User Guide for the Dell Networking OS Emulator

9.8(0.0)

Notes, cautions, and warnings

NOTE: A NOTE indicates important information that helps you make better use of your computer.

CAUTION: A CAUTION indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

WARNING: A WARNING indicates a potential for property damage, personal injury, or death.

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The Dell Networking OS Emulator

The Dell Networking Operating System (OS) Emulator is a virtualized environment where you can create simple network topologies and test various features of the Dell Networking OS. The virtual environment allows you to get familiar with the command line interface (CLI) without having access to a physical device.

NOTE: The Dell Networking Emulator is not intended to provide a complete emulation of a Dell switch hardware. It can only supplement, but not replace, training or testing on physical devices.

This guide provides an overview of how to install Dell networking OS Emulator, configure, and create simple topologies.

Supported Features

The Dell Networking Emulator supports the following features:

- Up to five data ports and one management port (five 40G or 10G ports)
- All management-related protocols and features such as simple network management protocol (SNMP), telnet, secure shell (SSH)
- Layer 1 link up/down status when connected to another Dell Networking OS instance
- Optics emulation
- Layer 3 features such as routing and forwarding
- Routing protocols such as border gateway protocol (BGP), open shortest path first (OSPF), intermediate system to intermediate system (ISIS), and routing information protocol (RIP)
- Management functionalities such as dynamic host configuration protocol (DHCP), Smartscripts, authentication, authorization, and accounting (AAA), remote authentication dial-in user service (RADIUS), terminal access controller access control system (TACACS+), management plane isolation
- Flash and nonvolatile random access memory (NVRAM)
- 40G and 10G interfaces
- Limited Layer 2 functionality such as LLDP, LACP

Unsupported Features

The Dell Networking Emulator does not support the following features:

- Most Layer 2 features

- Network boot
- Fast path
- Stacking
- virtual link trunking (VLT)
- Fast path features such as quality of service (QoS), buffer carving, Layer 2 virtual local area networks (VLANs)

Minimum System Requirements

The Dell Networking Emulator Requires the following:

- Any X86-based PC
- Microsoft Windows 7 operating system
- 16GB hard disk space for installing the ISO file
- A minimum of 512MB RAM per virtual machine instance
- Oracle VirtualBox, VMware, or Qemu.

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Getting Started

You can install the Dell Networking OS Emulator on Oracle VirtualBox, VMware, or Qemu. This user guide explains how to install and use the Dell Networking OS Emulator on an Oracle VirtualBox.

Configure the Virtual Machine

Before using the virtual machine (VM), configure the network settings as explained in this section. When you configure the VM, the first interface you configure on VirtualBox is always the Management Ethernet and the consecutive interfaces are data interfaces. Use the data interfaces to create network topologies.

You can configure the VMs either to communicate with only the other VMs or to communicate with the host system.

Installing VirtualBox

To install VirtualBox on Windows, follow these steps:

1. Download the Windows installer of VirtualBox from this location:
   https://www.virtualbox.org/wiki/Downloads
2. Install VirtualBox accepting the default settings.

Installing the Dell Networking OS Emulator on VirtualBox

To install the Dell Networking OS Emulator on VirtualBox, follow these steps:

1. Download the Dell Networking OS Emulator installer file and save it to a location on your local system (for example C:\Dell_OS).
2. Open VirtualBox.

   The VirtualBox window opens. Click the **New** button.
3. In the Create Virtual Machine window, create a name for the VM instance. Select **BSD** from the Type drop-down. Select **NetBSD (32 bit)** from the Version drop-down and click **Next**.

