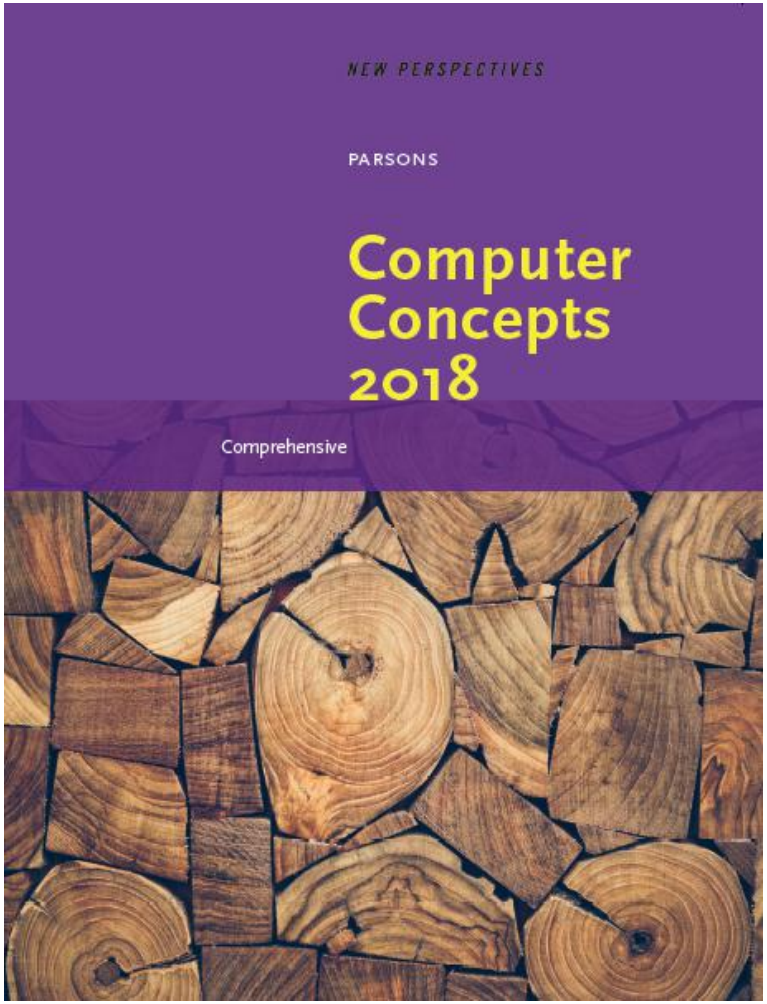
Computer Concepts 2018



Module 3
Networks

Module Contents

- Section A: Network Basics
- Section B: The Internet
- Section C: Internet Access
- Section D: Local Area Networks
- Section E: File Sharing

Section A: Network Basics

- Communication Systems
- Communication Channels
- Network Topology
- Network Nodes
- Communication Protocols

Section A: Objectives (1 of 2)

- Replicate Shannon's diagram of a general communication system, including all nine labels
- Give two examples of PANs, LANs, and WANs
- List four examples of wired channels used for networks
- State the two wireless channels most commonly used for communication networks
- List two advantages and four disadvantages of wireless channels
- State what differentiates broadband from narrowband

Section A: Objectives (2 of 2)

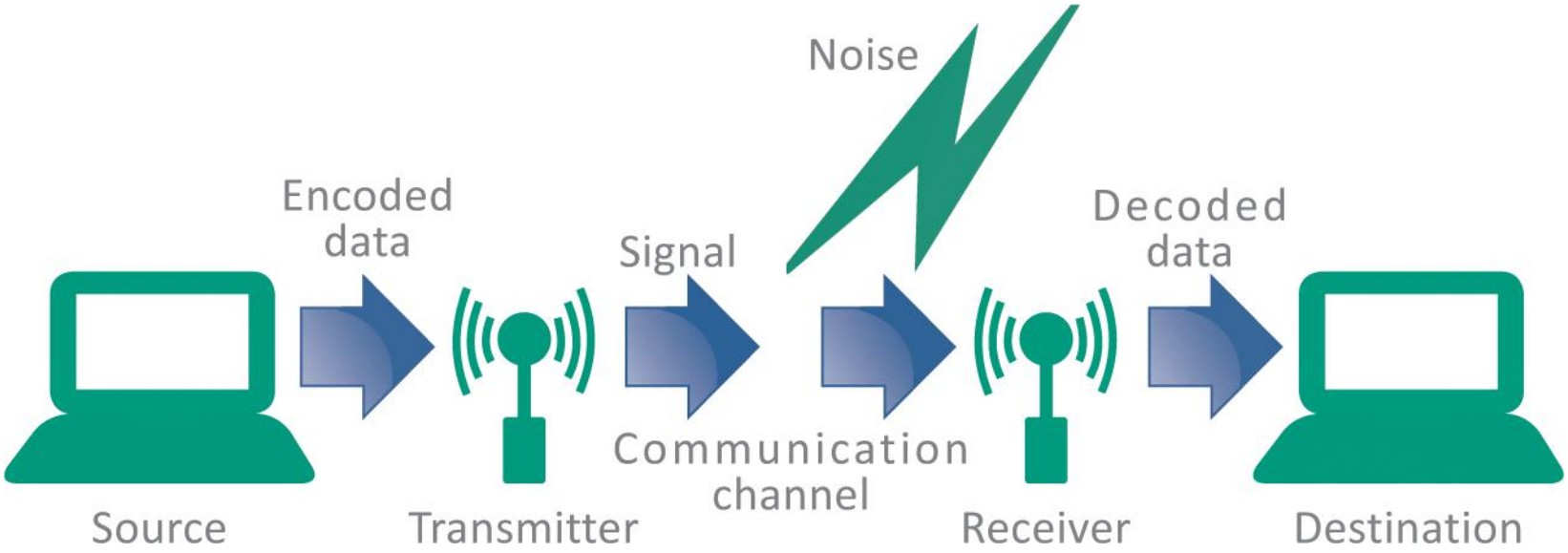
- Draw a diagram showing how data from a smart thermostat could travel over several networks with different topologies
- Compare and contrast mesh and star topologies based on dependability, security, capacity, expandability, control, and monitoring
- List two examples of DTEs and two examples of DCEs
- Explain the difference between a modem and a router
- List five tasks that are handled by communication protocols

Communication Systems (1 of 5)

- Networks can be classified in many ways; as a network user, you'll want to keep in mind the idea of control and how it affects your privacy and security
- A network links things together
- A **communication network** (or communication system) links together devices to data and information can be shared among them

Communication Systems (2 of 5)

- In 1948, Claude Shannon, an engineer at Bell Labs, published and article describing a communication system model applicable to networks of all types
- His diagram illustrates the essence of a network



Communication Systems (3 of 5)

- Networks can be classified according to their size and geographic scope
- **PAN** (personal area network)
  - PANs connect smart devices or consumer electronics within a range of about 30 feet (10 meters) and without the use of wires or cables. The reference to *personal* indicates that the network serves a single individual, rather than multiple users. A PAN could be used to sync data from a handheld device to a desktop computer, ship data wirelessly to a printer, or transmit data from a smartphone to a wireless headset.

Communication Systems (4 of 5)

- **LAN** (local area network)
  - LANs are data communication networks that connect personal computers within a very limited geographical area—usually a single building. School computer labs and home networks are examples of LANs. Wi-Fi networks that you can access in airports, coffee shops, and other public places are LANs. The in-house networks operated by most businesses are also LANs.

Communication Systems (5 of 5)

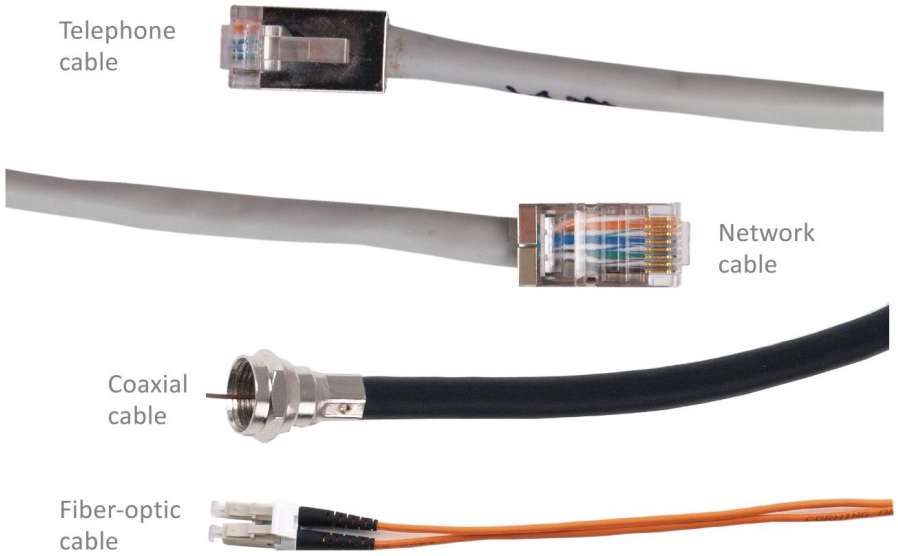
- **WAN** (wide area network)
  - WANs cover a large geographical area and usually consist of several smaller networks, which might use different computer platforms and network technologies. The Internet is the world's largest WAN. Other public WANs include telephone systems, cable television systems, and satellite based communication systems.

Communication Channels (1 of 10)

- A **communication channel** is the medium used to transport information from one network device to another
- **Wired channels** transport data through wires and cables
- **Wireless channels** transport data from one device to another without the use of cable or wires

Communication Channels (2 of 10)

- Wired channels include twisted pair wires used for telephone land lines, coaxial cables used for cable television networks, Category 6 cables used for LANs, and fiber-optic cables used for high-capacity trunk lines



Communication Channels (3 of 10)

- When you set up a wired connection, you don’t have to worry about hackers intercepting your data from outside your house
- There are ways to tap into a wired network, but they require physical access to the cable or fairly sophisticated snooping equipment

Communication Channels (4 of 10)

- Cables can be shielded against interference and encased in protective casings for installations that are outdoors and underground.
- Wired connections are dependable. Their carrying capacity and speed are not affected by airborne interference from rain, snow, or electrical devices.
- Wired connections are more secure than their wireless counterparts because a device can join a wired network only if it is physically connected by a cable.

Communication Channels (5 of 10)

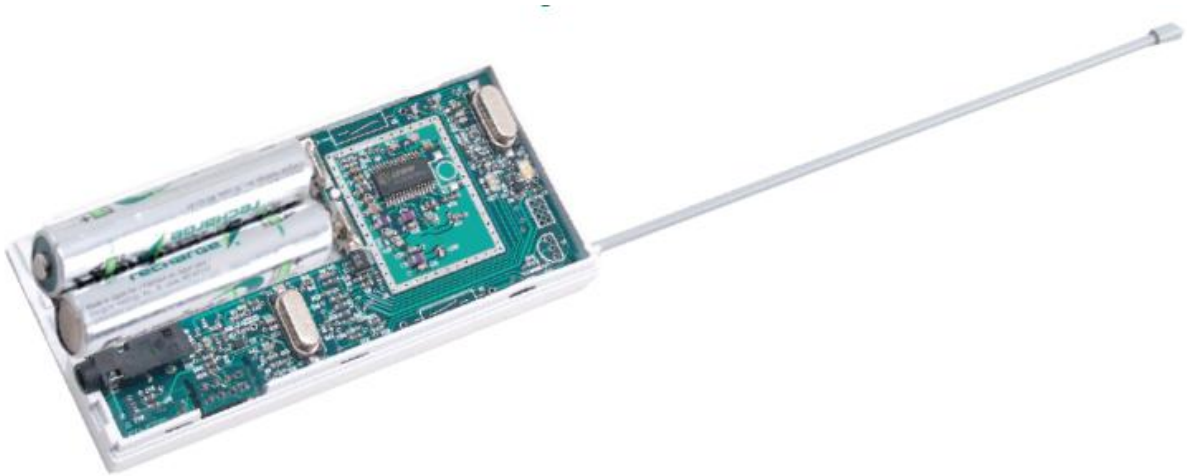
- In WANs, wired installation can be costly because cables have to be suspended from poles or buried underground. They can be damaged by weather events and digging in the wrong place. Repairs to underground cables require heavy equipment to locate, access, and fix the break.
- LAN devices connected by cables have limited mobility. Desktop computers tend to be better candidates for wired connections, whereas laptops, tablets, and handheld devices can retain their mobility when they are not tethered to a cable.
- Cables are unsightly, tend to get tangled, and collect dust. Running cables through ceilings, walls, and floors can be challenging. Cables can also carry electrical surges that have the potential to damage network equipment.

