Telecommunications, Networks, and the Internet

OBJECTIVES

- **Describe the features of a contemporary corporate network infrastructure and key networking technologies**

- **Evaluate alternative transmission media, types of networks, and network services**

- **Assess the role of the Internet and the World Wide Web in a firm's information technology infrastructure**

OBJECTIVES (Continued)

- **Identify and describe the most important tools for communication and e-business**

- **Identify and describe the challenges posed by networking and the Internet and management solutions**

- Challenge: Outdated networking environment, high maintenance costs, and poor service to 19 schools and 8,000 students
- Solutions: Install a TCP/IP networking environment that handles both voice and data traffic, and supports intranet for teachers
- Standardize desktop operating systems and hardware
- Illustrates the importance of using Internet-based networking technologies to achieve business and service goals

**TELECOMMUNICATIONS AND NETWORKING IN
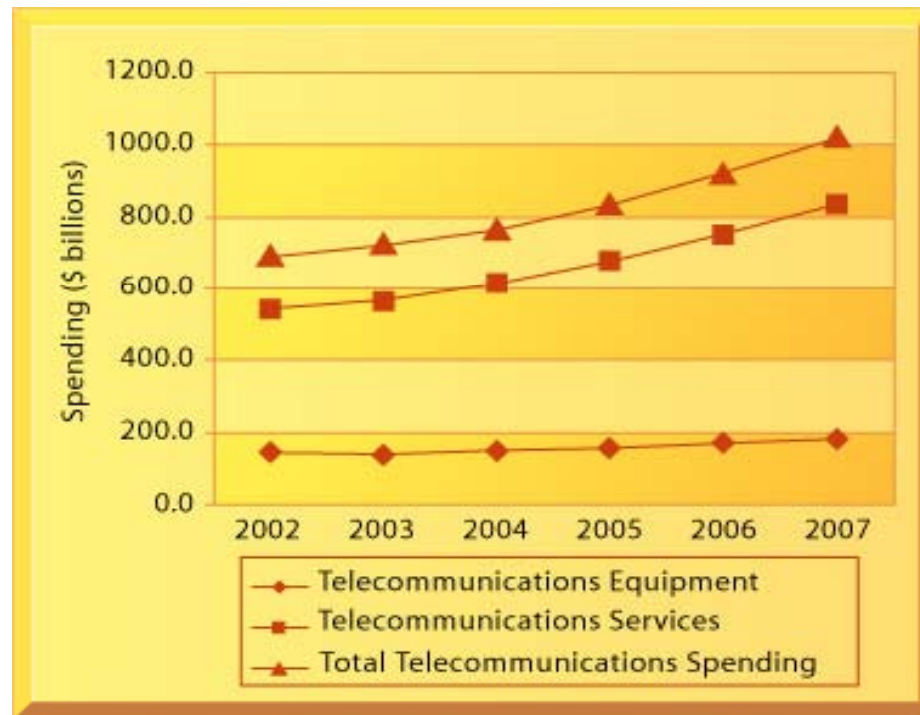TODAY'S BUSINESS WORLD**

- **A networking and communications revolution led by Internet-based technologies**

- **1 billion instant messages per day**

- **4 billion e-mails each day**

- **65 million music files downloaded**

TELECOMMUNICATIONS AND NETWORKING IN TODAY'S BUSINESS WORLD

- **Estimated 3.9 billion photos sent over the Internet**

- **$769 billion spent in the United States on telecommunications equipment and services**

- **Today, networking and the Internet are synonymous with doing business.**

Telecommunications spending in the United States, 2002–2007

Figure 8-1

The Business Telecommunications Environment

- **Telecommunications environment provides connectivity by providing communication channels for text, voice, and video images.**

- **The network infrastructure for a large corporation consists of many different kinds of networks for both data and voice communication.**

- **Most of these different kinds of networks are moving towards a common Internet foundation.**

TELECOMMUNICATIONS AND NETWORKING IN TODAY'S BUSINESS WORLD
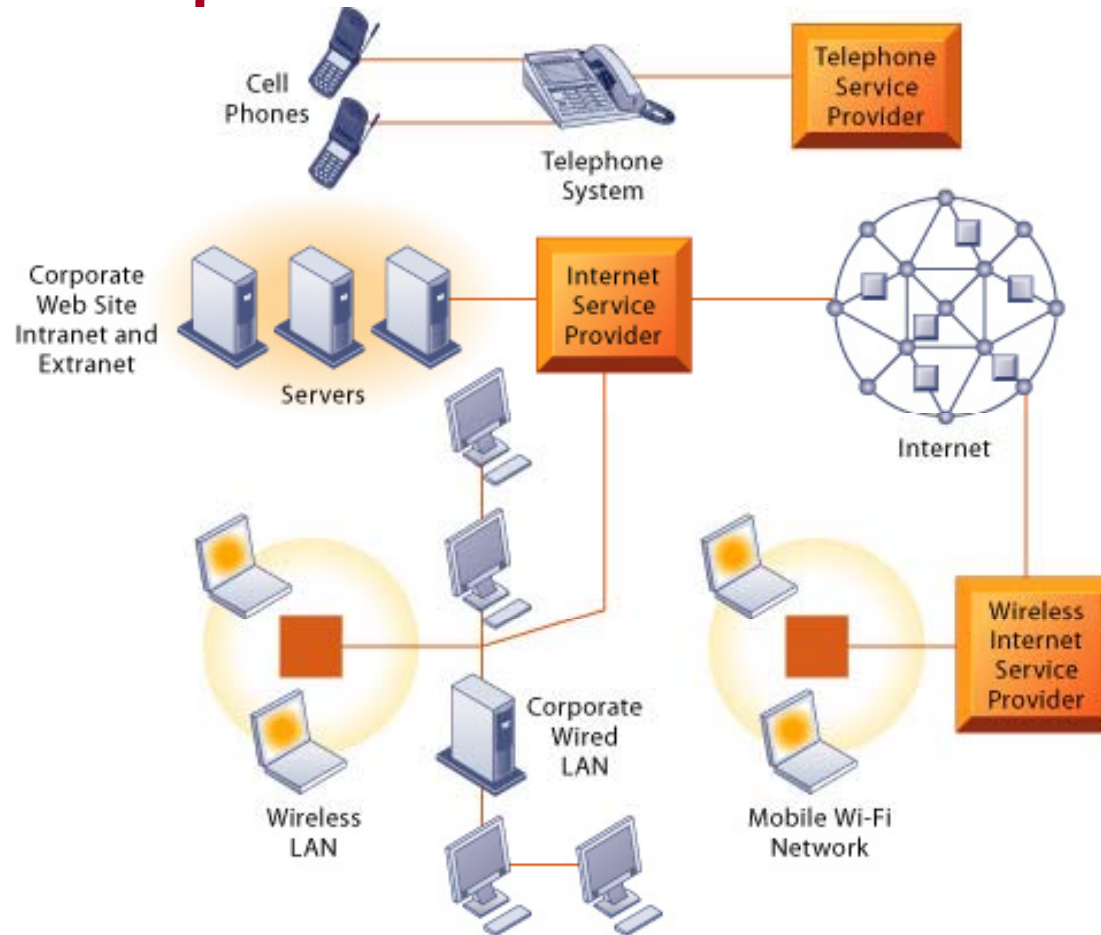
Corporate Network Infrastructure

