Building Highly Efficient Red Hat Enterprise Virtualization 3.0 Cloud Infrastructure with Mellanox Interconnect

Reference Design

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1 Introduction

This reference design describes how to integrate and use Red Hat Enterprise Virtualization Manager (RHEV-M) to control a cloud based on:

- Servers with Red Hat OS and KVM
- Mellanox products for network connectivity and storage

Through significant customer engagements, building data centers, and working closely with IaaS architects and administrators, Mellanox in collaboration with Red Hat formed a new architecture which enables an integrated computing, network and storage technology cloud solution. Through intelligent discovery, awareness and automation, the new joint solution provides the highest levels of virtualization and application performance.

The new collaboration is designed to deliver a high-performance and efficient cloud infrastructure. Performance, application service levels, security, and usability no longer need to be compromised, and importantly, users will benefit from the most cost effective cloud infrastructure.

The purpose of this document is to describe virtualization networking management with RHEV-M as cloud orchestrator and Mellanox InfiniBand HCAs and switches as a fabric interconnect.

This reference architecture demonstrates how to build a fully integrated InfiniBand FDR interconnect cloud infrastructure with RHEV-M.

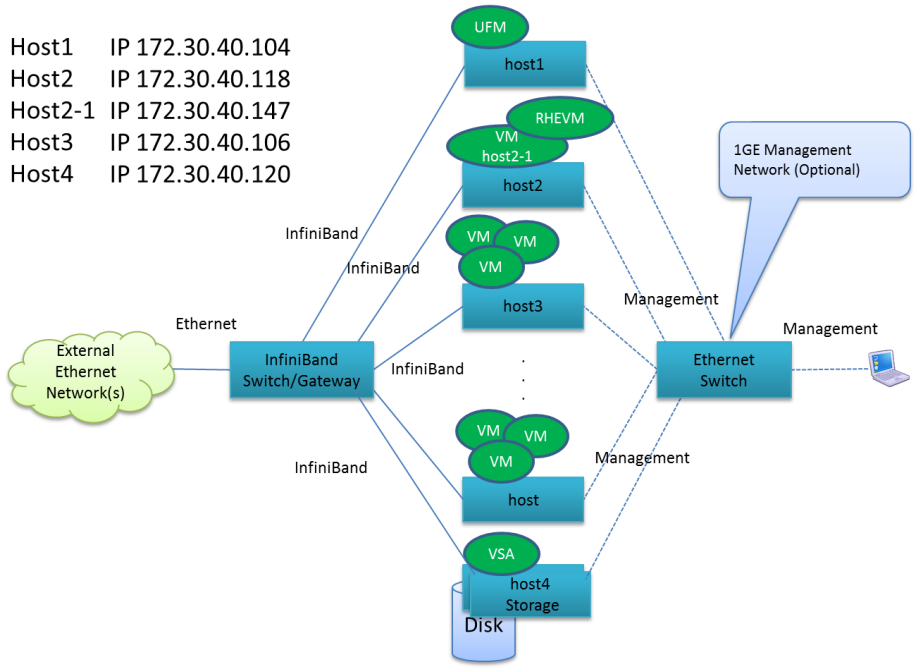
This reference architecture covers the installation and setup of the infrastructure, including:

- Installation and configuration of the RHEV and Mellanox components: Adapters, switches, storage accelerator and fabric manger
- Datacenter configuration - various configuration flows needed to operate the network
- Monitoring and troubleshooting

2 Getting Started

2.1 Basic Test Bed Configuration

Figure 1: Basic Test Bed Scenario - Example



2.2 Required Hardware

Table 1: Required Hardware

Equipment	Notes
Mellanox SX6036 InfiniBand/Gateway switch OR Grid Director 4036E InfiniBand/Gateway switch	Used for data/storage networks. The gateway functionality is used for connecting to external Ethernet networks.
Ethernet Switch (Optional)	1GE - Used for Management network. Management network can be done over a (separate) IB partition as well.
Server (refer to the UFM User Manual specific server information)	Used for UFM application
Server (refer to the VSA User Manual specific server information)	Used for VSA application
Server (refer to Red Hat Enterprise Virtualization 3.0 - Installation Guide)	Used for RHEV-M application
Server (refer to Red Hat Enterprise Linux 6.2 - Installation Guide)	Used as virtual machine (VM) hosts in the clusters

2.3 Required Software Packages

- [1]Mellanox OFED Driver
  Please contact cloudsupport@mellanox.com to obtain this package.
- [1]Unified Fabric Manager (UFM)
- [1]Mellanox Storage Accelerator (VSA) – version 2.1.1-1
- [1]Mellanox Network Manager (MNM) – version 1.0
  Please contact cloudsupport@mellanox.com to obtain this package.
- Red Hat Enterprise Linux (RHEL) 6.2 (or higher)
- Red Hat Enterprise Virtualization 3.0 (RHEV, RHEV-M) or higher

[1] Mellanox Technologies packages are supported by Mellanox and not included in the Red Hat distributions.

3 Software Installation and Basic Configuration

Integrated cloud solution contains several software applications and HW components. The following chapter supplies basic software installations procedures for the cloud.

3.1 RHEV-M Installation (Host2-1)

To perform initial installation and configuration of the Red Hat Enterprise Virtualization Manager (RHEV-M), follow the steps below on "host2-1":

Step 1: Install Red Hat Enterprise Linux (RHEL) 6.2. You may use the default installation of RHEL – "Basic Server".

Figure 2: Red Hat Enterprise Linux Installation

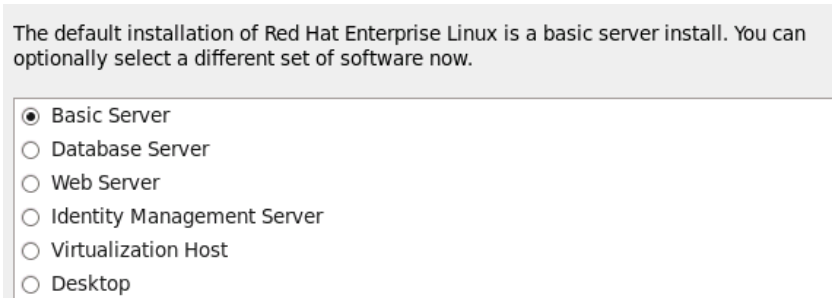


Figure 3: Red Hat Enterprise Linux Installation

Step 2: Make sure your VM has installed RHEL 6.2 successfully.

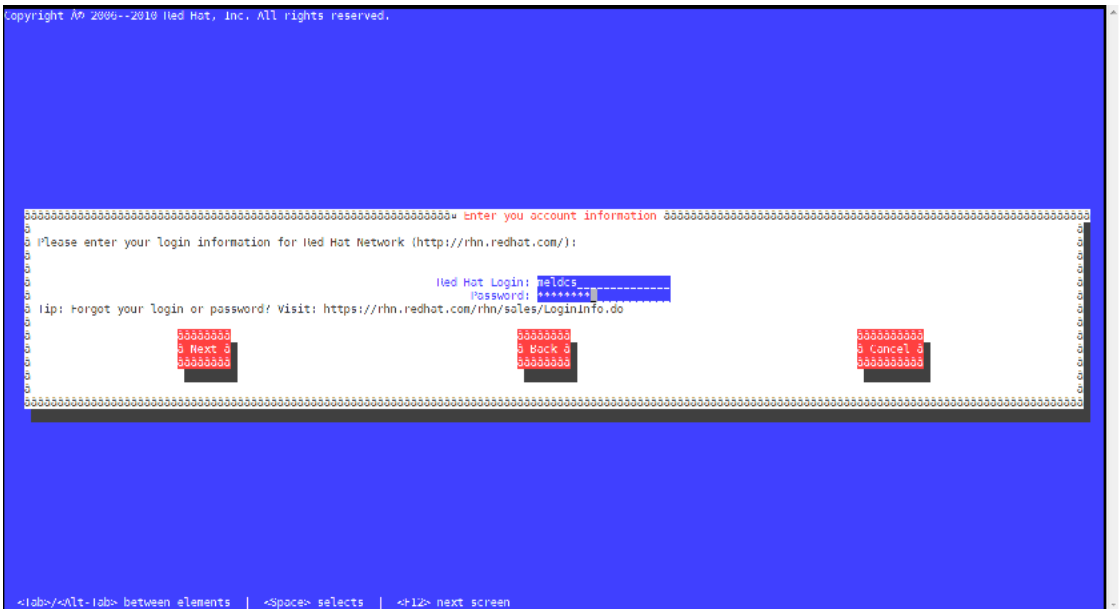
Step 3: Make sure that the NTP service is activated.

```
[root@host2-1]# /etc/init.d/ntpd status
ntpd is stopped
[root@host2-1]# /etc/init.d/ntpd start
Starting ntpd:                                             [  OK  ]
[root@host2-1]# /sbin/chkconfig ntpd on
[root@host2-1]# /etc/init.d/ntpd status
ntpd (pid  5197) is running...
[root@host2-1]#
```

Step 4: Register to Red Hat Network to be able to subscribe to the required channels.

```
[root@host2-1]#rhn_register
…
```

Figure 4: Red Hat Network – Register



Step 5: Subscribe to the required channels. Run:

```
[root@host2-1]#rhn-channel --add
--channel=rhel-x86_64-server-6-rhevm-3
Username: meldcs
Password:
[root@host2-1]#rhn-channel --add
-channel=jbappplatform-5-x86_64-server-6-rpm
Username: meldcs
Password:
[root@host2-1]#rhn-channel --add
--channel=rhel-x86_64-server-supplementary-6
Username: meldcs
Password:
[root@host2-1]#
```

Step 6: Confirm the list of channels to which the server is subscribed.

```
[root@host2-1]#rhn-channel -list
jbappplatform-5-x86_64-server-6-rpm
rhel-x86_64-server-6
rhel-x86_64-server-6-rhevm-3
[root@host2-1]#
```

Step 7: If installed, the classpathx-jaf package must be removed. It conflicts with some of the components installed to support JBoss.

```
[root@host2-1]# yum remove classpathx-jaf
Loaded plugins: product-id, rhnplugin, security, subscription-manager
Updating certificate-based repositories.
Unable to read consumer identity
Setting up Remove Process
No Match for argument: classpathx-jaf
jbappplatform-5-x86_64-server-6-rpm
| 1.3 kB     00:00
jbappplatform-5-x86_64-server-6-rpm/primary
|  94 kB     00:00
jbappplatform-5-x86_64-server-6-rpm
401/401
rhel-x86_64-server-6-rhevm-3
| 1.6 kB     00:00
```

```
rhel-x86_64-server-6-rhevm-3/primary
|  23 kB     00:00
rhel-x86_64-server-6-rhevm-3
121/121
rhel-x86_64-server-supplementary-6
| 1.8 kB     00:00


rhel-x86_64-server-supplementary-6/primary
|  91 kB     00:00
rhel-x86_64-server-supplementary-6
249/249
Package(s) classpathx-jaf available, but not installed.
No Packages marked for removal

[root@host2-1]#
```

Step 8: Use `yum` to ensure that the most up to date versions of all installed packages are in use.

```
[root@host2-1]#yum upgrade
…
```

Step 9: Use `yum` to initiate installation of the RHEV-M package and all dependencies.

```
[root@host2-1]#yum install rhevm
…
```

NOTE: You must run this command as the root user.