Communication Channels (6 of 10)

- The most widespread wireless channels for communication networks are radio signals and microwaves
- Most wireless channels transport data as RF signals commonly called radio waves
- RF signals are sent and received by a transceiver (a combination of a transmitter and a receiver) that is equipped with an antenna

Communication Channels (7 of 10)

Devices used with wireless connections are equipped with transceivers that include a transmitter for sending data and a receiver for collecting data. A transceiver has an antenna, which may be visible or may be housed out of sight within a device's system unit.



Communication Channels (8 of 10)

- Microwaves (the waves themselves, not your oven!) provide another option for transporting data wirelessly
- Microwaves are electromagnetic signals that can be aimed in a single direction and have more carrying capacity than radio waves
- Microwave installations usually provide data transport for large corporate networks

Communication Channels (9 of 10)

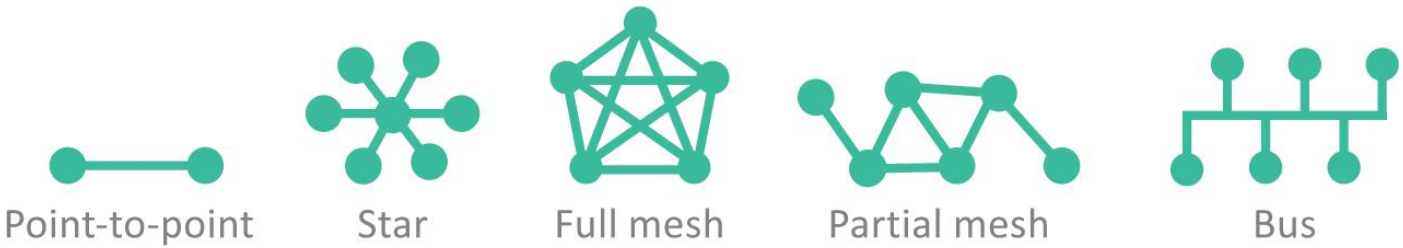
- Advantages of wireless
  - Mobility
  - No unsightly cables
  - Less susceptible to power spikes
- Disadvantages of wireless
  - Speed
  - Range
  - Security
  - Licensing

Communication Channels (10 of 10)

- **Bandwidth** is the transmission capacity of a communication channel
- Network channels that are capable of moving at least 25 megabits of data per second (25 Mbps) are classified as **broadband**
- Channels slower than 25 Mbps are classified as **narrowband**

Network Topology (1 of 2)

- In the context of communication networks, topology refers to the structure and layout of network components, such as computers, connecting cables, and wireless signal paths
  - Point-to-point topology refers to the process of peripheral devices connecting to a host device using expansion ports, USB cables, or Bluetooth
  - Star topology connects multiple devices to a central device
  - Mesh topology connects multiple devices to each other, either as a full mesh or as a partial mesh
  - The less popular bus topology connects devices in a linear sequence



Network Topology (2 of 2)

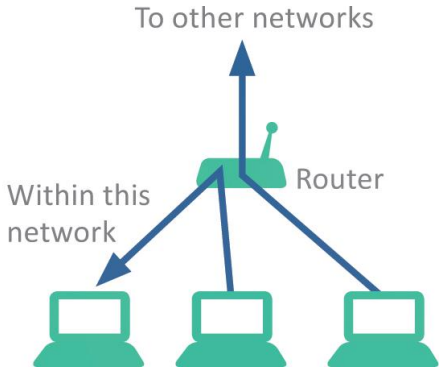
		
Dependability	If the central point fails, data cannot flow anywhere on the network. If one of the devices fails, however, the rest of the network remains operational.	There is no central point of failure; redundant paths between devices can be used to bypass failed devices.
Security	Data that travels on a star pathway makes only one stop between the sender and destination. The threat area for any transmission encompasses only three devices and two channels.	Within a mesh, data travels through several devices and over multiple channels. Each leg presents a potential security risk. The chance of a security breach rises as the number of devices and channels increases.
Capacity	Star topologies are limited by the amount of data that can be handled by the central device.	Mesh topologies offer higher capacities because data can be transmitted from different devices simultaneously.
Expandability	Expandability is limited by the number of devices that can be attached to the central device within its immediate area of wireless coverage or maximum cable length.	The network can be expanded infinitely. As new devices are added, the network continues to repeat the signal as necessary until it reaches the farthest devices.
Control	Setup and updates are primarily done on the central device, which also can be used to shut down the entire network.	Setup is more complex, as each device must be configured to send, receive, and forward network data. There is no central point at which the network can be shut down.
Monitoring	All data passes through a central point, which is easy to monitor for legitimate or illicit purposes.	Data does not pass through a central point, making data more challenging to monitor.

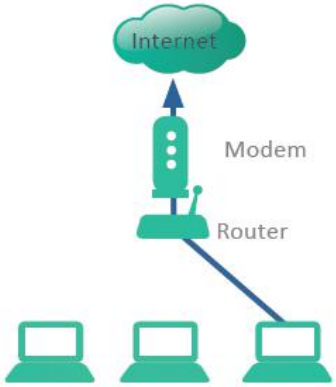
Network Nodes (1 of 3)

- Any device on a network is called a **node**
- Devices on a network are classified as DTEs or DCEs
  - **DTE** stands for data terminal equipment and can be any device that stores or generates data
  - **DCE** stands for data communication equipment; these devices control the speed of data over networks, convert signals from cables to wireless, check for corrupted data, and route data to its destination

Network Nodes (2 of 3)

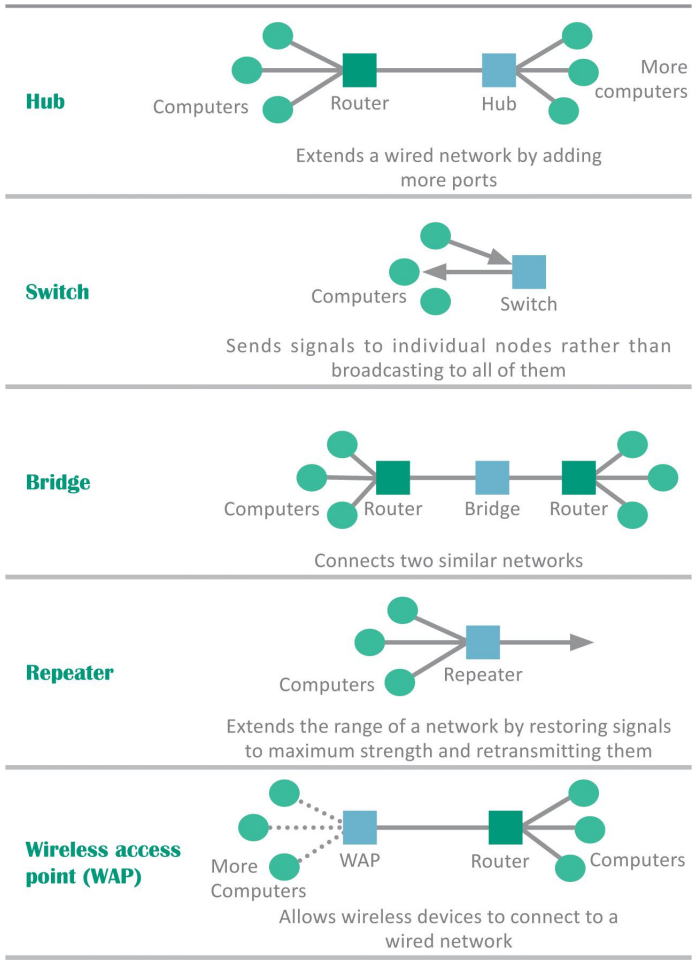
- A router is a device that controls the flow of data within a network and also acts as a gateway to pass data from one network to another
- A modem contains circuitry that converts the data-carrying signals from a digital device to signals that can travel over various communications channels





Network Nodes (3 of 3)

- DCEs such as repeaters, switches, and hubs can extend the range of your home network



Communication Protocols (1 of 3)

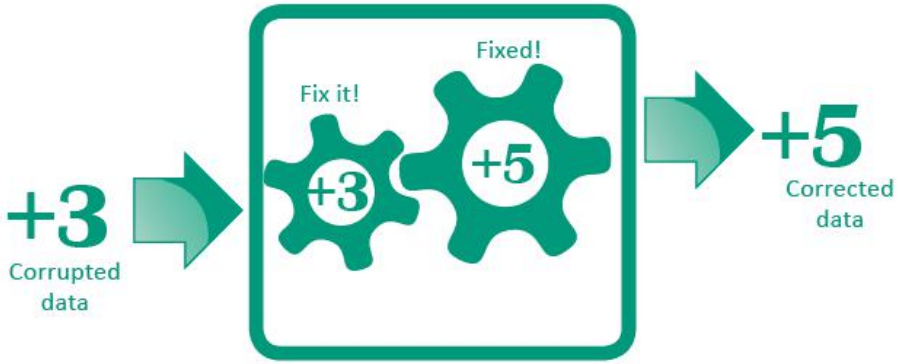
- In the context of networks, a communication protocol refers to a set of rules for efficiently transmitting data from one network node to another
- This process is called handshaking
- Networks use more than one protocol, and the collection of protocols for a network is referred to as a protocol stack

Communication Protocols (2 of 3)

- **PHYSICAL PROTOCOLS**
  - Specify cable and signal standards for the channels that carry data
- **TRANSPORT PROTOCOLS**
  - Make sure data gets to its destination by establishing standards for dividing data into chunks, assigning addresses, and correcting errors
- **ARRIVAL PROTOCOLS**
  - Convert data into standard formats that can be used by applications, such as email, Web browsers, and Skype

Communication Protocols (3 of 3)

- Error correction is one of the responsibilities of communication protocols
- Digital networks—those that transmit digital signals—can be easily monitored to determine if interference has corrupted any signals



Section B: The Internet

- Background
- Internet Infrastructure
- Packets
- Internet Addresses
- Domain Names

Section B: Objectives (1 of 2)

- Briefly describe how the Internet developed from the ARPANET
- Explain the state of Internet governance and funding
- Draw a diagram showing the interrelationship among the three tiers of Internet service providers
- Describe how packets are created and how they are carried on packet-switching networks
- State the roles of TCP, IP, and UDP

Section B: Objectives (2 of 2)

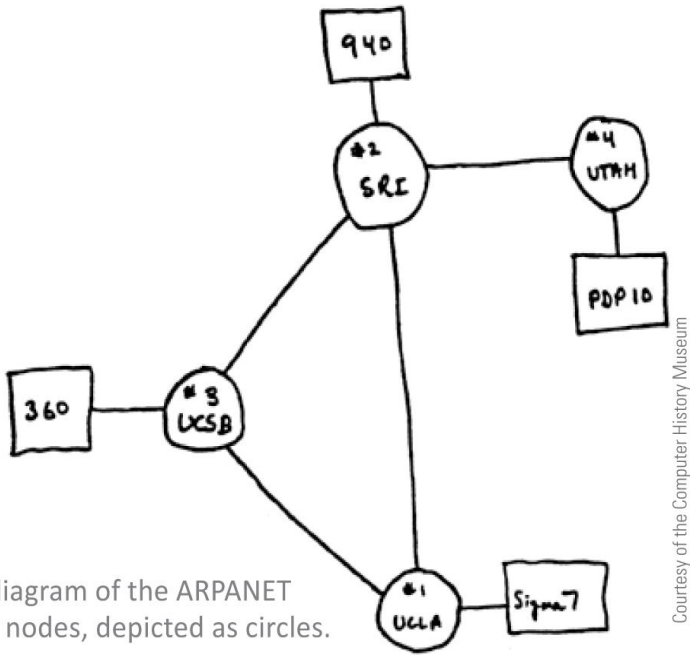
- Identify IPv4 and IPv6 addresses
- Explain the differences between static addresses and dynamic addresses
- Draw a diagram illustrating how a router deals with private and public IP addresses
- List at least five top-level domains
- Explain the role of the domain name system and why it is one of the Internet's vulnerabilities

Background (1 of 5)

- The history of the Internet begins in 1957
- In a response to the Soviet Union launching Sputnik, the first man-made satellite, the U.S. government resolved to improve its scientific and technical infrastructure
- One of the resulting initiatives was the Advanced Research Projects Agency (ARPA)

Background (2 of 5)

- ARPA designed a project to help scientists communicate and share valuable computer resources, and called The ARPANET
- The ARPANET, created in 1969, connected computers at UCLA, the Stanford Research Institute, the University of Utah, and UC California at Santa Barbara



The original diagram of the ARPANET included four nodes, depicted as circles.

