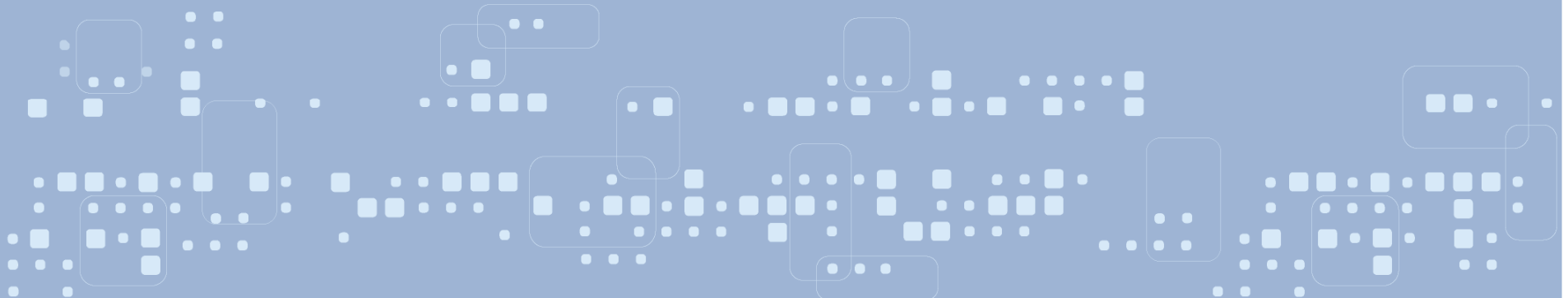


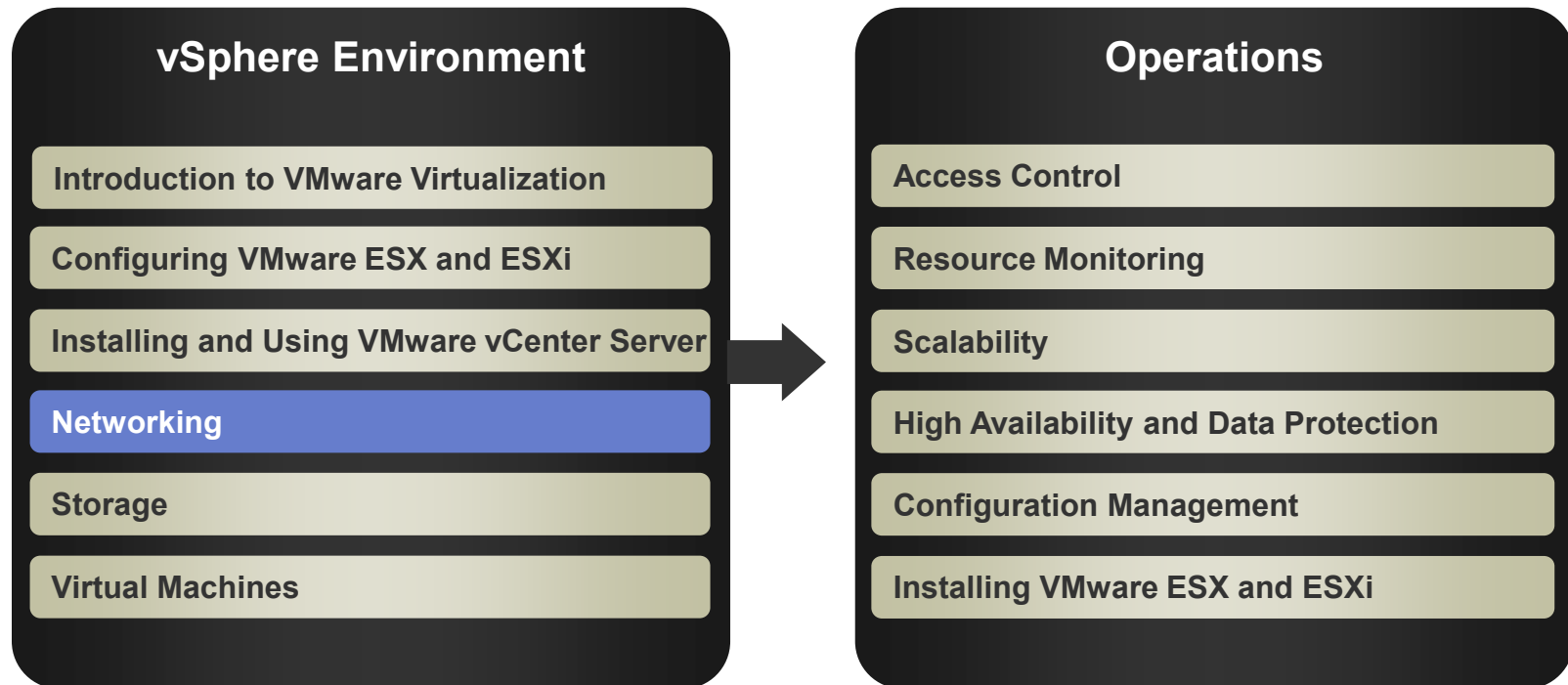


Networking

Module 5



You Are Here



Importance

- VMware ESX™/ESXi networking features allow virtual machines to communicate with other virtual and physical machines, allow management of the ESX/ESXi host, and allow the VMkernel to access IP-based storage and perform VMotion™ migrations. Failure to properly configure ESX/ESXi networking can negatively affect virtual machine management and storage operation.

Module Lessons

Lesson 1: vNetwork Standard Switches

Lesson 2: vNetwork Distributed Switches

Lesson 3: Modifying Virtual Switch Properties



Lesson 1: vNetwork Standard Switches

Lesson Objectives

- Describe the components of a vNetwork standard switch
- Describe the vNetwork connection types
- View the vNetwork standard switch configuration

What Is vNetwork?

vNetwork capabilities optimally align physical and virtual machine networking, and provide the networking for hosts and virtual machines.

vNetwork supports two types of virtual switches:

- > vNetwork standard switches**
 - Virtual switch configuration for a single host
- > vNetwork distributed switches**
 - Virtual switches that provide a consistent network configuration for virtual machines as they migrate across multiple hosts

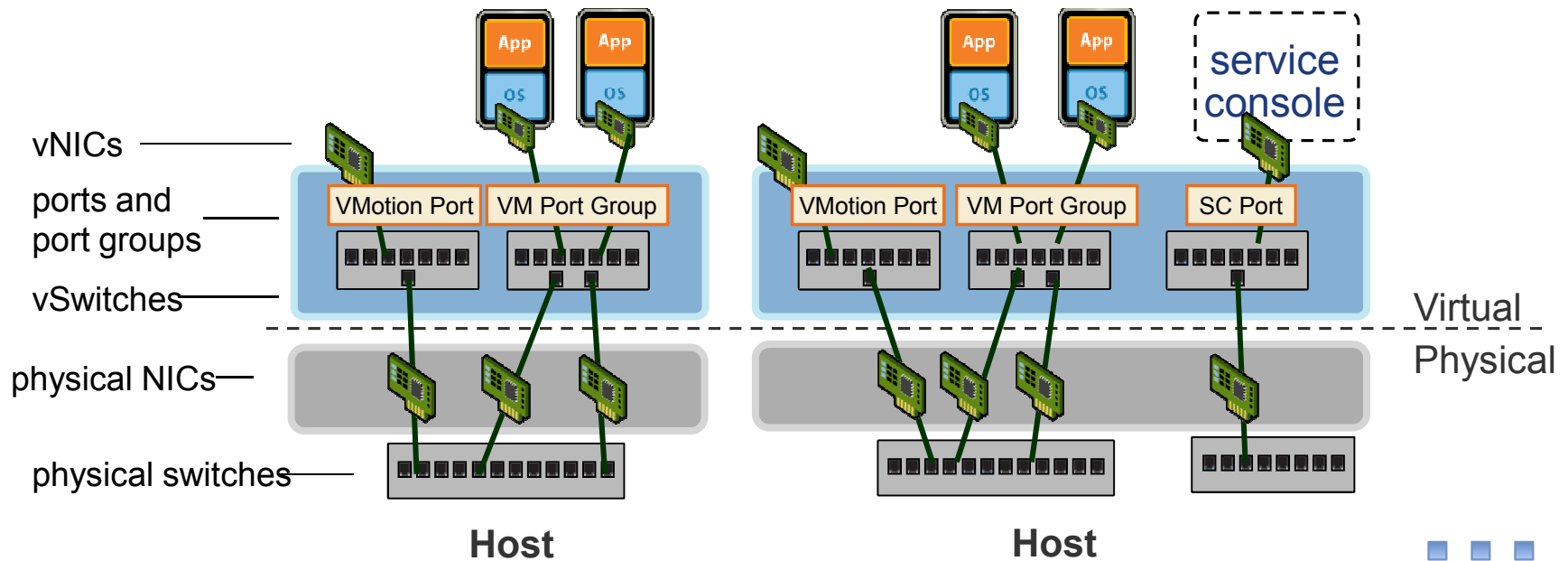
vNetwork Standard Switch

A vNetwork standard switch (vSwitch)