Step 10: Once package installation is complete the RHEV-MR must be configured. Use the rhevm-setup script command:

```
[root@host2-1]#rhevm-setup
Welcome to RHEV Manager setup utility
HTTP Port  [8080] :
HTTPS Port  [8443] :
Host fully qualified domain name, note that this name should be fully
resolvable  [host2-1.lab.mtl.com] :
Password for Administrator (admin@internal) :
Warning: Weak Password.
Confirm password :
Database password (required for secure authentication with the locally
created database) :
Warning: Weak Password.
Confirm password :
Organization Name for the Certificate: Mellanox
The default storage type you will be using  ['NFS'| 'FC'| 'ISCSI']
[NFS] : ISCSI
Should the installer configure NFS share on this server to be used as
an ISO Domain? ['yes'| 'no']  [yes] : no
Firewall ports need to be opened.
You can let the installer configure iptables automatically overriding
the current configuration. The old configuration will be backed up.
Alternately you can configure the firewall later using an example
iptables file found under /usr/share/rhevm/conf/iptables.example
Configure iptables ? ['yes'| 'no']: yes

RHEV Manager will be installed using the following configuration:
=================================================================
http-port:                    8080
https-port:                   8443
```

```
host-fqdn:                      host2-1.lab.mtl.com
auth-pass:                      ********
db-pass:                        ********
org-name:                       Mellanox
default-dc-type:                ISCSI
override-iptables:              yes
Proceed with the configuration listed above? (yes|no): yes

Installing:
Creating JBoss Profile...                                  [ DONE ]
Creating CA...                                             [ DONE ]
Setting Database Security...                               [ DONE ]
Creating Database...                                       [ DONE ]
Updating the Default Data Center Storage Type...           [ DONE ]
Editing JBoss Configuration...                             [ DONE ]
Editing RHEV Manager Configuration...                      [ DONE ]
Configuring Firewall (iptables)...                         [ DONE ]
Starting JBoss Service...                                  [ DONE ]

**** Installation completed successfully ******

     (Please allow RHEV Manager a few moments to start up.....)


Additional information:
* SSL Certificate fingerprint:
2E:EB:D8:9C:61:DD:99:0E:85:9C:76:02:26:B5:57:B5:3E:D6:1F:3A
* SSH Public key fingerprint:
ac:7e:ec:f2:47:91:c3:90:18:98:ae:5d:e0:88:b4:e2
* The firewall has been updated, the old iptables configuration file was
saved to /usr/share/rhevm/conf/iptables.backup.104857-07312012_5209
* The installation log file is available at:
/var/log/rhevm/rhevm-setup_2012_07_31_10_47_13.log
* Please use the user "admin" and password specified in order to login
into RHEV Manager
* To configure additional users, first configure authentication domains
using the 'rhevm-manage-domains' utility
* To access RHEV Manager please go to the following URL:
http://host2-1:8080
[root@host2-1]#
```

To ensure that the installation does not fail, make sure that the locale settings are as follows:

```
(host)#locale
LANG=en_US.UTF-8
LC_CTYPE="en_US.UTF-8"
LC_NUMERIC="en_US.UTF-8"
LC_TIME="en_US.UTF-8"
LC_COLLATE="en_US.UTF-8"
LC_MONETARY="en_US.UTF-8"
LC_MESSAGES="en_US.UTF-8"
LC_PAPER="en_US.UTF-8"
LC_NAME="en_US.UTF-8"
LC_ADDRESS="en_US.UTF-8"
LC_TELEPHONE="en_US.UTF-8"
LC_MEASUREMENT="en_US.UTF-8"
LC_IDENTIFICATION="en_US.UTF-8"
LC_ALL=
```

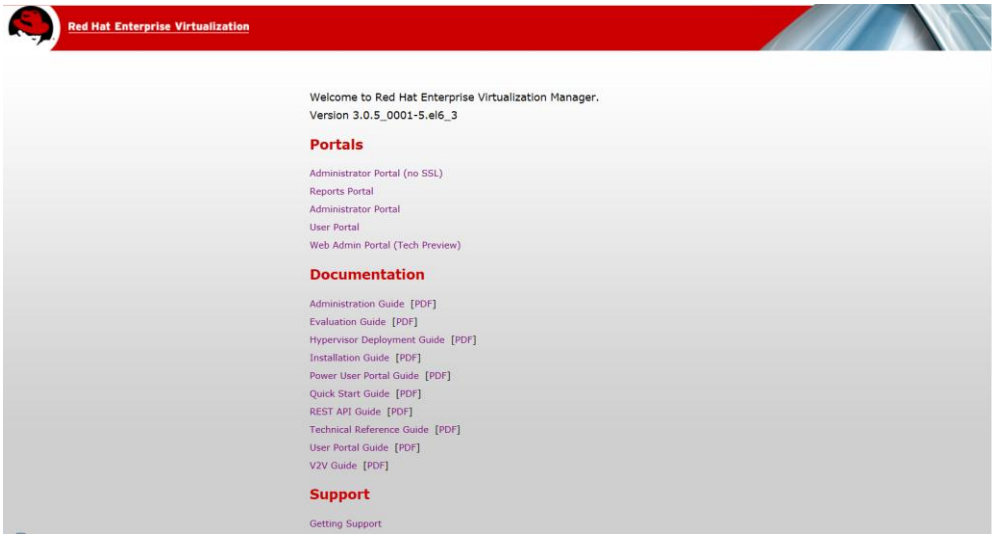
NOTE: You can access the administration portal by pointing your Internet Explorer to http://your_server:8080 (assuming you followed the defaults).

Use the administrator username and password you supplied in the configuration step. You

will be instructed to install .NET Framework.

Step 11: You can access the administration portal by pointing your internet browser to http://host2-1:8080 (assuming you followed the defaults).

Figure 5: RHEV-M Portal



For advance configuration of the RHEV-M refer to "Red Hat Enterprise Virtualization 3.0 - Installation Guide".

3.2 RHEV Host Installation (Host3)

Follow these steps for RHEV installation:

Step 1: Install RHEL 6.2. You may use the default installation of RHEL – "Basic Server".

Figure 6: Red Hat Enterprise Linux Installation

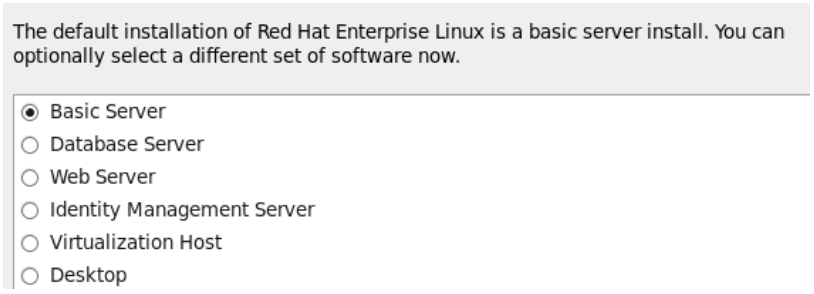


Figure 7: Red Hat Enterprise Linux Installation (4)

Step 2: Make sure your VM has installed RHEL 6.2 successfully.

Step 3: Make sure that the NTP service is activated.

```
[root@host3]# /etc/init.d/ntpd status
ntpd is stopped
[root@host3]# /etc/init.d/ntpd start
Starting ntpd:                                             [  OK  ]
[root@host3]# /sbin/chkconfig ntpd on
[root@host3]# /etc/init.d/ntpd status
ntpd (pid  5197) is running...
[root@host3]#
```

Step 4: Register to Red Hat Network to be able to subscribe to the required channels.

```
[root@host3]#rhn_register
…
```

Figure 8: Red Hat Network – Register

Step 5: Subscribe to the required channels. Run:

```
[root@host3]# rhn-channel --add --channel=rhel-x86_64-server
Username: meldcs
Password:
[root@host3]# rhn-channel --add
--channel=rhel-x86_64-rhev-mgmt-agent-6
```

```
Username: meldcs
Password:
[root@host3]#
```

Step 6: Confirm the list of channels to which the server is subscribed. Run:

```
[root@host3]#rhn-channel –list
rhel-x86_64-rhev-mgmt-agent-6
rhel-x86_64-server-6
[root@host3]#
```

Step 7: Add a manual host entry to the `/etc/hosts` file (on the Red Hat Enterprise Linux host) for the RHEV-M server to enable vdsm and other services to connect properly to the host.

```
10.0.0.1 server1.example.com rhev-manager.server1.example.com

For example:

172.30.40.147 host2-1.lab.mtl.com rhev-manager.host2-1.lab.mtl.com
```

Step 8: Open firewall ports.

The following commands will remove and existing firewall rules and add the ports required by RHEV-M to the iptables rules that open the required ports for the agent to function properly.

```
[root@host3]# iptables --flush
[root@host3]# iptables --append INPUT -m state --state
ESTABLISHED,RELATED -j ACCEPT
[root@host3]# iptables --append INPUT -p icmp -j ACCEPT
[root@host3]# iptables --append INPUT -i lo -j ACCEPT
[root@host3]# iptables --append INPUT -p tcp --dport 22 -j ACCEPT
[root@host3]# iptables --append INPUT -p tcp --dport 16514 -j ACCEPT
[root@host3]# iptables --append INPUT -p tcp --dport 54321 -j ACCEPT
[root@host3]# iptables --append INPUT -p tcp -m multiport --dports
5634:6166 -j ACCEPT
[root@host3]# iptables --append INPUT -p tcp -m multiport --dports
49152:49216 -j  ACCEPT
[root@host3]# iptables --append INPUT -j REJECT --reject-with
icmp-host-prohibited
[root@host3]# iptables --append FORWARD -m physdev !
--physdev-is-bridged -j REJECT    --reject-with icmp-host-prohibited
[root@host3]# /etc/init.d/iptables save
[root@host3]# chkconfig iptables on
[root@host3]# service iptables restart
```

Step 9: The RHEV-M makes use of `sudo` to perform operations as root on the host. The default configuration stored in `/etc/sudoers` contains values to allow this. To configure sudo access. Add `/etc/sudoers` the following entry

```
root ALL=(ALL) ALL
```

Step 10: Enable SSH access for root user. Add `/etc/ssh/sshd_config` file has the entry.

```
PermitRootLogin yes
```

Step 11: Restart the SSH server, in case of a change in the `/etc/ssh/sshd_config` file.

```
[root@host3]# service sshd restart
```

For advanced configuration of the RHEV-M refer to “Red Hat Enterprise Virtualization 3.0 - Installation Guide”.

3.3 Mellanox OFED Driver Installation (All Hosts)

Any host in the fabric shall have Mellanox OFED installed.

Follow those steps for basic Mellanox OFED installation on all hosts.

Step 1: Make sure you download Mellanox OFED from www.mellanox.com and locate it in your file system.

Step 2: [2]Install Mellanox OFED from the source.

```
# yum install libstdc++-devel flex bison gcc-c++ libstdc++-devel
zlib-devel libtool glibc-devel gcc kernel-devel rpm-build
iscsi-initiator-utils redhat-rpm-config tcl-devel
```

Step 3: Download the OFED iso. Run:

```
# mkdir /mnt/tmp
# mount –o loop MLNX_OFED_LINUX-1.5.3-3.0.0-rhel6.2-x86_64.iso
/mnt/tmp
# cd /mnt/tmp
# ./mlnxofedinstall
```

Step 4: Reboot the server (in case the firmware is updated).

Step 5: Verify Mellanox OFED installation. When running `ibv_devinfo` you should see an output similar to this:

```
(host)# ibv_devinfo

hca_id: mlx4_0
        transport:                      InfiniBand (0)
        fw_ver:                         2.9.1080
        node_guid:                      0002:c903:000d:1410
        sys_image_guid:                 0002:c903:000d:1413
        vendor_id:                      0x02c9
        vendor_part_id:                 26428
        hw_ver:                         0xB0
        board_id:                       MT_0DD0110009
        phys_port_cnt:                  2
                port:   1
                        state:                  PORT_ACTIVE (4)
                        max_mtu:                2048 (4)
                        active_mtu:             2048 (4)
                        sm_lid:                 24
                        port_lid:               22
                        port_lmc:               0x00
                        link_layer:             IB

                port:   2
                        state:                  PORT_ACTIVE (4)
                        max_mtu:                2048 (4)
                        active_mtu:             1024 (3)
                        sm_lid:                 0
                        port_lid:               0
                        port_lmc:               0x00
                        link_layer:             Ethernet
```

Step 6: Set up your IP address for your “ib0” interface by editing the `ifcfg-ib0` file and running `ifup` as follows:

[2] If your kernel version does not match with any of the offered pre-built RPMs, you can add your kernel version by using the “mlnx_add_kernel_support.sh” script located under the docs/ directory. For further information, please refer to MlNX_OFED User Manual Section Pre-installation Notes mlnx_add_kernel_support.sh tool.

```
# vi /etc/sysconfig/network-scripts/ifcfg-ib0
DEVICE=ib0
BOOTPROTO=none
ONBOOT="yes"
IPADDR=192.168.20.103
NETMASK=255.255.255.0
NM_CONTROLLED=yes
TYPE=Infiniband

# ifup ib0
```

Step 7: Add eIPoIB Interfaces. Make sure the host is connected to an InfiniBand network and that you have the latest Mellanox OFED that supports eIPoIB.

Step 8: Locate the interface. Make sure that you have the following line in the file `/etc/infiniband/openib.conf`:

```
E_IPOIB_LOAD=yes
If the E_IPOIB_LOAD = no , please change it and reload openibd process,
as follows:
#/etc/init.d/openibd restart
```

Step 9: Run the following command after OFED installation to see all the eIPoIB interfaces:

```
# cat /sys/class/net/eth_ipoib_interfaces
eth5 over IB port: ib0
```

Step 10: [3]To find the right interface, run:

```
# ibdev2netdev
mlx4_0 port 2 ==> eth0 (Up)
mlx4_0 port 1 ==> eth5 (Down)
mlx4_0 port 1 ==> ib0 (Up)
```

Here we can see that our interface (eth5) is associated with the first port on the first HCA.

Step 11: To further ensure that this interface is a PV-IPoIB interface, you may run:

```
#ethtool -i eth5
driver: eth_ipoib
version: 1.0.0
firmware-version: 1
```

For additional options and advance installation refer to Mellanox OFED User Manual.

