Tintri

TECHNICAL WHITE PAPER

Deploying Red Hat Enterprise Virtualization On Tintri VMstore Systems Best Practices Guide

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Intended Audience

This Best Practices Guide for deploying Red Hat Enterprise Virtualization (RHEV) on Tintri VMstore systems will assist individuals who are responsible for the design and deployment of Tintri VMstore™ systems for running RHEV environments. This document will discuss configuration of the Red Hat Enterprise Virtualization Manager (RHEV-M) and configuring host servers in a RHEV cluster, using Tintri per-VM features to deploy, configure and manage data protection of virtual machines (VMs) hosted on Tintri VMstores.

Introduction

Deploying storage for your virtualized environments should be a straightforward process. Tintri VMstore is designed so that IT administrators with a working knowledge of vSphere can successfully deploy Tintri's purpose-built VM storage for RHEV in minutes.

Tintri VMstore delivers extreme performance and VM density, and a wide variety of powerful features, which are seamlessly integrated with RHEV. Examples include snapshots, clones, instant bottleneck visualization, and automatic virtual disk alignment. Tintri VMstore extends and simplifies the management of virtual machines (VMs) through native VM-level data management constructs so both compute and storage use the same fundamental management object: a VM.

This guide highlights the key considerations and configuration settings that promote a high-performance and reliable networking environment for connecting your RHEV assets and clusters to Tintri VMstore systems.

Consolidated List of Practices

The table below includes the recommended practices in this document. Click the text in the "Recommendation" column or see the section later in the document that corresponds to each recommendation for additional information.

Tags	Recommendation
Architecture Overview	**DO:** Create separate RHEV clusters as needed for multiple hosts that are of different CPU type.
Storage Configuration	**DO:** Ensure that the data network on both controllers reflects the same network speeds and also Duplex is set to full on the Tintri VMstores.
Storage Configuration	**DO:** Create multiple NFS submounts for different hypervisors hosted on a Tintri VMstore.
Storage Configuration	**DO:** Follow RHEV deployment requirement to create separate submounts for RHEV ISO domain and RHEV Data domains.
Storage Configuration	**DO:** Prevent unsecured user access to the Tintri VMstore.
Storage Configuration	**DO:** Use RHEV bonding to create bonded logical networks for the different network interfaces.

Storage Configuration	**DO:** Share ISO domains across RHEV Data Centers. ISO images that have been created in one ISO domain can be used by other Data Centers that is managed by the RHEV-M without duplicating efforts.
Storage Configuration	**DO: RHEV Data Domains, within the same RHEV Data Center, can be shared between different RHEV Clusters. RHEV restrictions prevent sharing of RHEV Data Domains between RHEV Data Centers.**
Storage Configuration	**DO:** Use Tintri VMstore SnapVM™ and CloneVM™ features to snap and clone VMs between Data Centers. Refer to the SnapVM™, CloneVM™ and ReplicateVM™ section of this document.
Storage Configuration	**DO NOT:** Create a RHEV Export Domain with Tintri VMstores. It is not necessary to create RHEV Export Domains with Tintri VMstores.
Storage Configuration	**DO:** Create one RHEV Data domain per RHEV Data Center. A RHEV-M Data Center admin can take advantage of Tintri VMstore features with a single RHEV Data domain per Data Center to manage images and migration.
RHEV Virtual Machines on Tintri VMstores	**DO:** It is recommended to use *Allocation Policy: Thin Provision* for virtual disks for space savings and capacity planning purposes.
RHEV Virtual Machines on Tintri VMstores	**DO NOT:** Create more than 10 VMs per physical core.
Zero-Copy Virtual Machine Provisioning	**DO:** Use Tintri SnapVM™ and CloneVM™ features for virtual machine templates and to create virtual machine clones in RHEV Data Centers.
Zero-Copy Virtual Machine Provisioning	**DO NOT:** Use RHEV Templates with Tintri VMstores. Use Tintri SnapVM™ and CloneVM™.
Zero-Copy Virtual Machine Provisioning	**DO:** Use Tintri VMstore's Protect feature to ensure that your RHEV virtual machines and RHEV supported applications are protected locally on the VMstore and across RHEV environments with multiple Tintri VMstores.

Architecture Overview

Figure 1 shows an example of a deployment of RHEV with two Tintri VMstores, three host servers, and a RHEV-M instance. A RHEV data center can have more than one cluster but the physical hosts within a cluster should be from the same CPU family.

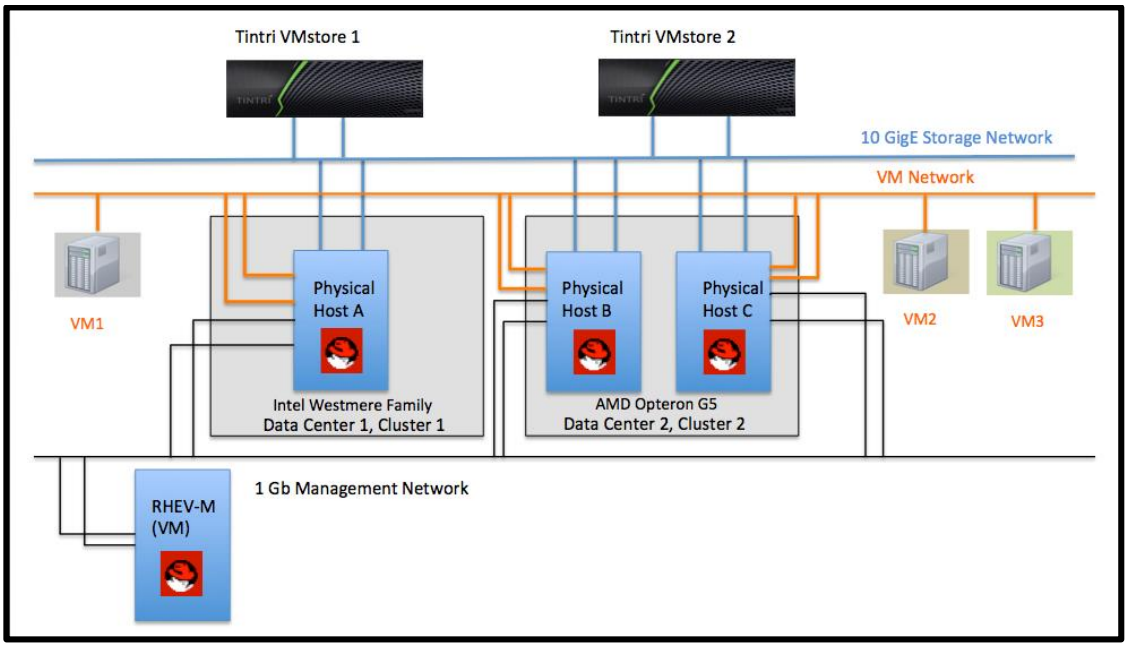

Figure 1: Architectural overview of Tintri VMstore deployment in a RHEV Environment.

If the host is not from the same CPU family type, attempts to configure a host server to an existing cluster will fail with an error message similar to the following:

DO: Create separate RHEV clusters as needed for multiple hosts that are of different CPU type.

The architecture referenced in this paper is an example of a supported RHEV configuration in a single site. A single RHEV Data Center can also have multiple clusters, each with hosts of different CPU family types. The configuration example, in this document, is used to show that ISO domains can be shared between Data Centers without having to create multiple ISO domains on Tintri VMstores. For detailed information on sharing ISO domains between RHEV Data Centers, review the Storage Configuration section.

