# Networking

## Module 5

# You Are Here

## vSphere Environment

Introduction to VMware Virtualization

Configuring VMware ESX and ESXi

Installing and Using VMware vCenter Server

Networking

Storage

Virtual Machines

## Operations

Access Control

Resource Monitoring

Scalability

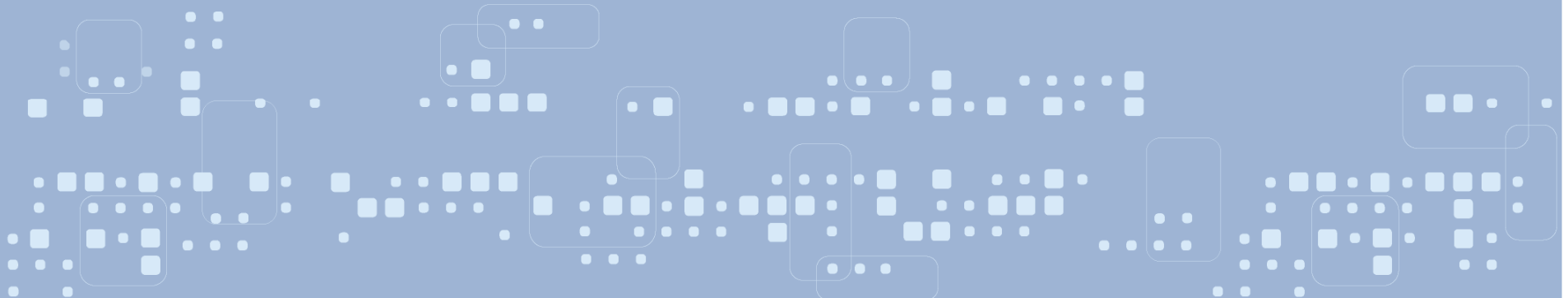High Availability and Data Protection

Configuration Management

Installing VMware ESX and ESXi
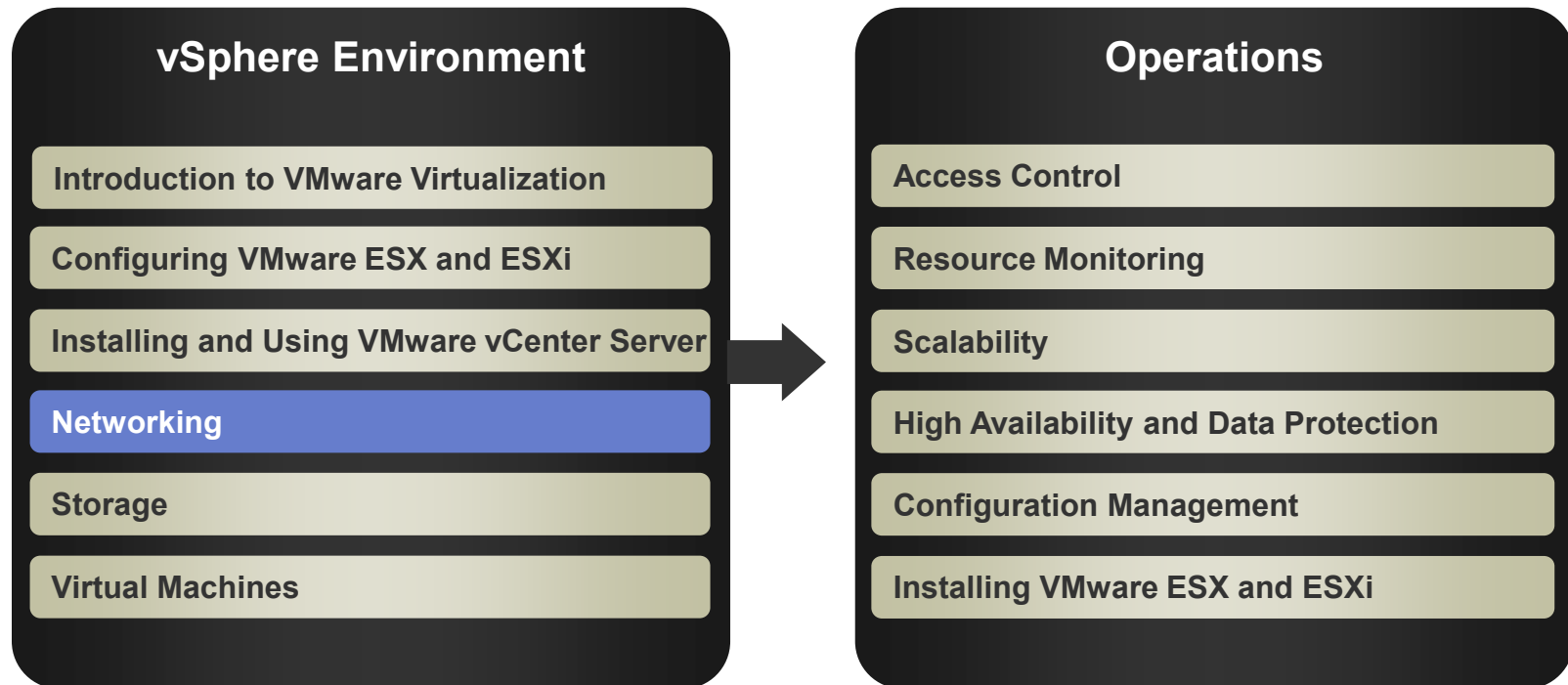
# Importance

> 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**

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# Lesson 1:
# vNetwork Standard Switches