- Directs network traffic between virtual machines and links to external networks
- Combines the bandwidth of multiple network adapters and balances traffic among them. It can also handle physical NIC failover.
- Models a physical Ethernet switch
 - Default number of ports is 56 (4,088 maximum).
 - A virtual machine's NIC can connect to a port.
 - Each uplink adapter uses one port.

vNetwork Standard Switch Components

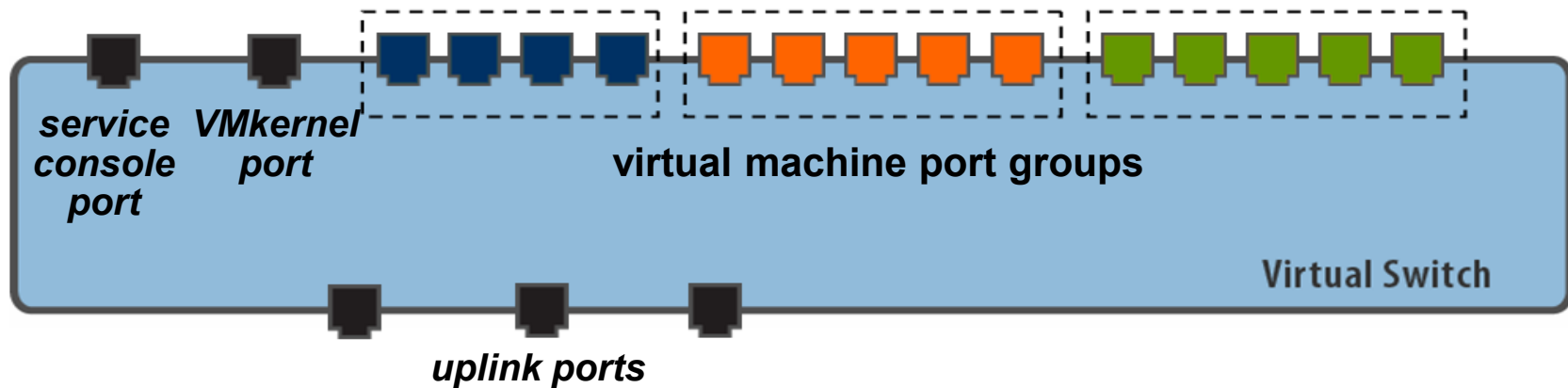
Network configuration at the host level



vSwitch Ports

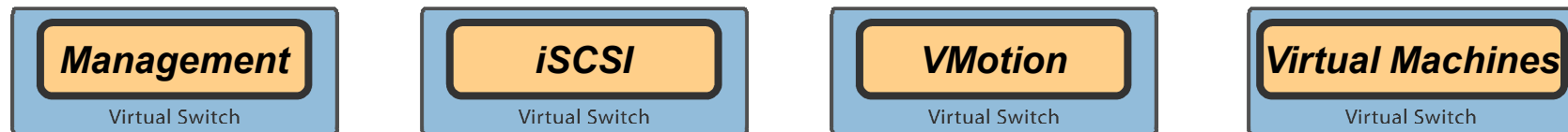
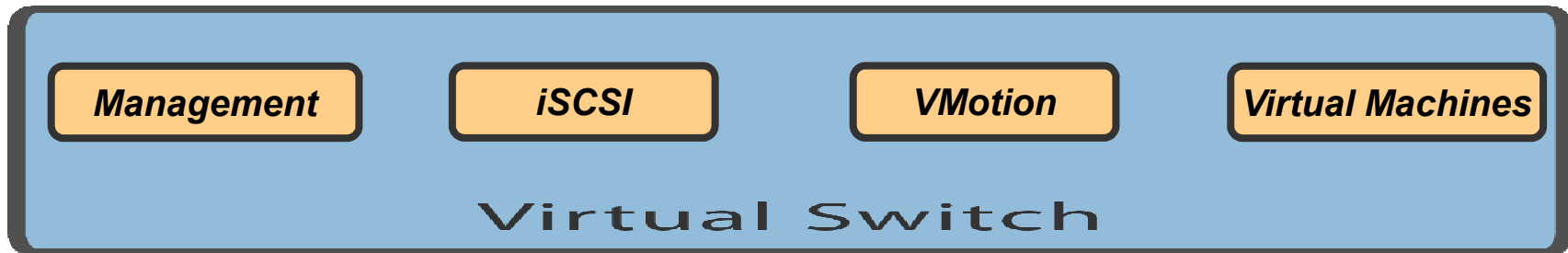
A vSwitch allows the following connection types:

- VMkernel port (used for VMotion, iSCSI, NFS)
- Service console port (ESX only)
- Virtual machine port group



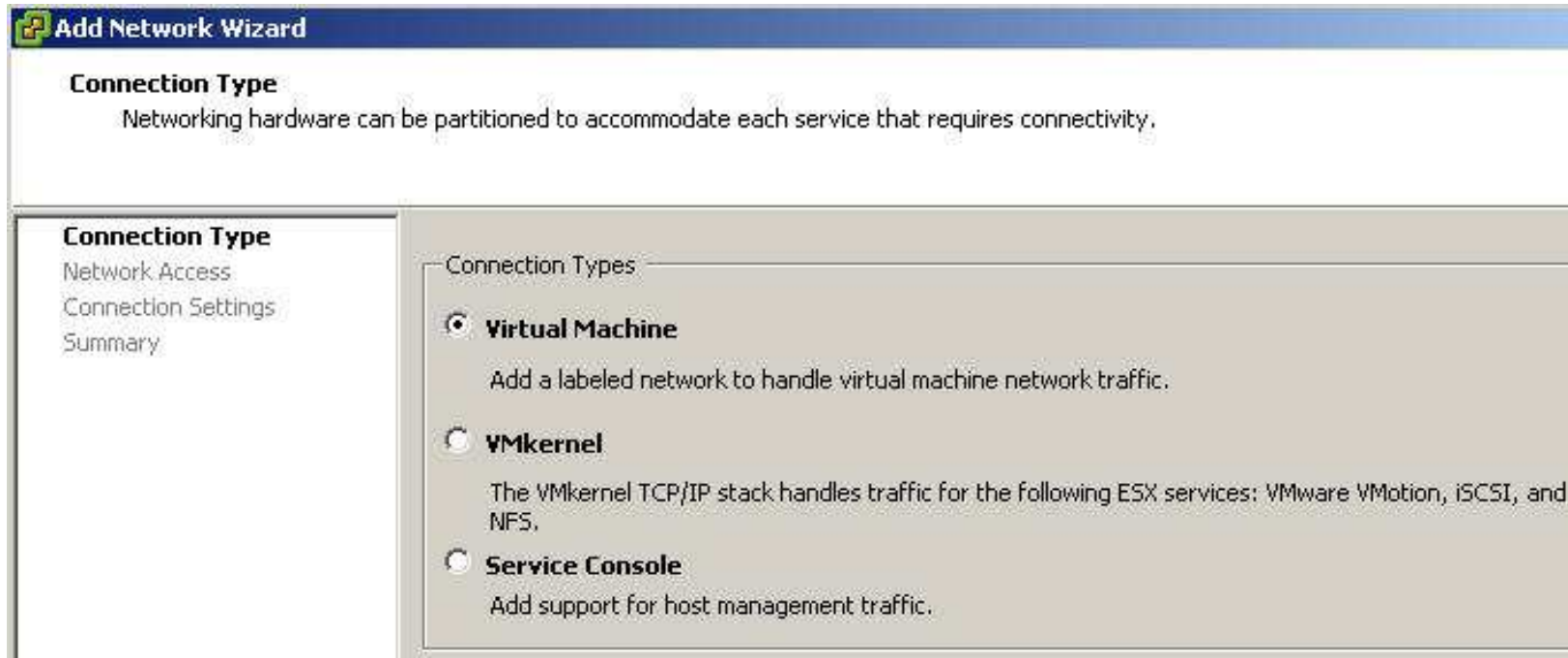
vSwitch Examples

Different networks can coexist on the same virtual switch. Or they can exist on separate virtual switches.