NOTE: RHEV-M UI can be accessed using any supported web browsers. A list of the supported web browsers for RHEV 3.3 is located in the RHEV Manager Client Requirements section.

Configuration

For RHEV-M server requirements, review the Red Hat Enterprise Virtualization Manager Hardware Requirements. The Virtualization Host Hardware Requirements additional detailed information on RHEV host server requirements such as a list of supported CPU models for RHEV. Use the information in these links to determine if your hosts meet the minimum requirements for RHEV.

Host Configuration

Load and run the RHEV 3.3 hypervisor ISO to configure your RHEV hosts.

NOTE: Tintri VMstore supports RHEV 3.3 and later. Tintri VMstore OS 3.0.0.5 or later is required for multi-hypervisor support with RHEV.

Possible Error Condition

Although unlikely, hosts from the same CPU family type could encounter the following error message when attempting to register a host with the RHEV-M: "*2014-08-05 17:07:10,775 ERROR [org.ovirt.engine.core.bll.VdsDeploy] (pool-4-thread-49) [1df0d989] Error during host 111.111.111.111 install, prefering first exception: org.ovirt.otopi.dialog.SoftError: Host 111.111.111.111 reports unique id which already registered for HQTM-AMD01.fully.qualified.domain.name*". This error condition is not related to Tintri but an issue with RHEV.

To fix this issue, run the following commands as root on your RHEV hosts and compare the output between the host systems:

1. hostname
2. cat /etc/vdsm/vdsm.id
3. cat /etc/libvirt/libvirtd.conf |grep host_uuid

If two host machines have the same conflicting vdsm.id, run the following commands on the new RHEV host to give it a unique vdsm id:

1. uuidgen > /etc/vdsm/vdsm.id
2. service vdsm restart

Re-execute the *cat* commands to verify that a new vdsm.id has been generated for the host. Registering host *111.111.111.111* with RHEV-M should complete successfully with the new vdsm.id. Figure 2 shows an example of a RHEV hosts added into the RHEV clusters.

Figure 2: RHEV Hosts configured in RHEV Clusters.

Storage Configuration

Each Tintri VMstore is fully redundant with two controllers – an active and a standby. In figure 3, controller A is the active controller on the Tintri T650 in the example. The two 10GbE ports used for data can be configured in either active-standby or in active-active (using LACP) configurations. The T650 in figure 3 is configured in active-standby mode. The active data network is on port A.2a and port A.2b is the slave port in this example. The active and slave ports are both connected to a 10GbE network switch. The configuration of the data network on the standby controller B will also look similar to Controller A.

DO: Ensure that the data network on both controllers reflects the same network speeds and also Duplex is set to full on the Tintri VMstores.

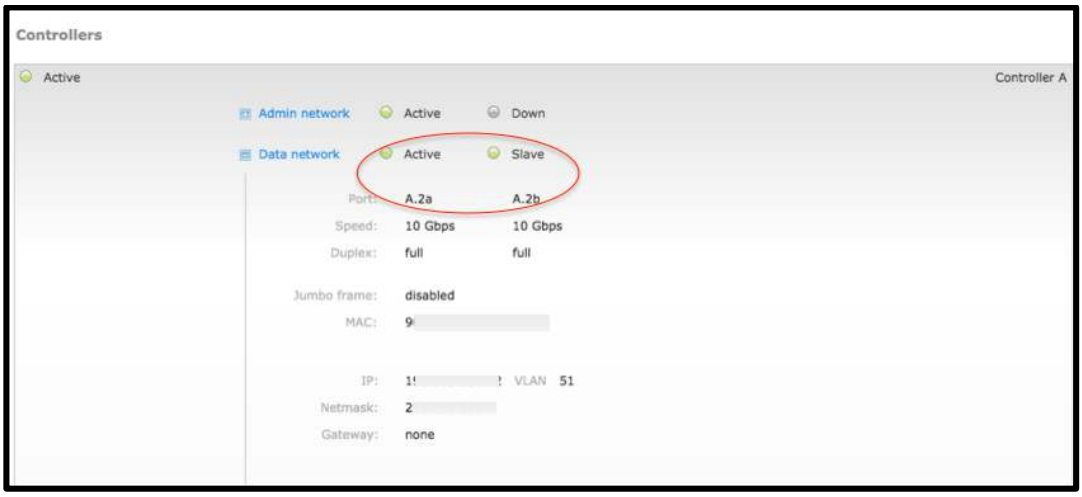

Figure 3: Active Controller on a Tintri VMstore.

Submounts

Before a Tintri VMstore is added to a RHEV host as storage, we recommend that you create separate NFS submounts if you plan to use Tintri VMstore in a multi-hypervisor configuration. Create submounts for RHEV ISO domain type and RHEV Data domain type on a Tintri VMstore.

DO: Create multiple NFS submounts for different hypervisors hosted on a Tintri VMstore. This will simplify and distinguish submounts for planned multi-hypervisor support in the data center and assist Tintri support with troubleshooting issues with RHEV.

DO: Follow RHEV deployment requirement to create separate submounts for RHEV ISO domain and RHEV Data domains.

The following steps illustrate how to create NFS submounts on a Tintri VMstore from a Red Hat Enterprise Linux host that has access to the Tintri VMstore data network:

1. mount –t nfs –o vers=3 TintriVMstore.*fully.qualified.domain.name*:/tintri /mnt
2. cd /mnt
3. mkdir RHEV1_Data
4. mkdir RHEV1_ISO
5. chown 36:36 RHEV1_Data
6. chmod 666 RHEV1_Data
7. Repeat steps 5 and 6 for RHEV1_ISO

The NFS submount created should have the following properties when compared to the figure 4. This NFS submount is now ready to be deployed as a RHEV Storage.

Figure 4: Tintri VMstore NFS submount for RHEV Data Domain.

Repeat steps 1 through 6 as needed additional RHEV Data Centers and RHEV Domain types on Tintri VMstores.

Hypervisor Setup on Tintri VMstore UI

In the Tintri VMstore UI, select *Settings* from the upper right hand corner of the web interface. *Adjust your VMstore's settings* window will pop-up. Select the Hypervisor managers on the left hand column and add the RHEV-M hypervisor. In the following example, the RHEV Manager *dc-rhev.fully.qualified.domain.name* is added to a Tintri VMstore using the default *@internal* domain.

DO: Prevent unsecured user access to the Tintri VMstore. When all the required RHEV Storage Domain submounts have been created, **unmount** TintriVMstore.*fully.qualified.domain.name:*/tintri from /mnt in step 1.

When the RHEV credentials are configured, click on *Test hypervisor managers* to test the configuration. Figure 5 shows an example of configuring a RHEV-M with Tintri VMstore.