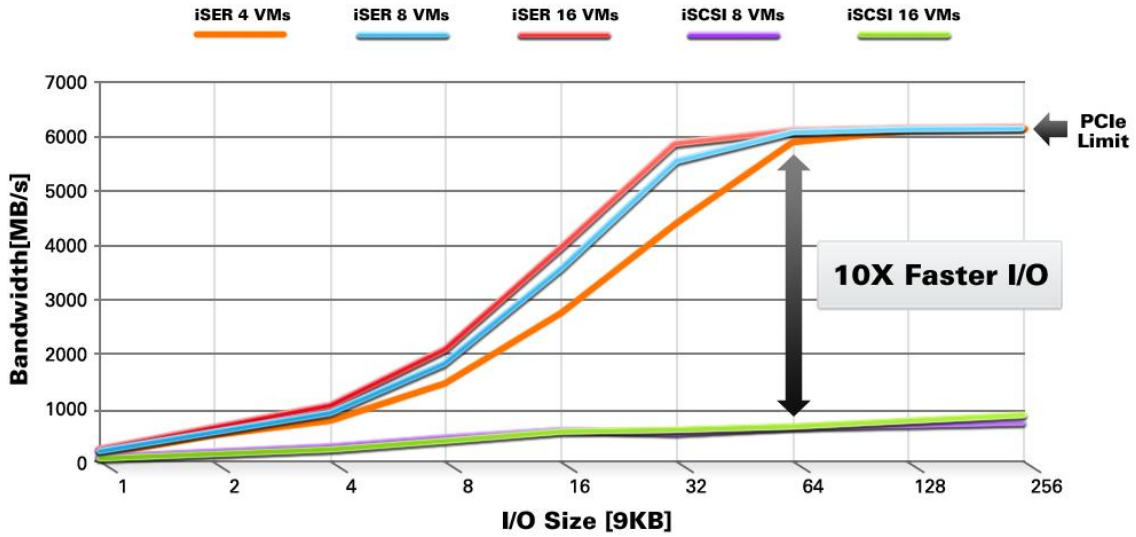
3.4 Mellanox VSA Installation (Host4)

iSER- ConnectX's RDMA capabilities can be used to accelerate hypervisor traffic such as storage access, VM migration, data and VM replication. The use of RDMA moves the data from node-to-node to the ConnectX hardware, producing much faster performance, lower latency/access-time, and lower CPU overhead, which provides zero-copy message transfers for SCSI packets. Thus, the RAID for a cluster may now be connected via InfiniBand and result in saving additional storage connector such as Fibre Channel, thereby greatly reducing the cost of the cluster. when using RDMA-based iSCSI (iSER) compared to traditional TCP/IP based iSCSI, RDMA can provide 10X faster performance. This will also consolidate

[3] If your kernel version does not match with any of the offered pre-built RPMs, you can add your kernel version by using the "mlnx_add_kernel_support.sh" script located under the docs/ directory. For further information, please refer to MlNX_OFED User Manual Section Pre-installation Notes mlnx_add_kernel_support.sh tool.

the efforts of both Ethernet and InfiniBand communities, and reduce the number of Storage protocols a user has to learn and maintain.

Figure 9: Using ConnectX-3 Adapter Results in Faster I/O Traffic Delivery rather than using Multiple 10GbE Ports from Competitors



Mellanox's Storage Accelerator (VSA) software is a highly scalable, high performance, low-latency software solution for tier-one storage and gateways that provides ultra-fast remote block storage access and accelerates access to SAN, DAS, or Flash based storage.

Once the VSA is installed on your server, run vscli and perform the following VSA commands to enter VSA configuration mode::

```
(host)# vscli

VSA-root> config

VSA-/# show disks/
 State     Idx                Name                Size Cache Vendor   Model
Serial              Rev  paths
running     1  3600605b0032a49601601f69931f3bb42 667GB   0    LSI
MR9265-8i 0042bbf33199f6011660492a03b00506 3.14   1
running     2  3600605b0032882501643ddec0204767e 890GB   0    LSI
MR9265-8i 007e760402ecdd431650822803b00506 3.14   1
running     3  3600605b0032867601643c9ecd0d3de2c 890GB   0    LSI
MR9265-8i 002cded3d0ecc9431660672803b00506 3.14   1

VSA-/# add servers/ rhev-servers  ips=192.168.20.101;192.168.20.103
VSA-/# add targets/iqn.iser.1 transport=iser,volumes=d1
VSA-/# set targets/iqn.iser.1 server=rhev-servers
VSA-/# save
```

For Mellanox VSA installation and advance configuration, refer to the Mellanox VSA User Manual.

3.5 Mellanox UFM Installation (Host1)

Mellanox's Unified Fabric Manager™ (UFM™) is a powerful platform for managing scale-out computing environments. UFM enables data center operators to efficiently monitor and operate the entire fabric, boost application performance and maximize fabric resource utilization.

For Mellanox UFM installation and basic configuration, refer to the Mellanox UFM User Manual.

3.6 Mellanox Network Manager Plugin

3.6.1 Installing Mellanox Network Manager Server

Copy the file `mellanox_nm_server.tar.gz` to the server that is running UFM.

```
# cd /tmp
# tar zxvf mellanox_nm_server.tar.gz
# cd mellanox_nm_server
# ./install.sh
```

3.6.2 Installing Mellanox Network Client

Copy the file `mellanox_nm_client.tar.gz` to each server in the fabric.

```
# cd /tmp
# tar zxvf mellanox_nm_client.tar.gz
# cd mellanox_nm_client
# ./install.sh
```

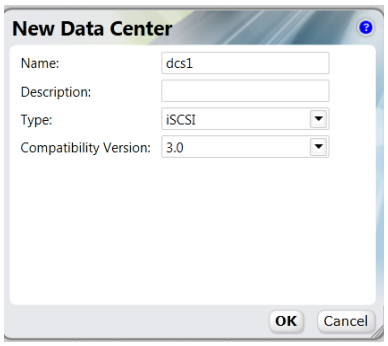
4 RHEV Manager Configuration

Before you begin configuring your Red Hat Enterprise Virtualization Manager (RHEV-M), make sure it is installed and running.

4.1 Add Data-Center

To add a new data center in your RHEV-M portal click on the ***New Data Center*** button

Figure 10: New Data Center

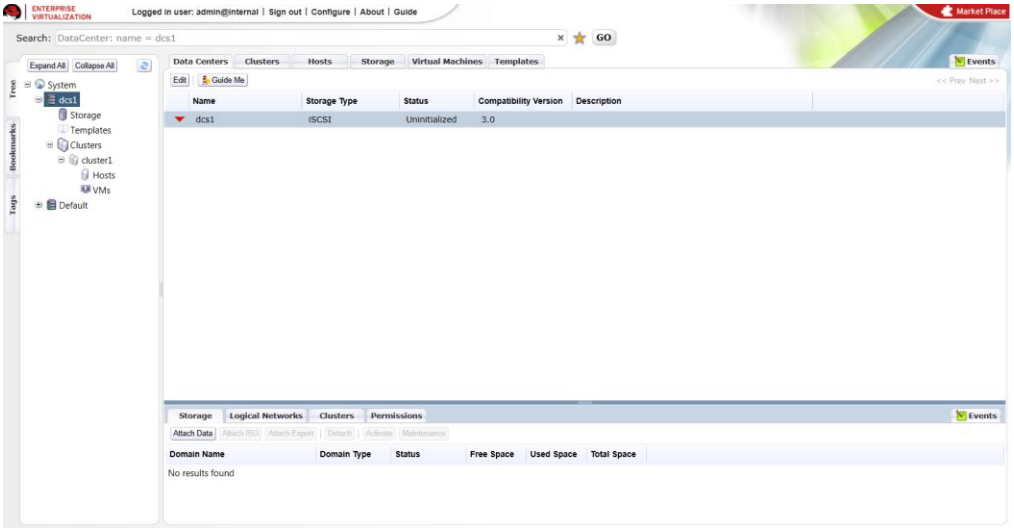


4.2 Add Cluster

To add new cluster for your data center in your RHEV-M, click on the ***New Cluster*** button:

Figure 11: New Cluster

Figure 12: Data Center

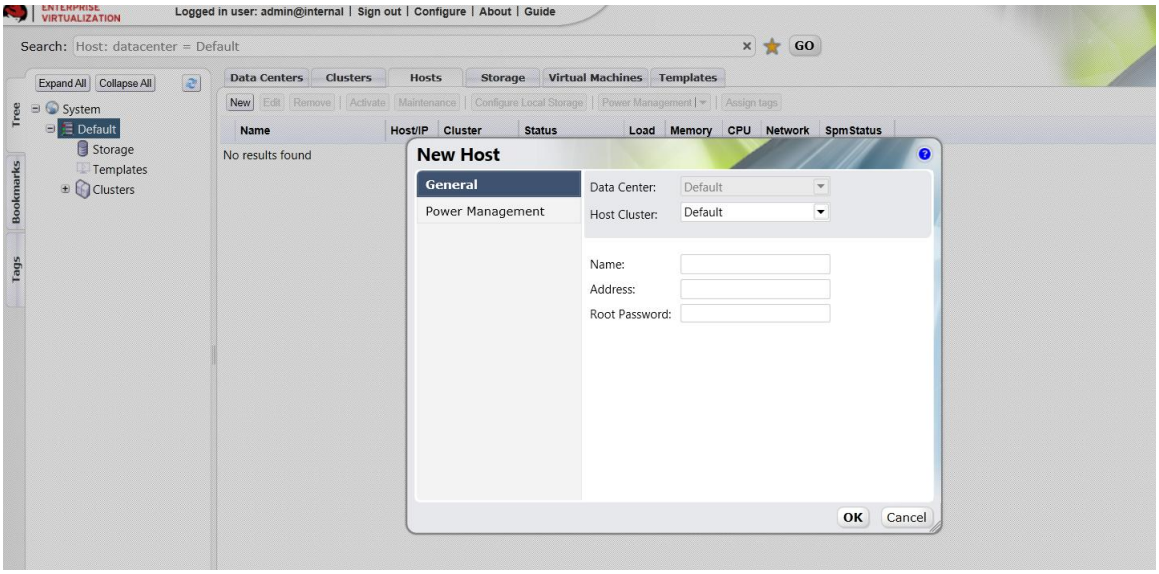


4.3 Add Host

Follow these steps in order to add a host:

Step 1: Go to ***Hosts*** tab and click on ***New***.

Figure 13: Adding a Host

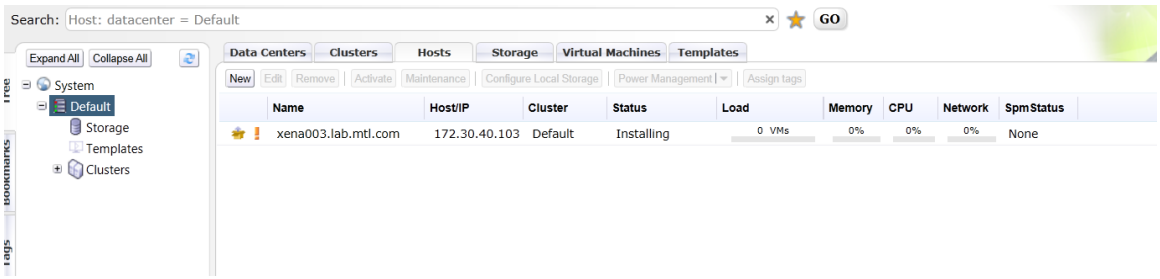


Step 2: Fill in the details as desired.

After filling in the required details the installation starts

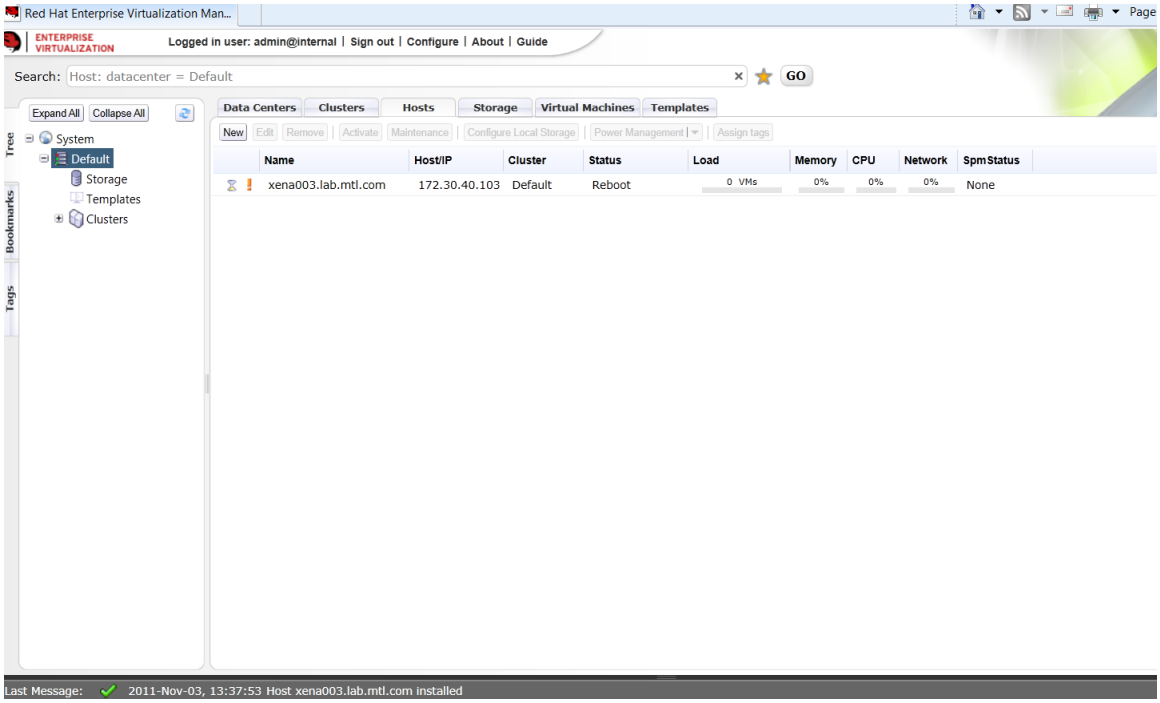
NOTE: If you intend to use UFM or Mellanox Network Plugin, it is necessary that the hostname you give the host you add is the same as the hostname in UFM.

