Unit 3: Virtual Networking and Remote Access

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6G7Z1004: ADVANCED COMPUTER NETWORKS AND OPERATING SYSTEMS

After reading this unit and completing the exercises, you will be able to:

- Explain virtualization and identify characteristics of virtual network components
- Create and configure virtual servers, adapters, and switches as part of a network
- Describe techniques for incorporating virtual components in VLANs
- Explain methods for remotely connecting to a network, including dial-up networking, virtual desktops, and thin clients
- Discuss VPNs and the protocols they rely on
- Identify the features and benefits of cloud computing and NaaS

Virtualization

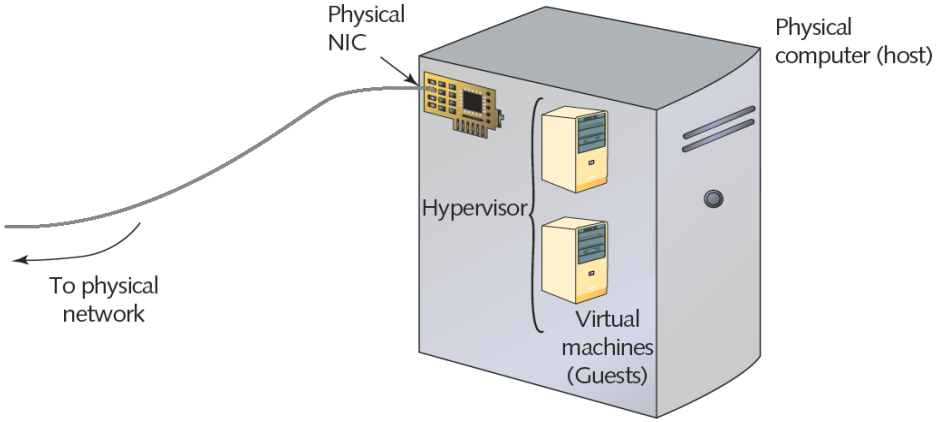
- Emulation of a computer, OS environment, or application on a physical system
- Virtual machines (VMs)
  - Virtual workstations
  - Virtual servers
- Can be configured to use different types of:
  - CPU
  - Storage drive
  - NIC
- VM appears to user no different than physical computer:
  - Running the same software

Virtualization (cont'd.)

Host
- Physical computer

Guest
- Virtual machines

Hypervisor
- Manages virtual machines



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Advantages of Virtualization

- Efficient use of resources
- Cost and energy savings
- Fault and threat isolation
- Simple backups, recovery, and replication

Disadvantages of Virtualization

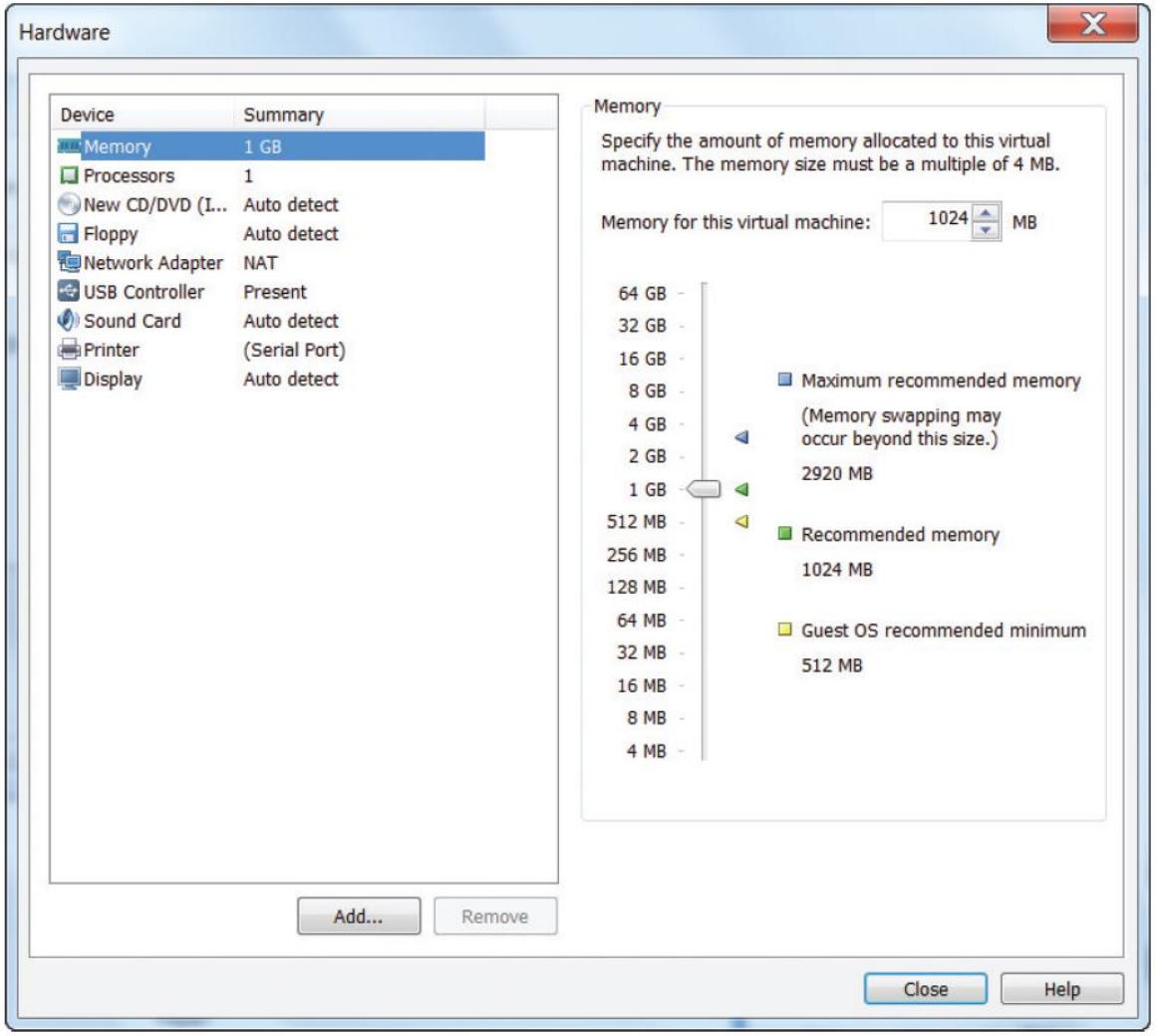
- Compromised performance
- Increased complexity
- Increased licensing costs
- Single point of failure

Virtual Network Components

- Virtual network
  - Can be created to consist solely of virtual machines on a physical server
- Most networks combine physical and virtual elements

Virtual Machines and Adapters

- Virtualization program
  - Assigns VM's software and hardware characteristics
  - Often easy to use, step-by-step wizard
- Operating system images
  - Available for download online
  - Or on disc from software vendors
- Network connection
  - Requires virtual adapter (vNIC)