Figure 8-2

Networking and Communications Trends

The seven major trends in telecommunications:

- **Rapid technological innovation has resulted in a proliferation of new hardware devices and new alternatives for business communications.**

- **Continuing telecommunications deregulation has encouraged competition and created many alternatives.**

Networking and Communications Trends (Continued)

- **Distinctions between telephone, cable television, Internet, and satellite telecommunication are blurred.**

- **Growing dominance of Internet technologies in voice, video, and data communications**

- **Rapid growth in "last-mile" high-speed broadband connections to homes and businesses**

Networking and Communications Trends (Continued)

- **Rapid growth in wireless telephone, wireless computer networks, and mobile Internet devices**

- **Growing scope of communication-intense services and products**

The Business Value of Telecommunications and Networking

Business value impacts of the telecommunications and Networking are:

- **Declining transaction costs**

- **Declining agency costs**

- **Increased agility**

The Business Value of Telecommunications and Networking (Continued)

- **Higher quality management decisions**

- **Declining geographical barriers**

- **Declining temporal barriers**

- **The extremely rapid growth in business networking and telecommunications results from the extraordinary value of participating in networks like the Internet.**

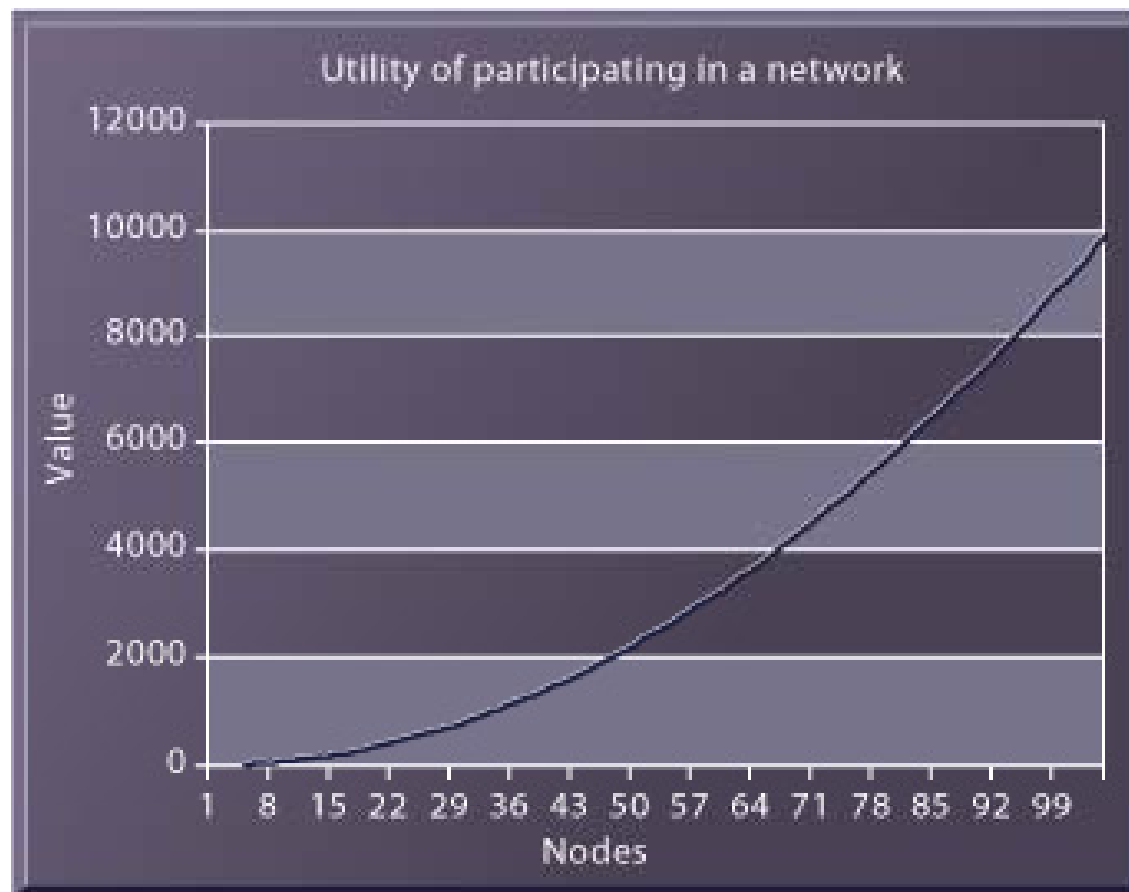# TELECOMMUNICATIONS AND NETWORKING IN TODAY'S BUSINESS WORLD

Metcalfe's Law

Figure 8-3

Networks and Corporate Infrastructure

- **A network consists of two or more connected computers.**

- **Each computer on the network contains a network interface device called a network interface card (NIC).**

- **The connection medium for linking network components can be a telephone wire, coaxial cable, or radio signal in the case of cell phone and wireless local area networks.**

Networks and Corporate Infrastructure (Continued)

- **The network operating system (NOS) routes and manages communications on the network and coordinates network resources.**

- **Networks also contain a switch or a hub acting as a connection point between the computers.**

- **Hubs are very simple devices that connect network components, sending a packet of data to all other connected devices.**

Networks and Corporate Infrastructure (Continued)

- **A switch has more intelligence than a hub and can filter and forward data to a specified destination. Switches are used within individual networks.**

- **A router is a special communications processor used to route packets of data through different networks, ensuring that the message sent gets to the correct address.**