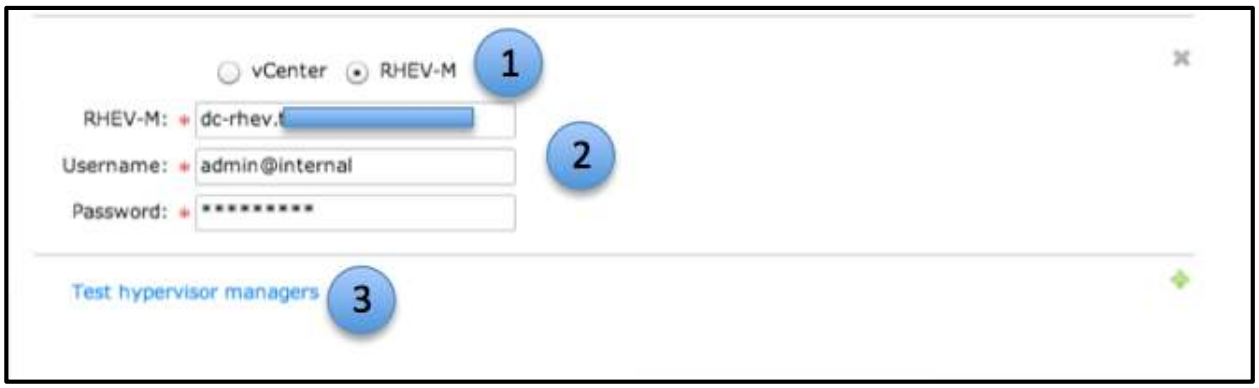

Figure 5: Configuring RHEV-M with Tintri VMstore.

You have successfully configured RHEV-M with a Tintri VMstore. The whole process of adding a Tintri VMstore to a RHEV environment literally takes minutes when a Tintri VMstore is properly racked, powered, and networked.

Host Network Configuration

When configuring network interfaces, we recommend that you use RHEV network bonding to ensure that no single physical port connection is a point of network failure. In figure 6, physical host C's storage network is **bond0** and connected to a 10 GigE network switch using VLAN 51. In addition to network bonding, the use of VLAN ensures that the logical networks for RHEV VM network, RHEV management network, and RHEV storage network in the RHEV cluster are properly identified and separated. It is also recommended to verify that the network speeds for the physical network are identical in a logical network bond.

DO: Use RHEV bonding to create bonded logical networks for the different network interfaces on the RHEV host. Ensure that the network speed match for each bonded network interface.

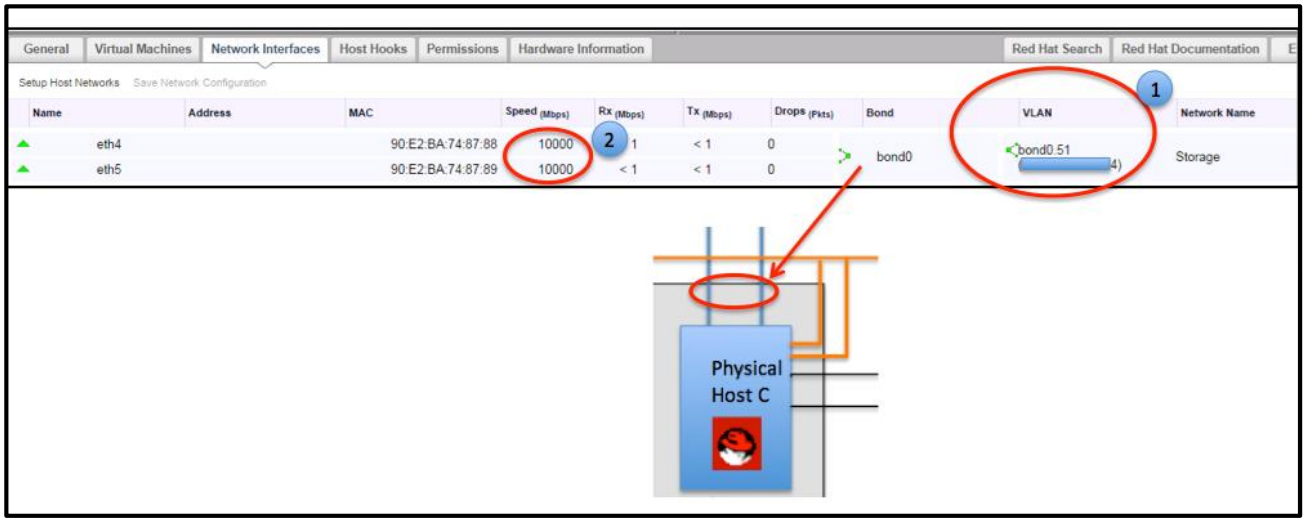

Figure 6: Host Network Configuration.

Additionally, the RHEV storage network is setup with *(Mode 1) Active-Backup* to ensure port availability in bond0 for the RHEV storage network from the host side. Active-Backup should work with all switch vendors and topologies. Figure 7 shows the RHEV supported network bonds on a RHEV host.

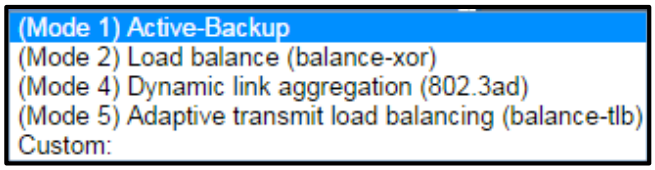

Figure 7: RHEV supported Network Bonds.

NOTE: Refer to your specific switch vendor documentation if other bonding technology is preferred. Be sure to update the switch ports as well if another bonding method is used.

In the Logical Networks tab of the Clusters view in the RHEV-M UI, select the Manage Networks to assign the type of networks for each logical network created as shown in figure 8. Use the *Required* checkbox to ensure that the cluster has the minimum number of logical networks. If a RHEV host does not have the required logical networks, RHEV will prevent the host from being added into the cluster.

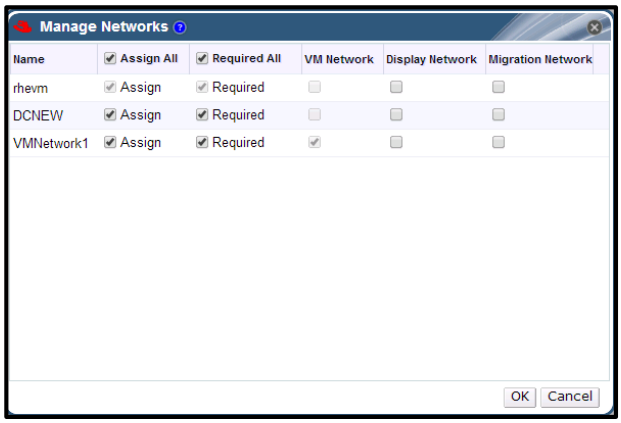

Figure 8: RHEV Manage Networks.

Storage Domains

To add a new domain/storage type to a RHEV environment, ensure the following minimum parameters are updated:

- Name:
  - Example of an invalid name: Tintri 650
  - Example of a valid name: Tintri_650
- Data Center:
  - RHEV Data Center that will have access to this storage
- Domain Function/Storage Type:
  - RHEV allows one ISO domain per Data Center.
  - An ISO domain on a Tintri VMstore can be shared between multiple Data Centers as long as the VMstore data network is accessible from the host
  - Select ISO/NFS for ISO domain on a Tintri VMstore
  - Select Data/NFS for a RHEV Data domain on a Tintri VMstore
- Use Host:
  - This is a RHEV host that has storage network access to the Tintri VMstore
- Export path:
  - Example: TintriVMstore.*fully.qualified.domain.name*:/tintri/RHEV_DC2

A RHEV installation has three types of domains:

1. RHEV Export Domain. This is a temporary storage repository for moving images between data centers and RHEV environments. It is not necessary to create RHEV export domains when using Tintri VMstores.
2. RHEV ISO Domain. Create one RHEV ISO domain that can be shared across RHEV Data Centers.
3. RHEV Data Domains. Create one RHEV Data domain per RHEV Data Center.

