Pengantar Telekomunikasi (D3)

Dosen : S. Indriani L, M.T

Genap
2012/2013

CHAPTER 1

NETWORKS, TELECOMMUNICATIONS, AND MOBILE TECHNOLOGY

Bobot Penilaian dan Syarat Ujian

✳ Tugas dan Quiz 30%

✳ Ujian Tengah Semester 30%

✳ Ujian Akhir Semester 40%

  Total 100 %

Syarat untuk mengikuti UAS : minimum kehadiran 80%

(maksimum ketidakhadiran adalah 3 kali)

Rules in my class

* Mahasiswa datang tepat waktu, mahasiswa sudah berada didalam kelas, apabila dosen sudah ada di kelas maka mahasiswa yang datang setelahnya tidak diperbolehkan masuk ke dalam kelas demi menjaga ketertiban selama perkuliahan.

* Mahasiswa berpakaian rapih dan sopan. (wanita tidak menggunakan riasan muka dan aksesoris secara berlebihan, pria tidak menggunakan aksesoris secara berlebihan, rambut rapih, tidak panjang)

* Selama perkuliahan berlangsung tidak ribut, tidak menyalakan HP ataupun menerima telepon didalam kelas.

* Tugas dikerjakan di kertas A4, diluar yang telah ditentukan tidak diterima.

* Tidak ada tugas/quiz/ujian susulan (kecuali untuk Ujian Akhir disertai bukti rawat inap di Rumah sakit)

Any Questions?

SECTION 1.1

NETWORKS AND TELECOMMUNICATIONS

The Digital Hospital

- Hackensack University medical center has invested $72 million in IT projects since 1998. It is one of the nation's most aggressive technology adopters.

- Benefits include:
  - Mortality rates down 16% in 4 years
  - Quality of care and productivity have increased

- Health care spending accounts for 15% of the US economy, about $1.7 trillion
  - Any efficiency gains will affect the overall economy
  - In addition, hospitals using electronic prescription systems have seen 80% fewer prescription errors

IT Projects of Hackensack Univ Medical Center

Patients can use 37-inch plasma TVs in their rooms to surf the Internet for information on their medical conditions. They can also take interactive courses about their condition and find out how to take care of themselves after discharge

From virtually anywhere in the world, physicians can make hospital rounds with the help of a life-size robot. Using laptops with joy sticks and Web links, doctors drive the robot around the hospital to confer by remote video with patients and other doctors. Used by a doctor during a blizzard to check up on his patients.

Pocket-sized PCs that hook wirelessly into the hospital's network allow doctors the freedom to place pharmacy orders and pull up medical records from anywhere in the hospital

Nurses use wireless laptops to record patients' vital signs, symptoms and medications. Doctors can sign into the same central system from their laptops to order prescriptions and lab tests and read their patient's progress

The hospital's internal Web site stores all is medical images. Doctors can view crystal clear digital versions of their patients' X-rays, MRIs and CT scans from any computer in or out of the hospital.

A giant robot named Robbie, equipped with arms, reads prescriptions entered into the hospital's computer system and then grabs medications stored on pegs on the wall. The pills are then dropped into containers that are marked for each patient.

INTRODUCTION

- ***Telecommunication system*** *-* enable the transmission of data over public or private networks

- ***Network*** *-* a communications, data exchange, and resource-sharing system created by linking two or more computers and establishing standards, or protocols, so that they can work together

NETWORK BASICS

- **Local area network (LAN)** A computer network that uses cables or radio signals to link two or more computers within a geographically limited area, generally one building or a group of buildings. A networked office building, school, or home usually contains a single LAN. The linked computers are called workstations.

- **Wide area network (WAN)** A computer network that provides data communication services for business in geographically dispersed areas (such as across a country or around the world). The Internet is a WAN that spans the world.

- **Metropolitan area network (MAN)** A computer network that provides connectivity in a geographic area or region larger than that covered by a local area network, but smaller than the area covered by a wide area network. A college or business may have a MAN that joins the different LANs across its campus.

NETWORK BASICS
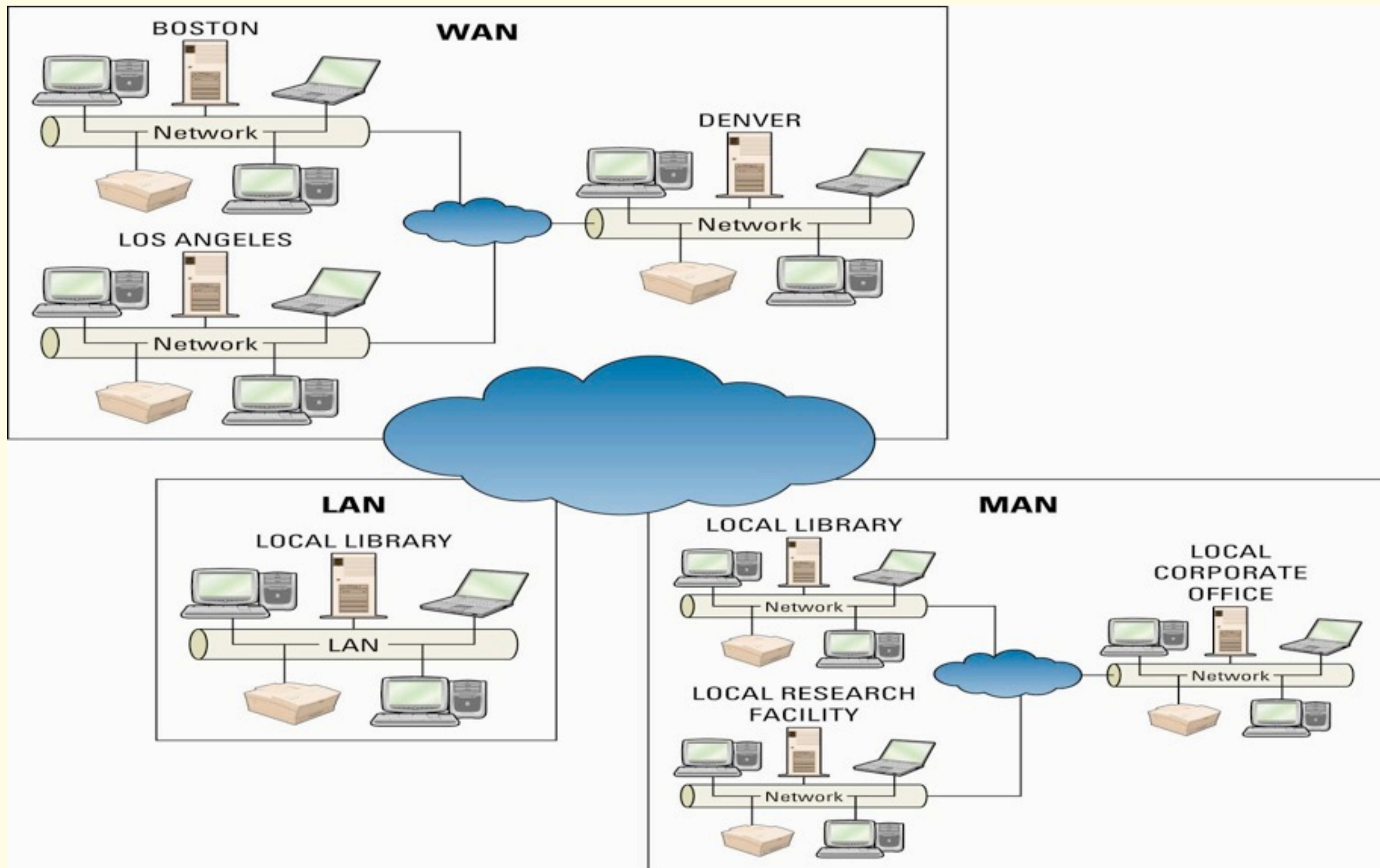
Using Networks and Telecommunications For Business Advantages

- Network and telecommunication competitive advantages include:
  - Voice over IP
  - Networking businesses
  - Increasing the speed of business
  - Securing business networks

Using Networks and Telecommunications For Business Advantages

– The SABRE airline reservation system is a classic example of a strategic information system that depends upon communication provided through a network.

– SABRE Airline Solutions pioneered technological advances for the industry in areas such as revenue management, pricing, flight scheduling, cargo, flight operations and crew scheduling.

– In addition, not only did SABRE help invent e-commerce (now referred to as ebusiness) for the travel industry, the company holds claim to progressive solutions that defined — and continue to revolutionize — the travel and transportation marketplace.

NETWORK BASICS

- Networks are differentiated by the following:
  - Architecture - peer-to-peer, client/server
  - Topology - bus, star, ring, hybrid, wireless
  - Protocols - Ethernet, Transmission Control Protocol/Internet Protocol (TCP/IP)
  - Media - coaxial, twisted-pair, fiber-optic

ARCHITECTURE

- There are two primary types of architectures
  - Peer-to-peer (P2P) network
  - Client/server network

Peer-to-Peer Networks

- ***Peer-to-peer (P2P) network*** - any network without a central file server and in which all computers in the network have access to the public files located on all other workstations

Connection such as Internet or Cables
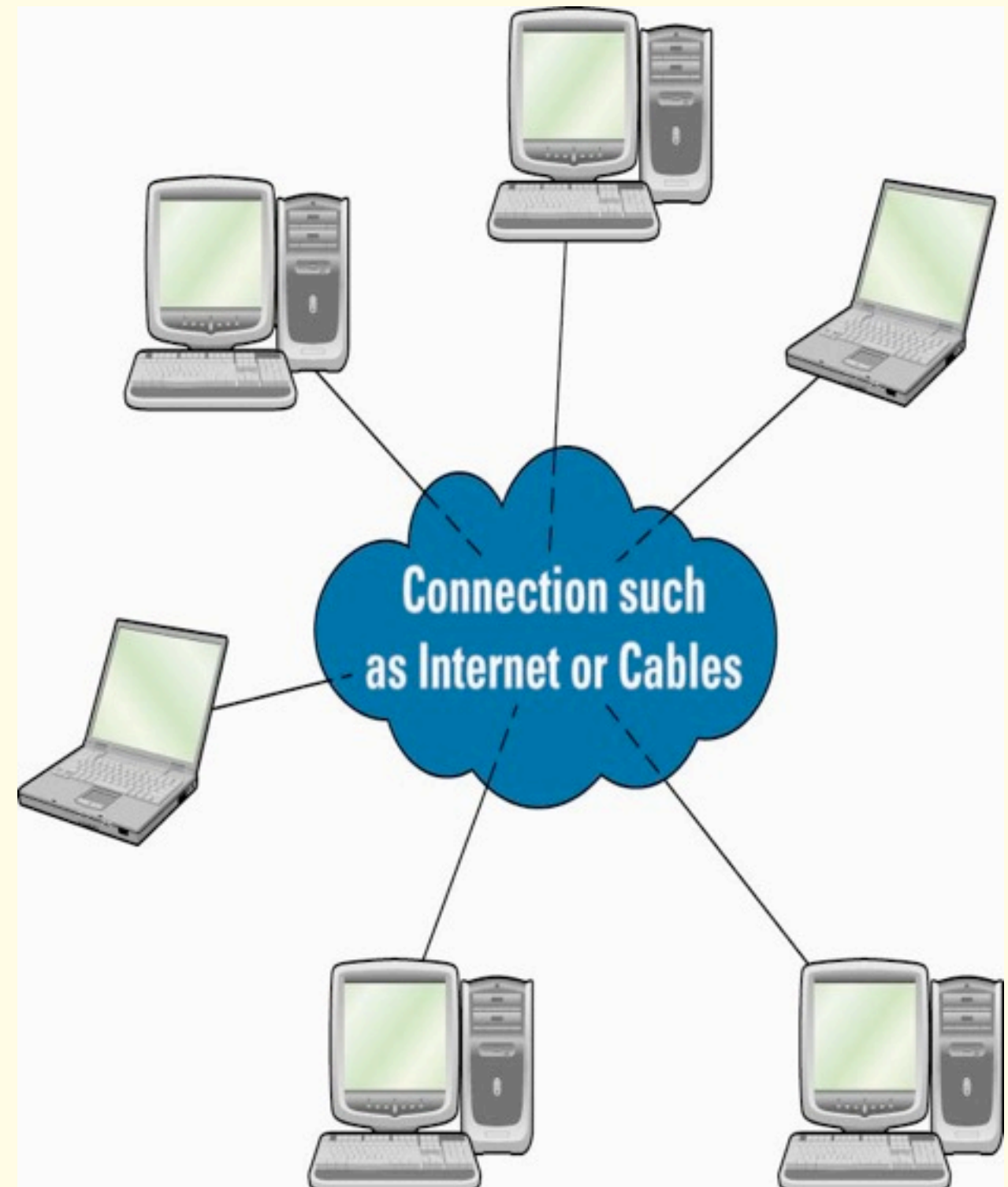
Peer-to-Peer Networks

- P2P is a popular technology for file sharing software applications like Kazaa, WinMX and Overnet. P2P technology helps the P2P client applications upload and download files over the P2P network services.

- P2P technology can also be found in other places. Microsoft Windows XP , for example, contains a component called "Windows Peer-to-Peer Networking." P2P is especially popular in homes where an expensive, dedicated server computer is neither necessary nor practical.

Peer-to-Peer Networks

- Finally, the P2P acronym has acquired a non-technical meaning as well.
  - Some people have described this second meaning of "P2P" as "people-to-people." From this perspective, P2P is a model for developing software and growing businesses that help individuals on the Internet meet each other and share common interests.
  - So-called **social networking** technology is an example of this concept.

