

Data Communications

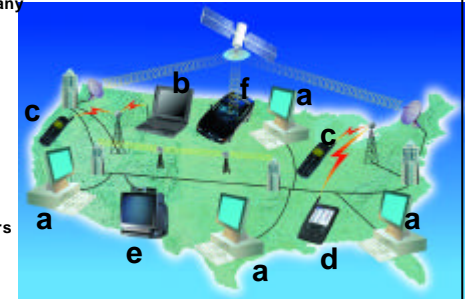
Part I: Telecommunications

Computer communications

- Process in which one computer transfers data, instructions, and information to another computer(s)

Communications system contains many types of devices

- (a) personal computers
- (b) notebook computers
- (c) Web-enabled cellular telephones
- (d) Web-enabled handheld computers
- (e) WebTV™
- (f) GPS receivers



What is needed for successful communications?

sending device

communications device

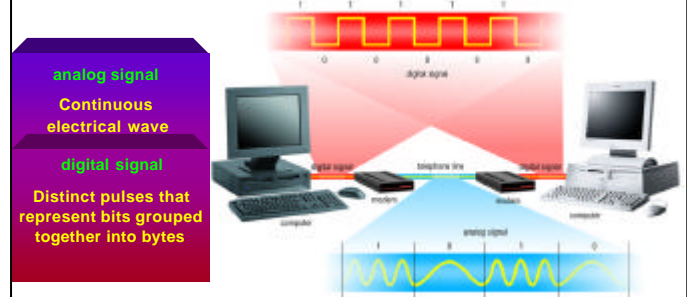
communications channel

communications device

receiving device

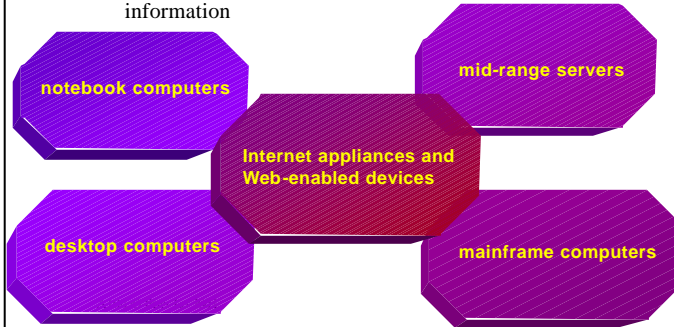
Primary function of a communications device

- To convert digital signals to analog signals or analog signals to digital signals



Sending and receiving device

- Initiates or accepts transmission of data, instructions, and information

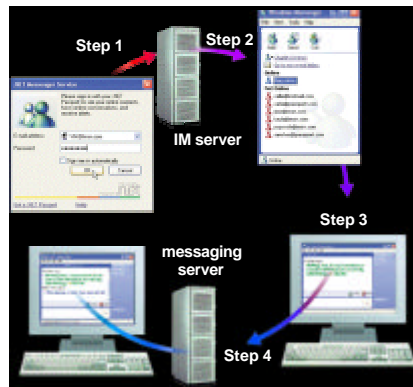


What are some uses of communications technology?



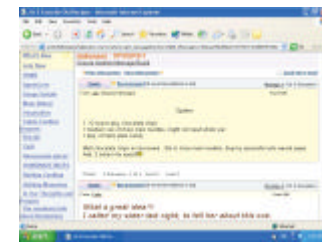
Instant messaging (IM)

- 1: Login to the IM server
- 2: Server checks if any established friends, family, or co-workers, called buddies, are online
- 3: Send instant messages to online buddy
- 4: Instant message travels through messaging server and then to online buddy



Chat room

- Area on the Web where users conduct written discussions about a particular subject
- Also called threaded discussion



