Hyper-V Installation Guide, 17.2.0

November 2017

Supporting AT&T Vyatta Network Operating System

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About This Guide

This guide describes how to install and upgrade the AT&T Vyatta vRouter (referred to as a virtual router, vRouter, or router in the guide) running on Hyper-V systems.

Installing the System

Overview of installing on Microsoft Hyper-V

Microsoft Hyper-V is a virtualization platform. Like other virtualization platforms, Hyper-V provides the ability to run multiple virtual machines on a single hardware platform. You can run the AT&T Vyatta vRouter as a virtual machine on the Hyper-V platform.

This document is for running the AT&T Vyatta vRouter image on a Windows-based system installed with Hyper-V.

Hyper-V Manager is the management system for Hyper-V. Hyper-V Manager enables you to manage multiple physical servers that are running Hyper-V, in addition to all the virtual machines that are running on each of the physical servers. On Hyper-V, virtual machines are created by using virtual machine templates. For each release of its software, AT&T provides a Hyper-V virtual machine template that you can use to create virtual machines that are running the AT&T Vyatta vRouter. In addition, AT&T also provides an ISO image that you can install on any system that is running a hypervisor.

AT&T provides a prebuilt Virtual Hard Disk (VHD) for Hyper-V that you can use to run the AT&T Vyatta vRouter on a Hyper-V virtual machine. Using the VHD simplifies the installation.

Refer to Installing the AT&T Vyatta vRouter Hyper-V VHD *(page 8)* for procedures to create an AT&T Vyatta vRouter virtual machine by using the VHD for Hyper-V.

AT&T also provides an ISO that you can install on a Hyper-V virtual machine.

Refer to Installing the AT&T Vyatta vRouter ISO on Hyper-V *(page 9)* for procedures to install the AT&T Vyatta vRouter ISO on a Hyper-V virtual machine.

Hyper-V feature restrictions

This section describes the following restricted vRouter features that do not function or require specific Hyper-V configuration in the Hyper-V environment.

Restricted features include:

- LACP does not work on Hyper-V
- VRRP in RFC-Compliant mode

  Currently, no Hyper-V settings allow RFC-compliant MAC address behavior for VRRP interfaces. To prevent RFC compatibility issues when running a vRouter on a Hyper-V platform, by default, RFC-compliant MAC address behavior is not enabled on the vRouter.
- Port Mirroring (SPAN, RSPAN, ERSPAN)

  Hyper-V must have MAC address spoofing enabled in order for Port Mirroring to work.

VRRP in RFC-Compliant mode

VRouter features that do not work in the Hyper-V environment include the behavior of RFC-compliant MAC addresses for VRRP interfaces.

The default behavior of non-RFC-compliant MAC addresses is required for any deployment in which Hyper-V provides Layer 2 services, because it appears that Hyper-V does not support delivery of multicast packets sent from a virtual MAC. For more information, refer to Hyper-V documentation.

Port Mirroring (SPAN, RSPAN, ERSPAN)

Regardless of the flavor used, the vRouter replicates traffic to the destination interface from a multitude of MAC addresses from which the traffic was originally received. Hyper-V blocks all such traffic unless a Hyper-V feature called MAC Spoofing is enabled. For more information, refer to Hyper-V documentation.

Note:

A Google search of "hyper-v mac spoofing" yields good results.

Preparing for installation

The VM install image is the simplest way to get a vRouter up and running quickly. If the parameters of the VM install image do not meet your requirements or additional settings are required, then the vRouter can be installed from the ISO.

Before installing the AT&T Vyatta vRouter software, prepare for the installation by performing the following steps:

- Download the AT&T Vyatta vRouter Hyper-V files. Refer to Downloading the AT&T Vyatta vRouter files for Hyper-V *(page 8)* for instructions on how to download the available files.
- Install Hyper-V on a server. The AT&T Vyatta vRouter installation procedures requires that the Hyper-V server is operational. Hyper-V and accompanying documentation can be obtained from Microsoft at http://www.microsoft.com.
- If you are using Hyper-V 2012, do not enable the following features:
  - Router guard
  - DHCP guard
  - IP address rewrite
  - Generic Routing Encapsulation (GRE)
- Make sure that you have a minimum of 2 GB of free space on the system for a root partition. A minimum of 4 GB of free space is recommended for a production installation.
- Make sure that you have a minimum of 4 GB of RAM on the system. A minimum of 4 GB is recommended for a production installation.
- The data plane supports from 1 to 128 CPUs. At least 4 CPUs are recommended for optimum performance.