We recommend that you take advantage of Tintri's SnapVM™, CloneVM™, and ReplicateVM™ features to more efficiently move images, clone VMs, and replicate VMs to protect your RHEV environment without using a RHEV Export Domain.

DO: Share an ISO domain across RHEV Data Centers. ISO images that have been created in one ISO domain can be used by other Data Centers that are managed by the RHEV-M without duplicating efforts. You can create additional ISO domains on other Tintri VMstores as a backup but it cannot be added to RHEV Data Centers that have an existing ISO domain.

DO: RHEV Data domains can be shared between different RHEV Clusters within the same RHEV Data Center. RHEV restrictions prevent sharing of RHEV Data domains between RHEV Data Centers.

DO: Use Tintri VMstore SnapVM™ and CloneVM™ features to snap and clone VMs between Data Centers. Refer to the SnapVM™, CloneVM™ and ReplicateVM™ section of this document.

DO NOT: Create a RHEV Export Domain with Tintri VMstores. It is not necessary to create RHEV Export Domains with Tintri VMstores.

NOTE: The maximum number of ISO (one) domains allowed in a RHEV Data Center is a RHEV restriction. This was validated with RHEV version 3.3.4-0.53.el6ev.

With a new RHEV Storage Domain, configure the Domain name, the Data Center that the Storage Domain should belong to (see figure 9). If an ISO storage type has not been configured for the RHEV Data Center, select the drop-down menu in step 3. Select ISO/NFS option in step 4 to configure an ISO storage type for the RHEV Data Center. If an ISO storage type is already configured for the Data Center, the ISO/NFS option is not available in the drop down menu. Determine the *Use Host* in step 5 and complete the *Export Path* in step 6. It is a RHEV recommendation to use default values for the *Advanced Parameters*.

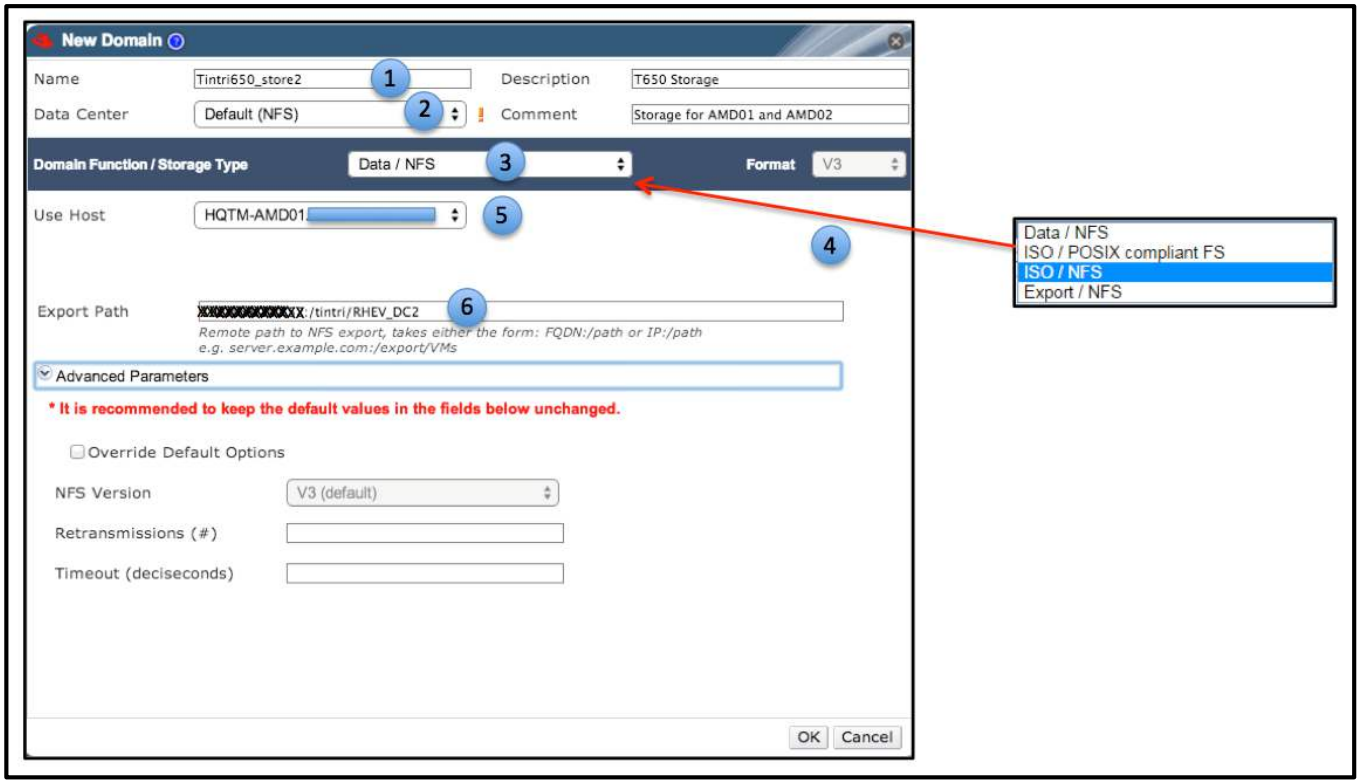

Figure 9: Adding a new Storage Domain to a RHEV Data Center.

A single RHEV ISO domain or ISO storage can be shared between multiple RHEV Data Centers. The RHEV host within a Data Center must be able to access the Tintri VMstore via the storage network. Complete the process of adding a new domain for the RHEV Data Center by selecting *OK*. In figure 10, *Data Center: Default* is configured with a RHEV Data Domain and a RHEV ISO domain. If the Data Center does not have an existing ISO storage, the *Attach ISO* option is available. Select and attach an existing ISO storage to share between Data Centers.