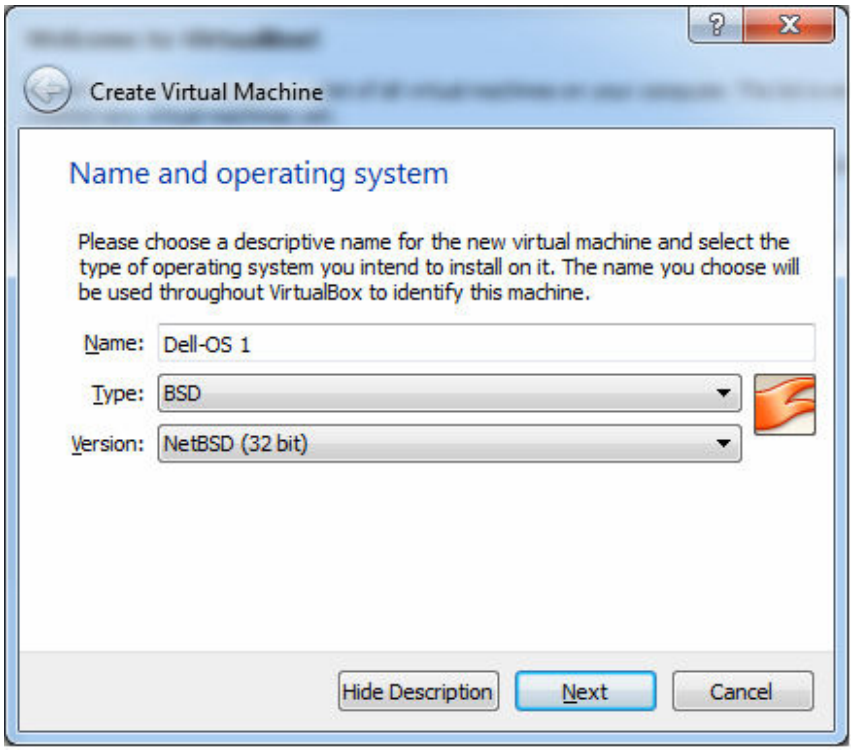

Figure 1. Create a Name for a VM

4. Allocate 512MB.

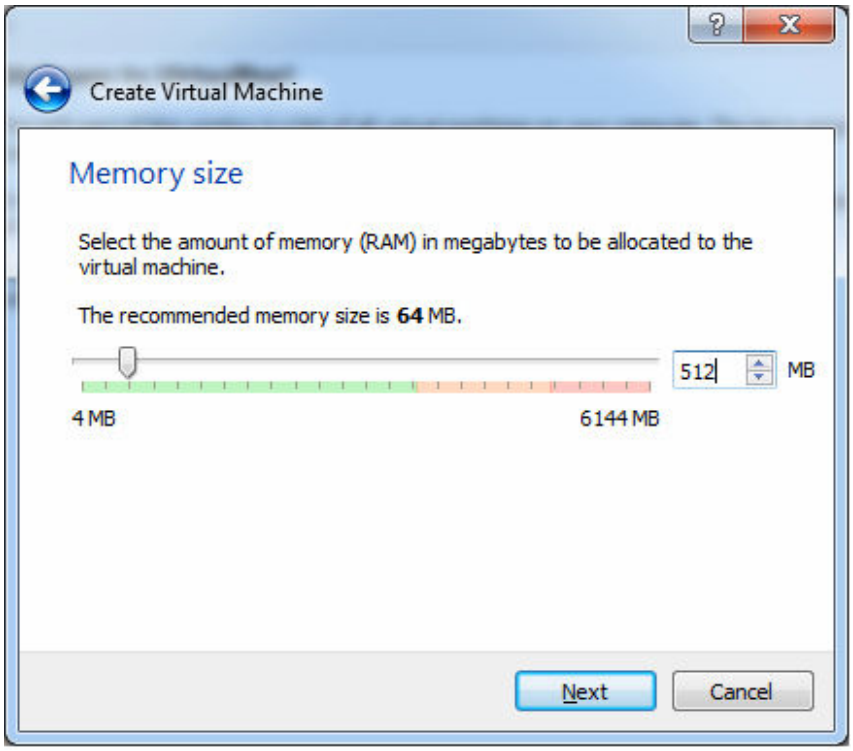

Figure 2. Allocate RAM for a VM

5. On the next window, make sure that the **Create a virtual hard drive now** radio button is selected and click **Create**.