Note: The vRouter works only on Generation 1 Hyper-V systems.

Hyper-V VM settings

While within Hyper-V you can assign vCPUs to VMs, these vCPUs are effectively threads that compete with the threads of other VMs for resources. AT&T recommends dedicated CPUs for the vRouter so that the data plane gets cache hits and there is not continual in and out swapping of data when forwarding packets. AT&T recommends 1 CPU for every interface and 1 CPU for every control plane.

AT&T recommends the following settings for a vRouter VM to make the vCPU in Hyper-V as close to a dedicated CPU as possible:

- VM reserve: 100
- VM limit: 100
- Relative weight: 10000

AT&T also recommends that you switch hyperthreading off for the hypervisor.

Hyper-V device-driver versions

To avoid serious performance issues, AT&T recommends that you ensure that all device drivers are up to date on the Hyper-V instance on which you plan to install an AT&T VM. For more information about the types of performance issues that you might experience if you do not have the latest device drivers, refer to the following Microsoft support bulletins:

- 2902166
- 2986895

Downloading the AT&T Vyatta vRouter files for Hyper-V

To download the VHD file and the ISO image files, follow the procedure in this section.

Before downloading the files, determine the type of installation that you require. The `.vhd` file includes the Hyper-V template and Hyper-V-specific customizations and optimizations for the AT&T Vyatta vRouter. If you are going to use the Hyper-V template, download the `.vhd` file. Otherwise, download only the `.iso` file.

To download and copy the AT&T Vyatta vRouter VHD for Hyper-V:

> **Note:** For detailed instructions on how to download software from the Business Center website, refer to *Software Download User Guide* available at this website.

1. Go to the Business Center website at https://www.att.com/ebiz/registration/home.jsp#/login and sign in.
2. Select **Support**.
3. From the Support page, select **Product Help**.
4. Select **Vyatta**, **5600**, and **ISOs**.
5. From the list of AT&T Vyatta vRouter downloadable files, locate the Hyper-V files.
   a. Click on the required file to proceed with the download.

      Result: After you click on the file to be downloaded, the **Export Compliance** screen with an Export Compliance statement is displayed followed by an End User License Agreement (EULA).

   b. You must agree to accept both the statement and the EULA to download the file. If you have any concerns with the EULA, consult AT&T technical support.
6. Save the downloaded file to a location on your Hyper-V server.
7. Make a copy of the `.vhd` file in a location where other VHD files are stored. For example, `C:\Users\Public\Public Documents\Hyper-V\Virtual` hard disks.

   Info:

   Note: The original AT&T Vyatta vRouter VHD can be copied again to create additional AT&T Vyatta vRouter virtual machines as required.
8. Rename the new file as appropriate, to reflect the identity of the virtual machine that you are using.

Installing the AT&T Vyatta vRouter Hyper-V VHD

To simplify the installation process, AT&T provides an optimized Hyper-V virtual hard disk (VHD) for each release. The VHD includes the AT&T Vyatta vRouter with optimizations for virtual environments and Hyper-V-specific customizations and optimizations.

Creating the AT&T Vyatta vRouter virtual machine

After a copy of the AT&T Vyatta vRouter VHD is created on the Hyper-V machine, you can create a virtual machine from it.

> **Note:** The following procedure describes the creation by using Hyper-V Manager on Windows Server 2012. A similar procedure is required for other versions of Hyper-V Manager or Virtual Machine Manager (VMM).

To create an AT&T Vyatta vRouter virtual machine:

1. Within Hyper-V Manager, select the Hyper-V server to which you wish to add the new virtual machine.
2. From the **Action** menu, select **New#Virtual Machine** to start the **New Virtual Machine Wizard**.

   Info: The **Before You Begin** screen is displayed.

   a. Click **Next** to create a virtual machine with a custom configuration.

      Result: The **Specify Name and Location** screen is displayed.

b. On the **Specify Name and Location** screen, specify a name for the virtual machine that you are going to create.
c. Click **Next**.

   Result: The **Specify Generation** screen is displayed.

d. On the **Specify Generation** screen, select either **Generation 1** or **Generation 2** and click **Next**.

   Result: The **Assign Memory** screen is displayed.

e. On the **Assign Memory** screen, specify the amount of memory that is required for the virtual machine. A minimum of 2 GB is recommended.
f. Click **Next**.

   Result: The **Configure Networking** screen is displayed.