Specifying a VM's memory in Vmware
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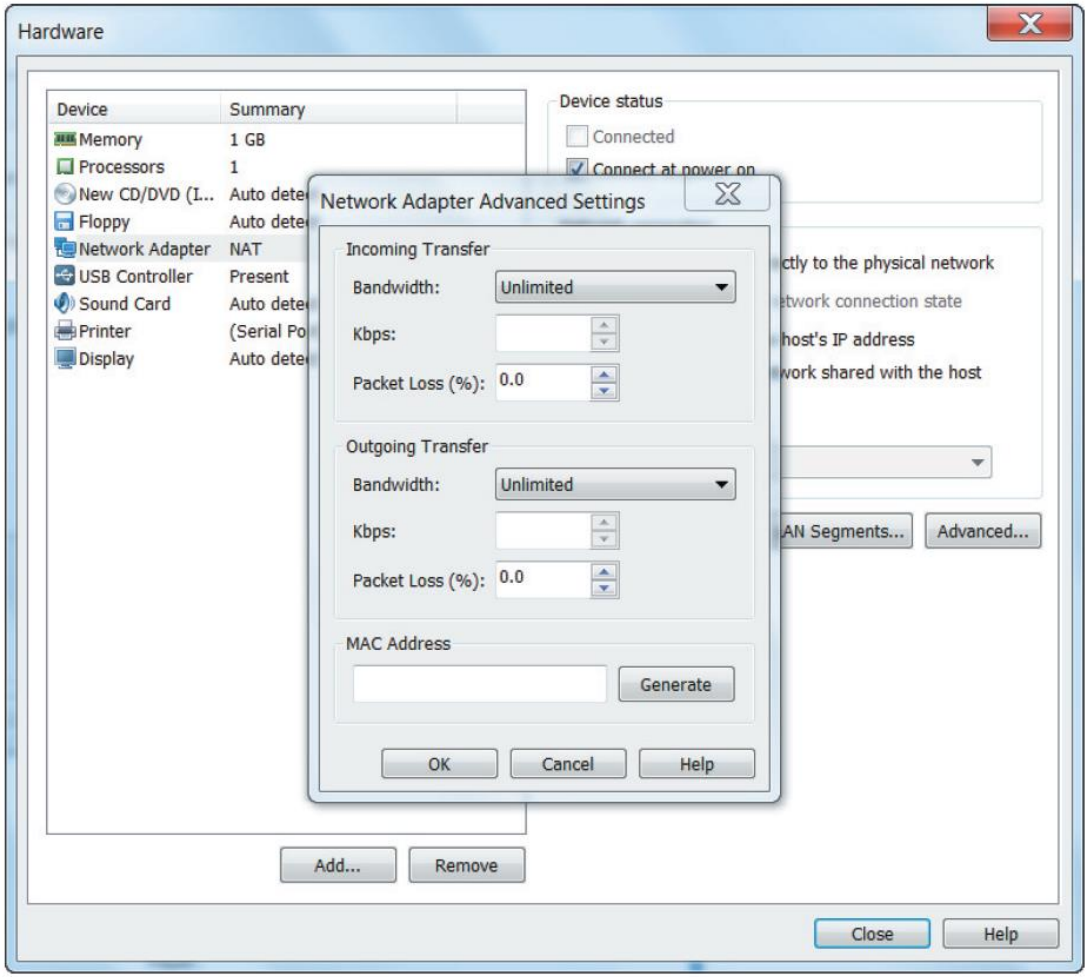

Customizing vNIC properties in Vmware
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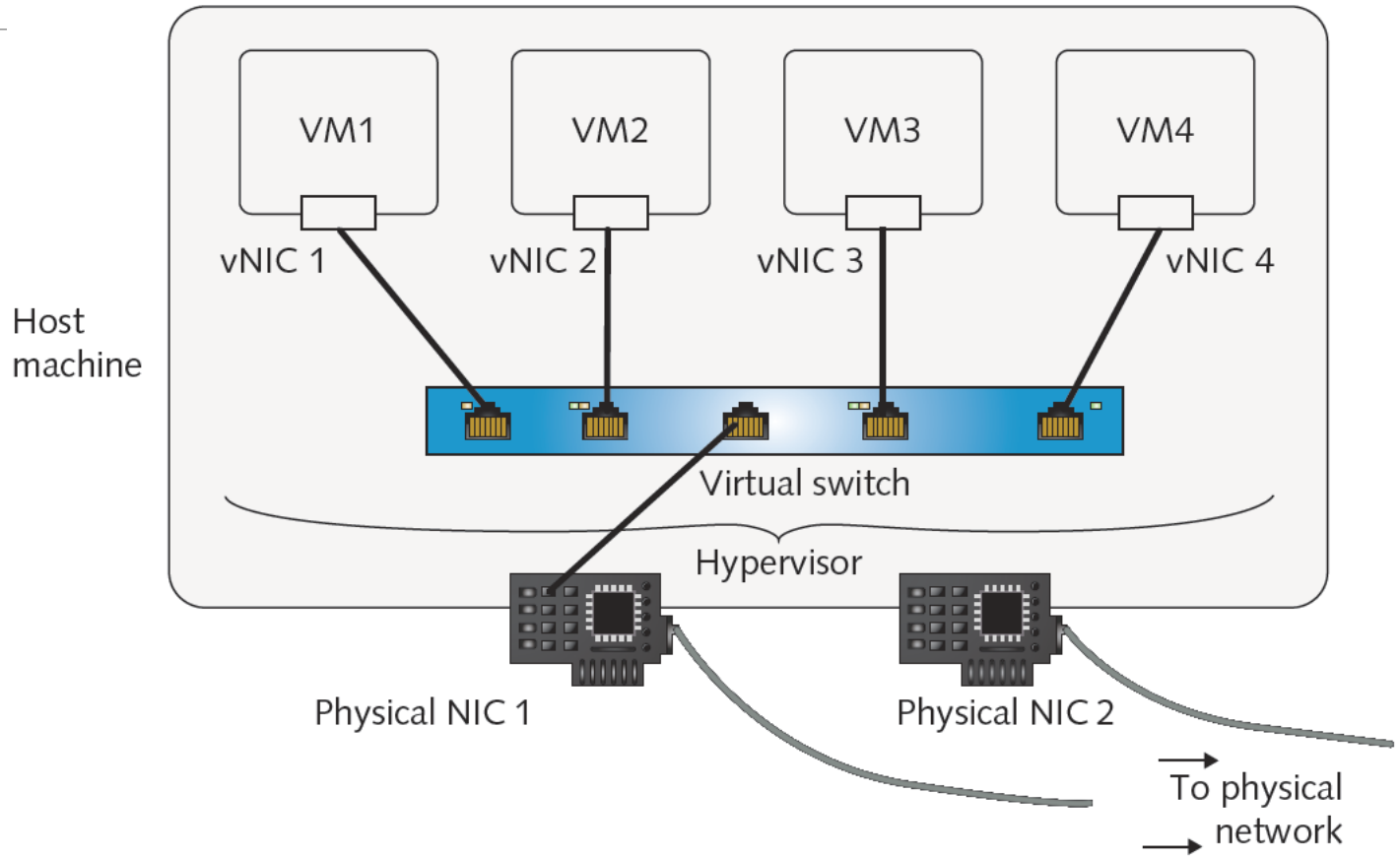
Virtual Switches and Bridges

- Virtual bridge
  - Created when first VM's NIC is selected
  - Connects VM with host
  - Resides in RAM
- Virtual switch
  - Logically defined device
  - Operates at Data Link layer
  - Passes frames between nodes
  - Connects vNICs with a network



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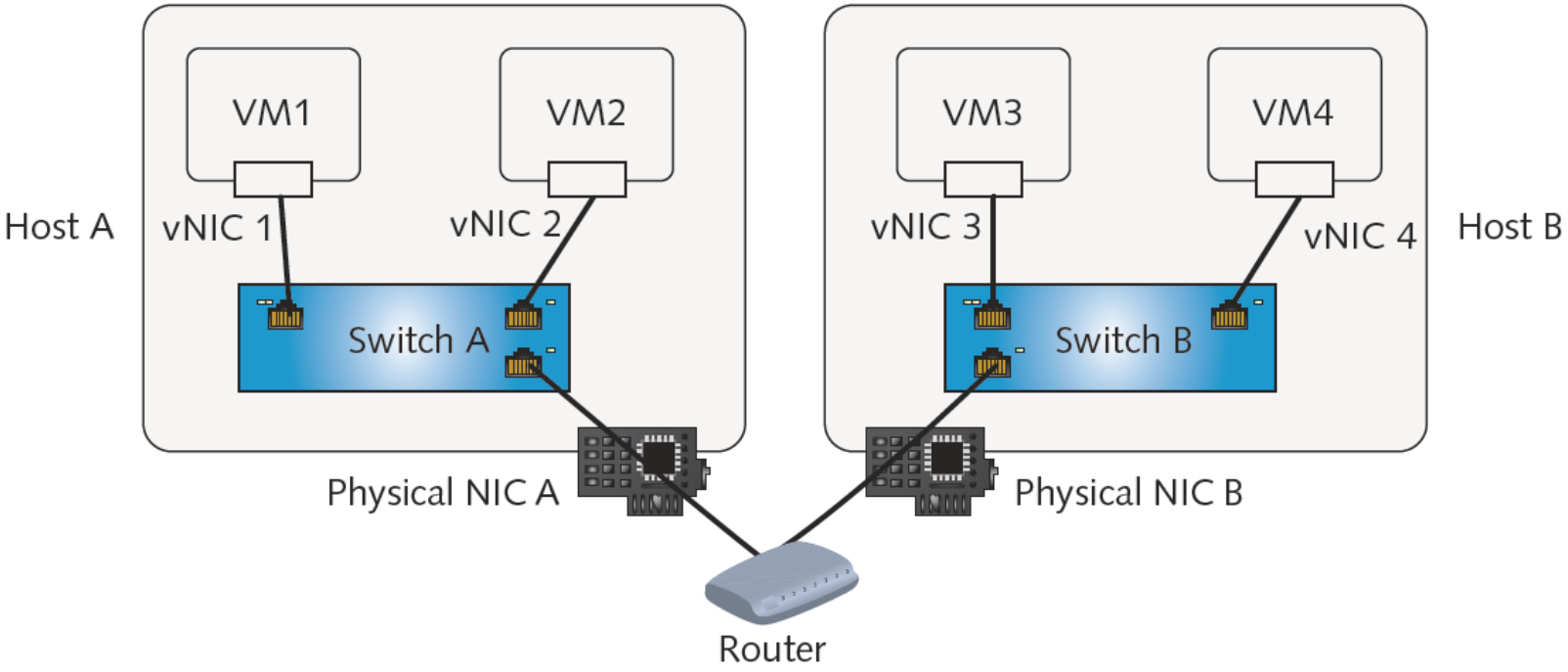