Module Number 5-5

## Lesson Objectives

> Describe the components of a vNetwork standard switch

> Describe the vNetwork connection types

> View the vNetwork standard switch configuration

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# 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
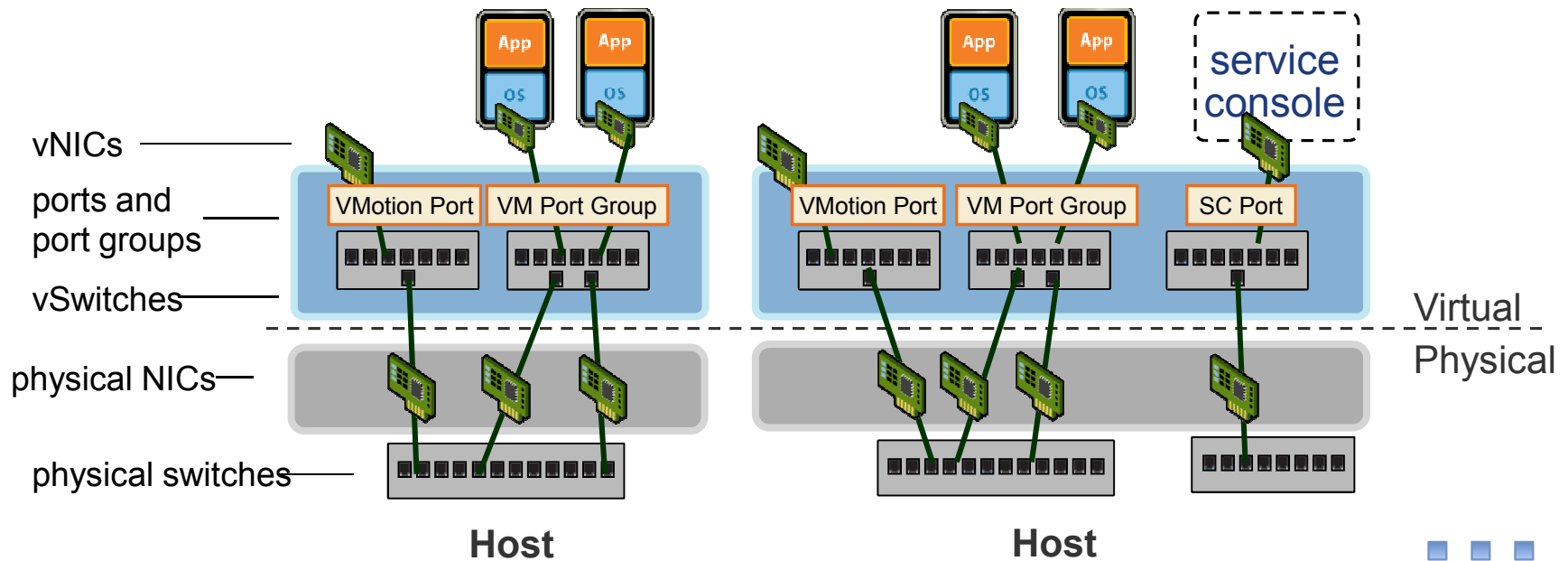
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# vNetwork Standard Switch

## 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.

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# vNetwork Standard Switch Components

Network configuration at the host level



vNICs

ports and
port groups

vSwitches

physical NICs

physical switches

App — OS
App — OS

service
console

VMotion Port    VM Port Group

VMotion Port    VM Port Group    SC Port

Virtual
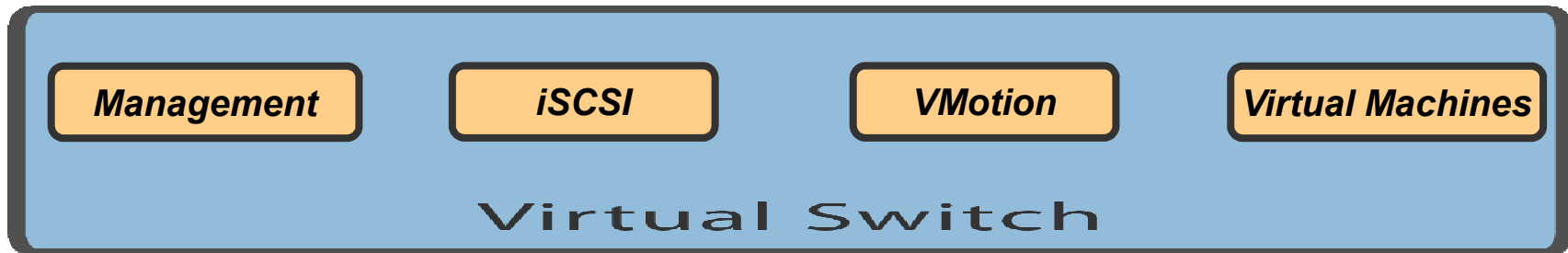Physical

**Host**

**Host**

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# 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



*service console port*    *VMkernel port*    **virtual machine port groups**

**Virtual Switch**

*uplink ports*
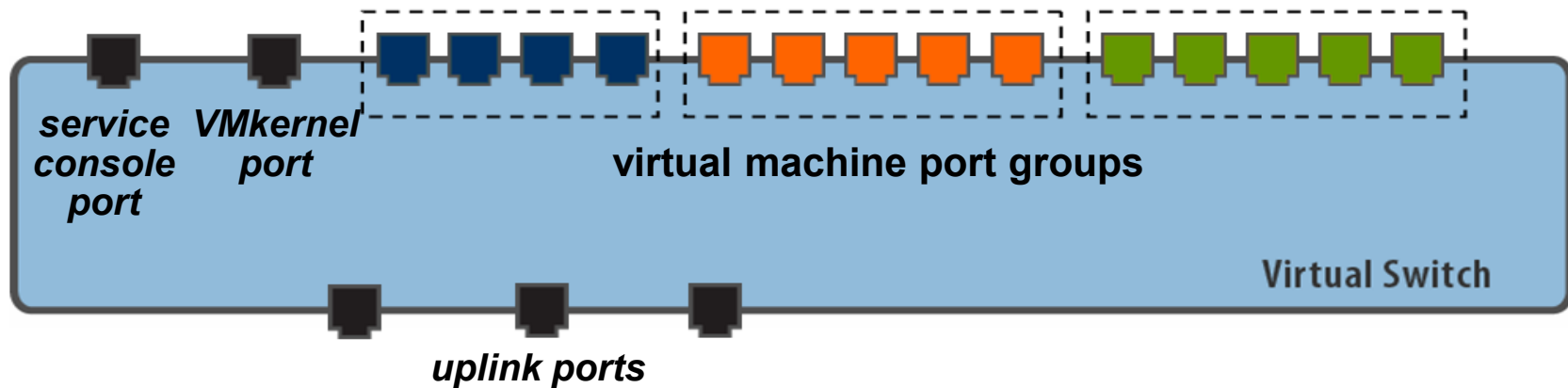
# vSwitch Examples

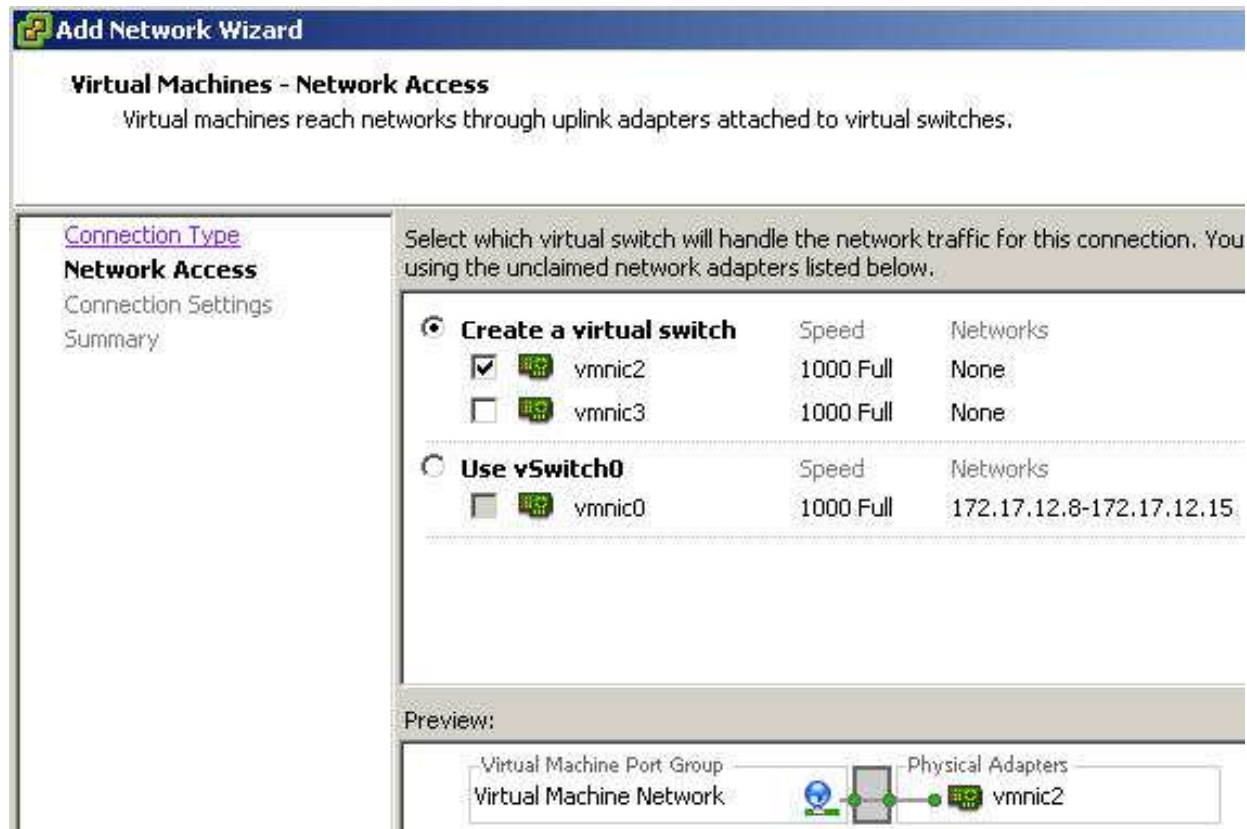**Different networks can coexist on the same virtual switch. Or they can exist on separate virtual switches.**