3. On the **Configure Networking** screen, specify the virtual network to use.
4. Click **Next**.

   Result: The **Connect Virtual Hard Disk** screen is displayed.

5. On the **Connect Virtual Hard Disk** screen, select **Use an existing virtual hard disk** and browse to the copy of the AT&T Vyatta vRouter VHD that you created.
6. Click **Next**.

   Result: The **Completing the New Virtual Machine Wizard** screen is displayed.

7. On the **Completing the New Virtual Machine Wizard** screen, confirm that the information that you provided is correct.
8. Click **Finish**.

   Info: The new virtual machine is created and is displayed in the list of virtual machines in Hyper-V Manager.

9. Configure the number of virtual processors for the Virtual Machine.

   Info: Counter-intuitively this is done after initial Virtual Machine creation. Click on Processor in the left-hand margin and select the number needed for your installation. The data plane supports is from 1 to 128 CPUs. For optimum performance, three processors for each NIC plus one for the control plane is recommended.

10. Start the AT&T Vyatta vRouter virtual machine.

    Result: It boots as an image-based system from the virtual hard disk.

11. Test the installation.

    Info: Refer to the next sections.

Installing the AT&T Vyatta vRouter ISO on Hyper-V

Follow the procedure in this section to install the AT&T Vyatta vRouter ISO on Hyper-V. Before installing the AT&T Vyatta vRouter ISO on Hyper-V, download the ISO file. Refer to Downloading the AT&T Vyatta vRouter files for Hyper-V *(page 8)*.

Note: If you are installing a 32-bit virtual machine, use the AT&T Vyatta vRouter virtual ISO that is made specifically for this type of virtual machine.

Note: For AT&T Vyatta vRouter running on Hyper-V, refer to http://technet.microsoft.com/en-in/library/cc917873.aspx for information on how to configure a network adapter. The AT&T Vyatta vRouter supports the **Synthetic network adapter** only. Do not select **Emulated network adapter** when you configure network adapters for a virtual machine running on the AT&T Vyatta vRouter.

Creating a virtual machine that boots from the AT&T Vyatta vRouter ISO

After a copy of the AT&T Vyatta vRouter ISO is downloaded to the Hyper-V machine, you can create a virtual machine and boot it from the ISO.

> **Note:** The following example describes the procedure using Hyper-V Manager on Windows Server 2012. A similar procedure is required for other versions of Hyper-V Manager or Virtual Machine Manager (VMM).

To create a virtual machine:

1. Within Hyper-V Manager, select the Hyper-V server to which you wish to add the new virtual machine.
2. From the **Action** menu, select **New#Virtual Machine** to start the New Virtual Machine Wizard.

   Info: The **Before You Begin** screen is displayed.

   a. On the **Before You Begin** screen, click **Next**.

      Result: The **Specify Name and Location** screen is displayed.

   b. Click **Next**.

      Result: The **Assign Memory** screen is displayed.

3. On the **Assign Memory** screen, specify the amount of memory that is required for the virtual machine. A minimum of 2 GB is recommended.
4. Click **Next**.

   Info: The **Configure Networking** screen is displayed.

5. On the **Configure Networking** screen, specify the virtual network to use.
6. Click **Next**.

   Info: The **Connect Virtual Hard Disk** screen is displayed.

7. On the **Connect Virtual Hard Disk** screen, select **Create a virtual hard disk** and specify the name, location, and size of the virtual hard disk.

   a. Click **Next**.

      Result: The **Installation Options** screen is displayed.

8. On the **Installation Options** screen, select **Install an operating system from a boot CD/DVD#ROM**, and **Image file (.iso)** then browse to the location of the AT&T Vyatta vRouter ISO that you downloaded.

   a. Click **Next**.

      Result: The **Completing the New Virtual Machine Wizard** screen is displayed.

   b. On the **Completing the New Virtual Machine Wizard** screen, confirm that the information that you provided is correct.

   c. Click **Finish**.

      Result: The new virtual machine is created and is displayed in the list of virtual machines in Hyper#V Manager.

Start the virtual machine and connect to it by using Hyper#V Manager.

Installing the AT&T Vyatta vRouter

The system boots from the AT&T Vyatta vRouter ISO. To install the AT&T Vyatta vRouter onto the virtual hard disk associated with the virtual machine, perform the following steps:

1. On the **Virtual Machine Connection** screen.
2. At the Vyatta command prompt, run the `install image` command and follow the prompts to install the AT&T Vyatta vRouter onto the virtual hard disk.
3. Enter a username for the administrator account.

