Atteining Kulkey, Atteining Atteining Kulkey				

Figure 325: the policies present in the VNF Components

To modify an existing Affinity Policy, click the policy present in the list of components of the element. After selecting the policy, the attributes window allows the user to modify the active fields.

	Affinity Policy : Affi	nity Policy
Туре		
Affinity Polic	у	
Name		
Affinity Polic	у	
Description		
Policy Affini	у	
ID		
15815380-d4	b1-46ea-852b-fe15	5dd4d10e4

Figure 326: Affinity policies of the VNF Component

For this policy, we set the Name field with the value Affinity, and the Description field with the value Affinity Policy. All the fields must be fulfilled until the green tick is present on the right side of the box. When finished with the update of the fields, execute an **Update** of the component. This action was described in the previous chapter.

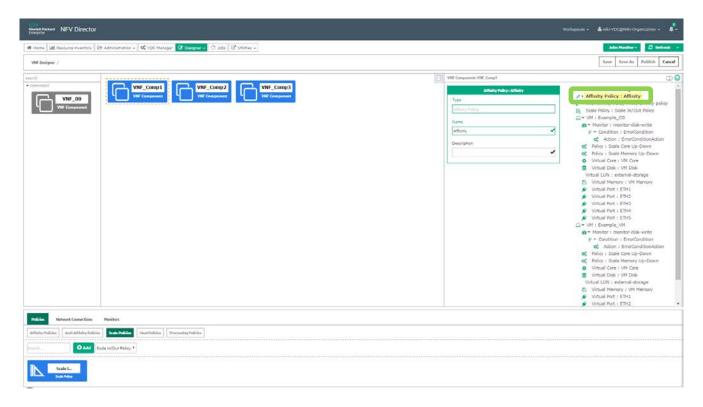


Figure 327: The Affinity policies in the VNF Component

3.2.4.2 Modifying Anti-Affinity Policies

An Anti-Affinity Policy allows us to indicate where and over what artifact the assigning of resources is going to take place. At this level, the Affinity policies are limited to the ones that were created in the components previously.

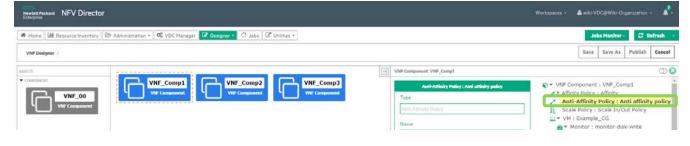


Figure 328: Modifying the Anti-Affinity policies

To modify an existing Affinity Policy, click the policy in the list of components of the element. Then the attributes window allows the user to modify the active fields.

VNF Component: VNF_Comp1	
Anti-Affinity Policy : Anti-Affinitty Policies	
Туре	
Anti-Affinity Policy	
Name	
Anti-Affinitty Policies 🗸	
Description	
Polices AntiAffinity	
ID	
713269bc-4913-41be-9efd-83e7b95063e6	

Figure 329: Attributes of the Anti-Affinity policies

For this policy, we set the **Name** field with the value **Affinity**, and the **Description** field with the value **Affinity**. All the fields must be fulfilled until the green tick is present on the right side of the box. When finished with the update of the fields, execute an **Update** of the component. This action was described in the previous chapter.

Hendret Parkard NFV Director	Workspaces - 👗 wiki-VDCgWiki-Organization - 🔺 -
Wit Home Iddl. Resource Inventory Image: Control Contro Control Control Control Control Con	Jobs Henitor - C Refresh - Save Save As Publish Cancel
Image: Second	Inity Policy : Affinity Affinity Policy : Affinity Policy : Anti affinity policy Eacle Policy : Scale InfOUND Policy Eacle Policy : Scale InfOUND Policy E VI : Example_CG Antion : Emotondition Condition : Emotondition Condition : Emotondition Policy : Scale Core Up-Down Virtual Core : VM Core Virtual Disk : VM Disk Virtual Disk : VM Disk Virtual Intor: ETH1 Virtual Intor: ETH2 Virtual Intor: ETH2 Virtual Port : ETH3 Virtual Port : ETH4 Virtual Port : ETH5 Virtual Port : ETH5 Virtual Port : ETH6 Virtual Port : ETH6
Putidies Network Connections Monitors Attributy Putidies Amin-Attributy Putidies Scale Publicles Incommitting Publicles	
State Lu Scale Lu Out Policy •	

Figure 330 : The elements of an Anti-Affinity policy

3.2.4.3 Adding Scale Policies

The Scale policies are a set of orders and presets that conduct and manage the escalation processes over the different elements of the system. To clarify what types of policies we use and which are the best to be applied depending on the needs of the user, we will go over the scaling policies nature.

- Scale Up:Acts when a specific category's attribute of an artifact need to be dimensioned to an upper value,
so this policy is going to act over elements as CPU or Memory.Scale DownActs when a specific category's attribute of an artifact need to be dimensioned to a lower value,
- so this policy is going to act over elements as CPU or Memory. Scale In: Acts when an artifact needs to be eradicated in all its conditions and states. This type of policies permits the deletion of a number of elements, all of them equal to the artifact that acts as target of the policy.
- Scale Out Acts when an artifact needs to be cloned in all its conditions and states. This type of policies permits the creation of a number of elements, all of them equal to the artifact that acts as target of the policy.

Scale Policy : Scale Policy VNF	
Туре	Scale Policy : Scale Policy VNF
Scale Policy	VNF Component : VNF_Comp1 VNF Component : VNF_Comp2
Name	VNF Component : VNF_Comp3
Scale Policy VNF	
Description	
Scale Out Policy	
ID	
effd5429-1e51-48d0-92a6-db1a3e6c1ac3	



Note that the policy that will be created is going to be applied over the VNF that the user is creating. As you can see in the image above, on the right side, you can see the different elements that compose the future VNF. The Scale Policy is an element of the VNF, not an element of one of the components of the VNF, in this case, VNF Component: VNF_Comp1, VNF Component: VNF_Comp2, VNF Component: VNF_Comp3.

3.2.4.3.1 The Scale Up and Scale Down policies

The policies Scale Up and Scale Down are the responsible to extend or shrink specific components of the element. They are usually related to the **Core** and **Memory** elements of our Virtual Machines, when a Scale Up or Scale Down operation is triggered, the operation will check for the presence of these policies. If some policy exists, the operation will read the policy to apply it. The category that configures the policy is **SCALE**. Inside this category, we should configure the following attributes:

DECREASEAMOUNT	
1024	-
DESTINY	
INFO,Amount	
DOSCALE	
Туре	
INCREASEAMOUNT	
1024	1
Max Scale Value	
2048	1
Min Scale Value	
1024	1

DECREASEAMOUNT: The amount of unities that are going to be eliminated. For this policy, it will be erased of the memory. In this case, 1024 Mb. **DESTINY:** The category and attribute that is going to be modified by the policy. In this case the "Amount" of memory in Mb, reflected in the category "INFO".

DOSCALE: Not editable by the user.

INCREASEAMOUNT: The amount of unities that are going to be enhanced. For this policy, it will be created for the memory. In this case, 1024 Mb. Max Scale Value: The maximum amount of the specific resource that can be reached through a scale operation, in this case, 2048 Mb.

Min Scale Value: The minimum amount of the specific resource that can be reached through a scale operation, in this case, 1024 Mb.

Note that the Scale Up/Down policies are implemented by defect in the base components. Keep in mind before starting a Scale Up/Down operation is that the policy is going to act without knowing if the situation on the OpenStack platform can afford what is expected by the policy. This means that, to guarantee the escalation, the user should be sure that the resources present in the OpenStack platform are enough to carry out the escalation, the limitation of the resources in the OpenStack platform must be checked by the user.

3.2.4.3.2 The Scale Out and Scale In policies

The Scale Out policies in the VNF Designer are Scale Out policies. This means that the component can be duplicated or cloned. The policy is going to allow the user to duplicate the VNF if necessary. The maximum number of clones reachable is set by the Max Scale Value attribute in the RANGE category. In this case the value set is 10, so, when the policy will act, the VNF can be cloned ten times.

To create a new escalation policy over a Virtual Machine, first we should have a VM artifact in our work space (Third section of the Designer), with all its attributes and elements correctly filled. Once we have our VM, we need to go to the bottom of the web page, click **Policies**, and we will be able to see the below screen:

Policies Ne	twork Connections	Monitors			
Affinity Policies	Anti-Affinity Policies	Scale Policies	Heal Policies	Processing Policies]
Search	G Add Sca	ale In/Out Policy 🔻)		
Sa Sa	le Policy				

Figure 332: Adding Scale policies to the VNF

Once we see this screen, we can create the policy by clicking • Add . The next step is filling the attributes of the policy and setting the target and name for the policy.

We should keep in mind that **the escalation policies should be set at the proper level to get the desired effect**. We have two options to create the escalation policies: Creating the escalation policy at component level, and creating the policy at VNF level:

Component level. When we set a Scale Out/In policy at this level, the escalation operation will be applied to the elements that conform the component. This means that the escalation is going to take place over the Virtual Machines of the component, only over these machines, and only over the original template of the Component. The modifications over the instances will not be reflected in the escalated elements.

For example, if we have a Component with One VM, and a Scale policy with an Incremental Value of 1:

- The user starts an escalation operation, the VNF Component will create another Virtual Machine cloning the one that already exists.
- At the end of the first escalation operation, the user will have two VMs over the same component.
- Later, this VNF Component needs to grow again and the user starts another escalation operation.
- When the process has finished, the user has three Virtual Machines, due to the escalation process is performed over the original design of the VNF Component, not over the result of the first escalation process.