Internet telephony

- Enables you to talk to other people over the Internet

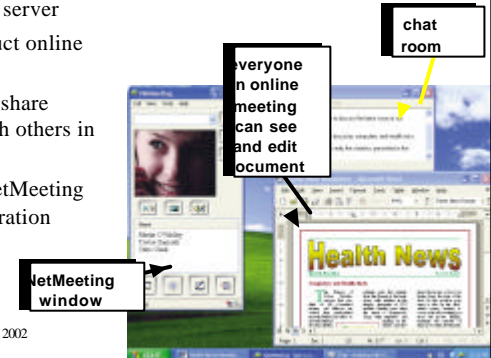


A106 © Peter Lo 2002

9

Collaboration

- Working with other users connected to a server
- You can conduct online meetings
- Allows you to share documents with others in real time
- Microsoft's NetMeeting allows collaboration



A106 © Peter Lo 2002

Groupware

- Software application that helps groups of people work together on projects and share information over a network
 - ◆ Lotus Notes
 - ◆ Microsoft Exchange

manage projects

communicate

schedule meetings

make group decisions

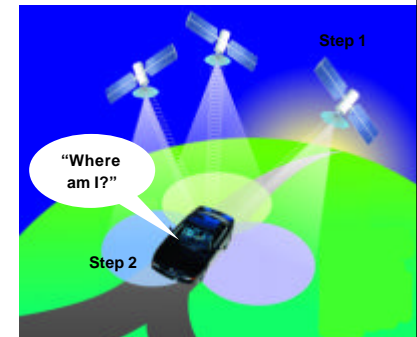
A106 © Peter Lo 2002

11

Global positioning system (GPS)

1: GPS satellites orbit the earth. Every thousandth of a second, each satellite sends a signal that indicates its current position to the GPS receiver.

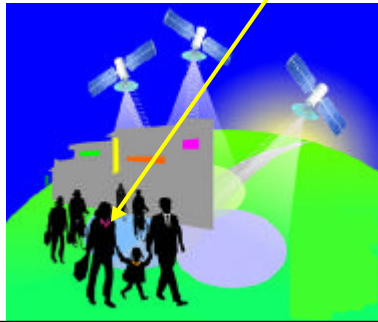
2: GPS receiver (such as in a car) determines its location on Earth by analyzing signals from the satellites.



A106 © Peter Lo 2002

Digital Angel

- Necklace, bracelet, or receiver woven into fabric that communicates with another party using GPS satellite system
- Measures and sends biological information to satellite



A106 © Peter Lo 2002

Data Communications

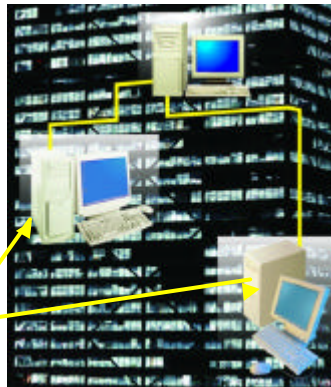
Part II: Networks

A106 © Peter Lo 2002

14

Local area network (LAN)

- Network in limited geographical area such as home, school computer laboratory, or office building

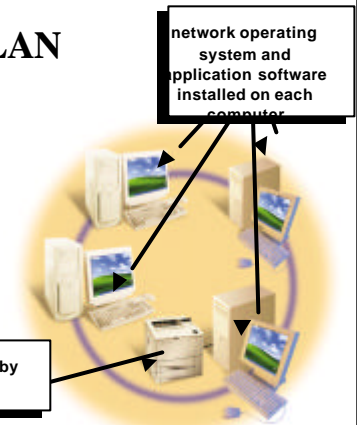


nodes in network

A106 © Peter Lo 2002

Peer-to-peer LAN

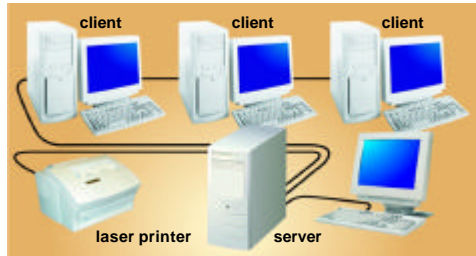
- Small network that shares hardware, data, or information located on any other computer in network
- Each computer stores files on its own storage devices