Client/Server Networks

- ***Client*** - a computer that is designed to request information from a server
  - A PC using an Internet browser is a client
- ***Server*** - a computer that is dedicated to providing information in response to external requests; requires server operating system
  - ***Client/server network*** - model for applications in which the bulk of the back-end processing takes place on a server, while the front-end processing is handled by the clients
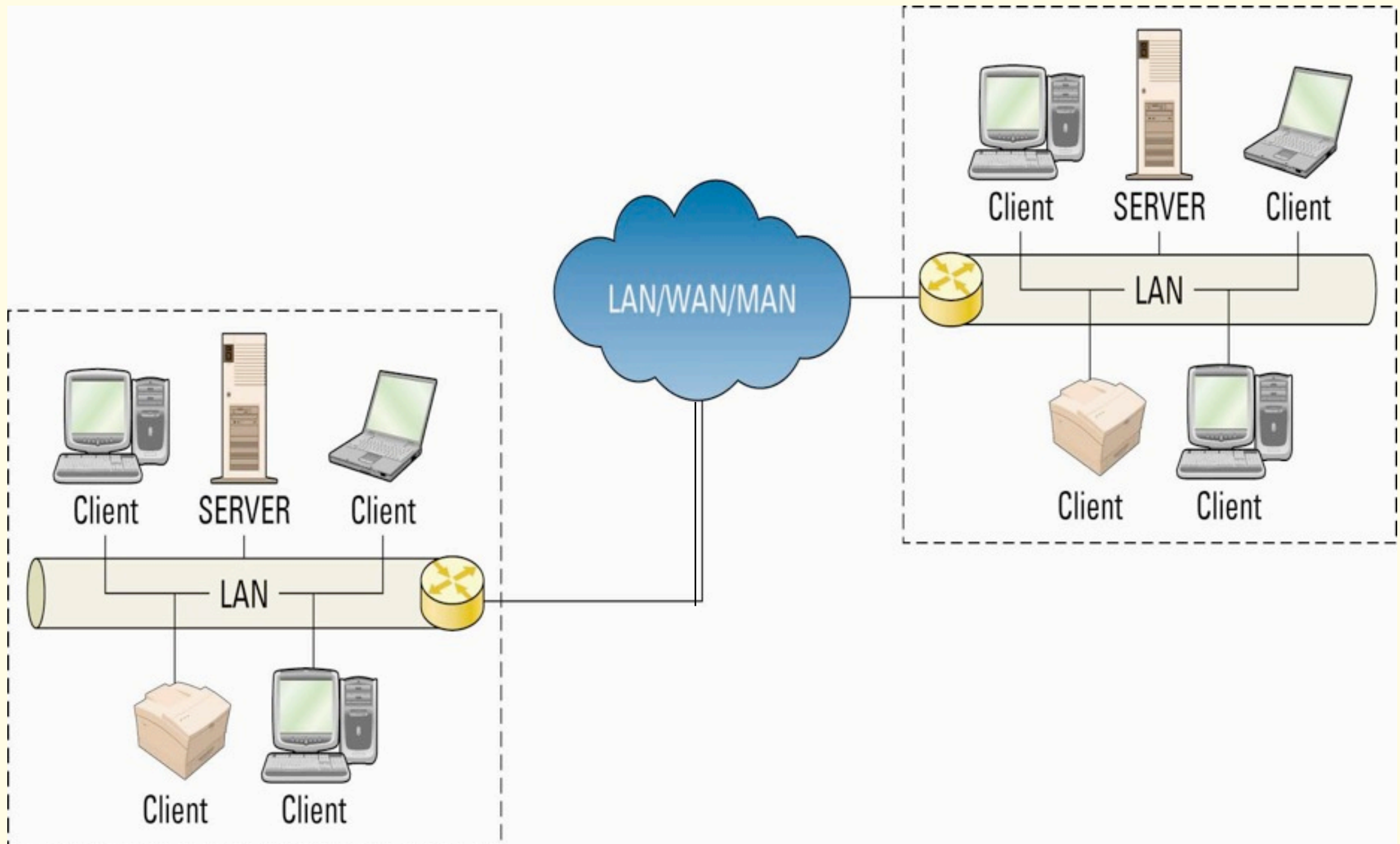
Client/Server Networks

- ***Network operating system (NOS)*** - the operating system that runs a network, steering information between computers and managing security and users
- ***Packet-switching*** - occurs when the sending computer divides a message into a number of efficiently sized units called packets, each of which contains the address of the destination computer

    (http://www.pbs.org/opb/nerds2.0.1/geek_glossary/packet_switching_flash.html)

- ***Router*** - an intelligent connecting device that examines each packet of data it receives and then decides which way to send it onward toward its destination (http://computer.howstuffworks.com/router1.htm)
    - A preemptive attack on viruses before they enter the network is the best way to protect the network
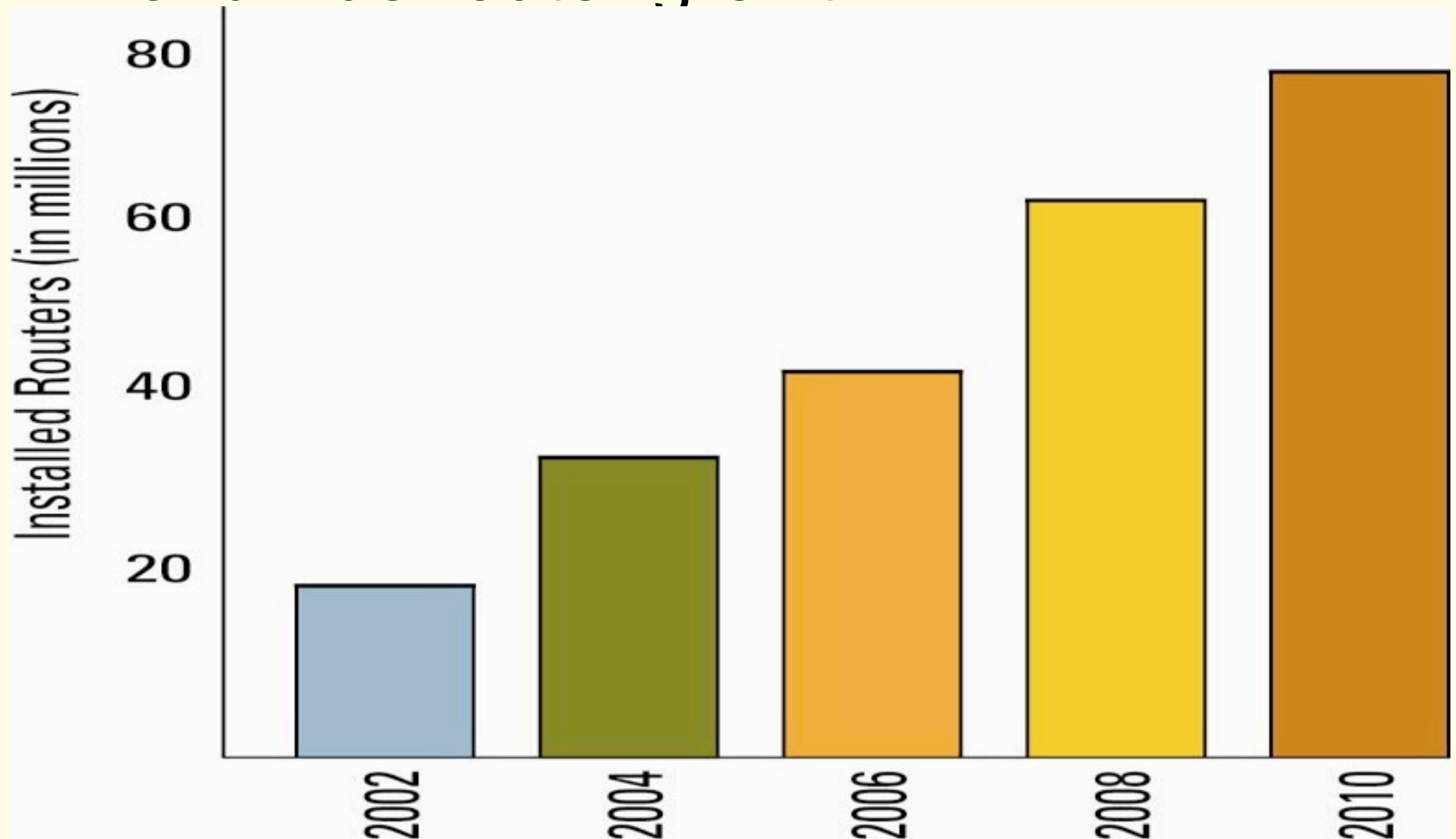
Internet Infrastructure & Routers

- Internet Infrastructure
- Router

Client/Server Networks

# Client/Server Networks

- Worldwide router growth

TOPOLOGY

- *Network topology -* refers to the geometric arrangement of the actual physical organization of the computers and other network devices) in a network
  - **Bus -** All devices are connected to a central cable, called the bus or backbone. Bus networks are relatively inexpensive and easy to install for small networks
  - **Star -** All devices are connected to a central device, called a hub. Star networks are relatively easy to install and manage, but bottlenecks can occur because all data must pass through the hub
  - **Ring -** All devices are connected to one another in the shape of a closed loop, so that each device is connected directly to two other devices, one on either side of it. Ring topologies are relatively expensive and difficult to install, but they offer high bandwidth and can span large distances
  - **Hybrid -** Groups of star-configured workstations are connected to a linear bus backbone cable, combining the characteristics of the bus and star topologies
  - **Wireless -** Devices are connected by a receiver/transmitter to a special network interface card that transmits signals between a computer and a server, all within an acceptable transmission range
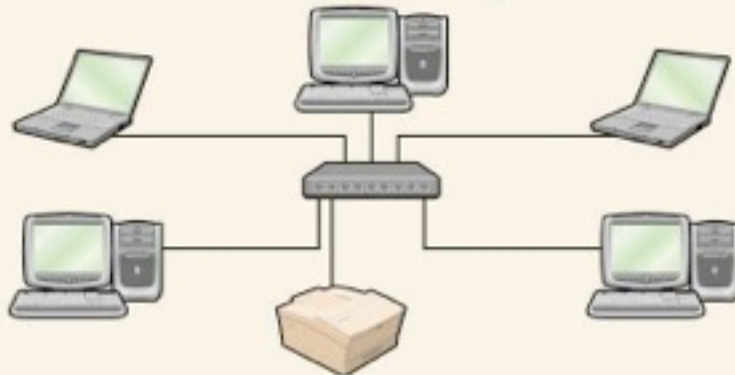
TOPOLOGY
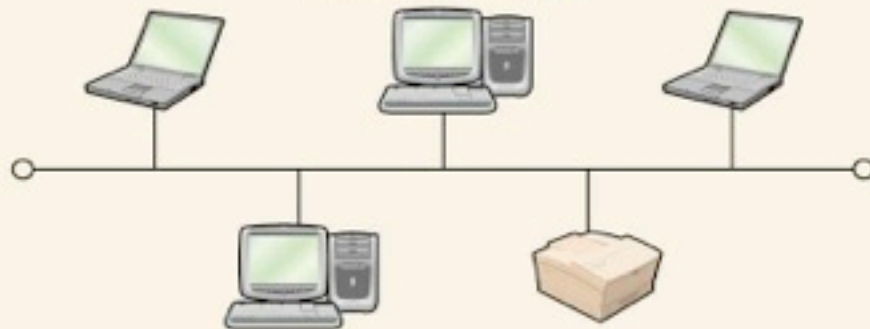
BUS Topology

STAR Topology

RING Topology
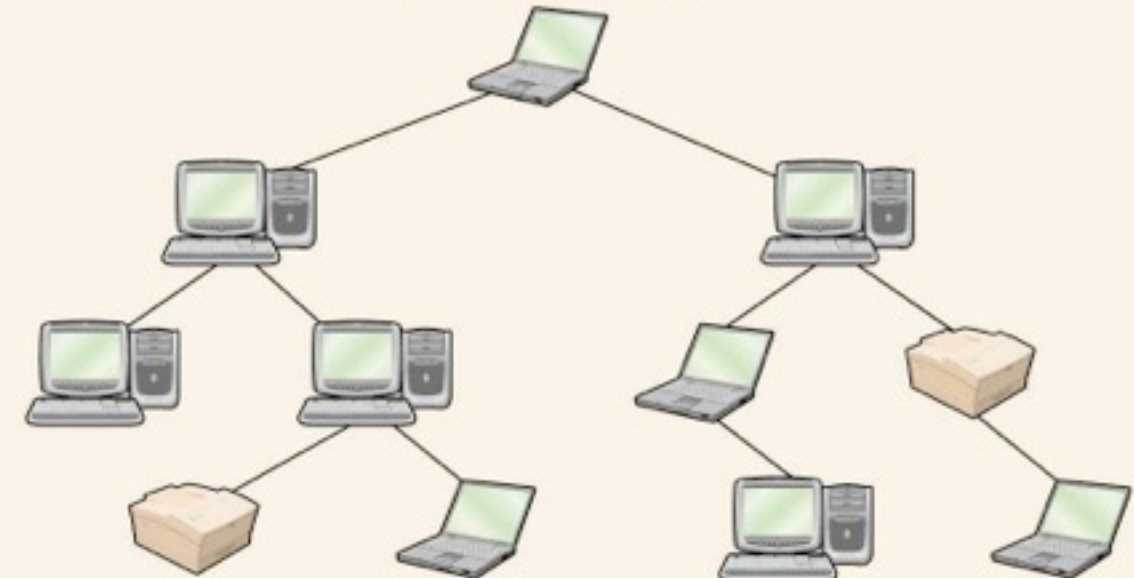
Hybrid Topology

Wireless Topology

WIRELESS LAN/WAN/MAN

ACCESS POINT

ACCESS POINT
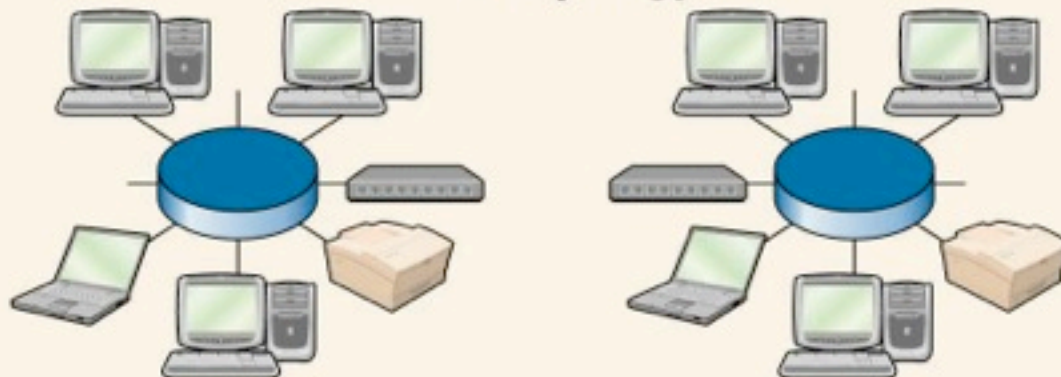
PROTOCOLS

- ***Protocol*** - a standard that specifies the format of data as well as the rules to be followed during transmission
  - The most popular network protocols are
    - Ethernet
    - Transmission Control Protocol/Internet Protocol (TCP/IP)
- ***Interoperability*** - the capability of two or more computer systems to share data and resources, even though they are made by different manufacturers