VNF Level. When we set a Scale Out/In policy at this level, the escalation will be applied over all the components of the VNF. So, if we configured an **Increment Value** of **1**, each component of the VNF will be duplicated by cloning one time. Basically, we will reproduce our VNF structure one time, including the Scale policies present in the VNF Components. These policies are going to be executed, too, when we trigger the escalation operation.

Notice that an escalation is never going to take place if the Decrement Value, Increment Value and the Min Scale Value are in conflict. The following cases clarify what we mean by conflict:

A Scale Out operation at VNFC level, because we will use number of Virtual Machines: if our policy was set at VNF level, we would talk about number of VNF Components, but the behavior of the policy would be the same.

Number of VM	Decrement	Increment	Min	Max	Conflict
1	1	1	1	1	Min and Max has the same value, no Scale Out will be performed due the number of VM already suits the Max value.
2	1	1	2	3	Max value is not enough to settle the amount of VM that the operation will create with and increment of one. Four VMs will be created, with a Max value of 3. No Scale out will be performed.
3	1	1	3	6	The Scale Out will be performed only one time. With this configuration, the Scale Out can only be executed once in a row.

We will implement our escalation policies for our VNF at the level that shown in the image below. It will only act over the VNF Component, which is part of the component.

🗞▼ VNF :				
<u> </u> Scale Policy : S	Scale In/Out Policy			
♥▼ VNF Component : VNFC_01				
Scale Policy	: Scale In/Out Policy			
□ VM : standa				
	Decrement Value			
	1			
Scale Policy : Scale In/Out Policy	Increment Value			
Туре	1			
Scale Policy	Max Scale Value			
Name	10 🗸			
Scale In/Out Policy	Min Scale Value			
Description	1 -			
✓	Add new item to the list			
	Scale Mandatory Type			
	MUST 🗸			
	Select a policy target :			
	VNF Component :Wiki-VNFC-02			
	VNF Component :Wiki-VNFC-03			
	VNF Component :Wiki-VNFC			

Figure 333: Editing the attributes of a Scale policy

For this policy, the fields Name and Description in the category GENERAL have been filled with the values Scale Policy and Policy to scale VM respectively. And in the category RANGE, we are going to construe the value in each field.

The Decrement Value and Increment Value are related to the number of VMs that are going to be duplicated or erased. If we have a value of 1 as decrement value, it means that in case of a Scale IN, the number of VMs that are going to be erased is only one. In case of increment, the logic to apply it is the same. For a value of 2, if we have one VM, we will end up having three VMs. In case of having two VMs, we will finish with six VMs.

The difference between selecting MUST or SHOULD as the value for the GENERAL. Type is that in case we have selected MUST, if the system is close to running out of resources during the assigning, the application will throw an error message. If the value is SHOULD, the application will throw a warning message, and continue with the execution without stopping. In this case, the value of the Type attribute is MUST, so if the resources available are close to be depleted in the moment of the assigning, the application will throw an error. In other case, the execution will continue.

We should select at least one target for the policy. We are designing a VNF, so our target can only be a VNF Component. To select one, left-click in the checkbox in the list of VNF Components related to the VNF. After selecting one, we are done with the configuration of the policy.

3.2.4.4 Adding Heal Policies

The heal policy is used for defining how to Heal the VNF or VNF Component. To add a heal policy, first select the **Heal Policies** tab in the bottom area of the designer.

-	
	Policies Monitors Vluns
	Affinity Policies Anti-Affinity Policies Scale Policies Heal Policies Processing Policies
	Search Add heal_policy

Then click **Add** to add a heal policy to the current VNF Component.

In the inspector area, customize the HealCause attribute of the heal policy.

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🕷 Home 🕍 Resource Inventory 🗈 Administration + 🖉 VC Hanager 🕼 Octoper + 🖉 Jake	Jobs Henitise + 🛛 D. Befreish 👒			
VNE Component Designer /	Save As Publish Cancel			
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3.2.4.5 Adding Processing Policies

To add a processing policy, we should first select the **Processing Policies** tab in the bottom area of the designer.

Policies Monitors Vluns
Affinity Policies Anti-Affinity Policies Scale Policies Heal Policies Processing Policies
Search 🗘 Add 👻 postpre_policy 🕇

Processing policies could be added to both VNF Component level and VM level. By default, we can add the processing policy to VNF Component level when we click **Add**.

Policies Monitors Vluns				
Affinity Policies Anti-Affinity Policies	Scale Policies	Heal Policies	Processing Policies	
Search C Add -	postpre_policy *			
postpre Processing Policy				

There is a drop-down icon at the left side of the Add button. Click it and you will see a list of two items.

Policies Monitors	Vluns
Affinity Policies Anti-Affin	ity Policies Scale Policies Heal Policies Processing Policies
Search	Add v postpre_policy v
A	Add to VM
postpre A	Add to VNFC
Processing Policy	

Click Add to VM, then you can add the processing policy to the VM level. Select the target VM tab, and click Add to VM, then you will add a processing policy to the VM.

Affinity Policies Anti-	Affinity Policies Scale Policies	Heal Policies Processin	g Policies
VM :standard	2		
Search	• Add to VM + postpre_po	licy *	
VM2_pro Processing Poli			

The image above shows how the Pre/Post processing policies will be created, all the attributes editable are wrapped in the category "PROCESSING_JOB", a Pre/Post-processing has to have a workflow to be processed, and it should have an operation as target for the triggering of the policy, for this policies is also possible to identify an order of execution, a complex task could have more than one Workflow or process involved. We are going to explain what each attribute of the category "PROCESSING_JOB" is and how these attributes should be filled to have a successful use of the policy.

- **Type:** The type only can take two values: **PRE** or **POST**, corresponding with one of the two types of actions that will take place when the policy will be executed.
- WorkFlow: The policy needs an element that contains all the logic of the process that is going to be executed. This mandatory element is implemented through a Workflow that is customized for the specific operation. This means that a Pre-processing policy can have more than one workflow prepared to be executed. Each workflow will have a Pre/Post-processing policy assigned to be executed, so the same entity could have several Pre-Post policies related, but entities cannot share their processing policies with each other.
- Operation: The Operation attribute represents the operation from which the policy will be triggered. These operations are Deploy, Undeploy, Scale Up, Scale Down, Scale In and Scale Out, basically the core operations of the solution.
- OrderBy: This is a numerical attribute. We can introduce the order of execution that should be followed during the execution of the operation. If we have more than one policies related to the same operation, we can sort the execution introducing a number in this attribute. This way, if we introduce the number 2, our policy will wait for the first policy to be executed, and only after that will out policy start its execution.

3.2.5 Adding Network Connections to the component

We will cover this topic in another section due to the peculiarities of this elements and its function. The Network connections refer to the elements that are going to be connected through an End_Point. An End_Point is the point of connection between higher components. This means that the communication that is going to take place between entities needs elements to dictate what can be accessed from other entities.

To create a new connection, click **Network Connections** at the bottom Menu of the designer. After that, click **Padd**. The network connection will be created with the editable fields empty, as in the image below on the left.

Policies Network Connections Monitors	Policies Network Connections Monitors
Search C Add Endpoint •	Search Add Endpoint T
Network Connection	EndPoint Network Connection



The designer allows us to create Network Connections without limit, but it makes no sense connecting different components, elements or entities more than one time. Having duplicate connections is considered a bad practice. The user can create an End_Point for each element if preferred, but it is not an optimal approach. The most optimal method is to create an End_Point for various elements of the same component. This will be explained later in the document.

→ Network Connection: EndPoint		
	→ Net	work Connection: EndPoint
End Point : EndPoint		
Туре		Coloria and
		Select a port :
End Point		▼VNF Component :VNF Comp3
Name		▼VM :Example_CG
		Virtual Port :ETH4
EndPoint 🗸		
Description		Virtual Port :ETH3
		Virtual Port :ETH1
Example EndPoint 🗸		Virtual Port :ETH5
		Virtual Port :ETH2
Select a port :		▼VNF Component :VNF_Comp1
		▼VM :Example_CG
		Virtual Port :ETH2
		Virtual Port :ETH4
		Virtual Port :ETH1
		Virtual Port :ETH5
		Virtual Port :ETH3
		▼VNF Component :VNF_Comp2
		▼VM :Example CG
		Virtual Port :ETH3
		Virtual Port :ETH1
		Virtual Port :ETH5
		Virtual Port :ETH4
		Virtual Port :ETH2
		VICUAL FOIL (ETTZ

Figure 335: The attributes of an EndPoint

In the example case, our VNF is going to have two VNF components. As in the image above, our VNF components are named VNF Component: VNF_Comp1 and VNF Component: VNF_Comp2. Both components have two Virtual Machines. Each component's Virtual Machines have five configurable Virtual Ports to be connected to the EP of other components or elements.

At this moment, the user should decide between creating a unique **End_point** for the VNF that is being created, and creating more than one EPs and configure each one of them based on the specific needs of the use case.

If we decide to create a unique EP for the VNF component, meaning that all the components that will try to connect to the future VNF that it is being designed by the user will do it through the unique EP of the component. One way to connect the EP to all the VMs present in the two "VNF components" that conform our VNF is as follows.