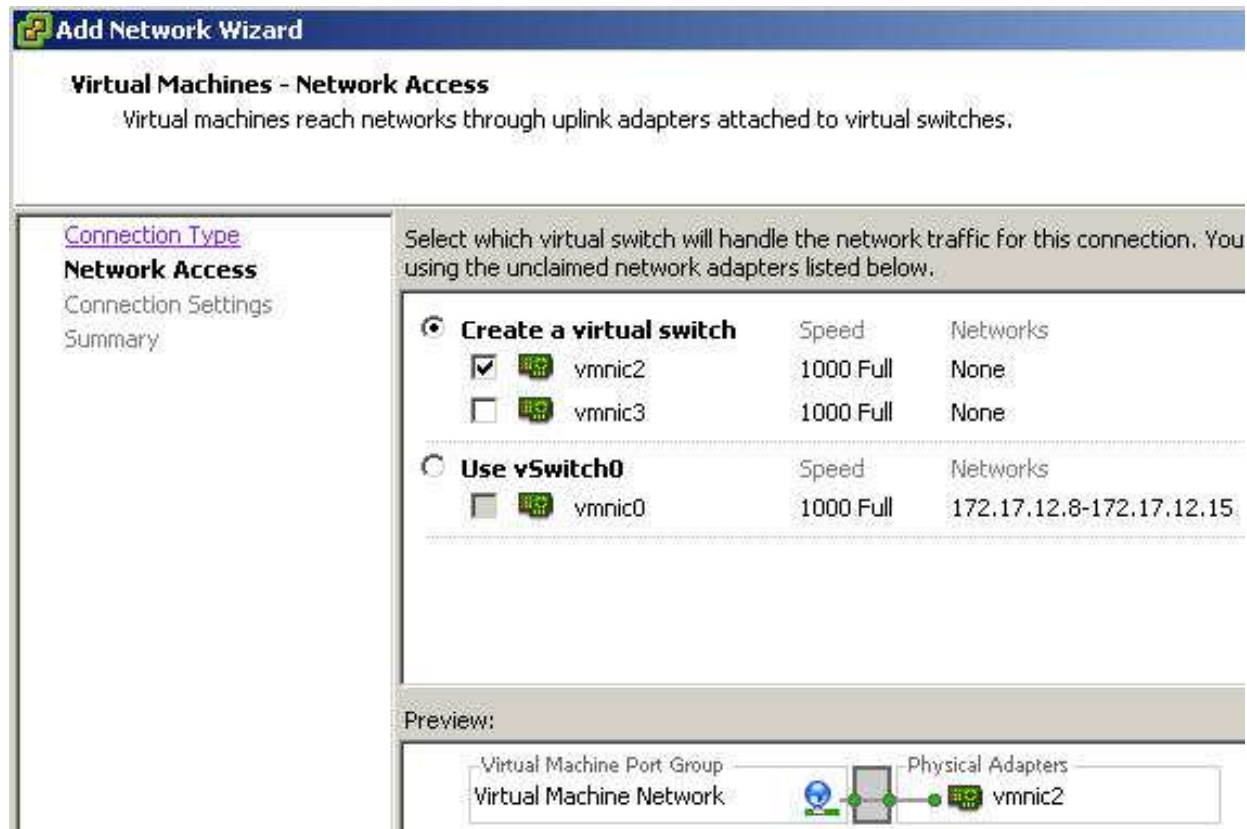
Adding a Network: Connection Type

1. In the **Configuration** tab, click **Add Networking**.
2. In the Add Network wizard, choose desired connection type: **Virtual Machine**, **VMkernel**, or **Service Console**.



Adding a Network: Network Adapters

- Create a new virtual switch or add the connection type to an existing virtual switch.



Add Network Wizard

Virtual Machines - Network Access
Virtual machines reach networks through uplink adapters attached to virtual switches.

Connection Type
Network Access
Connection Settings
Summary

Select which virtual switch will handle the network traffic for this connection. You using the unclaimed network adapters listed below.

<input checked="" type="radio"/> Create a virtual switch		Speed	Networks
<input checked="" type="checkbox"/>	vmnic2	1000 Full	None
<input type="checkbox"/>	vmnic3	1000 Full	None

<input type="radio"/> Use vSwitch0		Speed	Networks
<input type="checkbox"/>	vmnic0	1000 Full	172.17.12.8-172.17.12.15

Preview:

Virtual Machine Port Group: Virtual Machine Network

Physical Adapters: vmnic2

Adding a Network: Connection Settings

- Name the connection and optionally define a VLAN ID (1–4,094) if using VLANs.

The screenshot displays the 'Add Network Wizard' interface. The title bar reads 'Add Network Wizard'. Below it, the section is titled 'Virtual Machines - Connection Settings' with a subtitle: 'Use network labels to identify migration compatible connections common to two or more hosts.' On the left, a navigation pane lists 'Connection Type', 'Network Access', 'Connection Settings' (which is selected), and 'Summary'. The main area is titled 'Port Group Properties' and contains two input fields: 'Network Label:' with the text 'Production' entered, and 'VLAN ID (Optional):' with a dropdown arrow. Below this is a 'Preview:' section showing a diagram of a 'Virtual Machine Port Group' labeled 'Production' connected to 'Physical Adapters' labeled 'vmnic2'.

vSwitch Configuration

Display vNetwork standard switches.

View:

Virtual Switch

Distributed Virtual Switch

Networking

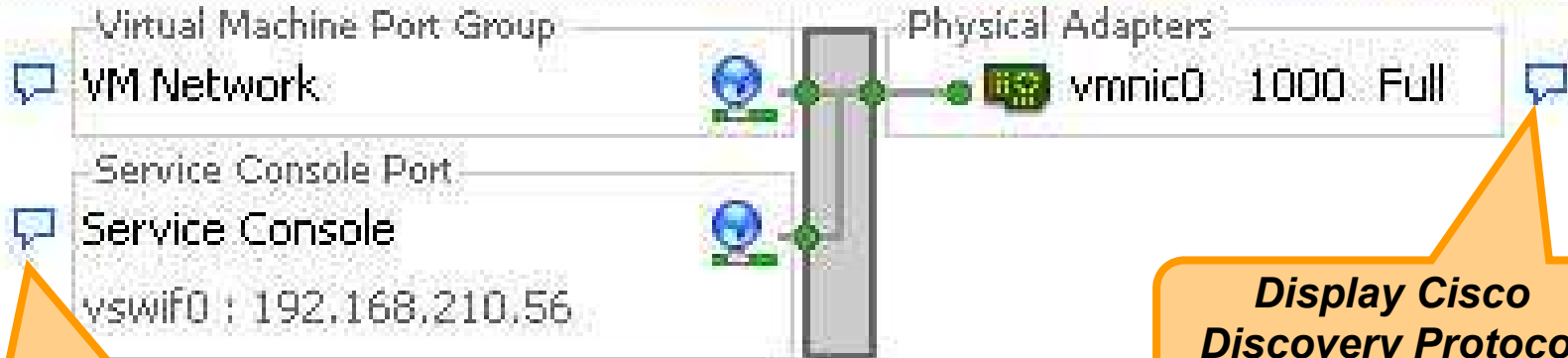
Delete the virtual switch.

Display virtual switch properties.

Virtual Switch: vSwitch0

Remove...

Properties...



Display port group properties.

Display Cisco Discovery Protocol information.

Physical Network Considerations

Discuss VMware vSphere™ networking needs with your network administration team:

- Number of physical switches
- Network bandwidth required
- Physical switch support for 802.3AD (for NIC teaming)
- Physical switch support for 802.1Q (for VLAN trunking)
- Network port security
- Cisco Data Protocol (CDP) and its operational modes: listen, broadcast, listen and broadcast, and disabled.

Lesson Summary

- A vNetwork consists of two types of switches: standard switches and distributed switches.
- A standard switch allows virtual machine networking and is configured at each host.
- There are three connection types: virtual machine, VMkernel, and service console.



Lesson 2: vNetwork Distributed Switches

Lesson Objectives

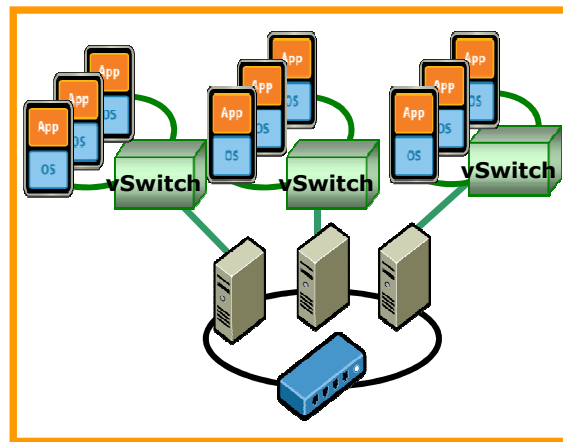
- List the benefits of using vNetwork distributed switches
- Describe the vNetwork distributed switch architecture
- Create a vNetwork distributed switch
- Manage the vNetwork distributed switch using the VMware vSphere Client

	ESXi Single Server	Essentials	Essential Plus	Standard	Advanced	Enterprise	Enterprise Plus
ESX/ESXi	ESXi Only	✓	✓	✓	✓	✓	✓
vCenter Server Compatibility	None	vCenter Server for Essentials	vCenter Server for Essentials	vCenter Server Foundation & Standard	vCenter Server Foundation & Standard	vCenter Server Foundation & Standard	vCenter Server Foundation & Standard
Cores per Processor	6	6	6	6	12	6	12
vSMP Support	4-way	4-way	4-way	4-way	4-way	4-way	8-way
Memory/Physical Server	256GB	256GB	256GB	256GB	256GB	256GB	No license limit
Thin Provisioning	✓	✓	✓	✓	✓	✓	✓
VC Agent		✓	✓	✓	✓	✓	✓
Update Manager		✓	✓	✓	✓	✓	✓
VMSafe		✓	✓	✓	✓	✓	✓
vStorage APIs		✓	✓	✓	✓	✓	✓
High Availability (HA)			✓	✓	✓	✓	✓
Data Recovery			✓		✓	✓	✓
Hot Add					✓	✓	✓
Fault Tolerance					✓	✓	✓
vShield Zones					✓	✓	✓
VMotion					✓	✓	✓
Storage VMotion						✓	✓
DRS						✓	✓
vNetwork Distributed Switch							✓
Host Profiles							✓
Third Party Multipathing							✓