Ethernet

- ***Ethernet*** - a physical and data layer technology for LAN networking
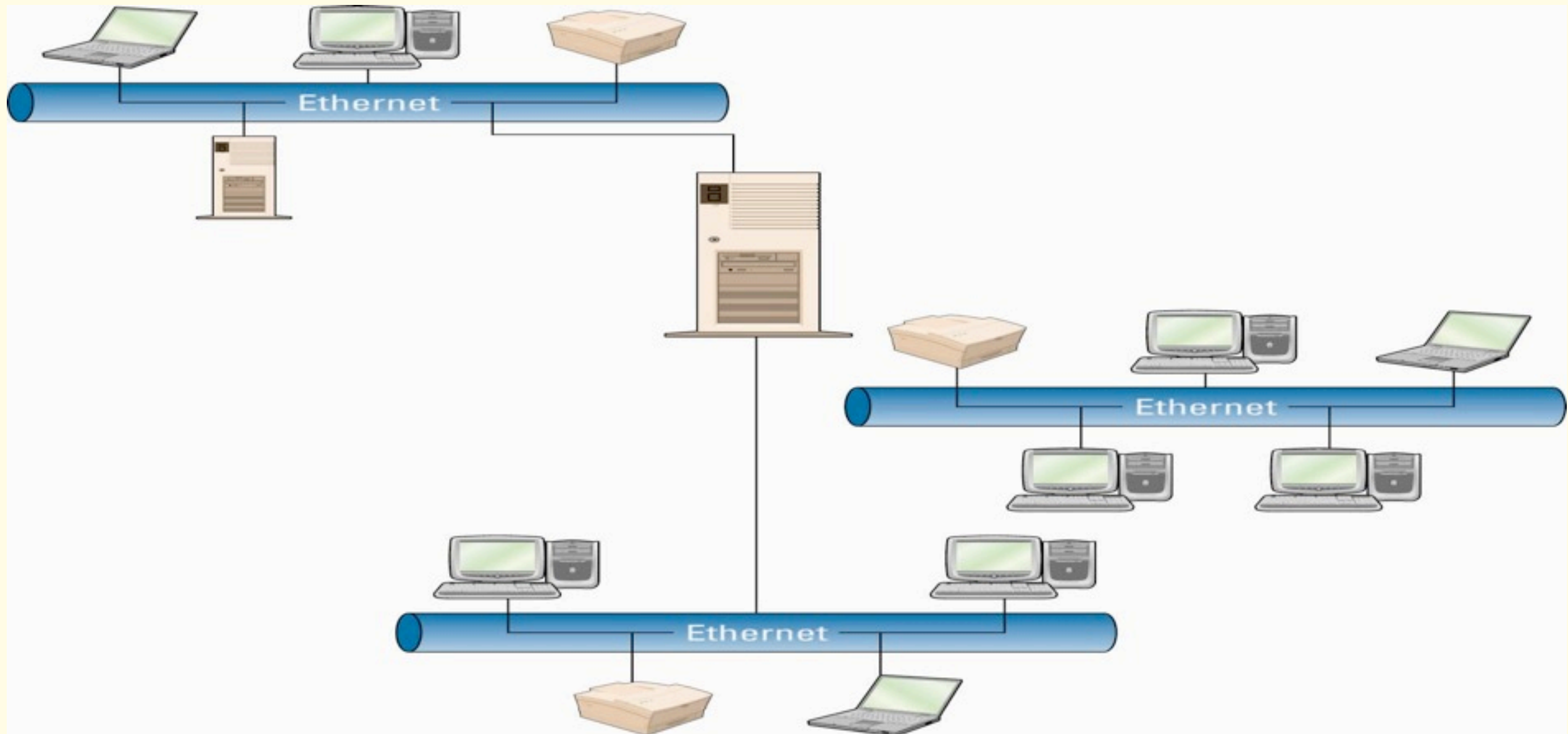
Ethernet Terminology

- **Medium** - Ethernet devices attach to a common medium that provides a path along which the electronic signals will travel. Historically, this medium has been coaxial copper cable, but today it is more commonly a twisted pair or fiber optic cabling.
- **Segment** - A single shared medium as an Ethernet segment.
- **Node** - Devices that attach to that segment are stations or nodes.
- **Frame** - The nodes communicate in short messages called frames, which are variably sized chunks of information.
  - Frames are analogous to sentences in human language. The **Ethernet protocol** specifies a set of rules for constructing frames. There are explicit minimum and maximum lengths for frames, and a set of required pieces of information that must appear in the frame.
  - Each frame must include, for example, both a **destination address** and a **source address**, which identify the recipient and the sender of the message. The address uniquely identifies the node, just as a name identifies a particular person. No two Ethernet devices should ever have the same address.

Ethernet

- Ethernet medium reaches every attached node, the destination address is critical to identify the intended recipient of the frame.

A Small Ethernet Network
©2003 HowStuffWorks
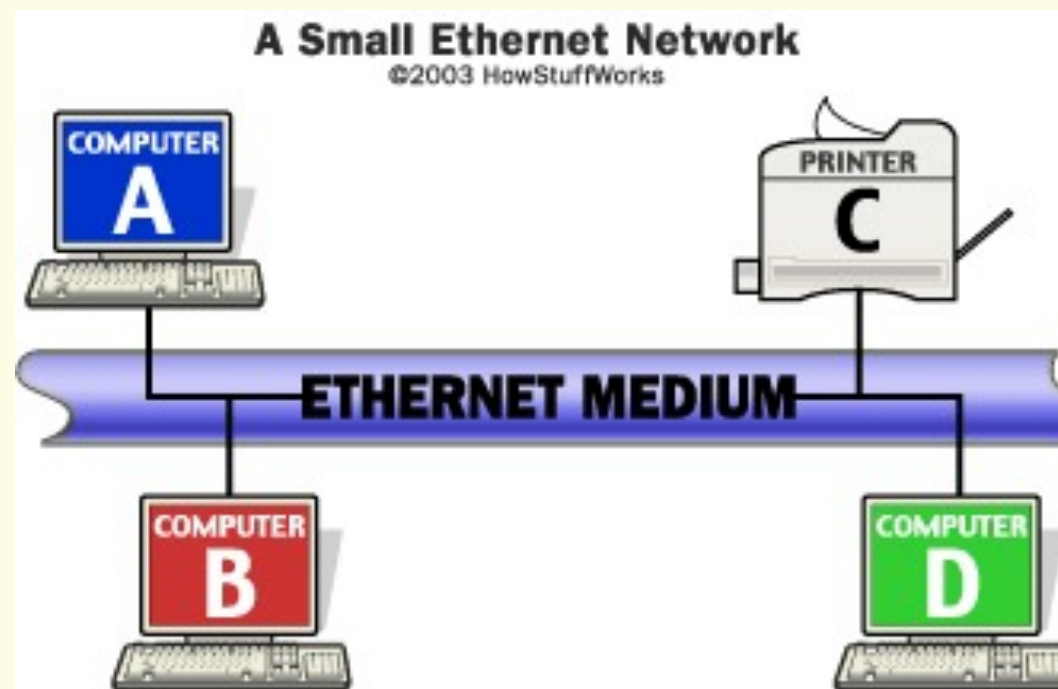
- For example, in the figure above, when computer B transmits to printer C, computers A and D will still receive and examine the frame. However, when a station first receives a frame, it checks the destination address to see if the frame is intended for itself. If it is not, the station discards the frame without even examining its contents.

Ethernet

- ***Ethernet*** is the most widely installed LAN access method, originally developed by Xerox
  - When it was first widely deployed in the 1980s, the maximum speed was 10 megabits per second (10Mbps)
  - More recently, the speed is up to 100Mbps and Gigabit Ethernet technology extends the performance up to 1,000 Mbps = 1Gbps
  - The advantages of Ethernet include:
    - It is easy to understand, implement, manage and maintain
    - Allows for low-cost network implementations
    - Provides extensive flexibility for network installation
    - Guarantees successful interconnection and operation of standards-compliant products, regardless of manufacturer

Transmission Control Protocol/

- ***Transmission Control Protocol/Internet Protocol (TCP/IP) -*** provides the technical foundation for the public Internet as well as for large numbers of private network

TCP/IP Four-Layer Reference Model

Applications	FTP, SMTP, Telnet, HTTP, SNTP
Transport	TCP
Internet	IP
Network Interface	Ethernet, Token Ring, FDDI
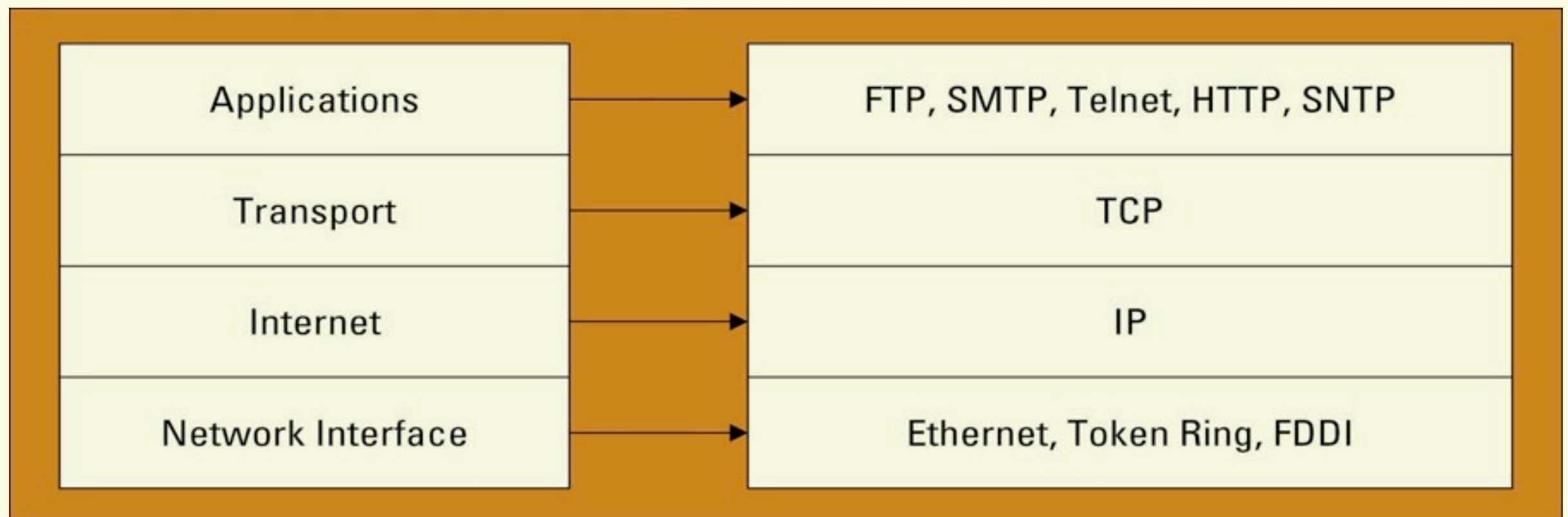
Transmission Control Protocol/

- *Application layer* – serves as the window for users and application processes to access network services

- *Transport layer* – handles end-to-end packet transportation

- *Internet layer* – formats the data into packets, adds a header containing the packet sequence and the address of the receiving device and specifies the services required from the network

- *Network interface layer* – places data packets on the network for transmission

Transmission Control Protocol/

- The most common telecommunications protocol
- Developed by the DOD to connect a system of computer networks that became known as the Internet
- Uses a special transmission method that maximizes data transfer and automatically adjusts to slower devices and other delays encountered on a network
- Although more than 100 protocols make up the entire TCP/IP protocol suite, the two most important are
  - TCP which ensures that the amount of data received is the same as the amount transmitted
  - IP which provides the addressing and routing mechanism that acts as a postmaster

Transmission Control Protocol/

- TCP/IP suite of applications includes five protocols:
  - **File Transfer Protocol (FTP)** Allows files containing text, programs, graphics, numerical data, and so on to be downloaded off or uploaded onto a network.
  - **Simple Mail Transfer Protocol (SMTP)** TCP/IP's own messaging system for e-mail.
  - **Telnet Protocol** Provides terminal emulation that allows a personal computer or workstation to act as a terminal, or access device, for a server.
  - **Hypertext Transfer Protocol (HTTP)** Allows Web browsers and servers to send and receive Web pages.
  - **Simple Network Management Protocol (SNMP)** Allows the management of networked nodes to be managed from a single point

VOICE OVER IP (VoIP)