Network Connection: End Point
End Point : End Point
Ena Point i Ena Point
Туре
End Point
Name
End Point
Description
Example ENd Point
Select a port :
▼VNF Component :VNF_Comp2
▼VM :Example CG
Virtual Port : ETH3
Virtual Port :ETH1
Virtual Port :ETH5
Virtual Port :ETH4
Virtual Port :ETH2
✓VM :Example VM
Virtual Port :ETH5
Virtual Port :ETH1
Virtual Port : ETH2
Virtual Port :ETH3
Virtual Port :ETH4
▼VNF Component :VNF_Comp1
▼VM :Example CG
Virtual Port : ETH5
Virtual Port : ETH4
Virtual Port : ETH2
Virtual Port : ETH3
Virtual Port :ETH1
✓VM :Example VM
Virtual Port :ETH2
Virtual Port : ETH4
Virtual Port :ETH1
Virtual Port : ETH5
Virtual Port :ETH3

For this End Point, the Name and Description attributes have been filled with the values End Point and Example End Point, respectively. As we explained in the previous chapter, to have a unique EP connecting all the VMs of our VNF components with the VNF being created, we need to connect at least one Virtual port of each machine to the End Point.

As you can see in the image on the left, we selected the Virtual Port: ETH1 of each Virtual Machine. In this case, and only for didactic purposes, the VNF Components and Virtual Machines are equal. Normally, each component reflects different configurations depending on the future use and characteristics of the VNF.

With this configuration, all the communication between the VNF and the Virtual Machines of the Components will take place through the End Point that we are creating.

The designer allows to create more than one connection with the same Virtual Machine, but this is a bad practice, not only because we are duplicating a connection, but also because a Virtual Port only manages one connection, and does not permit more than one element connected.

Figure 336: First possible way to connect the EPs of a VNF

The other way to proceed with the creation of EP for our VNF is to create more than one End Points to manage the communication of the VNF. This can be done by creating one EP per VNF Component, or by creating an EP per each Virtual Machine. The decision only depends on the user's needs.

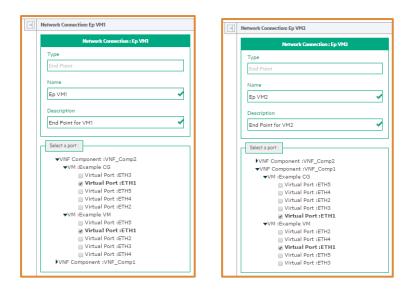


Figure 337: Second possible way to connect the EPs of a VNF

The previous image shows how we can connect two End Points, each one of them connected to the two Virtual Machines present in each VNF component. When the VNF needs to reach the first VNF Component (VNF_Comp1) the communication will take place through the End Point Ep VM1. When the VNF tries to connect to the second VNF Component (VNF_Comp2) it will use the End Point Ep VM2.

Figure 338: Third possible way to connect the EPs of a VNF

The previous image shows how we can connect four End points. Each one of them is connected to the one Virtual Machine present in each VNF component. In this case, when the VNF needs to reach the VM:Example VM of the first VNF Component (VNF_Comp1), the communication will take place through the End Point Ep VM1, if the VNF tries to reach the second Virtual Machine of the same component, VM:Example CG the communication will take place through the end point Ep VM2. In case that the VNF try to reach the VM:Example VM of the second VNF Component (VNF_Comp2), the communication will take place through the End Point Ep VM3, if the VNF tries to reach the second Virtual Machine of the same component, Ep VM3, if the VNF tries to reach the second Virtual Machine of the same component, Ep VM3, if the VNF tries to reach the second Virtual Machine of the same component, Ep VM3, if the VNF tries to reach the second Virtual Machine of the same component, Ep VM3, if the VNF tries to reach the second Virtual Machine of the same component, Ep VM3, if the VNF tries to reach the second Virtual Machine of the same component, Ep VM3, if the VNF tries to reach the second Virtual Machine of the same component, VM:Example CG, the communication will take place through the end point Ep VM4.

Once a Virtual Port is in use by some End Point, it will not be available to be connected to other EPs. The configurations previously shown are the common and recommended.

3.2.6 Adding Monitors to the component

Monitors are elements that allow the user configure an observer for the element monitored. This means that depending on how we configure our monitor, it will receive different information about the behavior and changes of the component monitored. This monitoring has the objective to react when the system needs some resources, mainly solving this lack with the launching of escalation actions.

A Monitor must be connected and related to a Virtual Machine. If the user does not have a Virtual Machine already instantiated in the work Space (third part of the Designer), the **Monitors** tag will not be shown as Active, so we are not going to be able to create a Monitor.

As you can see in the image below, once the user has created a VNF, this element has all the monitors implemented in the Virtual Machines present in the VNF Components that conform the VNF. In this case, two components, with two Virtual Machines for each one of them.

VNF Component :VNF_Comp2 VNF Component :VNF_Comp1	VNF Component :VNF_Comp2 VNF Component :VNF_Comp1
VM :Example CG VM :Example VM	VM :Example CG VM :Example VM
Search • Add monitor-network-transmitted •	Search O Add monitor-network-transmitted 🔻
Memory NetworkTx	HDD-Write NetworkTx HDD-Write NetworkTx

Figure 339: Different Monitors owned by some components of the VNF

If the user wants to create a new monitor over one of the four Virtual Machines present in the VNF, the user only needs to select which VM is going to be the owner of the monitor. To select the Virtual Machine, select a VNF Component: either VNF_Comp1 and VNF_Comp2. After selecting a VNF component, select the Virtual Machine that is going to harbor the Monitor.

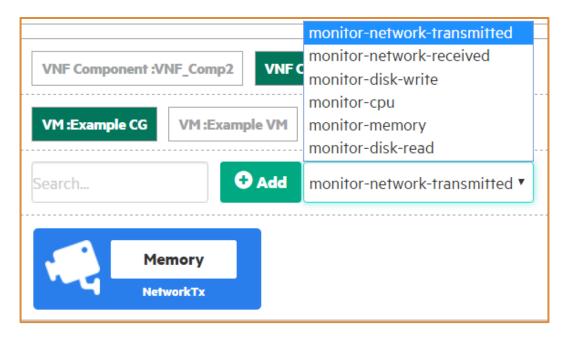


Figure 340: Type of Monitors available to be added

If the user has properly selected a Virtual Machine, the user will be able to create a Monitor of the type listed in the image

above. As you can see in the image, the Monitor, whatever the kind, will be created under the influence of the Virtual Machine. In the figure, we can see all the types of possible Monitors that the application allows us to create. To create one type of monitor, select the type and click . This action will add a Monitor of the type selected to the Virtual Machine, and it will pair that monitor to the element determined by the Monitor's type. A monitor of type CPU will be matched with the CPU related to the Server that is going to be used with the Virtual Machine in use. The rest of the monitors operate the same way.

3.2.6.1 Types of Monitors

All the attributes of a Monitor, from our point of view are reduced to the **Name** and **Description** of the element. This is because we have already chosen the type, and the element which is going to be monitored. The attributes that remain empty are those two previously mentioned. The other two important categories to configure are **Action** and **Condition**. The way to treat these categories is discussed later in the chapter.

The types of Monitor we can deploy over our Virtual Machines are:

Monitor Disk Write:	Monitors writing operations over the Virtual Disk associated to the Server related to the Virtual Machine.
Monitor Disk Read:	Monitors reading operations over the Virtual Disk associated to the Server related to the Virtual Machine.
Monitor CPU:	Monitors operations over the Virtual CPU associated to the Server related to the Virtual Machine.
Monitor Network Transmitted:	Monitors transmission operations over the Virtual Network related to the Virtual Machine.
Monitor Network Received:	Monitors the messages received through the Virtual Network related to the Virtual Machine.
Monitor Memory:	Monitors operations over the Virtual Memory associated to the Server related to the Virtual Machine.

A Virtual Machine can have one type of Monitor for each kind of artifact related to it.

VNF Component :VNF_Comp2 VNF Component :VNF_Comp			
VM :Example CG VM :Example VM			
Search O Add monitor-network-tra	nsmitted 🔻		
Net-Rc NetworkTx NetworkTx	Core NetworkTx	Memory NetworkTx	CPU NetworkTx

Figure 341: All the Monitors assigned to one of the Components of the VNF.

In the image above, we can see a Virtual Machine named VM: Example CG, with five different Monitors configured.

3.2.6.2 Configuring error Actions for Monitors

Monitors need to be configured to start their activity in case some attribute of the monitored element reaches a certain state, or some of its attributes exceed a quantity or surpass a number of communications. To achieve this behavior, the monitor has a Condition and an Action attribute that need to be filled. Unlike the general attributes of the monitor, Condition:ErrorCondition and Action:ErrorConditionAction work together as a trigger. When the condition is met, the action will take place.

Monitor : Net-Rc	
	₽
Туре	🚓 Action : ErrorConditionA
Monitor	
Name	
Net-Rc	✓
Description	
Description	
	~
GENERAL	~
I GENERAL	
requency Unit	
Frequency Unit 600 Seconds	
600 seconds	
	<u> </u>
600 Seconds	<u> </u>
600 seconds	
600 Seconds	

Figure 342 : Attributes of Error Action in a Monitor

As you can see in the image above, the monitor has the typical attributes **Name** and **Description**, and the attribute **Type** is not editable, as usual. To change the value of the previous fields, click in the field's box and introduce a valid name and description for the monitor.

The **GENERAL**. Frequency attribute refers to time gap between each capture by the monitor. It is set in milliseconds. In this case, the value automatically set is 600. To change the value of the attribute, proceed as explained in the previous chapter.