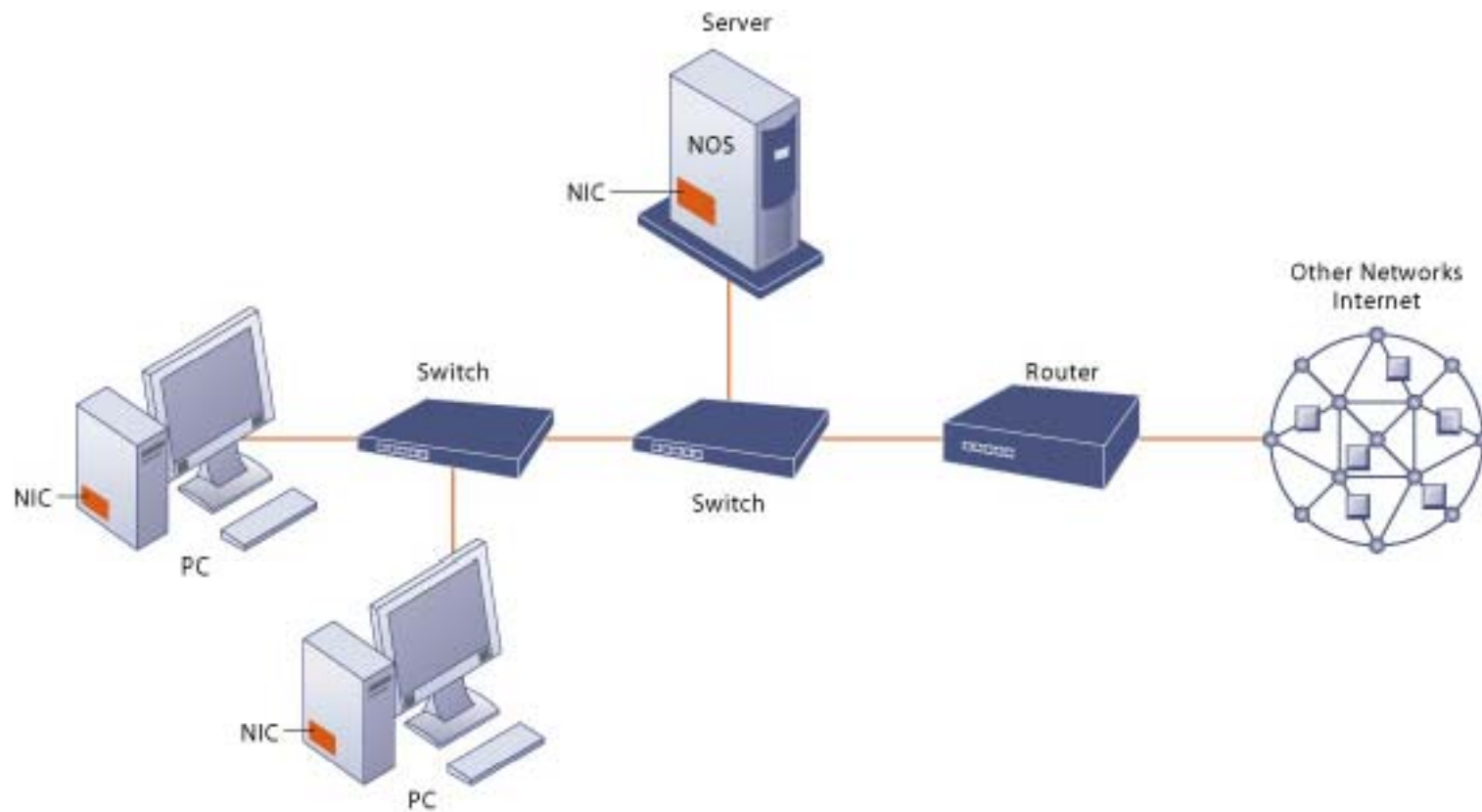**CONTEMPORARY NETWORKING INFRASTRUCTURE**

Components of a Simple Network

Figure 8-4

CONTEMPORARY NETWORKING INFRASTRUCTURE

Key Digital Networking Technologies

- **Client/Server Computing**

- **Packet Switching**

- **TCP/IP and Connectivity**

Client/Server Computing:

- **Client/server computing is a distributed computing model in which much of the processing power is located within small, inexpensive client computers.**

- **The powerful clients are linked to one another through a network that is controlled by a network server computer.**

- **The server sets the rules of communication for the network and provides every client with an address so others can find it on the network.**

Packet Switching:

- **In packet-switched networks, messages are first broken down into small bundles of data called packets.**

- **These packets are sent along different communication paths and then the packets are reassembled once they reach their destinations.**

Packet Switching: (Continued)

- **Packet switching makes more efficient use of the communications capacity of a network.**

- **The packets include information for directing the packet to the right address and for checking transmission errors along with the data.**

CONTEMPORARY NETWORKING INFRASTRUCTURE

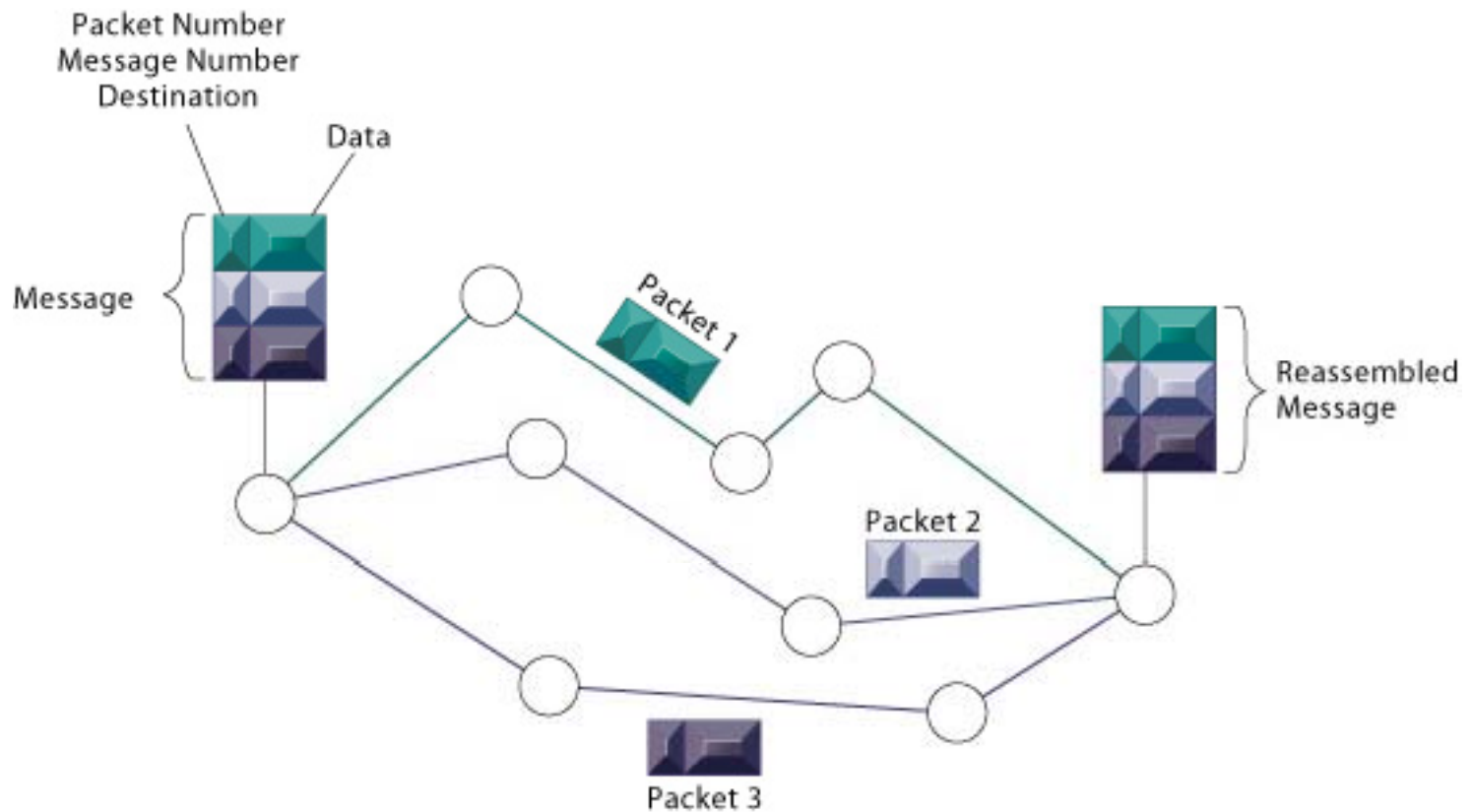# Packed-Switched Networks and Packet Communications

Figure 8-5

TCP/IP and Connectivity:

- **TCP/IP is the communications protocol used by the Internet and all Internet devices.**

- **TCP/IP provides for breaking up digital messages into packets, routing them to the proper addresses, and then reassembling them into coherent messages.**

- **TCP/IP uses a suite of protocols: TCP and IP.**

Transmission Control Protocol (TCP):

- **Handles the movement of data between computers**

- **Establishes a connection between the computers, sequences the transfer of packets, and acknowledges the packets sent**