- ***Voice over IP (VoIP)*** - uses TCP/IP technology to transmit voice calls over long-distance telephone lines
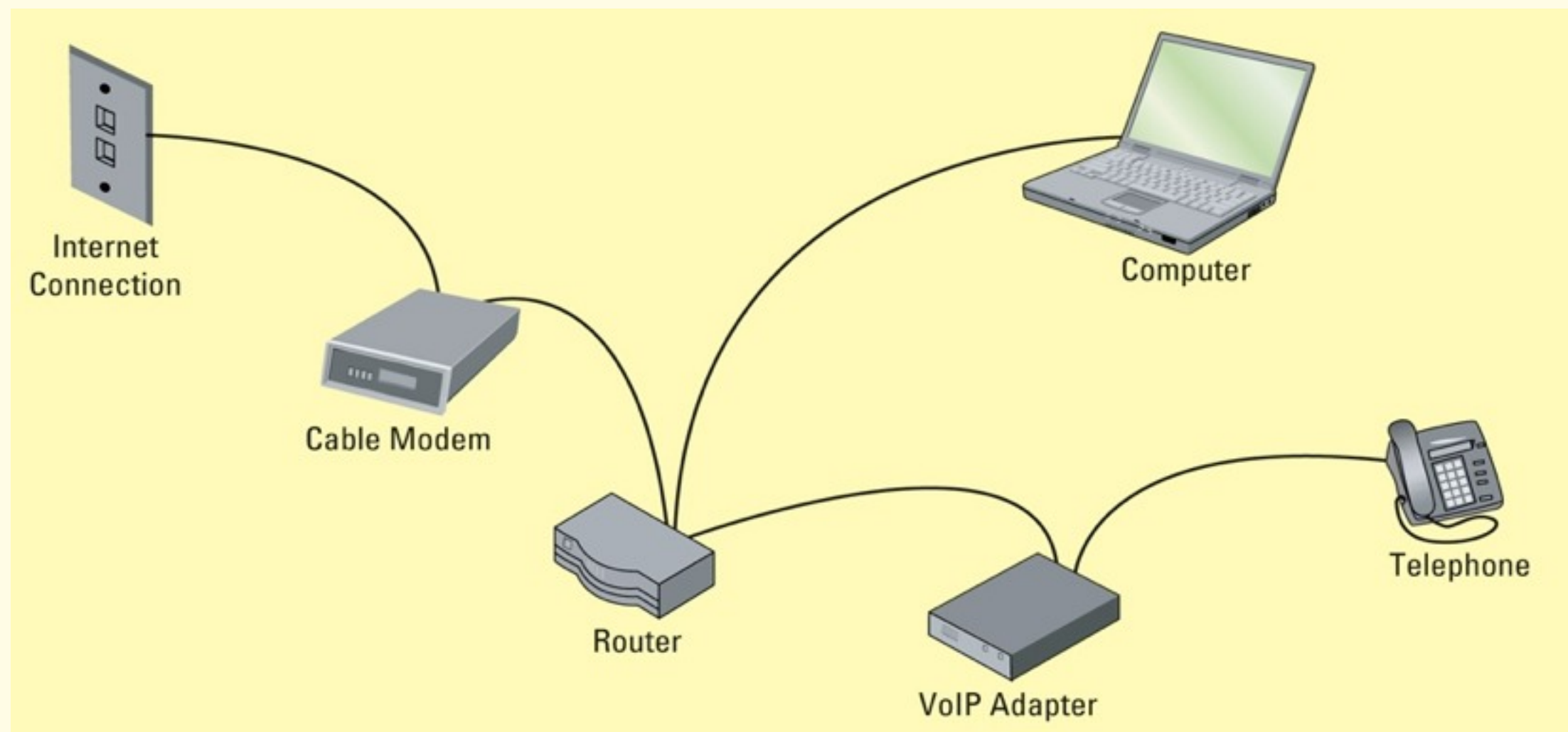
VOICE OVER IP (VoIP)

- The start-up Skype pairs P2P (peer-to-peer) technology with a PC's sound card to create a voice service, which the user can use to call other Skype users

- Vonage lets the user place calls to any person who has a mobile or landline (regular telephone) number

  - Vonage sends the call over a cable via a digital-to-analog converter

- A few providers even offer an adapter for a traditional handset that plugs into a broadband modem

- All of these vendors are providing VoIP, but the service and its features can vary significantly

- Unfortunately, VoIP routes calls through the same paths used by network and Internet traffic, therefore it has the same vulnerabilities and is subject to the same Internet threats.

- Much like data, VoIP traffic can be intercepted, captured or modified. Any threat that slows down or degrades service even slightly will disrupt business. As a result, VoIP traffic must be secured.

VOICE OVER IP (VoIP)

Add-in	Function
Skype Office Toolbar	This add-on makes calls to names or phone numbers in a Word document, Excel spreadsheet, or PowerPoint presentation. After installing the add-in, users can use it to turn phone numbers in the document into links, which can be clicked to make a voice call or send an SMS message. Users can send the file they are working on in the Office application to a Skype contact.
Skylook	This add-on is an extension to Outlook that records calls and voice-mail to MP3 files and accesses them from Outlook. Users can call Outlook contacts over Skype and have emails read over the phone.
HotRecorder for VoIP	This add-on records Skype calls automatically using a third-party program, such as HotRecorder for VoIP (HR4VoIP). It works with Skype 3.0, as well as other VoIP applications such as Net2Phone, Google Talk, and Yahoo Messenger.
Universal Chat Translator	Today's business world is increasingly international in nature. If a user needs to communicate with people who speak another language, install the Universal Chat Translator to translate Skype chat conversations and read them. The add-on translator supports Arabic, Chinese (simplified and traditional), Dutch, French, German, Greek, Japanese, Italian, Korean, Portuguese, Russian, and Spanish. It translates the messages sent to the other language and translates the received messages to English. The translation takes place in real time for active chats or conversations can be stored in a chat history.
uSeeToo	This add-on shares photos, drawings, maps, and other graphical images. Users can add text captions and other content. It includes a drawing board, and it allows users to create, show, and save multiple boards.
PresenterNet	This add-in conducts interactive web meetings, sales presentations, "webinars," and more, using PowerPoint and Skype teleconferencing. It works with Windows, Windows Mobile, Linux, and Macintosh, and with Internet Explorer, Firefox, and Safari browsers.
Unyte	This add-in shares desktop applications with Skype contacts and others, and will share with multiple users.
TalkandWrite Extra for Skype 3.0	This add-on is a document collaboration program that allows two users to remotely work on the same document and annotate it, add text, and more, with the changes made by either party immediately made available to both.
RemoteCall	This add-in connects to remote desktops during a Skype call by clicking an icon added to the Skype Contacts and Tools menus.

MEDIA

- When information is sent across the network, it is converted into electrical signals (either analog electro-magnetic waves or digital voltage pulses)

  – To travel from one location to another, a signal must travel along a physical path; this is the transmission media

- *Network transmission media* - refers to the various types of media used to carry the signal between computers

  – Wire media (guided)
  – Wireless media (unguided)

Wire Media

- *Wire media* - transmission material manufactured so that signals will be confined to a narrow path and will behave predictably

- Three most commonly used types include:

  1. **Twisted-pair wiring** - refers to a type of cable composed of four (or more) copper wires twisted around each other within a plastic sheath

  2. **Coaxial cable** - carries a wide range of frequencies with low signal loss

  3. **Fiber optic** (or optical fiber) - refers to the technology associated with the transmission of information as light impulses along a glass wire or fiber

Wire Media

Twisted-Pair Cabling (10Base-T)

- Protective outside cover
- Inner, single-wire cover
- Copper wire

Coaxial Cable

- Protective outside cover
- Copper/Aluminum mesh
- Insulater
- Copper center conductor
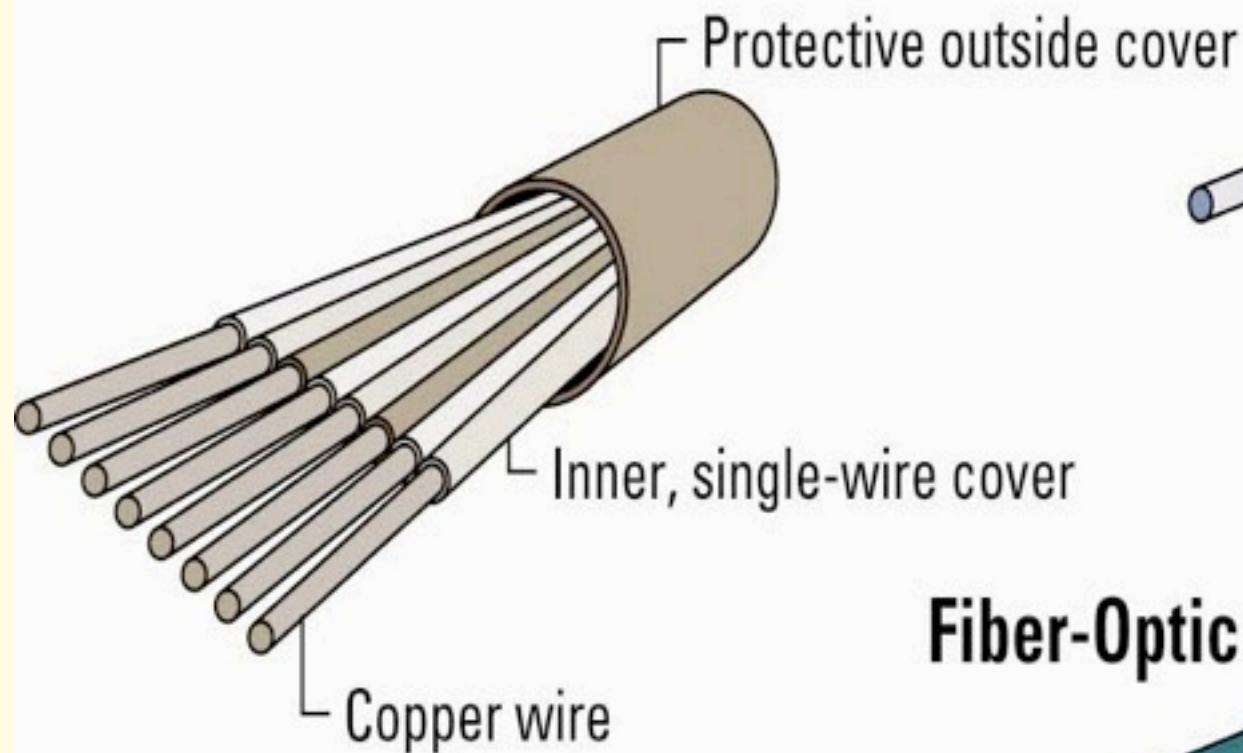
Fiber-Optic Cable
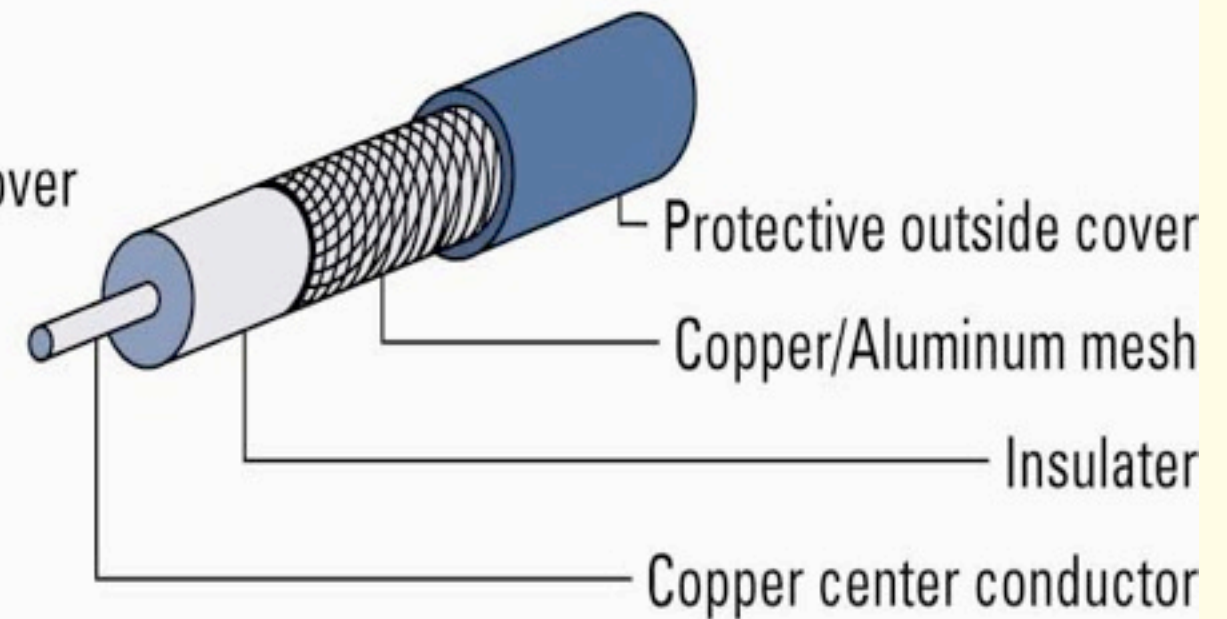
- Jacket
- Cladding
- Glass fiber core
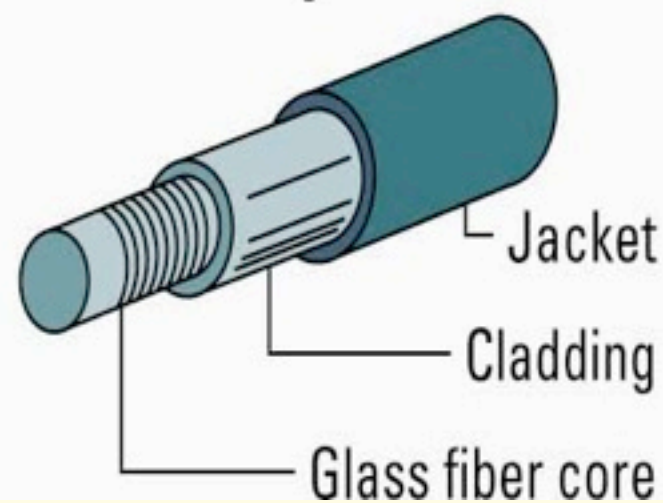
Wireless Media

- *Wireless media* - natural parts of the Earth's environment (atmosphere, outer space) that can be used as physical paths to carry electrical signals such as microwave, infrared light waves and radio waves
  - Cellular telephones
  - Wireless modems
  - Wireless LANs

NETWORKING BUSINESSES

- Industry-leading companies have developed Internet-based products and services to handle many aspects of customer and supplier interactions

- Customers now expect seamless retailing between online and in-store

NETWORKING BUSINESSES

E-Business Network Characteristics

- Provide for the transparent exchange of information with suppliers, trading partners, and customers.

- Reliably and securely exchange information internally and externally via the Internet or other networks.

- Allow end-to-end integration and provide message delivery across multiple systems, in particular, databases, clients, and servers.

- Respond to high demands with scalable processing power and networking capacity.

- Serve as the integrator and transaction framework for both digital businesses and traditional brick-and-mortar businesses that want to leverage the Internet for any type of business.