The DEPLOYMENT. Type attribute refers to the element that is going to be monitored. In the image, the artifact selected is the Hypervisor. You can see the other two possible options. If the user selects VIM, the monitor will target this element for monitoring. If the user selects AUTO, the system will decide which element is going to be monitored.

 Monitor: CPU	D	Action : ErrorConditionAction
Action : ErrorConditionAction	monitor : CPU P Condition : ErrorCondition	
	Action : ErrorConditionAction	Name
Name	Action : ErrorConditionAction	ErrorConditionAction
ErrorConditionAction		Operation_Mode
Operation_Mode CLOSED_LOOP	Name	CLOSED_LOOP •
Туре	ErrorConditionAction	Туре
SCALE_UP *	Operation_Mode CLOSED LOOP	SCALE_UP T
Choose an action target : VNF_Component :VNF_00 VM :Example_VM	CLOSED_LOOP OPEN_LOOP SCALE_UP	EMAIL NONE [Add to Event] SCALE_DOWN SCALE_IN SCALE_OUT
	Choose an action target : VNF Component :VNF_00 VM :Example_VM	SCALE_OUT_AND_CONNECT SCALE_UP SCRIPT

Figure 343. Attributes to configure an Error Condition Action in a Monitor

In the image above, we can see the different attributes of the Action:ErrorConditionAction. As always, we can see the field Name filled with the value ErrorConditionAction. After the Name, two attributes are present: GENERAL.Operation_Mode and GENERAL.Type. GENERAL.Operation_Mode, can only take two values, CLOSED_LOOP and OPEN_LOOP. This means that if the value chosen was CLOSED_LOOP, the action to take is not going to wait for the user's operations to end. For example, if the monitor is configured to launch a SCALE_IN, the monitor will launch the scaling process without respect the running processes of the user. If the user chooses OPEN_LOOP, the monitor will wait to launch the Action until the user's operations are finished.

The "GENERAL. Type it refers to the type of the operation that the monitor it is going to throw if the condition is met. We should take into consideration that the user can configure a monitor that will never be used. For example, the user creates a monitor that has – as target – a Virtual Machine with a SCALE_OUT value in the field GENERAL. Type, It implies that the Virtual Machine is the owner of an Entity Scale (which is an error, as a Virtual Machine has no child suitable to be the child of the Entity Scale policy associated to the VM. So, the Scale Out has no element to be escalated, there is no child for the Entity Scale policy), and it also implies that that this policy has an element acting as child that can be the target of the policy. This is a condition that can never take place. The Scale_Out operations are launched at least over a VNF component level. This way we always have a child element to be escalated.

As you can see, a monitor can be used over a wide number of operations, mainly scale operations. These operations were explained in the chapter *Adding Scale Policies*. The operations that were not explained in a previous section are:

- SCRIPT: Refers to the case when, for a specific Condition, the monitor must launch a Script and not start an operation.
- NONE [add to Event]: Refers to situations when CPU use breaches threshold or the disk is about to run out of space. In such cases, an alarm will be raised, then we will handle this alarm and will perform associated ACTIONs like SCALE UP/DOWN/SCRIPT.
- EMAIL: Refers to the case when the occurrence of an event must be notified to an entity or subject.

In the section **Choose an action target**, the designer allows us to choose which element is going to be monitored. In this case, the user can choose from three elements, the VNF that it is being designed, the VNF Component that is part of the VNF, and the Virtual Machine that is member of this VNF component. Note that if during the design we have more than one VNF components, or these components has more than one Virtual Machines, they will be listed in this section.

3.2.6.3 Configuring error conditions for Monitors

The monitors need to have configured a condition that will act as trigger for the action of the monitor. Such conditions are configured by an expression that includes some attributes, referenced by their exact name and the value of the attribute referenced. Also, it should reflect how the condition is going to treat the changes in the attribute, for example, when the attribute's value becomes greater than the value reflected in the monitor.

Monitor: CPU	
Condition : ErrorCondition	 Monitor : CPU ^p ▼ Condition : ErrorCondition ^k ^k
Expression network_bytes_transmitted >90	
Name ErrorCondition	

Figure 344 : Attributes to configure an Error Condition for a Monitor.

For the condition present in the Monitor Net-Rc, (image above) the attribute GENERAL.Name has a value of ErrorCondition and the GENERAL.Expression attribute has a value of network_bytes_transmitted >90, so, when the monitored element reaches 90 bytes transmitted through the network, the monitor will launch the operation present in the Action (in this case a SCALE_UP, see previous subchapter) GENERAL.Type.

To modify the value of the attributes, click in the box of the attribute and type a valid new value.

3.2.7 Deletion of elements of the designer.

There are various ways to delete a component in the designer. The user should not misunderstand the concept of delete and cancel in the designer. If the user's intention is to eliminate one component of the design, the user will erase unitarily the component selected. If the user's intention is to dismiss the design of the main component, the user will use the option **Cancel** of the top menu of the designer to delete all the design with all the components inside.

The first way to delete a component is by using the button 🥙 present at the end of the top of the attributes menu:

Hendett Rackard NFV Director						Workspaces + 📥 UserGuide_1@Org_UserGuide2 + 🌲 +	
# Home	Litit Resource Inventory	😂 Management +	O ^o VDC Manager	C Designer +	🔅 Jobs	C ^a Unilines -	Jobs Monitor - 🖉 Refresh 👘 -
VNP Compo	nent Designer / VNF_Compo	nent					Save Save As Publish Cancel Import Export
COMPONENT		Evanue Evanue	ple_VM	Example_CO	i.		VYE Example_CG
++	standard	E BASKS R	M _	VM			VH:Example_CG Type

Figure 345: One way to delete a component in the VNF Designer.

This icon is only available if the user has selected a component in the workspace. It would be highly unproductive if the users were able to erase the component they are working on before it has been created.

To finally perform the deletion, click 🥙 The following window will be displayed:

Are you sure?	
You will delete this item. Are you sure?	
	Yes Cancel

Figure 346: Confirmation window for the deletion of an element in the designer.

To delete the component, click **Yes**. The component element selected will be deleted, and no message or jobs are generated by this action.

3.2.8 The list of the component's elements

As we said before, the list of elements of the component permits the user to change the attributes of the element selected. In the images below, the user has selected different elements/artifacts. These artifacts have their own attributes, but they have common categories. This implies that some elements need to be fulfilled or configured before saving the component.



Figure 347: Different elements that conform the VNF

When explaining how to create policies of various types, we discussed how to change the values of the attributes of these elements. Below these lines are the attributes that are shown suitable to be edited after selecting the artifact in the list.

_		
Ξ	VMI Example_VM	
	VM i Example_VM	
	Туре	
	VM	
	Name	
	Example_VM	
	Description	
		•
	GENERAL	^
	Image	
	cirros	✓
	Туре	
	KVM	•
		^
	AdminPassword	
		~
	AdminUser	
		~
	E KEYPAIR	•
	Pubkey_Data	
		~

	Virtual Core I VM Core	~
Amount		
1		\$
Core Architecto	ure	
shared		
Numa ID		
0		-
Name		
VM Core		✓

Virtual Port : ETH1	
INFO	^
	-
	~

Figure 348: Categories of some elements of the VNF

If you run into any problems filling some attributes during the creation of the component, or if the component is not accessible from this list, it is not necessary to edit the component.

3.2.9 Publishing your component

Once we have finished designing our new component, in order to make it usable, we must save it before we can include it in a VNF. First, we should properly fill the Name attribute of our future component. To do this we should select our work space that represents the VNF component that is being configured.

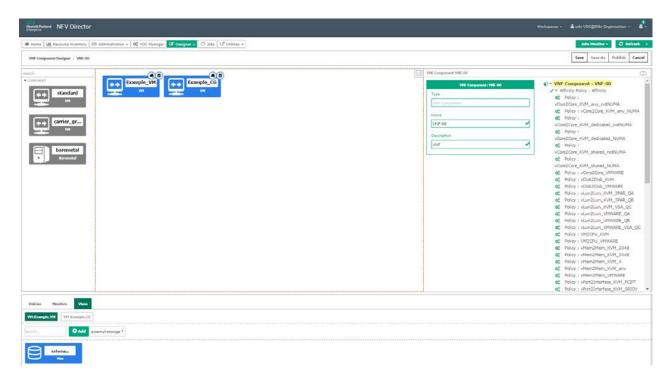


Figure 349: Save and Publish your VNFs

As we can see in the image above, the user gave as value for the attribute "Name", "VNF", this name is what will be shown in the "VDC Manager" when the user look for the component to be used, If we have completely finished fulfilling the different attributes for our specific purpose in each element, and we are pretty sure that we have all the elements needed correctly configured we will proceed to save the component.

To save the component, click **save** at the top-right side of the web UI. The application is going to create the user's component. After saving it, the component must be published to become available to be used in the "VDC Manager". The component is published by clicking **Publish** in the previously mentioned menu.

If the publishing was successful, when the user opens the "VDC Manager" and selects the **VNF** element, the component that has been published will be available as an element to be the target od operations that the "VDC Manager" can carry out.

3.2.10 Making the designed components visible

To make our VNF components visible for the VDC Manager, we should assign them to a VNF Group. Otherwise, it would be impossible for the VDC Manager to use these components.

To make these elements visible, the user must go to the **Management** section of the web platform's top menu, and select the section **WNF Registration & Management**. Once there, we need to select our group and click **Action**. Then the user will see a list like in the image below.