A106 © Peter Lo 2002

Client/server LAN

- Network in which one or more computers act as a server and other computers on the network can request services from server



17

Wide area network (WAN)

- Network that covers large geographic area
- Internet is world's largest WAN



A106 © Peter Lo 2002

Internet use of peer-to-peer (P2P)

- Enables users with same networking software to connect to each other's hard disks and exchange files directly

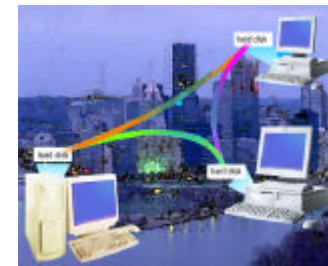


A106 © Peter Lo 2002

19

Metropolitan area network (MAN)

- Backbone network that connects local area networks in a metropolitan area such as a city or town



A106 © Peter Lo 2002

20

Network topology

- Configuration, or physical arrangement, of devices in a communications network
- Networks usually use combinations of three topologies

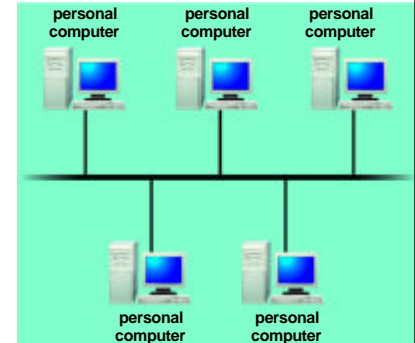


A106 © Peter Lo 2002

21

Bus network

- Consists of a single central cable, to which all computers and other devices connect
- Bus is physical cable or backbone
- Inexpensive and easy to install



A106 © Peter Lo 2002

Ring network

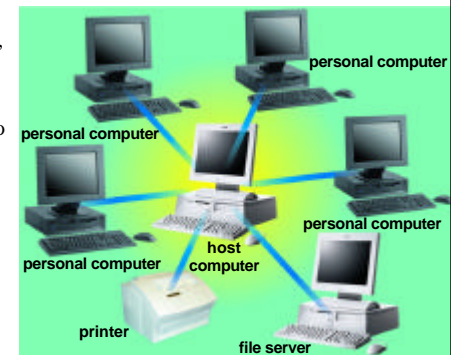
- Cable forms closed ring, or loop, with all computers and devices arranged along ring
- Data travels from device to device around entire ring, in one direction



A106 © Peter Lo 2002

Star network

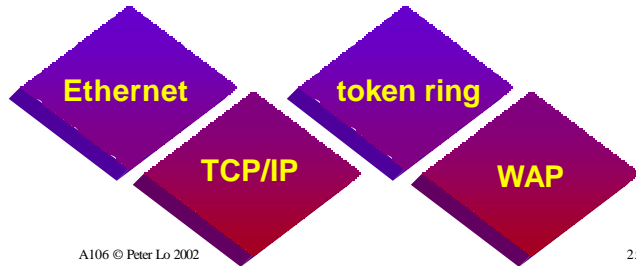
- All devices connect to a central computer, called the hub
- All data transferred from one computer to another passes through hub



A106 © Peter Lo 2002

Network communications technologies

- Specific combinations of hardware and software that allow different devices on several types of networks to communicate

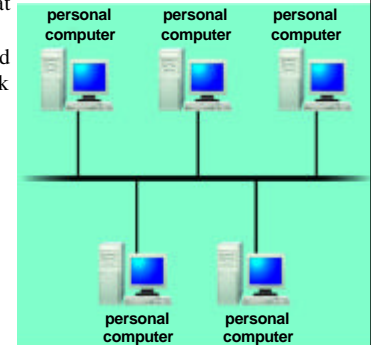


A106 © Peter Lo 2002

25

Ethernet

- LAN technology that allows personal computers to contend for access to network
- Based on bus technology



A106 © Peter Lo 2002

Token ring

- LAN technology that controls access to network by requiring network devices to share or pass a special signal, called a token
- Device with token can transmit data over network
- Only one token exists per network
- Based on ring topology, although it can use star topology

