### Lesson 9: Creating and Configuring Virtual Networks

MOAC 70-410: Installing and Configuring Windows Server 2012



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### Overview

- Exam Objective 3.3: Create and Configure Virtual Networks
- Virtual Networking
- Creating Virtual Switches

### Virtual Networking

Lesson 9: Creating and Configuring Virtual Networks

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# Virtual Networking

- Virtual networking components are used in place of physical ones in a virtual environment, such as:
  - Virtual network adapters
  - Virtual switches
- Allows you to connect to virtual and physical environments
- Hyper-V allows you to create multiple switches and adapters to provide a flexible networking environment

## **Creating Virtual Switches**

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# **Creating Virtual Switches**

- A switch has a series of ports, each of which is connected to a computer's network interface adapter. Any computer connected to the switch can transmit data to any other computer connected to the same switch.
- Virtual switches created by Hyper-V can have an unlimited number of ports, so administrators don't have to be concerned about connecting switches together or about uplinks and crossover circuits.

### Creating the Default Virtual Switch

- Hyper-V provides you with the opportunity to create a virtual switch for each of the physical network adapters installed in the host computer. These switches enable virtual machines to participate on the networks to which the physical adapters are connected.
- When you create a virtual switch, the networking configuration in the host operating system on the parent partition changes:
  - The new virtual switch appears in the Network Connections window, and if you examine its properties, you can see that the switch is bound to the operating system's TCP/IP client.

### Creating the Default Switch

B	Add Roles and Fea	tures Wizard	x
Create Virtual Swith Before You Begin Installation Type Server Selection Server Roles Features Hyper-V Virtual Switches Migration Default Stores	Add Roles and Fear itches Virtual machines require virtual switch role, you can create virtual machines a One virtual switch will be created for e at least one virtual switch now to prov can add, remove, and modify your virt Network adapters: Name Ethernet	es to communicate with other computers. After you install this nd attach them to a virtual switch. each network adapter you select. We recommend that you create ide virtual machines with connectivity to a physical network. You ual switches later by using the Virtual Switch Manager.	<b>x</b>
Default Stores Confirmation Results	(i) We recommend that you reserve network adapter, do not select it	one network adapter for remote access to this server. To reserve a	a
		< Previous Next > Install Cancel	

#### The Create Virtual Switches page, displayed during a Hyper-V role installation

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#### Creating the Default Virtual Switch

Organize      Organize      Disable this network device Diagnose this connection Rename this connection     Pethernet     Enabled     Broadcom NetXtreme Gigabit Eth     Vethernet (Broadcom NetXtreme Gigabit Eth     Vethernet (Broadcom NetXtreme     Gigabit Ethernet - Virtual Switch)     Connect using:         Vethernet Adapter #2         Configure     This connection uses the following items:         Vethernet Microsoft Network Adapter Multiplexor Protocol         Alprev V Strensible Virtual Switch         Alprev Virtual Switch         A	Network Connection	ons 📃 🗖 🗙
Organize       Disable this network device       Diagnose this connection       Rename this connection       VEthernet (Broadcom NetXtreme Gigabit Eth       Image: Connect using: Connect using: Connect using: Connect using: Connect using: Configure         This connection uses the following items:       Image: Configure       This connection uses the following items: Configure         Image: Configure       Image: Configure       Image: Configure       This connection uses the following items: Configure         Image: Configure       Image: Configure       Image: Configure       Image: Configure       Image: Configure <td< th=""><th>(a) → ↑ 😰 → Control Panel → Network and Internet → Network Connections</th><th>✓ ♂ Search Network Connections ♀</th></td<>	(a) → ↑ 😰 → Control Panel → Network and Internet → Network Connections	✓ ♂ Search Network Connections ♀
Ethernet       Enabled       Sigabit Ethernet - Virtual Switch)       Connect using:         Image: Sigabit Ethernet - Virtual Switch       Image: Sigabit Ethernet - Virtual Ethernet - V	Organize 🔻 Disable this network device Diagnose this connection Rename this connection	r 🌵 vEthernet (Broadcom NetXtreme Gigabit Eth 💌 🗔 🔞
Install       Uninstall       Properties         Install       Uninstall       Properties         Description       Allows your computer to access resources on a Microsoft network.         OK       Cancel	Ethernet Enabled Broadcom NetXtreme Gigabit Eth VEthernet (Broadcom NetXtreme Gigabit Ethernet - Virtual Switch) zacker.local	Networking         Connect using:

A virtual switch and its properties, displayed in the host operating system

#### Creating the Default Virtual Switch

Network Connection	IS <b>– – X</b>
💿 💿 🔻 😰 🕨 Control Panel 🕨 Network and Internet 🕨 Network Connections	✓ ♂ Search Network Connections
Organize   Disable this network device Diagnose this connection Rename this connection	Ethernet Properties X
Ethernet Enabled Broadcom NetXtreme Gigabit Eth       Image: Comparison of the state of the	Networking       Sharing         Connect using:       Image: Configure         This connection uses the following items:       Configure         This connection uses the following items:       Image: Configure         Image: Context of the twork of the two two the two
2 items   1 item selected	

A network interface adapter in the host operating system, bound to a virtual switch

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### The Default Virtual Switch

- An external network switch provides connections external to the Hyper-V environment
- The virtual network configuration overlays the physical network configuration
- The virtual switch is connected to the physical switch and the network adapter in the host computer is connected to the virtual switch
- It is the same as connecting two physical switches together

### Creating a New Virtual Switch

There are three types of switches that you can create in the Virtual Switch Manager:

- **External:** Bound to networking protocol stack in the host OS and connected to a physical network interface adapter in the Hyper-V server. Virtual machines running on the server's parent and child partitions can all access the physical network to which the physical adapter is connected.
- **Internal:** Bound to a separate instance of the networking protocol stack in the host OS, independent from the physical network interface adapter and its connected network. The virtual machines on the child partitions cannot access the physical network through the physical adapter.
- **Private:** Exists only in the Hyper-V server and is accessible only to the virtual machines running on the child partitions.

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#### Create a New Virtual Switch



The Virtual Switch Manager dialog box

#### Create a New Virtual Switch

21 20	Virtual Switch Manager for CZ2
<ul> <li>Virtual Switches</li> <li>New virtual network switch</li> <li>Private Virtual Switch</li> <li>Internal only</li> <li>Global Network Settings</li> <li>MAC Address Range</li> <li>00-15-5D-02-12-00 to 00-15-5D-0</li> </ul>	Virtual Switch Manager for CZ2         Image:         Name:         Broadcom NetXtreme Gigabit Ethernet Virtual Switch         Notes:         Image:         Connection type         What do you want to connect this virtual switch to?         Image:         Broadcom NetXtreme Gigabit Ethernet         V         What do you want to connect this virtual switch to?         Image:         Image:         What do you want to connect this virtual switch to?         Image:         Value         Image:         Image: </th
	OK Cancel Apply

#### The Virtual Switch Properties page

### Configuring MAC Addresses

- Every network interface has a Media Access Control (MAC) address that uniquely identifies the device on the network.
- On physical network adapters, the MAC address is assigned by the manufacturer.
- Hyper-V has a pool of 256 addresses to assign to VMs as you create them.

### **Configuring MAC Addresses**



The MAC Address Range in the Virtual Switch Manager

### Creating Virtual Network Adapters

Once you have created virtual switches in Hyper-V Manager, you can connect virtual machines to them by creating and configuring virtual network adapters.