Hewlett Packa Enterprise	MFV Directo	r							Workspaces 🕶	🛓 UserGuide_1@Org_1	kserGuide2 • 🌲
Home	M Resource Invento	ry 🕑 Management +	08 VDC Manager	🕼 Designer 🔸	🗘 Jobs	🗗 Utilities 🕶			Jobs	Monitor -	3 Refresh
					VNF G	roup Registra	tion				
		Organization		-	VDC	forditure :	-		Actions		
		VNF Group Name	Description		VDC	42 (m) m(0-40	VDC Description	v	Create VNF Group Edit VNF Group	b	
		Oracleadmin	Oracle admin	VAPP group	Ten_userG	juide2	Wallmart VDC		Delete VNF Group VNF Group Templates Assignment		
									Activate VNF Group Manage VNF Group Quota		
										-	
		• 4 4 1 ≝ /1 ►	i i i i i i i i i i i i i i i i i i i	ems per page					1:10	r f 1 items	
		Templates Instances									

Figure 350: Adding our VNFs to the proper group to make them available to be used

In the list, the user must select **VNF Group Template Assignment** by clicking the element. Once selected, the user will see the following window:

Template Assignment VNF Group		
Organization Name		
Org_UserGuide2		1
VDC Name		
Ten_userGuide2		×
VNF Group Name		
Öracleadmin		1
Name	V Description	·
VNF_userGuide	VNF for the User Guide	
le e 1 👘 /1 ► ►I 10 💌 items per page		1 <u>-</u> 1 of 1 iten
Name	> Description	Reset Save Cance

Figure 351: Configuration window for the addition of the VNF designed.

In the lower half of this window, the user can see the name of the VNF components and VNFs designed with the "VNF Designer" or with the "VNF Component Designer". To make such elements usable by the VDC Manager, select the two of them. If the user has more elements of the two types in the list, tick or untick the box at the left of the name of the components to select or unselect them.

After selecting the items, to make the changes effective, the user should click **Save** at the right bottom corner.

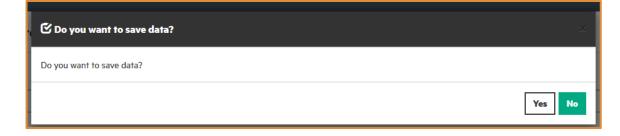


Figure 352: Confirmation window for the addition of the VNFs

If the assigningt is successful, the user will see a message as the one in the image below.

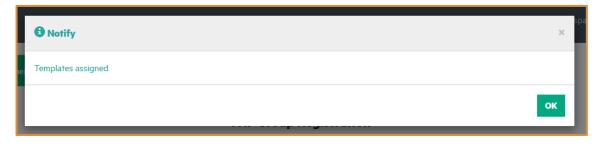


Figure 353: Notification of the addition of the VNFs

The VNFs should always be associated with at least one VNF Group. If the user is of VDC level, it is recommended to associate all the VNFs.

Chapter 4 NFV Director Users Management

4.1 My Account

My Account is a view accessible for all users by clicking **Users** in the **Management** menu in the top bar. It shows the logged user information, its role, assigned entity, profiles and operations.

In this view, the logged user can edit their own information and reset their password

4.1.1 User Data Update

To update the logged user data from My Account, follow these steps:

1) Click **Edit**, and update the user data:

User Management	My account						
							Actions -
	User Info					Edit	
	Username		Phone		Choose your language	Reset password	
	nfvd	✓	44234234	✓	English		•
	Username		Phone		Choose your language		
	Name		Email		Choose your theme		
	nfvd	×	new-emailo@hpe.com	✓	HP Enterprise Theme	(Light)	•
	Name		Email		Choose your theme		
	Surname						
	nfvd	✓					
	Surname						

Figure 354: My Account

Only the following fields can be changed (the rest of them, role, entity, profiles and operations are read-only):

- Phone
- Email
- Language
- Theme
- 2) Click Save.



Figure 355: My Account - Save/Cancel buttons

4.1.2 User Password Reset

To reset the logged user password from My Account, follow these steps:

1) Click **Reset password**, and update the user data.

	Actions	•
Edit		
Reset password		

Figure 356: Resetting password

A modal window to change the password is shown.

2) Change the password.

Currently, you have two possibilities:

a) Auto-generate a new password.

Change User Password	
 Auto generate new password (will be sent by email) 	
	OK Cancel

Figure 357: Changing User Password – Auto generate new password

Then a new password and SSH key pair are generated and sent to you automatically.

b) Insert your own password and public SSH key.

Change User Password	
Auto generate new password	
(will be sent by email)	
Old password	
Old password	
Password	Retype password
Password	Password validation
Public Key	
Public SSH Key	
	OK Cancel

Figure 358: Changing User Password

4.2 User Registration

To create a new user, follow these steps:

- Click User Management in the Management menu In the appearing screen, there are two tabs, User Management and My account. In User Management, the users table is displayed.
- 2) Click the User Management tab, and in Actions, click Create User.

DC_TEST DC_TEST	DC_TEST	
DC_TEST DC_TEST	DC TEST	
	DC_TEST	datacenter
nfvd nfvd	nfvd	domain
TEST_ORG TEST_ORG	TEST_ORG	Tenant
TEST_ORG_2 TEST_ORG_2	TEST_ORG_2	Tenant

Figure 359: User Management screen

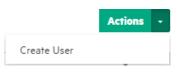


Figure 360: "Create User" action

Then a modal window will be displayed, requiring the new user data:

Jser Info			
Username	Phone	Choo	ose your language
Username	Phone	Choo	▼ ose your language
Name	Email	Choo	ose your theme
Name Surname Surname	Email	Choo	ose your theme
Resources		Profiles	Operations
		 Administrator Provisioning 	 Manage Domain Users Manage Tenant Users

Figure 361: User Creation form

- 3) Insert the personal user data in the "New User" window:
 - Username: the string that identifies the user in the system
 - Name: the name of the user
 - Surname: the surname of the user
 - Phone: the phone of the user
 - Email: the email address where the user will receive a mail with their password
 - Language: default Portal language
 - Theme: default Portal theme
- 4) Select the role and entity of the user
 - a) Creating a Domain Manager User

This type of user can be created by another Domain User. You must select **Domain Manager** as "Assigned role".

Assigned role	
Domain Manager	
Organization Manager	
VDC Manager	
VNF Group Manager	
DC Manager	

Figure 362: Possible user roles

b) Creating a Datacenter User

This type of user can be created by a Domain User or another Datacenter User. Currently, it can only manage a datacenter, so once the role is selected, the datacenter to be managed by the new user is required and mandatory.

•
•

Figure 363: Assigning DC to DC manager user

If the logged user is a Datacenter User, only its own datacenter can be assigned to the new user. Otherwise, if the user is being created by a Domain User, any Domain Datacenter can be assigned to it.

c) Creating an Organization Manager User

This type of user can be created by a Domain User or another Organization User. Currently, it can only manage an organization, so once the role is selected the organization to be managed by the new user is required and mandatory.

•
•

Figure 364: Assigning Organization to Organization manager user

If the logged user is an Organization User, only its own organization can be assigned to the new user. Otherwise, if the user is being created by a Domain User, any Domain Organization can be assigned to it.

d) Creating a VDC Manager User

This type of user can be created by a Domain User, an Organization User or another VDC User. Currently, it can only manage a VDC, so once the role is selected, the VDC to be managed by the new user is required and mandatory.

Assigned role	
VDC Manager	•
Assigned Organization	
TEST_ORG (Organization for testing)	•
Assigned VDC	
TEST_VDC (TEST_VDC)	•

Figure 365: Assigning VDC to VDC manager user

If the logged user is a VDC User, only its own VDC can be assigned to the new user. Otherwise, if the user is being created by an Organization User, any Organization VDC can be assigned to it.

e) Creating a VNF Group user

This type of user can be created by a Domain User, an Organization User, a VDC user or another Group User. Currently, it can only manage a Group, so once the role is selected the Group to be managed by the new user is required and mandatory.

Assigned role	
VNF Group Manager	•
Assigned Organization	
TEST_ORG (Organization for testing)	•
Assigned VDC	
TEST_VDC (TEST_VDC)	•
Assigned VNF Group	
TEST_VNFG (VNF Group)	-

Figure 366: Assigning VNF Group to VNF Group manager user

If the logged user is a Group User, only its own Group can be assigned to the new user. Otherwise, if the user is being created by a VDC User, any VDC VNF Group can be assigned to it.

5) Select the profiles and operations of the user

When the organization role has been selected, the profiles and operations that are specific to the user role are shown.

You can select or unselect a complete profile, or several operations within a profile.

Profiles

Operations

- Administrator
 Manage Domain Users
- Provisioning
- Template Designer
- Monitoring

Manage Organization Users
 Manage VDC Users
 Manage VNF Users
 Manage DataCenter Users

Figure 367: Selecting Profiles & Operations when creating a user

6) Click Create.

Once the user is created ,an email is sent to its email address indicating the user password (automatically generated).

4.3 User Edition

To update a user's data, follow these steps:

1) Select the user to update in the users table (User Management)

Username 🔺	✓ Name	~	Surname	~	Role	~
DC_TEST	DC_TEST		DC_TEST		datacenter	
nfvd	nfvd		nfvd		domain	
TEST_ORG	TEST_ORG		TEST_ORG		Tenant	
TEST_VDC	TEST_VDC		TEST_VDC		VDC	
TEST_VNF_GROUP	TEST_VNF_GROUP		TEST_VNF_GROUP		vApp Group	

Figure 368: Users table

2) At the screen below, at the selected user info, click Edit.