Internet Protocol (IP):

- **Responsible for the delivery of packets**

- **Includes the disassembling and reassembling of packets during transmission**

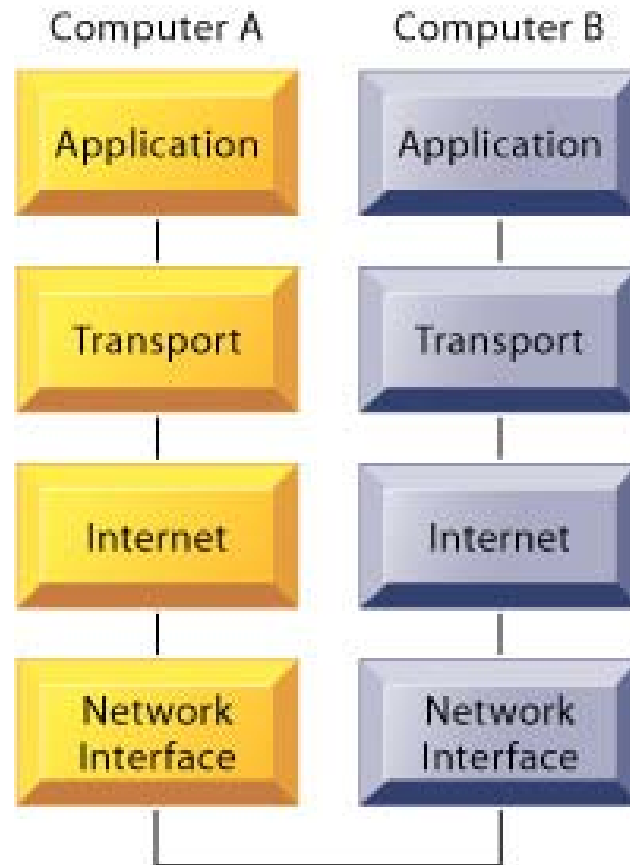**CONTEMPORARY NETWORKING INFRASTRUCTURE**

The TCP/IP Reference Model

Figure 8-6

Physical Transmission Media

The different kinds of physical transmission media used by the networks are:

- **Twisted Wire**

- **Coaxial Cable**

- **Fiber Optics and Optical Networks**

- **Wireless Transmission**

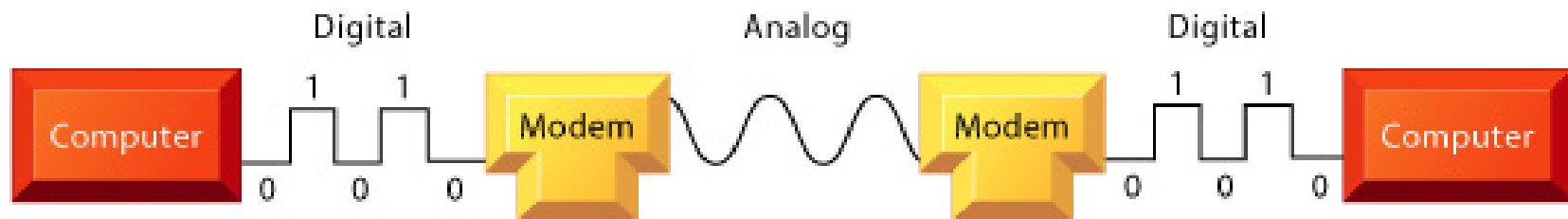# CONTEMPORARY NETWORKING INFRASTRUCTURE

Functions of the Modem

Figure 8-7

CONTEMPORARY NETWORKING INFRASTRUCTURE

Types of Networks

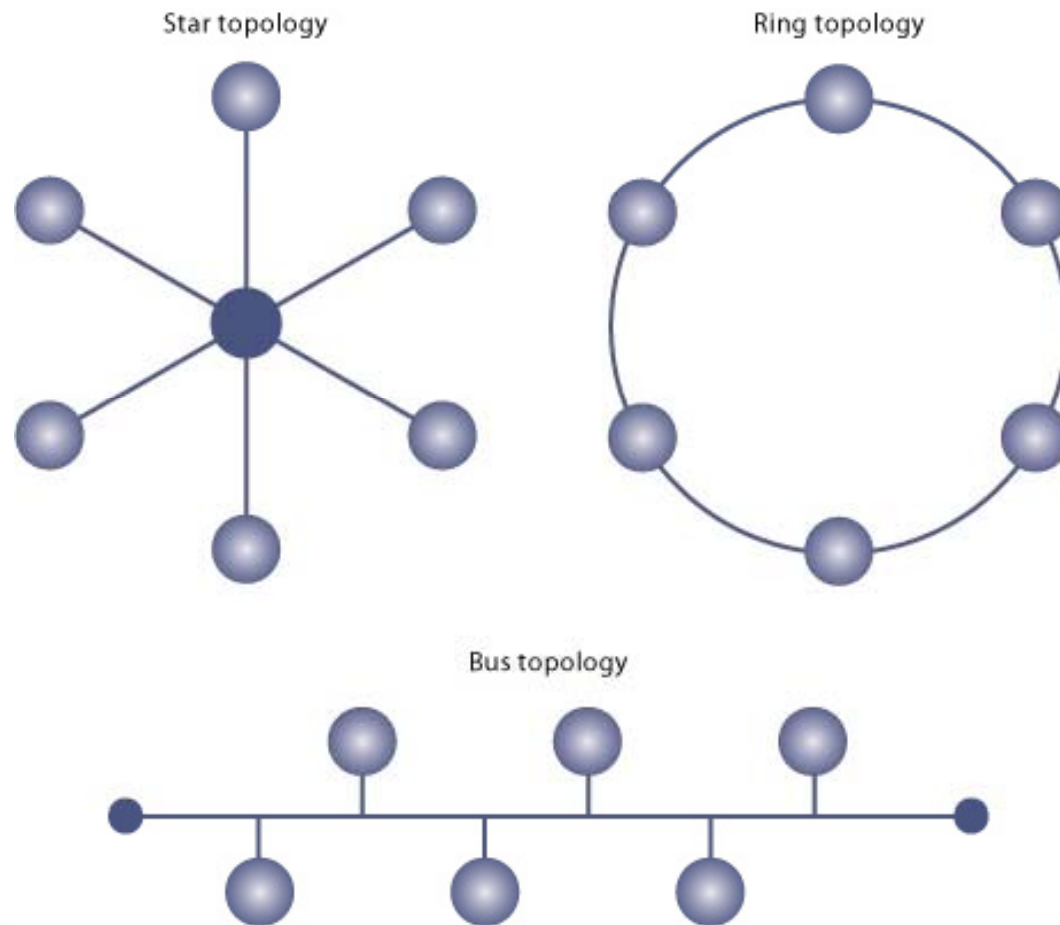| Type	Area
Local Area Network (LAN)	Up to 500 meters (half a mile); an office or floor of a building
Campus Area Network (CAN)	Up to 1,000 meters (a mile); a college campus or corporate facility
Metropolitan Area Network (MAN)	A city or metropolitan area
Wide Area Network (WAN)	Transcontinental or global area

CONTEMPORARY NETWORKING INFRASTRUCTURE

Network Topologies

Star topology

Ring topology

Bus topology

Figure 8-8

Broadband Network Services and Technologies

A number of network services and technologies are available to companies that need high-speed transmission or access to the Internet.