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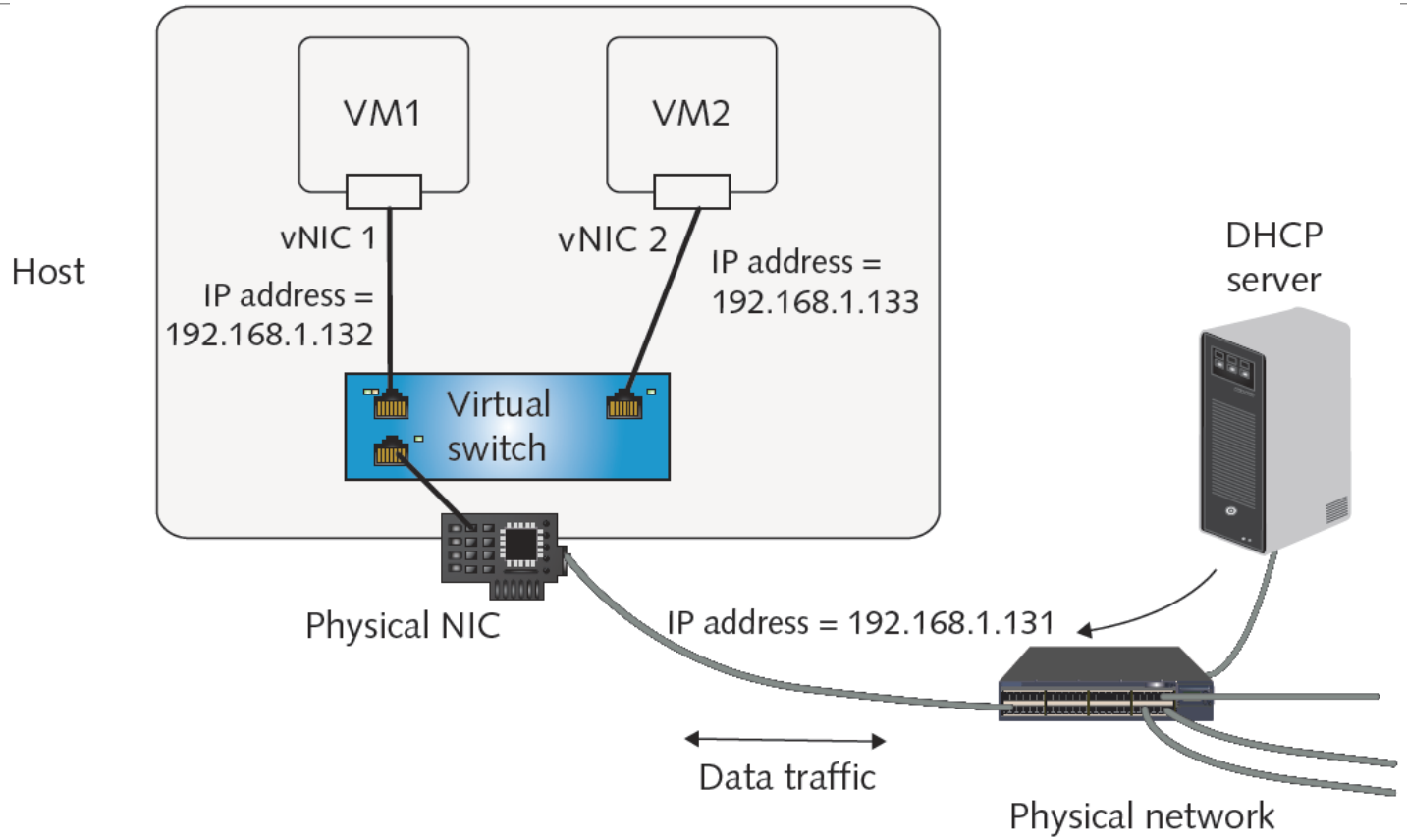
Network Connection Types

Frequently-used network connection types

- Bridged
- NAT
- Host-only

Network Connection Types - Bridged

- vNIC accesses physical network using host machine's NIC
- Obtains own IP address, default gateway, and netmask from DHCP server on physical LAN



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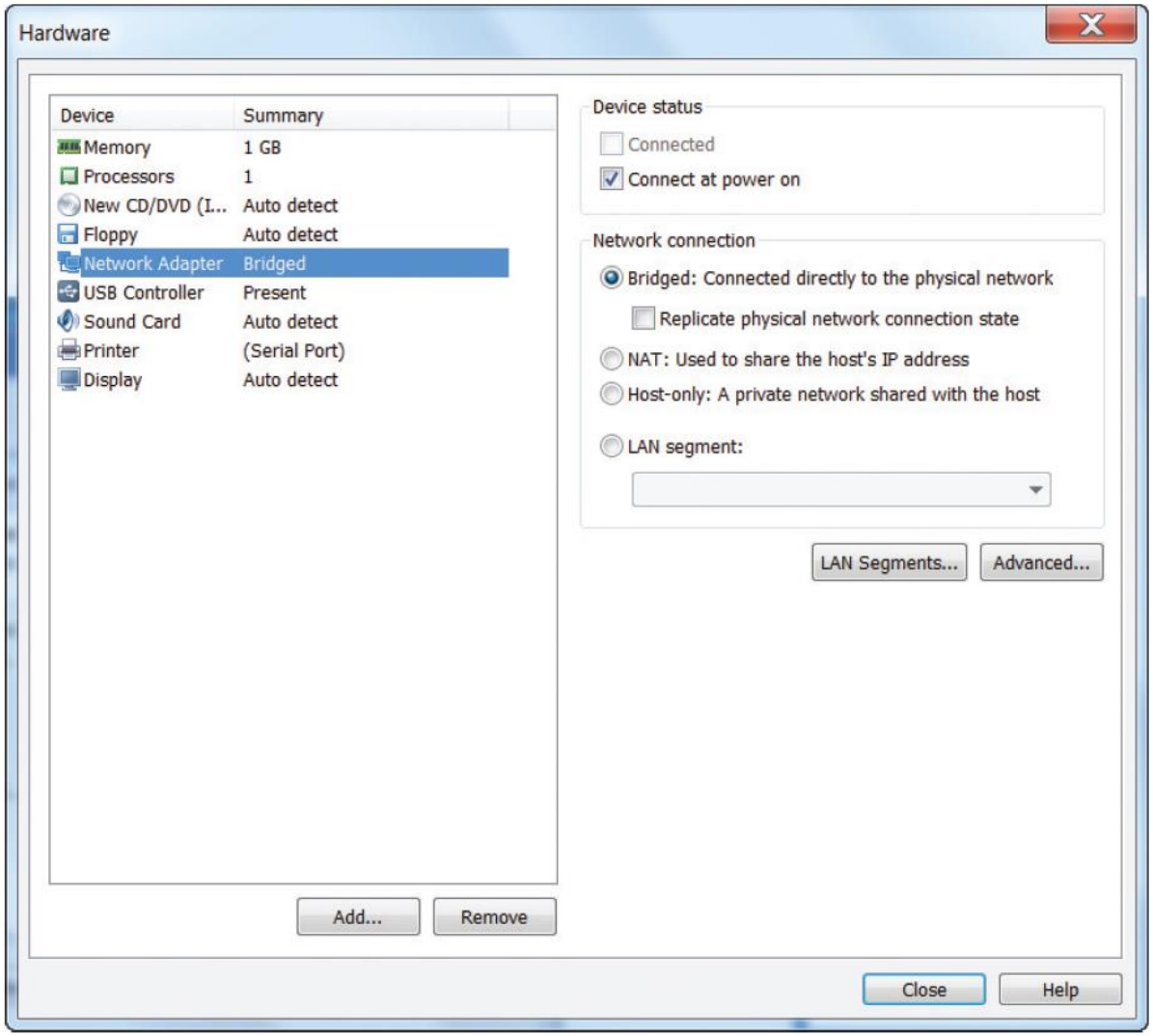

