

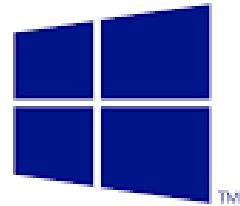


Hunan University of Arts and Science

Networking Theory & Applications

CIS 291

2018 - 2019



Windows Server® 2012

Part 3



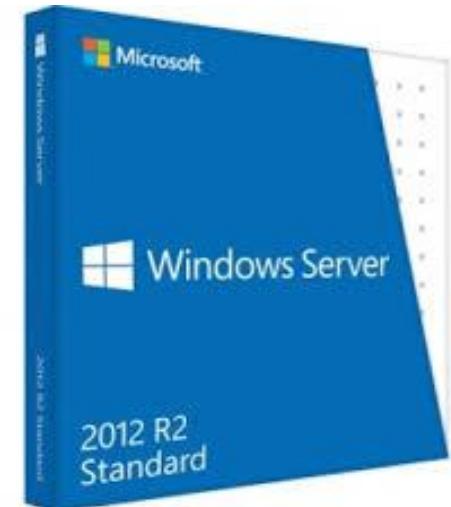
Chapter 3

Configuring Hyper-V

配置Hyper-V

Objectives in this chapter: 本章的目标

- 1- Create and configure virtual machine settings
- 2- Create and configure virtual machine storage
- 3- Create and configure virtual networks



Objective 3.3: Create and configure virtual networks

- 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