- **Frame relay:** Packages data into frames for high-speed transmission over reliable circuits that require less error checking than packet switching

Broadband Network Services and Technologies (Continued)

- **Asynchronous Transfer Mode (ATM):** Parcels data into uniform 53-byte cells for high-speed transmission; can transmit data, video, and audio over the same network

- **Integrated Services Digital Network (ISDN):** Dial-up network access standard that can integrate voice, data, and video services

Broadband Network Services and Technologies (Continued)

- **Digital Subscriber Line (DSL):** Series of technologies for high-capacity transmission over copper wire

- **Cable modem:** Service for high-speed transmission of data over cable TV lines that are shared by many users

- **T lines:** Dedicated lines for high-speed secure data transmission and Internet connection

Technically, the Internet is a global information system defined by three characteristics:

- **A network composed of computers and other devices that are logically linked together by a unique address space based on the Internet Protocol**

- **A network where network devices are able to support communications using TCP/IP or other compatible protocols**

- **A network that provides high-level services layered on a communication and network infrastructure**

Internet Addressing, Architecture, and Governance

The Domain Name System:

Every device connected to the Internet has a unique 32-bit numeric IP address.

- A Domain Name System (DNS) converts IP addresses to English-like domain names.

- The domain name is the name that corresponds to the unique 32-bit numeric IP address for each computer connected to the Internet.

Internet Addressing, Architecture, and Governance (Continued)

The Domain Name System:

- **DNS servers maintain a database containing IP addresses mapped to their corresponding domain names.**

- **To access a computer on the Internet, users need only specify its domain name.**

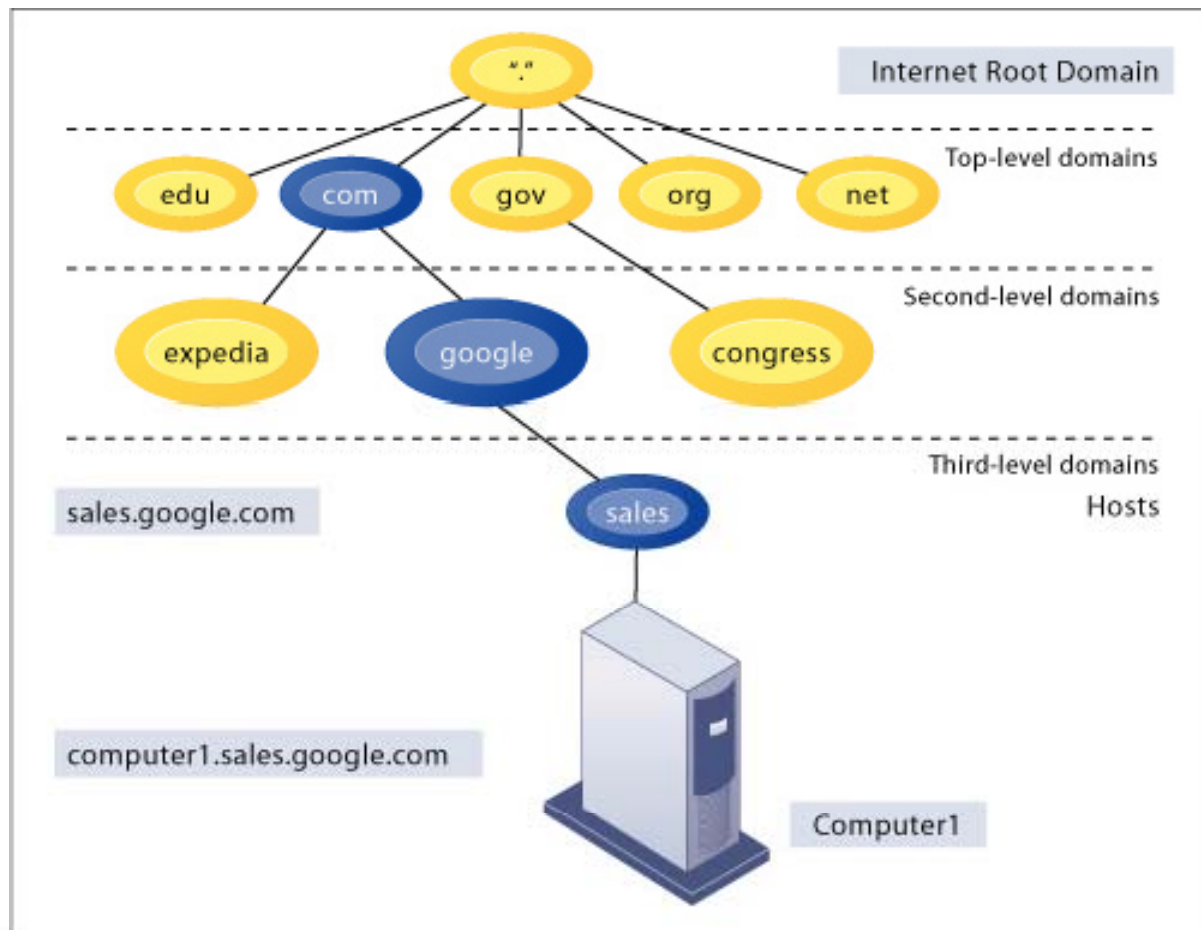**THE INTERNET**

The Domain Name System

Figure 8-9

Limitations on IP Addresses: IPv4 and IPv6:

- **Internet Protocol version 4 (IPv4):** A 32-bit string of numbers organized into four sets of numbers ranging from 0 to 255; contains up to 4 billion addresses

- **Internet Protocol version 6 (IPv6):** 128-bit addresses, contains over a quadrillion possible unique addresses
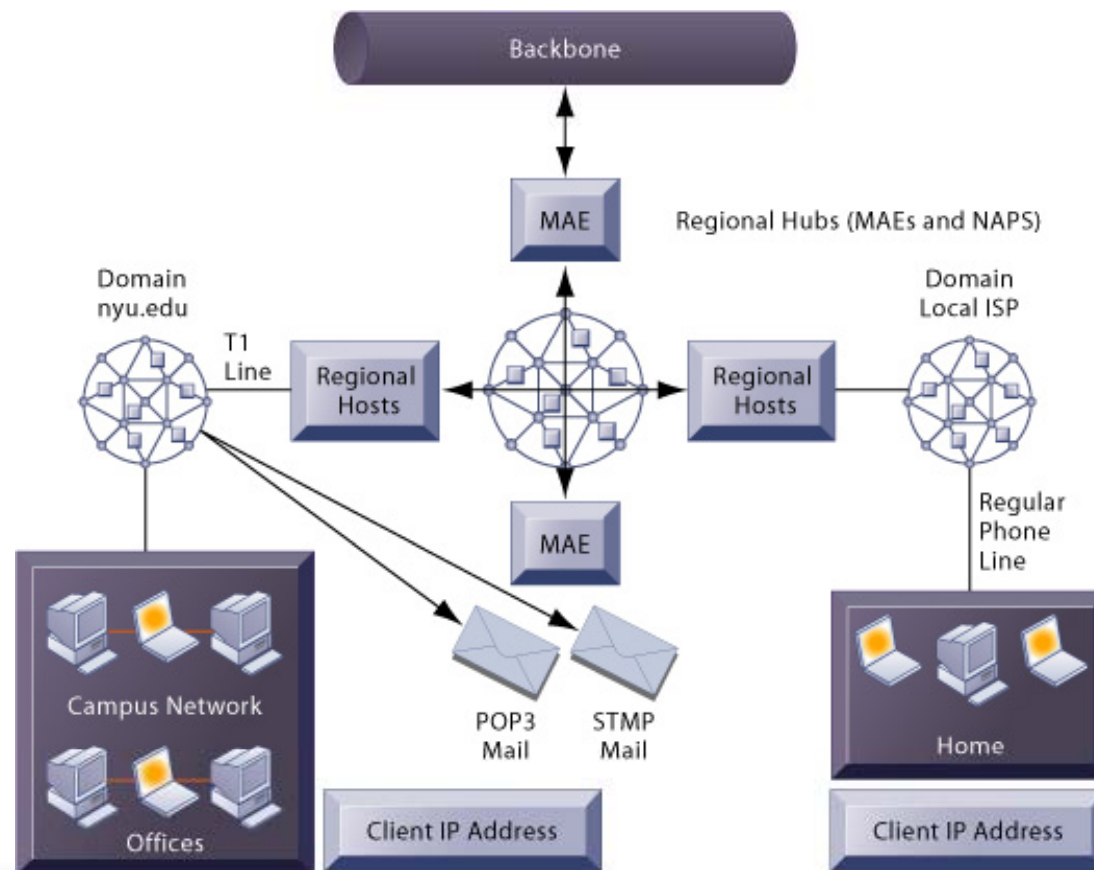
Internet Architecture:

Internet Network Architecture

Figure 8-10

Internet Governance:

No one "owns" the Internet, however, worldwide Internet policies are established by the following organizations:

- **Internet Architecture Board (IAB)**

- **Internet Corporation for Assigned Names and Numbers (ICANN)**

Internet Governance: (Continued)

- **Internet Network Information Center (InterNIC)**

- **Internet Engineering Steering Group (IESG)**

- **Internet Engineering Task Force (IETF)**

- **Internet Society (ISOC)**

- **World Wide Web Consortium (W3C)**

THE INTERNET

Major Internet Services

- **E-mail:** Person-to-person messaging; document sharing

- **Usenet newsgroups:** Discussion groups on electronic bulletin boards

- **LISTSERVs:** Discussion groups using e-mail mailing list servers

- **Chatting and instant messaging:** Interactive conversations

Table 8-6

Major Internet Services (Continued)

- **Telnet:** Logging on to one computer system and doing work on another

- **FTP:** Transferring files from computer to computer

- **World Wide Web:** Retrieving, formatting, and displaying information (including text, audio, graphics, and video) using hypertext links

Table 8-6 (Continued)

THE INTERNET
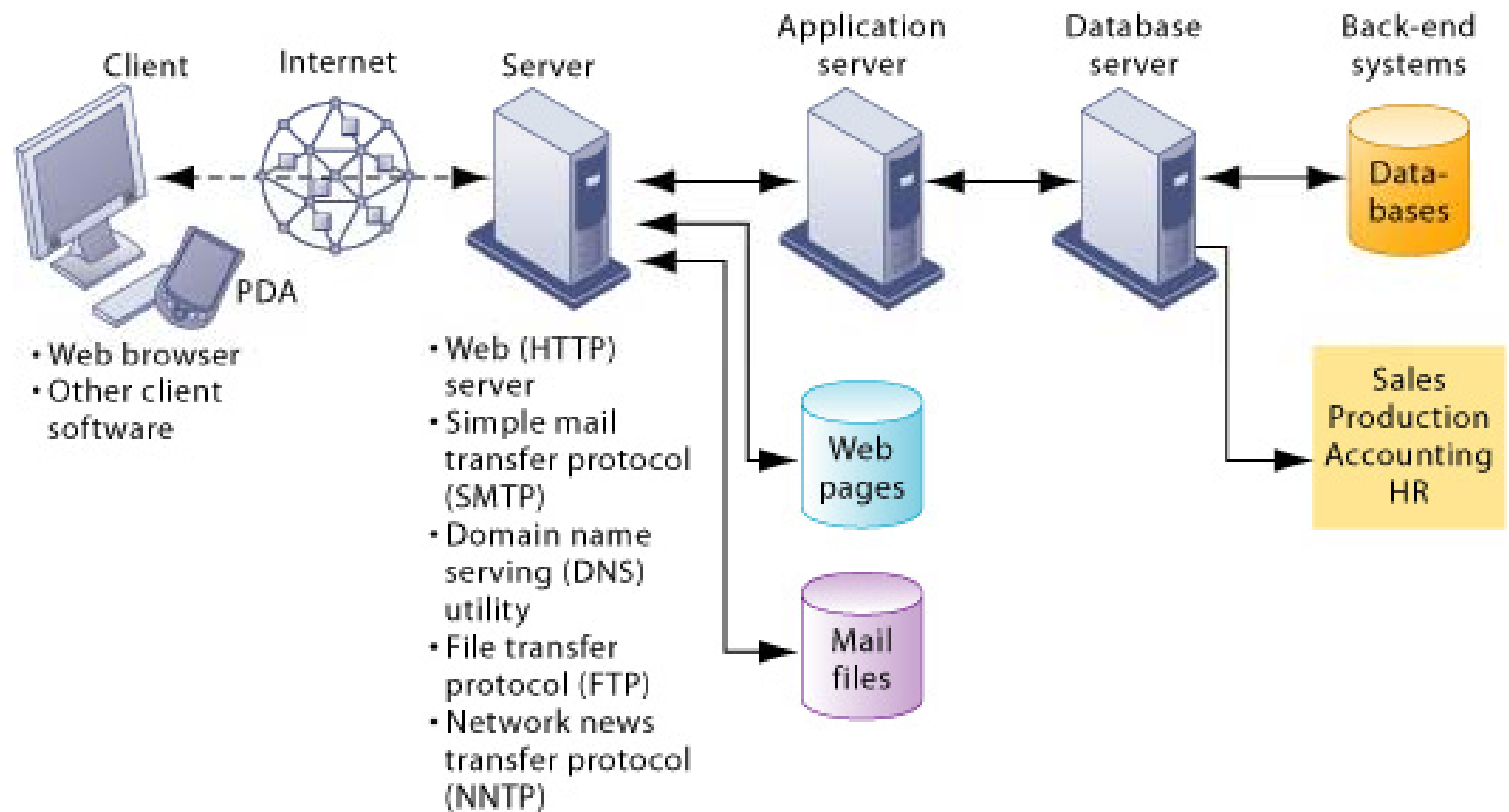
Client/server Computing on the Internet