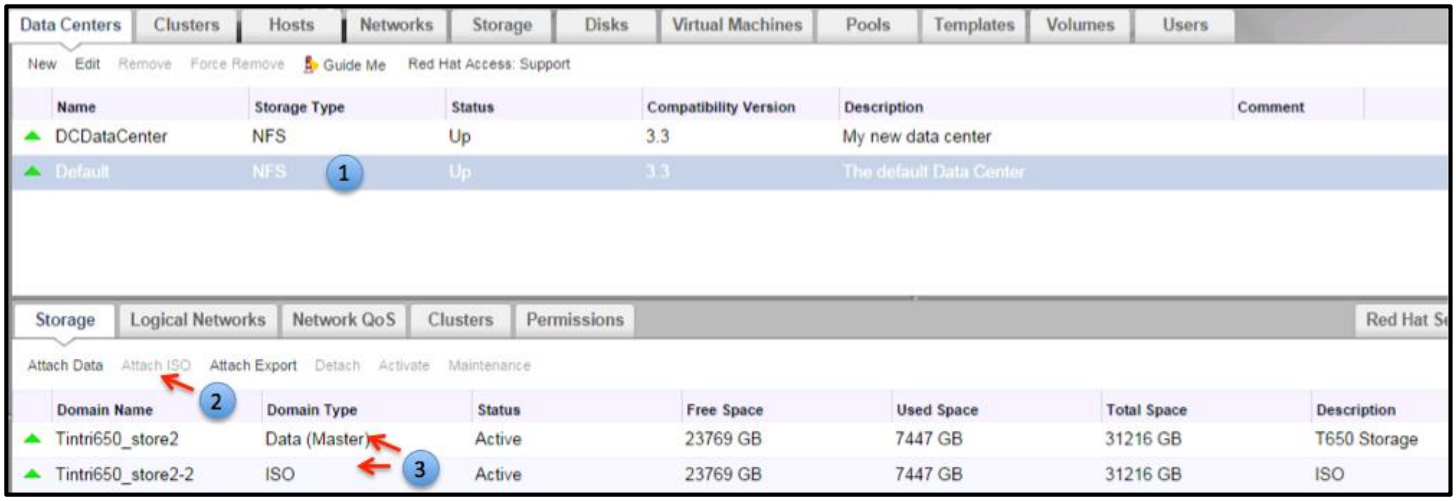

Figure 10: RHEV Data Center with two Storage Domains.

Tintri650_store2-2 ISO storage, as shown in figure 11, is shared between 2 Data Centers in this lab. Using a single ISO storage and sharing it between Data Centers allow the ISO images to be efficiently used by the Data Centers without having to recreate duplicate ISO images on multiple ISO domains.

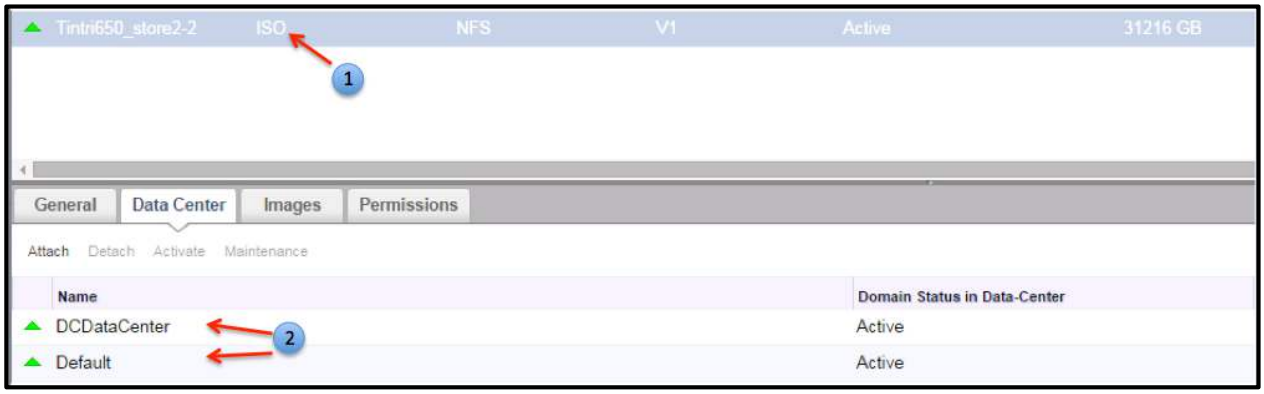

Figure 11: Tintri NFS submount shared between 2 RHEV Data Centers as an ISO Domain.

Although you can create multiple RHEV Data domains for each RHEV Data Center, we recommend that you create one RHEV Data domain on a Tintri VMstore for each Data Center. This simplifies management of RHEV Data domains for each Data Center.

However, if there are requirements to create more than 1 RHEV Data domain per RHEV Data Center, you can certainly do so and the configuration is supported with Tintri VMstore systems. There are no Tintri VMstore restrictions that will prevent multiple RHEV Data domains for each Data Center.

DO: Create one RHEV Data domain per RHEV Data Center. A RHEV-M Data Center admin can take advantage of Tintri VMstore features with a single RHEV Data domain per Data Center to manage images and migration.

There may be some requirements to use a particular ISO storage in a RHEV Data Center. For example, if a RHEV administrator decided to point to a different ISO storage, you must detach the existing RHEV ISO domain from the RHEV Data Center before adding a new ISO domain.

To detach a RHEV storage domain from an existing Data Center, select the Data Centers tab from the RHEV-M UI (see figure 12). Identify and select the Data Center to perform the Storage Domain detach. Select the Storage tab in the bottom pane of the window, right click on the storage domain and set the

domain to maintenance status. Right click on the domain again and select *Detach* to remove it from the existing Data Center. An ISO storage domain can be attached and detached from an existing Data Center without impacting other RHEV Data Centers. If there is such a need to retire any existing RHEV storage, the same process can be used to detach a RHEV Data domain from an older Tintri VMstore and attach a RHEV Data domain from a new Tintri VMstore to the Data Center for system upgrades.

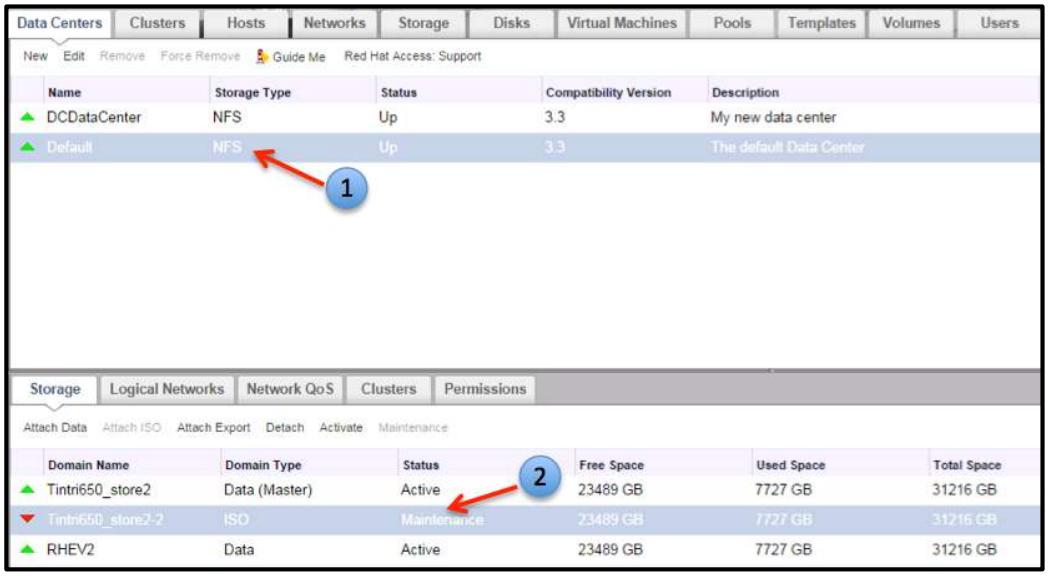

Figure 12: Detach RHEV Storage from a RHEV Data Center.

Adding ISO images to the ISO Domain

To populate an ISO Domain, review Populating the ISO Storage Domain section of the RHEV installation guide. You can also use tools such as winSCP on a Windows client to upload ISO images into the ISO Domain. In the example configuration, winSCP was used to copy ISO and RHEV tools from a Windows machine to the RHEV host. As shown in figure 13, ISO images were copied to /rhev/data-center/mnt/Tintri_VMstore_ISO_path/images/11111111-1111-1111-1111-111111111111/.