Hyper-V Virtual Switch

- Virtual switches in Hyper-V are Layer 2 switches.
- Can have unlimited ports.
- Acts like a physical switch.
- Allows communications of
 - Child VM to Child VM (Private)
 - Child to Network (External)
 - Child to Parent VM (Internal)



Активация Windows

Чтобы активировать Windows, перейдите
параметрам компьютера.

1- 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.

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

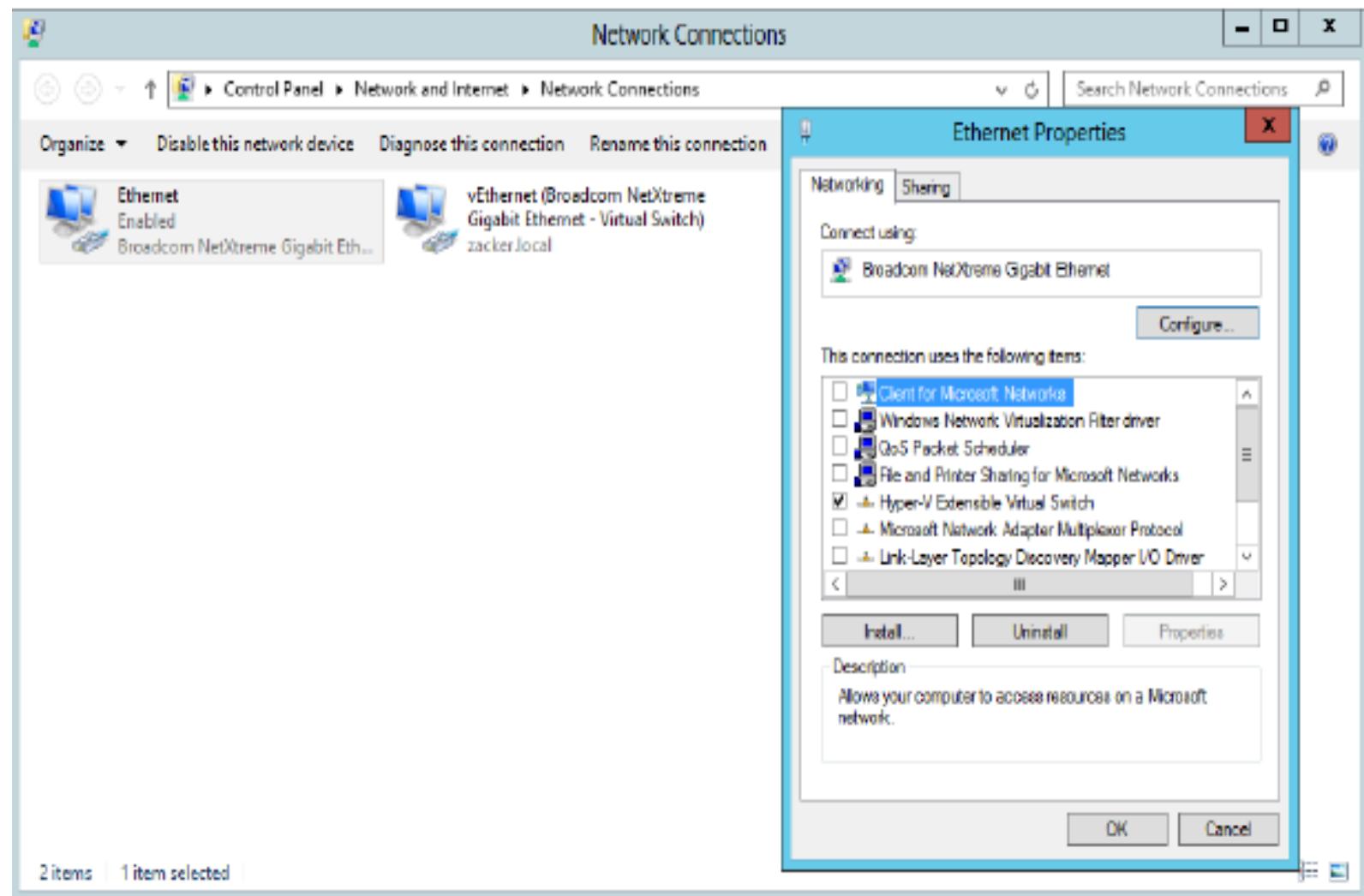
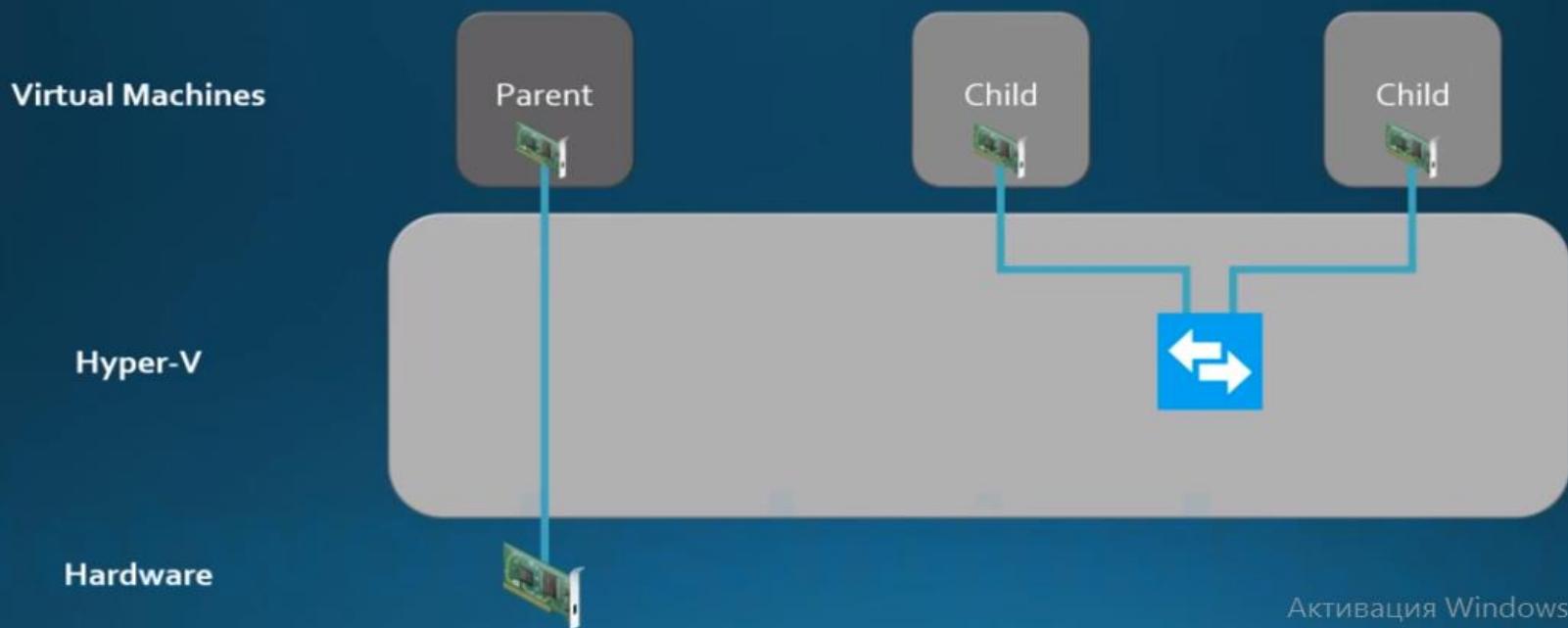