Figure 14: Installation in Progress



After finishing the installation, the installer restarts the host. The virtual desktop and server manager daemon should be up and running.

Figure 15: Installation Complete



Step 3: Add storage support by applying the `iscsi.py` patch to enable iSER support.

NOTE: You should get the iscsi.py.patch from Mellanox support ready for RHEV 3.0. For RHEV 3.1 and up you should skip this section.

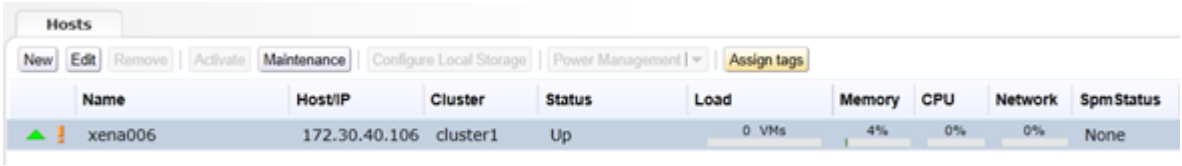
Step 4: Copy `iscsi.py.patch` to `/tmp`, and run:

```
[root@host3]# cd /usr/share/vdsm/storage
[root@host3]# patch iscsi.py < /tmp/iscsi.py.patch
[root@host3]# service vdsmd restart
```

Step 5: Verify that the VDSM daemon is up. Run:

```
[root@host3]# /etc/init.d/vdsmd status
VDS daemon server is running
```

Figure 16: Host is UP



4.4 Add Storage

Perform the following operations in order to add storage domain using RHEV-M.

Step 1: Connect to the RHEV-M Portal.

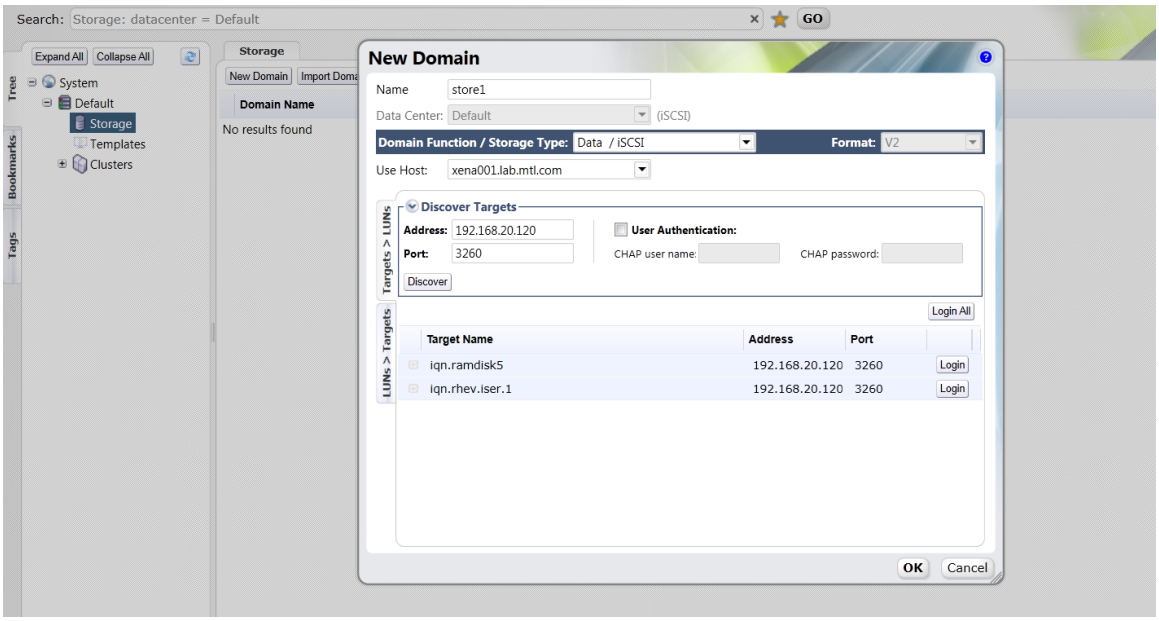
Step 2: Click ***System*** → ***Default*** → ***Storage*** → ***New Domain***.

Step 3: Enter a name for the domain.

Step 4: Enter an IP of the VSA host.

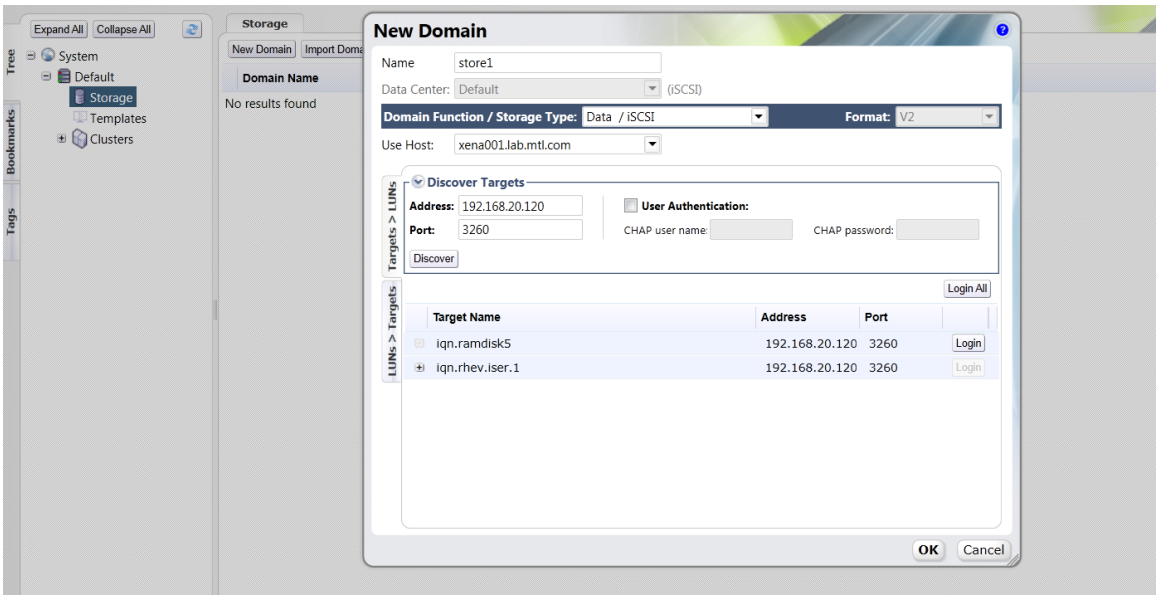
Step 5: Click on ***Discover***.

Figure 17: Discovering Targets



Step 6: Click on ***Login*** locatedon the right of your chosen target.

Figure 18: Login to Target



Step 7: Choose the LUN you wish to add and click ***OK***.

Figure 19: Choosing an LUN

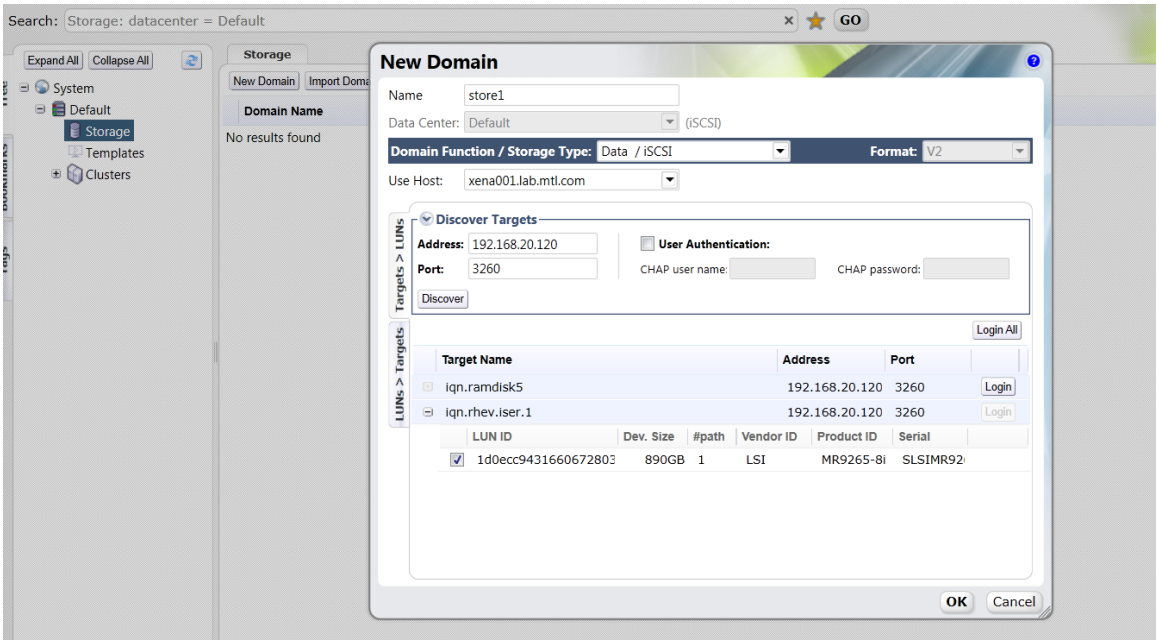


Figure 20: After Adding a Storage Domain

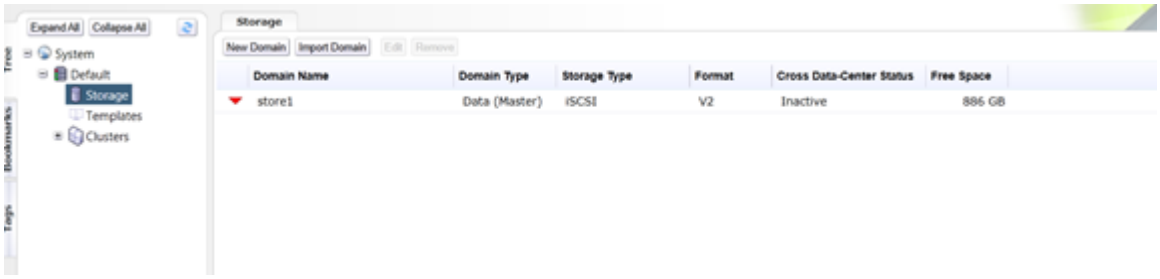
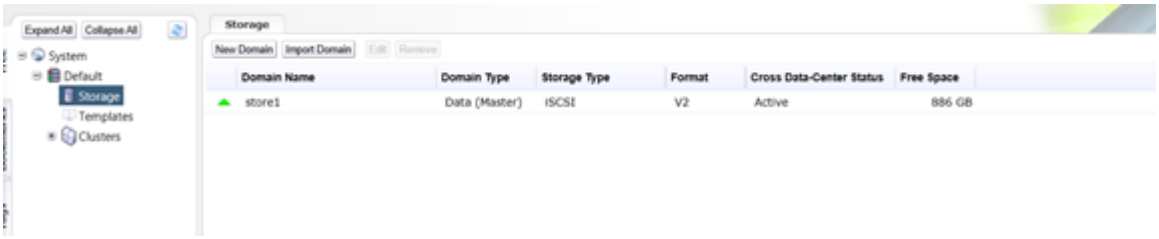


Figure 21: Successfully Adding a Storage Domain

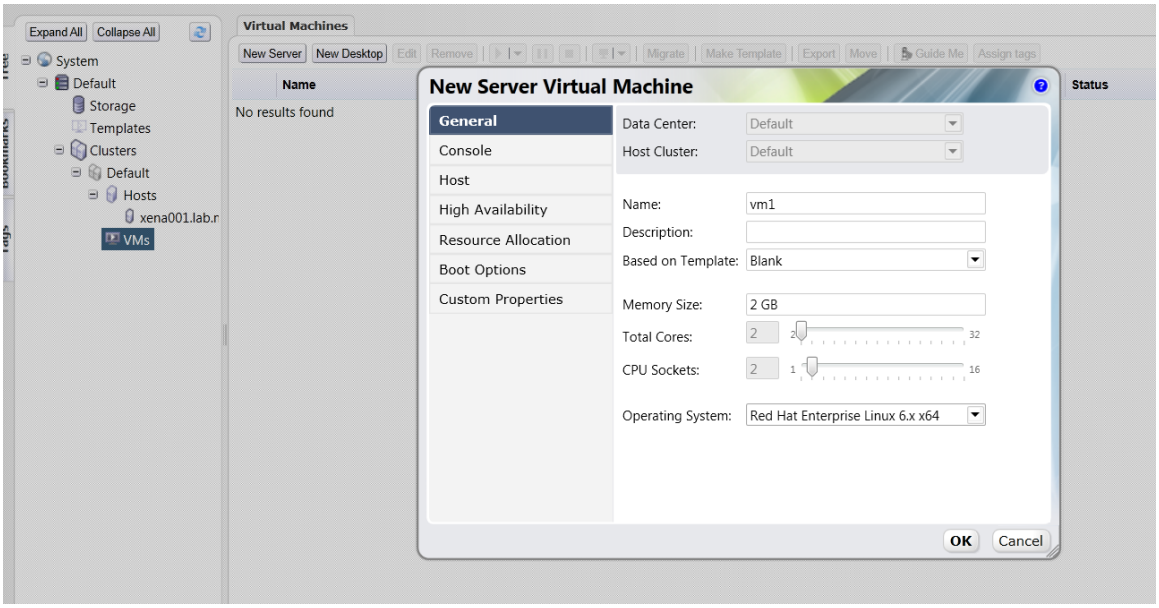


4.5 Adding Virtual Machines to a Cluster

Step 1: Click on ***System*** → ***Default*** → ***Clusters*** → ***Default*** → ***VMs*** → ***New Server***.