NETWORKING BUSINESSES

- ***Virtual private network (VPN)*** *-* a way to use the public telecommunication infrastructure (e.g., Internet) to provide secure access to an organization's network

- ***Valued-added network (VAN)*** *-* a private network, provided by a third party, for exchanging information through a high capacity connection

NETWORKING BUSINESSES
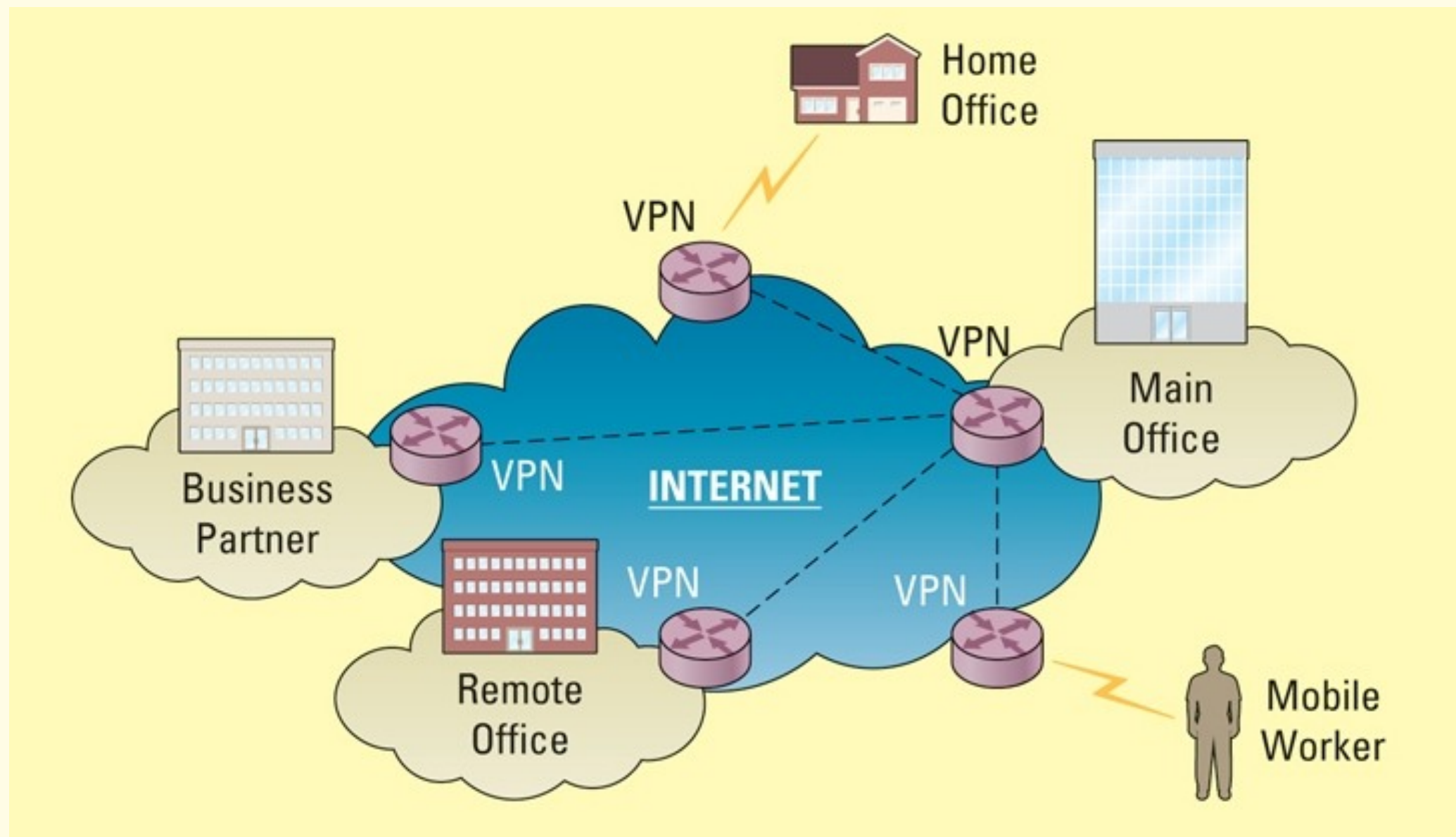
INCREASING THE SPEED OF

- ***Bandwidth*** - is the difference between the highest and the lowest frequencies that can be transmitted on a single medi-um, and it is a measure of the medium's capacity

- ***Broadband*** - refers to high-speed Internet connections transmitting data at speeds greater than 200 kilobytes per second (Kbps)

INCREASING THE SPEED OF

Transmission Medium	Typical Speeds
Twisted pair—voice telephone	14.4 Kbps–56 Kbps
Twisted pair—digital telephone	128 Kbps–1.544 Mbps
Twisted pair—LAN	10 Mbps–100 Mbps
Coaxial cable—LAN	10 Mbps–1 Gbps
Wireless—LAN	6 Mbps–54 Mbps
Microwave—WAN	50 Kbps–100 Mbps
Satellite—WAN	50 Kbps–100 Mbps
Fiber-optic cable—WAN	100 Mbps–100 Gbps

KEY: bps   = bits per second
Kbps = thousand bits per second
Mbps = million bits per second
Gbps = billion bits per second

INCREASING THE SPEED OF

Internet Function	Dial-up (56K)	Satellite (512K)	DSL (1M)	Cable (1M)	Wireless (5M)
An email	1 sec.	<1 sec.			
A basic web page (25K)	10 sec.	<1 sec.			
One five-minute song (5M)	15 min.	2 min.	1 min.		40 sec.
One two-hour movie (500M)	20 hrs.	4 hrs.	2 hrs.		70 min.

INCREASING THE SPEED OF

Technology	Typical Download Speed (Mbps)	Typical Uplink Speed (Mbps)	Advantages	Disadvantages
Digital subscriber line (DSL)	.5–3	1.0	– Good upload rates – Uses existing telephone lines	– Speeds vary depending on distance from telephone company's central office – Slower downloads than less expensive alternatives
Cable	.5–4	.5–1	– Uses existing cable infrastructure – Low-cost equipment	– Shared connections can overload system, slowing upload times
TI/T3 dedicated line	1.5–3	1.5–3	– Uses existing phone wiring	– Performance drops significantly with range – Susceptible to cross talk
Fiber-to-the-home	4.5	10.2	– Fast data speeds – Infrastructure has long life expectancy – Low maintenance – Low power costs	– Not widely available – Significant deployment cost (for company)
Fixed wireless	.5–12	.5	– Typically inexpensive to install, no underground digging	– Weather, topography, buildings, and electronics can cause interference
Satellite	.5–2	.05	– Nearly universal coverage – Available in otherwise inaccessible areas	– Expensive service/equipment – Upload/download delays

SECURING BUSINESS NETWORKS

- There have been many network security problems - networks are a tempting target for mischief and fraud

- An organization has to be concerned about…
  – Proper identification of users and authorization of network access
  – The control of access, and the protection of data integrity

Data Sharing

- Even more important than the sharing of technology resources is the sharing of data

- Either a LAN or a WAN permits users on the network to get data (if they are authorized to do so) from other points on the network

SECTION 1.2

MOBILE TECHNOLOGY

BUSINESS DRIVERS FOR A

- Companies worldwide are going wireless to increase productivity, speed delivery to market, and reduce operating costs

- Untethered connectivity, anytime, anywhere, has fueled a major market and technology disruption, which has permeated almost every consumer market worldwide.
  - The domino effect of the success of wireless technology has resulted in a unique opportunity for innovation and creativity in technology, marketing, and business strategy.

- Wireless transmissions rely on radio waves, microwaves, and satellites to send data across high frequency radio ranges that later connect to wired media

BUSINESS DRIVERS FOR A

- The terms *mobile* and *wireless* are often used synonymously, but actually denote two different technologies
  - *Mobile* means the technology can travel with the user, but it is not necessarily in real-time
  - *Wireless* gives users a live (Internet) connection via satellite or radio transmitters
  - State government agencies, such as transportation departments, use wireless devices to collect field information, tracking inventory, reporting times, monitoring logistics, and completing forms — all from a mobile environment.
  - The transportation industry is using wireless devices to help determine current locations and alternate driving routes.

BUSINESS DRIVERS FOR

Drivers of Wireless Technology Growth	
Universal access to information and applications	People are mobile and have more access to information than ever before, but they still need to get to the point where they can access all information anytime, anywhere, anyplace.
The automation of business processes	Wireless technologies have the ability to centralize critical information and eliminate redundant processes.
User convenience, timeliness, and ability to conduct business 24373365	People delayed in airports no longer have to feel cut off from the world or their office. Through wireless tools and wireless solutions such as a BlackBerry RIM device, they can access their information anytime, anywhere, anyplace.

BUSINESS DRIVERS FOR A

Mobile Devices Changing Business

■ **Wireless local area network (wLAN):** uses radio waves rather than wires to transmit information across a local area network.

■ **Cellular phones and pagers:** provide connectivity for portable and mobile applications, both personal and business.

■ **Cordless computer peripherals:** connect wirelessly to a computer, such as a cordless mouse, keyboard, and printer.

■ **Satellite television:** allows viewers in almost any location to select from hundreds of channels.

■ **WiMAX wireless broadband:** enables wireless networks to extend as far as 30 miles and transfer information, voice, and video at faster speeds than cable. It is perfect for Internet service providers (ISPs) that want to expand into sparsely populated areas, where the cost of bringing in cable wiring or DSL is too high.

■ **Security sensor:** alerts customers to break-ins and errant pop flies. Its dual sensors record vibration and acoustic disturbances—a shattered window—to help avoid false alarms.

BUSINESS DRIVERS FOR A

Step	Description
Defining risks	Before a realistic assessment of any mobile strategy can be put in place, companies must define evaluation criteria. Many companies look at technology and applications in isolation, without defining any potential risks to the organization: risks both if the project is undertaken and if it is not.
Knowing the limits of technology	It is imperative that companies not only examine the abilities of any technology to provide needed functionality, but also to explore any limits of the chosen technology. Setting realistic expectations for any mobile technology, both to IT resources deploying the solution and to the ultimate users, is a necessary component of any successful mobile strategy.
Protecting data from loss	Companies must take concrete and immediate steps to assure protection of mobile corporate information assets. Security must be a multi-faceted approach and encompass a variety of techniques covering all areas of exposure.
Compliance in the mobile enterprise	The move to mobility, with far more devices "free to roam wild," will cause a major upsurge in occurrences of data breaches, some of which may not even be discovered, or not discovered for a significant period. Companies must formulate a mobile security strategy before the problem becomes overwhelming.
Staying flexible and embracing change	Companies should not assume that once created, a mobile strategy is a fixed and/or finished product. With the high rate of change in the marketplace (e.g., devices, connection types, applications), it is incumbent upon the organization to monitor and modify the policy on a regular basis.

USING CELLULAR TECHNOLOGIES

- Cellular telephones (cell phones) work by using radio waves to communicate with radio antennas (or towers) placed within adjacent geographic areas called cells

- A telephone message is transmitted to the local cell by the cellular telephone and then is passed from antenna to antenna, or cell to cell

USING CELLULAR TECHNOLOGIES

- In less than twenty years, the mobile telephone has gone from being rare, expensive equipment of the business elite to a pervasive, low-cost personal item.
- Several countries, including the UK, now have more mobile phones than people.
  - There are over five hundred million active mobile phone accounts in China.
  - Luxembourg has the highest mobile phone penetration rate in the world, at 164%.
  -
  - .

USING CELLULAR TECHNOLOGIES

– The total number of mobile phone subscribers in the world was estimated at 3.3 billion at the end of 2007, thus reaching an equivalent of over half the planet's population.

– At present, Africa has the largest growth rate of cellular subscribers in the world, its markets expanding nearly twice as fast as Asian markets.

– The availability of prepaid or 'pay-as-you-go' services, where the subscriber is not committed to a long-term contract, has helped fuel this growth in Africa as well as in other continents.

USING CELLULAR TECHNOLOGIES

Base Station

Cell
Each cell is typically sized at about 10 square miles

Each cell has a base station that consists of a tower and a small building containing radio equipment
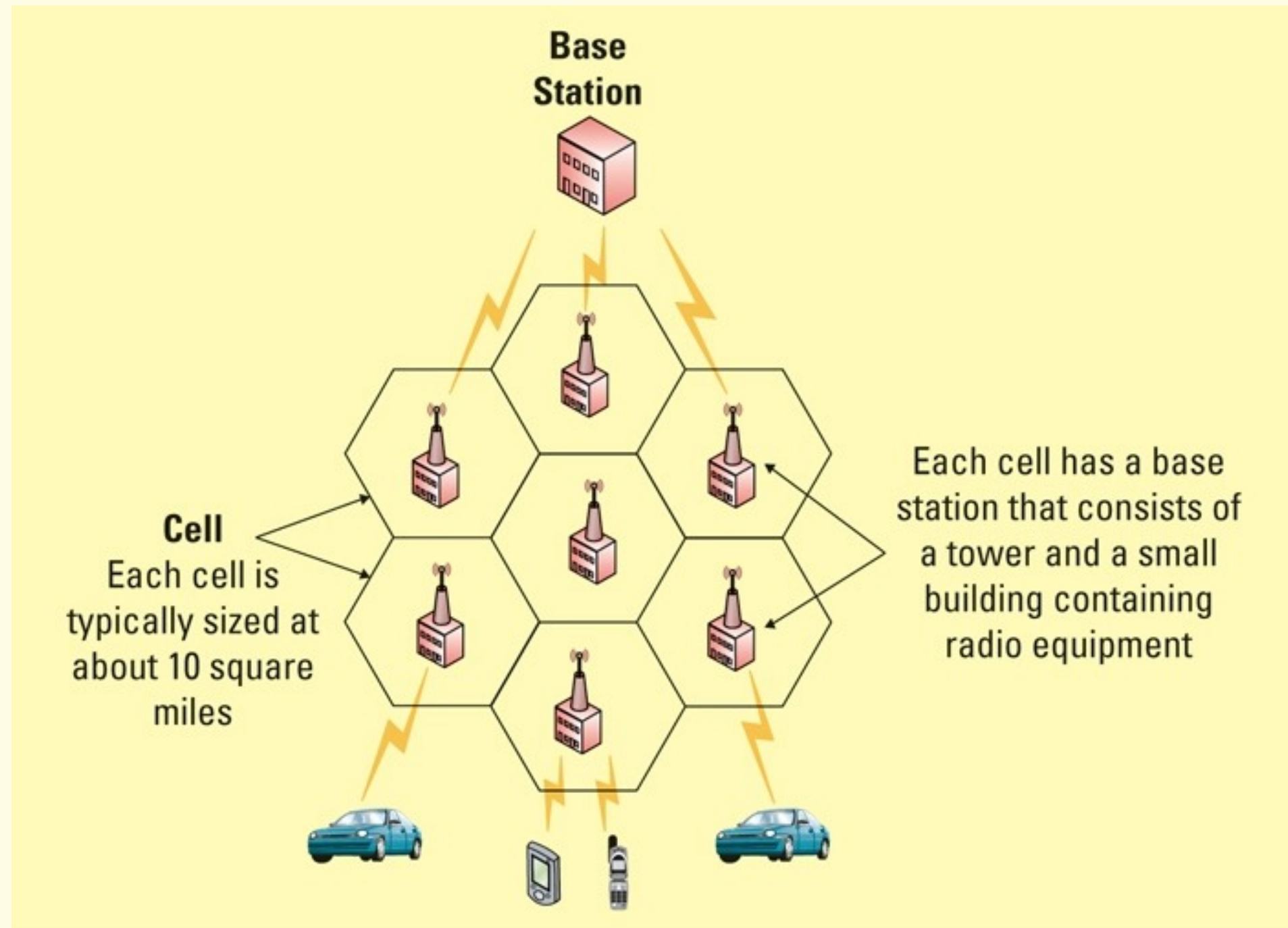
USING CELLULAR TECHNOLOGIES

Generation	Technology	Advantages and Disadvantages
1G	AMPS (Advanced Mobile Phone Service)	– Analog voice service only
2G	CDMA (Code Division Multiple Access) TDMA (Time Division Multiple Access) GSM (Global Systems for Mobile Communications PDC (Personal Digital Cellular)	– Digital voice service – 9.6 Kbps to 14.4 Kbps data service – Enhanced calling features (such as caller ID) – No always-on data connection
3G	W-CDMA (Wideband Code Division Multiple Access)	– Superior voice quality – Always-on data connection up to 2 Mbps – Broadband data services (such as streaming audio and video)
4G	W-CDMA (Wideband Code Division Multiple Access) MC-CDMA (Multi Carrier CDMA)	– Wi-fi access networks – Always-on data connection 20–100 Mbps – Converged data and voice over IP

# USING CELLULAR TECHNOLOGIES

- The latest trends in cell phones reflect a convergence of voice, video and data communications

- By blending information with entertainment, cell phones are center-stage in the evolving trend of mobile infotainment

Personal Data Assistants

- **Personal digital assistants** (PDA) are small, handheld computers capable of entirely digital communications transmission

  – The first generation of successful PDAs were Palm Pilots. They primarily functioned as electronic organizers with support for address books, calendars, email, notes, etc.