FIGURE 3-27 A network interface adapter in the host OS, bound to a virtual switch

2- Creating a New Virtual Switch

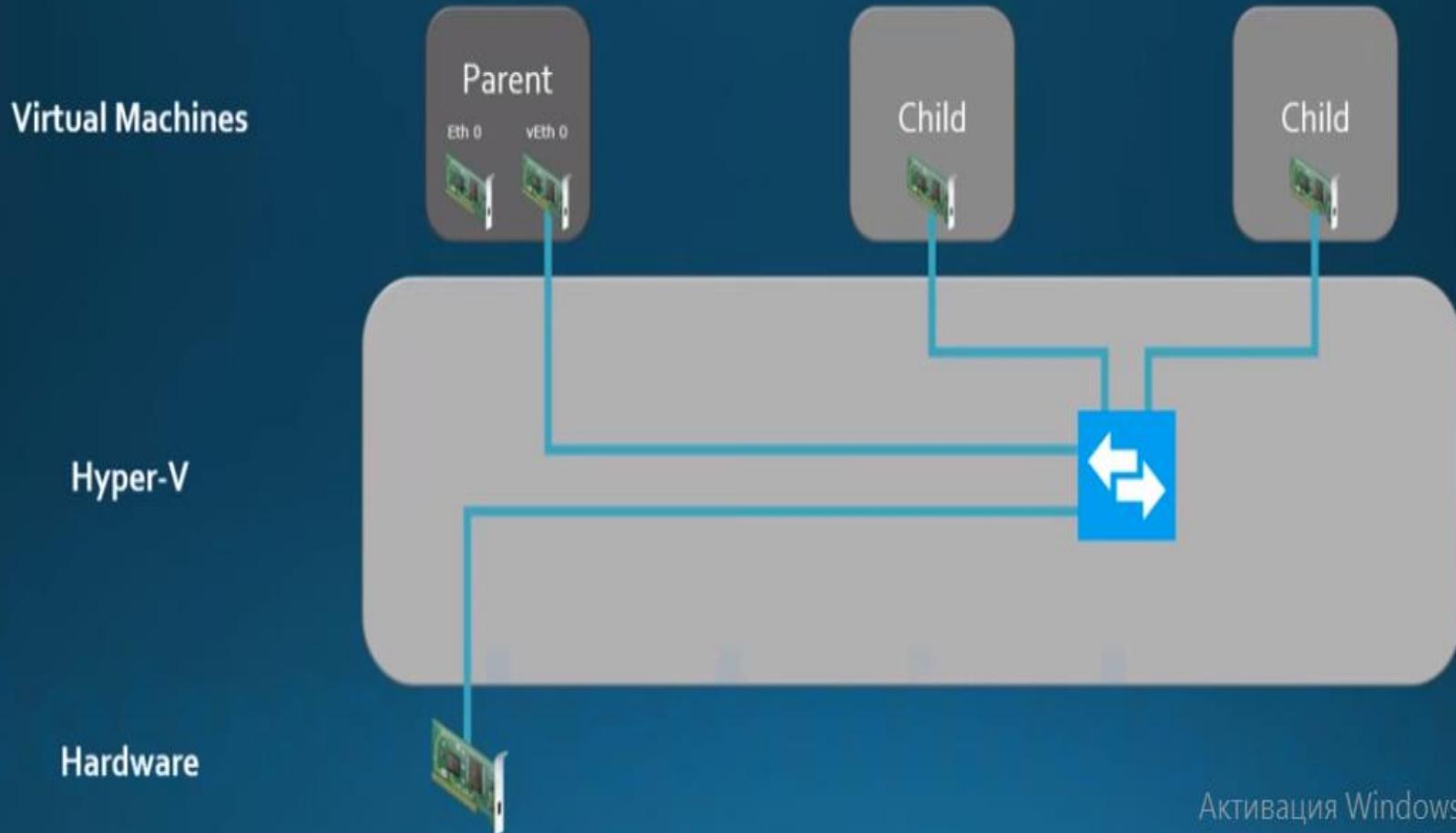
Hyper-V in Windows Server 2012 R2 supports three types of switches, which you must create in the Virtual Switch Manager before you can connect VMs to them:

Private Virtual Switch



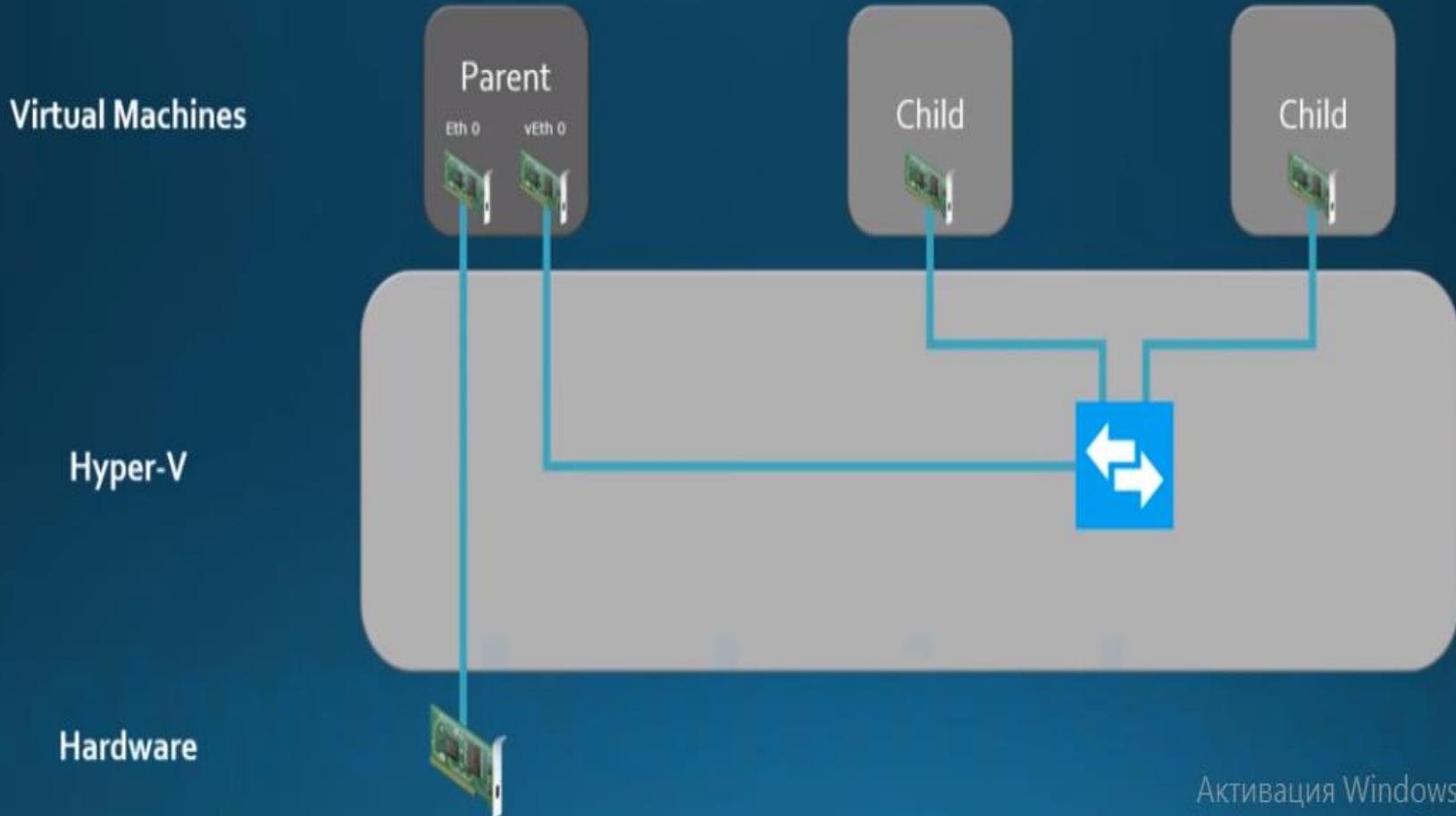
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External Virtual Switch