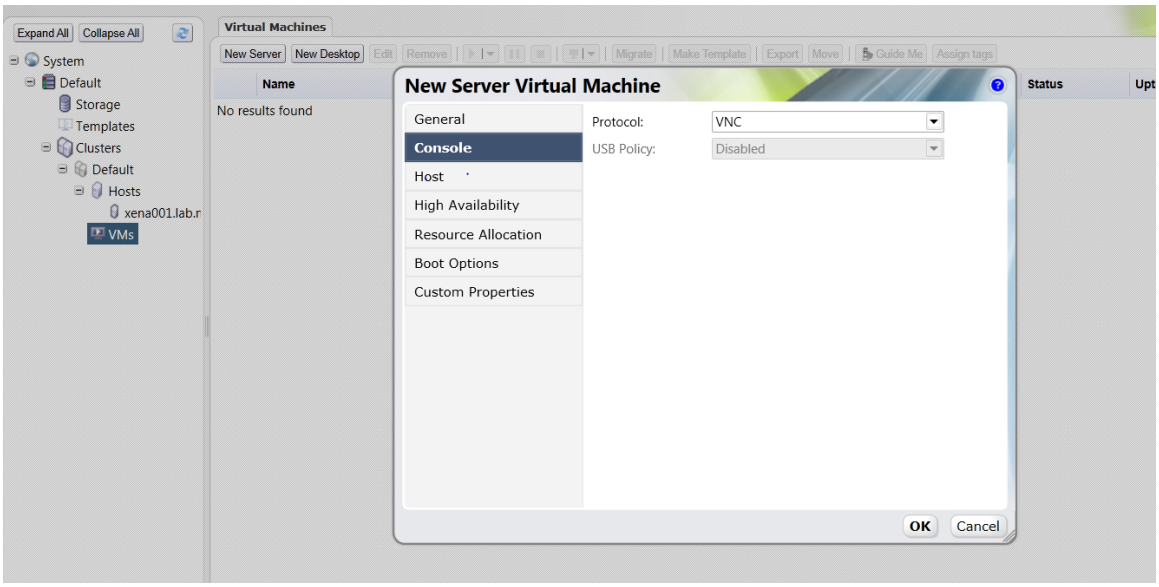
Step 2: Fill the details in ***General*** tab.

Figure 22: Adding New Virtual Machine - General



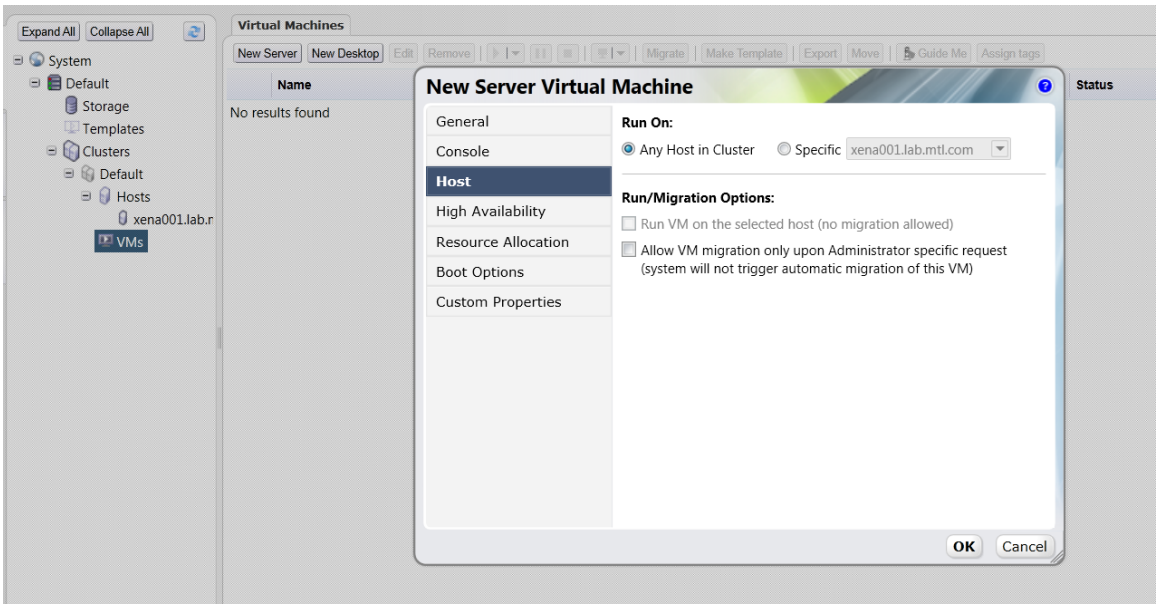
Step 3: Select ***VNC*** protocol in ***Console*** tab.

Figure 23: Adding a New Virtual Machine - Console



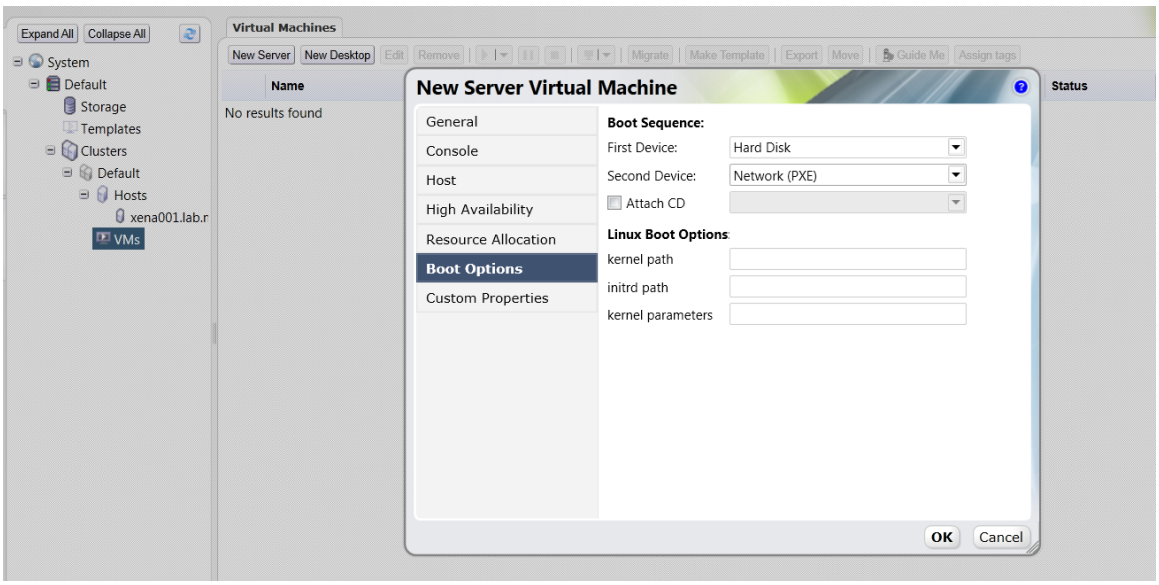
Step 4: In the ***Host*** tab, select the host you want the VM to run on.

Figure 24: Adding a New Virtual Machine - Host



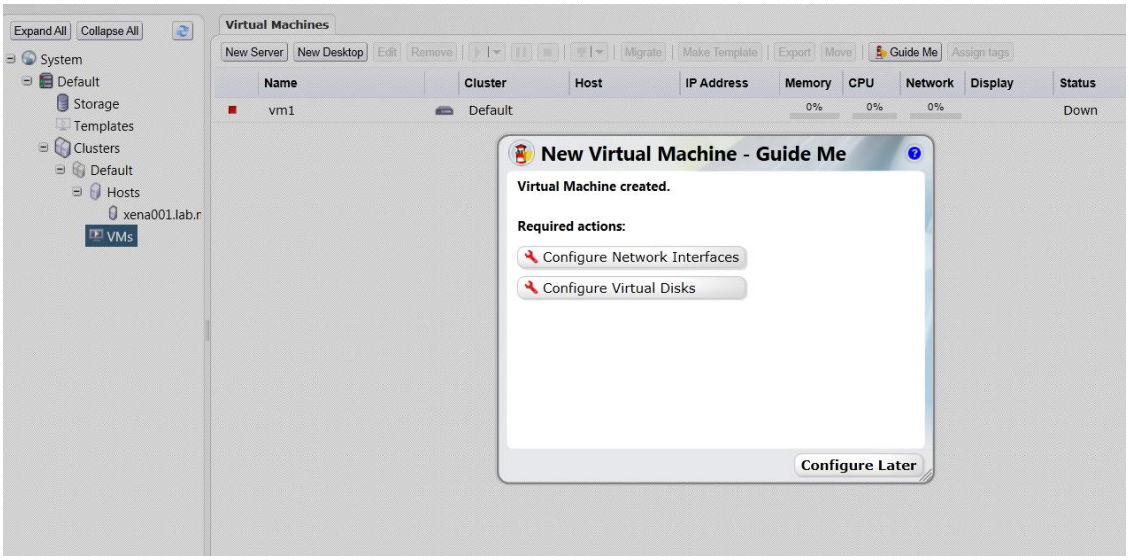
Step 5: Go to ***Boot Options*** tab and choose ***Hard Disk*** as the ***First Device*** and ***PXE*** as the ***Second Device*** then click the ***OK*** button at the bottom.

Figure 25: Adding a New Virtual Machine – Boot Options



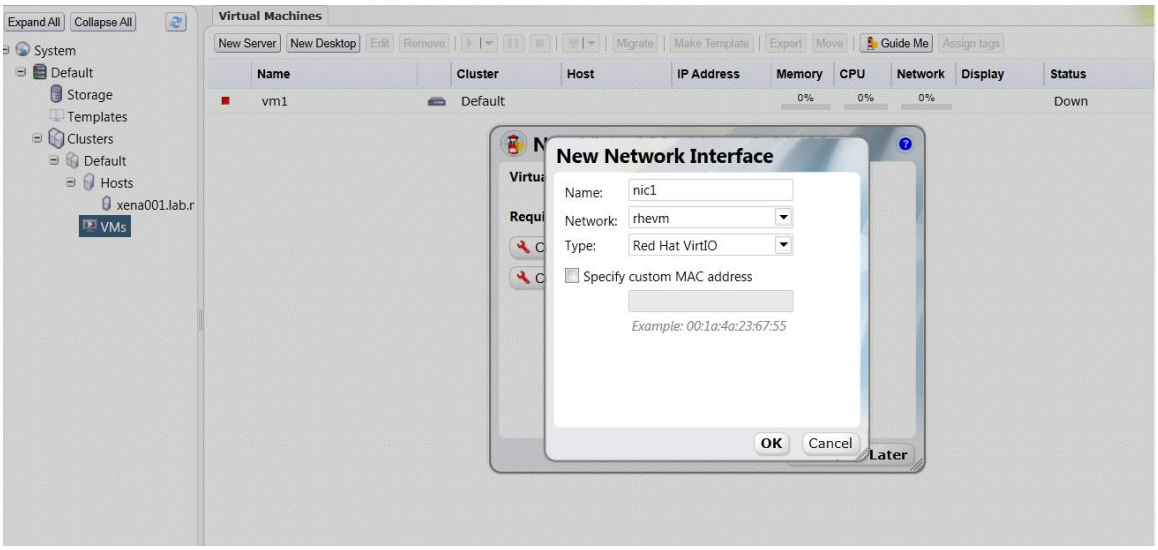
Step 6: A wizard will pop up. Choose ***Configure Network Interface***.

Figure 26: Adding a New Virtual Machine – Configuration



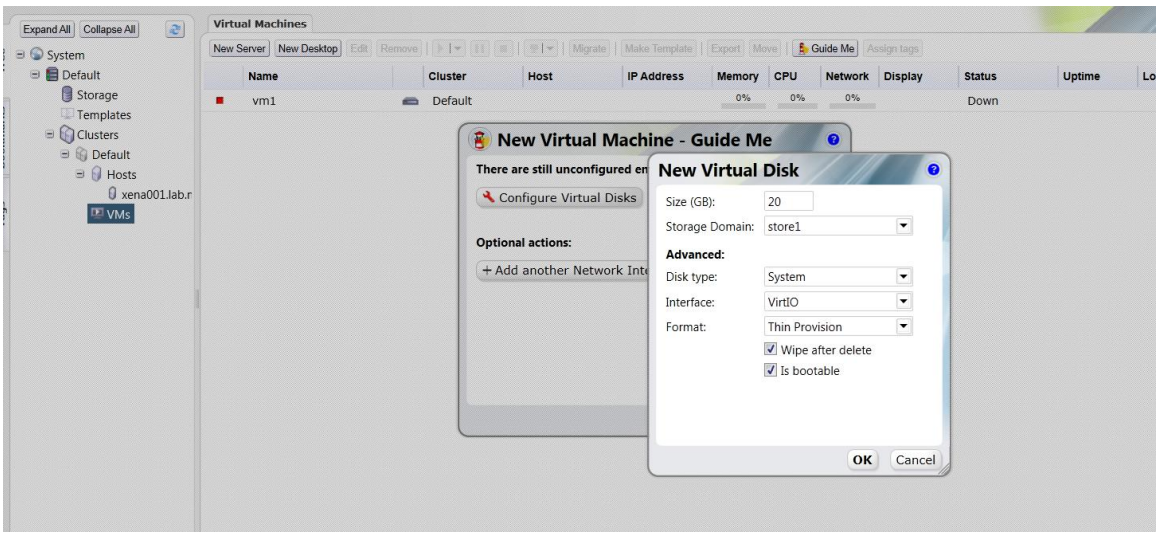
Step 7: Complete the details for the new HCA.