4. Enter a password for the new username that you provided for the administrator.

   Info:

   Note: If you do not enter a username for the administrator, the device uses the default username, that is `vyatta`.

5. Shut down the virtual machine.
6. From the **Media** menu on the **Virtual Machine Connection** screen, select **DVD Drive#Eject xxx.iso** (where *xxx* is the name of the AT&T Vyatta vRouter ISO that you downloaded). This configuration allows the virtual machine to boot to the virtual hard disk instead of the ISO.
7. Start the virtual machine.

   Result: This time it boots as an image#based AT&T Vyatta vRouter from the virtual hard disk.

8. Test the installation.

Operating an AT&T Vyatta vRouter virtual machine

After you create an AT&T Vyatta vRouter virtual machine on Hyper-V, you can operate the virtual machine in the same way as any other virtual machine on Hyper-V.

To operate the AT&T Vyatta vRouter virtual machine:

1. Select the AT&T Vyatta vRouter virtual machine in the left pane of Hyper-V and right-click on the machine to see the list of options.
2. Click **Start**.
3. Select the **Console** tab to access the AT&T Vyatta vRouter console.

   Info:

Testing your installation

After the system has successfully booted, you see the vyatta login: prompt. This prompt indicates that the system is operational.

Verifying the release and system type

The next step is to confirm that the correct release is running on the device. To verify the release and system type:

1. Log in with the username and password that you provided during installation. During installation, if the default vyatta default user was not chosen and a new user was created, then use the new username and password to log in. Use the default password of vyatta unless you have changed it.
2. Run the `show version` command.

   Result:

   The Version: line displays the version number of the system that is running. Make sure that the displayed result is the correct version.

   The System type: line displays the type of hardware on which the system is running and whether it is in a virtual environment. Make sure that the displayed result is the correct version.

   The Boot via: line displays the type of system that is running.

Verifying connectivity

The final step is to confirm that the AT&T Vyatta vRouter can be accessed on the local network. A quick-and-easy way to do this is to configure an Ethernet interface on the system and then ping the interface from another host on the network.

Note: In the AT&T Vyatta vRouter, a data-plane interface is an abstraction that represents the underlying physical or virtual Ethernet interface of the systems.The terms Ethernet interface and data-plane interface are synonymous in this guide.

To test system connectivity:

1. At the command prompt, enter the commands that are shown in the example, substituting an IP address from your existing subnet.

   Example: The example uses the following network and IP address.

   - The network is 192.168.1.0/24.
   - The IP address of the interface is 192.168.1.81.

   Make the appropriate substitutions for your network, as shown in the following example that shows how to configure a test Ethernet interface.

   ```
   vyatta@vyatta:~$ configure
   vyatta@vyatta# set interfaces dataplane dp0sN address 192.168.1.81/24
   vyatta@vyatta# commit
   vyatta@vyatta# save
   vyatta@vyatta# exit
   vyatta@vyatta:~$
   ```

2. From another host on the same subnet, ping the interface to ensure that it is up. From a Linux or Windows command prompt, enter the following command, substituting the IP address you assigned to the interface.

   Example:

   ```
   ping 192.168.1.81
   ```

   Result: If the AT&T Vyatta vRouter can be reached, you see replies from it in response to the pings. If so, your system is installed and can be accessed on your network.

Upgrading the System

Release-specific upgrade information

Your system may have special upgrade considerations, depending on the release.

For release-specific upgrade information, and to ensure that configuration information is correctly preserved across upgrades, consult the release notes for your release.

Upgrade overview

The method you use to upgrade your system depends on the method you used to install the system.

- If you installed the AT&T Vyatta vRouter by using the AT&T Vyatta vRouter Virtual Hard Disk (VHD) for Hyper-V, then upgrade with the instructions given in Upgrading a VHD-installed system *(page 13)*.
- If you installed the AT&T Vyatta vRouter by using the AT&T Vyatta vRouter ISO, then upgrade with the instructions given in Upgrading an ISO-installed system *(page 15)*.

Before upgrading

Perform the following tasks before upgrading your system:

- Save your existing configuration file for reference. Your configuration file is named `config.boot` and is located in the directory `/config` .
- Make sure that you have enough space on your root partition to load the image. You can determine the amount of space available by using the `show system storage` command.

Upgrading a VHD-installed system

The AT&T Vyatta vRouter VHD for Hyper-V consists of the following:

- AT&T Vyatta vRouter ISO
- Other Hyper-V-specific modifications and optimizations.