Jsername	Phone		Choose your lai	Reset password	
TEST_ORG	✓ 612123123		English	Delete	
sername	Phone		Choose your lang	juage	_
ame	Email		Choose your the	eme	
TEST_ORG	✓ antonio.navarro@	hpe.com 🗸	HP Enterprise	Theme (Light)	
ame	Email		Choose your the	me	
urname TEST_ORG	✓				
	✓	Profiles	Oj	perations	
TEST_ORG urname Resources Assigned role		 Administrator 	×	Manage Organization	
TEST_ORG urname Resources	✓ 	✓ Administrator✓ Provisioning	×		
TEST_ORG urname Resources Assigned role		 Administrator 	8	Manage Organization Users	

Figure 369: "Edit User" Action

The updatable fields will be enabled, so you can update them. The user updatable fields are the following:

- Phone
- Email
- Language
- Theme

The user role can be updated, but if the user has an Organization, VDC or VNF Group role, the Assigned Organization cannot be updated.



Figure 370: Fixed Organization when updating user role

The user roles and profiles can be updated, too.

4.4 Resetting Password

To reset a user's password, follow these steps:

- 1) Select the user to update in the users table (User Management).
- 2) At the screen below with the selected user info, click Reset password.

					A	Actions -
ser Info					Edit	
Username		Phone		Choose your language	Reset password	
osername		Phone		Choose your language	Delete	
TEST_ORG_2	-	612123123	~	English	The state and the second	•
Username		Phone		Choose your language		
Name		Email		Choose your theme		
TEST_ORG_2	1	antonio.navarro@hpe.com	-	HP Enterprise Theme (I	Light)	•
Name		Email		Choose your theme		
Surname						
TEST_ORG_2	1					
Summer -						

Figure 371: "Reset password" action

3) Click **OK** in the displayed window.

Change User Password	
 Auto generate new password (will be sent by email) 	
	OK Cancel

Figure 372: Change User Password - Confirmation Window

The new password will be auto-generated and sent to the user by email.

4.5 Deleting a user

For delete an existing user follow these steps:

- 1) Select the user to delete in the users table (User Management)
- 2) At the screen below, at the selected user info, click Delete.

ser Info					Edit
Jsername		Phone		Choose your language	Reset password
TEST_ORG_2	1	612123123	1	English	Delete
Jsername		Phone		Choose your language	
lame		Email		Choose your theme	
TEST_ORG_2	1	antonio.navarro@hpe.com	~	HP Enterprise Theme (Light)
Vame		Email		Choose your theme	
Surname					
TEST_ORG_2	1				
Surname					

Figure 373: "Delete User" Action

3) Click **Yes** in the confirmation window.



Figure 374: User Deletion - Confirmation Window

The selected user will be deleted.

Chapter 5 NFV Director Job tracking

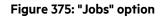
Some actions requested from the Portal launch a process that is executed in background. That process is responsible for performing the action you requested, and is called a job.

You can see the list of jobs that have been executed by you, or by a user of a lower level.

There are two ways to access Job tracking.

1) Click **Job** in the top bar.

🔟 Summary 🗁 Management 🗸 🗷 Designer 🗸 🔅 Jobs 🌐 Instances 🕇	- C Utilities -
--	-----------------



Then you access the Job tracking screen:

					Job	s Managem	ent							
Sea	rch Job Id	×	Q										C	Actions
unni	ing Jobs Historic	Jobs												
	Operation	✓ User Name	~	Entity	~	Status	Start Date 💌	~	End Date	~	Dđ:	Organization	~	Tenant
						•								
	< ◀ 1 /1 ►													

Figure 376: Jobs tracking screen

2) At Jobs Monitor, click the job operation link

	Operation	Name	Start time	End time	
0	deployTenant	Activating organization: TEST_ORG	2016-04-07 14:02:18		

Figure 377: Running Job link in Jobs Monitor

Then you will access the Job tracking screen with the selected job filtered:

Operation ~	User Name ~	Entity	Status ~	Start Date 🔹 1	End Date 🗸 🗸	Doma
deployTenant	nfvd	TEST_ORG	T IN_PROGRESS	07/04/2016 14:02:46	07/04/2016 14:02:46	local.

Jobs Management

Figure 378: Jobs Management - Running Jobs

You have two tabs in Job screen:

		Running Jobs: Historic Jobs:	jobs that cu jobs that ha	,	•				
			Jol	os Manageme	ent				
Sea	rch Job Id	×						S	Actions
nni	Operation	lobs Y User Name	- Entity - V	Status ~	Start Date 💌 1 🔍 👻	End Date V	Dở	Organization ~	Tenant
	deleteUsers	nfvd	TEST_ORG_2	ок	14/04/2016 16:42:37	14/04/2016 16:42:37	loc	TEST_ORG_2	
	createUsers	TEST_ORG@TEST_ORG	TEST_VNF_GROUP	ок	14/04/2016 15:42:01	14/04/2016 15:42:08	loc	TEST_ORG	TEST_TE
	undeployTenant	TEST_ORG@TEST_ORG	TEST_TENANT_2	ок	14/04/2016 14:44:07	14/04/2016 14:48:12	loc	TEST_ORG	
		TEST_OKG@TEST_OKG							
	undeployTenant	TEST_ORG@TEST_ORG	TEST_TENANT_2	ок	14/04/2016 14:04:46	14/04/2016 14:10:56		TEST_ORG	
	undeployTenant updateTenant		TEST_TENANT_2 TEST_TENANT_2	ок ок	14/04/2016 14:04:46 14/04/2016 14:01:50		loc	TEST_ORG TEST_ORG	TEST_TE
		TEST_ORG@TEST_ORG				14/04/2016 14:10:56	loc loc	-	TEST_TE
	updateTenant	TEST_ORG@TEST_ORG TEST_ORG@TEST_ORG	TEST_TENANT_2	ок	14/04/2016 14:01:50	14/04/2016 14:10:56 14/04/2016 14:01:54	loc loc	TEST_ORG	TEST_TE
	updateTenant deployTenant	TEST_ORG@TEST_ORG TEST_ORG@TEST_ORG TEST_ORG@TEST_ORG	TEST_TENANT_2 TEST_TENANT_2	ок	14/04/2016 14:01:50 14/04/2016 13:43:59	14/04/2016 14:10:56 14/04/2016 14:01:54 14/04/2016 13:50:31	loc loc loc	TEST_ORG TEST_ORG	TEST_TEN
	updateTenant deployTenant createTenant	TEST_ORG@TEST_ORG TEST_ORG@TEST_ORG TEST_ORG@TEST_ORG TEST_ORG@TEST_ORG	TEST_TENANT_2 TEST_TENANT_2 TEST_TENANT_2	ок ок ок	14/04/2016 14:01:50 14/04/2016 13:43:59 14/04/2016 13:42:50	14/04/2016 14:10:56 14/04/2016 14:01:54 14/04/2016 13:50:31 14/04/2016 13:42:57	loc loc loc loc	TEST_ORG TEST_ORG TEST_ORG	_

Figure 379: Jobs Management - Historic Jobs

5.1 Filtering jobs

You can look for a specific job if you know its ID (it can be recovered from the notifier once the job has been launched).



Figure 380: Filtering Job by ID



Figure 381: Filtering Jobs by entity

- Show all jobs of my entity:
- Show all jobs:

jobs related to your associated entity jobs related to your associated entity and to its lower entities

• Show all my jobs:

jobs related to your associated entity and to its lower entitie jobs launched by you

The jobs showed in the table can be sorted and filtered using the text box in the headers:

0	Operation ~	User Name \vee	Entity ~	Status ~	Start Date 💌	,
				•		

Figure 382: Filtering and Ordering Jobs table

5.2 Show a job details

To view the details of a job, select the job and all its information will be shown in a form below the jobs table.

A job can have several associated tasks related between them. If so, such tasks are shown in a GANTT diagram once the job has been selected. You can see the status of every job task, and also the time it was executed.

If the selected job is still running, you can refresh its diagram by clicking Refresh Data.

	Job Details	
Jobld: 6db0e71d-4dc7-43ff- Status: IN_PROGRESS Domain: local.unica Tenant: Start Date: 07/04/2016 14:0 User Name: nfvd	Entity: TEST_ORG Organization: VNF Group: 2:46 End Date: 07/04/2	
	April	2016
	Thurs	iday, 7
Name	14:02	14:03
✓ TLD INVENTORY ORGANIZATION		
✓ Provision Enterprise	Provision Ent	
✓ Provision Macronet	P	
✓ TLD ACTIVE OO		
✓ Activate OO	A	
✓ TLD ACTIVATE ENTERPRISE PROFILE		
✓ TLD ACTIVATE ENTERPRISE		
✓ TLD ACTIVATE MACRONET		
✓ TLD ORGANIZATION STATUS CHANGE		
✓ Organization Status Change		Orga

Figure 383: Job GANTT Diagram

5.3 Performing Retry/Rollback on a failed job

Failed jobs can be retried. To retry a failed job, select the failed job and click **Retry**. Then the failed job will be launched again.

Once a job has failed, the tasks that have been executed can be rolled back if the user does not want to retry it. To roll back a failed job, select the failed job and click on **Rollback** action. The all job task will be rolled back.

5.4 Aborting a running job

The execution of a running job can be aborted on the "Running Jobs" screen.