Figure 27: Adding a New Virtual Machine – Adding a New Network Interface



Step 8: Click on ***Configure Virtual Disks*** and fill in the details.

Figure 28: Adding a New Virtual Machine – Adding a New Virtual Disk



Step 9: Click ***Configure Later*** to finish.

Figure 29: Adding a New Virtual Machine – Finishing Configuratiin secon

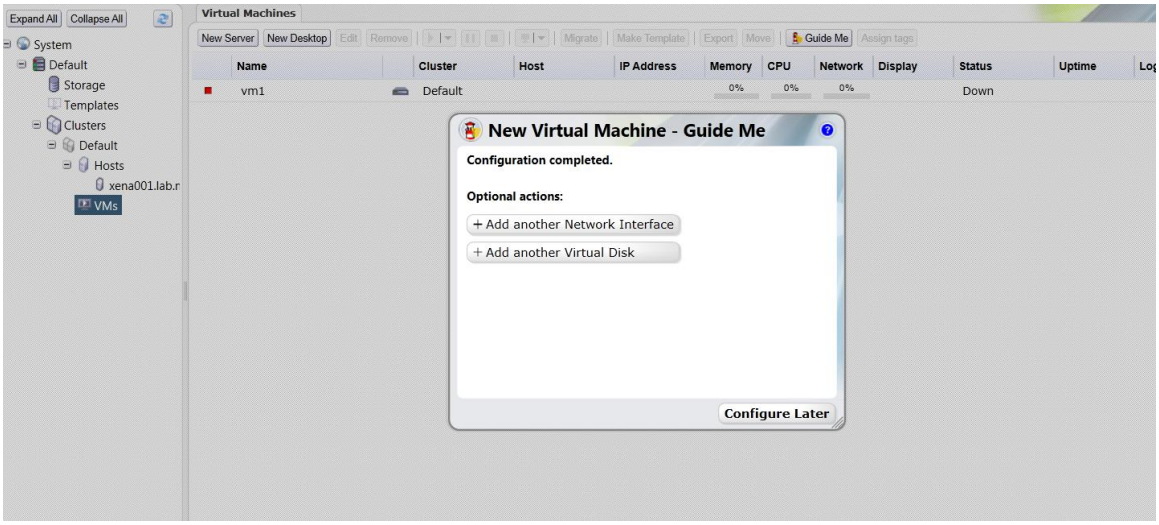
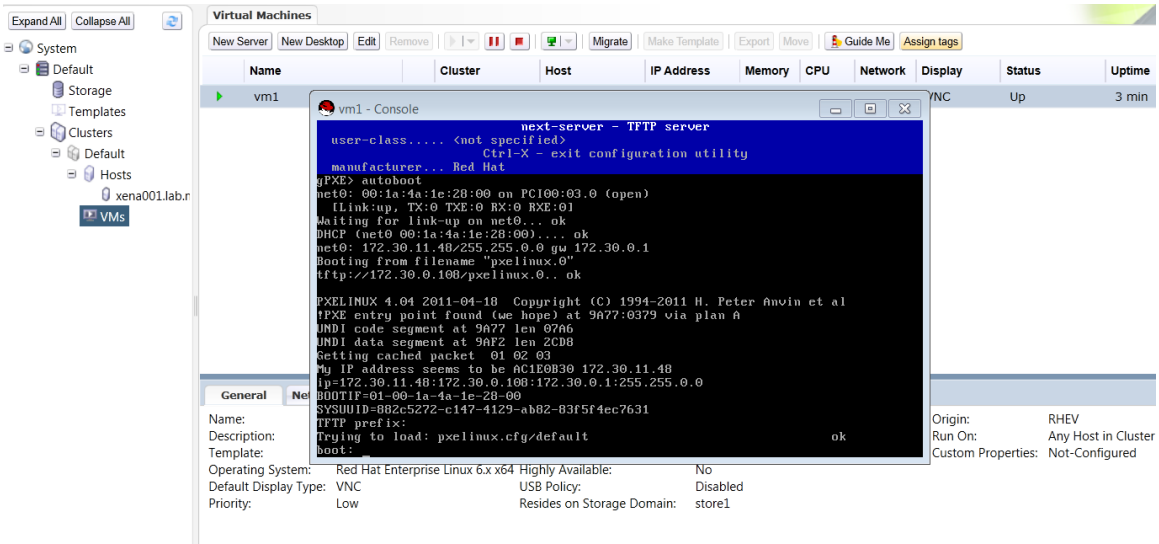


Figure 30: Adding a New Virtual Machine – VMs Screen

Step 10: Right click on the line of the VM and choose ***Run***.

Step 11: In order to start the VM console, right-click and select ***Console***.

Figure 31: Adding a New Virtual Machine – VNC Screen

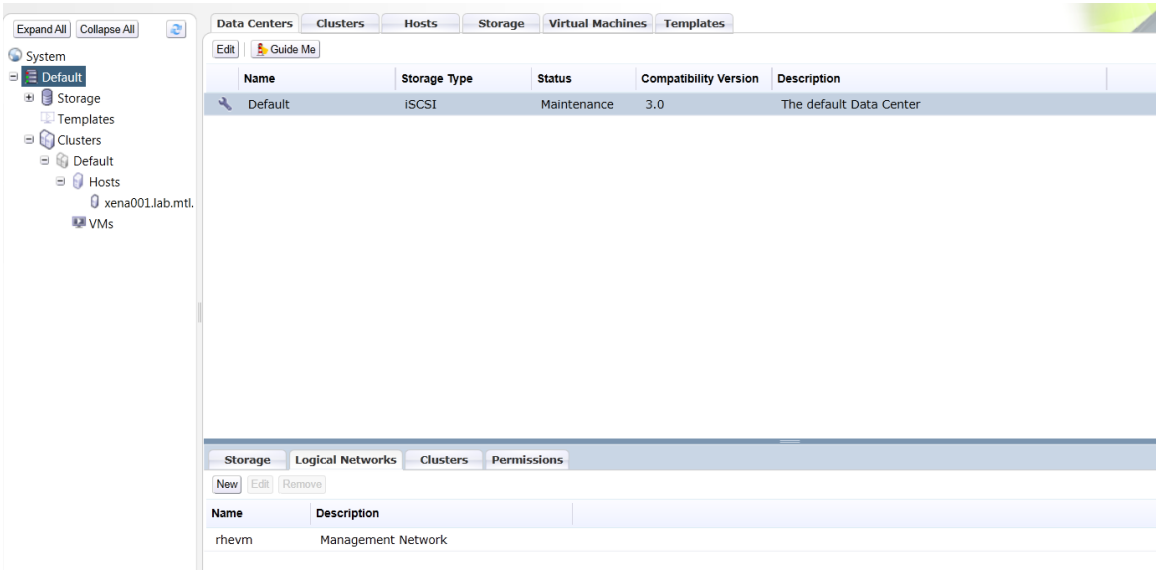


4.6 Add a Network to the Cluster

Step 1: Go to ***System → Default***.

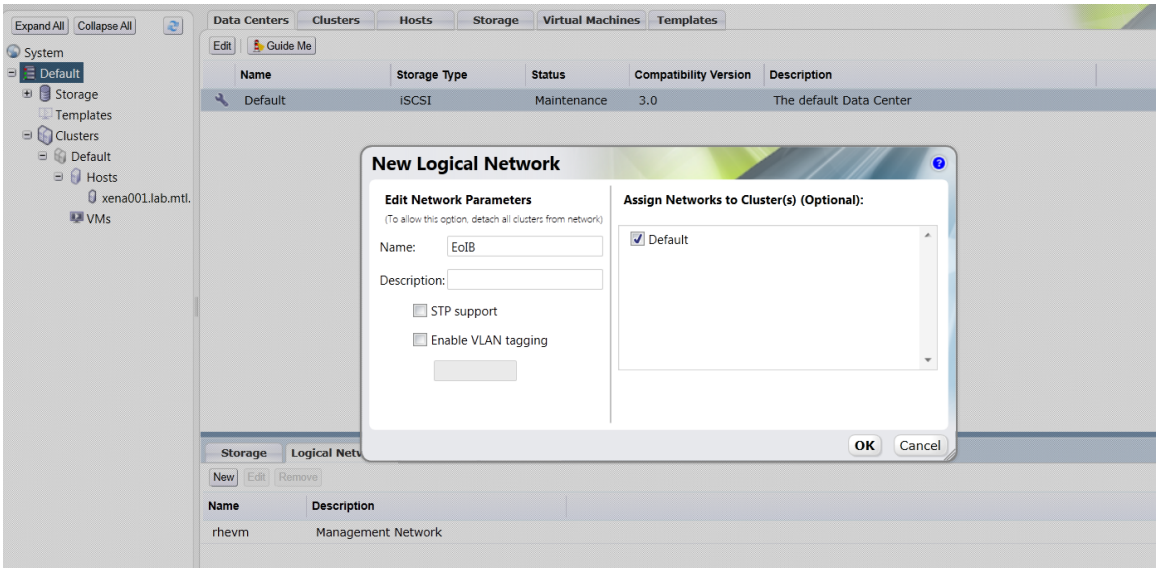
Step 2: Click on ***Logical Networks*** and then on ***New***.

Figure 32: Logical Networks



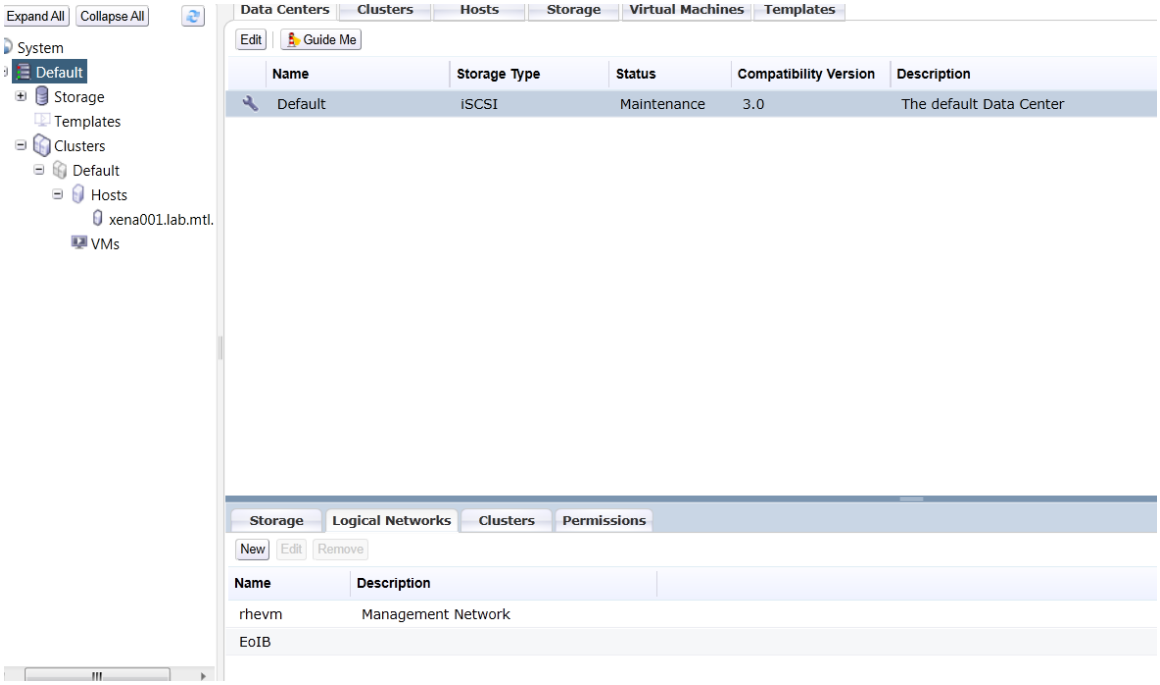
Step 3: Fill in the details for the new ***Logical Network***.

Figure 33: Adding a New Logical Network



You should now be able to see the new logical network.