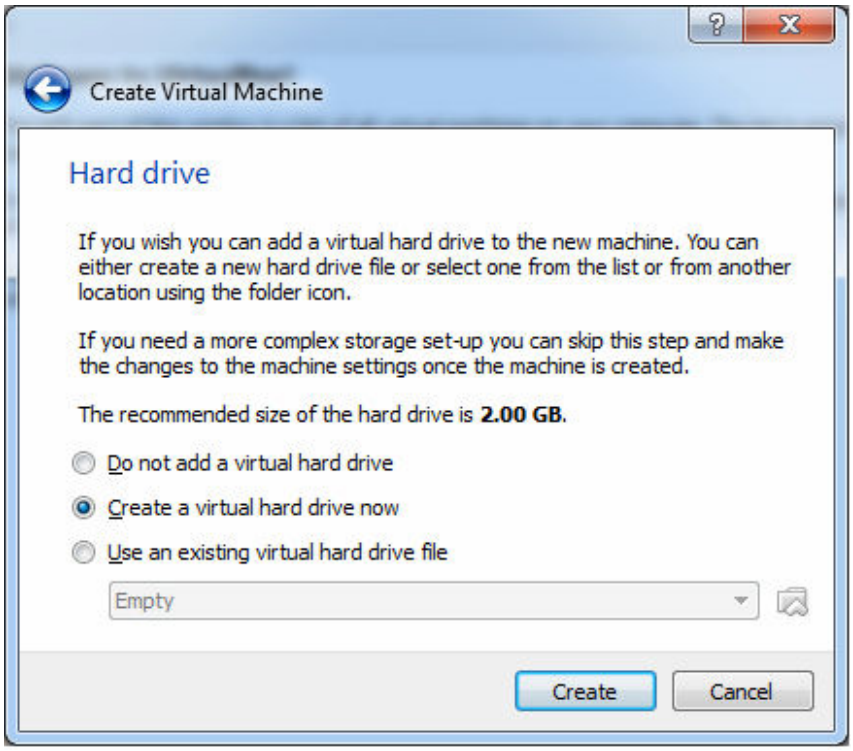

Figure 3. Create a VM

6. On the next window, make sure that the **VDI (VirtualBox Disk Image)** radio button is selected and click **Next**.

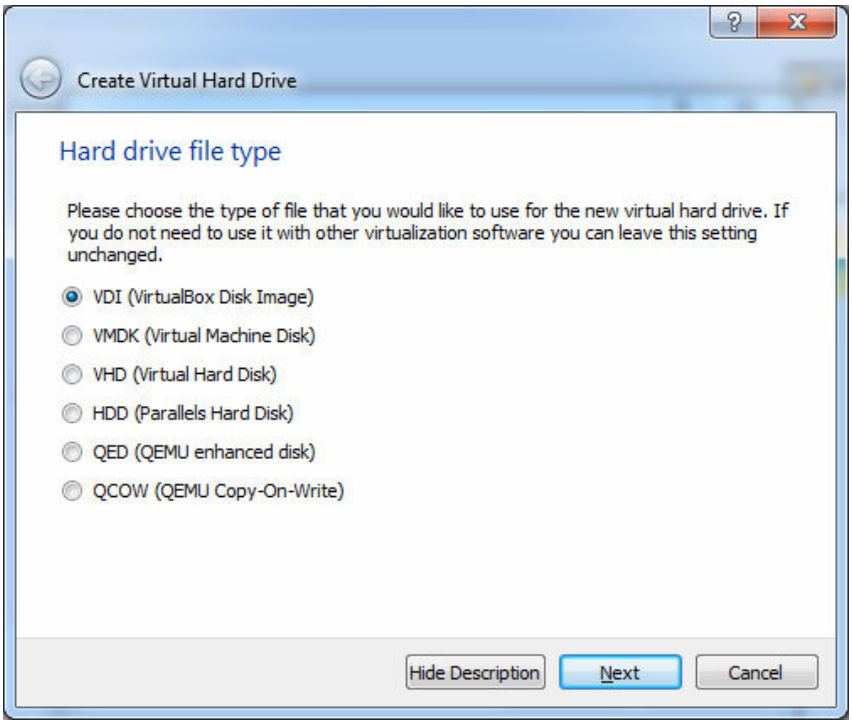

Figure 4. Create a VM

7. On the next window, make sure that the **Dynamically allotted** radio button is selected and click **Next**.

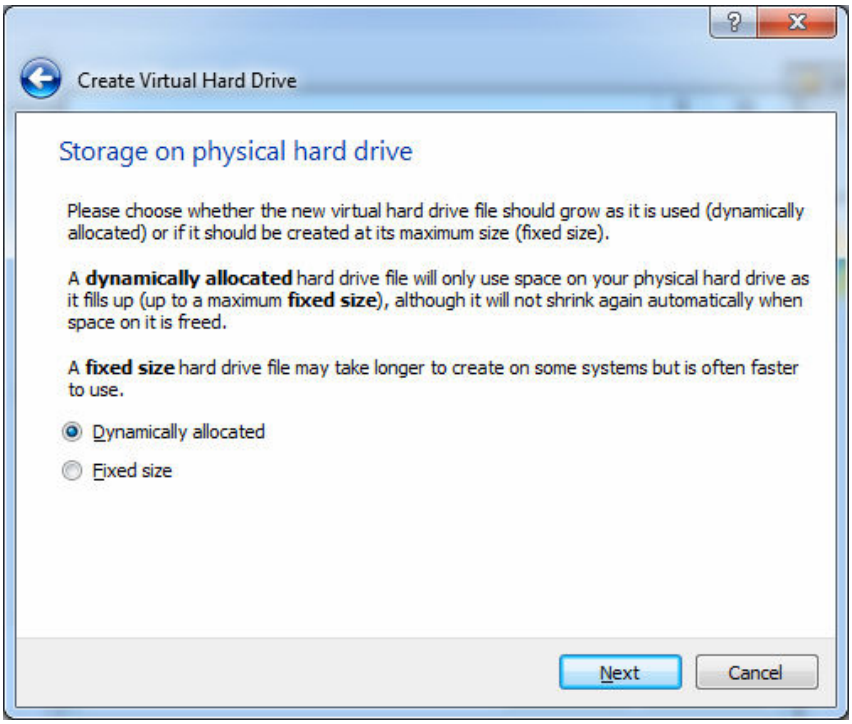

Figure 5. Select Hard Drive Storage Type

8. Select **16 GB** as the virtual hard drive space and click **Create**.

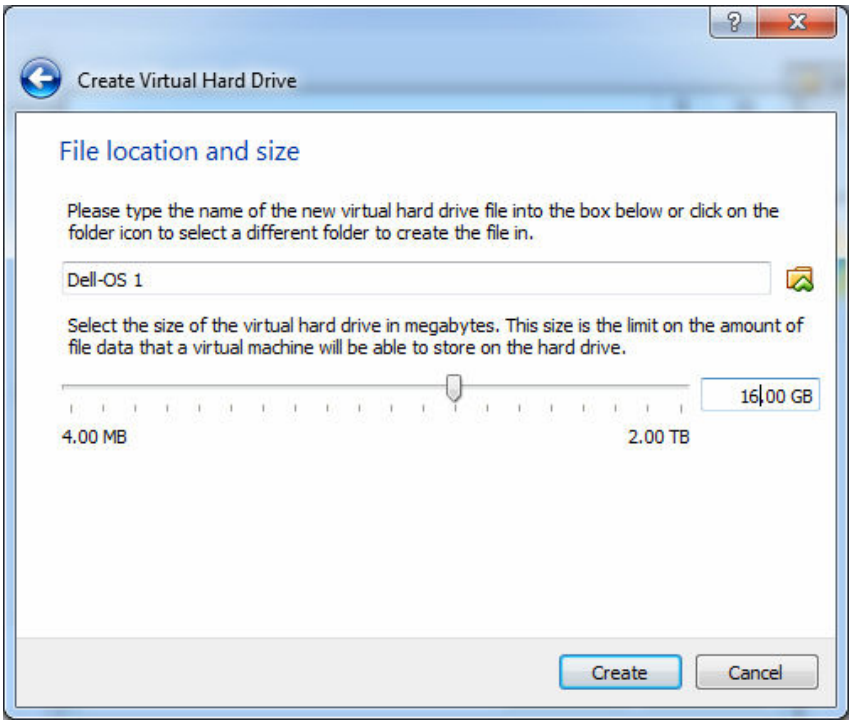

Figure 6. Allocate Space for the Hard Drive of a VM

A new VM instance is created.