Selecting the Bridged option for a vNIC in VMware
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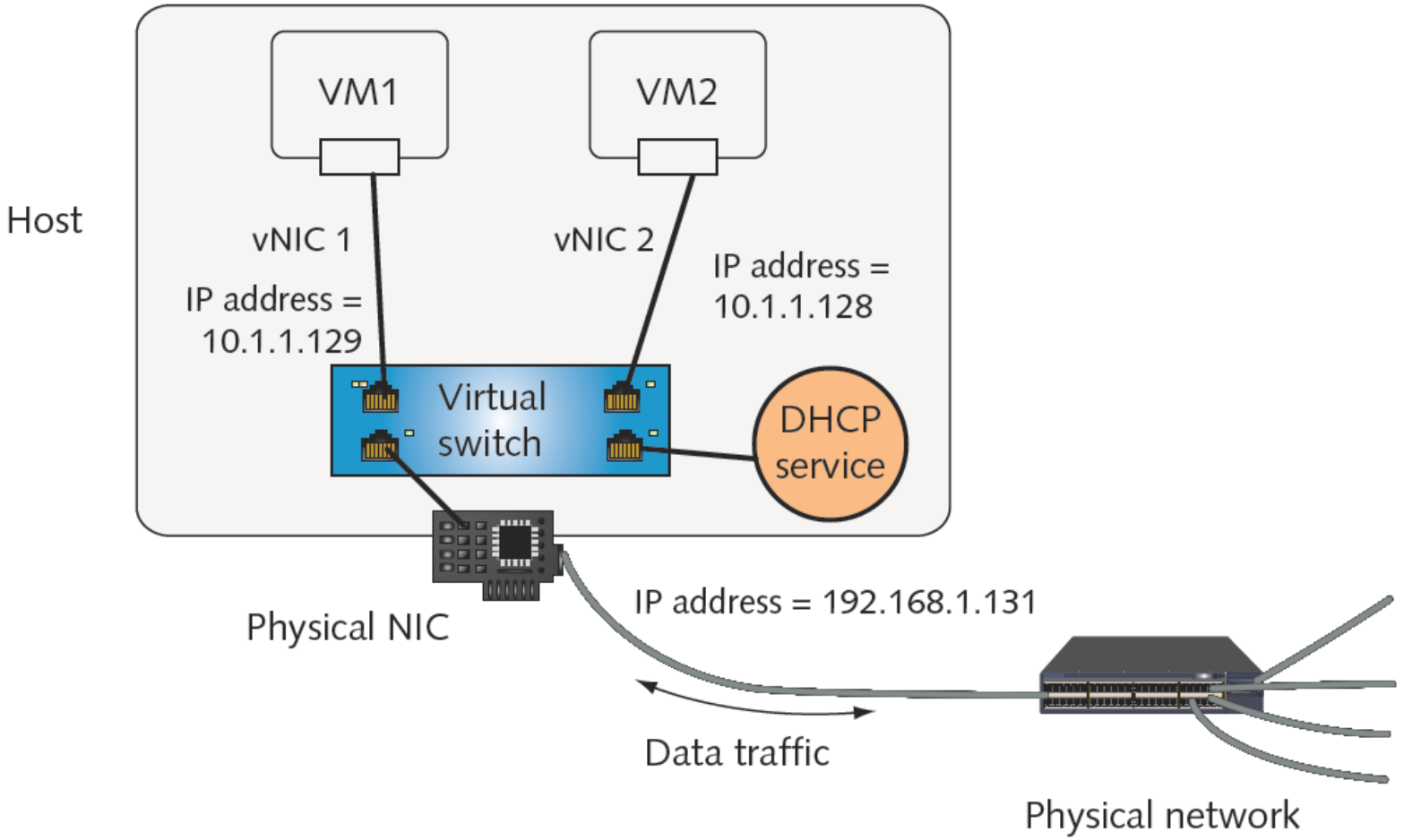
Network Connection Types - NAT

- vNIC relies on host to act as NAT device
- Obtains IP addressing information from host
- Virtualization software acts as a DHCP server
- Default network connection type in VMware, VirtualBox, and KVM



vNIC accessing a network in NAT mode
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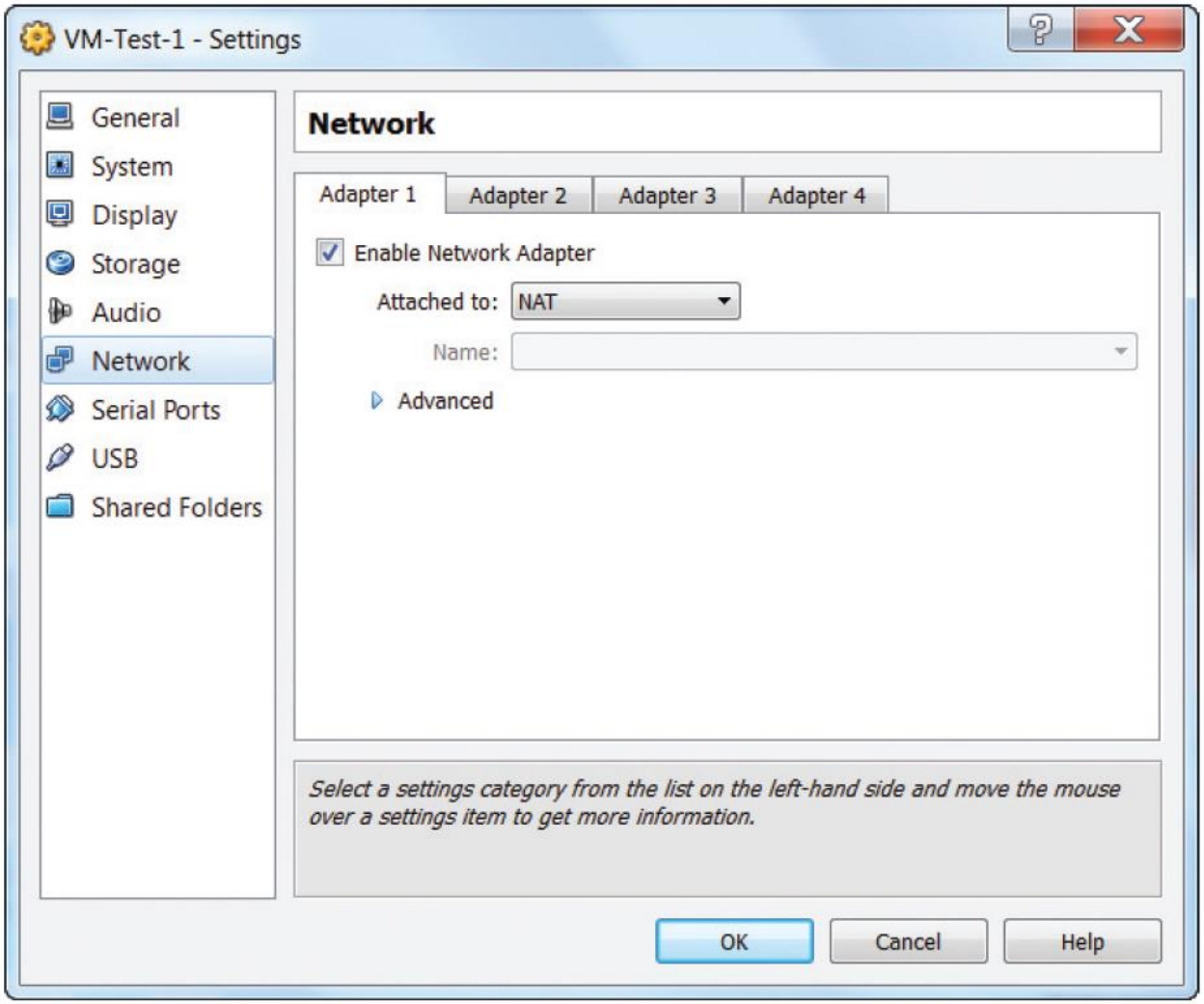