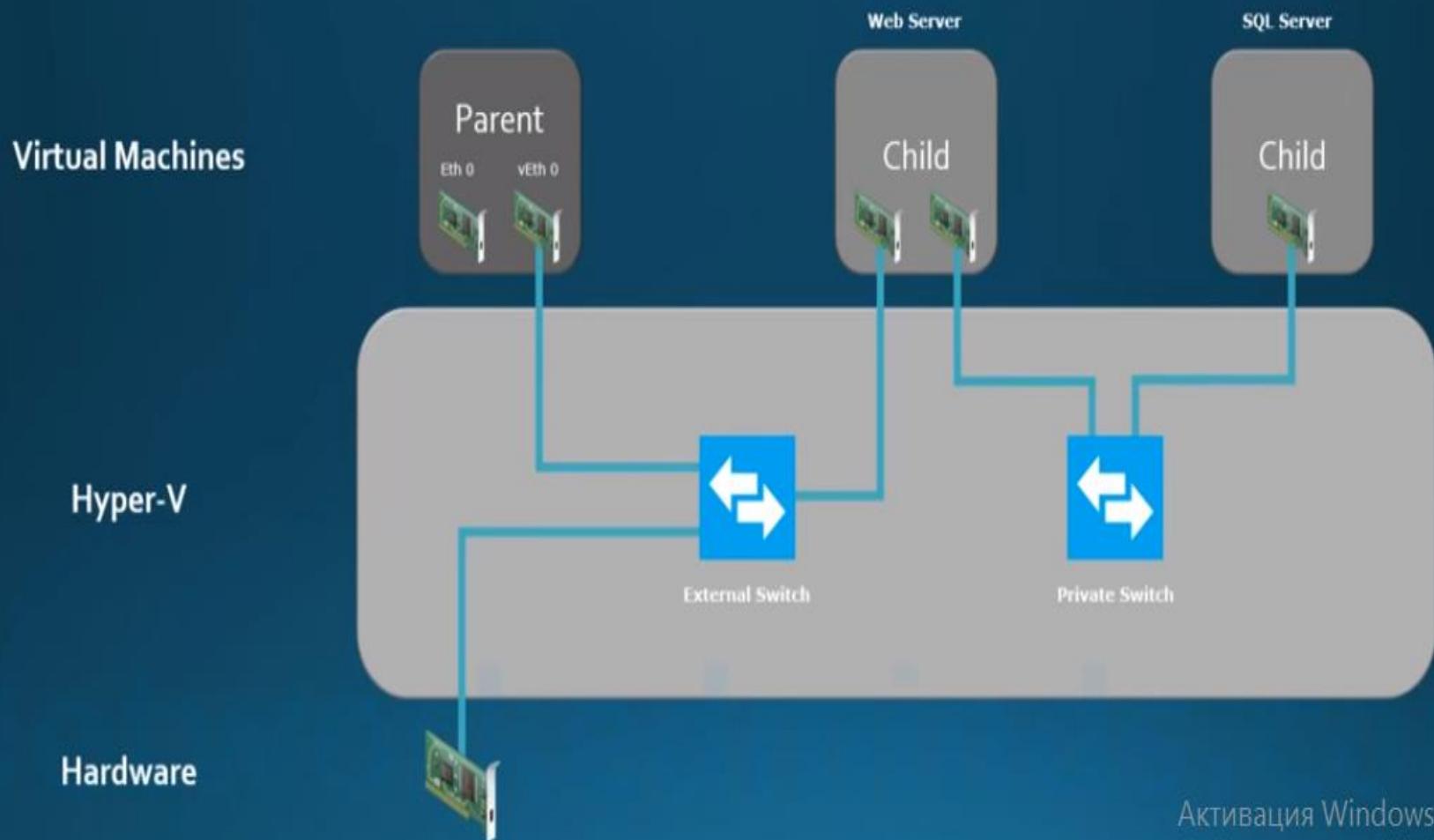
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Internal Virtual Switch



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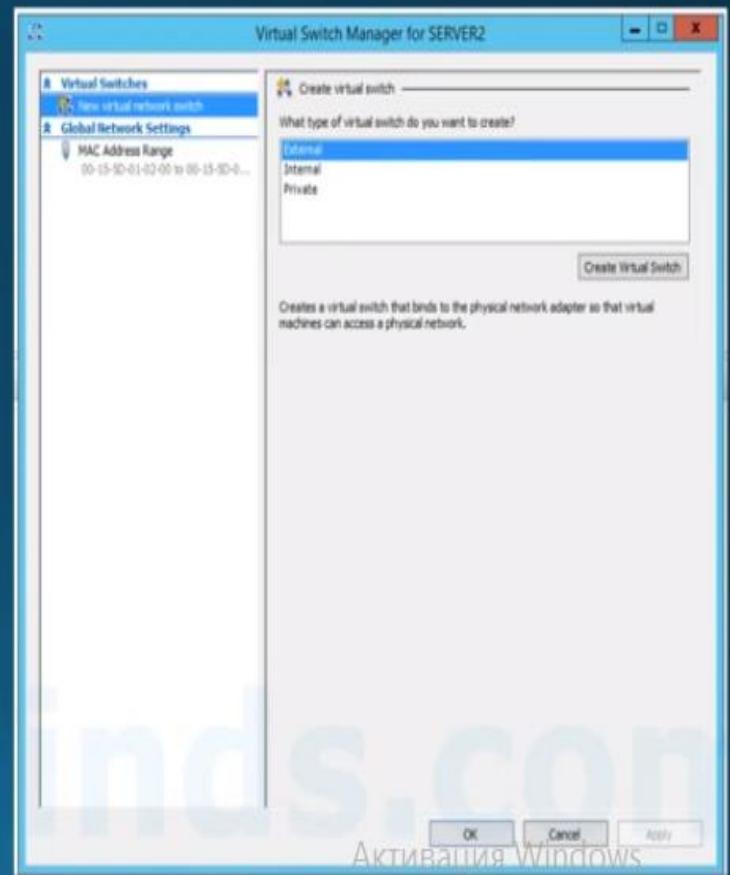
Hybrid Virtual Switch Environment