9. On the VirtualBox main window, select Settings > Storage.

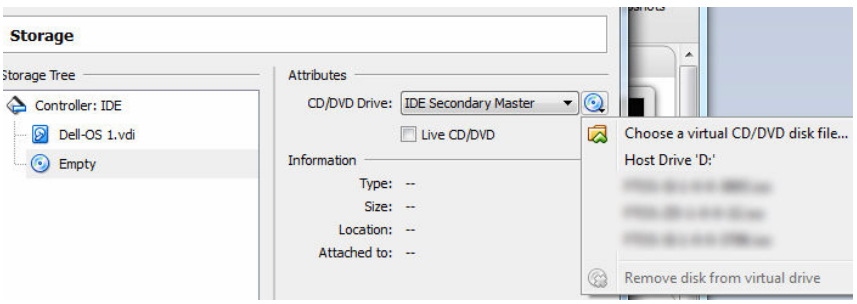

Figure 7. Storage Settings

10. In the Storage Tree pane, click **Empty**.
11. In the Attributes pane, click the  icon and click **Choose a virtual CD/DVD disk file**.
12. Browse to the folder where you have the Dell Networking OS Emulator image file, select it and click **Open**.
13. On the Settings window, click **OK**.

Enabling the Management Interface

To access a VM from the host system using the Management interface, the host system and the Management interface must be on the same subnet. To enable the management interface, follow these steps:

1. On the VirtualBox main window, select Settings > Network.

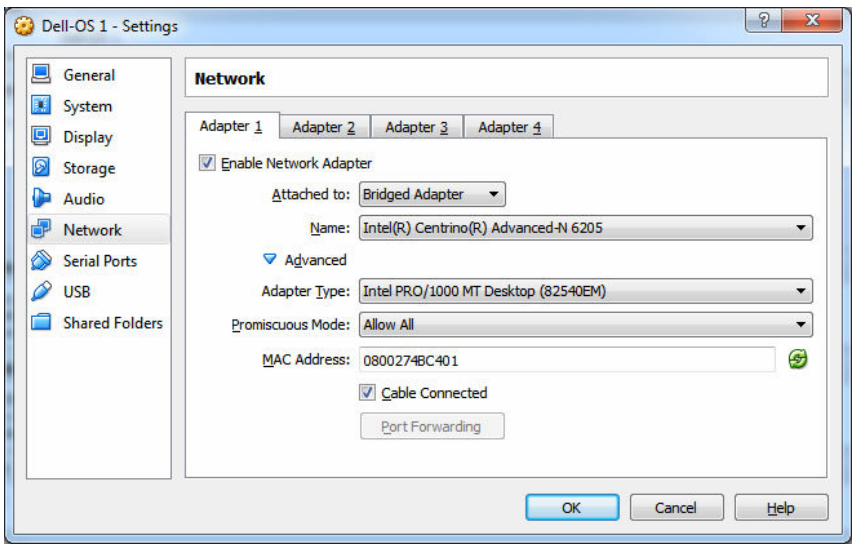

Figure 8. Configure Management Interface

2. Under the Adapter 1 tab, make the following changes:
   a. Check the **Enable Network Adaptor** check box.
   b. Select **Bridged Adaptor** in the Attached to drop-down. This option allows the VM and host system to communicate so that you can use telnet to connect to the VM.
   c. Expand **Advanced**.
   d. In the Adapter Type drop-down, select Intel PRO/1000 MT Desktop (82540EM).
   e. Select **Allow All** in the Promiscuous Mode drop-down box.
   f. Make sure that the **Cable Connected** check box is selected.

Enabling Data Interfaces Using the GUI

To enable data interfaces using the graphical user interface (GUI), follow these steps:

1. On the VirtualBox main window, select Settings > Network:

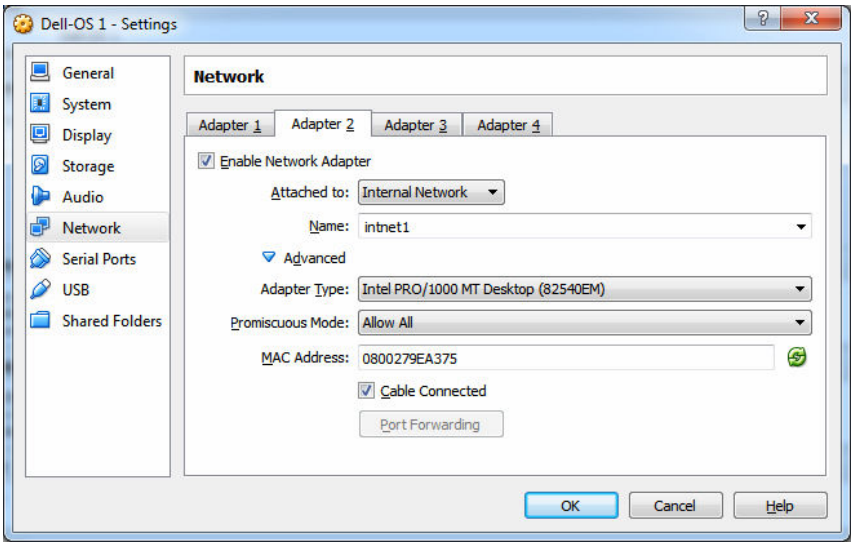

Figure 9. Configure VirtualBox Data Interface

2. Under the Adapter 2 tab, make the following changes:
   a. Check the **Enable Network Adaptor** check box.
   b. Select **Internal Network** in the **Attached to** drop-down. Selection this option allows communication between virtual instances of Dell Networking OS Emulator.
   c. Enter a name to the virtual instance.
   d. Expand **Advanced**.
   e. In the Adapter Type drop-down, select **Intel PRO/1000 MT Desktop (82540EM)**.
   f. Make sure that the **Cable Connected** check box is selected.
   g. Select **Allow All** in the Promiscuous Mode drop-down box.
3. Repeat Step 2 for the Adaptor 3 and Adaptor 4 tabs. Provide different names in the Name field. For example, you can name Adapter 2 as intnet1, Adapter 3 as intent 2, and Adapter 4 as intnet3.

Enabling Interfaces Using VirtualBox Commands

Even though you can enable interfaces using the VirtualBox GUI, you can create only four interfaces including one management interface. To create more interfaces, use the command interface of VirtualBox. To create an interface using VirtualBox commands, follow these steps:

1. On Windows command prompt, navigate to the VirtualBox installation folder.
   ```
   cd C:\Program Files\Oracle\VirtualBox
   ```
2. Enable an interface using the following command:
   ```
   VBoxManage modifyvm network-test --nic5 intnet
   ```
   This command creates the fifth interface and assigns to Internal Network so that it can communicate with the other data interfaces.
3. To change the name of the interface from intnet5, use the following command:
   ```
   VBoxManage modifyvm network-test --intnet5 "test1"
   ```
4. Enable Promiscuous mode.
   ```
   VBoxManage modifyvm network-test --nicpromisc5 allow-all
   ```

You can use the CLI to create all ports without using the Virtualbox GUI. The first interface you create is always the management port.

Cloning a Dell Networking OS Emulator Instance

Although you can have only one instance of Dell Networking OS Emulator to test the features, to create a topology, you need more than one instance of Dell Networking OS Emulator. Cloning eliminates the need to create another virtual machine using another copy of the Dell Networking OS Emulator ISO file.

To clone a VM instance, follow these steps:

1. On the VirtualBox main window, right-click the VM that you already have and click **Clone**.

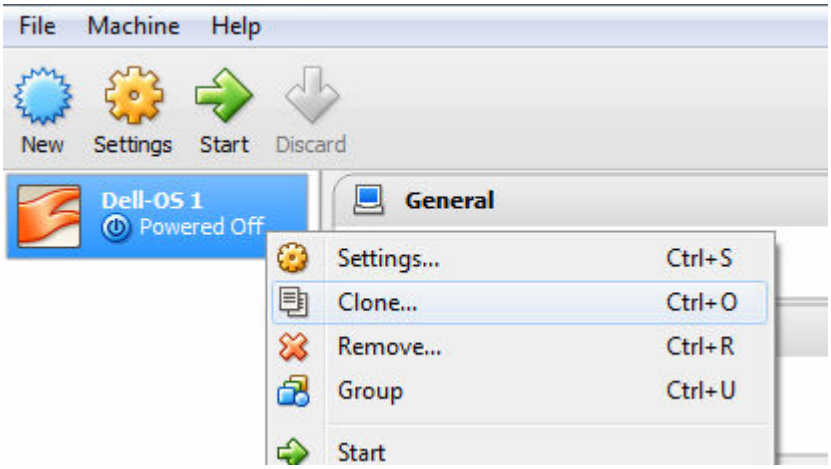

Figure 10. Clone a VM

2. On the **Clone Virtual Machine** window, enter a name.

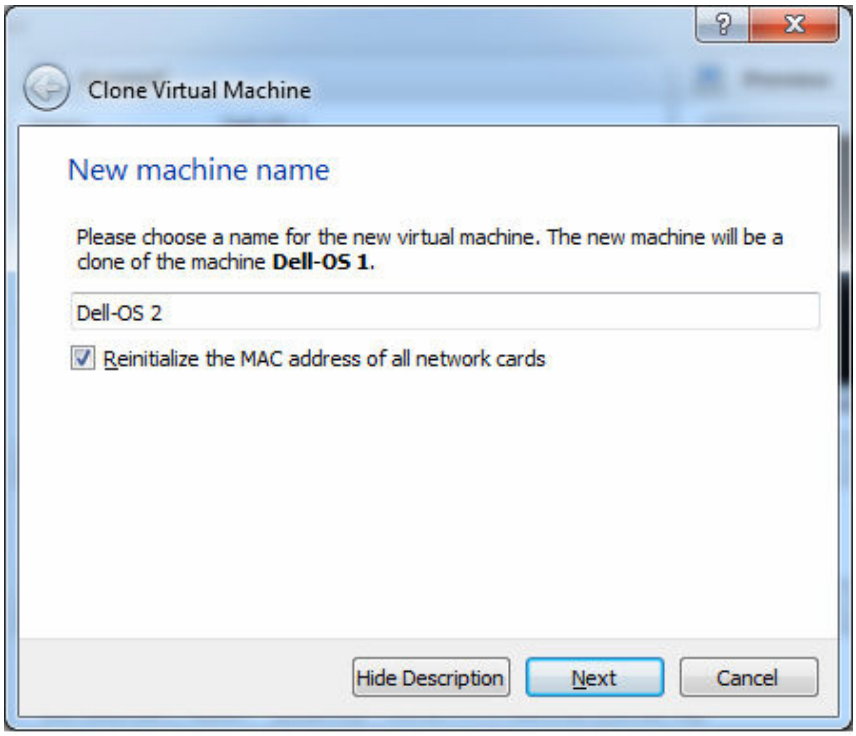

Figure 11. Enter a name to the VM Clone

3. Check the **Reinitialize the MAC address of all network cards** check box. Selecting this option prevents the new VMs from acquiring the same MAC addresses from the original VM.
4. Click **Next**.
5. On the Clone Type window, select **Full Clone**.

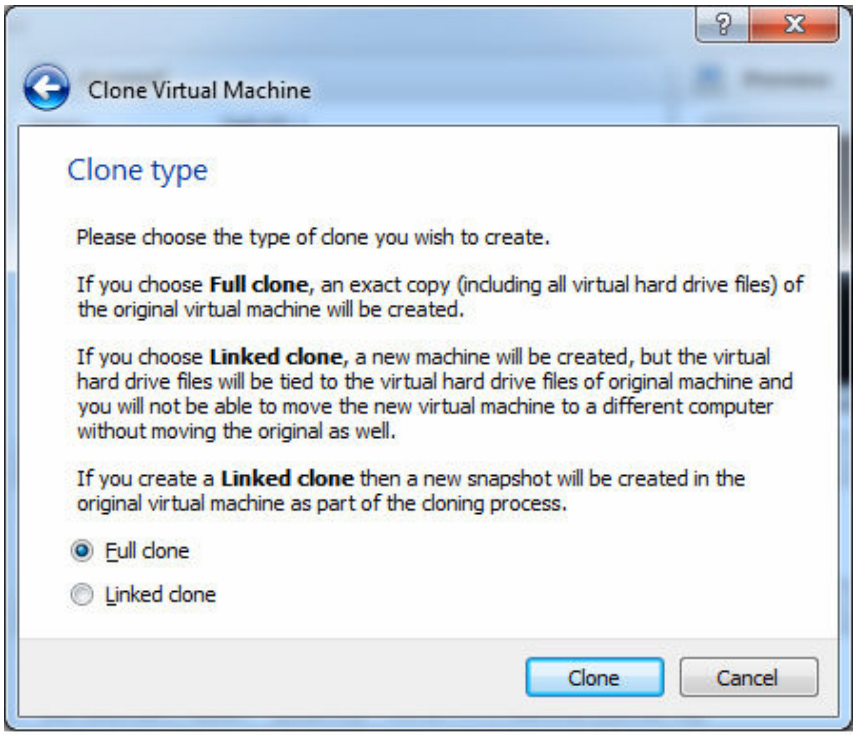

Figure 12. Full Clone

6. Click **Clone**.

You can follow the same procedure to clone up to four virtual instances. Including the original VM, you can have five virtual instances of Dell Networking OS Emulator.

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Using the Emulator

This section explains how to use the Dell Networking OS Emulator and create simple topologies.

Create a Topology

You can connect a virtual interface (Adapter 2 or higher) of a VM to a virtual interface of another VM by providing the same name in the Network settings. For example, if you name an interface of a VM as intnet1 and do the same on another VM, the two interfaces are virtually connected and can start sending and receiving data.

For example, the following shows the network settings of Dell-OS 1. The Name field under the Adapter 2 tab contains the name intnet1.

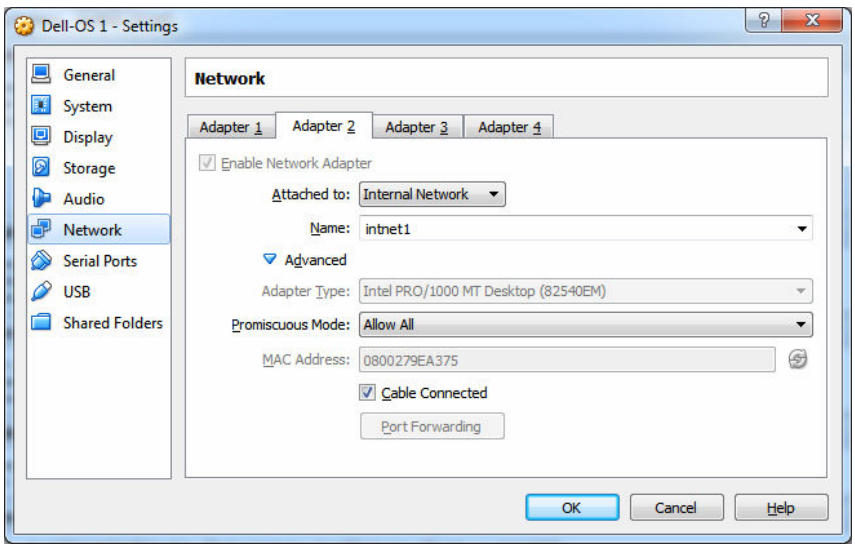


Figure 13. Dell-OS 1 Settings

The following shows the network settings of Dell-OS 2. The Name field under the Adapter 2 tab contains the name intnet1.