Select the job to abort and click Abort Job.

		ch Job Id X				Show all jobs of my entity Show all jobs Show all my jobs
0		Operation ~	User Name 🗸 🗸	Entity ~	Status	Abort Job
✓ undeployVdc		undeployVdc	TEST_ORG@TEST_ORG	TEST_VDC	IN_PROGRESS	19/04/2016 00:59:08 19/0

Jobs Management

Figure 384: Aborting a running job

Chapter 6 NFV Director Images management

This chapter shows the user how to register and upload new OS images into the Images Repository. Those images will be used to deploy virtual machines.

Users with any role can manage images if their own users have the corresponding operation assigned (Manage Images).

To access Image Management, click Images Management in the Management menu:

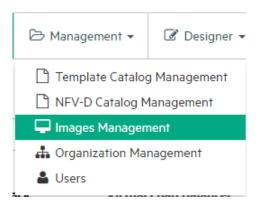


Figure 385: Image Management

The "Images Management" screen is displayed, where all the images are listed.

Images Management

Name	✓ Description	✓ Is Public	~	Status	~
Redhat 7.1 x64	Redhat 7.1 x64 Image	true		Continue Upload 🛛 🙃	
Red	Redhat 6.4 x64 Image	true		Active	
Windows 2003 x64	Windows 2003 x64 Image	false		Active	
					*

Figure 386: Images table

When the user selects an image, all its information will be shown in a new form below the images table:

Name			Description			
Red			Redhat 6.4 x64 Image			
Minimum Disk			Minimum RAM			
4		GB	4096	MB		
Container Format	Disk Format		Is Public			
bare 🔻	iso	Ŧ	Public	v		

Figure 387: Images data

6.1 Registering an image

To register a new image, follow the below steps:

1) Click Create Image.

	Actions	•
Create Image		

Figure 388: "Create Image" action

The registration window is displayed.

lame		Description		Metadata	
Redhat 6.4 x64	• 🗸	Redhat 6.4 x64 l	mage 🗸		
Container	Disk Format	Minimum Disk	Minimum RAM		
format bare	iso 🔻	5 GB	409 MB		
Browse	edhat-6.4x64.iso				
Is Public					

Figure 389: Create Image form

2) Insert the image data:

- Name: unique name for the image in the system
- Description: a string describing the image
- Container Format
- Disk Format
- Minimum Disk: minimum needed available disk for deploying the image
- Minimum RAM: minimum needed available memory RAM for deploying the image
- Is Public: indicates the visibility of the image
- Image File: when creating an image, you must indicate the local file that contains it, so it can be uploaded to the Images Repository from your machine
- 3) Click Save.

The image is registered and the uploading begins. The image will be unavailable for deployment until it will be completely uploaded on the Images Repository.

When the uploading starts, a progress bar is shown in the status column for that image.

The upload can be paused using the icon in image status field:

The upload can be resumed, too, after the upload is paused. In this case, the user will select the image file again. If a different file is selected, an error message is displayed.



Figure 390: "Continue Upload" option

Once the image is uploaded, a process is launched in the Repository to check if the uploading was correctly executed. This way, any error can be detected.

Upload finished	~

Figure 391: Uploaded Image status

When the process has checked that the uploading has been uploaded correctly the image status change to "Active".



6.2 Editing an image

To upload an existing image, follow the steps below:

- 1) Select the image you need to change.
- 2) Click Edit Image.

The Edit Image windows in displayed.

Edit Image					
Name		Description		Metadata	
Red	✓	Redhat 6.4 x64 Image	×		+
Minimum Disk		Minimum RAM			
4	GB	4096	МВ		
Container Format bare v	Disk Format iso •				
				Save Reset	Cancel

Figure 393: Image Edition form

- 3) Click + to add new row.
- 4) Perform the needed changes and click Save.All the image fields can be changed, including metadata. However, the image file cannot be uploaded again.

6.3 Deleting an image

To delete an existing image, follow the steps below:

- 1) Select the image you need to delete.
- 2) Click Delete Image. A confirmation window is displayed.



Figure 394: Deleting an image - Confirmation window

3) Click Yes, and the image will be deleted.

6.4 Image visibility

Image visibility determines which users can use the image. There are two types of visibility:

- Private: the image is only available for its user.
 - Public: depending on the image owner:
 - If the image belongs to a Domain, it can be used by every entity.
 - If the image belongs to a different entity (Organization, VDC or Group), it can be used by the Domain, and every entity in the owner Organization.

The image visibility is established by the owner at registration.

Once the image has been created, its visibility can be changed following the steps below:

1) Select the image in the images table and click Change Visibility.

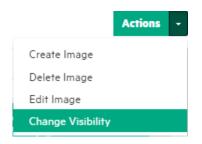


Figure 395: Change visibility action

A confirmation window is shown.

Change Image's visibility							
Do you want to change the visibilty of the image from public to private?							
Yes	No						

Figure 396: Changing Image from public to private - Confirmation Window

Change Image's visibility				
Do you want to change the visibility of the image from private to public?				
Yes	No			

Figure 397: Changing Image from private to public - Confirmation Window

2) Click Yes. The visibility will be changed and the images table is refreshed.

6.5 Image ownership

First, an image belongs to the entity of the user that registered it. However, its ownership can be changed:

- If your entity is the image owner
- If the image belongs to an entity that depends on your entity (all entities of a domain, Groups of a VDC, Groups and VDCs of an Organization)

Image ownership can be changed by the owner.

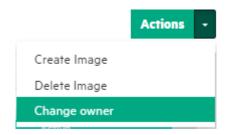


Figure 398: Change owner action

A user can get the ownership of an image if it belongs to an entity of lower level.

Name	Description ~	
TEST_ORG_2	Organization for testing	
TEST_ORG	Organization for testing	
4		

Figure 399: Assigning Image

Chapter 7 NFV Director Browser

7.1.1 Introduction

The NFVD Browser is the tool that allows the user to browse and edit all templates, instances and resources. It also provides a graph view to show the hierarchy of the components.

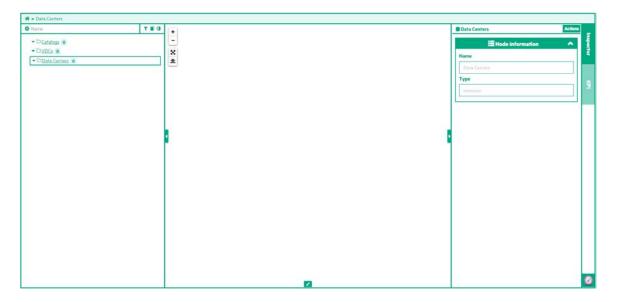
For each user, the browser will only present the template/instance/resource assigned to the user.

To access the NFVD Browser, log in the NVFD Director portal and enter the NFVDv4 workspace. For all types of users, there is a menu item, **Browser**, to access the NFVD Browser view.

7.1.2 Screens of the NFVD Browser

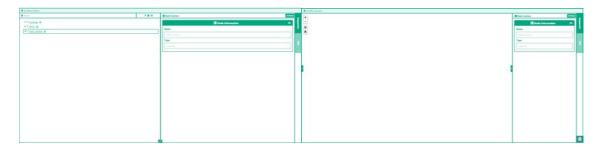
7.1.2.1 First Screen of the Browser

Once the user has entered the Browser view, you are going to see a screen like the below one:



In this window, we can differentiate three main parts. Besides the menu of the platform, on the left of the window, we can see a tree view with all visual able elements. In this tree, the user will find components/artifacts such as VNF template/instance, VDC instances, Data Centers and so on. In the middle, there is a graph area that will used to present the hierarchy of components. On the right, there are the inspector and KPI frames. This area is used to present the attributes of a component/artifact and the KPI values fed by the assurance module.

The areas can be hidden by clicking the hide/show buttons.



7.1.2.2 Navigate Tree

The Navigate Tree is the place where the user will find all elements. The full area is composed of:

- Breadcrumb
- Search input area
- Toolbar
- Tree Nodes

* » Catalogs Breadcrumb	
Search input	T 🗐 🛈
	Tool Bar
▼ □ <u>Catalogs</u> 0	
▼ □ <u>VDCs</u> 0 Tree Node	
▼ □ Data Centers	
I	

7.1.2.2.1 Tree Nodes

The user can access all components from the Navigator tree (all artifacts of catalog/template, instance/VDC can be accessed from the graph view; few types of artifacts of resource/Data center can be accessed from the tree, such as Server).

There are two types of nodes:

- Element Node the nodes are linked to the components and artifacts. Each node has an icon on the left, which stands for different type and a label to show the name of the element. For the artifacts, the label is in *Italic*.
- Group Node in the sub-tree, the element nodes are grouped by their types, the group nodes show the type name in the label and the number of element nodes on the right. It has a dedicated icon on the left.

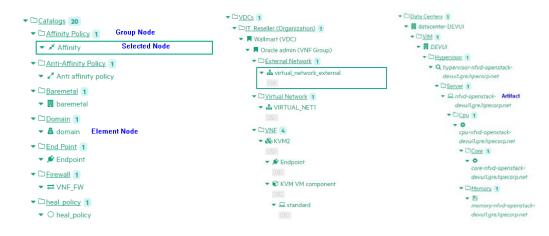
Selected Node

If a node is selected, it will be highlighted by a rectangle border. The content of the inspector is always synchronized with selected node. In browse mode, the selected node will change as your mouse pointer moves in the tree, and in the edit mode the selected node only changes by clicking in the tree. (Refer to tool bar of Navigate tree).