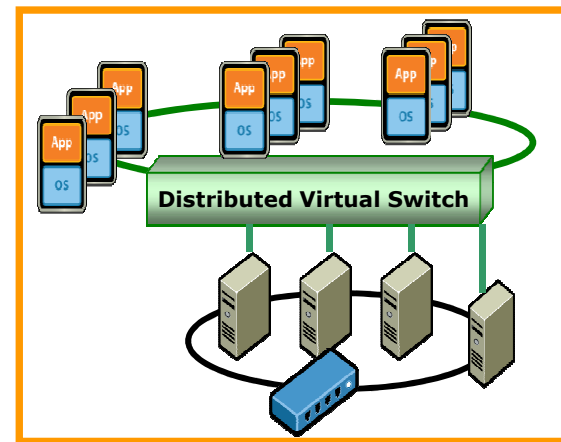
Benefits of Distributed Switches

The benefits of distributed switches over standard switches:

- Simplify datacenter administration
- Provide support for private VLANs
- Enable networking statistics and policies to migrate with virtual machines during a migration using VMware VMotion™
- Provide for customization and third-party development

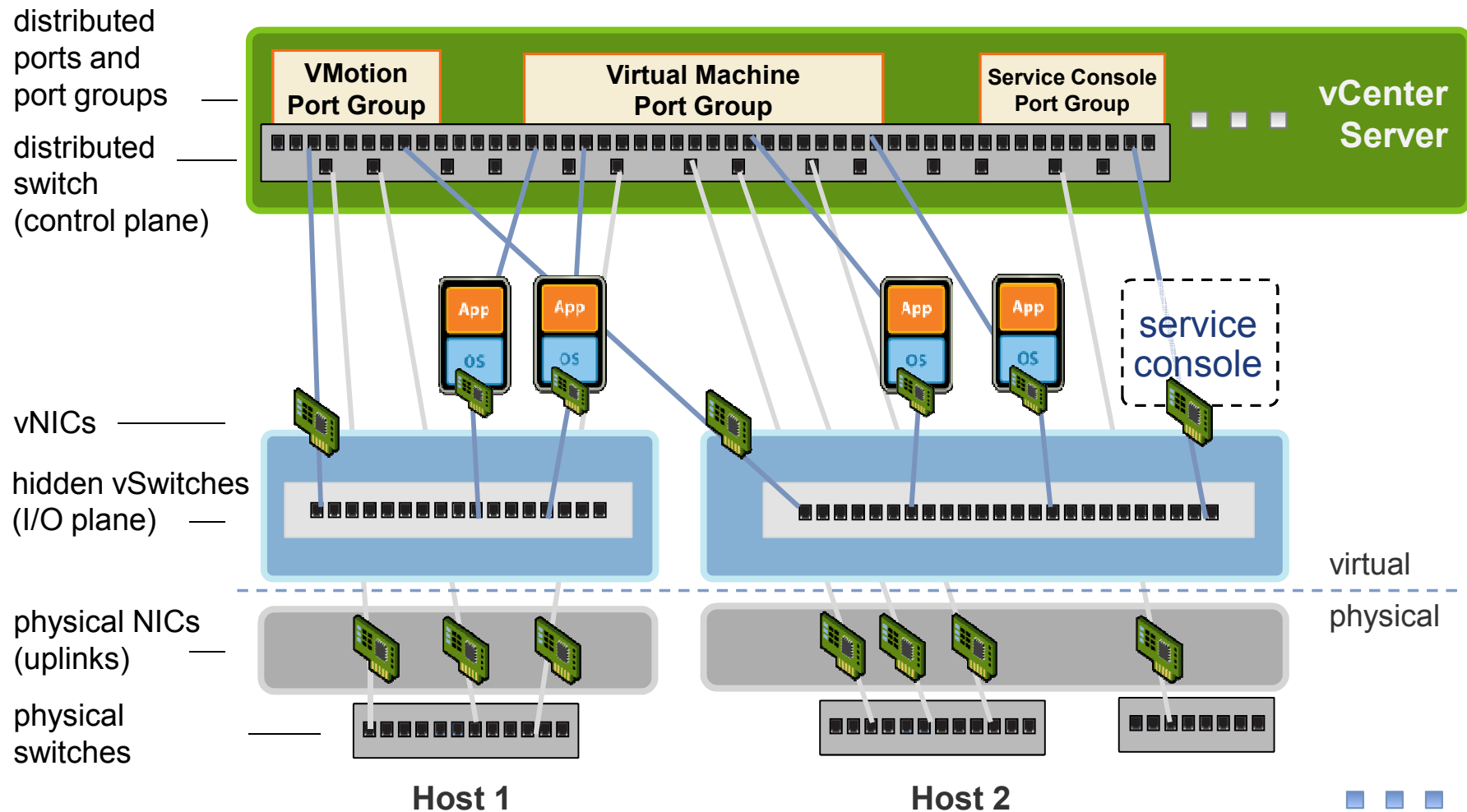


standard switches



distributed switches

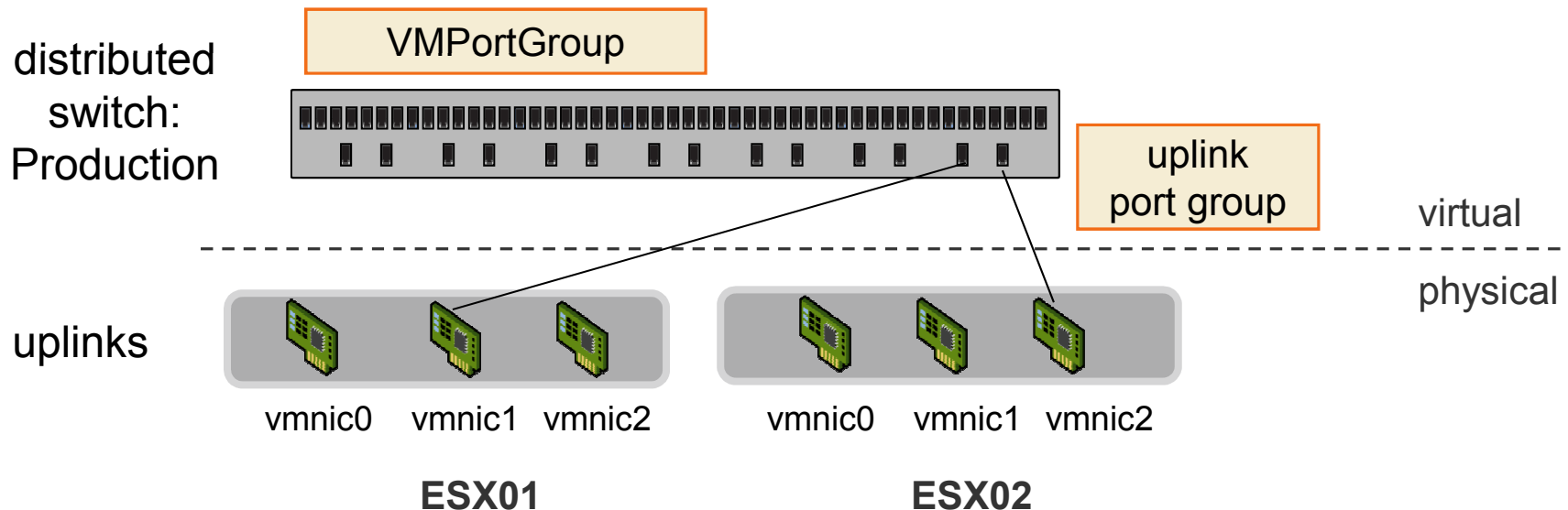
vNetwork Distributed Switch Architecture



Distributed Switch Example

Example:

- Create a distributed switch named Production, to be used for virtual machine networking. Assign uplinks, vmnic1 on host ESX01 and vmnic2 on host ESX02, to the distributed switch.



Creating a Distributed Switch

Create vNetwork Distributed Switch

General Properties

Specify the vNetwork distributed switch properties.

General Properties
Add hosts and physical adapters
Ready to complete

General

Name:

Number of dvUplink ports:

Maximum number of physical adapters per host

Create vNetwork Distributed Switch

Add hosts and physical adapters

Select hosts and physical adapters to add to the new vNetwork distributed switch.

General Properties

Add hosts and physical adapters

Ready to complete

When do you want to add hosts and their physical adapters to the new vNetwork distrib

- Add now
 Add later

Host/Physical adapters	In use by switch	Physical adapter details
<input checked="" type="checkbox"/>  sc-quail04.vmeduc.com		
Select physical adapters		
<input checked="" type="checkbox"/>  vmnic1	--	View details...
<input type="checkbox"/>  vmnic2	--	View details...
<input type="checkbox"/>  vmnic3	--	View details...
<input type="checkbox"/>  sc-quail07.vmeduc.com		

Enter name of switch, number of uplink ports, then choose the physical adapters from each host to add to the switch.