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The Virtual Switch Manager

- Used to create Virtual Switches in Hyper-V
- PowerShell can be used also:
New-VMSwitch <switch name> -NetAdapterName <adapter name> [-SwitchType Internal|Private]
- Options for Virtual Switches:
 - Allow management OS to share this network adapter
 - Enable Single Root I/O Virtualization (SR-IOV)
 - Enable Virtual LAN ID for Management OS



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Break

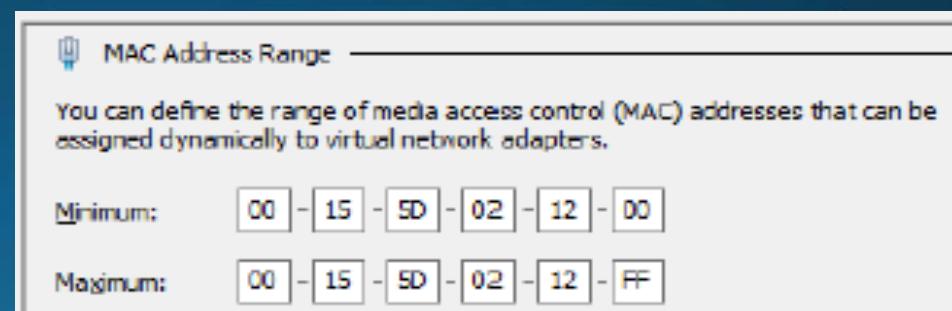
3- Configuring MAC Addresses

- 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 and permanently entered in the adapter's firmware.
- The MAC address is a 6-byte hexadecimal value, the first three bytes of which are an organizationally unique identifier (OUI) that specifies the manufacturer, and the last three bytes of which identify the adapter itself.
- The server has at least one real MAC address, provided in its physical network adapter, but Hyper-V cannot use that one address for all the virtual adapters connecting VMs to the network.
- Hyper-V creates a pool of MAC addresses during the installation of the role and it assigns addresses from this pool to VMs as you create them. Hyper-V has a pool of 256 addresses to assign to VMs as you create them.
- To view or modify the MAC address pool for the Hyper-V server, you open the Virtual Switch Manager and, under Global Network Settings, select MAC Address Range, as shown in Figure 3-29.

Virtual MAC Addresses

- Virtual network card = Virtual MAC address
- MAC address = 48 bits
- First 24 bits or 3 bytes = organizational unique ID (OUI)
- Last 24 bits or 3 bytes = organizations uniqueness
- Hyper-V creates a pool of virtual MAC addresses
- First 3 bytes are always 00-15-5D
- By default Hyper-V has 256 MAC addresses for use.



параметрам компьютера.