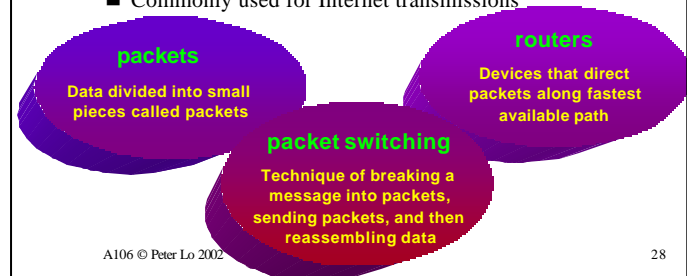


A106 © Peter Lo 2002

27

TCP/IP

- Short for transmission control protocol/Internet protocol
- Transmits data by breaking it up into packets
- Commonly used for Internet transmissions



A106 © Peter Lo 2002

28

Wireless Applications Protocol (WAP)

- Allows wireless mobile devices to access Internet and its services
- Wireless device contains client software, which connects to Internet service provider's server



A106 © Peter Lo 2002

29

Intranet

- Internal network that uses Internet technologies
- Lets company make information accessible to employees and facilitate working in groups
- Typically includes a connection to Internet

has a Web server

accessible via a Web browser

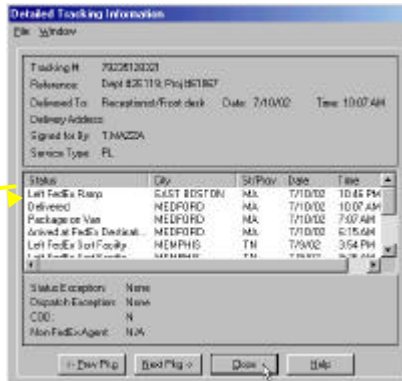
users can post and update information on intranet by creating and posting a Web page

A106 © Peter Lo 2002

Extranet

- Allows customers or suppliers to access part of company's intranet

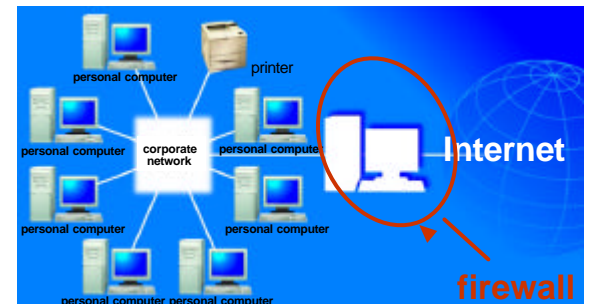
customer checking package on Fed Ex's intranet via the Internet



A106 © Peter Lo 2002

Firewall

- Hardware and/or software that restricts access to data and information on network



Home network

- Multiple computers connected together in home
- Ways to connect
 - ◆ Ethernet – connect each computer via cable
 - ◆ HomePLC (powerline cable) – use electrical lines in house
 - ◆ Phoneline – use telephone lines
 - ◆ HomeRF (radio frequency) – wireless



A106 © Peter Lo 2002

Intelligent Home Network

- Extends basic home network to include features such as lighting control, thermostat adjustment, and security system



A106 © Peter Lo 2002

34

Communications Software

- Programs that help establish connection to another computer or network

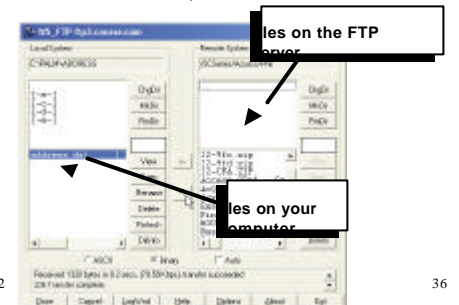


A106 © Peter Lo 2002

35

File Transfer Protocol (FTP)