Viewing Distributed Switches

The screenshot displays the VMware vSphere interface. At the top, a navigation breadcrumb is highlighted with an orange box, showing the path: Home > Inventory > Networking. Below this, the left-hand navigation pane shows a tree structure under 'VC-QUAIL04.vmeduc.com', including 'Training', 'VM Network', and 'Production'. The 'Production' folder is expanded, showing 'Production-DVUplinks-71' and 'dvPortGroup'. The main content area is titled 'Production' and has several tabs: 'Getting Started', 'Summary', 'Networks', 'Ports', 'Configuration', 'Virtual Machines', 'Hosts', 'Tasks & Events', and 'Alarms'. The 'Configuration' tab is selected. Below the tabs, there are buttons for 'Remove', 'Add Host...', 'New Port Group...', and 'Edit Settings.'. The main area shows a diagram of the distributed switch configuration. A 'dvPortGroup' is shown with 'VLAN ID: --' and 'Virtual Machines (0)'. To the right, a 'Production-DVUplinks-71' folder is expanded, showing four 'dvUplink' objects. A 'Pan and Zoom' window is overlaid on the diagram, showing a zoomed-in view of the switch configuration. A blue callout box in the bottom left corner contains the text: 'Use the **Configuration** tab to modify the switch.'

Connecting a Virtual Machine to a Port Group

Connect a virtual machine by assigning the port group to its network adapter.

The screenshot shows the 'vSauce04-1 - Virtual Machine Properties' dialog box with the 'Options' tab selected. The 'Network adapter 1' is highlighted in the left-hand list, and its details are shown in the right-hand pane. The 'Network Connection' section is highlighted with an orange box, showing 'Network Label' set to 'dvPortGroup (Production)'. The 'Device Status' section shows 'Connect at power on' checked. The 'Adapter Type' is 'Flexible' and the 'MAC Address' is '00:50:56:a3:75:56'. The 'Specify Port' section is currently disabled.

Device	Type
Summary	256 MB
	1
Video card	Client Device
Client Device	Client Device
Network adapter 1 (edit...)	dvPortGroup (Produ...
SCSI controller 0	BusLogic Parallel
Hard disk 1	Virtual Disk

Device Status

- Connected
- Connect at power on

Adapter Type

Current adapter: Flexible

MAC Address

00:50:56:a3:75:56

Automatic Manual

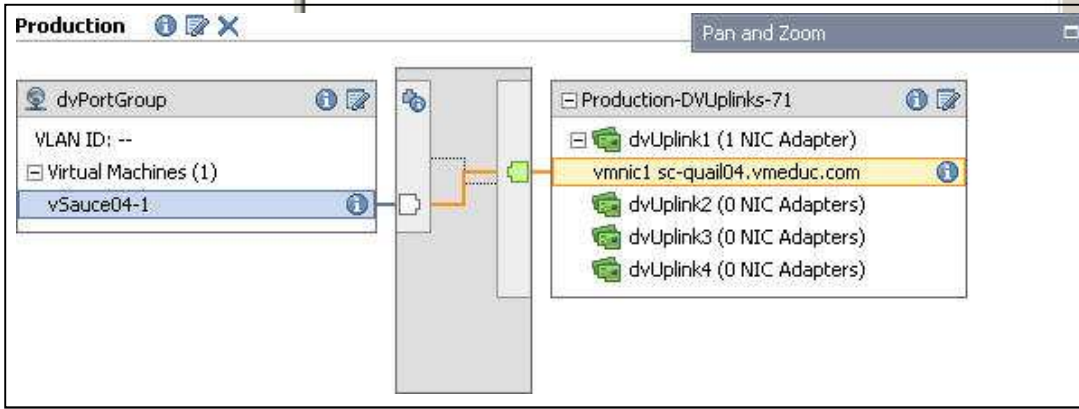
Network Connection

- Network Label
- dvPortGroup (Production)
- Port: N/A

Specify Port: (Advanced)

DVSwitch: []

Port ID: []



Adding a Host to a Distributed Switch

Right-click the distributed switch, then choose Add Host.

Add Host to Distributed Virtual Switch

Select host and physical adapters

Select a host and physical adapters to add to this distributed virtual switch. Use Host Profiles to add multiple hosts to the switch simultaneously. Host profiles can be accessed from the Home view. To add additional physical adapters to a host already added to the switch, go to Host > Configuration > Networking.

Select host and physical adapters	Host/Physical adapters	In use by switch	Physical adapter details	DVUplink port group
Ready to complete	sc-quail07.vmeduc.com			
	Select physical adapters			
	<input type="checkbox"/> vmnic0	vSwitch0	View details...	Production-DVUplinks-71
	<input checked="" type="checkbox"/> vmnic1	--	View details...	Production-DVUplinks-71
	<input type="checkbox"/> vmnic2	--	View details...	Production-DVUplinks-71
	<input type="checkbox"/> vmnic3	--	View details...	Production-DVUplinks-71

VMkernel and Service Console Connections

The screenshot displays the VMware vSphere interface for a host named 'sc-quail04.vmeduc.com'. The breadcrumb navigation at the top shows 'Home > Inventory > Hosts and Clusters'. The left sidebar shows a tree view with 'VC-QUAIL04.vmeduc.com' expanded to 'Lab Servers', listing 'sc-quail04.vmeduc.com' and 'sc-quail07.vmeduc.com'. The main content area shows the 'Configuration' tab for the host, with the 'Networking' section selected. The 'View' dropdown is set to 'Distributed Virtual Switch'. The 'Distributed Virtual Switch: VMotion' section is visible, showing a 'VMotion' switch with a 'Manage Virtual Adapters...' button. A 'Manage Virtual Adapters' dialog box is open in the foreground, showing a table of adapters:

Name	Network Connection
Service Console	
VMkernel	
vmk1	

The dialog box also includes fields for 'Port group', 'Port', 'VMotion', 'Fault tolerance logging', and 'HA communication'. The 'Add' button is highlighted in the dialog's toolbar.

Use the Manage Virtual Adapters dialog box to add a new virtual adapter or to migrate an existing one to a distributed switch.

Managing Physical Adapters (Uplinks)

View: Virtual Switch **Distributed Virtual Switch**

Networking

Distributed Virtual Switch: VMotion

Manage Virtual Adapters...

Manage Physical Adapters...

VMotion

dvPortGroup2
VLAN ID: --

VMotion-DVUplinks-74

- dvUplink1 (1 NIC Adapter)
- dvUplink2 (0 NIC Adapters)
- dvUplink3 (0 NIC Adapters)
- dvUplink4 (0 NIC Adapters)