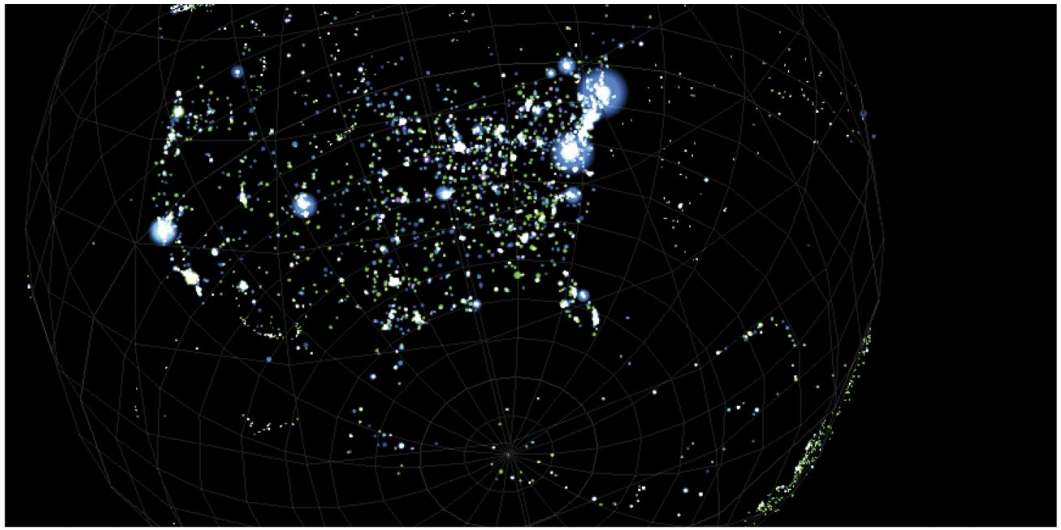
Courtesy of the Computer History Museum

Background (3 of 5)

- Early Internet pioneers used primitive command-line user interfaces to send email, transfer files, and run scientific calculations on Internet supercomputers
- In the 1990s, software developers created new user-friendly Internet access tools, and Internet accounts became available to anyone willing to pay a monthly subscription fee

Background (4 of 5)

- Today's Internet, with an estimated 500 million nodes and more than 3 billion users, is huge
- It is estimated that the Internet handles more than two exabytes of data every day; an exabyte is 1.074 billion gigabytes – a nearly unimaginable amount of data!



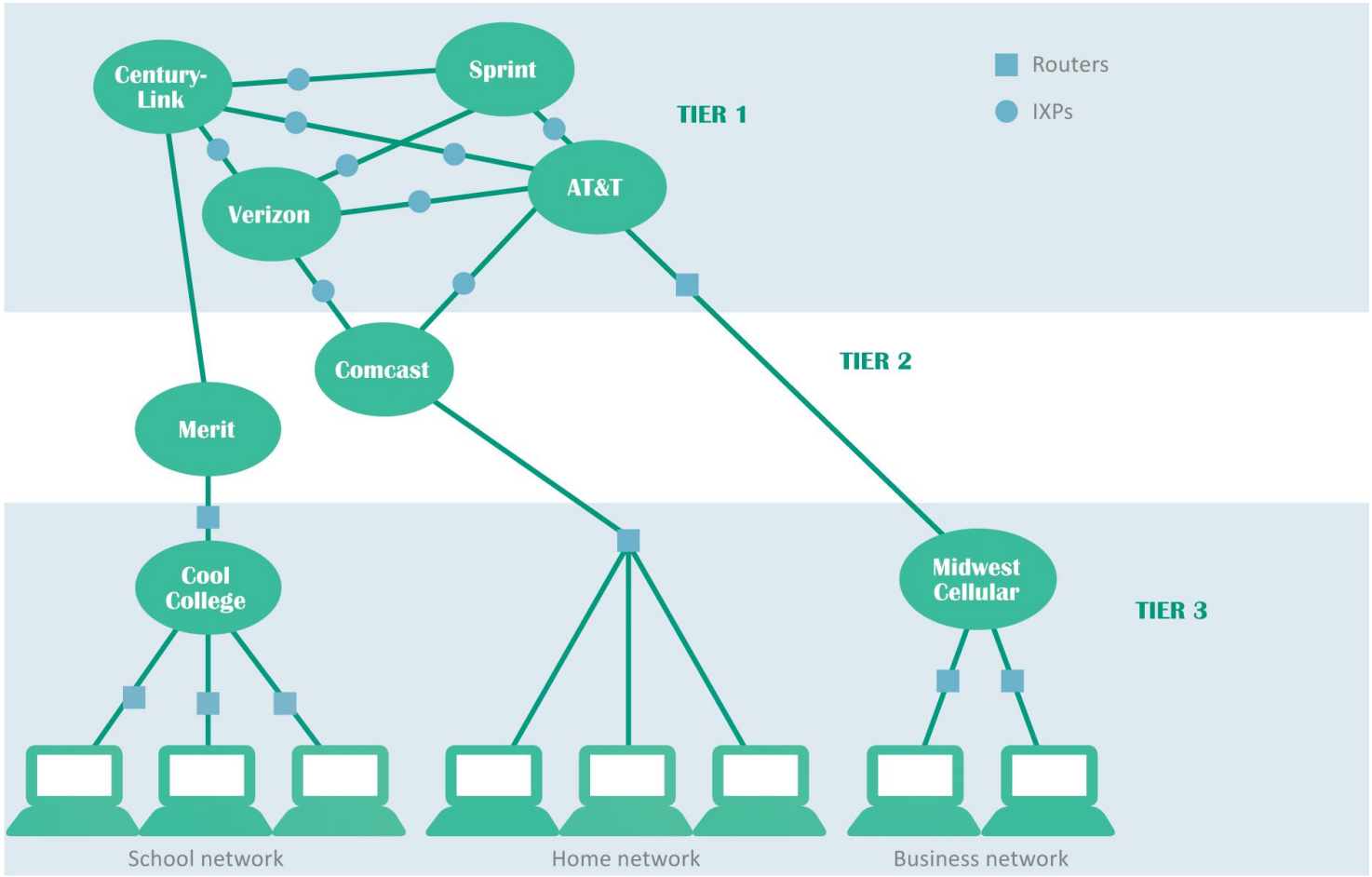
Background (5 of 5)

- In theory, no single person, organization, company, or government runs the Internet
- **Internet governance** is simply a set of shared protocols, procedures, and technologies that evolve through common agreement among network providers
- The organization that supervises internet addressing is **ICANN**, the Internet Corporation for Assigned Names and Numbers

Internet Infrastructure (1 of 3)

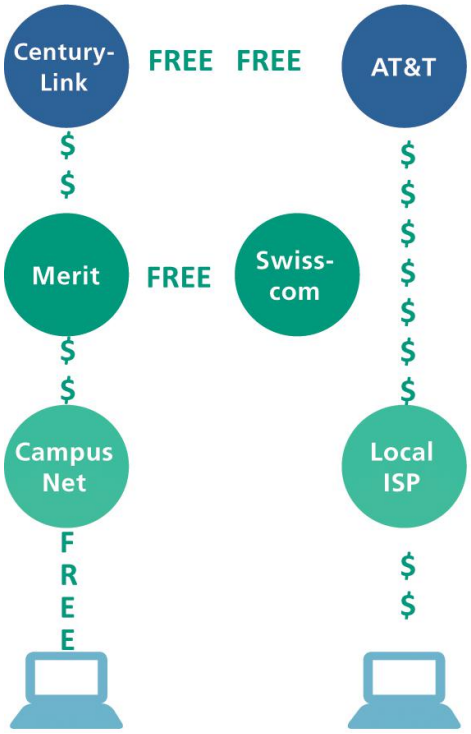
- The way networks fit together is referred to as the **Internet Infrastructure**
- Tier 1 networks, such as AT&T, CenturyLink, Verizon, and NTT Communications represent the top of the Internet hierarchy and form the **Internet backbone**, a system of high-capacity routers and fiber-optic communication links providing the main routes for data speeding across the Internet
- Networks that form the Internet are maintained by **Internet service providers** (ISPs)
- ISPs exchange data at **Internet exchange points** (IXPs)

Internet Infrastructure (2 of 3)



Internet Infrastructure (3 of 3)

- The internet is not free; ISPs make a substantial investment in equipment and infrastructure to connect consumers
- Tier 1 ISPs own and maintain millions of dollars of data communication equipment



Tier 1 service providers exchange data with other Tier 1 providers on a no-cost basis.

Tier 2 service providers exchange data on a no-cost basis with other Tier 2 providers, but they pay fees to connect to the backbone through Tier 1 providers.

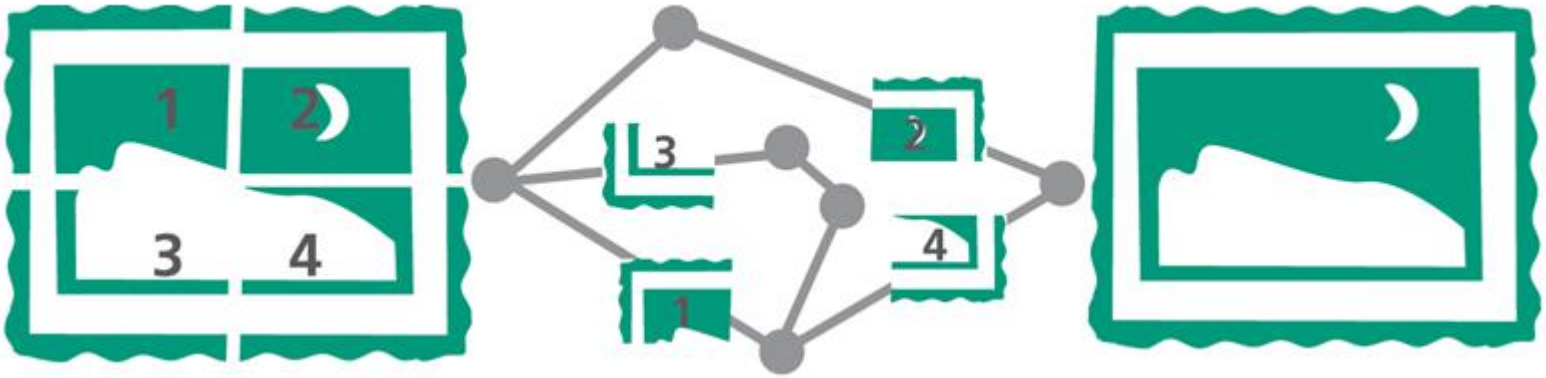
Tier 3 service providers connect to Tier 2 or Tier 1 providers and pay transit fees for the data exchanged.

Consumers either pay fees directly or their access is subsidized by an organization or government.

Packets (1 of 6)

- A packet is a parcel of data that is sent across a computer network; when packets reach their destination, they are reassembled into the original message according to their sequence numbers

Packets (2 of 6)

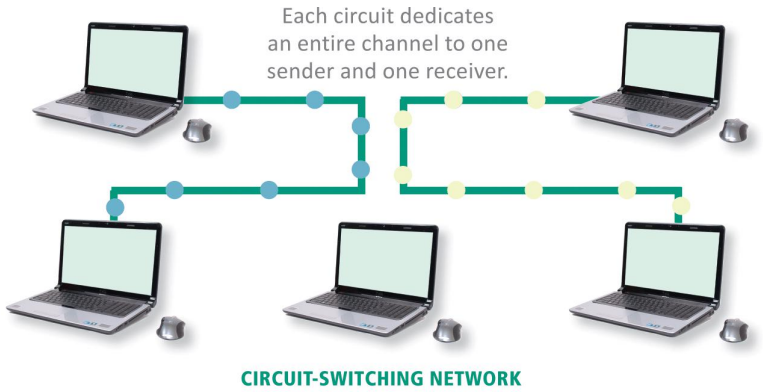


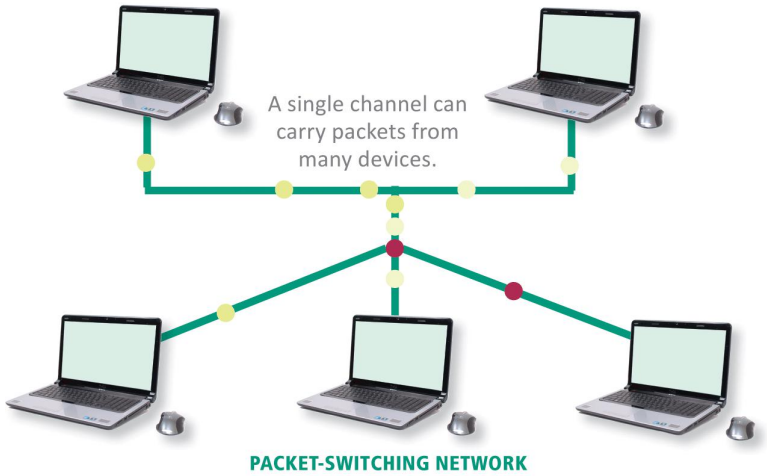
Messages divided into equal-size packets are easier to handle than an assortment of small, medium, large, and extra large files.