Selecting the NAT option for a vNIC in VirtualBox
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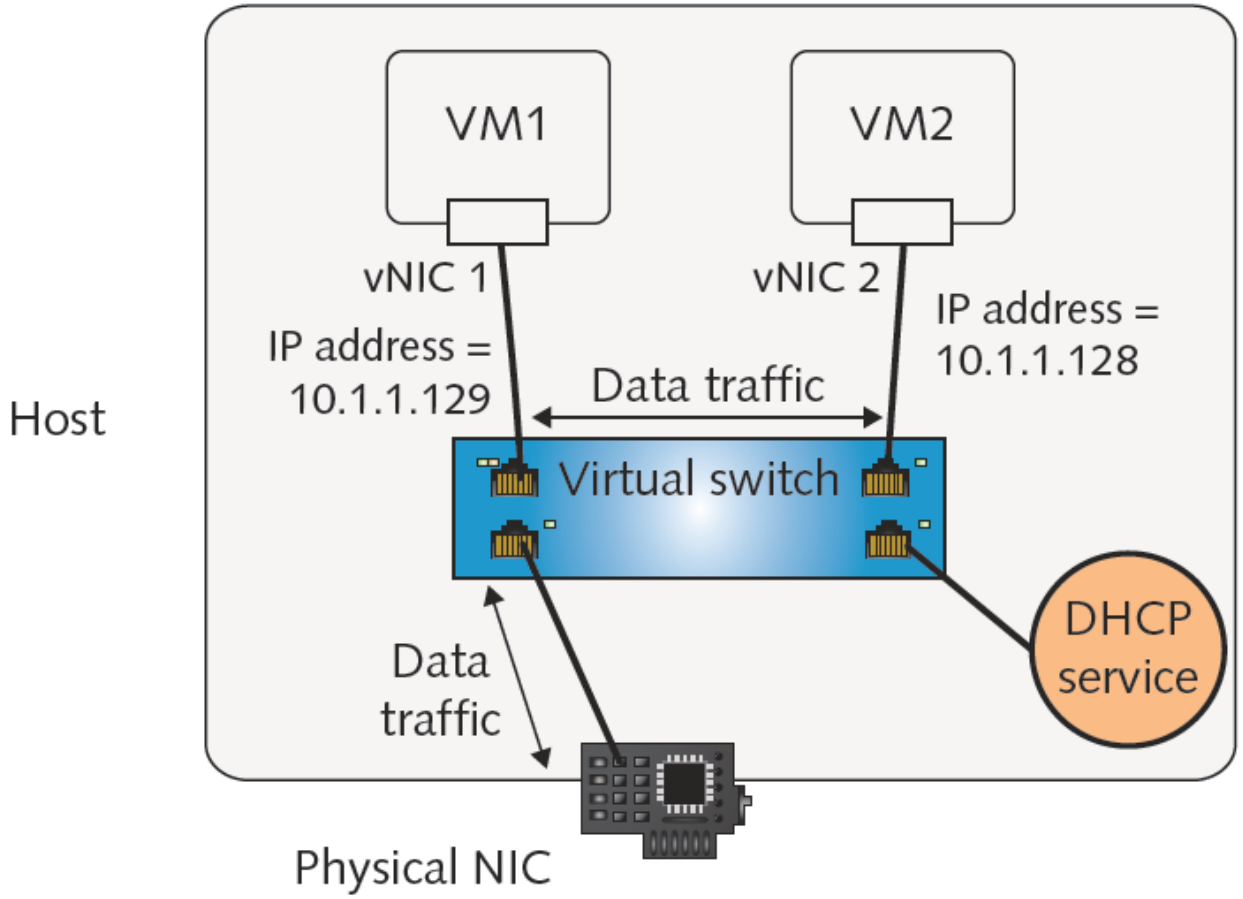
Network Connection Types - Host-only

- VMs on one host can exchange data with each other and the host
- Cannot communicate with nodes beyond the host
- Never receive or transmit data with host's physical NIC



Host-only network configuration
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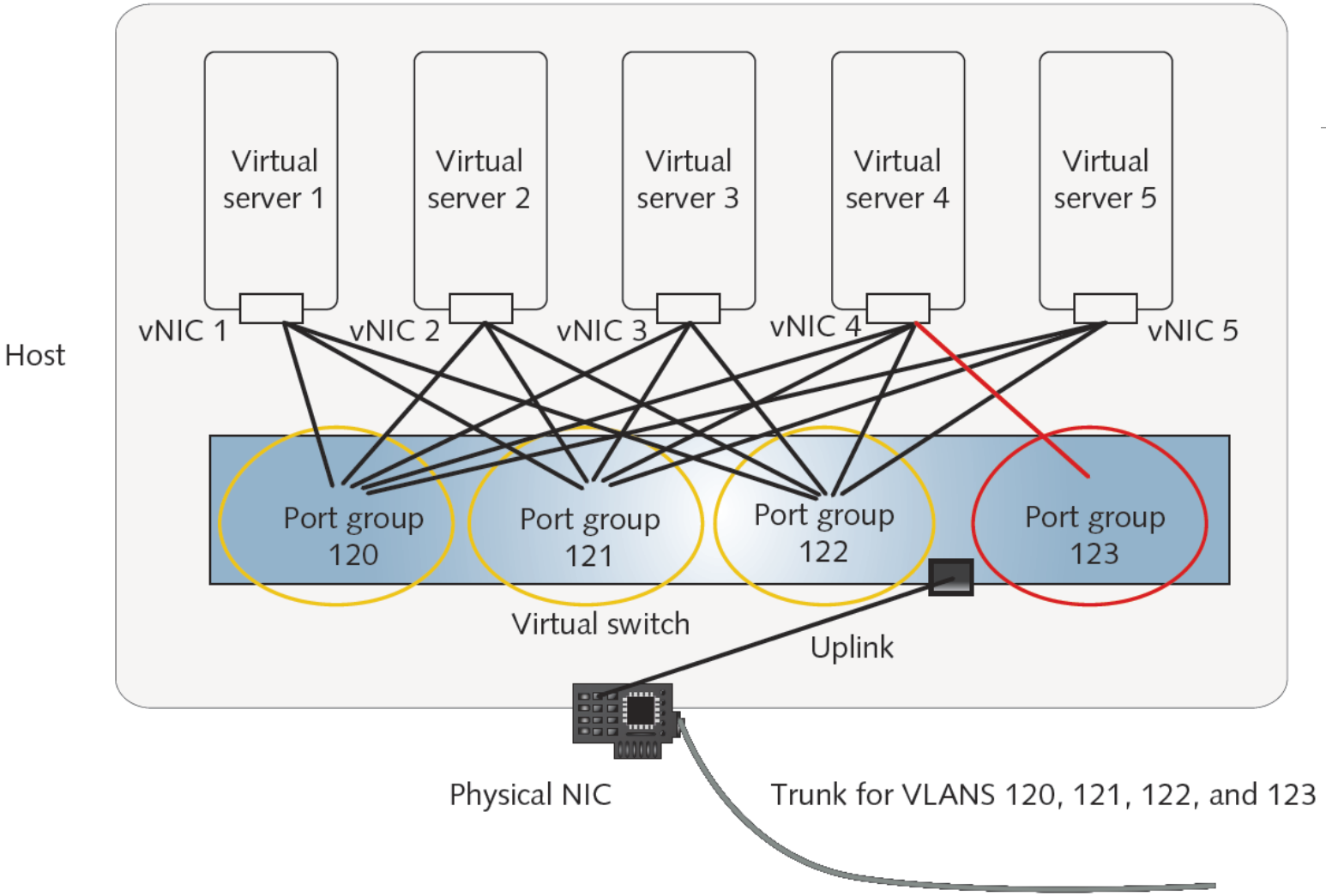
Virtual Appliances