| Management | iSCSI | VMotion | Virtual Machines |

**Virtual Switch**

| Management | iSCSI | VMotion | Virtual Machines |
| Virtual Switch | Virtual Switch | Virtual Switch | Virtual Switch |

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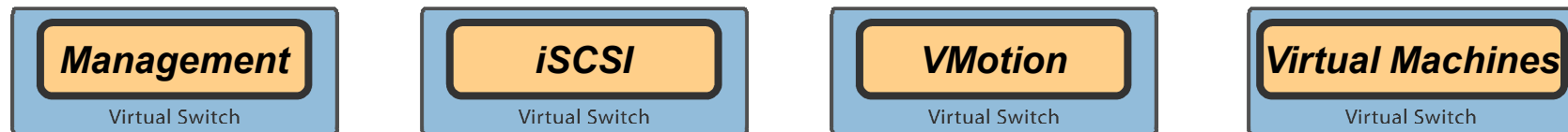
# Adding a Network: Connection Type

1. In the **Configuration** tab, click **Add Networking**.

2. In the Add Network wizard, choose desired connection type: **Virtual Machine**, **VMkernel**, or **Service Console**.
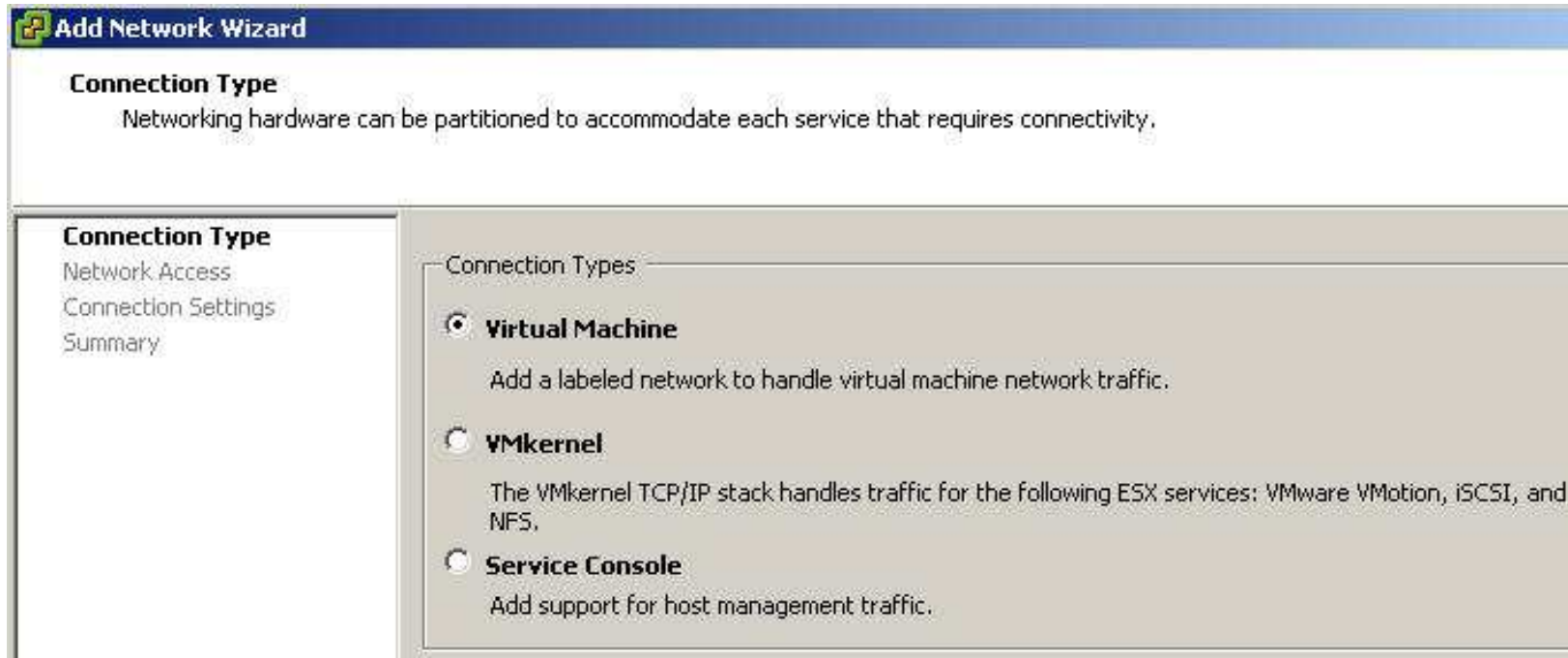
# Adding a Network: Network Adapters

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

# Adding a Network: Connection Settings

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



**Add Network Wizard**

**Virtual Machines - Connection Settings**
Use network labels to identify migration compatible connections common to two or more hosts.