Packets (3 of 6)

- Communication networks use a technology called circuit switching, which establishes a private link between one telephone and another for the duration of a call
- A more efficient alterative to this process is packet switching technology, which divides a message into several packets that can be routed independently to their destination

Packets (4 of 6)





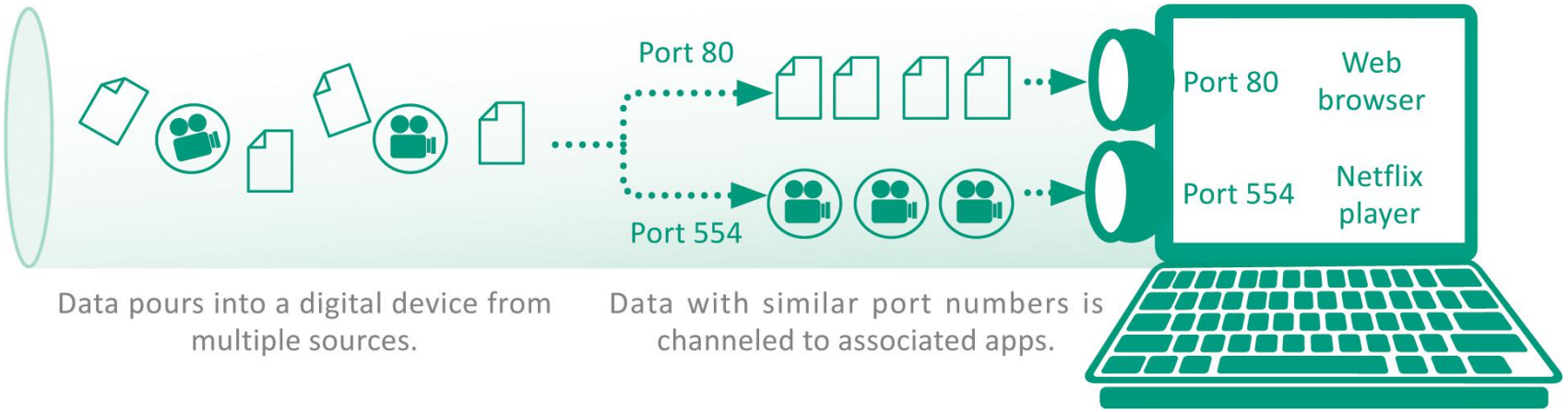
Packet-switching networks (bottom) provide a more efficient communication system than circuit-switching networks (top).

Packets (5 of 6)

- One of the core Internet protocols, **TCP** (Transmission Control Protocol) is responsible for dividing files into chunks, adding headers containing information for reassembling packets in their original order, and verifying that the data was not corrupted while in transit (a process called error checking)
- **UDP** (User Datagram Protocol) is an alternative transport protocol which is faster than a TCP but does not perform error checking and cannot reorder packets

Packets (6 of 6)

- A communication port (usually referred to simply as a port) is a virtual end point for data entering and leaving a digital device
- Communication ports are not a physical circuit, but rather an abstract concept of a doorway, an opening, or a portal through which data flows



Internet Addresses (1 of 3)

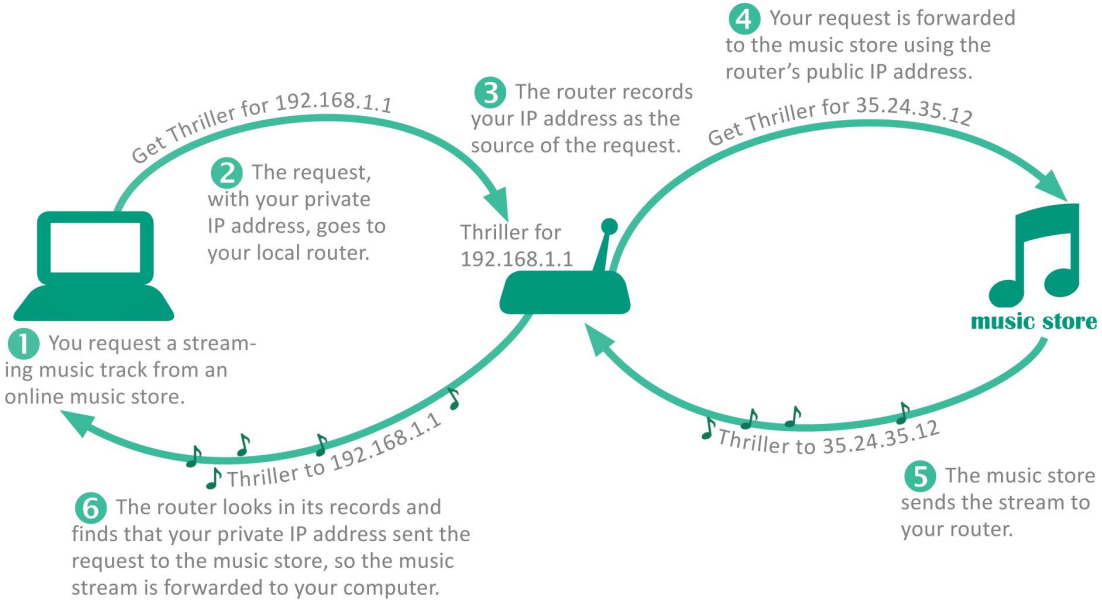
- Internet Addresses are controlled by **IP** (Internet Protocol), which is part of the Internet protocol suite
- Many devices on the Internet have permanently assigned IP addresses called **static addresses**
- IP defines two sets of addresses: IPv4 and IPv6
  - **IPv4** – (Internet Protocol version 4); is the Internet address standard; uses 32-bit addresses to identify Internet connected devices
  - **IPv6** – (Internet Protocol version 6); uses 128 bits for each address; produces billions and billions of unique Internet addresses

Internet Addresses (2 of 3)

- Internet addresses that are temporarily assigned to a device are called **dynamic addresses**
- IP addresses can be assigned by a network administrator, but more commonly they are automatically assigned by **DHCP** (Dynamic Host Configuration Protocol)
- A **private IP address** can be allocated by any network without supervision from ICANN – but it cannot be used to send data over the Internet; it's not routable

Internet Addresses (3 of 3)

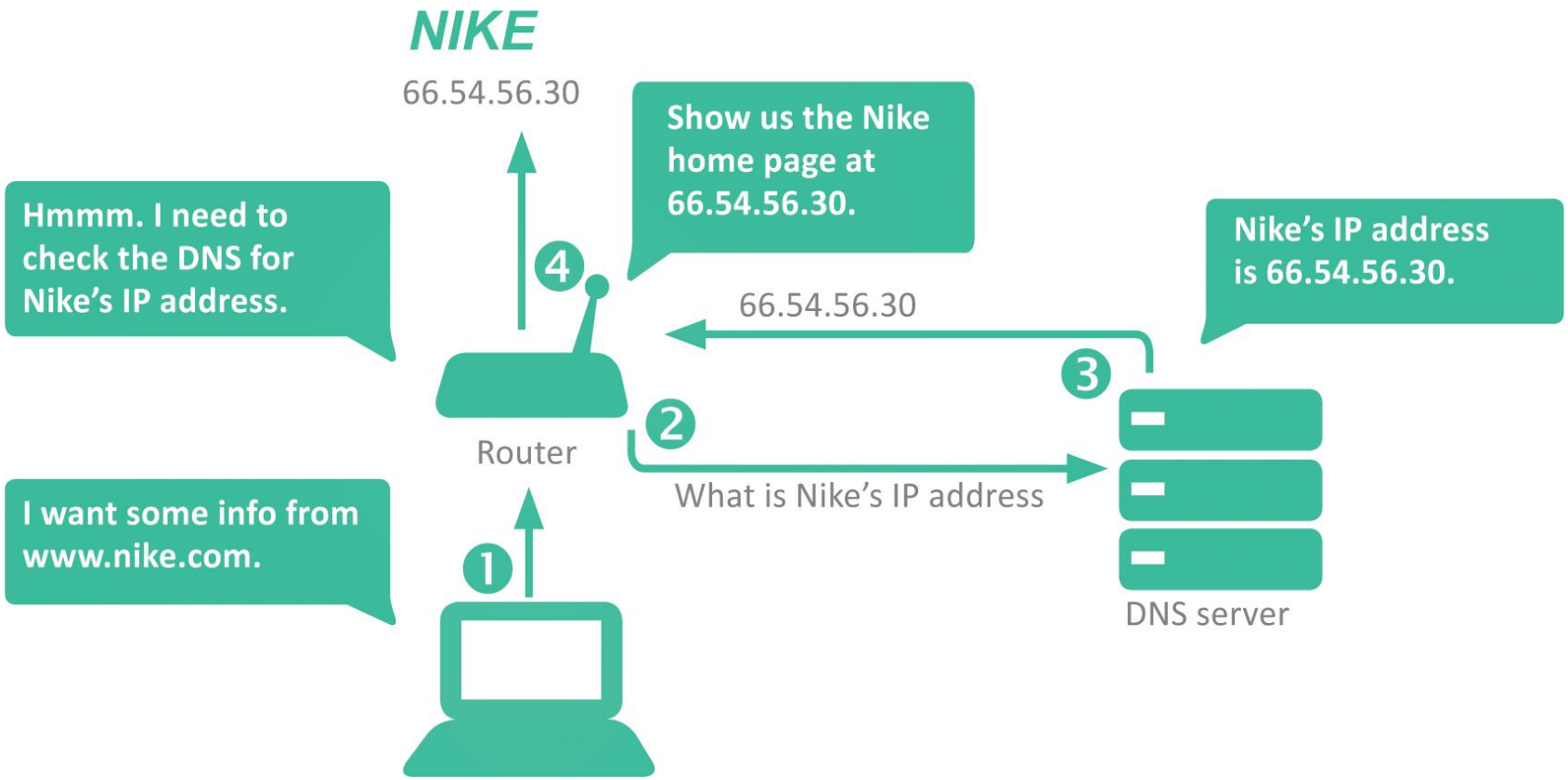
- Because a private IP address cannot be routed over the Internet a local router connects instead
- The local router has a public IP address that is routable over the Internet



Domain Names (1 of 3)

- It's hard to remember the string of numbers in an IP address; most Internet destinations also have an easy-to-remember **domain name**, such as nike.com
- The mechanism for tracking domain names and their corresponding IP addresses is called the **domain name system (DNS)**
- A domain name ends with an extension that indicates its **top-level domain**, such as .edu or .org
- **Domain name servers** are scattered around the world and maintain lists of all domain names and their corresponding IP addresses

Domain Names (2 of 3)



Domain Names (3 of 3)

- Altering DNS records can change the destination of email, browser connections, and download requests
- Unauthorized changes to the DNS are called DNS spoofing

Section C: Internet Access

- Connection Basics
- Cable Internet Service
- Telephone Network Internet Service
- Satellite Internet Service
- Mobile Broadband Service
- Wi-Fi Hotspots

Section C: Objectives (1 of 2)

- List three acceptable speeds for the following: basic Skype video calls, streaming standard-definition movies, and viewing YouTube videos
- Explain the significance of asymmetric Internet connections
- Define latency and state the type of Internet service that it affects most negatively
- List online activities that are most affected by jitter and packet loss

Section C: Objectives (2 of 2)

- Name three tools that you can use to troubleshoot an Internet connection
- Explain the pros and cons of fixed, portable, and mobile Internet access
- Rank each type of Internet service according to speed, then rank them according to dependability
- Draw diagrams of the infrastructures for cable, dial-up, DSL, mobile broadband, and Wi-Fi hotspot Internet services
- Discuss why mobile Internet access is globally the most popular way to connect to the Internet

Connection Basics (1 of 7)

- Data travels over the Internet at an incredible speed, but that speed varies; some Internet services are faster than others
- It is easy to check the speed of your Internet connection by running a few online tests

Connection Basics (2 of 7)

This speed test measured the rate of data flowing between the user's ISP in Macon, GA, and a Comcast server in Moncks Corner, SC.