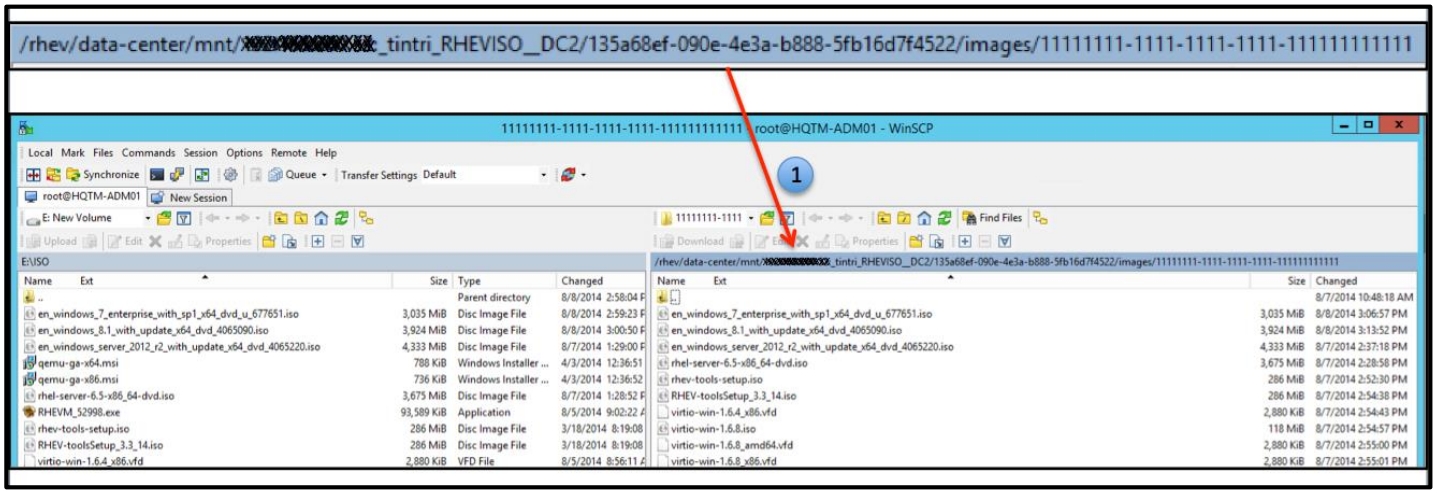

Figure 13: Using winSCP to copy ISO images to the ISO Domain.

Using winSCP to copy ISO images from a Windows system to the RHEV ISO domain can sometimes fail to rename the target file. In such cases, rename or move the temporary transfer file using your RHEV host that has access to the ISO domain (see figure 14).

```
-rw-r--r--. 1 root root  299448320 2014-09-16 00:25 RHEV-toolsSetup_3.3_14.iso.filepart
[root@HQTM-AMD01 11111111-1111-1111-1111-111111111111]# mv RHEV-toolsSetup_3.3_14.iso.filepart  RHEV-toolsSetup_3.3_14.iso
[root@HQTM-AMD01 11111111-1111-1111-1111-111111111111]#
```

Figure 14: Renaming ISO target file names in ISO Storage from a RHEV host.

Selecting the Images tab in the RHEV-M UI of the ISO domain will automatically refresh the image list. You have now successfully populated a RHEV ISO domain with an ISO image using winSCP (see Figure 15).

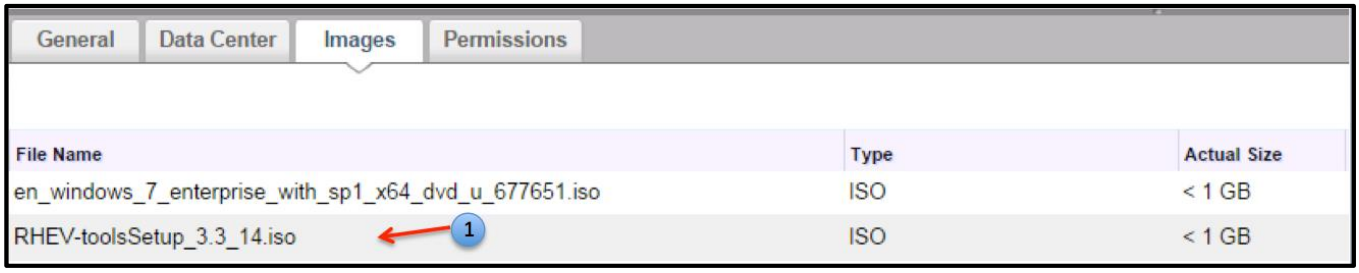

Figure 15: ISO Image in RHEV ISO Storage.

RHEV Virtual Machines on Tintri VMstores

Deploying and configuring a properly racked, powered, and networked Tintri VMstore with RHEV is easy and literally takes minutes. Creating virtual machines with RHEV is also easy. A Linux RHEV-M can be accessed from any supported web browser to manage your RHEV environment. For example, the test lab used for this best practice guide is accessed from a Windows 2008 R2 machine using Internet Explorer. By default, useful RHEV tools are located on the RHEV-M. The two directories within the RHEV-M that has useful tools are:

- /usr/share/rhev-guest-tools-iso
- /usr/share/virtio-win

To use SPICE console for managing your virtual machines with RHEV, the virt-viewer can be downloaded from Virtual Machine Manager.

To configure a VM in RHEV:

1. Determine which Cluster the VM will be created in.
2. Identify the Operating System
3. Determine the Boot Sequence
4. Attach the correct ISO version that corresponds with the Operating System (see figure 16).

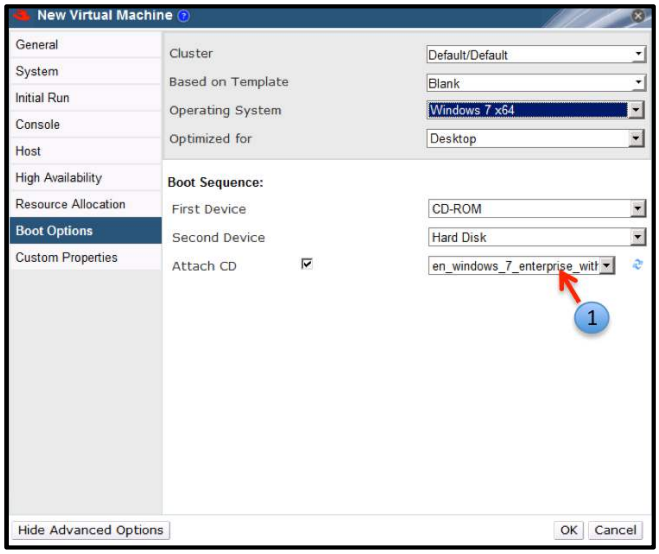

Figure 16: Attach CD to Virtual Machine.