Data Loading

In the beginning, there are only three root group nodes in the tree: Catalogs (templates), VDCs (instance) and Data centers (resource). There is no sub element in the tree. All data are loaded at the first time the user clicks the parent node or double-clicks the node for refresh.



After loading, sub-nodes will be added into the tree.

To load data, it will take time to query data and build the tree. During loading, the Navigate tree frame will be blocked by a spinner frame.

0000
▼ 🖵 standard
MA
▼ 28 VM_v
- IIIA
👻 🖉 Endpoint
1072
💌 🗞 Monitors ORG
(A/G)
👻 🗯 Endpoint
(CV/A)
▼ ♥ Monitor
★ 🗖 Vanī
Diffe Loading
✓ ∰ cpu N/A
 A Monitors VDC
11/4
👻 🖉 Endpoint
004
 Monitor
10/2
▼ □ Vm1
1072

Due to the amount of data, not all data (attributes) are loaded. When you click the element node, it may launch a second query to fetch the full object.

Refresh Data

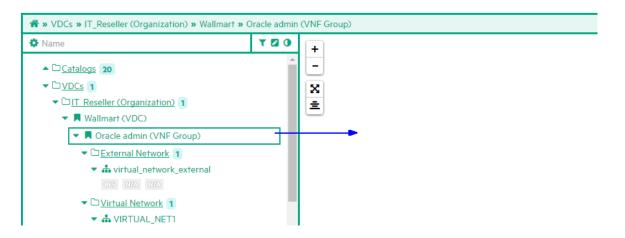
There is no **Refresh All** function in this view. You can refresh data by double-clicking the nodes. The 'refresh' action will clear and reload the data of the node. The sub-nodes are rebuilt as well.

Status of instances

For all instance components, there are 0 to 3 labels to show their status. Status informatuion is collected from the Fullfill module and the Assurance module. The status will be loaded with the node or from the toolbar. (Refer to the toolbar of the Navigate tree).

✓ Status ♀
 ✓ Status ♀
 ✓ Operational Status
 R/A
 R/A
 N/A
 N/A
 M/A
 M/A
 M/A

Launch VDC Manger



If you drag and drop the VNF group instance into the graph area, it will jump to the VDC manager with the dropped group.

7.1.2.2.2 Breadcrumb

🕷 » VDCs » IT_Reseller (Organization) » Wallmart » Oracle admin (VNF Group) » External Network » virtual_network_external

The breadcrumb is used to show the full hierarchy path of the selected node. You may click the path to change the selected node.

7.1.2.2.3 Toolbar

There are tree buttons in the toolbar: $extsf{T}$ 🖉 🛈

- Enable/Disable filter if the filter is active, and the search context is not empty, the tree will filter the nodes. (Refer to Tree Filter)
- Switch Tree working mode there are two modes of the tree: Browse mode and Edit mode. In Browse mode, the selected node will change to the node where the mouse is, and all attributes are read only. In Edit mode, the selected node can only be changed by clicking the tree node, and the attributes will become editable in the inspector. Note that not all attributes are editable, it depends on the status of the instance, user permissions, restrictions, and so on.

-	Status	0
1	Operational	Status

• Status setting – Set it to show the status of instances. Admin Status . If you want show the status, select the check box. The refresh button on the top right will launch queries to update all status information of the instance nodes in the current tree.

7.1.2.2.4 Search Input Area

The search input panel is the place to input the conditions for the filter function.

	O KV	✿ KVM2	× 20
	KVM VNF Type St KVM VM component III And	CVDCs 1 CDIT Reselver (Organization) 1 Wallmart (VDC)	
Image: Status T Image: Status	KVM2 KVM VM component KVM1 KVM VM component zation) 1	Cracle admin (VNF Group) C <u>VNF (1) & CVNF (1) & & KVM2 COL (COL) COL COL COL COL </u>	

By default, it only shows the input for Name filter. To show the advanced panel, click the icon on the left.

Input the Name, ID, Type or Status you want to search against (case sensitive), and click the filter button. The results will be displayed in a new tree.

To update the criteria or switch back to the full tree, click the remove filter button in the toolbar.

The criteria are combined by an OR logic by default. Select the AND check box in the advance panel to change it to AND.

7.1.2.3 Graph Area

This area is used to show the hierarchy of components. It shows all sub-components and artifacts, and also their relationships.

Catalogs = VM = star	andard
1	
standa	
standa	ano
	1085- UNES UNES UNES UNES UNES UNES UNES UNES
	any any
ſ	C Stale Cone. C Solar Trans.

Select the artifact in the graph. All of its attributes will be shown in the inspector.

	VM small 1	Action	
	Artifact Definition	^	Inspector
	ID		4
	36fb4aab-629c-4436-bf52-24b1610d59cd		
	Status		Ð
	INSTANTIATED		
	Url		
ES USES USES USES USES USES USES	/nfvd-ext/domains/302d6c43-50f3-4f39- 89ce-	*	
	Category		
₩ ETH2 ₩ ETH3 SVM Disk ₩ ETH4 ₩ MANAC	GENERIC		
	Family		
	VIRTUAL_MACHINE		
	Group		

Double-click the node to collapse/expand the node.

UM small 1	 	
	모 VM sma +	all 1

In the graph view, user can do the following:

- Move the node's position with the mouse
- Zoom in/out the view using the tool button or scrolling with the mouse
- Auto layout or center the view using the tool button

7.1.2.4 Inspector and KPI Area

This area is composed by two tab frames, inspector and KPI.

You can double-click the tab header to switch the layout of the frames between cascade and vertical view.

standard	Actions		standard	Actio	
Component Information	•	Inspector	Component Information	•	Inspector
Url		ĝ	Url		٩ ٩
/nfvd-ext/domains/302d6c43-50f3-4f39- 89ce-	* •		/nfvd-ext/domains/302d6c43-50f3-4f39- 89ce-	* *	Г
		F	Description		
Description		Ĕ,	vm basic for palette	✓	
vm basic for palette	 Image: A start of the start of		ld		
ld			00c14bc1-e82c-41ad-b349-cef1ee5f0a49		
00c14bc1-e82c-41ad-b349-cef1ee5f0a49				4	
	1		Name		
Name			standard	✓	-
standard	~		KPIs - standard		<u>0</u>
Root artifact id			VM Name Value Severity -	Time	9
36fb4aab-629c-4436-bf52-24b1610d59cd					
Туре					
vm					

The inspector always shows the attributes of the selected node (in tree or graph). In the edit mode, the user can edit the value of the attributes in the inspector. After modification, use the **Actions** button to commit the changes.

standard	Actions
	Actions (standard)
Component Info	Update

There is a context menu in the tree to commit data as well.

🔻 🖵 stand				
🔻 🖵 carrie	Actions (standard)	_		
	Update			

+)
_	J
X	1

Ξ

If the user switches to selecting another node without committing the modifications, the following dialog box will pop up:

Update Instance:					×
Warning: Unchecked	d modifications will b	e lost after update!			
Element	Attribute	Category	Old Value	New Value	
	Description	Component Information	vm basic for palette	vm basic for palette1	

Click **Update** to commit the updates and switch to the selected node.

Click Cancel to cancel the switch of selected node. (Updates not committed)

Click Cancel Anyway to switch the selected node without committing the updates. (Updates will be lost).

Note: If the update failed, user may refresh the data manually to re-synchronize the data.

KPls

The KPI panel shows the values of the selected node. The KPI values are collected from the Assurance module. If the values are not loaded by default, click the refresh button to get and refresh them.

EKPIs - Refresh

Abbreviations

Abbreviation	Definition
	Virtual Machine; virtualized computation environment that behaves very much like a
VM	physical computer/server
	Virtual Network Function; the "application" that provides the functionality currently provided
VNF	by devices
	Network Service; a composition of network functions (VNF or PNF) and defined by its
NS	functional and behavioral specification
	Network Function Virtualization; the approach to building telecom services using
NFV	virtualization approaches
	VNF Component; each VNF is composed of one or more components, often mapping to a
VNFC	VM
	Management and Orchestration; addressing the functionality required to deal with the new
MANO	abstractions; consists of NFVO, VNFM and VIM
	NFV Orchestrator; In charge of the orchestration and management of NFV Infrastructure
NFVO	and software resources, and realizing NS on NFVI.
	VNF Manager; responsible for VNF lifecycle management (such as Instantiation, update,
	query, scaling, termination). Can be implemented as part of the NFVO or supplied by the
VNFM	VNF provider.
VIM	Virtualized Infrastructure Manager; think OpenStack or Cloud OS
	NFV Infrastructure; the totality of all hardware and software components which build up the
NFVI	environment in which VNFs are deployed, managed and executed
	Element Management System; performs the typical management functionality for one or
EMS	several VNFs.
PNF	Physical Network Function; think today's devices.
CPU	Central Processing Unit; device in the compute node that provide the primary container interface
CFU	Network Function; functional block within a network infrastructure that has well-defined
NF	external interfaces and well defined functional behavior
	Network Interface Controller; device in a compute node that provides physical interface with
NIC	the infrastructure network
THE	Service Level Agreement; negotiated agreement between two or more parties, recording a
SLA	common understanding about the service and/or service behavior.
CPE	Customer Premises Equipment
ETSI	European Telecoms Standards Institute
HA	High Availability
SDN	Software Defined Network
HPSA	HPE Service Activator
UCA EBC	Unified Correlation Analyzer for Event Based Correlation
JSON	JavaScript Object Notation
XML	Extensible Markup Language
API	Application Programmatic Interface
DNS	Domain Name System
DHCP	Dynamic Host Configuration Protocol