The way you upgrade an AT&T Vyatta vRouter VHD-installed system depends on what part of the VHD has changed. The following table shows the upgrade options for VHD-installed systems.

Table 1: Upgrade options for AT&T Vyatta vRouter VHD-installed systems

What has changed	What you need to upgrade:
Hyper-V-specific modifications	Upgrade the full VHD. Use the procedure given in Upgrading the full VHD *(page 14)*.
AT&T Vyatta vRouter ISO	Upgrade just the AT&T Vyatta vRouter ISO. Use the add system image command. Use the procedure given in Upgrading the AT&T Vyatta vRouter ISO by using "add system image" *(page 14)*.
You are not sure	Use the procedure given in Upgrading the AT&T Vyatta vRouter ISO by using "add system image" *(page 14)*.

Upgrading the full VHD

When Hyper-V-specific content in the AT&T Vyatta vRouter VHD is changed, you must perform an upgrade to the new VHD, using the procedure in this section.

To upgrade the AT&T Vyatta vRouter VHD:

1. Save your current system configuration (`/config`) to a separate location on your network.
2. Using the new AT&T Vyatta vRouter VHD, create a new virtual machine in your Hyper-V environment. Refer to the instructions in Installing the AT&T Vyatta vRouter Hyper-V VHD *(page 8)*.
3. Perform initial configuration of the new virtual machine and test the installation to verify connectivity on the network.
4. Shut down the old system so that it does not conflict with the new system.
5. Load the configuration that you saved onto the new AT&T Vyatta vRouter virtual machine.
6. For each Ethernet interface in the loaded configuration, delete the hardware ID. (In configuration mode, use the `delete interface ethernet ethx hw-id` command, where *ethx* is the name of the Ethernet interface).
7. Reboot the system by using the `reboot` command. The system restarts with the new configuration.

Upgrading the AT&T Vyatta vRouter ISO by using "add system image"

When the ISO of the AT&T Vyatta vRouter VHD is changed, perform an upgrade to the ISO by following the procedure in this section.

The `add system image` command uses an AT&T Vyatta vRouter ISO file as the image source. It installs the image with existing images and sets the new image as the default boot image. The new image is run the next time you reboot the system.

To prepare for the upgrade, determine the location of the AT&T Vyatta vRouter ISO file and record the name of the file.

To upgrade the ISO:

1. Enter the `add system image` command. Use the location and name of the AT&T Vyatta vRouter ISO file as arguments in the command, as shown in Sample session: "add system image" *(page 14)*.
2. Before you reboot, confirm that the new image is loaded and ready to run the next time the system is rebooted. (Enter the `show system image` command; see the relevant example in Sample session: "add system image" *(page 14)*.)
3. Reboot the system by entering the `reboot` command. The system restarts with the new system image.

Sample session: "add system image"

The following example shows a session in which the `add system image` command is used to upgrade to the `xxx.iso` system image where *xxx* is the file name of the ISO image you have downloaded. In the following example, the image 3.2.1R1 is used.

```
vyatta@vyatta:~$ add system image /home/vyatta/xxx.iso
Checking MD5 checksums of files on the ISO image...OK.
Done!
What would you like to name this image? [3.2.1R1]:
OK.  This image will be named: 3.2.1R1
Installing "3.2.1R1" image.
Copying new release files...
Would you like to save the current configuration directory and config file? (Yes/No) [Yes]:
Copying current configuration...
Would you like to save the SSH host keys from your current configuration? (Yes/No) [Yes]:
Copying SSH keys...
Setting up grub configuration...
Done.
vyatta@vyatta:~$
```

The following example uses the **show system image** command to view installed images.

```
vyatta@vyatta:~$ show system image

The system currently has the following image(s) installed:

   1: xxx (default boot)
   2: yyy (running version)
```

Upgrading an ISO-installed system

The ISO preparation of the AT&T Vyatta vRouter has modifications and optimizations intended, in general, for virtual environments. On an ISO-installed system, use the `add system image` command to upgrade.

The `add system image` command uses an AT&T Vyatta vRouter ISO file as the image source. It installs the image with existing images and sets the new image as the default boot image. The new image is run the next time the system is rebooted.

To prepare for the upgrade, determine the location of the AT&T Vyatta vRouter ISO file and record the name of the file.