Manage Physical Adapters

Physical Adapter Details

General

Vendor/Model: Broadcom Corporation NetXtreme II 5706 Gigabit Ethernet

Location: PCI 14:04.0

Driver: bnx2

Status

Link Status: Connected

Configured Speed, Duplex: 1000 Mb, Full Duplex

Actual Speed, Duplex: 1000 Mb, Full Duplex

Observed IP Networks: None

Cisco Discovery Protocol

Device ID: --

Port ID: --

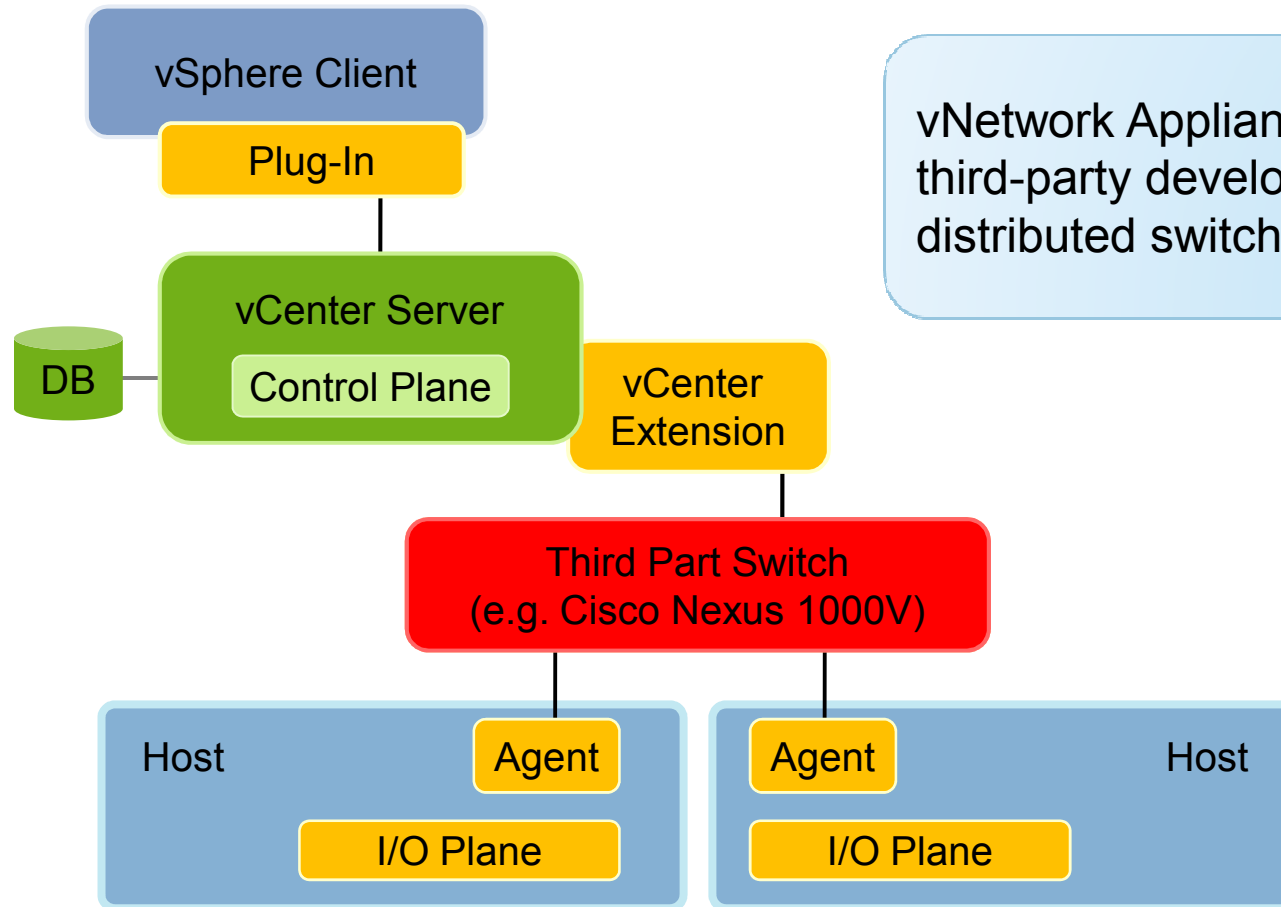
VMotion-DVUplinks-74

- <Click to Add NIC>
- dvUplink1
- vmnic2 Remove
- dvUplink2
- <Click to Add NIC>
- dvUplink3
- <Click to Add NIC>
- dvUplink4
- <Click to Add NIC>

Help OK Cancel

Modify physical adapter configuration at the host level.

Third-Party Distributed Switches



vNetwork Appliance APIs allow third-party developers to create distributed switch solutions.

Lab 4

In this lab, you will work with vNetwork standard and distributed switches.

1. View the default vNetwork standard switch configuration.
2. Create a vNetwork distributed switch for the virtual machine network.
3. Verify that your virtual machine has proper access to the Production network.
4. Create a distributed switch for the VMotion network.

Lesson Summary

- A vNetwork distributed switch is similar to a vNetwork standard switch, except that it is configured at the vCenter Server level.
- Although the distributed switch is controlled by vCenter Server, the VMkernel connection, the service console connection, and the physical uplinks are still managed on each host.
- It is possible to move virtual machines from a standard switch to a distributed switch, and vice versa.



Lesson 3: Modifying Virtual Switch Properties

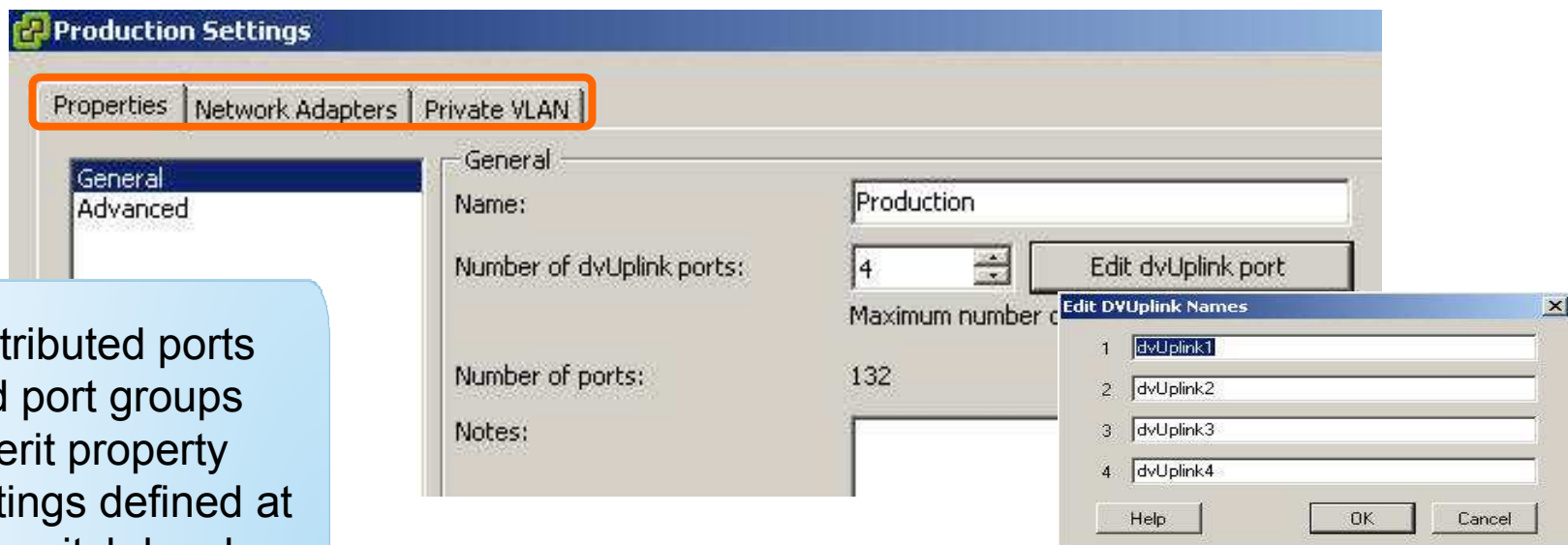
Lesson Objectives

- > Describe the properties of a distributed switch
- > Describe the properties and policies of a distributed port group

Editing General Switch Properties

The Properties tab has settings for general information, policies, and advanced settings.

- General information includes name, number of uplink ports and optional names, number of ports, and notes.

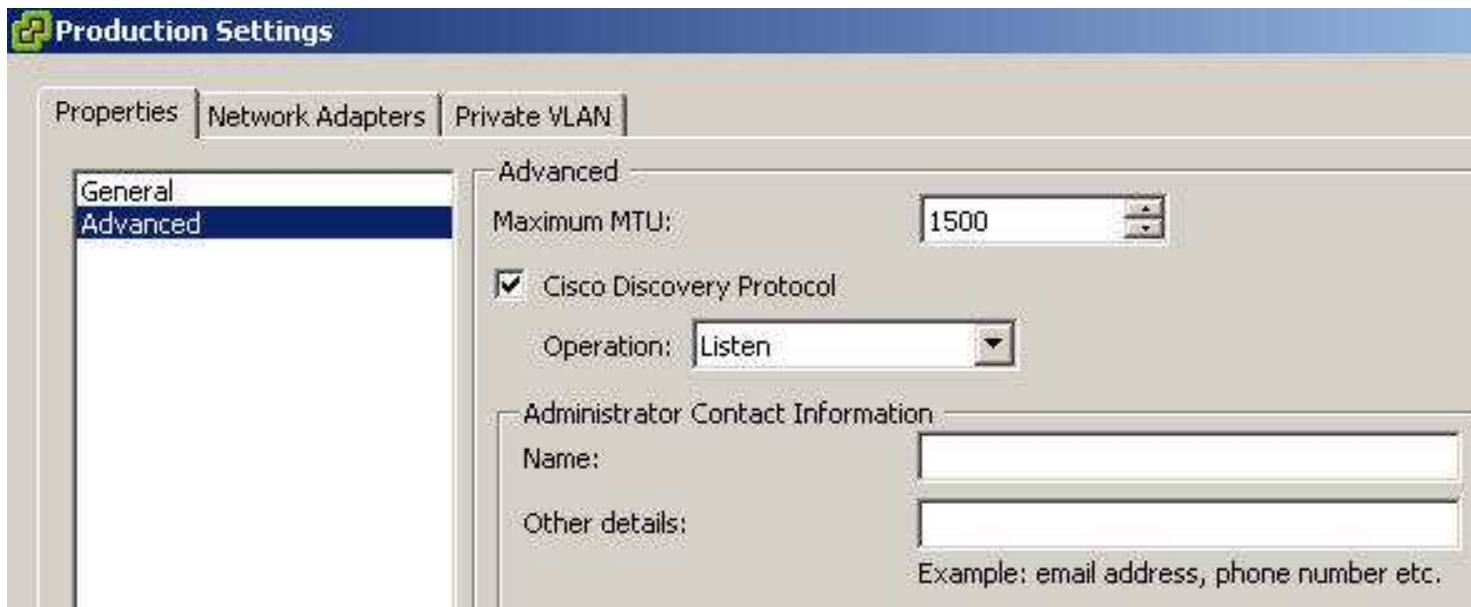


Distributed ports and port groups inherit property settings defined at the switch level.