#### Creating Virtual Network Adapters

<b>3</b> e	New Virtual Machine Wizard	x
Configure Ne	tworking	
Before You Begin Specify Name and Location Assign Memory Configure Networking Connect Virtual Hard Disk Installation Options Summary	Each new virtual machine includes a network adapter. You can configure the network adapter to us virtual switch, or it can remain disconnected.	2 8
	< Previous Next > Finish Cancel	

The Configure Networking page in the New Virtual Machine Wizard

#### Create a Virtual Network Adapter



A virtual machine's Settings dialog box

#### Create a Virtual Network Adapter

ServerB	
<ul> <li>★ Hardware</li> <li>M Add Hardware</li> <li>▲ BIOS Boot from CD</li> <li>■ BIOS</li> <li>■ Memory</li> <li>512 MB</li> <li>■ Processor</li> <li>1 Virtual processor</li> <li>■ IDE Controller 0</li> </ul>	Network Adapter     Specify the configuration of the network adapter or remove the network adapter.     Virtual gwitch:     Not connected     VLAN ID     Enable virtual LAN identification
Hard Drive     ServerB.vhdx      IDE Controller 1     OVD Drive	The VLAN identifier specifies the virtual LAN that this virtual machine will use for all network communications through this network adapter .
Vmguest.iso SCSI Controller UNEVORK Adapter Broadcom NetXtreme Gigabit Et UNEVORK Adapter	Enable bandwidth management     Specify how this network adapter utilizes network bandwidth. Both Minimum Bandwidth and Maximum Bandwidth are measured in Megabits per second.
Not connected COM 1 None COM 2 None None	Minimum bandwidth:       0       Mbps         Maximum bandwidth:       0       Mbps         Image: To leave the minimum or maximum unrestricted, specify 0 as the value.
None     None     None     None     Integration Services     All services offered	To remove the network adapter from this virtual machine, click Remove.     Remove     Use a legacy network adapter instead of this network adapter to perform a     network-based installation of the guest operating system or when integration     services are not installed in the guest operating system.
Snapshot File Location D:\Hyper-V\Config Smart Paging File Location D:\Hyper-V\Config	×

A new network adapter in the Settings dialog box

## Synthetic Adapters and Emulated Adapters

#### Synthetic adapter

- A purely virtual device that does not correspond to a real-world product.
- Synthetic devices in a virtual machine running on a child partition communicate with the parent partition using a high-speed conduit called the VMBus.

### Emulated adapter (or a legacy adapter)

 A standard network adapter driver that communicates with the parent partition by making calls directly to the hypervisor, which is external to the partitions, and is substantially slower.

### Synthetic Adapters and Emulated Adapters



Synthetic network adapters communicate using the VMBus

### Synthetic Adapters and Emulated Adapters



Emulated network adapters communicate using the hypervisor

## Configuring Hardware Acceleration Settings

- You can configure the following hardware acceleration settings if your network interface adapters supports them:
- Enable virtual machine queue (VMQ): Stores incoming packets intended for VMs in separate queues on the physical network adapter, and delivers them directly to the VMs, bypassing the processing normally performed by the virtual switch on the parent partition.
- Enable IPsec task offloading: Uses the components on the network adapter to perform some of the cryptographic functions required by IPsec.
- **Single-root I/O virtualization**: Enables the virtual adapter to take advantage of the SR-IOV capabilities of the physical adapter.

#### Configuring Hardware Acceleration Settings

2		Settings for ServerB on CZ2
ServerB	~	4 ▶   Q.
★ Hardware         Md Hardware         BIOS         Boot from CD         ■ Memory         S12 MB         ■ Processor         1 Virtual processor         ■ IDE Controller 0         ■ Hard Drive         ServerB.vhdx         ■ IDE Controller 1         ● DVD Drive         vmguest.iso         SCSI Controller         ■ Network Adapter         Broadcom NetXtreme Gigabit Et         Hardware Acceleration         Advanced Features         ■ Network Adapter         Internal Virtual Switch         ♥ COM 1         None         ■ Diskette Drive         None         ■ Diskette Drive         None         ▲ Management         ① Name         ServerB         ③ Snapshot File Location		Hardware Acceleration         Specify networking tasks that can be offloaded to a physical network adapter.         Virtual machine queue         Wrtual machine queue (VMQ) requires a physical network adapter that supports this feature.         Image: The set offload of
D:\Hyper-V\Config	~	<u>QK</u> <u>Cancel</u> <u>Apply</u>