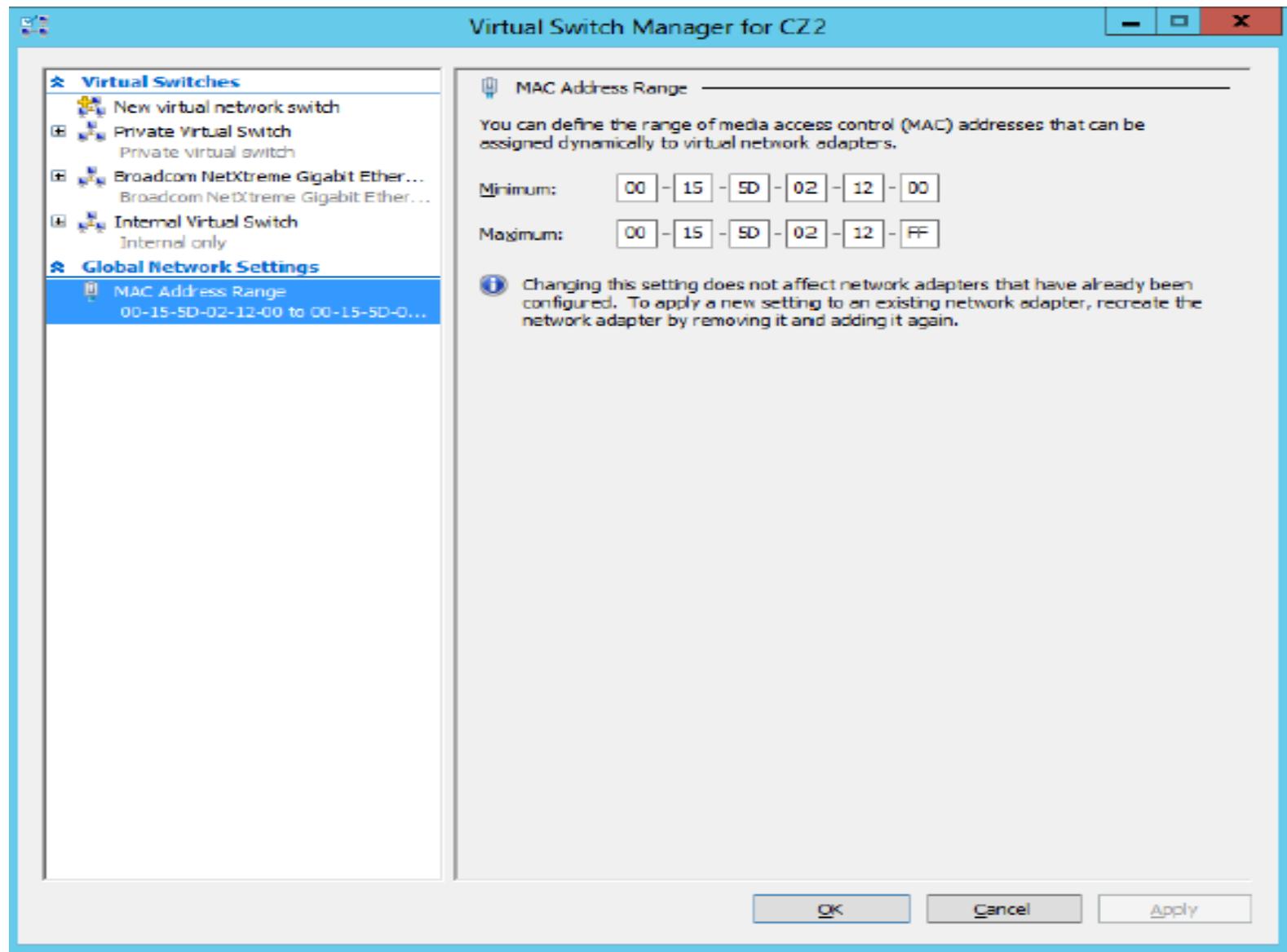


FIGURE 3-29 The MAC Address Range in the Virtual Switch Manager

4- 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.
- When you create a new VM, the default configuration includes one virtual network adapter. The New Virtual Machine Wizard includes a Configure Networking page, on which you can select one of the virtual switches you have created.
- you must use the following procedure:
 1. In Server Manager, on the Tools menu, select Hyper-V Manager to open the Hyper-V Manager console.
 2. In the left pane, select a Hyper-V server.
 3. In the Virtual Machines list, select a VM and, in the Actions pane, click Settings. The Settings dialog box for the VM appears.

4. In the Add Hardware list, select Network Adapter and click Add. A new adapter appears in the Hardware list, as shown in Figure 3-307.