  – The PDA only occasionally needs to connect to a companion PC for "synchronization." For instance, a PDA can be synchronized with a PC address book, calendar, and email inbox, via a USB cable. Newer PDA models can also connect to PCs wirelessly via Bluetooth , or connect to the Internet via wireless.

- *Smartphone* - combines the functions of a cellular phone and a PDA in a single device

Bluetooth

- ***Bluetooth*** – a telecommunications industry specification that describes how mobile phones, computers, and personal digital assistants (PDAs) can be easily interconnected using a short-range (30 feet) wireless connection
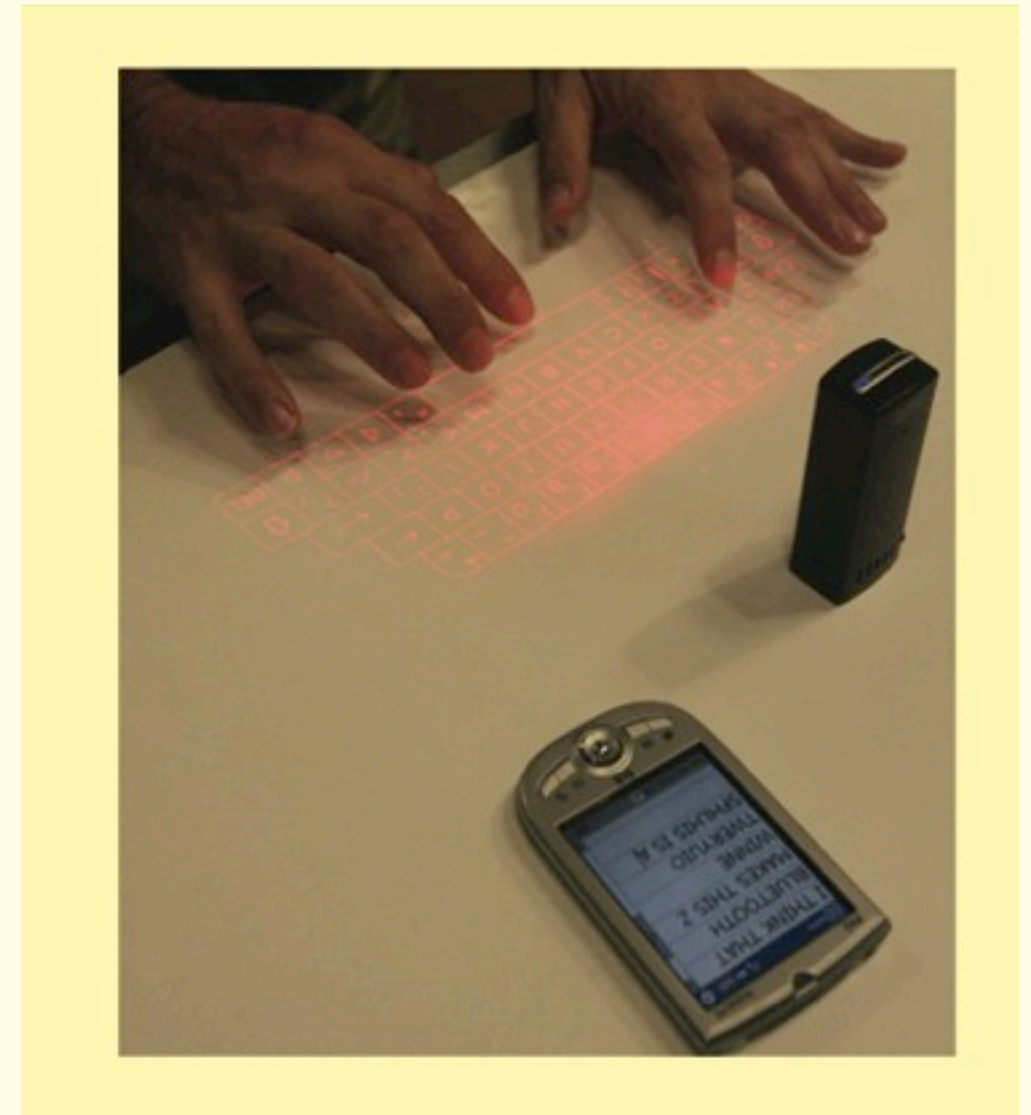
Bluetooth

- Since Bluetooth's development in 1994 by the Swedish telecommunications company Ericsson, more than 1,800 companies worldwide have signed on to build products to the wireless specifications

- Bluetooth is named to honor a 10th century Viking Kind, Harold Bluetooth, who is credited with uniting Denmark and bringing order to the country
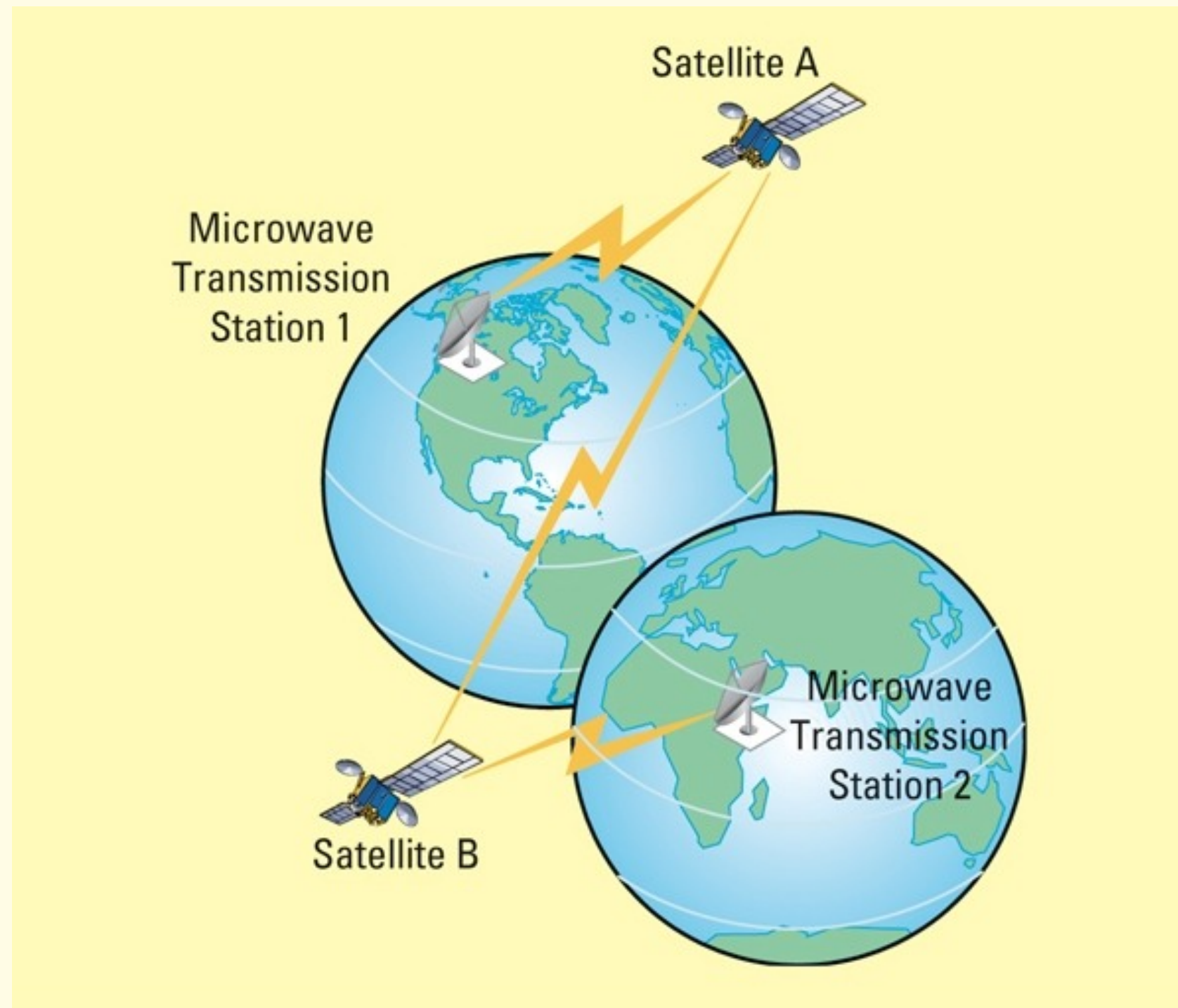
USING SATELLITE TECHNOLOGIES

- ***Microware transmitter*** – uses the atmosphere or outer space as the transmission medium to send a signal to a microwave receiver which passes it on to another transmitter or translates the signal to some other form such as digital impulses.

    - Long distance terrestrial transmissions require that microwave stations be positioned about 37 miles apart making it an expensive medium

    - Bouncing microwave signals off satellites enables them to serve as relay stations making it more cost effective

USING SATELLITE TECHNOLOGIES

- *Satellite* - a big microwave repeater in the sky; it contains one or more transponders that listen to a particular portion of the electromagnetic spectrum, amplifying incoming signals, and retransmitting them back to Earth
  - Conventional communication satellites move in stationary orbits approximately 22,000 miles above the Earth

USING SATELLITE TECHNOLOGIES

USING SATELLITE TECHNOLOGIES

- ***Location-based services (LBS) -*** are wireless mobile content services which provide location-specific information to mobile users moving from location to location

  – MasterCard now provides cardholders with a mobile, location-based search and directory service, so they can request the location of the nearest ATM be sent to their mobile phone via SMS (Short Message Service, aka "text message").

  The service, which works with all major mobile operators in the United States, is provided by MasterCard to cardholders free of charge (although operator text message rates may apply).

USING SATELLITE TECHNOLOGIES

Mass Market	
Emergency Services	■ Locate emergency call ■ Roadside assistance
Navigation Services	■ Navigation to point of interest (directions, maps) ■ Etourism ■ Avoidance of traffic jams
Tracking Services	■ Find-a-friend ■ Tracking of children ■ Elderly
Location Advertising	■ Located video push
Gaming	■ N-Gage (allows multiple gamers to play against each other over Bluetooth or wireless phone network connections)
Professional Market	
Workforce Organization	■ Field force management ■ Optimization of routes ■ Logistics ■ Enterprise resource planning
Security	■ Field tracking ■ Worker protection

Global Positioning System (GPS)

- ***Global Positioning System (GPS) -***the most popular location based service used today, is a "constellation" of 24 well-spaced satellites that orbit the Earth and make it possible for people with ground receivers to pinpoint their geographic location

- The GPS is owned and operated by the U.S. Department of Defense but is available for general use around the world.
  - In 1993, the Defense Department made this global positioning technology available for commercial use to anyone who has a GPS device. GPS devices have special microprocessors that analyze satellite signals.
  - The location accuracy is anywhere from 100 to 10 meters for most equipment

Global Positioning System (GPS)