Figure 8-11

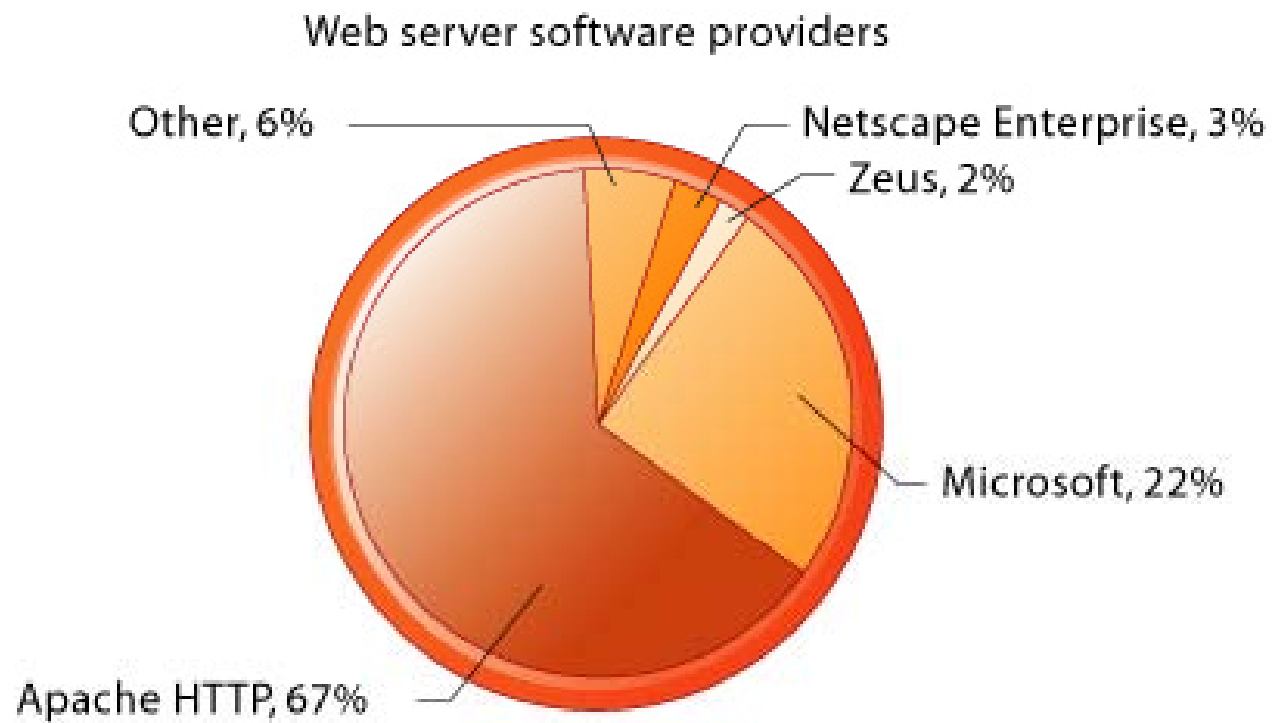# The Internet and Business Value

The World Wide Web:

- **Hypertext**

- **Web servers**

- **Searching for information on the Web**

THE INTERNET

Major Web Server Providers

Web server software providers

Other, 6% ——— ———— Netscape Enterprise, 3%

—— Zeus, 2%

——— Microsoft, 22%

Apache HTTP, 67% ———

Figure 8-12

Searching and Finding Information on the Internet

- **The Internet lowers search costs**

- **Search engines**

- **Intelligent agents and shopping bots**

- **Broadcast and push technology**

- **The semantic Web**

Intranets and Extranets

Intranets:

- **An intranet is an internal organizational network that provides access to data across a business firm.**

Extranets:

- **Allow authorized vendors and customers to have limited access to its internal intranet**

**TECHNOLOGIES AND TOOLS FOR COMMUNICATION
AND E-BUSINESS**

- **E-Mail**

- **Chatting and Instant Messaging**

- **Electronic Discussion Groups**

**TECHNOLOGIES AND TOOLS FOR COMMUNICATION
AND E-BUSINESS**

Groupware, Teamware, and Electronic Conferencing

- **Groupware: Provides capabilities for supporting enterprise-wide communication and collaborative work**

- **Teamware: Enables companies to implement collaboration applications easily that can be accessed using Web browser software**

**Groupware, Teamware, and Electronic Conferencing
(Continued)**

- **Electronic conferencing tools:** Provides a virtual conference table where participants can view and modify documents and slides or share their thoughts and comments using chat, audio, or video

Internet Telephony

- **Internet telephony:** Enable companies to use Internet technology for telephone voice transmission over the Internet or private networks

- **Voice over IP (VoIP) technology:** Uses the Internet Protocol (IP) to deliver voice information in digital form using packet switching

- **Unified messaging systems:** Combine voice mail, e-mail, and faxes so they can all be obtained from one system