Connection Basics (3 of 7)

- The most common measurement of connection speed is the amount of data that can be transmitted in a specified time; technically, it is a measure of capacity

SERVICE	Recommended Download	Recommended Upload
Skype video calling and screen sharing	300 Kbps	300 Kbps
Skype video calls (HD)	1.5 Mbps	1.5 Mbps
Skype three-person group calling	2 Mbps	512 Kbps
Netflix movie on a laptop computer	1 Mbps	
Netflix SD movie on a TV	2 Mbps	
Netflix 720p HD movie	4 Mbps	
Netflix "best video and audio experience"	5 Mbps	
YouTube basic videos	500 Kbps	
YouTube movies, TV shows, and live events	1 Mbps	
Amazon Prime Instant Video (SD)	900 Kbps	
Amazon Prime Instant Video (HD)	3.5 Mbps	
Netflix and Amazon 4K Streaming Video	15-25 Mbps	

Connection Basics (4 of 7)

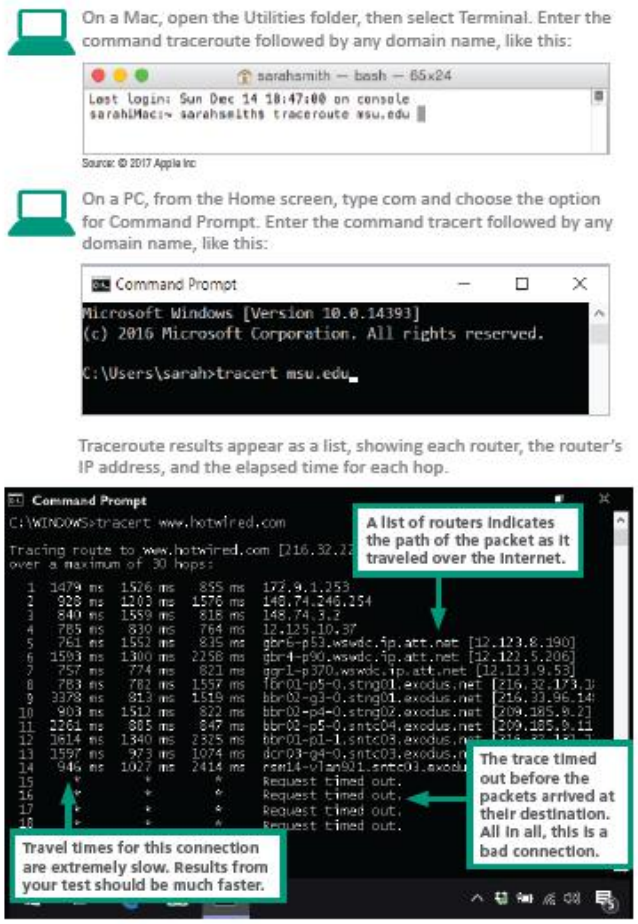
- ISPs control connection speeds based on the service plan you've selected
- Your **bandwidth cap** is the top speed allowed by your plan
- During peak times, ISPs can place further limits on speed, a process called **bandwidth throttling**
- When Internet upload speed differs from download speed, you have an **asymmetric connection**
- When upload and download speeds are the same, you have a **symmetric connection**

Connection Basics (5 of 7)

- **Ping** is utility software designed to measure responsiveness
- **Ping rate** indicates how quickly data can reach a server and bounce back to you
- **Latency** is the elapsed time for data to make a round-trip from point A to point B and back to point A
- **Jitter** measures the variability of packet latency caused when network traffic and interference can delay packets and create erratic data flow
- **Packet loss** refers to data that never reaches its destination or gets discarded because it arrives too late

Connection Basics (6 of 7)

- To determine whether or not your slow Internet connection is caused by your ISP or your computer you can use a Traceroute, a network diagnostic tool that lists each router and server



Connection Basics (7 of 7)

- Although public Internet access is available in many locations, such as coffee shops and libraries, most consumers like the convenience of having their own Internet connection

Fixed Internet Access

Fixed Internet access links your computer to an ISP from a stationary point, such as a wall socket or roof-mounted antenna. This service is dependable and relatively cost effective. You can't take it with you, so when you're away from home, you must depend on public access points.

Cable, DSL, ISDN, Fixed WiMAX, Satellite, Fiber-to-the-home

Portable Internet Access

Portable Internet access allows you to easily move your access device, as in the case of vehicle-mounted satellite dishes that can be deployed when the vehicle is parked. This service is primarily used in situations where mobile and fixed access are not available.

Mobile satellite

Mobile Internet Access

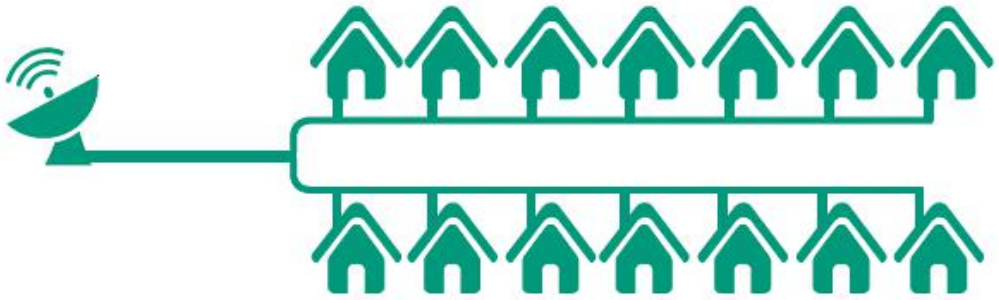
Mobile Internet access allows you to use the Internet while you are on the go, such as using a cell phone to collect your email while you are traveling by train. Data plans for these services can be costly.

Mobile broadband

Mobile WiMAX

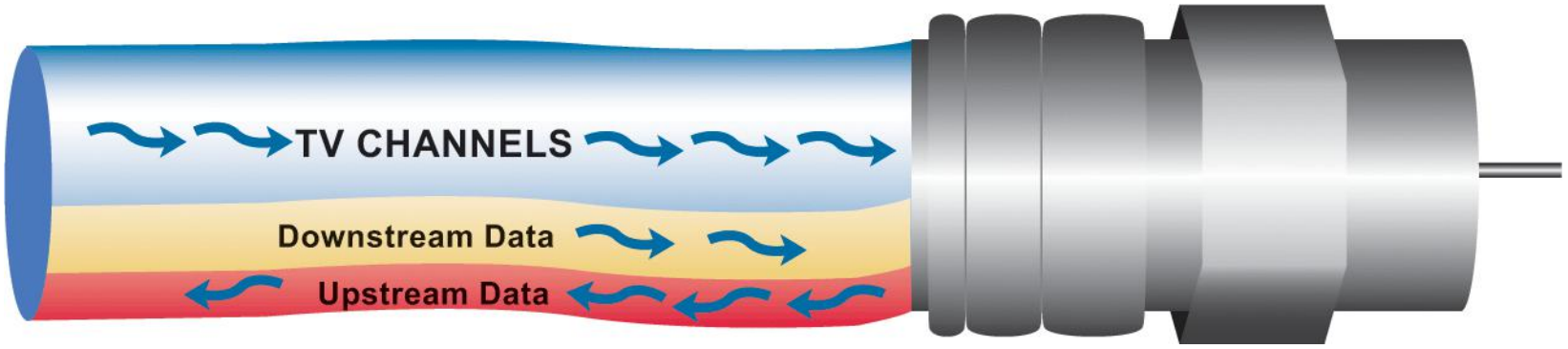
Cable Internet Service (1 of 2)

- The gold standard of fixed Internet access is cable Internet service, which is offered by the same companies that supply cable television
- CATV stands for community antenna television
- With cables branching out from a central location, the topology of a CATV system works well as the infrastructure for a digital data network



Cable Internet Service (2 of 2)

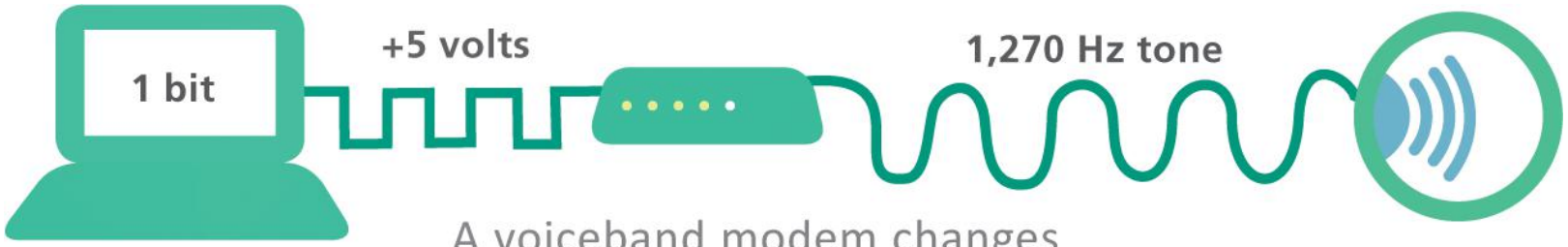
- CATV coaxial and fiber-optic cables have plenty of bandwidth to carry television signals for hundreds of channels in addition to digital data
- CATV cables provide bandwidth for television signals, incoming data signals, and outgoing data signals



Telephone Network Internet Service (1 of 4)

- Telephone companies offer four types of service: dial-up, ISDN, DSL, and FTTH
- A **dial-up** connection is a fixed Internet connection that uses a voiceband modem and the telephone company's circuit-switched network to transport data between your computer and your ISP
- A **voiceband modem** converts digital signals from a computer into audible analog signals that can travel over telephone lines

Telephone Network Internet Service (2 of 4)



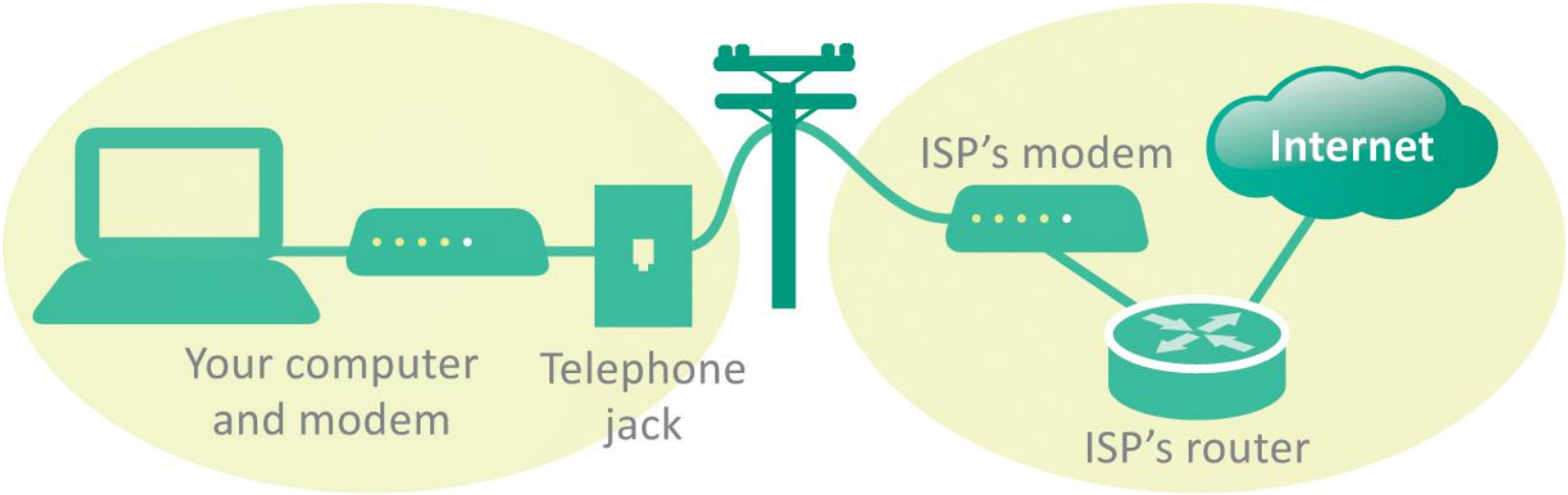
A computer generates digital signals.