Connection Type
Network Access
**Connection Settings**
Summary

Port Group Properties

Network Label: Production

VLAN ID (Optional):

Preview:

Virtual Machine Port Group          Physical Adapters
Production                                          vmnic2

# vSwitch Configuration

*Display vNetwork standard switches.*

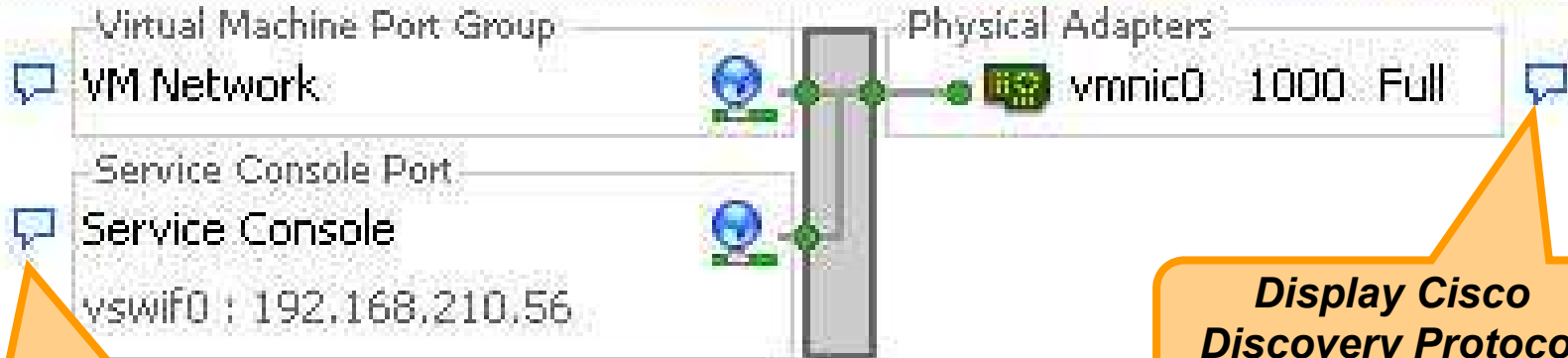**View:** Virtual Switch | Distributed Virtual Switch

## Networking

*Delete the virtual switch.*

*Display virtual switch properties.*

Virtual Switch: vSwitch0

Remove... | Properties...

Virtual Machine Port Group
- VM Network

Physical Adapters
- vmnic0   1000   Full

Service Console Port
- Service Console
- vswif0 : 192.168.210.56

*Display Cisco Discovery Protocol information.*

*Display port group properties.*

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# 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.

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# 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 | | | | | | | ✓ |

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# 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™

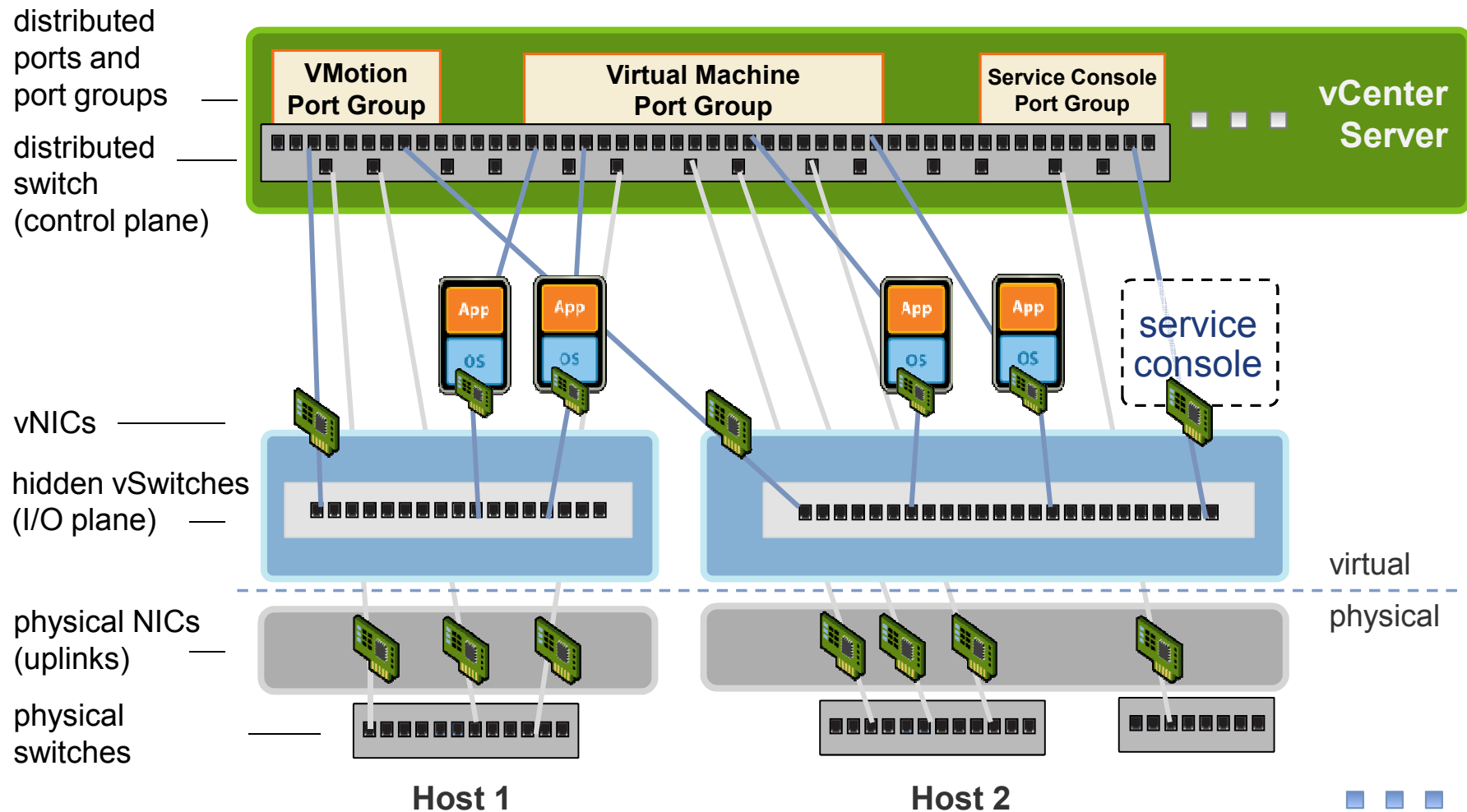> Provide for customization and third-party development
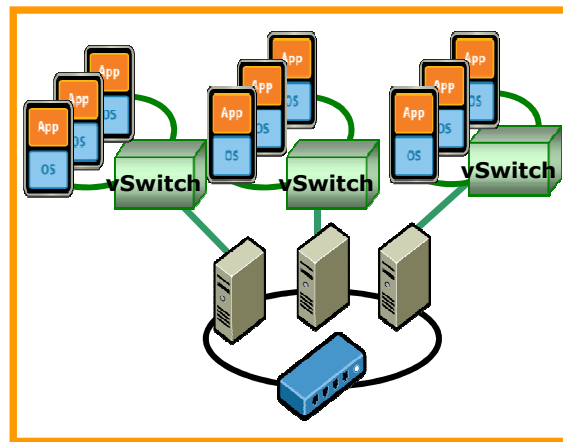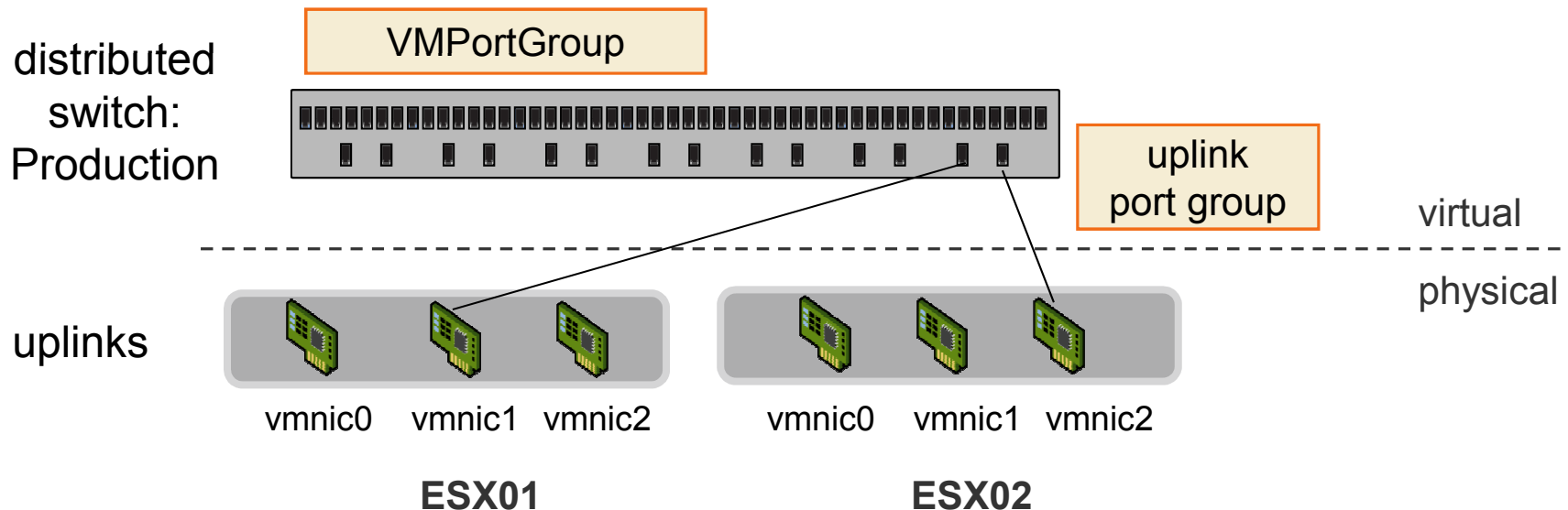