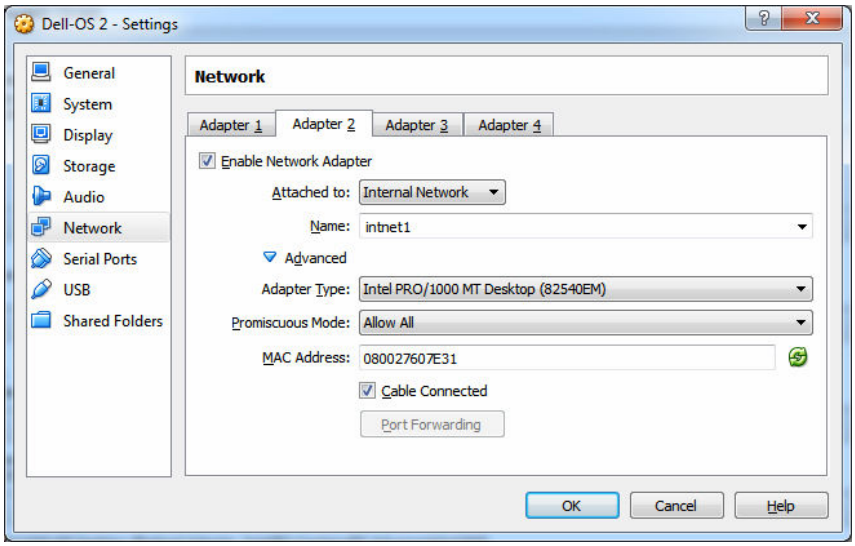


Figure 14. Dell-OS 2Settings

When you load the VMs, these two interfaces are connected to each other virtually. After you configure the interfaces, they can start sending and receiving data.

If you name an interface of the third VM as intnet1, the interfaces belonging to the three VMs are connected to each other.

NOTE: To establish a Layer 3 connection between interfaces, the interfaces must be on the same subnet.

Sample Topology

This section describes how to create and configure a simple topology by virtually connecting two interfaces of two VMs.

NOTE: The enable password for the Dell Networking OS Emulator is `calvin`.

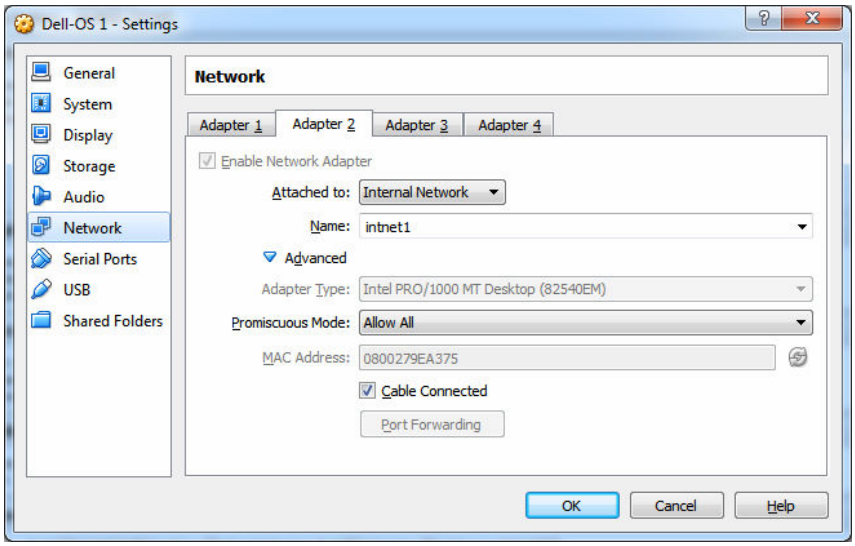


Figure 15. Network Settings on Dell-OS 1 VM

Interface configuration on Dell-OS 1 VM

```
Dell>enable
Dell#configure
Dell(conf)#interface fortyGigE 0/0
Dell(conf-if-fo-0/0)#ip address 192.168.1.1 255.255.255.252
Dell(conf-if-fo-0/0)#no shutdown
```