A voiceband modem changes outgoing digital signals into analog audio tones. Incoming signals are converted from tones to voltages.

Signals are sent over the same channel used for voice calls.

Telephone Network Internet Service (2 of 3)

- When you use a dial-up connection, a voiceband modem places a regular telephone call to your ISP; the circuit remains connected for the duration of the call to carry data between your computer and the ISP

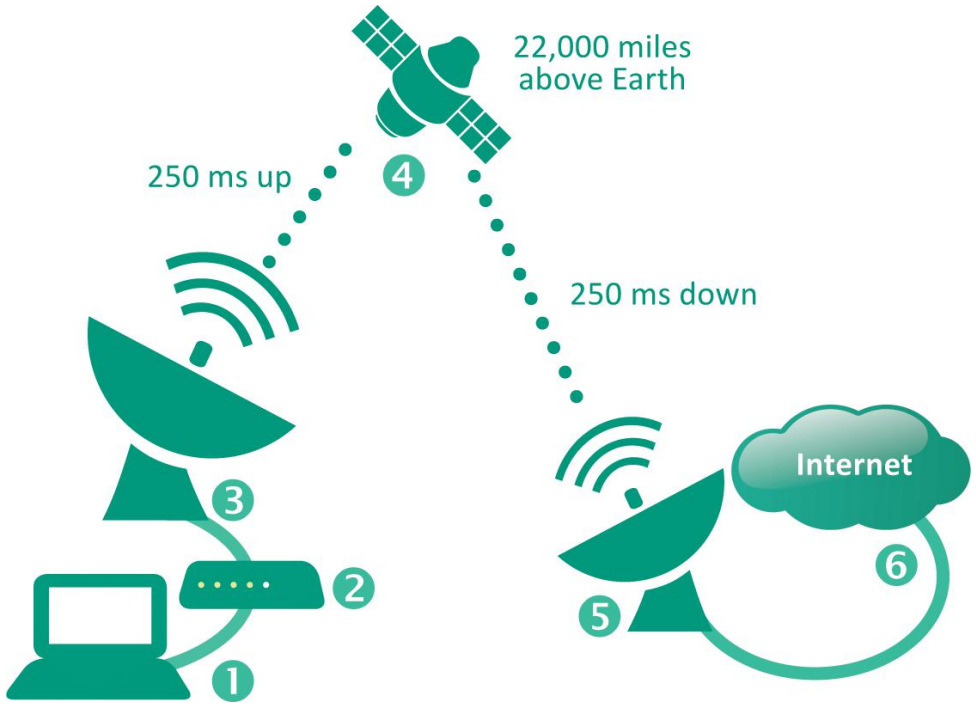


Telephone Network Internet Service (3 of 3)

- **ISDN** stands for Integrated Services Digital Network; it divides a telephone line into two channels, one for data and one for voice, by using packet switching
- **DSL** (digital subscriber line) is a high-speed, digital, always-on, Internet access technology that runs over standard phone lines; it's offered by AT&T's U-verse service
- **FTTH** (fiber-to-the-home) is the use of high-capacity fiber-optic cables, rather than coaxial cables, to connect homes to broader municipal networks

Satellite Internet Service

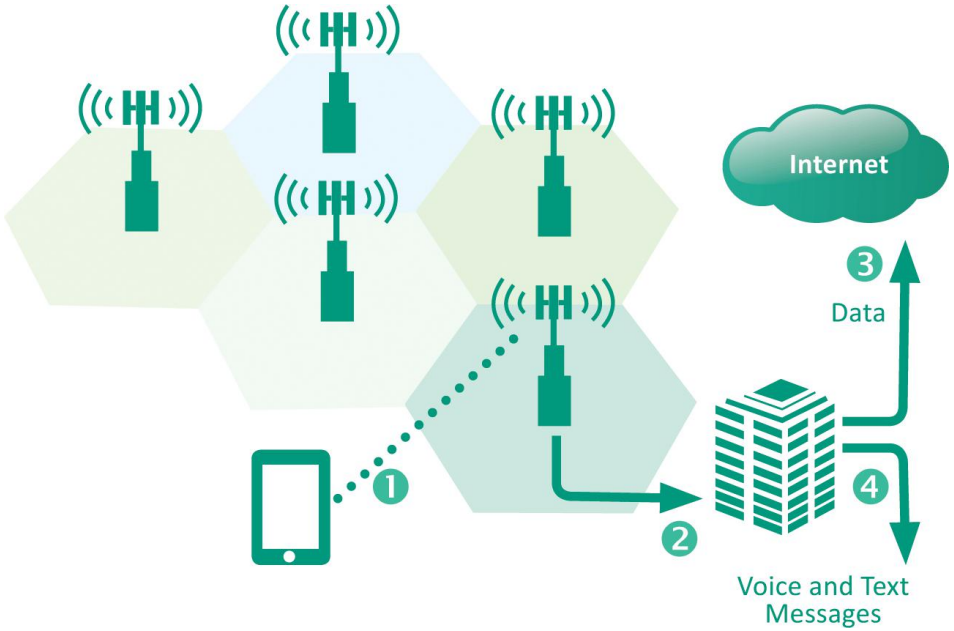
- Satellite Internet service is a means of distributing broadband asymmetric Internet access by broadcasting signals to a satellite
- In many rural areas, satellite Internet service is the only alternative to a slow dial-up connection



Mobile Broadband Service (1 of 3)

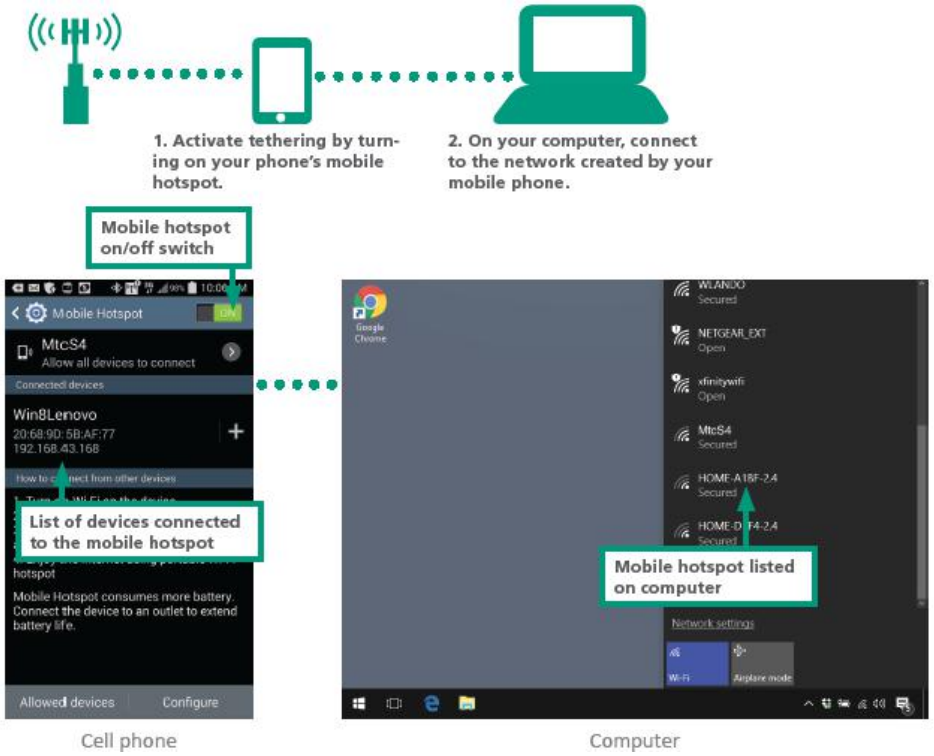
- Mobile broadband service has become so compelling that most of the Web has undergone a visual makeover to fit the requirements of smartphone-sized screens
- Cell networks transmit voice and data using radio signals; the signals flow between a device and a cellular radio tower (1), transmitters and receivers on each tower cover a specific area and use a unique frequency; data signals are passed to ground stations (2), where they are forwarded over a packet-switched network to the Internet (3); voice signals may be routed to a circuit-switched network (4)

Mobile Broadband Service (2 of 3)



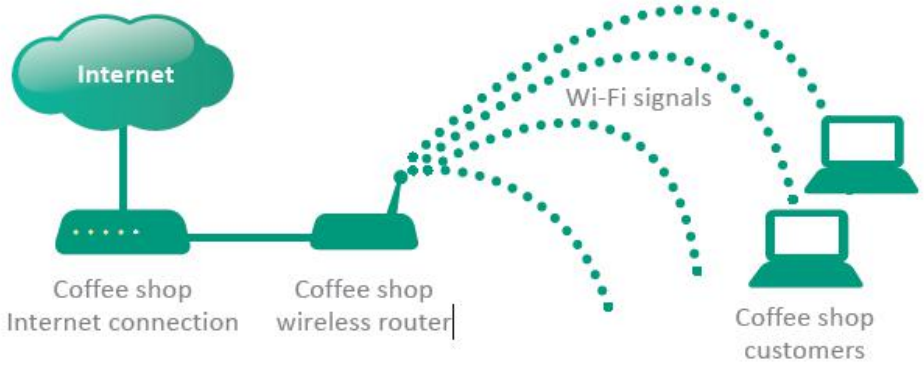
Mobile Broadband Service (3 of 3)

- Most of today's smartphones include a tethering feature that connects wirelessly with other digital devices
- Setting up tethering to create a mobile hotspot is easy, just remember though that data sent over the connection accumulates toward your monthly data usage total



Wi-Fi Hotspots (1 of 3)

- A Wi-Fi hotspot is a wireless local area network that offers Internet access to the public
- The network has an Internet connection and device called an access point that broadcasts Wi-Fi signals within a range of about 150 feet



Wi-Fi Hotspots (2 of 3)

- Low: Browsing. When using a Wi-Fi hotspot for simple browsing activities such as checking sports scores, reading Google news, and looking for directions, your security risk is fairly low if your computer's antivirus software is up to date.
- Low: Using secure sites. Your security risk is low when you are accessing secured Web sites that have addresses beginning with HTTPS. These secured sites, which are used for activities such as online banking, accessing medical records, and making credit card purchases, encrypt the data that you enter to keep it safe from eavesdroppers.

Wi-Fi Hotspots (3 of 3)

- MED: File sharing. Eavesdroppers might be able to access the files on your computer if you have file sharing turned on. When using public networks, you should turn file sharing off. You can do so manually if your operating system does not offer that option when you connected.
- HIGH: Using unsecured sites. When you log in to unsecured sites while using public Wi-Fi hotspots, a wireless eavesdropper could potentially snag your user ID and password information, then use it later to access your accounts. Logging in to your Webmail account, for example, could be risky if your user ID and password are transmitted over an unsecured connection.

Section D: Local Area Networks

- LAN Basics
- Ethernet
- Wi-Fi
- Set Up Your Own Network
- Network Monitoring
- IoT Networks

Section D: Objectives (1 of 2)

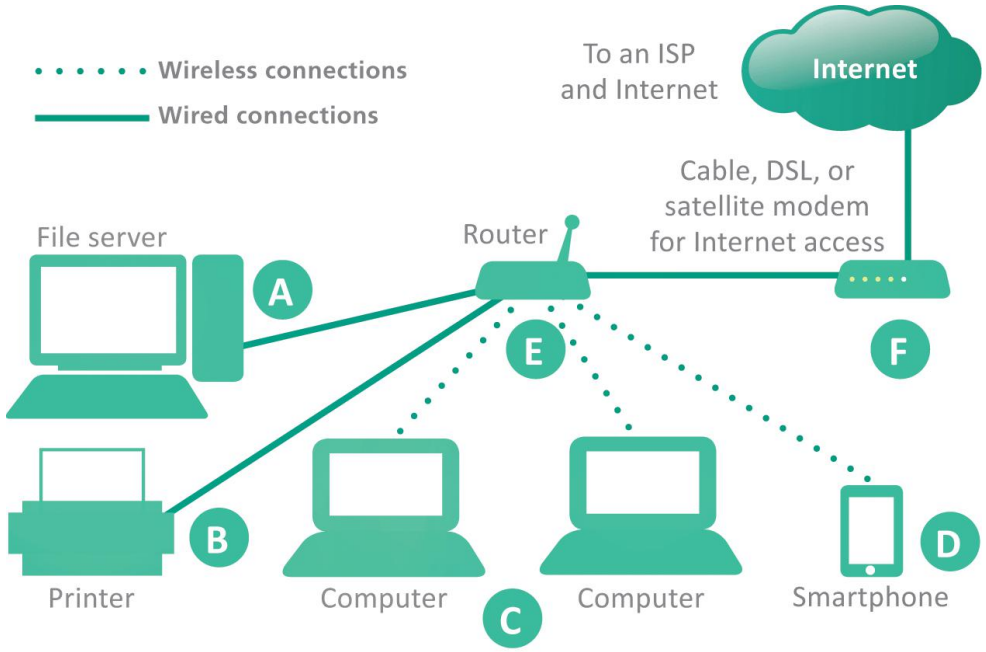
- Diagram the components and connection in a typical home LAN
- Explain the roles of MAC addresses and IP addresses in local area networks
- List five advantages of Ethernet wired network standards
- Explain the pros and cons of wireless mesh networks as compared to centralized wireless networks
- Compare the speeds and ranges of Ethernet and Wi-Fi

Section D: Objectives (2 of 2)

- List five steps for securely configuring a wireless router
- State the purpose of an SSID
- List four types of wireless encryption
- Provide two example scenarios for using RFID tags and NFC tags
- List three low-power wireless standards used for IoT networks
- Evaluate potential security exposure for data that is collected by IoT networks

LAN Basics (1 of 2)

- Local area networks are often referred to as LANs
- They are designed to provide connectivity for devices within a limited area, typically within the premises of a home, office building, business, or school



The plan for your network hinges on a centralized router that supports wired and wireless connections.