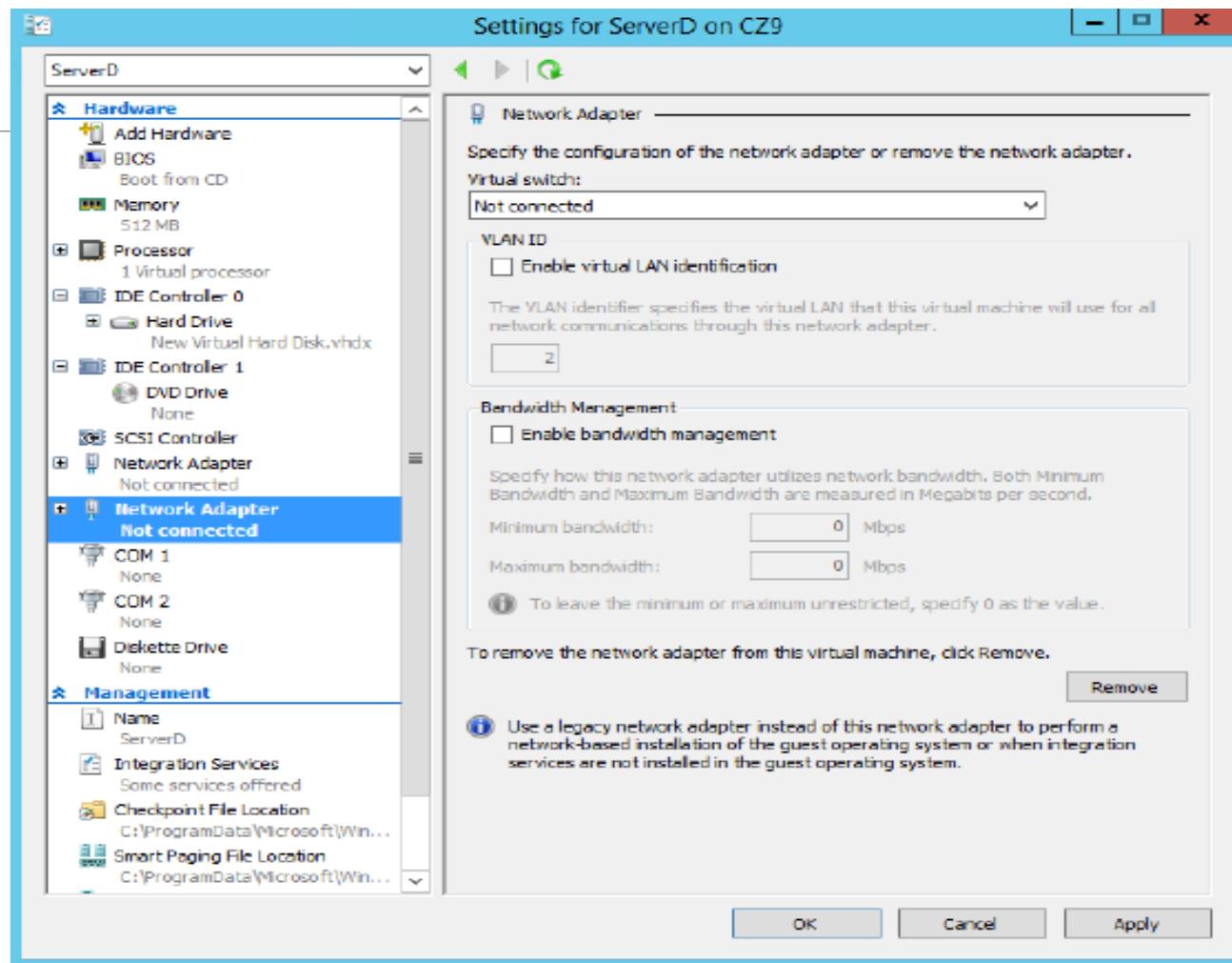


FIGURE 3-30 A new network adapter in the Settings dialog box

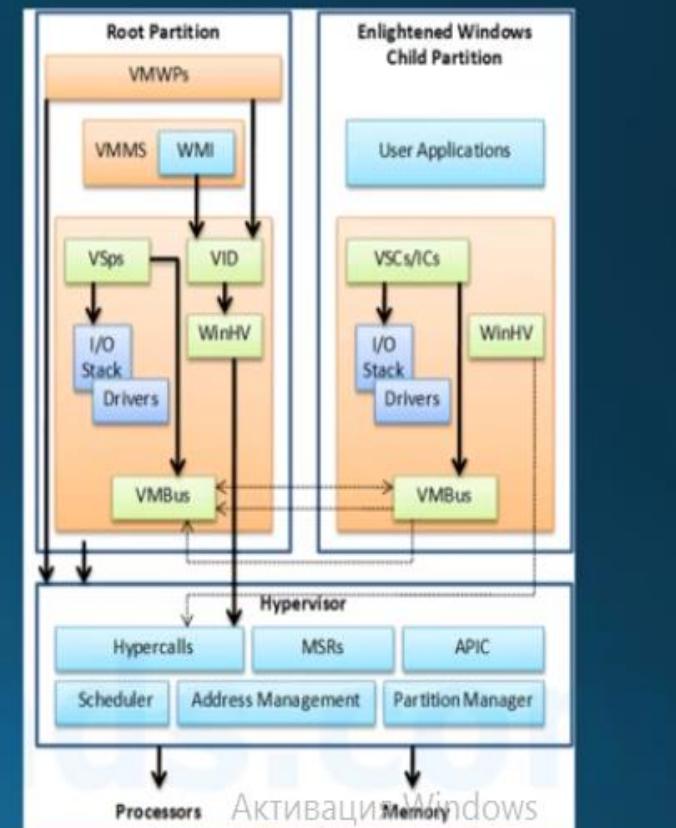
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5. In the Virtual Switch drop-down list, select the switch to which you want to connect the network adapter.
 6. If your host computer is connected to a physical switching infrastructure that uses VLANs to create separate subnets, you can select the Enable Virtual LAN Identification check box and enter a VLAN identifier to associate the network adapter with a particular VLAN on your physical network.
 7. To control the amount of network bandwidth allocated to the network adapter, select the Enable Bandwidth Management check box and supply values for the Minimum Bandwidth and Maximum Bandwidth settings.
 8. Click OK. The settings are saved to the VM configuration.

You can create up to 12 network adapters on a Windows Server 2012 R2 Hyper-V server: eight synthetic and four emulated.

5- Synthetic Adapters and Emulated Adapters

Synthetic vs Legacy NICs

- Legacy network adapters often known as emulated adapters are emulated DEC/Intel 21140 NICs
- Synthetic adapters use the VSC or Virtualization Service Client and talk directly to the Virtualization Service Provider via the VMBus.
- Legacy adapters make direct Hypercalls which are slower.
- Synthetic adapters require the guest integration services package.



1- Synthetic adapter mechanism

- The virtual switches you create in Hyper-V reside in the parent partition and are part of a component called the network Virtualization Service Provider (VSP).
- The synthetic network adapter in the child partition is a Virtualization Service Client (VSC).
- The VSP and the VSC are both connected to the VM Bus, which provides interpartition communications, as shown in Figure 3-31.
- The VSP, in the parent partition, provides the VSC, in the child partition, with access to the physical hardware in the host computer; that is, the physical network interface adapter.