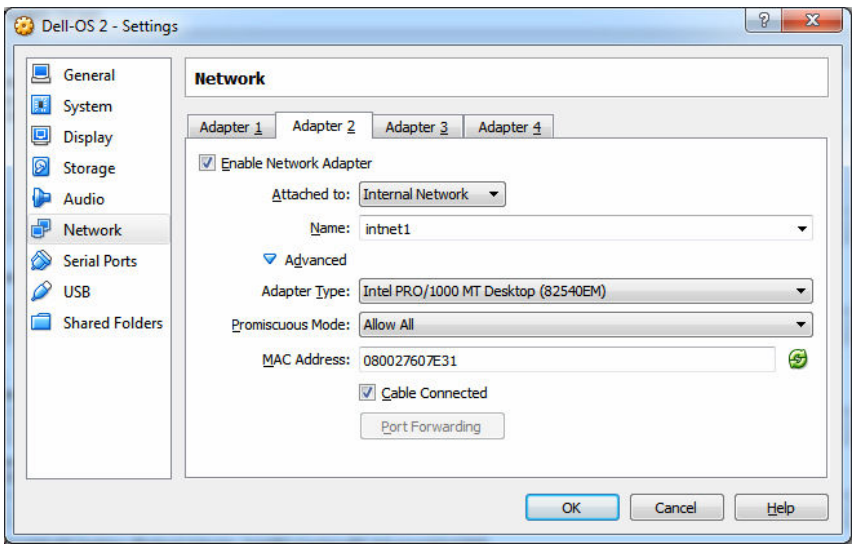


Figure 16. Network Settings on Dell-OS 2 VM

Interface configuration on Dell-OS 2 VM

```
Dell>enable
Dell#configure
Dell(conf)#interface fortyGigE 0/0
Dell(conf-if-fo-0/0)#ip address 192.168.1.2 255.255.255.252
Dell(conf-if-fo-0/0)#no shutdown
Dell(conf-if-fo-0/0)#exit
Dell#ping 192.168.1.1
Type Ctrl-C to abort.
```

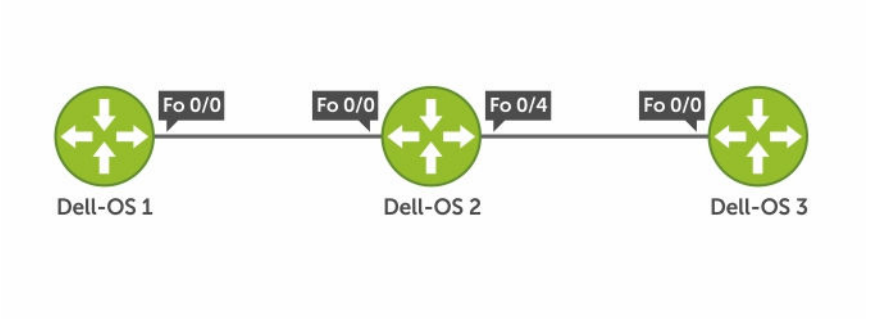
```
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
Success rate is 100.0 precent (5/5), round-trip min/avg/max = 0/0/0 (ms)
```

Sample Topology with OSPF

This section describes how to create and configure a topology by virtually connecting three devices and enabling OSPF. The three VMs in this example are Dell-OS 1, Dell-OS 2, and Dell-OS 3.

Network Settings

To connect the fortyGigE 0/0 interfaces of both Dell-OS 1 and Dell-OS 2, use the following network configurations on the VMs. The following configuration also connects the fortyGigE 0/4 interface of Dell-OS 2 to the fortyGigE 0/0 interface of Dell-OS 3.



- On Dell-OS 1, only Adapter 2 is enabled. The name of Adapter 2 is intnet1.
- On Dell-OS 2, Adapter 2 and Adapter 3 are enabled. The name of Adapter 2 is intnet1 and the name of Adapter 3 is intnet2.
- On Dell-OS 3, only Adapter 3 is enabled. The name of Adapter 3 is intnet2.

Even though only Adapter 3 is enabled on Dell-OS 3 VM, fortyGigE 0/0 is enabled, not fortyGigE 0/4.

To simulate a host or a different subnet, two loopback interfaces are also configured on the VMs.

Configuration on Dell-OS 1 VM

```
Dell>enable
Dell#configure
Dell(conf)#interface fortyGigE 0/0
Dell(conf-if-fo-0/0)#ip address 192.168.1.1 255.255.255.252
Dell(conf-if-fo-0/0)#no shutdown
Dell(conf-if-fo-0/0)#interface loopback 1
Dell(conf-if-lo-1)#172.16.1.1 255.255.255.255
Dell(conf-if-lo-1)#exit
Dell(conf)#router ospf 1
Dell(conf-router_ospf_1)#network 192.168.1.0 255.255.255.252 area 1
Dell(conf-router_ospf_1)#network 172.16.1.1 255.255.255.255 area 1
```

Configuration on Dell-OS 2 VM

```
Dell>enable
Dell#configure
Dell(conf)#interface fortyGigE 0/0
Dell(conf-if-fo-0/0)#ip address 192.168.1.2 255.255.255.252
Dell(conf-if-fo-0/0)#no shutdown
Dell(conf)#interface fortyGigE 0/4
```

```
Dell(conf-if-fo-0/4)#ip address 192.168.1.5 255.255.255.252
Dell(conf-if-fo-0/4)#no shutdown
Dell(conf-if-fo-0/4)#exit
Dell(conf)#router ospf 1
Dell(conf-router_ospf_1)#network 192.168.1.0 255.255.255.248 area 1
```

Configuration on Dell-OS 3 VM

```
Dell>enable
Dell#configure
Dell(conf)#interface fortyGigE 0/0
Dell(conf-if-fo-0/0)#ip address 192.168.1.1 255.255.255.252
Dell(conf-if-fo-0/0)#no shutdown
Dell(conf-if-fo-0/0)#interface loopback 1
Dell(conf-if-lo-1)#172.16.1.3 255.255.255.255
Dell(conf-if-lo-1)#exit
Dell(conf)#router ospf 1
Dell(conf-router_ospf_1)#network 192.168.1.0 255.255.255.252 area 1
Dell(conf-router_ospf_1)#network 172.16.1.3 255.255.255.255 area 1
Dell#ping 172.16.1.1
Type Ctrl-C to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:
Success rate is 100.0 precent (5/5), round-trip min/avg/max = 0/0/0 (ms)
```

More Configurations

For more configuration examples, see the *Dell Networking Configuration Guide for the S6000 System*.