To upgrade the ISO:

1. Enter the `add system image` command. Use the location and name of the AT&T Vyatta vRouter ISO file as arguments in the command, as shown in Sample session: "add system image" *(page 15)*.
2. Before you reboot, confirm that the new image is loaded and ready to run the next time the system is rebooted. (Enter the `show system image` command; see the relevant example in Sample session: "add system image" *(page 15)*.)
3. Reboot the system by entering the `reboot` command. The system restarts with the new system image.

Sample session: "add system image"

The following example shows a session in which the `add system image` command is used to upgrade to the `xxx.iso` system image where *xxx* is the file name of the ISO image you have downloaded. In the following example, the image 3.2.1R1 is used.

```
vyatta@vyatta:~$ add system image /home/vyatta/xxx.iso
Checking MD5 checksums of files on the ISO image...OK.
Done!
What would you like to name this image? [3.2.1R1]:
OK.  This image will be named: 3.2.1R1
Installing "3.2.1R1" image.
Copying new release files...
Would you like to save the current configuration directory and config file? (Yes/No) [Yes]:
Copying current configuration...
Would you like to save the SSH host keys from your current configuration? (Yes/No) [Yes]:
Copying SSH keys...
Setting up grub configuration...
Done.
vyatta@vyatta:~$
```

The following example shows how to display installed images.

```
vyatta@vyatta:~$ show system image
The system currently has the following image(s) installed:
   1: xxx (default boot)
   2: yyy (running version)
```

Installation and Upgrade Commands

add system image

Adds a binary system image to the currently running system.

Syntax:

`add system image` { *iso-filename* | *iso-URL* [**`username`** *username* **`password`** *password*] }

iso-filename
Name of the image file to be added.

iso-URL
URL location of the image file to be added.

`username` ***username***
Specifies the username that is required to log in to the remote system at the indicated URL location.

`password` ***password***
Specifies the password that is required to log in to the remote system at the indicated URL location. If the username is specified, then a password must also be specified.

Operational mode

Use this command to add a binary image to the currently running system. A system image can be added to a system that was installed by using a disk-based installation or an image-based installation. After an image is added, it is set as the new default boot image and is run the next time the system is booted.

The command validates the MD5 checksums of the files that are contained in the ISO image to ensure that the image has not been corrupted. In addition, the command does not allow more than one copy of an image to exist on the same system.

The *iso-filename* and *iso-URL* arguments provide the source for the ISO image file.

The following table shows how to specify the file syntax for different file locations.

Location	Specification
An absolute path	For *iso-filename*, use standard UNIX file specification.
A relative path	For *iso-filename*, you can also specify the path name relative to the current directory.
FTP server	Use the following syntax for the *iso-URL* argument: `ftp://user:passwd@host/image-file` where *user* is the username on the host, *passwd* is the password that is associated with the username, *host* is the host name or IP address of the FTP server, and *image-file* is the ISO image file, including the path. Alternatively, the username and password can be specified as **`username`** and **`password`** arguments of the `add system image` command. If you do not specify *user* and *passwd*, you are prompted for them.

Location	Specification
SCP server	Use the following syntax for the *iso-URL* argument: `scp://user:passwd@host/image-file` where *user* is the username on the host, *passwd* is the password that is associated with the username, *host* is the host name or IP address of the SCP server, and *image-file* is the ISO image file, including the path. Alternatively, the username and password can be specified as **`username`** and **`password`** arguments to the `add system image` command. If you do not specify *user* and *passwd*, you are prompted for them.
HTTP server	Use the following syntax for the *iso-URL* argument: `http://host/image-file` where *host* is the host name or IP address of the HTTP server and *image-file* is the ISO image file, including the path relative to the HTTP root directory.
TFTP server	Use the following syntax for the *iso-URL* argument: `tftp://host/image-file` where *host* is the host name or IP address of the TFTP server, and *image-file* is the ISO image file, including the path relative to the TFTP root directory.

clone system image

Creates a copy of a system image that is installed on the local system or a remote system.

Syntax:
`clone system image` [*user@host:*] *source-image-name new-image-name* [**`clean`**]

user
Username on a remote host. A username is required for remote host access through SCP and is not required for cloning a local system image.

host
Host name or IP address of a remote host. The host name or IP address is required for remote access through SCP and is not required for cloning a local system image.

source-image-name
Name of a system image to be copied. The source image can exist on the local system or a remote system.

new-image-name
Name of the new (copied) system image. An image with this name must not exist on the system.

`clean`
Creates an empty read/write directory tree for the new image, which is a new image that is functionally equivalent to the source image as it existed when it was originally installed.