GPS Enabled Device

GPS Enabled Base Station
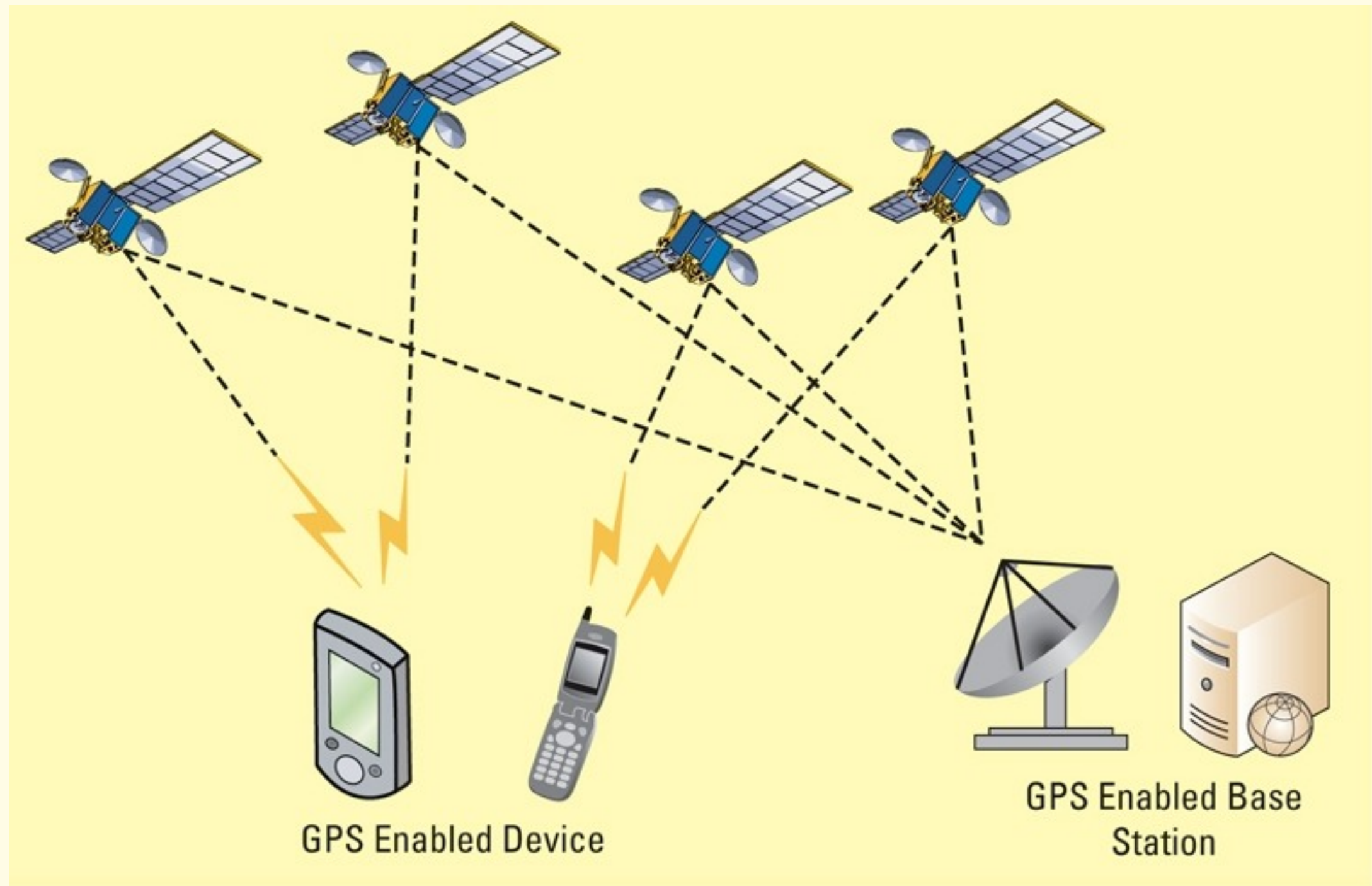
Global Positioning System (GPS)

- Automobiles have GPSs linked to maps that display in a screen on the dashboard driving directions and exact location of the vehicle.

- GM offers the OnStar system, which sends a continuous stream of information to the OnStar center about the car's exact location.

- The OnStar Vehicle Diagnostics automatically performs hundreds of diagnostic checks on four key operating systems — the engine/transmission, antilock brakes, air bags, and OnStar systems — in GM vehicles.

  – The vehicle is programmed to send the results via email to the owner each month. The unique email report also provides maintenance reminders based on the current odometer reading, remaining engine oil life, and other relevant ownership information.

Global Positioning System (GPS)

- Potential privacy issues
  - Target marketing: user's location can be used to classify customers for focused marketing efforts
  - Harassment: location information can be used to harass or target a user
  - Service denial: a health insurance firm might deny a claim if it learned that a user visited a high-risk area
  - Legal restrictions: some countries regulate the use of personal data

Global Positioning System (GPS)

- ***Geographic information system (GIS)*** - is designed to work with information that can be shown on a map

- Some cell phone providers equip their phones with GPS chips that enable users to be located to within a geographical location about the size of a tennis court

Global Positioning System (GPS)

- A GIS is useful for mobile applications, but it offers benefits that go well beyond what is required in a mobile environment.
  - For example, using a GIS, users can decide what information is and is not relevant to them, and formulate their queries based on their personal criteria.
  - Unlike a paper map, a GIS allows for in-depth analysis and problem solving that can make marketing, sales, and planning much more successful.

Global Positioning System (GPS)

- Common GIS uses:
  - Finding what is nearby
  - Routing information
  - Information alerts
  - Mapping densities – high crime areas for police
  - Mapping quantities: number of similar businesses in an area

USING WIRELESS TECHNOLOGIES

- *Wireless fidelity (wi-fi)* – a means of linking computers using infrared or radio signals

- Common examples of wireless devices include:
  - Cellular phones and pagers
  - Global positioning systems (GPS)
  - Cordless computer peripherals
  - Home-entertainment-system control boxes
  - Two-way radios
  - Satellite television

USING SATELLITE TECHNOLOGIES
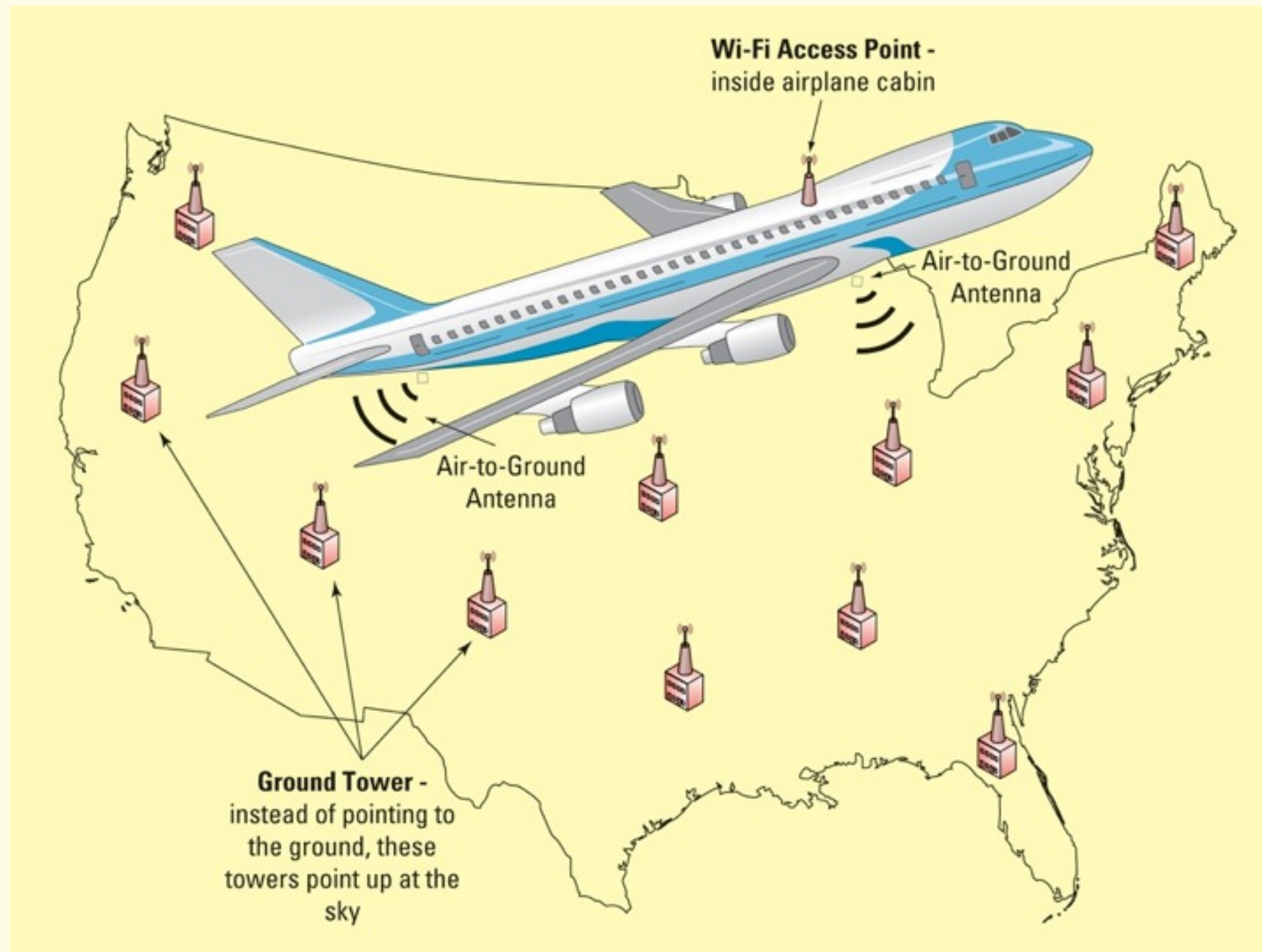
WiMAX

- The main problem with Wi-Fi access is that hot spots are very small, so coverage is sparse

- ***WiMAX -*** is a telecommunications technology aimed at providing wireless data over long distances in a variety of ways, from point-to-point links to full mobile cellular type access
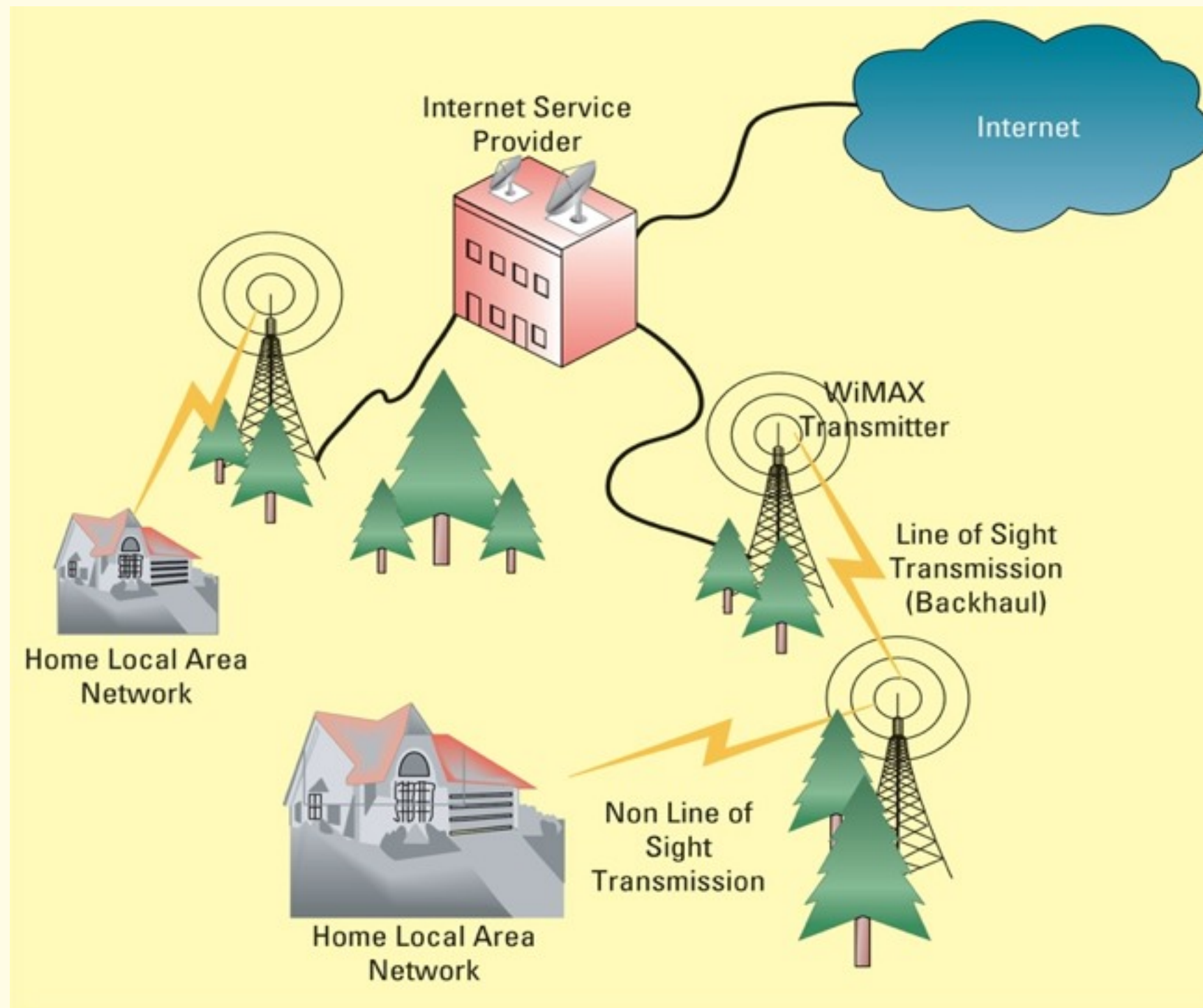
WiMAX

- A WiMAX system consists of two parts:
  - **A WiMAX tower** - A single WiMAX tower can provide coverage to a very large area - as big as 3,000 square miles

  - **A WiMAX receiver** - The receiver and antenna could be built into a laptop the way Wi-Fi access is today

WiMAX

- A WiMAX tower station can connect directly to the Internet using a high-bandwidth, wired connection (for example, a T3 line).

- It can also connect to another WiMAX tower using a line-of-sight, microwave link.
  - This connection to a second tower (often referred to as a backhaul), along with the ability of a single tower to cover up to 3,000 square miles, is what allows WiMAX to provide coverage to remote rural areas.

WiMAX

WiMAX

Benefit	Description
Long Range	The most significant benefit of WiMAX compared to existing wireless technologies is the range. WiMAX has a communication range of up to 30 miles, enough to blanket an entire city.
Low Cost	Base stations will cost less than $20,000 but will still provide customers with T1-class connections.
Wireless	By using a WiMAX system, companies/ residents no longer have to rip up buildings or streets or lay down expensive cables.
High Bandwidth	WiMAX can provide shared data rates of up to 70 Mbps. This is enough bandwidth to support more than 60 businesses at once with T1-type connectivity. It can also support over a thousand homes at 1 Mbps DSL-level connectivity.
Service	WiMAX can provide users with two forms of wireless service: 1. Non line of sight operates at 2 to 11 GHz, which at a lower level frequency has the ability to bend around obstacles more easily. A small antenna on a computer connects to the tower and is backward compatible with existing wi-fi technologies. 2. Line of sight can go as high as 66 GHz since the signal is stronger and more stable, which leads to greater bandwidth. A fixed dish antenna points straight at the tower or for communication between tower to tower.