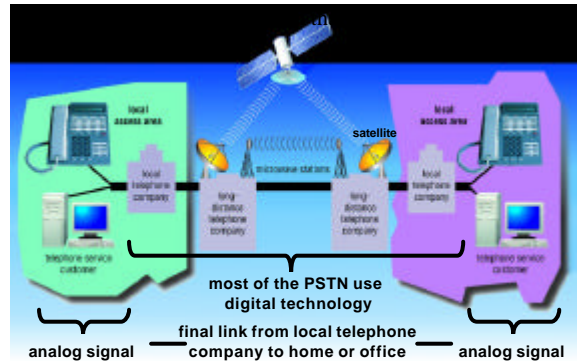
- Internet standard that allows you to upload and download files to and from a Web server, called the FTP server



A106 © Peter Lo 2002

36

Public Switched Telephone Network (PSTN)



Dial-up Line and Dedicated Line

- Dial-up line is temporary connection using telephone line for communications
- Dedicated line is line always connected between two communications devices

Advantages of dial-up line

1. Costs no more than making regular call
2. Computers at any two locations can establish a connection using modems and telephone network

Advantages of dedicated line

1. Quality and consistency of connection are better
2. Computer locations are fixed
3. Can be digital or analog

38

Transfer Rate

- Speed at which a line carries data and information
- Faster the transfer rate, the faster you can send and receive data and information
- Usually expressed as a measure of bits per second

bits per second
(bps)

kilobits per second
(Kbps)

megabits per second
(Mbps)

gigabits per second
(Gbps)

A106 © Peter Lo 2002

What are popular types of digital dedicated lines?

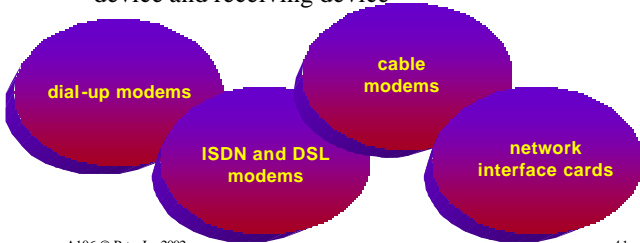
Type of Line	Transfer Rates	Approximate Monthly Cost
Dial-up	Up to 56 Kbps	Local or long-distance rates
ISDN (BRI)	Up to 128 Kbps	\$10 to \$40
ADSL	128 Kbps - 9 Mbps	\$40 to \$80
Cable TV (CATV)	128 Kbps - 2.5 Mbps	\$30 to \$50
T1	1.544 Mbps	\$1,000 or more
T3	44 Mbps	\$10,000 or more
ATM	155 Mbps to 622 Mbps	\$8,000 or more

A106 © Peter Lo 2002

40

Communications device

- Any type of hardware capable of transmitting data, instructions, and information between sending device and receiving device



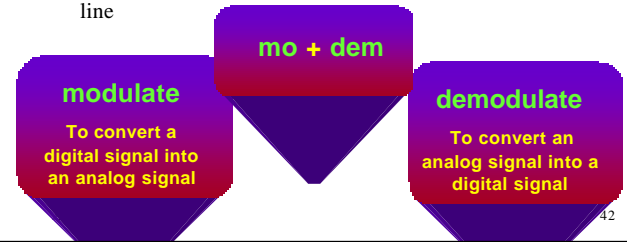
A106 © Peter Lo 2002

41

Dial-up modem



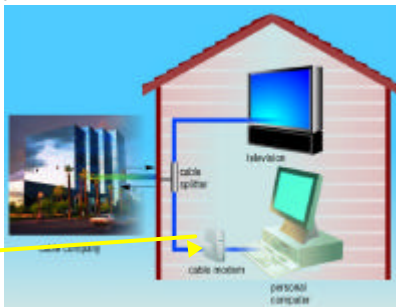
- Communications device that converts computer's digital signals to analog signals and analog signals to digital signals
- ISDN and DSL use digital modem with a digital telephone line



42

Cable modem

- Modem that sends and receives data over cable television network
- Much faster than modem or ISDN
- Usually attaches to network card



cable modem

A106 © Peter Lo 2002

Network interface card (NIC)