*standard switches*          *distributed switches*

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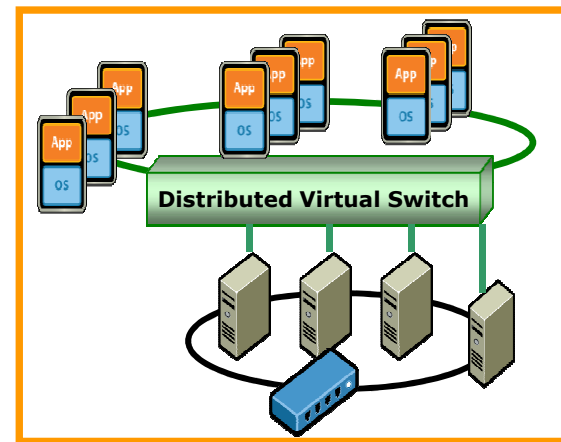
# vNetwork Distributed Switch Architecture

distributed ports and port groups

distributed switch (control plane)

**VMotion Port Group**

**Virtual Machine Port Group**

**Service Console Port Group**

**vCenter Server**

**App**   **App**

**OS**   **OS**

**App**   **App**

**OS**   **OS**

**service console**

vNICs

hidden vSwitches (I/O plane)

virtual

physical

physical NICs (uplinks)

physical switches

**Host 1**

**Host 2**

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# 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.

VMPortGroup

distributed
switch:
Production

uplink
port group

virtual

physical

uplinks

vmnic0    vmnic1    vmnic2          vmnic0    vmnic1    vmnic2

**ESX01**                                **ESX02**

# 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: Production

Number of dvUplink ports: 4

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 distri...
○ Add now
○ Add later

| Host/Physical adapters | In use by switch | Physical adapter details |
|---|---|---|
| ☐ ☑ 🖥 sc-quail04.vmeduc.com | | |
| **Select physical adapters** | | |
| ☑ vmnic1 | -- | View details... |
| ☐ vmnic2 | -- | View details... |
| ☐ vmnic3 | -- | View details... |
| ☐ ☐ 🖥 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



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.

# Adding a Host to a Distributed Switch

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

# VMkernel and Service Console Connections



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)



Modify physical adapter configuration at the host level.

# Third-Party Distributed Switches

vSphere Client

Plug-In

vCenter Server

Control Plane

DB

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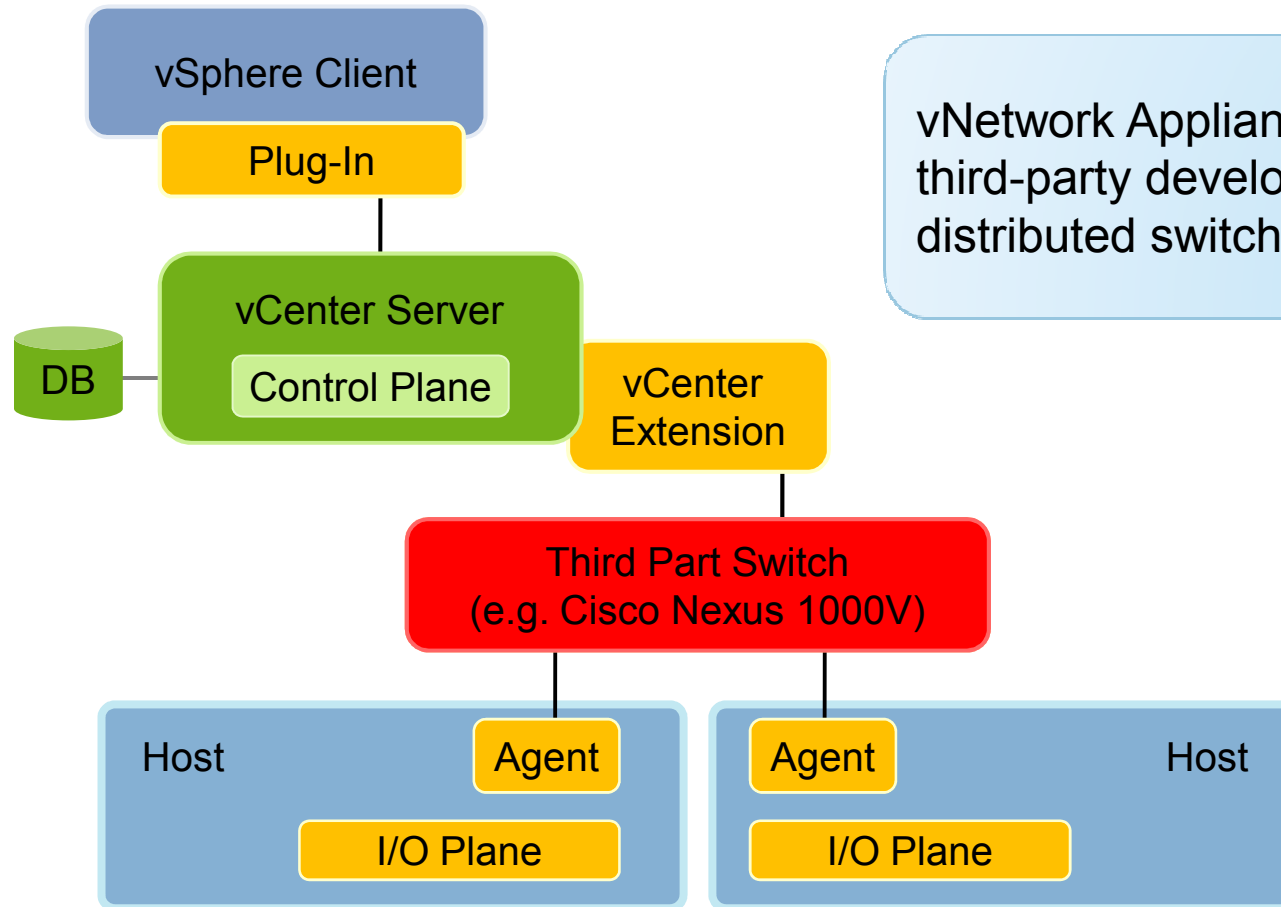
vNetwork Appliance APIs allow third-party developers to create distributed switch solutions.