Close the *New Virtual Machine* window by clicking on *OK*. A *New Virtual Machine – Guide Me* window pops up. Click on *Configure Virtual Disks* to attach a disk to the virtual machine. In the *Add Virtual Disk* window, determine the following for your virtual disk (see figure 17):

1. Size
2. Interface: VirtIO
3. Allocation Policy: Thin Provision
4. Storage Domain:
5. Is Bootable:
    a. Sets the bootable flag on the disk for the OS install on this virtual disk

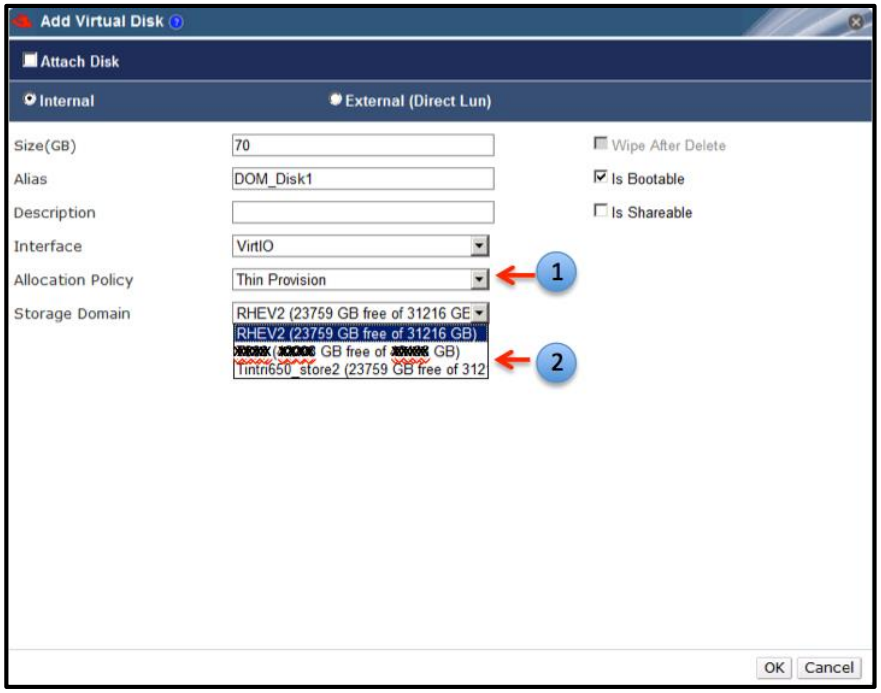

Figure 17: Adding Virtual Disk.

Tintri VMstore supports *Allocation Policy: Preallocated* and *Allocation Policy: Thin Provision*. However, preallocated disk provisioning is more expensive and wasteful. A VM with preallocated virtual disk does not necessarily utilize all of the assigned capacity. We recommended that you use *Thin Provision*. If additional disk capacity is required with the virtual disk, power off the VM, deactivate the virtual disk from RHEV-M and extend size as needed for the thin provisioned virtual disk (see figure 18).

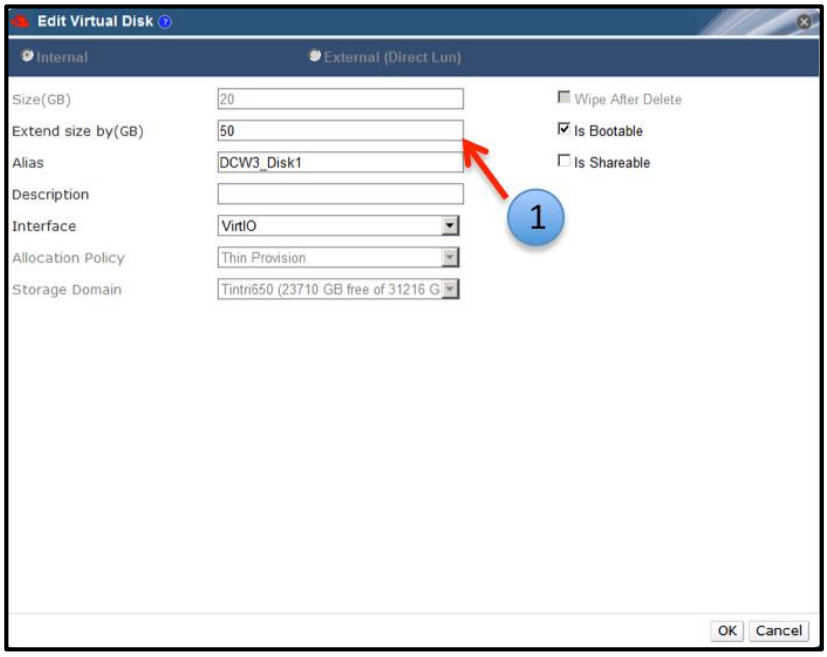

Figure 18: Extend existing Virtual Disk size.

DO: We recommend that you use *Allocation Policy: Thin Provision* for virtual disks for space savings and capacity planning purposes.

NOTE: When cloning with Tintri VMstores, Tintri converts thick provisioned disks to thin provisioned.

If you need to expand existing capacity on an active virtual machine, use the RHEV-M *Add Disk* option to add additional thin provisioned virtual disk to the powered up virtual machine (see figure 19). When a new virtual disk has been created, use the *Add* option in the *Virtual Machines* tab to attach the new virtual disk to the virtual machine.

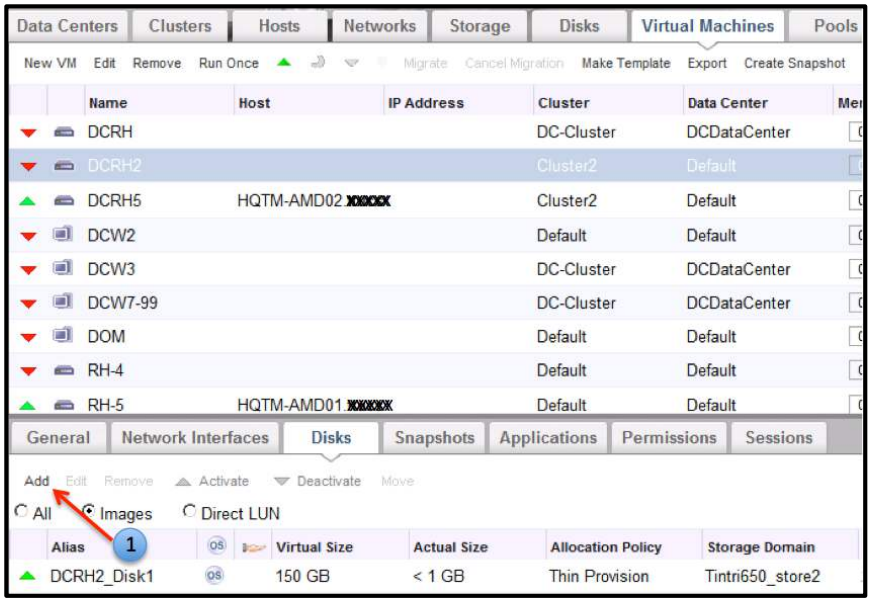

Figure 19: Adding Virtual Disk to an existing Virtual Machine.

DO NOT: Create more than 10 VMs per physical core. Refer to the Red Hat Enterprise Virtualization Sizing Guide for RHEV recommendation on the recommended number of guests per physical core on a RHEV host.

Installing Drivers and Guest Tools

Installing SCSI controller drivers for Windows virtual machines are done at OS install phase of a Windows virtual machine. This will allow your Windows virtual machine to detect the unallocated disk volume. With Windows guest virtual machines, you can use the *Change CD* option to switch the ISO image during OS installation to install the required SCSI drivers or use the *Boot Options* in the Run Virtual Machine window to attach a floppy from the ISO domain (see Figure 20).