- Card inserted into expansion slot of personal computer or other device, enabling it to connect to a network

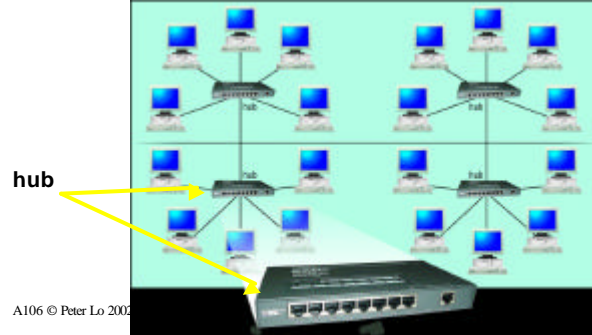


A106 © Peter Lo 2002

44

Hub

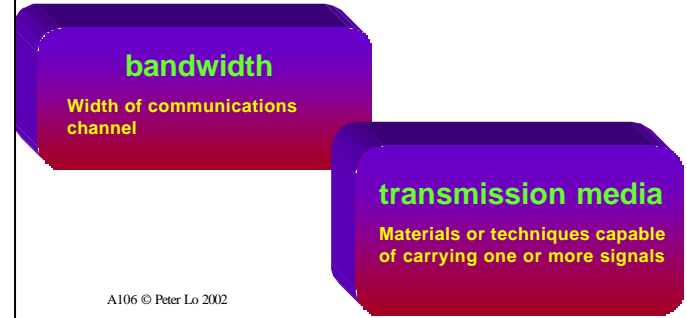
- Device that provides a central point for cables in a network



A106 © Peter Lo 2002

Channel

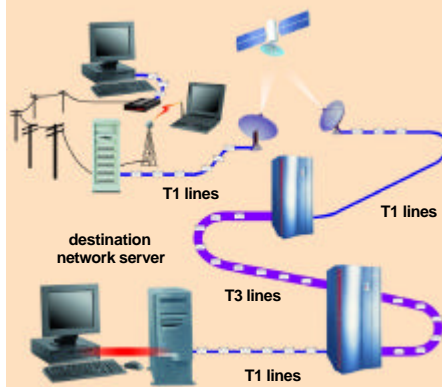
- Communications path between two devices



A106 © Peter Lo 2002

Sending a request over the Internet

- 1: Sending device requests information
- 2: When request leaves the ISP, it travels over a variety of lines until it reaches Internet backbone
- 3: Request travels over T3 lines along Internet backbone
- 4: Request travels over T1 lines until it reaches destination network server



A106 © Peter Lo 2002

Physical transmission media

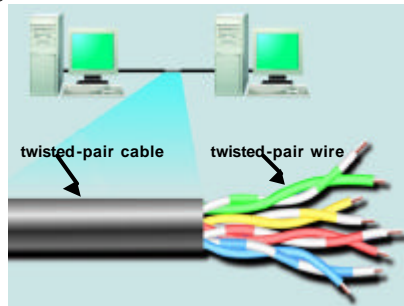
- Wire, cable, and other tangible (touchable) materials used to send communications signals

Type of Cable and LAN	Transfer Rates
Twisted Pair	
• 10Base-T (Ethernet)	10 Mbps
• 100Base-T (Fast Ethernet)	100 Mbps
• 1000Base-T (Gigabit Ethernet)	1000 Mbps
• Token ring	4 - 16 Mbps
Coaxial Cable	
• 10Base2 (ThinWire Ethernet)	10 Mbps
• 10Base5 (ThickWire Ethernet)	10 Mbps
Fiber-Optic Cable	
• 10Base-F (Ethernet)	10 Mbps
• 100Base-FX (Fast Ethernet)	100 Mbps
• FDDI (Fiber Distributed-Data Interface) token ring	100 Mbps