Figure 34: Displaying the New Logical Network



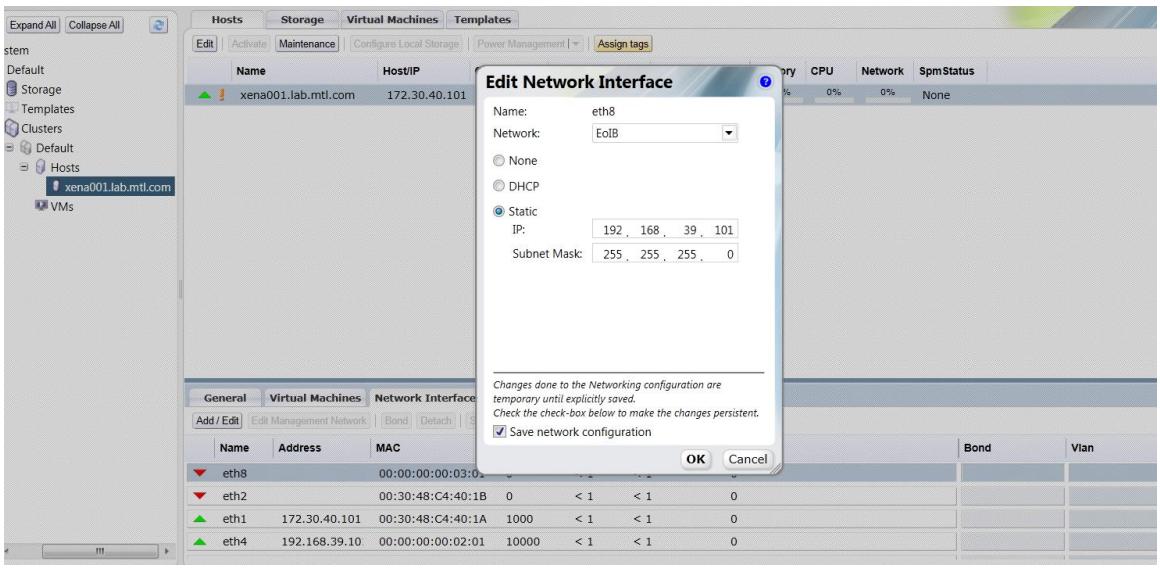
Step 4: Go to each host you want to connect to the new logical network and click ***Edit*** on the interface.

Step 5: Find which interface is eIPoIB. Run:

```
(config) # cat /sys/class/net/eth_ipoib_interfaces
eth5 over IB port: ib0
```

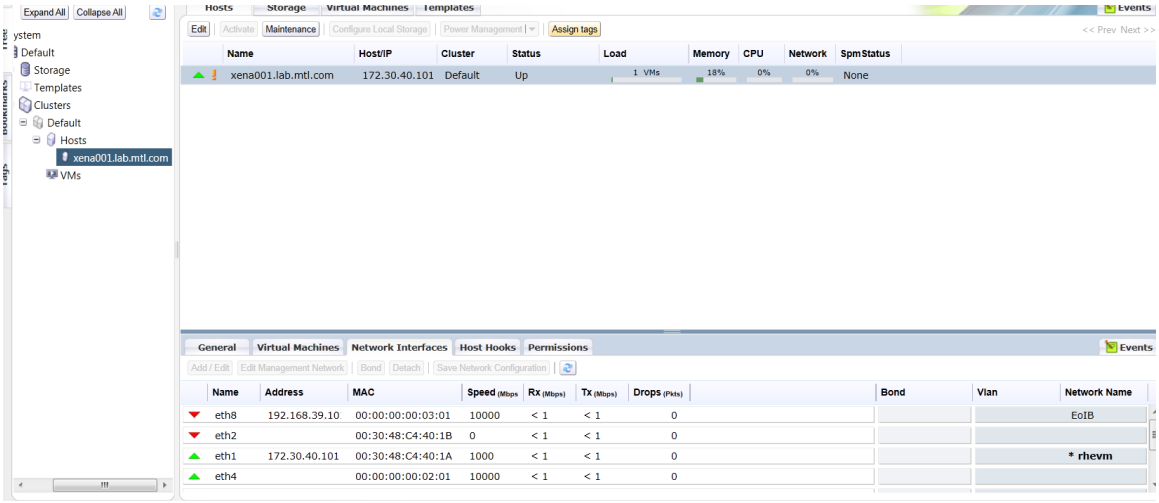
Step 6: Give it an IP address and save the configuration.

Figure 35: Adding a Network Interface to the Logical Network



You should now see the logical network name under the column ***Network Name*** for this interface.

Figure 36: Displaying the Network Interface of the Logical Network



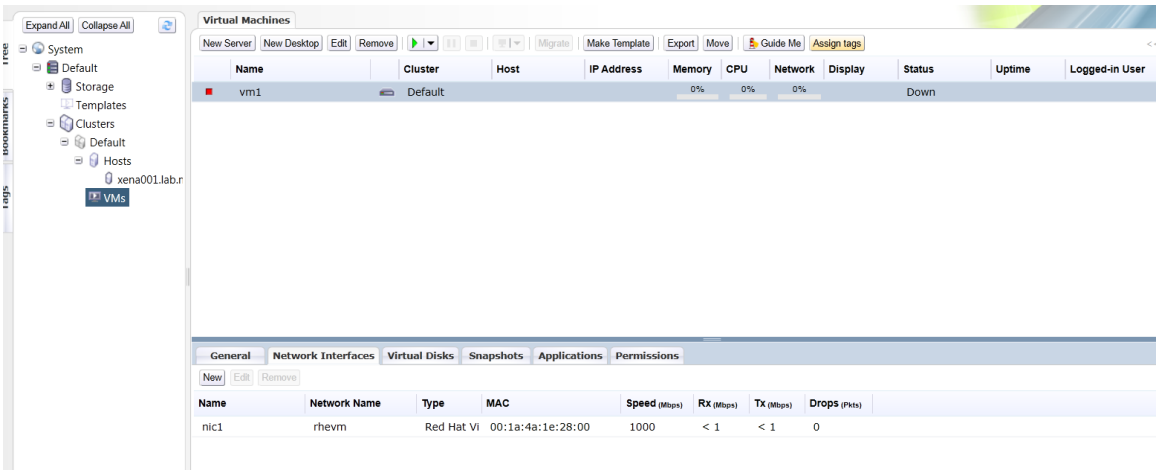
4.7 Add an Interface to VM

Step 1: Go to the ***VMs*** pane.

Step 2: Click on ***Network Interface*** tab.

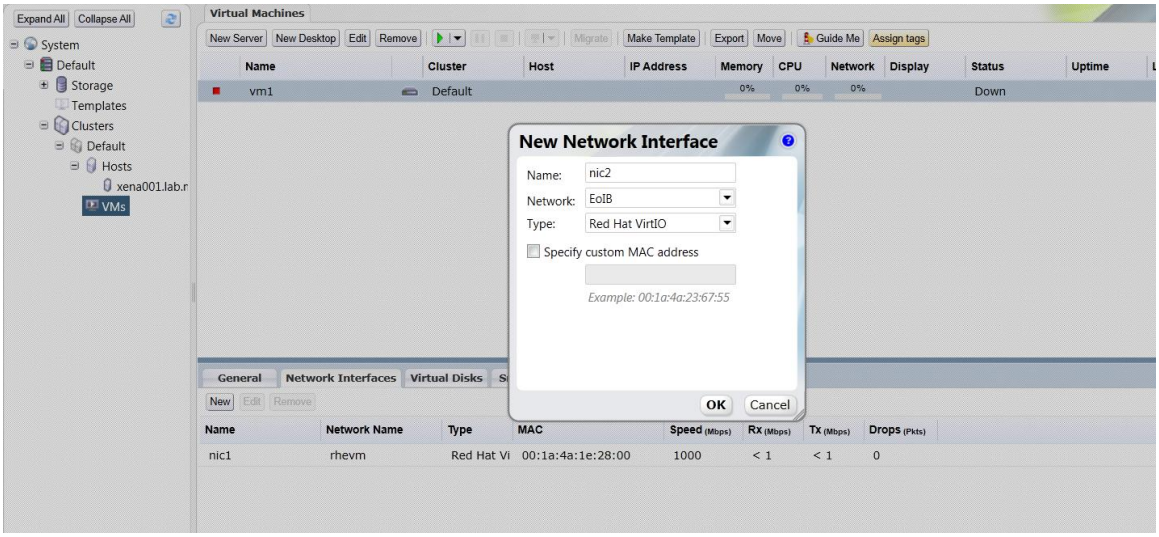
Step 3: Click on ***New*** button – a pop-up will open.

Figure 37: Virtual Machine – Network Interfaces View



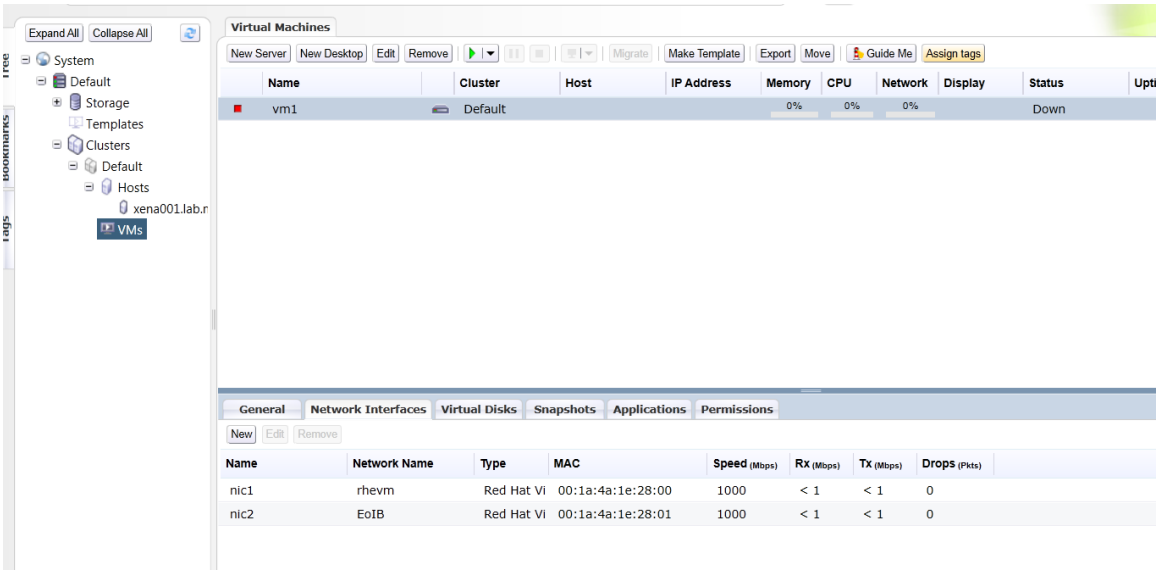
Step 4: Fill in the details for the HCA.

Figure 38: Adding a New Network Interface



You should now see the new added network interface.

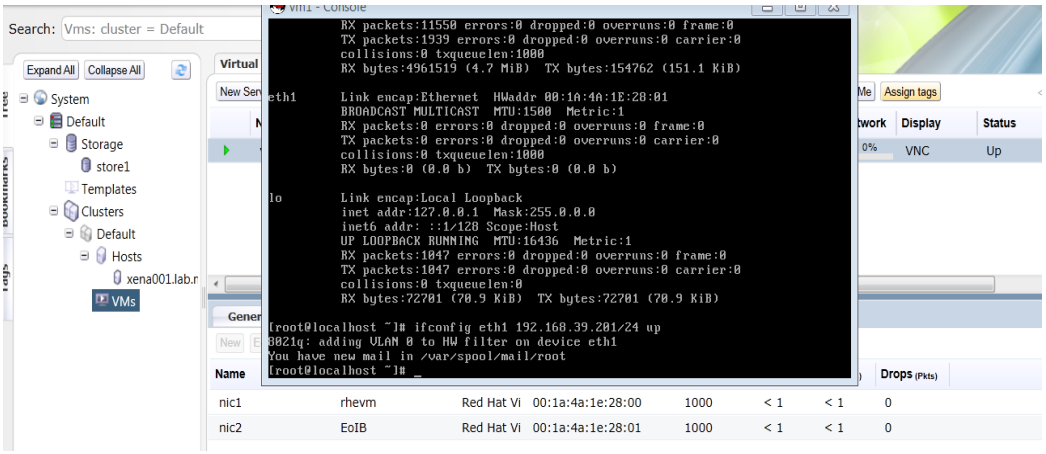
Figure 39: Displaying the New Network Interface



Step 5: Start the VM.

Step 6: Verify that the host has a new network interface for the VM. Run the command `ifconfig -a`.

Figure 40: Verifying the New HCA is Up



5 Using UFM to Automate Network Mangement

Mellanox's Unified Fabric Manager™ (UFM™) is a powerful platform for managing scale-out computing environments. UFM enables data center operators to efficiently monitor and operate the entire fabric, boost application performance and maximize fabric resource utilization. UFM's automated and application-centric approach bridges the gap between servers, applications and fabric elements, thus enabling administrators to manage and optimize from the smallest to the largest and most performance-demanding clusters.

UFM provides the ability to monitor, troubleshoot, configure and optimize all fabric aspects available via only one interface. UFM's central dashboard provides a one-view fabric-wide status view.

UFM includes an advanced granular monitoring engine that provides real-time access to switch and host data, enabling cluster-wide monitoring of fabric health and performance, real-time identification of fabric-related errors and failures, quick problem resolution via granular threshold-based alerts, and a fabric utilization dashboard.

Fabric congestion is difficult to detect when using traditional management tools resulting in unnoticed congestion and fabric under-utilization. UFM's unique traffic map quickly identifies traffic trends, traffic bottlenecks, and congestion events spreading over the fabric which enables the administrator to identify and resolve problems promptly and accurately.

Using UFM one can set specific service levels for different applications to ensure that critical applications get the right priority according to the fabric. QoS management is performed using a unique intelligent algorithm that determines the optimal configuration for each device location in the topology and its QoS capabilities.