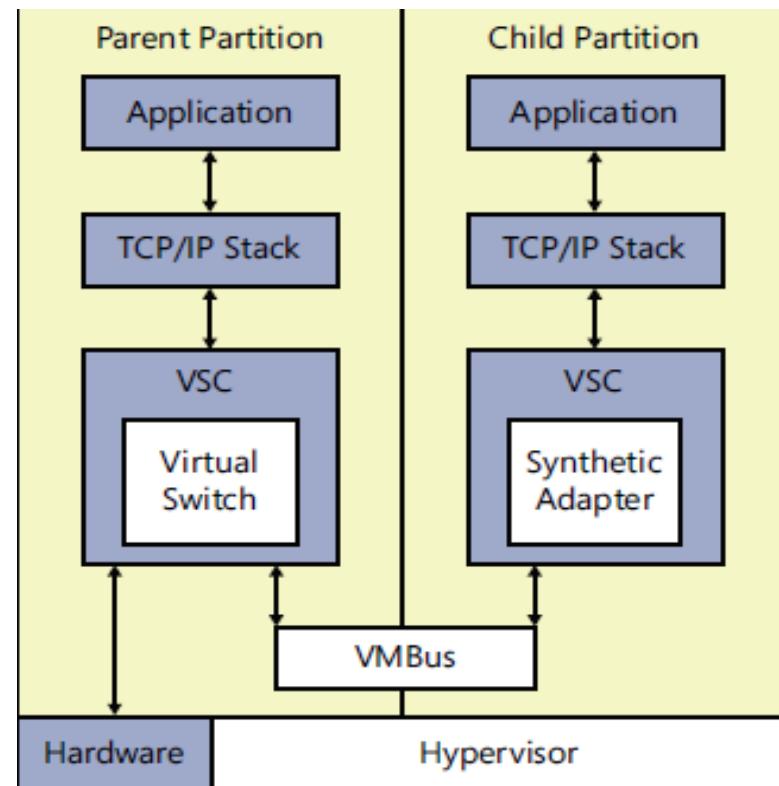


FIGURE 3-31 Synthetic network adapters communicate by using the VM Bus

2- Emulated adapter mechanism

To install an emulated adapter, you use the same procedure described earlier, except that you select Legacy Network Adapter from the Add Hardware list.

Unlike synthetic adapters, emulated adapters load their drivers before the OS, so it is possible to boot the VM by using the Preboot eXecution Environment (PXE) and then deploy an OS over the network.

This is one of two scenarios in which using an emulated adapter is preferable to using a synthetic adapter.

The other is when you are installing an OS on your VMs that does not have a Guest Integration Services package available for it.

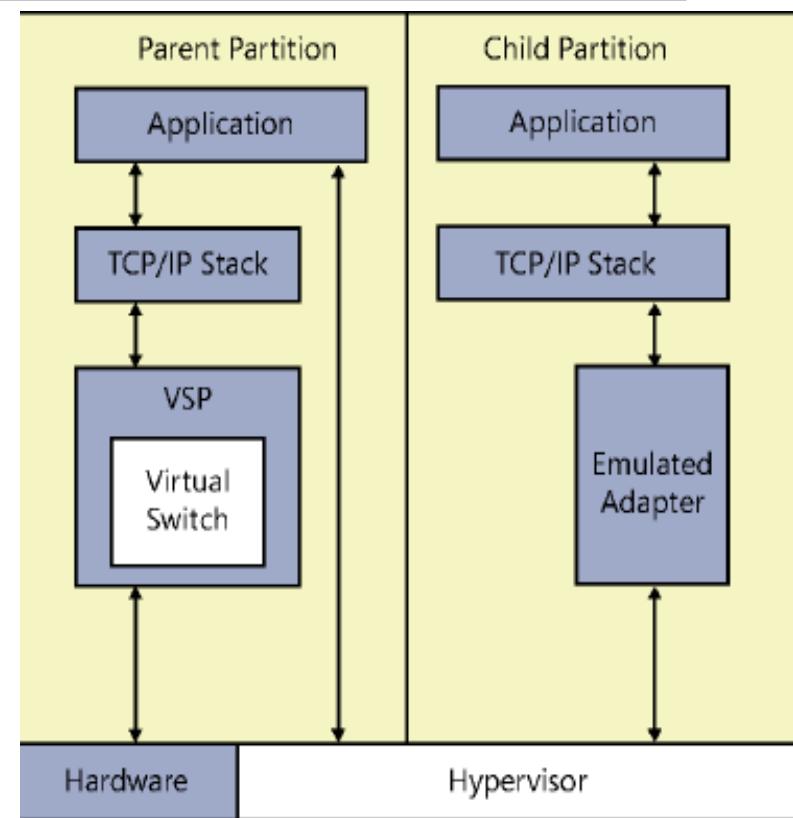


FIGURE 3-32 Emulated network adapters communicate by using the hypervisor

6- Configuring hardware acceleration settings

You can configure the following hardware acceleration settings if your network interface adapters supports them:

Hardware Acceleration Settings

- Enable Virtual Machine Queue or VMQ
 - Allows packets to be queued at the network card for direct delivery to the VM, bypassing the processing at the virtual switch.
- Enable IPsec Task Offloading
 - Allows the physical NIC to perform some of the cryptographic functions for Ipsec.
- Single-Root I/O Virtualization
 - Allows the virtual adapter to use SR-IOV capabilities of the physical adapter.

Note: Hardware Acceleration requires a **Synthetic NIC**

Активация Windows
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Configuring advanced network adapter features

The Advanced Features page provides additional options for supporting network adapter capabilities, as follows:

- Static MAC Address
 - Allows for a static MAC address to be assigned rather than the dynamic MAC address from the pool.
- Enable MAC Address Spoofing
 - Allows the virtual NIC to transmit and receive for a MAC not directly assigned. Useful/required for Network Load Balancing.
- Enable DHCP Guard
 - Prevent DHCP from rogue DHCP servers.
- Port Mirroring Mode
 - Allows the adapter to forward any package it receives to another adapter for analysis... Such as Wireshark or Network Monitor
- NIC Teaming
 - Allows the adapter to team with other adapters inside of the VM for additional bandwidth.

7- Configuring NIC teaming in a virtual network environment

- Windows feature for multiple adapters to be teamed together for bandwidth aggregation or fault tolerance.
- Virtual Machines are limited to two adapters in only one team.
- Physical Machines can have up to 64 adapters in a single team.