Operational mode

Use this command to create a copy of a system image that is installed on the local system or a remote system.

If *user@host* is specified, the image is fetched from the named host by using the Secure Copy Protocol (SCP). If *user@host* is omitted, *source-image-name* is the name of an image that exists on the system, and *new-image-*

name is the image name that the system uses for the clone. No image that is named *source-image-name* can exist on the system.

Command completion is performed for local image names if *user@host* is not specified. No command completion is performed on remote image names if *user@host* is specified.

If the **clean** argument is omitted, the command copies the `squashfs` file that is being used by the image named *source-image-name* and the read/write directory tree of *source-image-name*. If the **clean** argument is given, the read/write directory tree of *source-image-name* is not copied. Instead, an empty read/write directory tree is created for the new image, which creates a new image that is functionally equivalent to the source image as it existed when it was initially installed.

Images created by this command behave the same as images that are installed by install image *(page 18)* or add system image *(page 16)*.

Both the HTTPS and SSH services must be enabled on the remote system for clone system image *(page 17)* to work properly. The HTTPS service is enabled by using the `set service https` command in configuration mode. The SSH service is enabled by using the `set service ssh` command in configuration mode.

delete system image

Deletes an image from the local disk drive.

Syntax:

```
delete system image [ image-name ]
```

When the command is entered without an image name, the system prompts for the image to delete.

image-name

Name of an image to be deleted.

Operational mode

Use this command to delete an image from the local disk drive.

The image and all its local files, including its configuration file, are destroyed. Because this command is destructive, the system prompts for confirmation.

Command completion displays all valid completions for the *image-name* argument. If the *image-name* argument is omitted, the system displays a list of available images and prompts you to select one.

If the system was originally installed in disk-based mode, an **image-name** option is available that you can use to direct that the disk-based installation must be deleted.

The system does not allow you to delete the currently running system image. However, the system does allow you to delete the image currently selected to be run at the next reboot. If you delete that image, the system uses the currently running image when the system is next rebooted.

install image

Installs a binary image of the system.

Syntax:

```
install image
```

Operational mode

Use this command to install a binary image of the system.

After the installation is completed, you can add multiple image versions to the same partition by using the `add system image` command, and you can then choose which version to boot by using the `set system image default-boot` command. This functionality allows you to move easily between different versions of the system.

If you have a new system and want to install from scratch, you can boot LiveCD or LiveUSB and run the `install image` command to install the image on LiveCD or LiveUSB to the disk. The `install image` command operates similarly to the `install system` command—it creates and formats a new disk partition and then installs the image to the partition while preserving the system configuration.

rename system image

Renames an image.

Syntax:
`rename system image` *old-image-name new-image-name*

old-image-name
Name of an existing image to be renamed.
new-image-name
New name for the image.

Operational mode.

Use this command to rename an image.

The old name must match the name of an image on the system. The system does not allow you to rename the currently running system image. The new system image name cannot be in use by another image.

set system image default-boot

Selects an image to be run when the system is next rebooted.

Syntax:
`set system image default-boot [` *image-name* `]`

If the command is used without specifying an image name, the system displays a list of available images and prompts you to select one.

image-name
Name of an image to be run when the system is rebooted.

Operational mode

Use this command to select an image to run when the system is next rebooted.

When multiple system images have been installed by using the `add system image` command, you can use this command to direct the system to boot from a specific system image the next time the system is restarted.

Command completion displays all valid completions for the *image-name* argument. If the *image-name* argument is omitted, the system displays a list that shows all images that are installed on the system and prompts you to select one. If the system was originally installed in disk-based mode, a special **`image-name`** option is available so that you can select the disk-based system as the default system from which to boot.

show system image

Displays a list of all images that are installed on the system.

Syntax:
`show system image [` **`storage`** | **`version`** `]`

`storage`
Displays the amount of disk space that is used by each image.
`version`
Includes the image version number in the display of system images.

Operational mode

Use this command to display a list of all images that are installed on the system.

The command output identifies the image that is currently running and the image that has been selected to run when the system is next rebooted. If the system was originally installed in disk-based mode, one of the image names identifies that installation.