UFM uses a logical fabric model to manage the fabric as a set of business-related entities such as time critical applications or services. The logical fabric model enables fabric monitoring and performance optimization on the application level rather than just at the individual port or device level. Managing the fabric using the logical fabric model provides improved visibility into fabric performance and potential bottlenecks, improved performance due to application-centric optimizations, quicker troubleshooting, and higher fabric utilization.

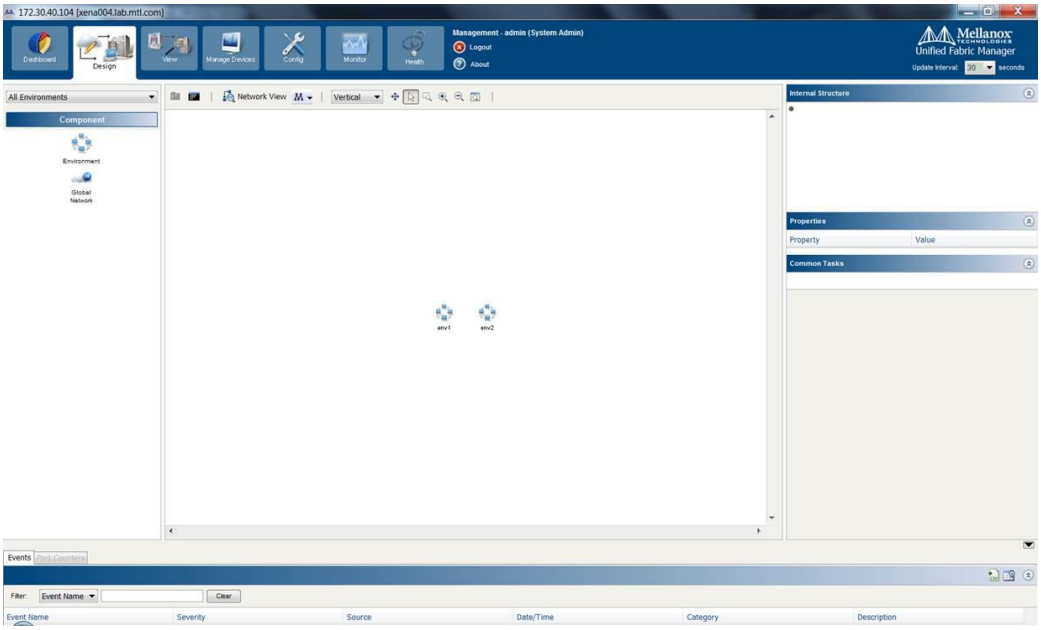
Refer to UFM User Manual for detailed installation and configuration options.

5.1 Basic UFM Configuration Flow

Follow the next steps for basic UFM configuration. The following steps show how to create a logical server and UFM Network, and finally connecting between them.

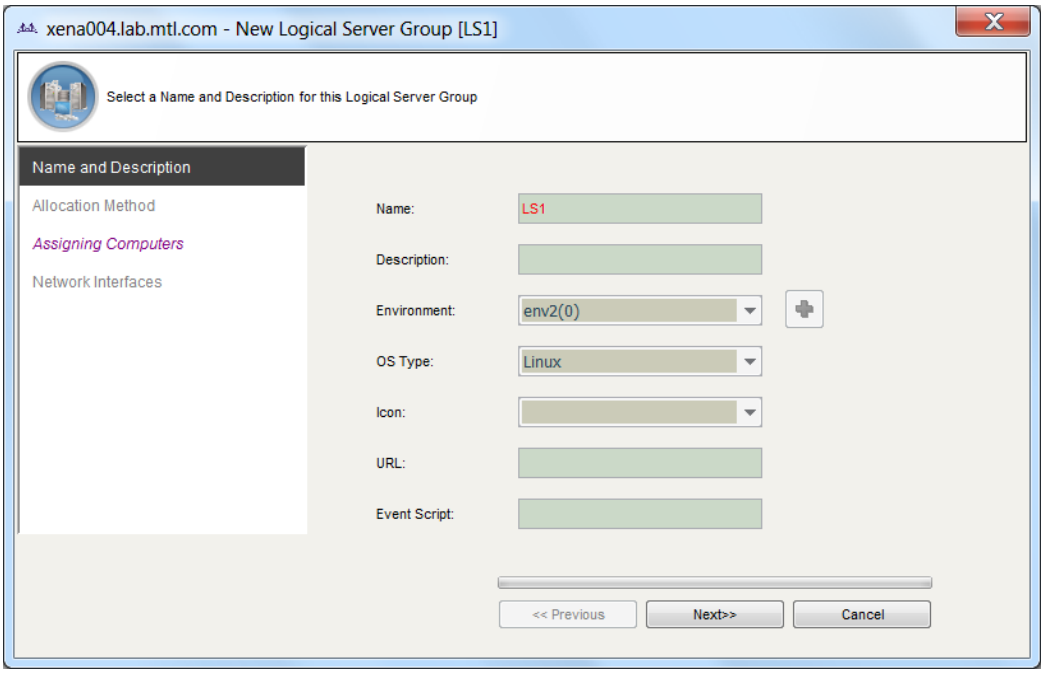
Step 1: Create an environment.

Figure 41: UFM Environment



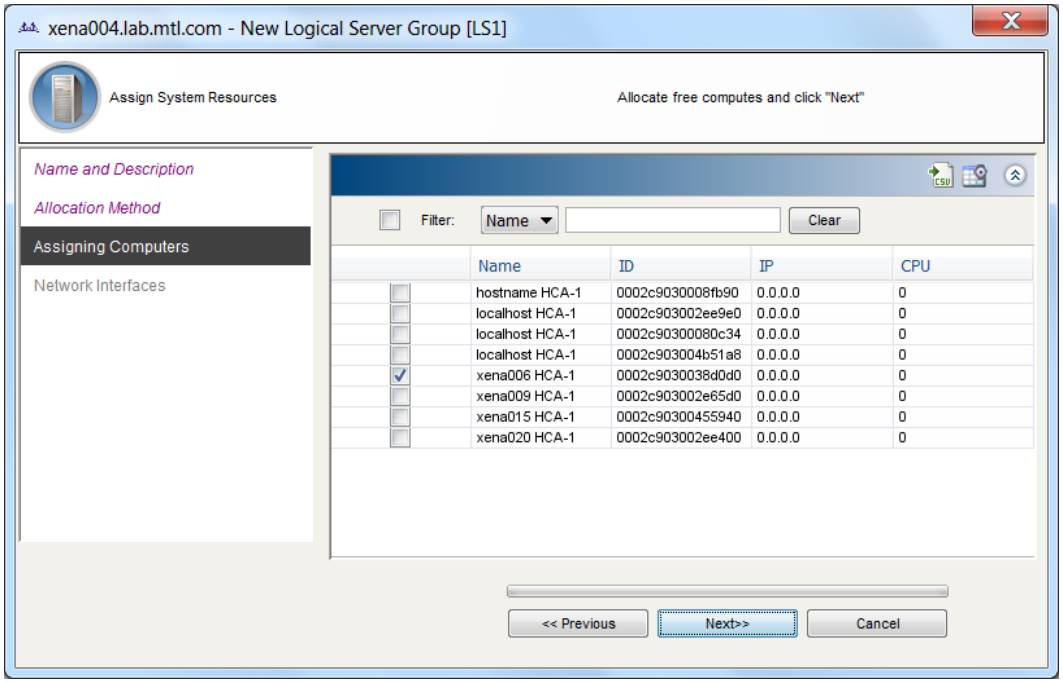
Step 2: Add a logical server. UFM logical server is equivalent to datacenter cluster in the RHEV-M architecture model.

Figure 42: New Logical Server



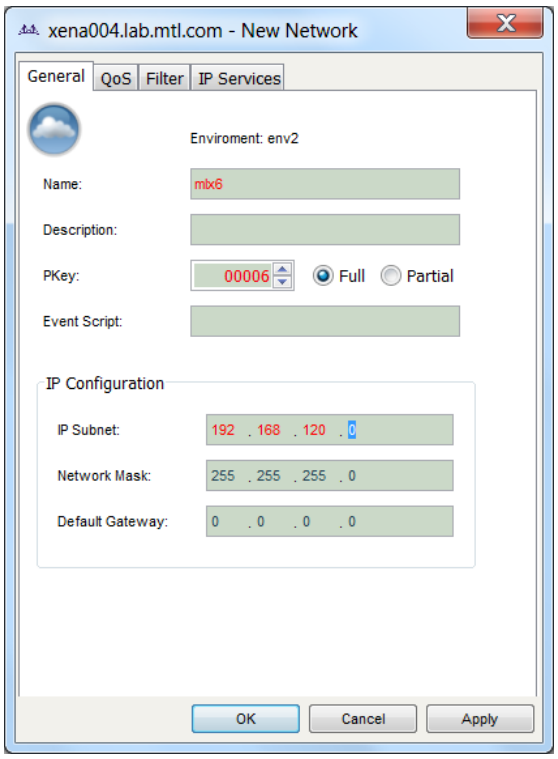
Step 3: Add all hosts in the RHEV-M cluster.

Figure 43: Add Hosts



Step 4: Create a new network. Add partition key (PKey)

Figure 44: Add Hosts



Step 5: Connect the logical server (cluster) to the network. By doing this, all hosts located under this logical server (cluster) will be connected.

Figure 45: Connect the Logical Sever to the Network.

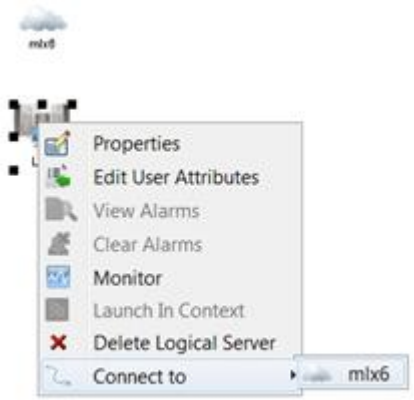


Figure 46: UFM Network Connected to the UFM Logical Server

Refer to UFM User Manual for advanced configuration options.

6 Mellanox Network Manager Plugin

Mellanox Network Manager Plugin performs seamless integration between Mellanox UFM and the RHEV Manager. After installing the plugin, (see section 3.6 Mellanox Network Manager Plugin), the interconnectivity between the hosts in the network over eIPoIB interface is performed seamlessly.

For advanced configuration, please contact cloudsupport@mellanox.com**.**

7 Troubleshooting

7.1 Host is Not Added to Logical Server in UFM

Check that you see the server in UFM. If it does not appear there, run:

```
#cat /sys/class/infiniband/mlx4_0/node_desc
```

The output should be something other than localhost HCA-1.

You can change it by running, for example:

```
#echo "web1 HCA-1" > /sys/class/infiniband/mlx4_0/node_desc
```

7.2 Migration of VM Fails

Step 1: Check that libvirtd on the target is listening on TCP port.

```
# netstat -nap |grep libvirtd
tcp        0      0 0.0.0.0:16509               0.0.0.0:*
LISTEN      30771/libvirtd
```

Step 2: From the source, run:

```
#virsh -c qemu+tcp://target_host/system capabilities
```

Where `target_host` is the host name of the target.

The command should return without errors.

Step 3: Check that the file `/etc/sysconfig/libvirtd` has the following lines:

```
LIBVIRTD_ARGS=--listen
DAEMON_COREFILE_LIMIT=unlimited
```

Step 4: Check that the port libvirtd is not blocked by a firewall.

7.3 Connection Verification of Virtual Machines Using eIPoIB

Check that you can run the command `virsh list` without errors.

If you get a prompt for authentication edit the file `/etc/libvirt/libvirt.conf` by changing this line:

```
auth_unix_rw="sasl"
```

To:

```
auth_unix_rw="none"
```

7.4 Low Latency Performance Tuning

The below links provides a tactical tuning overview of Red Hat Enterprise Linux 6 for latency sensitive workloads and describes important tuning parameters and settings that can improve performance for Mellanox adapters. Each setting, along with its potential effect, is described to help in making an informed judgment concerning its relevance to the user's system, the system workload, and the performance goals.

- Performance Tuning Guidelines for Mellanox Network Adapters
- Low Latency Performance Tuning Guide for Red Hat Enterprise Linux 6

8 Related Documentation

For additional information, see the following documents:

Table 2: List of Related Documents

Document	Location
Red Hat Enterprise Virtualization 3.0 - Installation Guide	http://docs.redhat.com/docs/en-US/Red_Hat_Enterprise_Virtualization/3.0/pdf/Installation_Guide/Red_Hat_Enterprise_Virtualization-3.0-Installation_Guide-en-US.pdf
Mellanox OFED User Manual	www.mellanox.com > Products > Adapter IB/VPI SW > Linux SW/Drivers http://www.mellanox.com/content/pages.php?pg=products_dyn&product_family=26&menu_section=34
Mellanox UFM User Manual	http://license1.mellanox.com
Mellanox VSA User Manual	http://license1.mellanox.com
Mellanox Cloud Interface plugin	Please contact cloudsupport@mellanox.com.
Red Hat - Low Latency Performance Tuning	https://access.redhat.com/knowledge/articles/221153
Mellanox - Low Latency Performance Tuning	Performance Tuning Guidelines for Mellanox Network Adapters