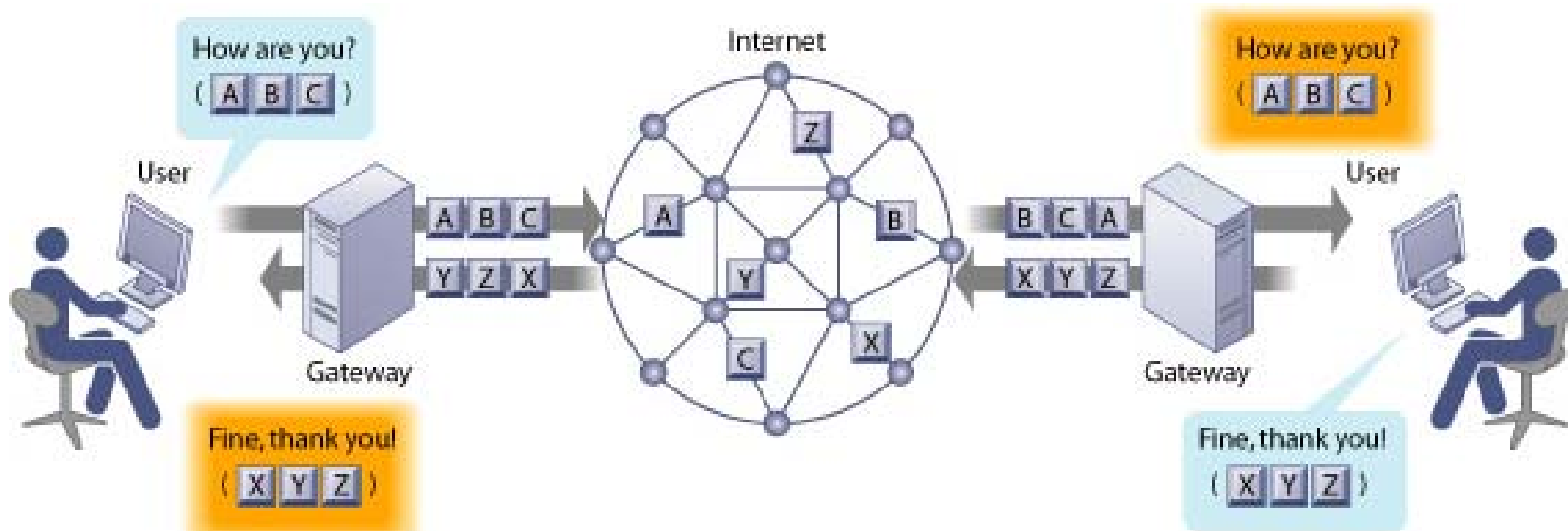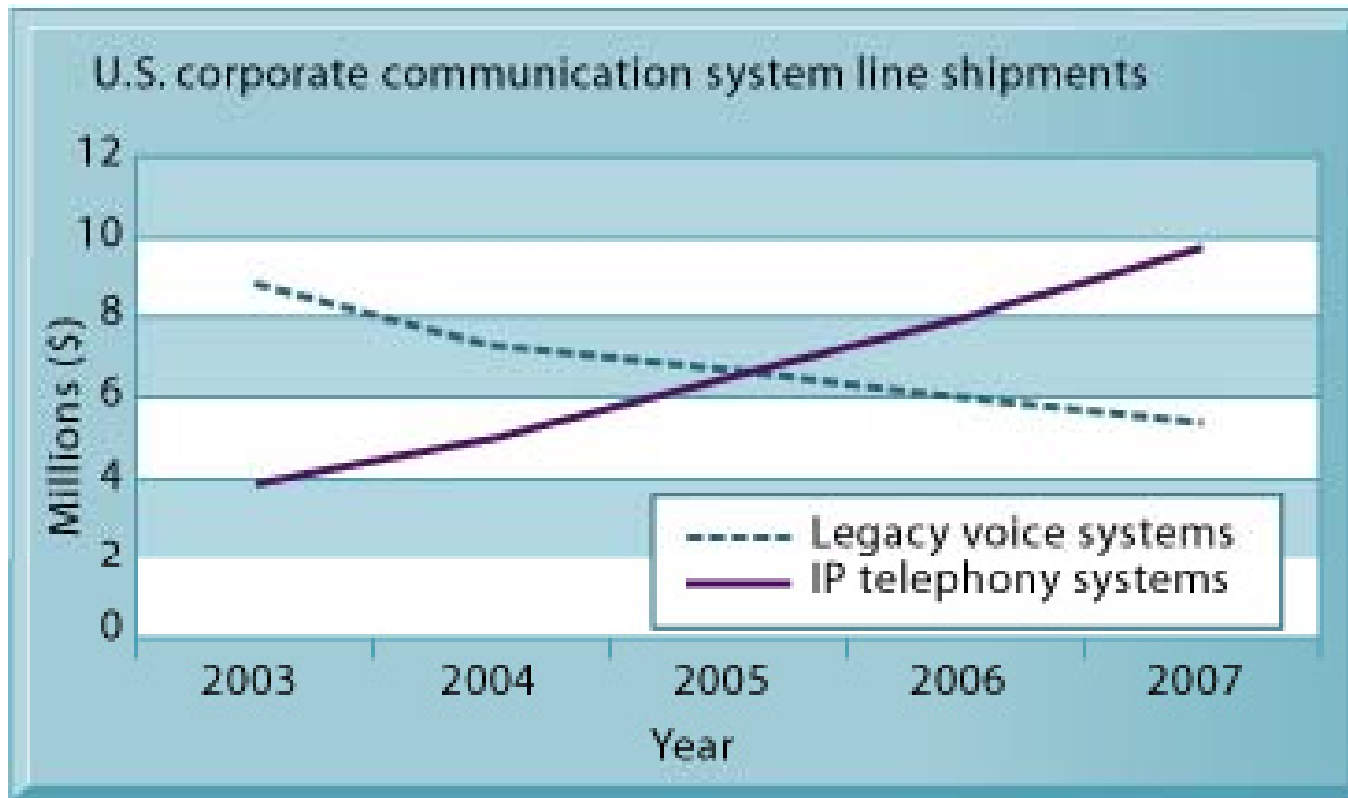**TECHNOLOGIES AND TOOLS FOR COMMUNICATION AND E-BUSINESS**

How IP Telephony Works

Figure 8-13

TECHNOLOGIES AND TOOLS FOR COMMUNICATION AND E-BUSINESS

The Growth of Internet Telephony

U.S. corporate communication system line shipments

Legend:
- ----- Legacy voice systems
- —— IP telephony systems

Source: Infotech and authors.

Figure 8-14

TECHNOLOGIES AND TOOLS FOR COMMUNICATION
AND E-BUSINESS

Virtual Private Networks

- **A virtual private network based on the Internet Protocol provides a secure connection between two points across the Internet, enabling private communications to travel securely over the public infrastructure**

**TECHNOLOGIES AND TOOLS FOR COMMUNICATION
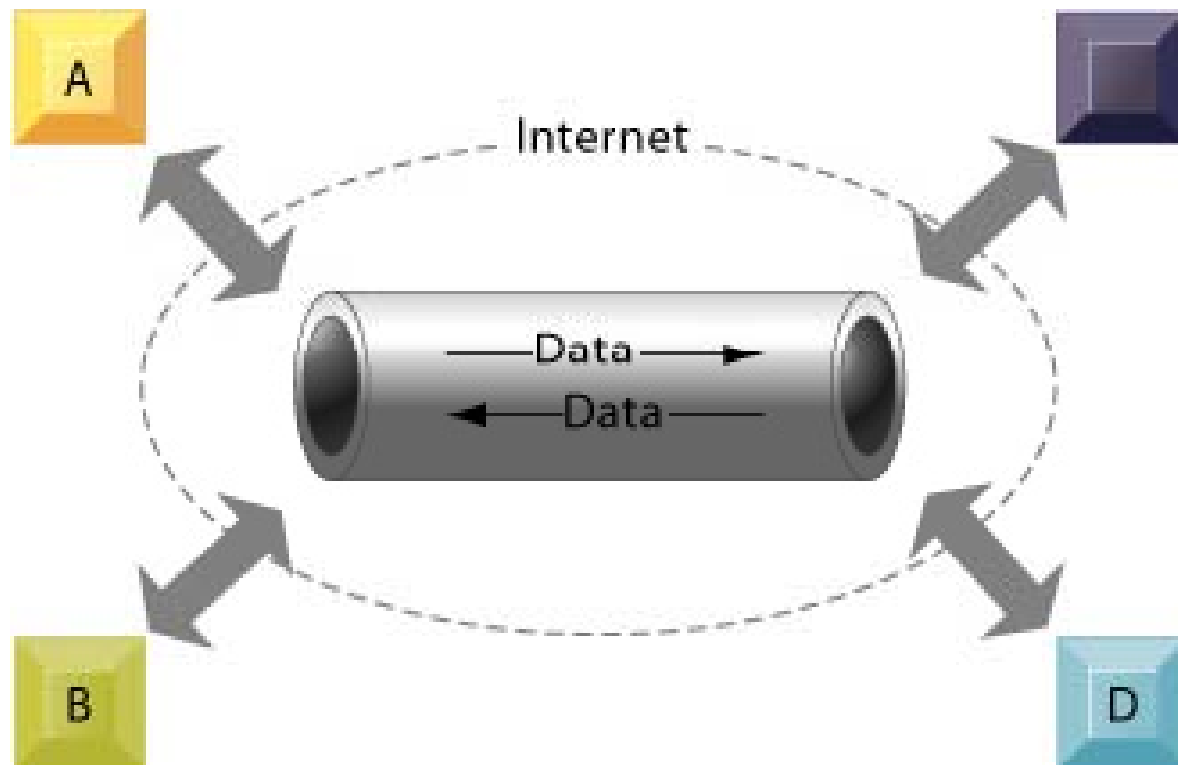AND E-BUSINESS**

A Virtual Private Network using the Internet

Figure 8-15

Management Opportunities:

- **Firms have the opportunity to radically reduce the cost of communicating with their employees, vendors, and customers. There are many new opportunities to develop new business models based on the new telecommunications technologies.**

Management Challenges:

- **Loss of management control**

- **Organizational change requirements**

- **Scalability, Reliability, and Security**

Solution Guidelines:

- **Developing a strategic networking plan**

- **Managing the change**