- Alternative to test servers for new software
- Virtual appliance includes:
  - Image of operating system, software, hardware specifications, and application configuration
- Most commonly virtual servers
- Popular functions
  - Firewall
  - E-mail solutions
  - Network management
  - Remote access

Virtual Networks & VLANs

- Virtual network
  - Refers to how VMs connect with other virtual and physical network nodes
- Virtual network management
  - Nearly identical to physical network management
- To add VMs to a physical VLAN:
  - Modify virtual switch's configuration
    - Steps vary for different virtualization programs



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Remote Access & Virtual Computing

Remote access

- Allows user to connect with LAN or WAN in different geographical location
- Allows access to shared resources as any other client on LAN or WAN
- Requires transmission path and appropriate software

Popular remote access techniques

- Dial-up networking
- Microsoft's Remote Access Service (RAS)
  - Or Routing and Remote Access Service (RRAS)
- Virtual Private Networks (VPN)

Dial-Up Networking

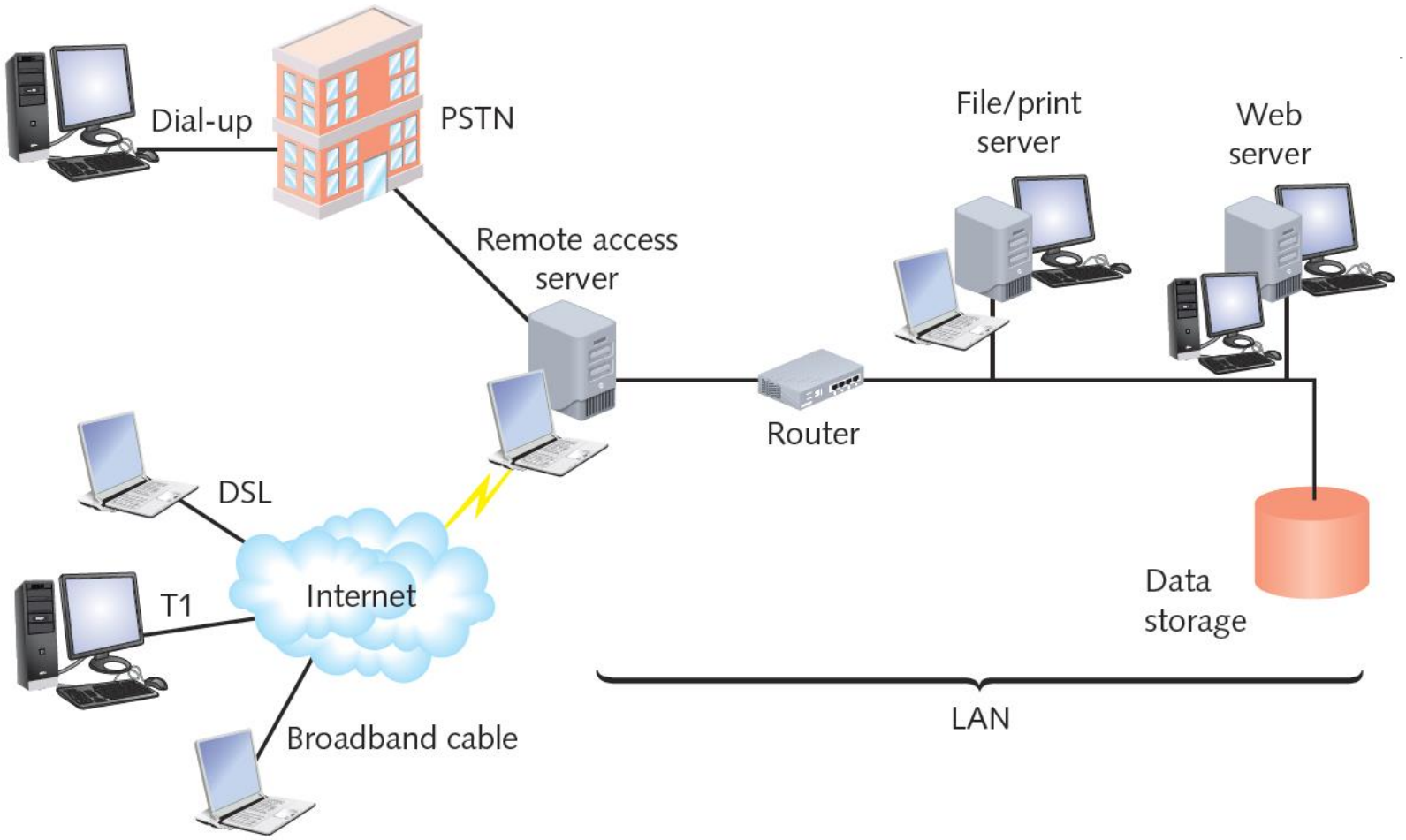
- Dialing directly into private network's or ISP's remote access server
- Usually refers to connection using PSTN
- Remote access server attached to group of modems
- Client must run dial-up software
- After authentication, user allowed access
- Remote access server can serve multiple users
- Low throughput
- Less popular today

Remote Access Servers

Accepts connections regardless of Internet connection type

RRAS (Routing and Remote Access Service)

- Microsoft's remote access software
- Available with Server 2003, 2008, 2008 R2, XP, Vista, and 7 operating systems
- Enables server to act as a router
- Includes multiple security provisions



Clients connecting with a remote access server
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Remote Access Protocols

SLIP (Serial Line Internet Protocol)

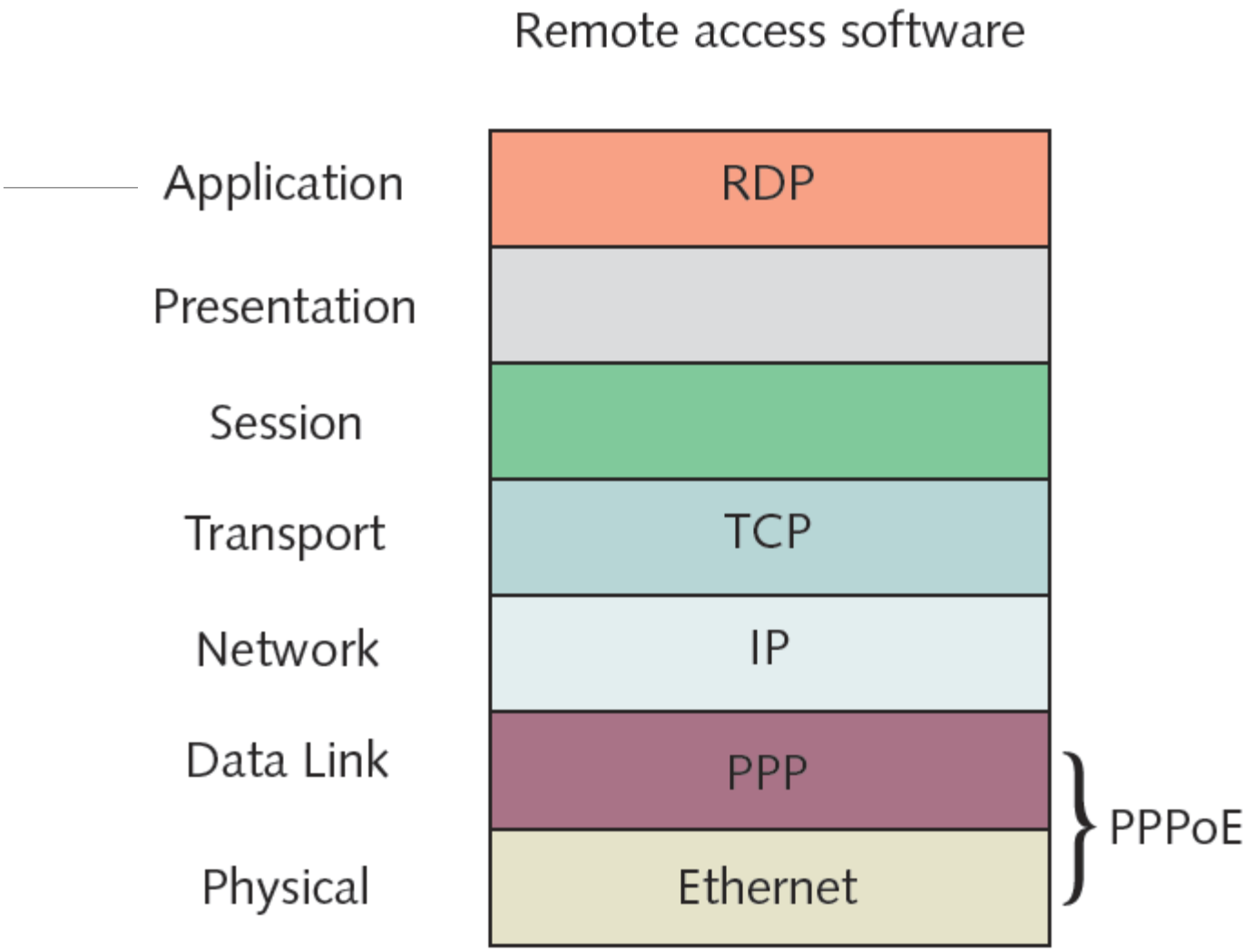
- Earlier and less sophisticated than PPP
- Can only carry IP packets
- Requires significant amount of setup
- Does not support data encryption
- Asynchronous transmission