48

Twisted-pair cable

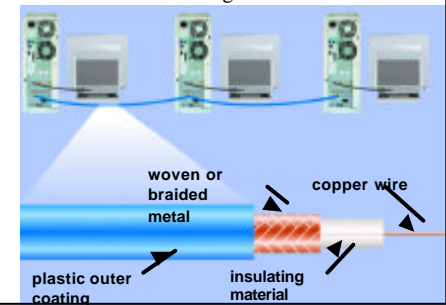
- Transmission media used by telephone system and network cabling



A106 © Peter Lo 2002

Coaxial cable

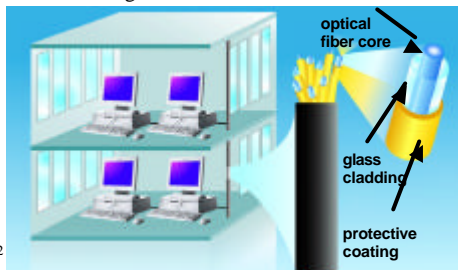
- Single copper wire surrounded by at least three layers
- Often used for cable television wiring



A106 © Peter Lo 2002

Fiber-optic cable

- Contains core of dozens or hundreds of thin strands of glass or plastic
- Uses light to transmit signals



A106 © Peter Lo 2002

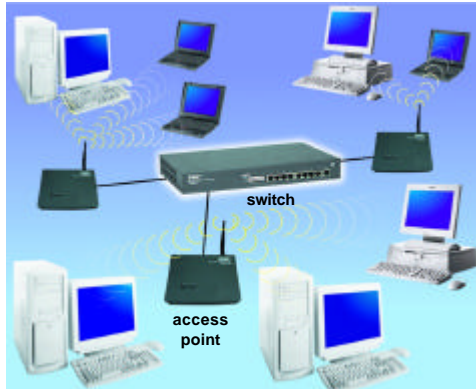
Wireless transmission media

- Send communications signals through air or space
- Used when inconvenient, impractical, or impossible to install cables

Channel	Transfer Rates
Broadcast radio	Up to 2 Mbps
Microwave radio	45 Mbps
Communications satellite	50 Mbps
Cellular radio	9,600 bps to 14.4 Kbps
Infrared	1 to 4 Mbps

52

Wireless local area network



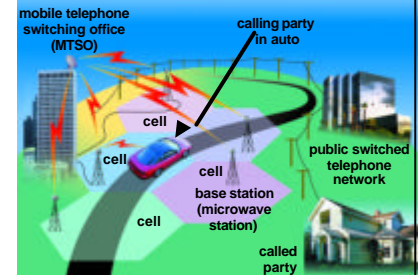
53

Cellular radio

- Form of broadcast radio used widely for mobile communications

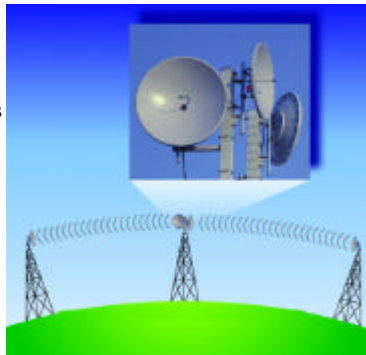


A106 © Peter Lo 2002



Microwave station

- Earth-based reflective dish that contains antenna, transceivers, and other equipment necessary for microwave communications
- Uses line-of-sight transmission
 - ◆ Must transmit in straight line with no obstructions between microwave antennas



A106 © Peter Lo 2002

Communications satellite

- Space station that receives microwave signals from an earth-based station, amplifies the signals, and then broadcasts the signals back over a wide area to any number of earth-based stations



A106 © Peter Lo 2002

Infrared (IR)

- Wireless transmission media that sends signals using infrared light waves
- Requires line-of-sight transmission
- Many computers and devices have an IrDA port that enables transfer of data using infrared light rays



A106 © Peter Lo 2002

References

- Computers in Your Future (Ch. 6)
- Introduction to Computing (Ch. 2, 8)
- Discovering Computers World 2003 (Ch. 6)

A106 © Peter Lo 2002

58