LAN Basics (2 of 2)

- LANs can be classified by their protocols; Ethernet and Wi-Fi are the two most popular
- The Windows OS provides a tool for setting up a LAN called a **homegroup**; this makes it easy to share files among local computers, but does not provide Internet access
- Most LANs are set up using a router so that they have proper security and Internet access
- The circuitry that enables a device to access a LAN is called a **network interface controller** (NIC)
- NICs contain a **MAC address** (media access control address) used to identify devices on LANs

Ethernet (1 of 4)

- Ethernet is a wired network technology that is defined by IEEE 802.3 standards
- Ethernet's success is attributable to several factors
  - **Easy** – it's easy to understand, implement, manage, and maintain
  - **Secure** – the wired connections in an Ethernet LAN are more secure than wireless LAN technologies
  - **Inexpensive** – as a nonproprietary technology, Ethernet equipment is available from a variety of vendors; market competition keeps prices low

Ethernet (2 of 4)

- **Flexible** – current Ethernet standards allow extensive flexibility in network configurations
- **Compatible** – Ethernet is compatible with Wi-Fi wireless technology; it's easy to mix wired and wireless devices on a single network

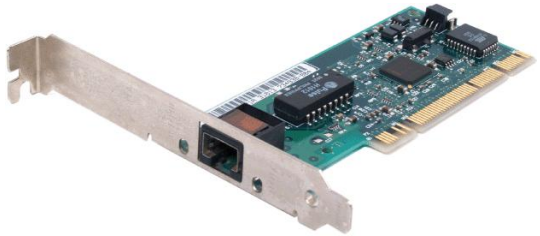
Ethernet (3 of 4)

- Ethernet was originally a bus topology in which computers were all strung along a cable like birds on a power line
- Today's Ethernet LANs are usually arranged in a star topology with computers wired to central switching circuitry that is incorporated in modern routers
- Data sent from a computer on the network is transmitted to the router, which then sends the data to the destination device

Ethernet (4 of 4)

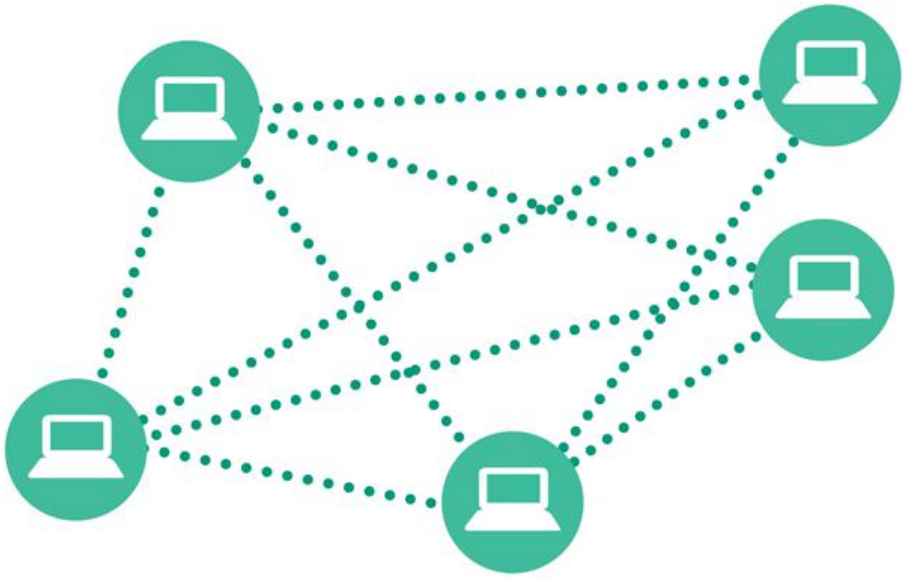
- Many computers have a built-in Ethernet port located on the system case; the port looks very similar to an oversized telephone jack
- If you want a wired network connection but your computer has no Ethernet port, you can purchase and install an Ethernet adapter (also called an Ethernet card)

Ethernet adapter for USB port



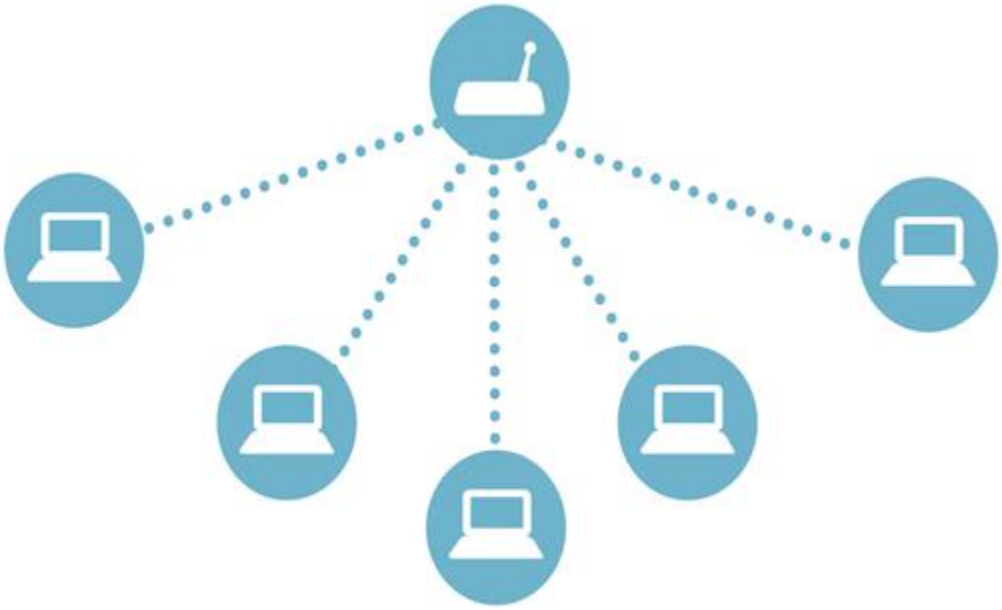
Ethernet adapter for expansion slot

Wi-Fi (1 of 2)



Wireless ad-hoc networks are conceptually simple but provide few security safeguards. This type of connection is best limited to occasional use when you want to temporarily connect two computers to share a few files.

Wi-Fi (2 of 2)



The most common wireless network technology uses a centralized device to handle data that travels from one device to another.

Set Up Your Own Network (1 of 2)

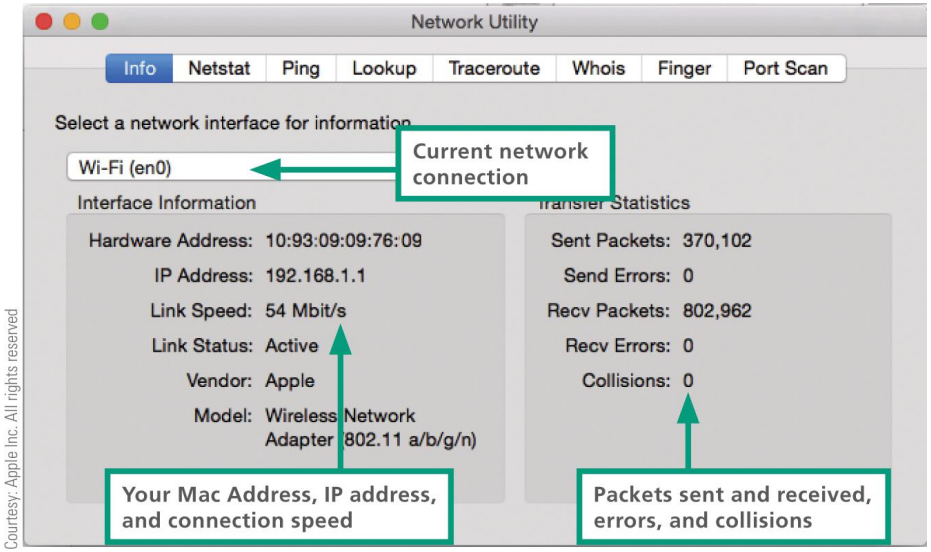
- Having your own network is great, but LANs can be a security risk
- Here's how to set up your own safe and secure LAN:
  - Plug in the router and connect it to your Internet modem
  - Configure the router
  - Connect wired and wireless devices
  - Change the router password
  - Create an **SSID** (service set identifier); this will be the name of your wireless network

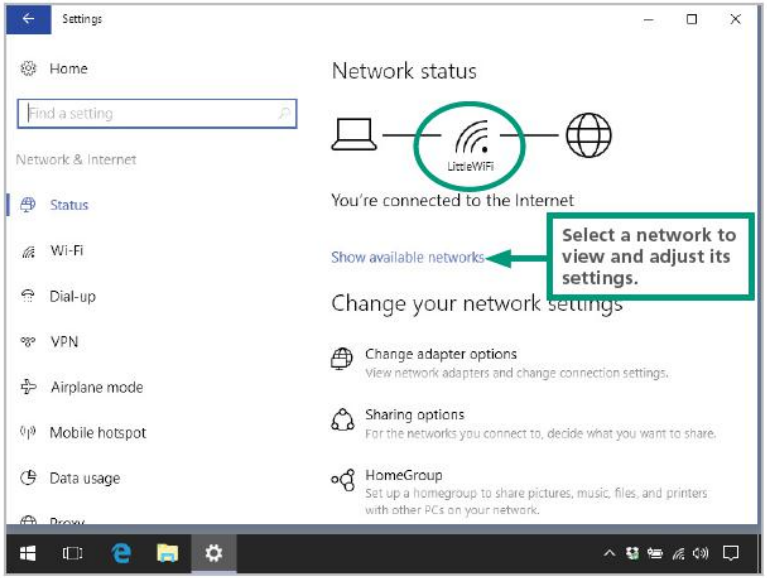
Set Up Your Own Network (2 of 2)

- Activate **wireless encryption** to scramble and unscramble data
  - **WEP** (wired equivalent privacy) is the oldest and weakest wireless encryption protocol
  - **WPA** (Wi-Fi Protected Access) and its cousins, WPA2 and PSK, offer more security
- Create a **wireless encryption key** (a network security key or password)
- Configure the **Guest Network** (a second network on your LAN's router)
- Activate **DHCP** (assigns addresses to each device that joins your network)

Network Monitoring

- When your network has stopped sending and receiving packets, you might be able to correct the problem by turning off your router and Internet modem, waiting a few seconds, and then turning them on again





IoT Networks (1 of 2)

- The Internet of Things (IoT) connects active sensors and passive tags to communications networks, making it easy to remotely monitor places and things
- Wi-Fi is fairly power hungry, so it's not an optimal IoT technology
- Existing wireless technologies such as **RFID** and **NFC** offer potential solutions
- Additional low-power short-range technologies developed specifically for IoT networks include **Bluetooth Smart**, **ZigBee**, and **Z-Wave**

IoT Networks (2 of 2)

- A sensor, such as a thermometer or heart rate monitor, actively collects data
- A tag contains passive data; an RFID tag in a passport, for example, contains personal data, such as the name and birth date that are stored on the tag, which is read electronically
- An NFC tag might be attached to merchandise, so that you can tap it with your cell phone to see its price and specifications