PPP (Point-to-Point Protocol)

- Known as PPPoE when used over Ethernet
- Standard for connecting home computers to ISP
  - Via DSL or broadband cable

Remote Virtual Computing

- Allows workstation to remotely access and control another workstation
- Host may allow clients a variety of privileges
- Can send keystrokes and mouse clicks to the host
  - Receive screen output in return
- Thin client
  - Workstation that uses such software to access LAN
  - Requires very little hard disk space or processing power



Protocols used in a remote access Internet connection
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Remote Virtual Computing (cont'd.)

Advantages

- Simple to configure
- Runs over any connection type
- Single host can accept simultaneous connections from multiple clients

Popular programs

- Microsoft Remote Desktop
- VNC (Virtual Network Computing)
- ICA (Independent Computing Architecture)

Remote Virtual Computing (cont'd.)

Remote desktop

- Comes with Windows client and server operating systems

VNC (Virtual Network Computing)

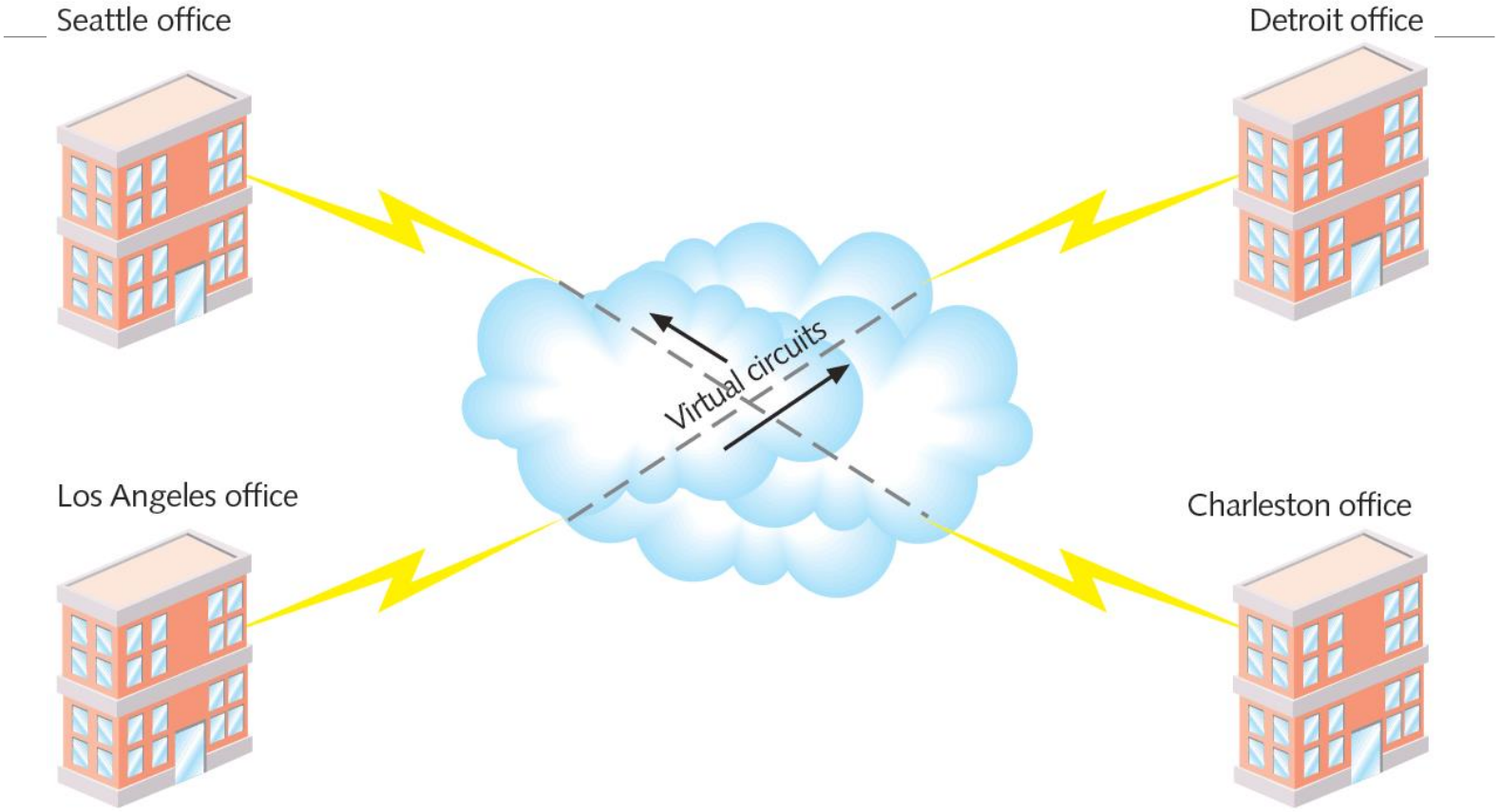
- Open source system

ICA (Independent Computing Architecture)

- Citrix System's XenApp
- Can work with virtually any operating system or application
- Easy to use

VPNs (Virtual Private Networks)

- Logically defined networks over public transmission systems
  - Isolated from other traffic on same public lines
- Requires inexpensive software
- Important considerations
  - Interoperability
  - Security
- Types
  - Site-to-site
  - Client-to-site