List of Acronyms

Acronym	Description
ACL	access control list
ADSL	Asymmetric Digital Subscriber Line
AH	Authentication Header
AMI	Amazon Machine Image
API	Application Programming Interface
AS	autonomous system
ARP	Address Resolution Protocol
AWS	Amazon Web Services
BGP	Border Gateway Protocol
BIOS	Basic Input Output System
BPDU	Bridge Protocol Data Unit
CA	certificate authority
CCMP	AES in counter mode with CBC-MAC
CHAP	Challenge Handshake Authentication Protocol
CLI	command-line interface
DDNS	dynamic DNS
DHCP	Dynamic Host Configuration Protocol
DHCPv6	Dynamic Host Configuration Protocol version 6
DLCI	data-link connection identifier
DMI	desktop management interface
DMVPN	dynamic multipoint VPN
DMZ	demilitarized zone
DN	distinguished name
DNS	Domain Name System
DSCP	Differentiated Services Code Point
DSL	Digital Subscriber Line
eBGP	external BGP
EBS	Amazon Elastic Block Storage
EC2	Amazon Elastic Compute Cloud
EGP	Exterior Gateway Protocol
ECMP	equal-cost multipath
ESP	Encapsulating Security Payload
FIB	Forwarding Information Base
FTP	File Transfer Protocol
GRE	Generic Routing Encapsulation
HDLC	High-Level Data Link Control
I/O	Input/Output
ICMP	Internet Control Message Protocol
IDS	Intrusion Detection System
IEEE	Institute of Electrical and Electronics Engineers

Acronym	Description
IGMP	Internet Group Management Protocol
IGP	Interior Gateway Protocol
IPS	Intrusion Protection System
IKE	Internet Key Exchange
IP	Internet Protocol
IPOA	IP over ATM
IPsec	IP Security
IPv4	IP Version 4
IPv6	IP Version 6
ISAKMP	Internet Security Association and Key Management Protocol
ISM	Internet Standard Multicast
ISP	Internet Service Provider
KVM	Kernel-Based Virtual Machine
L2TP	Layer 2 Tunneling Protocol
LACP	Link Aggregation Control Protocol
LAN	local area network
LDAP	Lightweight Directory Access Protocol
LLDP	Link Layer Discovery Protocol
MAC	medium access control
mGRE	multipoint GRE
MIB	Management Information Base
MLD	Multicast Listener Discovery
MLPPP	multilink PPP
MRRU	maximum received reconstructed unit
MTU	maximum transmission unit
NAT	Network Address Translation
NBMA	Non-Broadcast Multi-Access
ND	Neighbor Discovery
NHRP	Next Hop Resolution Protocol
NIC	network interface card
NTP	Network Time Protocol
OSPF	Open Shortest Path First
OSPFv2	OSPF Version 2
OSPFv3	OSPF Version 3
PAM	Pluggable Authentication Module
PAP	Password Authentication Protocol
PAT	Port Address Translation
PCI	peripheral component interconnect
PIM	Protocol Independent Multicast
PIM-DM	PIM Dense Mode
PIM-SM	PIM Sparse Mode
PKI	Public Key Infrastructure
PPP	Point-to-Point Protocol
PPPoA	PPP over ATM

Acronym	Description
PPPoE	PPP over Ethernet
PPTP	Point-to-Point Tunneling Protocol
PTMU	Path Maximum Transfer Unit
PVC	permanent virtual circuit
QoS	quality of service
RADIUS	Remote Authentication Dial-In User Service
RHEL	Red Hat Enterprise Linux
RIB	Routing Information Base
RIP	Routing Information Protocol
RIPng	RIP next generation
RP	Rendezvous Point
RPF	Reverse Path Forwarding
RSA	Rivest, Shamir, and Adleman
Rx	receive
S3	Amazon Simple Storage Service
SLAAC	Stateless Address Auto-Configuration
SNMP	Simple Network Management Protocol
SMTP	Simple Mail Transfer Protocol
SONET	Synchronous Optical Network
SPT	Shortest Path Tree
SSH	Secure Shell
SSID	Service Set Identifier
SSM	Source-Specific Multicast
STP	Spanning Tree Protocol
TACACS+	Terminal Access Controller Access Control System Plus
TBF	Token Bucket Filter
TCP	Transmission Control Protocol
TKIP	Temporal Key Integrity Protocol
ToS	Type of Service
TSS	TCP Maximum Segment Size
Tx	transmit
UDP	User Datagram Protocol
VHD	virtual hard disk
vif	virtual interface
VLAN	virtual LAN
VPC	Amazon virtual private cloud
VPN	virtual private network
VRRP	Virtual Router Redundancy Protocol
WAN	wide area network
WAP	wireless access point
WPA	Wired Protected Access