Third Part Switch
(e.g. Cisco Nexus 1000V)

Host

Agent

I/O Plane

Agent

Host

I/O Plane

## 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.

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# 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.

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# 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.
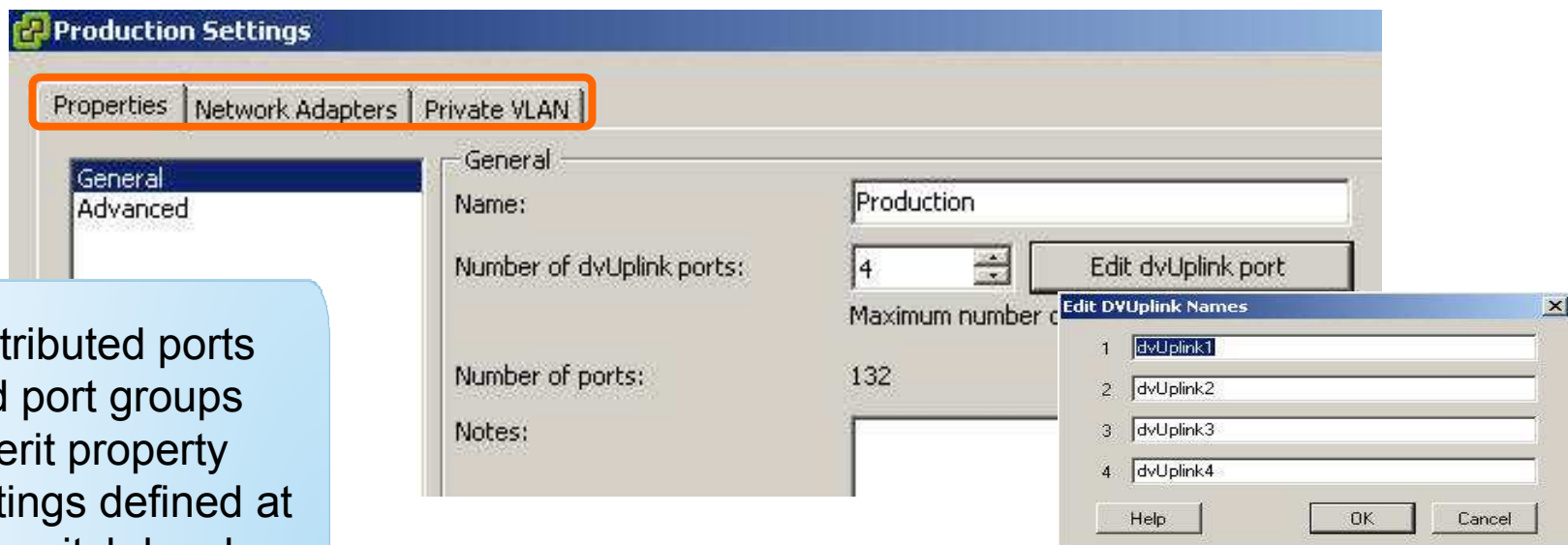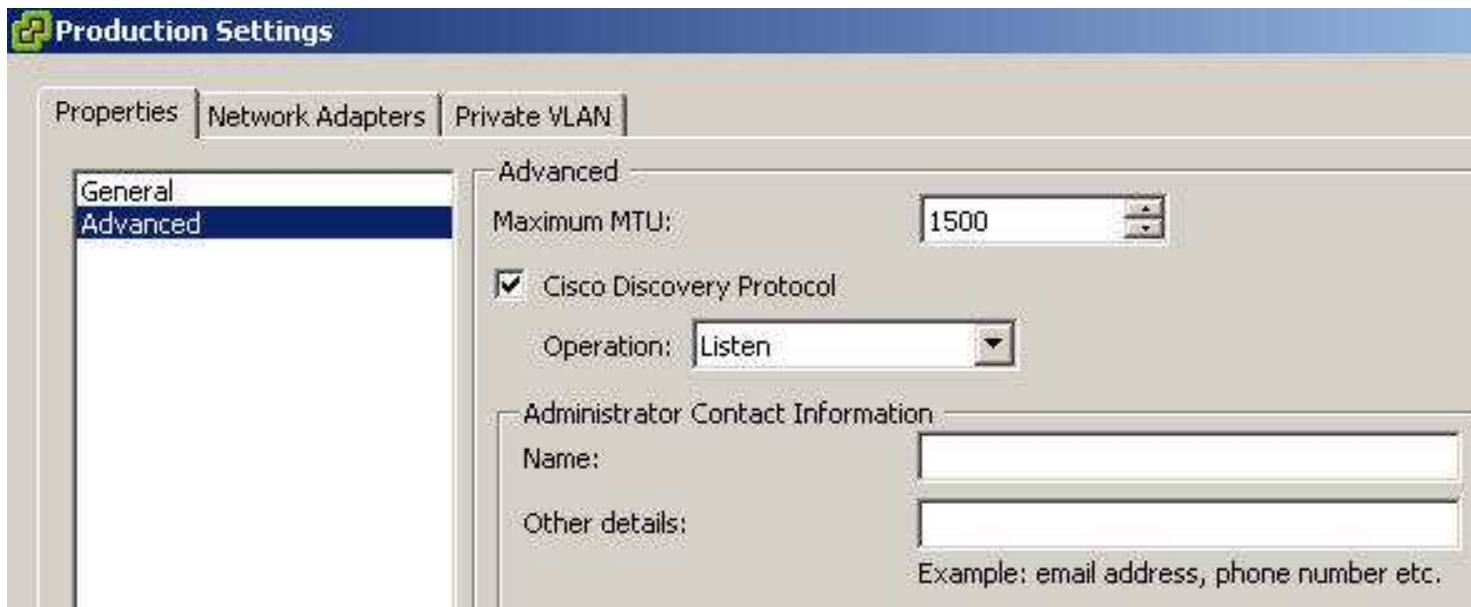


Distributed ports and port groups inherit property settings defined at the switch level.