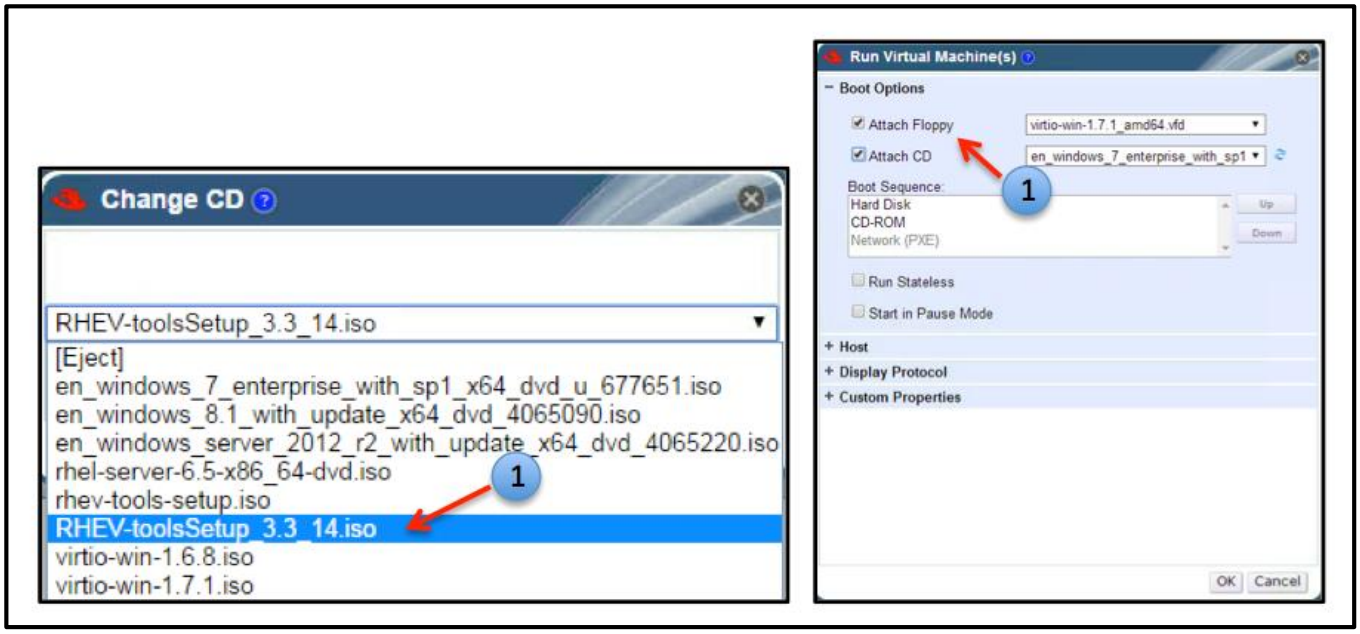

Figure 20: Using Change CD or Attach Floppy to install RHEV Virtual Machine drivers.

If attempting to install specific SCSI controller driver from the RHEV-toolsSetup ISO image, browse into the subdirectories of the mounted ISO image to find the correct drivers. For example, if the virtual disk is not discoverable during the Windows OS install phase, load the appropriate ISO image and browse into the subfolders for the particular OS version to discover and install the correct device driver (see Figure 21).

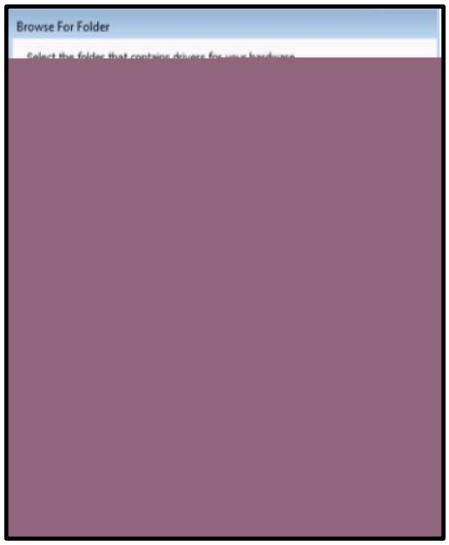

Figure 21: Browsing subfolders to install SCSI drivers.

If using the floppy to install the SCSI controller driver, browse into the correct OS folder and click on OK. As shown in figure 22, install the correct SCSI controller drivers and continue with installing the Windows OS on the virtual machine on the discovered disk. The OS install for the Windows virtual machine should complete successfully.

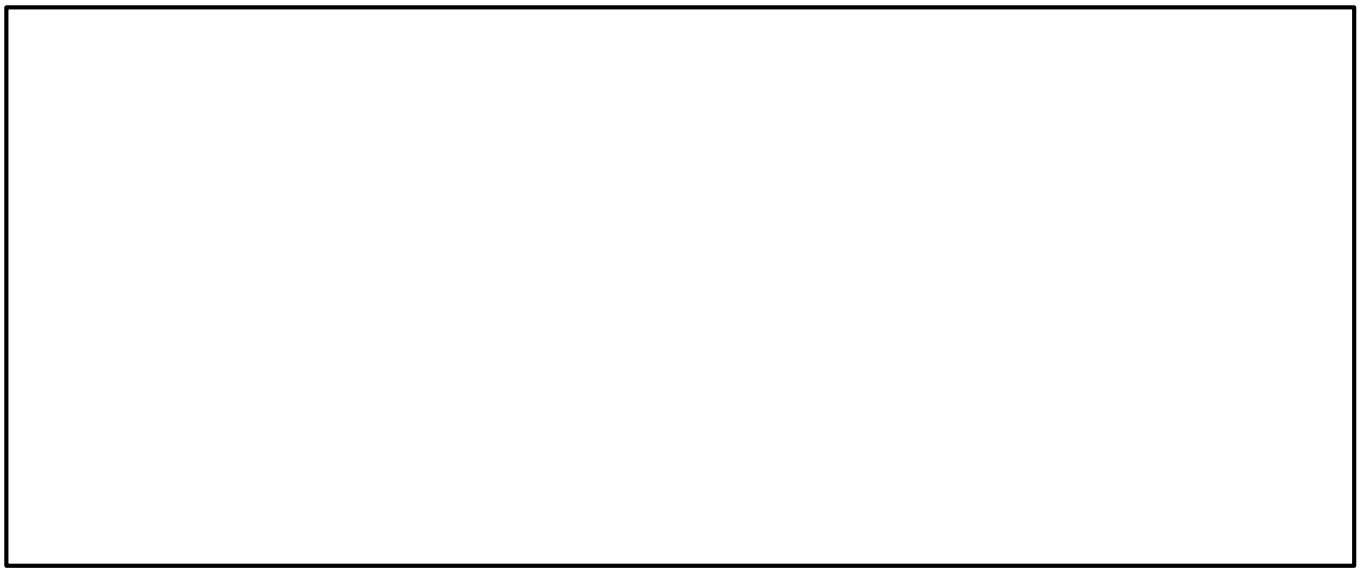

Figure 22: Installing SCSI Controller drivers for Windows OS install.

Once the OS installation is complete, install the rest of the required drivers and agents for your virtual machine. You can also use the RHEV-toolsSetup_3.3_14.iso to install the RHEV tools (i.e. network drivers, etc). Run the RHEV-toolssetup to bring up the InstallShield Wizard and install all the drivers and agent tools on the virtual machine (see figure 23).