Editing Advanced Switch Properties

Advanced information

- > Maximum MTU
- > Cisco Discovery Protocol
- > Administrator Contact Information



The screenshot shows the 'Production Settings' dialog box for a switch. The 'Advanced' tab is selected, and the 'Advanced' sub-tab is active. The 'Maximum MTU' is set to 1500. The 'Cisco Discovery Protocol' is checked, and the 'Operation' is set to 'Listen'. There are also fields for 'Administrator Contact Information', including 'Name' and 'Other details' (with an example: email address, phone number etc.).

Editing Distributed Port Group Settings

Distributed Port Group > Edit Settings

dvPortGroup Settings

General

Name: dvPortGroup

Description:

Number of ports: 128

Port binding: Static binding

- Static binding
- Dynamic binding
- Ephemeral - no binding

Port binding determines when a virtual machine is bound to the port.

Editing Port Group Policies

Distributed Port Group > Edit Settings

dvPortGroup-Production Settings

Policies

- General
- Policies**
- Security
- Traffic Shaping
- VLAN
- Teaming and Failover
- Miscellaneous
- Advanced

Security

Promiscuous Mode: Reject

MAC Address Changes: Accept

Forged Transmits: Accept

Ingress Traffic Shaping

Status: Disabled

Average Bandwidth: 100000 Kbits/sec

Peak Bandwidth: 100000 Kbits/sec

Burst Size: 102400 Kbytes

Egress Traffic Shaping

Status: Disabled

Average Bandwidth: 100000 Kbits/sec

Peak Bandwidth: 100000 Kbits/sec

Burst Size: 102400 Kbytes

VLAN

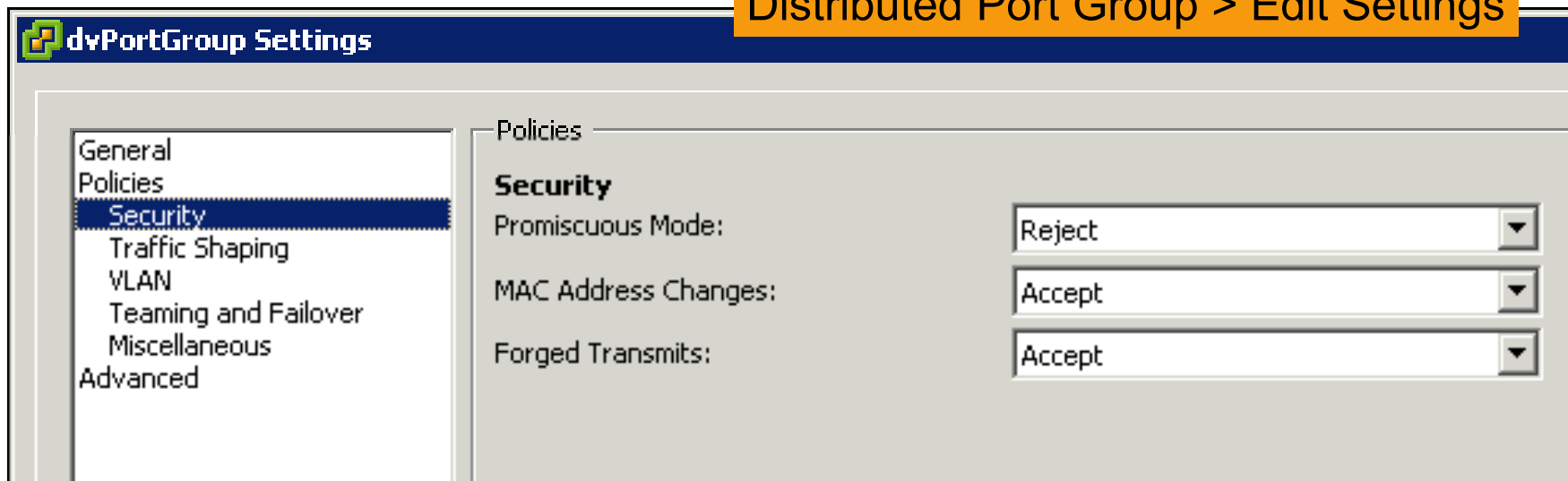
VLAN type: None

The Policies page shows settings for the five subcategories.

Security Policy

Administrators can configure Layer 2 Ethernet security options at the virtual switch and at the port groups.

Distributed Port Group > Edit Settings



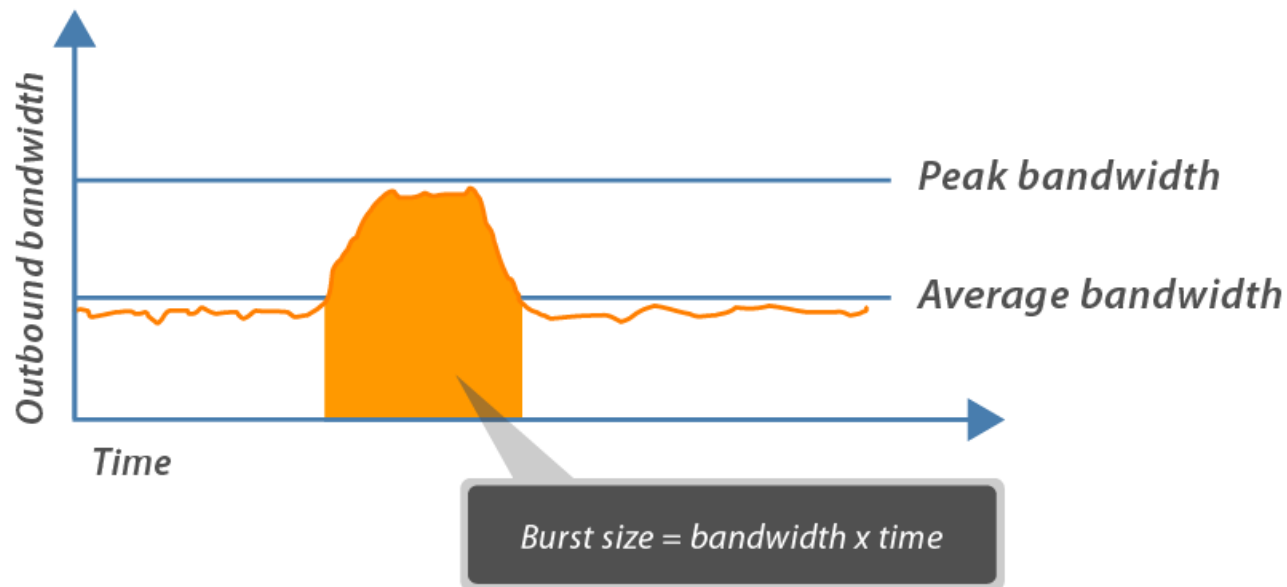
The screenshot shows the 'dvPortGroup Settings' dialog box. On the left is a navigation pane with the following items: General, Policies, Security (highlighted), Traffic Shaping, VLAN, Teaming and Failover, Miscellaneous, and Advanced. The main area is titled 'Policies' and contains a 'Security' section with three settings, each in a dropdown menu:

Setting	Value
Promiscuous Mode:	Reject
MAC Address Changes:	Accept
Forged Transmits:	Accept

Traffic-Shaping Policy

Network traffic shaping is a mechanism for controlling a virtual machine's network bandwidth.

Average rate, peak rate, and burst size are configurable.



Configuring Traffic Shaping

You can shape both inbound and outbound traffic on distributed switches.

Distributed Port Group > Edit Settings

The screenshot displays the 'dvPortGroup Settings' window. On the left is a navigation pane with the following items: General, Policies, Security, Traffic Shaping (highlighted), VLAN, Teaming and Failover, Miscellaneous, and Advanced. The main area is titled 'Policies' and contains two sections: 'Ingress Traffic Shaping' and 'Egress Traffic Shaping'. Each section has a 'Status' dropdown menu set to 'Enabled', and three input fields for 'Average Bandwidth', 'Peak Bandwidth', and 'Burst Size'. The units for bandwidth are 'Kbits/sec' and for burst size are 'Kbytes'.