Section E: File Sharing

- File Sharing Basics
- Accessing LAN Files
- Sharing Your Files
- Internet-based Sharing
- Torrents

Section E: Objectives (1 of 2)

- List seven factors that control your ability to share files
- State the name of the utilities you use to view a list of files on Macs and on Windows
- Explain the purpose of network discovery
- List three precautions you can take when working with shared files
- Define the three types of permissions that can be assigned to shared files

Section E: Objectives (2 of 2)

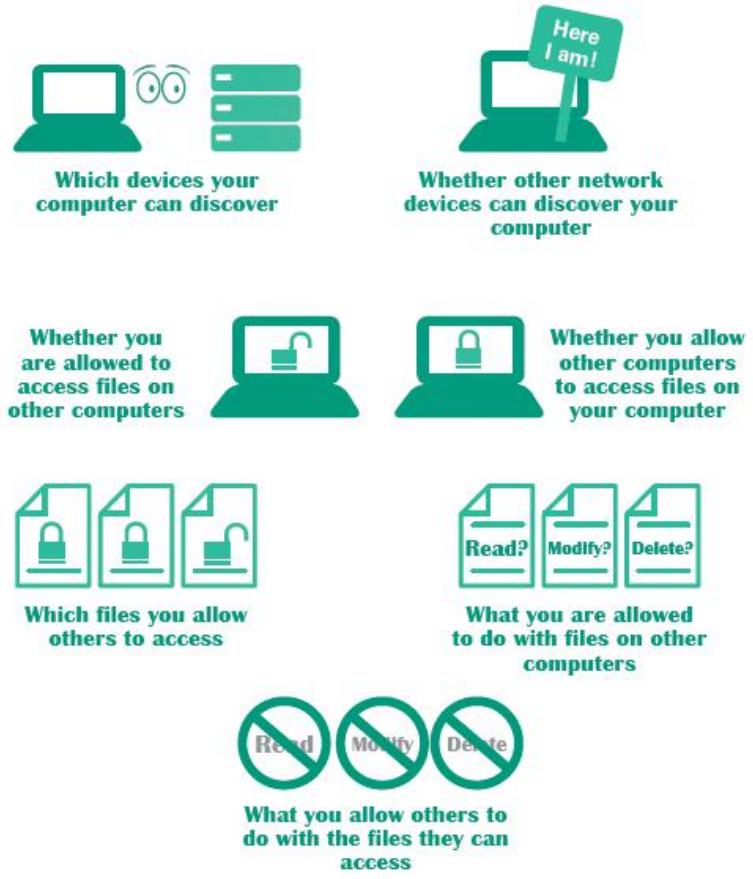
- Describe at least two situations in which FTP would be a useful technology
- List two factors that have a negative effect on files stored in the cloud
- Draw a diagram that explains how torrents work
- Discuss the legal issues that pertain to file sharing technologies, such as Napster and BitTorrent

File Sharing Basics (1 of 2)

- **File sharing** allows files containing documents, photos, music, and more to be accessed from computers other than the one on which they are stored
- Sharing can take place within a LAN or across multiple networks, including the Internet

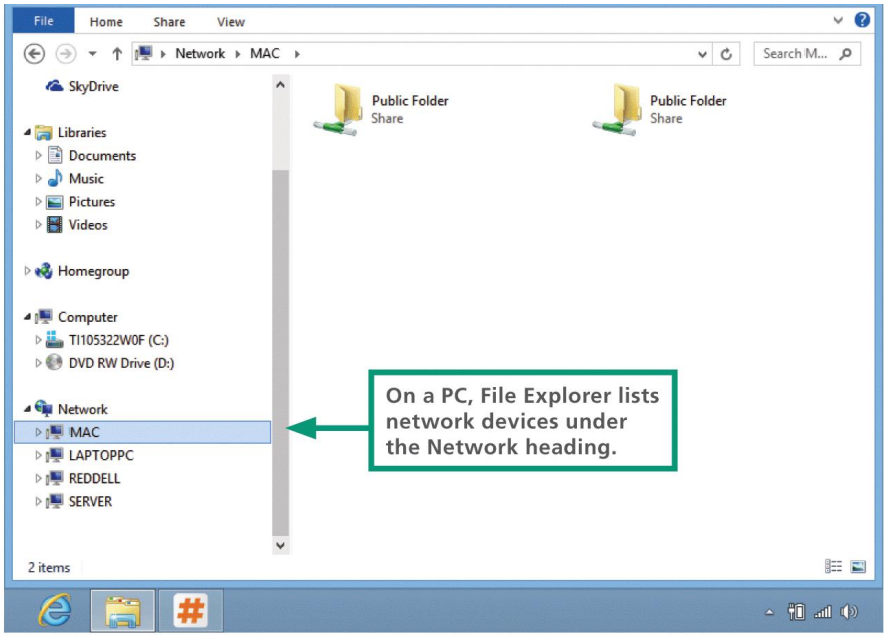
File Sharing Basics (2 of 2)

- Your ability to share files with other devices on a network depends on several factors

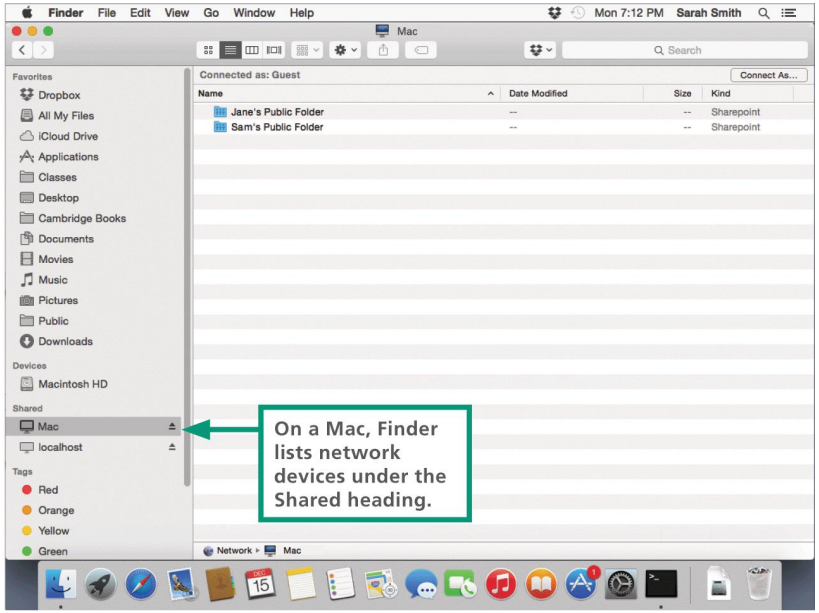


Accessing LAN Files (1 of 2)

- To see a list of devices on your network, you can use your OS's file management utility, such or as Finder of File Explorer



Windows PC File Explorer



Courtesy: Apple Inc. All rights reserved

Mac OS X Finder

Accessing LAN Files (2 of 2)

- The network utilities provided by operating systems automatically detect other devices when network discovery is turned on
- **Network discovery** is a setting that affects whether your computer can see other devices on a network, and whether your computer can be seen by others; it works in different ways on different devices
  - Mobile devices – the OS may not offer a way to see other devices on a network
  - Macs – Macos devices have no user-modifiable network discovery settings; offers file sharing settings instead
  - Windows – Some OSs offer network discovery setting that allows users to turn it off or on

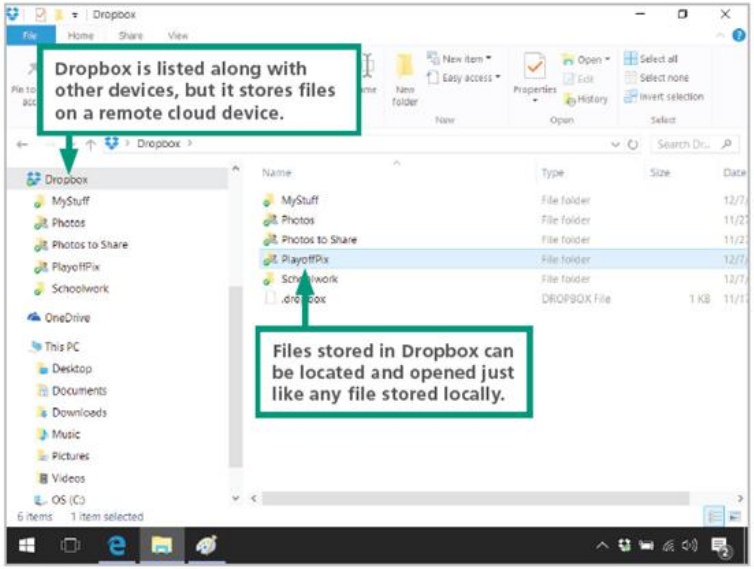
Sharing Your Files

- Permissions specify how shared files can be used
  - Read and write permission – (full control) allows access for opening, viewing, modifying, and deleting files
  - Read permission – allows authorized people to open a file and view it, but not modify or delete it
  - Write-only permission – works like drop box, allowing people to put files in one of your folders, but not open, copy, or change any files you have stored there

Internet-Based Sharing (1 of 3)

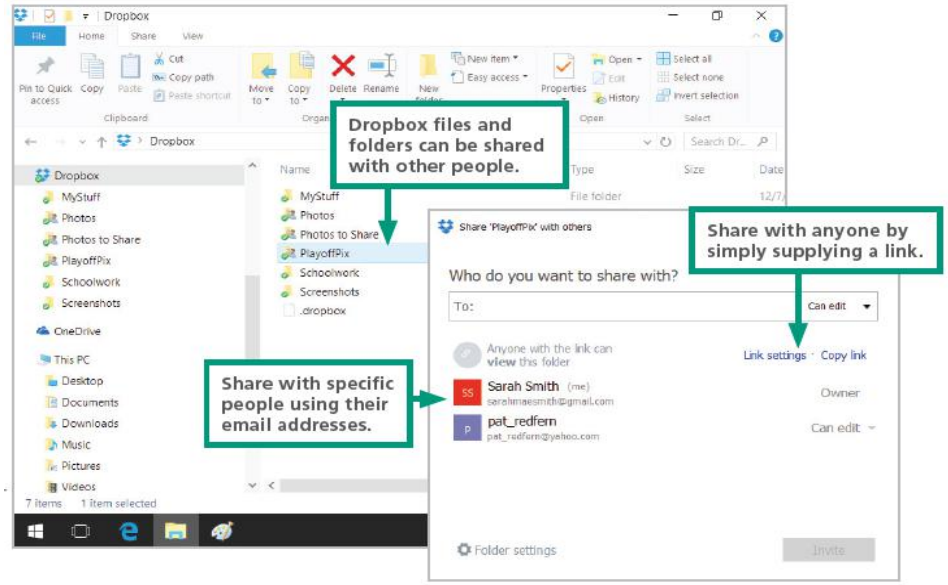
- **FTP** (File Transfer Protocol) provides a way to transfer files from one computer to another over any TCP/IP network, such as a LAN or the Internet
- You can access FTP servers with FTP client software, such as FileZilla, or with a browser
- Dropbox and similar **file hosting services** store files in the cloud

Internet-Based Sharing (2 of 3)



Dropbox can be accessed from the Dropbox.com Web site, or it can be installed as an app on a local device. On a local device, files and folders stored in your Dropbox can be accessed just as if they were stored locally.

Internet-Based Sharing (3 of 3)



Torrents (1 of 4)

- The concept of sharing files over the Internet, that started in the 1990s, spurred development of sophisticated, distributed protocols such as BitTorrent
- **BitTorrent** is a file sharing protocol that distributes the role of a file server across a collection of dispersed computers
- A BitTorrent network is designed to reduce the bandwidth bottleneck that occurs when many people attempt to download the same very large file, such as a feature-length film, application software or an interactive 3-D computer game

Torrents (2 of 4)

- **How a BitTorrent works**:
  - A BitTorrent network server breaks a movie file into pieces and begins to download those pieces to the first computer that requested the movie
  - As more computers request the file, they become part of a “swarm” that uses peer-to-peer technology to exchange movie segments with each other
  - After the server has downloaded all the segments to the swarm, its job is complete and it can service other requests

Torrents (3 of 4)

- The swarm continues to exchange movie segments until every computer in the swarm has the entire movie

Torrents (4 of 4)

- Every user who downloads from a torrent is automatically uploading to other users.