Radio Frequency Identification

- ***Radio frequency identification (RFID)*** - use active or passive tags in the form of chips or smart labels that can store unique identifiers and relay this information to electronic readers

- ***RFID tag*** - contains a microchip and an antenna, and typically work by transmitting a serial number via radio waves to an electronic reader, which confirms the identity of a person or object bearing the tag

Radio Frequency Identification

- RFID tags will be added to every product and shipping box

- At every step of an item's journey, a reader scans one of the tags and updates the information on the server

- Manufacturers and retailers can observe sales patterns in real-time and make swift decisions about production, ordering, and pricing

Radio Frequency Identification
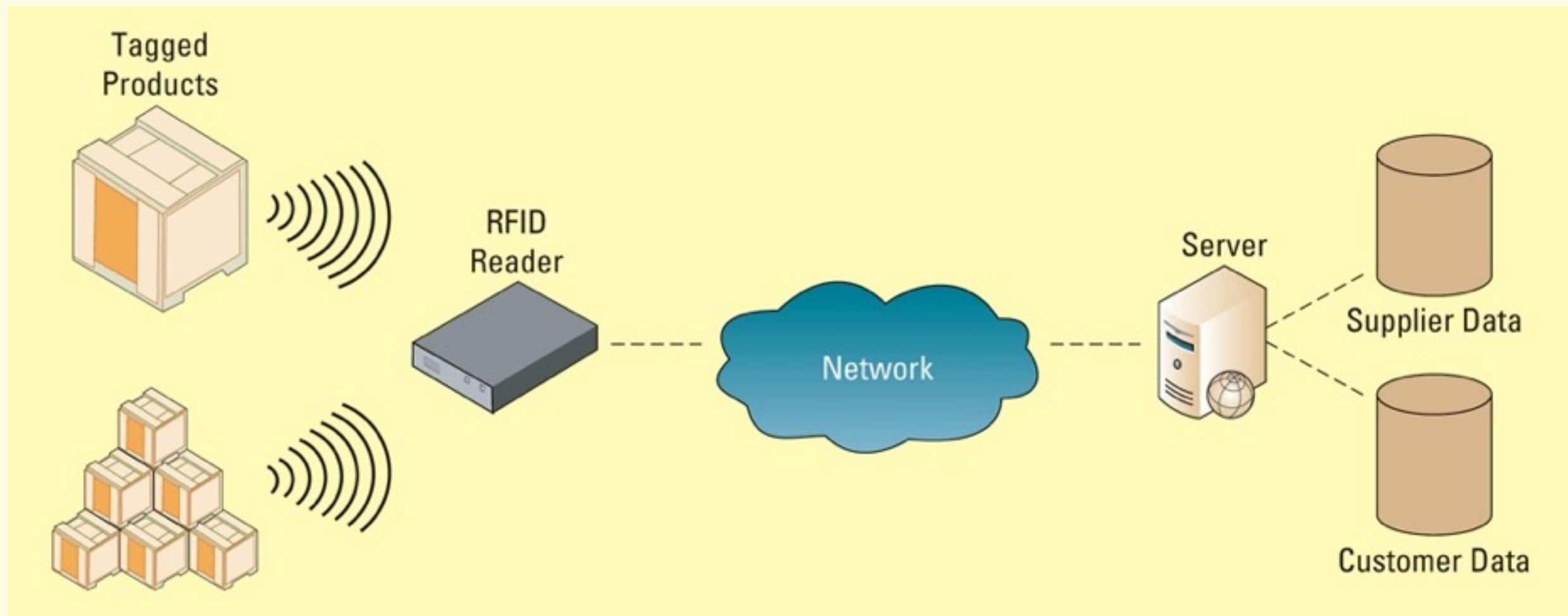
Radio Frequency Identification

RFID Use	Description
Preventing toilets from overflowing	You can purchase a "smart" toilet, one that shuts itself off when it is close to overflowing. According to AquaOne, its RFID-enhanced toilets are not only convenient, but they also prevent health risks in public places such as hospitals and nursing homes.
Identifying human remains	Hurricane Katrina left behind many unclaimed casualties, despite the tireless searches by countless people. Thanks to the VeriChip, RFID tags are now being used to locate bodies in an effort to reunite loved ones. This helps to identify cadavers during transport, and coroners are now able to collect body parts for burial in their rightful places.
Getting into nightclubs	Barcelona's Baja Beach Club is now grafting RFID tags into the arms of patrons who want instant access to the exclusive hangout. The tag also functions as a debit card.
Cooking with robots	Robotic pots and pans with RFID chips in the handles make it almost impossible to botch a meal. With these RFID chips, the cookware can be coordinated with a recipe card that has a similar chip. Then, the cookware will set its temperature and duration to the exact specifications the food calls for.
Timing athletic events	RFID transponders are being used as timing systems in major sporting events all over the world, including the Boston Marathon and Ironman championships (as described in the opening case). With a chip attached to an athlete's shoe, bicycle, etc., timing can begin and end with the utmost accuracy; the timer stops when the person crosses the finishing mat, which contains an antenna that will be signaled by the RFID chip. The technology is especially handy in very close finishes between competitors.
Tracking wheels of cheese	To track cheese through each process and handler until it is sold, RFID tags are being placed just under the edges of the food products. The industry is having problems with theft, loss, and even counterfeit cheese. While the idea of black market cheese may sound ridiculous, consider this—just one wheel of Parmesan cheese can be worth several hundred dollars.
Monitoring casinos	Casinos are already heavily monitored, but the unique betting habits of each player can now be logged, thanks to RFID tags inside betting chips. The chips keep track of high rollers and their spending patterns, and they make it even harder for thieves to counterfeit chips or steal them from other players. All of this technology is used to stack more odds in the house's favor.
Tracking razor blades	Thanks to low-cost RFID tags, Gillette can now afford to place small transponders in each package of its popular razor products. This is done in an attempt to salvage more razors as they make their way through a very convoluted supply chain. Many of the small products are lost or stolen. While it might sound trivial for the company to worry about losing a razor here and there, the problem is really far worse than that. Gillette's Mach 3 razor, retailing at more than $10 each, is one of the most commonly stolen items in a store.
Issuing passports	The U.S. State Department has approved of passports with microchips inside, and the technology is already being tested in trials. While the government maintains that its purpose is to improve communication between law enforcement agencies, others feel there will be more sinister repercussions.

MOBILE WORKFORCE TRENDS

- **Social Networking Gets Mobilized.**
  - Mobility is added to existing Internet business models, services and behaviors, driving traffic for wireless operators.
  - Teens and twenties accustomed to constant connectivity and habit-forming websites, such as MySpace and Facebook, lead a wave of membership in mobile social networks.
  - Location social networking including friend and event finder services are gaining popularity, even in the professional and over-50 segments.
  - Google, Yahoo!, and Skype are more compelling for users than wireless brands, which are hard-pressed to compete.
  - Social networking applications initially are preloaded on many mobile devices sold and later become downloadable.

MOBILE WORKFORCE TRENDS

- **Mobile TV — Now Showing for Early Adopters.**
  - In the short term, wireless users are unlikely to plunk down $5.99-9.99 per month for mobile TV service.
  - Instead, look for per-view or per-minute pricing for "sneaking," a consumer tendency to watch key minutes of a sports event or drama while engaged in another activity.
  - Sneaking leads to more regular viewing, and within 3-5 years, mobile TV will become an indispensable service.
  - Broadcast TV is the primary driver of revenues and consumer adoption, but peer-to-peer video is gaining interest, too. Operators are squaring off with content providers over control of the subscriber relationship and user experience.

MOBILE WORKFORCE TRENDS

- **Multi-Function Devices Become Cheaper and More Versatile.**
  - Intense competition and margin pressure will continue in the handset market, forcing prices of third-generation (3G) handsets below $90 and making them affordable for a wide range of users.
  - Seeking to replicate the success of camera phones, device manufacturers will produce more multi-function units with music-playing, location, video and other capabilities.
  - Twenty percent of all handsets sold in North America are application specific — built for a usage proposition, such as music or video consumption or business productivity.

MOBILE WORKFORCE TRENDS

- **Location-Based Services: And the Winner Is ... GPS!**
  - Yes, GPS is the location technology of choice for the wireless industry.
  - Handset manufacturers will continue to push GPS-enabled handsets as the technology evolves from popular in-car satellite navigation systems like TomTom to a broadly accepted feature in wireless phones.
  - With Nokia having launched its first GPS-enabled handsets in early 2007 and bandwidth available to support new multimedia services, location-based service providers are building critical mass.
  - Since there are 10 to 20 times more mobile phones sold than any other consumer electronics device, wireless is a huge driver for GPS adoption.

MOBILE WORKFORCE TRENDS

- **Mobile Advertising Breaks Loose.**
  - Major brands are shifting from basic SMS marketing to more sophisticated multimedia advertising.
  - RBC Capital Markets expects mobile marketing revenues to balloon from $45 million in 2005 to $1.5 billion by 2010.
  - With the technological ability to target and measure the effectiveness of mobile advertising, brands are more strategic in their approach.
  - Rich 3G content and video services and accuracy advancements in GPS-based location services deliver further value to brands targeting existing and potential customers in innovative ways.

MOBILE WORKFORCE TRENDS

- **Wireless Providers Move into Home Entertainment.**
  - Mobile makes headway against fixed broadband operators, who have dominated Internet and cheaper voice service provision in the home.
  - Wi-Fi will remains the primary wireless access technology.
  - The fixed operators may be strengthened by Wi-Fi capabilities in consumer electronics devices (set-top boxes, game consoles and MP3 players) that enable cost-effective content downloads.

MOBILE WORKFORCE TRENDS

- **Wireless Security Moves to the Forefront.**
  - There is a monumental need to put strong security measures in place.
  - This could be the year that hackers really start paying attention to millions of wireless devices, the growth in mobile data usage and vulnerable points between mobile and fixed networks.
  - CIOs consistently cite security as their number one concern in extending network access to wireless devices.
    - Attacks, viruses and data security now exceed device loss or theft as concerns.
  - Emerging services, such as VoIP and mobile payments, provide additional challenges.
  - Vulnerabilities directly affect the bottom line, corporate image, regulatory compliance and competitive advantage.

MOBILE WORKFORCE TRENDS

- **Enterprise Mobility — It's for Real Now.**
  - Enterprises can't resist the convenient, reliable, attractively priced, bundled mobile solutions entering the market.
  - Corporations switch from phones to mobile computers for transactions, data collection and messaging for a wide variety of employees.
  - Many voice communications processes, such as order placement and delivery notifications, dispatch operations and remote asset monitoring, continue to shift to wireless data to increase information access and field transaction volume across organizations.
  - Many corporations will completely replace their cellular handsets with a combined voice/data device or a data-only device.

OPENING CASE QUESTIONS

- How is WTC using telecommunication and network technologies to improve its competitive advantage in the professional sports broadcasting industry?
  - WTC deployed a WiMAX wireless network across the course.
  - The company used radio frequency identification (RFID) technology to track each athlete's progress, and used the WiMAX network's high bandwidth and geographic reach to transmit high-quality video and stream it over the Internet in near real time.
  - Home viewers and event spectators could view the video and monitor the athletes' progress by logging on to Ironmanlive.com.
  - Wi-Fi hotspots and an Internet cafe provided convenience access.
  - Staff used wireless technologies to plan and manage the event, enhancing their productivity and the athletes' well-being.

OPENING CASE QUESTIONS

- What security issues does WTC need to address?
  - WTC has to be concerned about proper identification of users and authorization of network access, the control of access, and the protection of data integrity.
  - WTC must identify users before they are granted access to its network and that access should be appropriate for the given user.
  - Since the majority of access to WTC systems is through wireless communications, WTC should use a VPN, VAN, and firewall to protect itself against unauthorized or malicious access.

CLOSING CASE ONE

- **What business value does the city receive from deploying a wireless network for its police department?**
  - By implementing wireless network, the City of Logan is able to realize the benefits of new wireless technology without compromising their network security.
  - By providing its officers with better access to information: real-time field reporting, database queries, and bi-directional communication, officers can spend more time protecting the public.
  - In addition to time savings, there was a significant improvement in the flow of information. With real-time communication across any available wireless network connection, reports can be filed immediately after an incident, instead of hours later when an officer returns from patrol.
  - Police officers are more productive and accurate in their work, which in turn creates a safer community.

CLOSING CASE ONE

- **Identify and describe the principal telecommunication and network technologies the police department is using.**
  - The department implemented a number of 802.11 WLAN/Hotspots throughout the city. They also use a mobile VPN that provides its users with stable always-on, secure connectivity to network applications and resources over any IP-based network.

CLOSING CASE ONE

- **What security risks must the police department be aware of in using wireless technology and what precautions should they be taking to ensure electronic protection?**
  - The main risks the police department should be aware of is someone intercepting their data transmissions. A few precautions the police department can take include:
  - Encryption of data sent via wireless devices
  - Authorization and authentication to use data services
  - Enable, use, and routinely test the inherent security features, such as authentication and encryption methods that are available in wireless technologies.
  - Firewalls and other appropriate protection mechanisms should also be employed.

CLOSING CASE ONE

- **How could the police department use RFID, WiMAX and some of the other technologies discussed in this chapter to create efficiencies?**
  - RFID could be used to tag all police department equipment.
  - RFID could be used to tag people who are incarcerated.
  - RFID could be used for tracking evidence - at the crime scene, during a criminal investigation and presentation in court, and while in storage.
  - A WiMAX network could function as a backhaul connecting all of the fiber-ready towers to one another.
  - WiMAX, which can produce a wireless cloud connectivity to the entire city using just a few base stations.
  - Deploy WiMAX network citywide and run all communications applications over it.
  - Using LBS applications with an integrated web and mobile based solution, will enable its police officers to quickly and easily access emergency data and graphics from wireless computers in their vehicles, and via handheld devices.

CLOSING CASE TWO

- **Describe the differences between UPS and FedEx's use of wi-fi**
  - FedEx deploys new technologies as soon as it can justify the cost and demonstrate improved efficiencies and customer benefit.
  - UPS refreshes its technology base roughly every five to seven years, when it rolls out a unified system in stages that it synchronizes with the life span of the older system.
  - The two companies are exploiting new wireless technologies in their differing attempts at aiding the two main components of their operations: pickup/deliver and packaging/sorting.

CLOSING CASE TWO

- **Identify two types of wireless business opportunities the companies could use to gain a competitive advantage**
  - The companies can use Bluetooth, RFID, satellite, and GPS to gain competitive advantages.
  - GPS can help with ensuring drivers are using the most direct route, or avoiding traffic, to reach customers.
  - Satellites could be used to gain access to company intranets from anywhere at anytime.