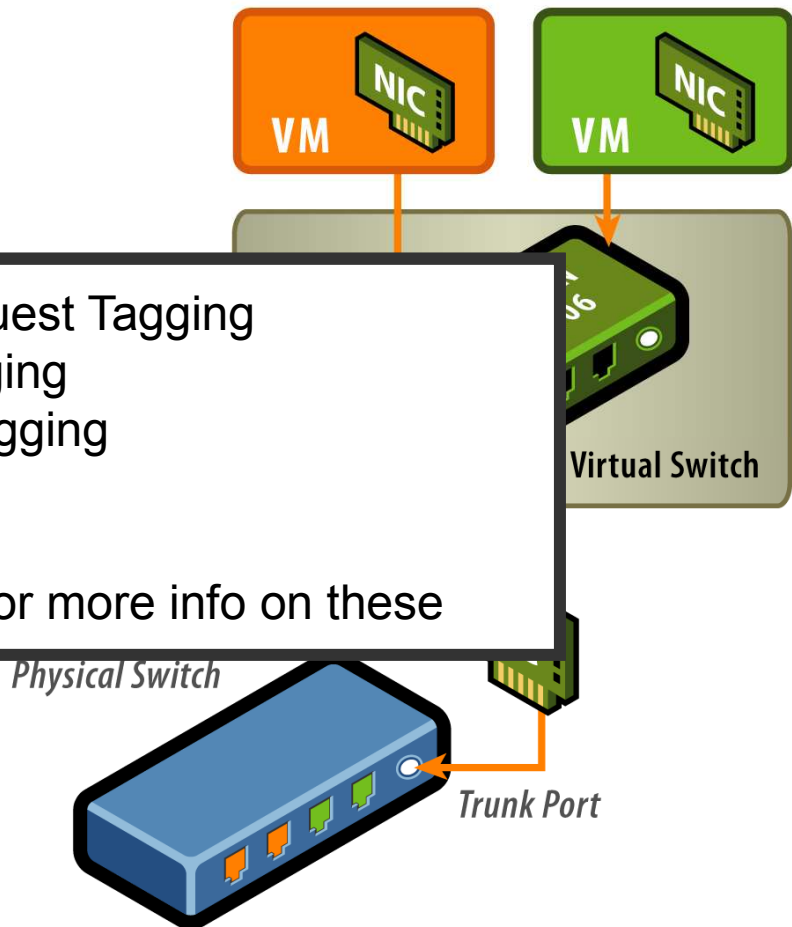
Section	Status	Average Bandwidth	Peak Bandwidth	Burst Size
Ingress Traffic Shaping	Enabled	100000 Kbits/sec	100000 Kbits/sec	102400 Kbytes
Egress Traffic Shaping	Enabled	100000 Kbits/sec	100000 Kbits/sec	102400 Kbytes

VLANs

ESX/ESXi supports 802.1Q
VLAN tagging.

Virtual switch tagging is one
of three tagging policies
supported.

- > VGT = Virtual Machine Guest Tagging
- > VST = Virtual Switch Tagging
- > EST = External Switch Tagging
- > Parameters exist for each policy.
- > Parameters exist for each policy. See URL in notes below for more info on these (untagged) as they return to the virtual machine.
- > There is little effect on performance.



VLAN Policies for Distributed Switches

Policies

VLAN

VLAN type:

No virtual switch tagging

Policies

VLAN

VLAN type:

VLAN ID:

Virtual switch tagging

Policies

VLAN

VLAN type:

VLAN trunk range: (e.g. 1-4,10-21)

Use for VLAN trunking.

Policies

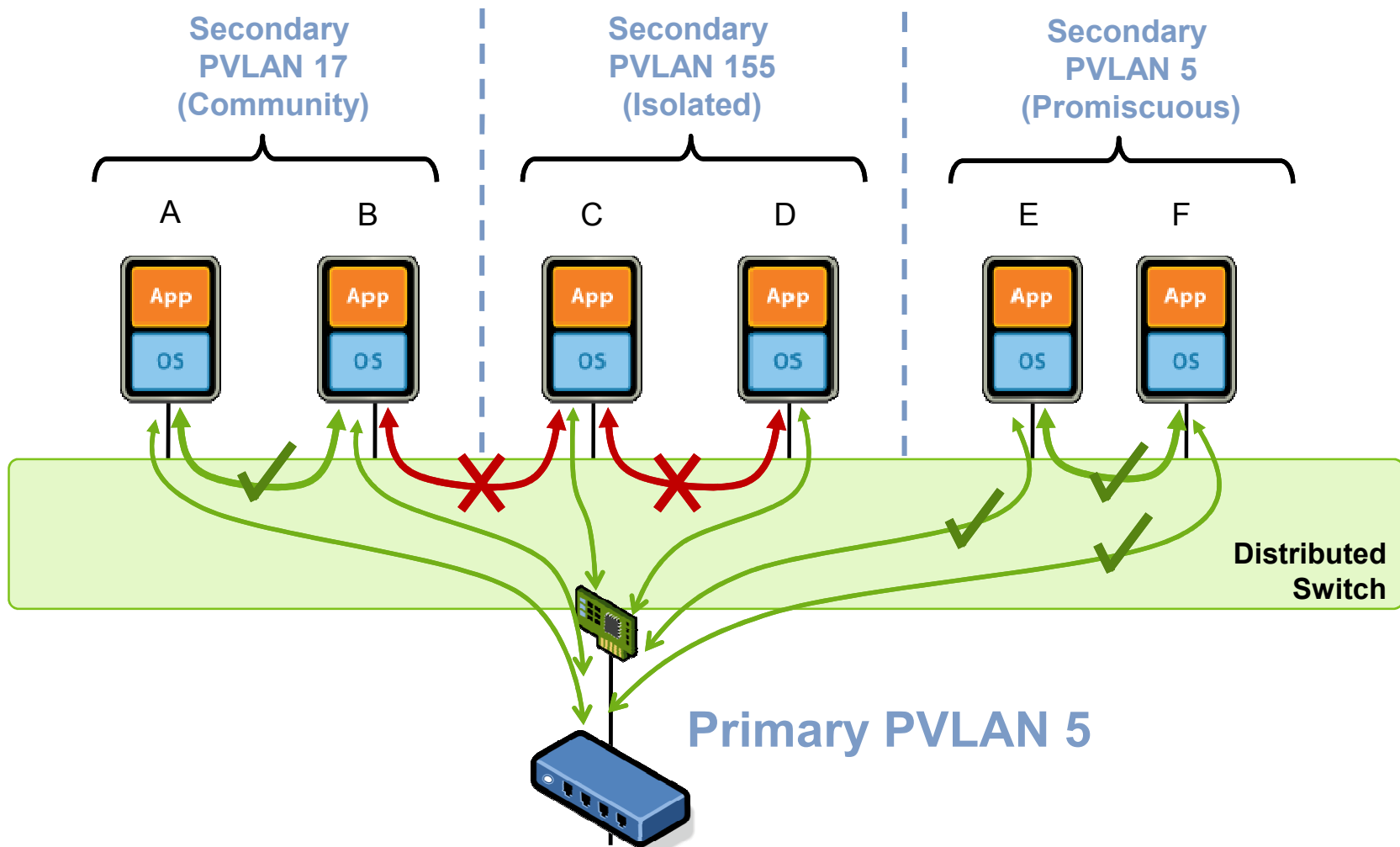
VLAN

VLAN type:

Private VLAN Entry:

Use to specify which PVLAN to use after PVLANS are set up.

Private VLAN Architecture



Configuring and Assigning PVLANS

dvSwitch-zir01 Settings

Network Configuration > Distributed Switch > Edit Settings

Properties | Network Adapters | **Private VLAN**

Enter or edit primary private VLAN ID.

Primary private VLAN ID
5
[Enter a private VLAN ID here]

1

Configure.

Enter or edit a secondary private VLAN ID and Type.

Secondary private VLAN ID	Type
5	Promiscuous
155	Isolated
17	Community
[Enter a private VLAN ID here]	Select

2

dv-Production Settings

Network Configuration > Distributed Port Group > Edit Settings

General
Policies
Security
Traffic Shaping
VLAN
Teaming and Failover
Miscellaneous
Advanced

Policies

VLAN

VLAN type:

Private VLAN

Private VLAN Entry:

Community (5, 17)
Promiscuous (5, 5)
Isolated (5, 155)
Community (5, 17)

3

Assign.

Advanced Settings

Distributed Port Group > Edit Settings

The screenshot shows the 'dvPortGroup Settings' window with the 'Advanced' tab selected. The 'Advanced' section includes options for 'Override port policies' (checked), 'Live port moving', and 'Configure reset at disconnect'. Below these are 'Port Name Format' settings, including a dropdown for 'DVS Name' and an 'Add' button. A blue arrow points from the 'Edit Override Settings...' link to the 'Port Group Override Settings' dialog box. This dialog box contains a table of settings and their override options.

Settings	Overrides Allowed?	
Block Port:	<input checked="" type="radio"/> Yes	<input type="radio"/> No
Traffic Shaping:	<input type="radio"/> Yes	<input checked="" type="radio"/> No
Vendor Configuration:	<input type="radio"/> Yes	<input checked="" type="radio"/> No
VLAN:	<input type="radio"/> Yes	<input checked="" type="radio"/> No
DVUplink Teaming:	<input type="radio"/> Yes	<input checked="" type="radio"/> No
Security Policy:	<input type="radio"/> Yes	<input checked="" type="radio"/> No

Blocking, traffic shaping, VLAN, NIC teaming, and security policies can be configured at the port level if permitted at the port group level.

Lab 5

In this lab, you will design a network configuration for an ESX host based on a set of requirements.

1. Analyze the requirements.
2. Design virtual switches and physical connections.

Lesson Summary

- Properties at the distributed port group level can be overridden per port.
- The security policy and the network traffic-shaping policy can be configured for a distributed port group or a standard virtual switch.
- Distributed switches support VLANs and private VLANs.

Key Points

- Both distributed switches and standard switches can be used in the vSphere environment.
- Both distributed switches and standard switches support the three connection types: virtual machines, VMkernel, and service console.
- Distributed switches are configured at the vCenter Server level, while standard switches are configured at the host level.