The Network Adapter Hardware Acceleration page in the Settings dialog box

#### Configuring Advanced Network Adapter Features

12	Settings for ServerB on CZ2	x
ServerB		
<ul> <li>★ Hardware</li> <li>▲ Add Hardware</li> <li>▲ BIOS Boot from CD</li> <li>■ Memory 512 MB</li> <li>■ Processor</li> <li>1 Virtual processor</li> <li>■ IDE Controller 0</li> <li>➡ Hard Drive ServerB.vhdx</li> <li>■ IDE Controller 1</li> <li>● DVD Drive vmguest.iso</li> <li>● SCSI Controller</li> <li>■ Metwork Advance</li> </ul>	Advanced Features       Advanced Features         MAC address       ● Dynamic         O 5tatic       00 - 15 - 5D - 02 - 12 - 01         MAC address spoofing allows virtual machines to change the source MAC address in outgoing packets to one that is not assigned to them.       Enable MAC address spoofing         DHCP guard       DHCP guard drops DHCP server messages from unauthorized virtual machines pretending to be DHCP servers.       =	
<ul> <li>Hetwork Adapter Broadcom NetXtreme Gigabit Et Hardware Acceleration Advanced Features</li> <li>Network Adapter Internal Virtual Switch</li> <li>COM 1 None</li> <li>COM 2 None</li> <li>Diskette Drive None</li> <li>Management</li> </ul>	Port mirroring     Port mirroring and outgoing packets and forwarding the copies to another virtual machine v	
ServerB  Integration Services All services offered  Snapshot File Location D:\Hyper-V\\Config	NIC Teaming       You can establish NIC Teaming in the guest operating system to aggregate bandwidth and provide redundancy. This is useful if teaming is not configured in the management operating system.       V       OK     Cancel	~

The Network Adapter Advanced Features page in the Settings dialog box

# Creating Virtual Network Configurations

Hyper-V makes it possible to

- Extend virtually any existing physical network configuration into its virtual space, or
- Create a completely separated and isolated network within the Hyper-V environment.

### Extending a Production Network into Virtual Space

- Microsoft recommends the use of at least 2 physical network adapters in a Hyper-V server, with 1 adapter servicing the parent partition, and the other connected to the child partitions.
- When you have more than 2 physical adapters in the server, you can create separate external virtual network switches for the physical adapters, and connect each one to a separate VM.

### Creating an Isolated Network

- By creating internal or private virtual switches, you can create a network that exists only within the Hyper-V space, with or without the parent partition included.
- Excellent for testing and evaluation purposes, or for classroom situations.
- You can also use VLANs to create isolated networks.

## Lesson Summary

- Networking is a critical part of creating a virtual machine infrastructure. Depending on your network plan, the virtual machines you create on a Windows Server 2012 Hyper-V server can require communication with other virtual machines, with the computers on your physical network, and/or with the Internet.
- A virtual switch, like its physical counterpart, is a device that functions at layer 2 of the Open Systems Interconnect (OSI) reference model. A switch has a series of ports, each of which is connected to a computer's network interface adapter. Any computer connected to the switch can transmit data to any other computer connected to the same switch.
- Hyper-V in Windows Server 2012 supports three types of switches: external, internal, and private, which you must create in the virtual Switch Manager before you can connect virtual machines to them.

## Lesson Summary

- Every network interface adapter has a Media Access Control (MAC) address (sometimes called a hardware address) that uniquely identifies the device on the network.
- Once you have created virtual switches in Hyper-V Manager, you can connect virtual machines to them by creating and configuring virtual network adapters.
- Selecting the Network Adapter option in the Add Hardware page creates what is known in Hyper-V terminology as a synthetic network adapter. Hyper-V supports two types of network and storage adapters: synthetic and emulated (sometimes called legacy).

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