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# Editing Advanced Switch Properties

## Advanced information

> Maximum MTU

> Cisco Discovery Protocol

> Administrator Contact Information

# Editing Distributed Port Group Settings

Distributed Port Group > Edit Settings

**dvPortGroup Settings**

General
Policies
   Security
   Traffic Shaping
   VLAN
   Teaming and Failover
   Miscellaneous
Advanced

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

General
Policies
   Security
   Traffic Shaping
   VLAN
   Teaming and Failover
   Miscellaneous
Advanced

Policies

**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
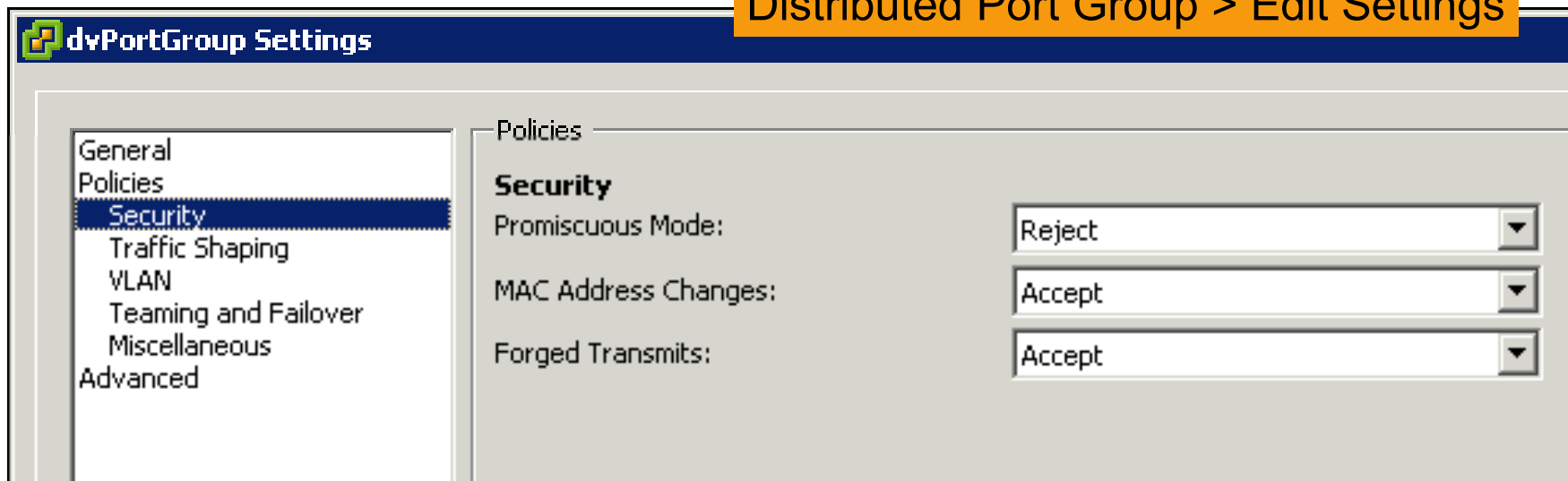
Burst Size:                102400      Kbytes

**VLAN**

VLAN type:                 None

The Policies page shows settings for the five subcategories.

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# Security Policy

**Administrators can configure Layer 2 Ethernet security options at the virtual switch and at the port groups.**
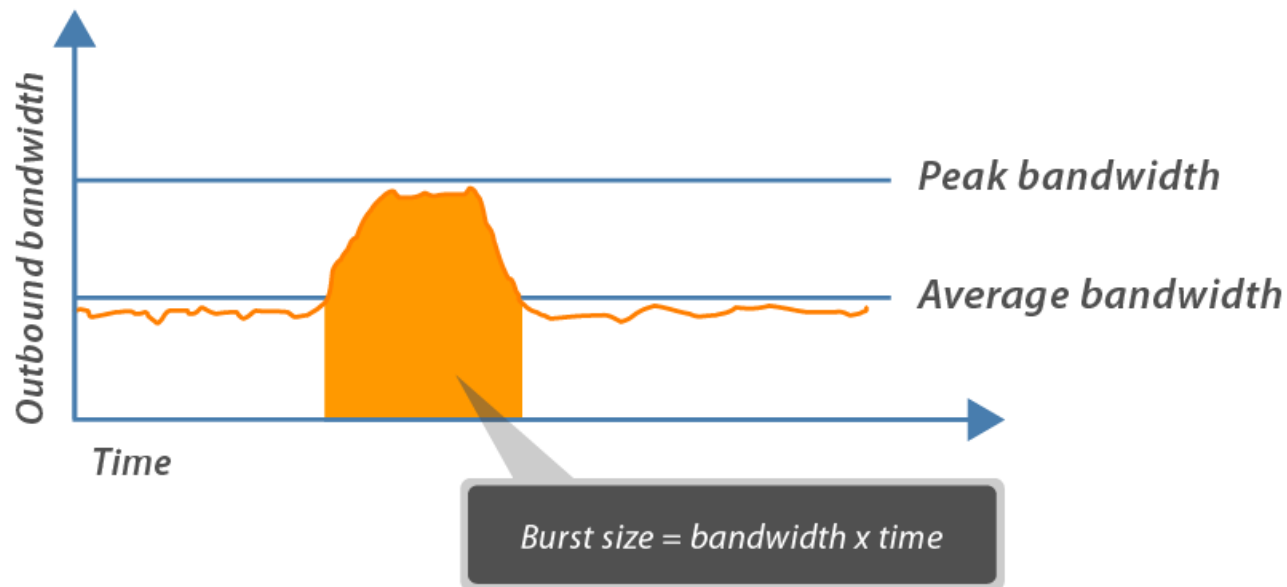
Distributed Port Group > Edit Settings



dvPortGroup Settings

General
Policies
  Security
  Traffic Shaping
  VLAN
  Teaming and Failover
  Miscellaneous
Advanced

Policies

**Security**

Promiscuous Mode:          Reject

MAC Address Changes:       Accept

Forged Transmits:          Accept

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# 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

# VLANs

**ESX/ESXi supports 802.1Q VLAN tagging.**

**Virtual switch tagging is one of three tagging policies**

**suppor**

VGT = Virtual Machine Guest Tagging
VST = Virtual Switch Tagging
EST = External Switch Tagging

> Pa
ma
exi

> Pa
(untagged) as they return to
the virtual machine.

> There is little effect on
performance.