Site-to-site VPN
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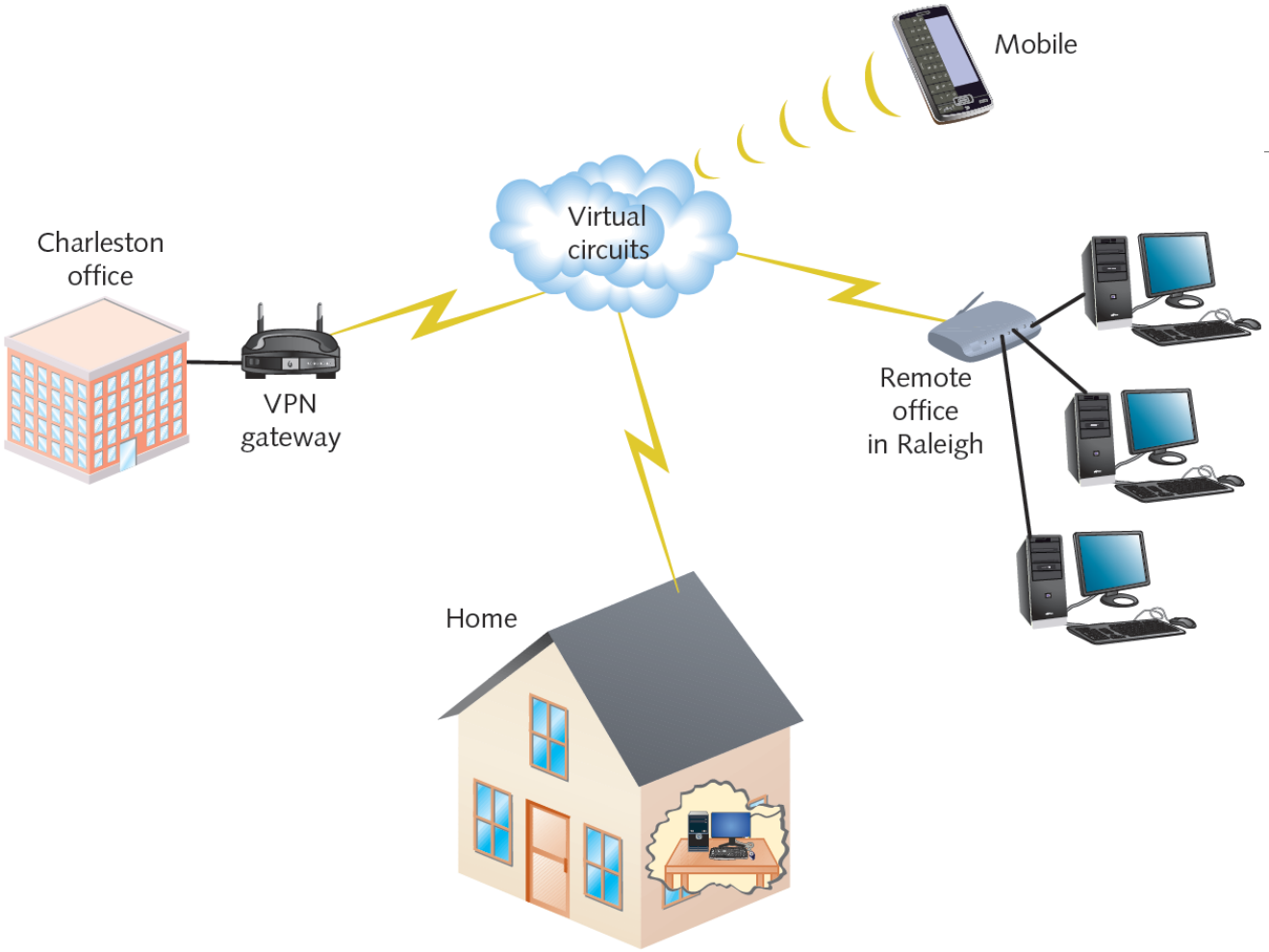

Client-to-site VPN
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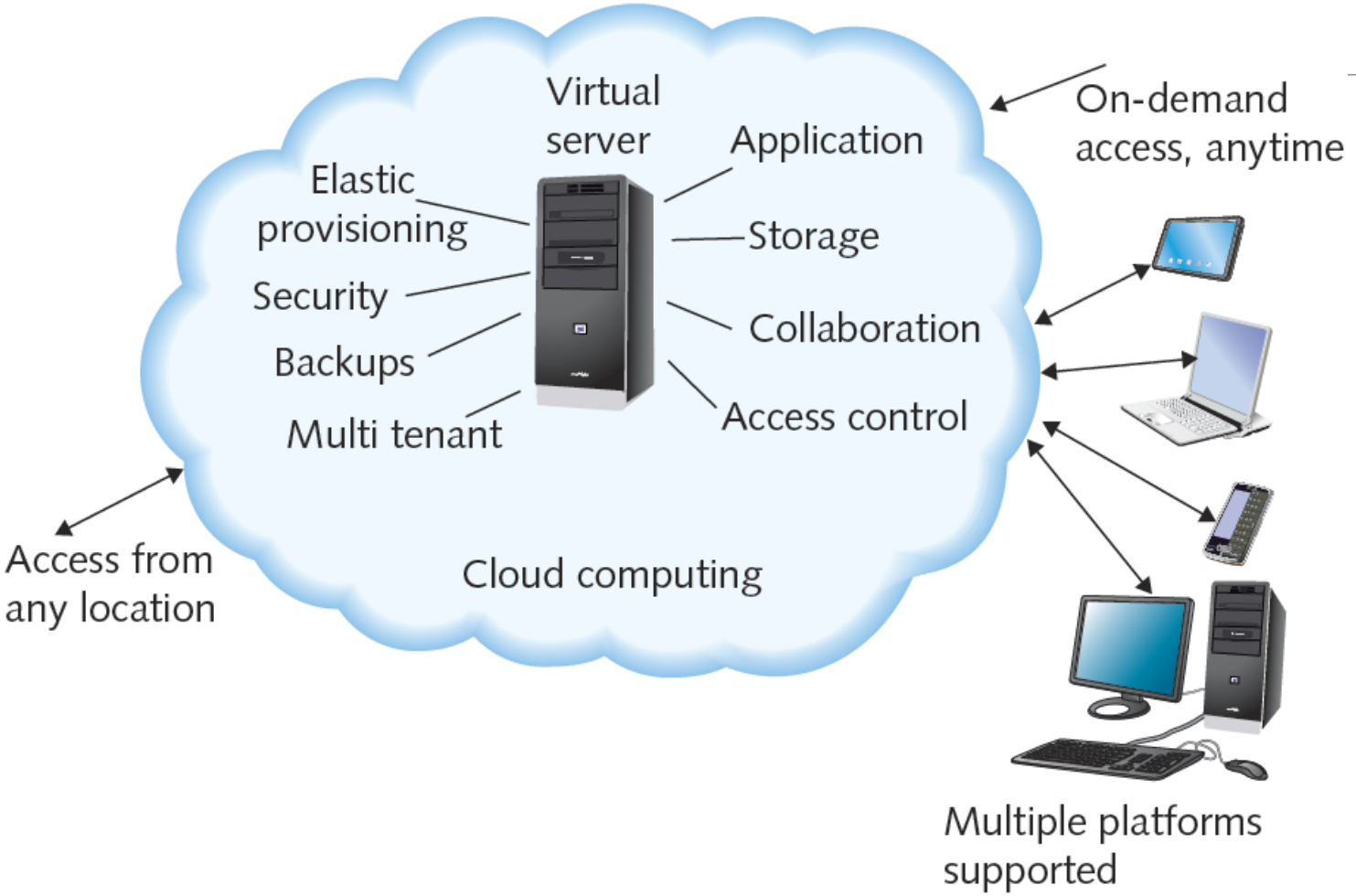
VPNs (cont'd.)

- Enterprise-wide VPN
  - Can include elements of client-to-site and site-to-site models
- VPNs tailored to customer's distance, user, and bandwidth needs
- Two major types of tunneling protocols
  - PPTP (Point-to-Point Tunneling Protocol)
  - L2TP (Layer 2 Tunneling Protocol)

Cloud Computing

- Internet frequently pictured as a cloud
- Cloud computing
  - Flexible provision of data storage, applications, and services
    - To multiple clients over a network
- Cloud computing distinguishing features
  - Self-service and on-demand
  - Elastic
  - Supports multiple platforms
  - Resource pooling and consolidation
  - Metered service



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Cloud Computing (cont'd.)

- Can provide virtual desktops
  - Operating environments hosted virtually
  - Different physical computer than one user interacts with
- NaaS (Network as a Service)
  - Service provider offers customers complete set of networking services
- Types of delivery
  - Public cloud
  - Private cloud

Summary

- Virtualization: emulation of a computer, operating system environment, or application on a physical system
- VMs exist as files on physical computer's hard disk
- Hypervisor software manages resource allocation and sharing among virtual machines
- Virtual switch allows VMs to communicate with each other and with nodes on a physical LAN or WAN
- Different methods of remote user access exist
- Cloud computing provides storage, applications, or services over a network