See URL in notes below for more info on these

**Virtual Switch**

**Physical Switch**

**Trunk Port**

VM NIC

VM NIC

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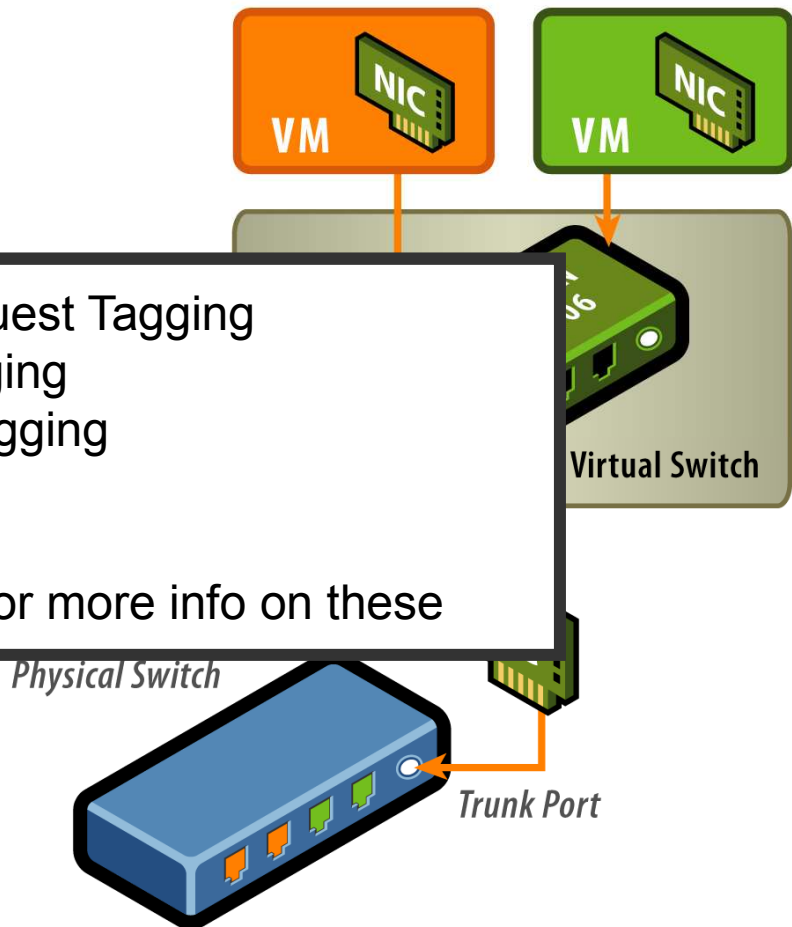
# VLAN Policies for Distributed Switches

| Policies |
| --- |
| **VLAN** |
| VLAN type: `None` ▾ |

→ No virtual switch tagging

| Policies |
| --- |
| **VLAN** |
| VLAN type: `VLAN` ▾ |
| VLAN ID: `1` ⬍ |

→ Virtual switch tagging

| Policies |
| --- |
| **VLAN** |
| VLAN type: `VLAN Trunking` ▾ |
| VLAN trunk range: (e.g. 1-4,10-21) |
| [ ] |

→ Use for VLAN trunking.

| Policies |
| --- |
| **VLAN** |
| VLAN type: `Private VLAN` ▾ |
| Private VLAN Entry: |
| `Promiscuous (5, 5)` ▾ |

→ Use to specify which PVLAN to use after PVLANs are set up.

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# Private VLAN Architecture

**Secondary PVLAN 17 (Community)**

**Secondary PVLAN 155 (Isolated)**

**Secondary PVLAN 5 (Promiscuous)**

A  B  C  D  E  F

App  App  App  App  App  App

OS  OS  OS  OS  OS  OS

**Distributed Switch**

**Primary PVLAN 5**

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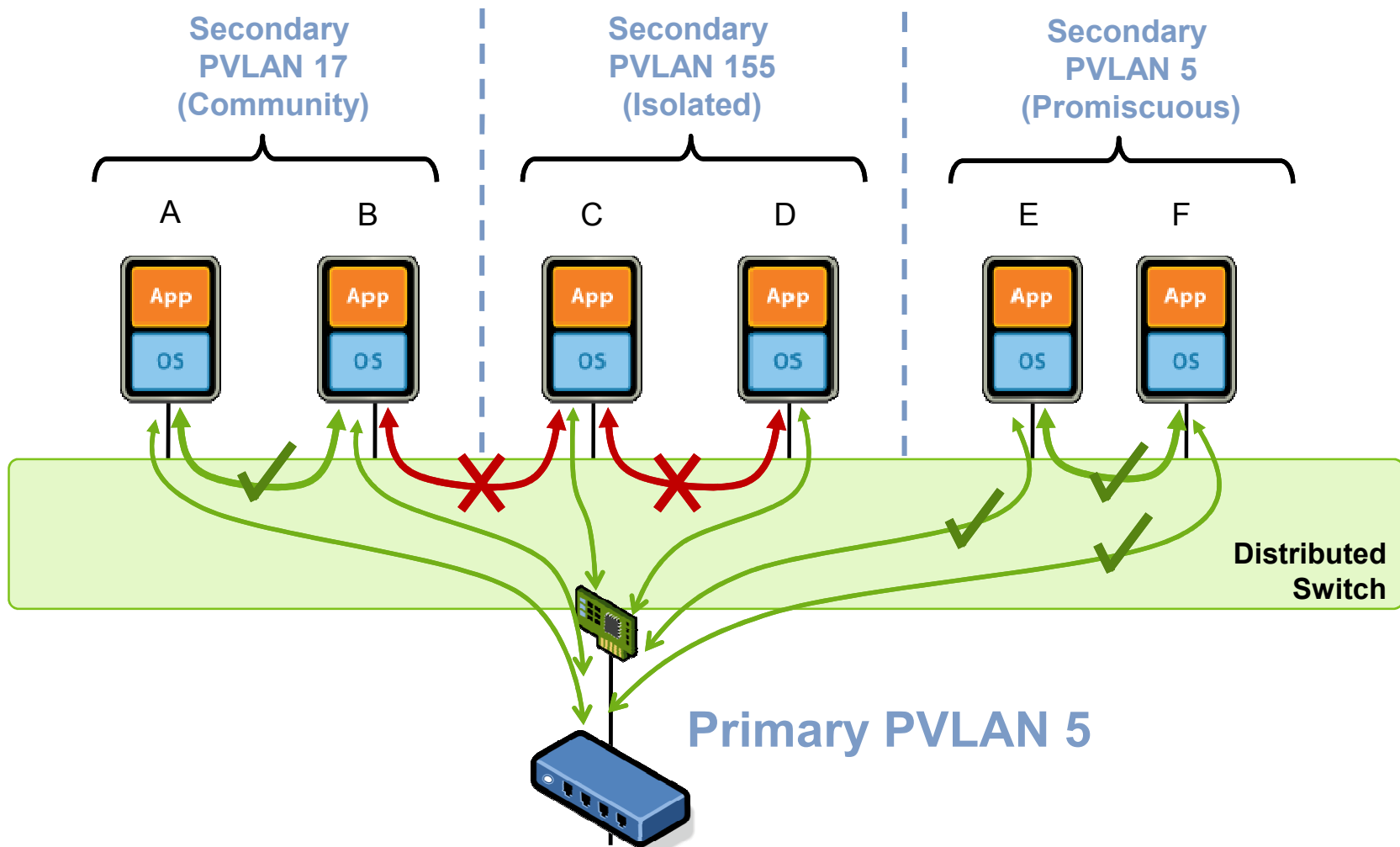
# Configuring and Assigning PVLANs



Network Configuration > Distributed Switch > Edit Settings

**dvSwitch-zir01 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**

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**

Configure.

Network Configuration > Distributed Port Group > Edit Settings

**dv-Production 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.

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# Advanced Settings



Distributed Port Group > Edit Settings

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.

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# 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.