# CSC 170 - Introduction to Computers and Their Applications

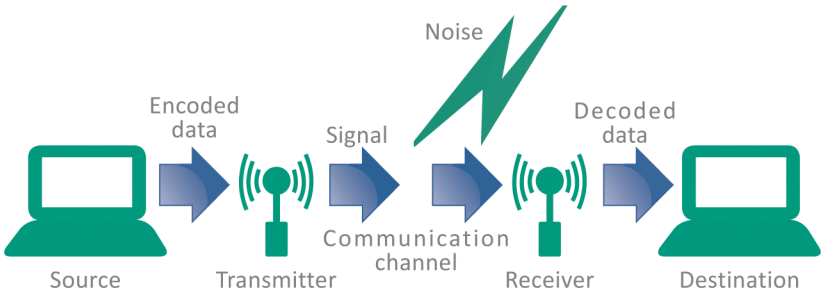
Lecture 6 – An Introduction to Networks

## Communication Systems

- 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

- 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

- Networks can be classified according to their size and geographic scope:
  - **PAN** (Personal Area Network)
  - LAN (Local Area Networks)
  - WAN (Wide Area Networks)

## Personal Area Networks

- 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.

## Local Area Networks

- 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.

## Wide Area Networks

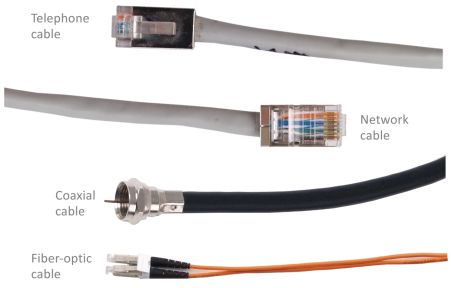
- WANs cover a large geographical area and usually consist of several smaller networks, which might use different computer platforms and network technologies.
  - The Internet is the world's largest WAN.
  - Other public WANs include telephone systems, cable television systems, and satellite based communication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

## Communications Channels

- 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.

## Communications Channels

- 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.




## Communications Channels

- 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.

## Communications Channels

- 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.

## Communications Channels

- 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.

## Communications Channels

- 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.

## Communications Channels

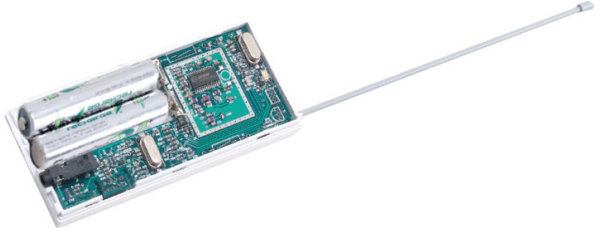
- Cables are unsightly, tend to get tangled, and collect dust. Running cables through ceilings, walls, and floors can be challenging. Cables can also carry electrical surges that have the potential to damage network equipment.

## Communications Channels

- 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.

## Communications Channels

- 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.



## Communications Channels

- 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.

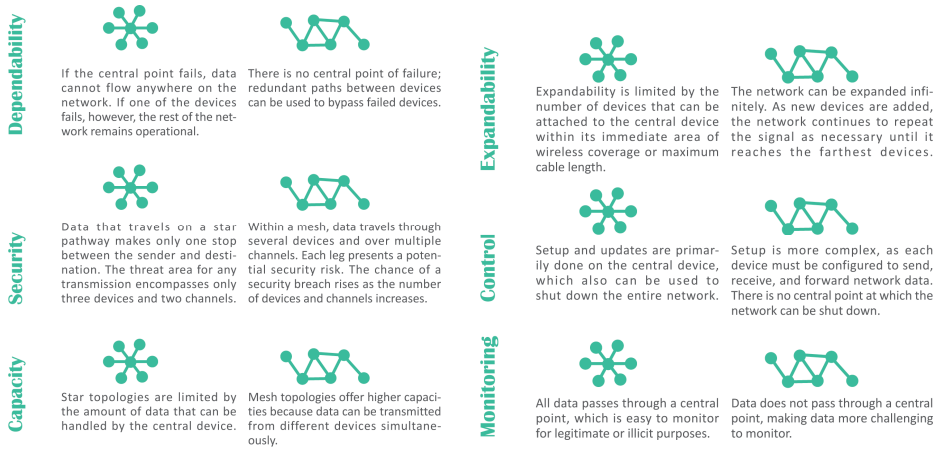
## Communications Channels

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

# Communications Channels

- ***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

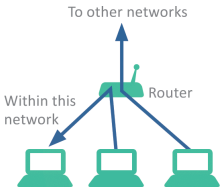


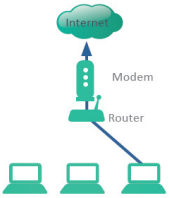
# Network Nodes

- 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

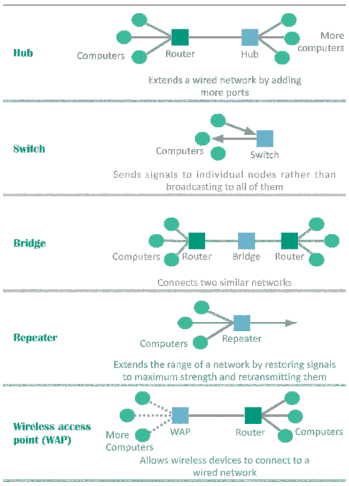
- A ***router*** is a device that controls the flow of data within a network and also acts as a gateway to pass data from one network to another.
- A ***modem*** contains circuitry that converts the data-carrying signals from a digital device to signals that can travel over various communications channels.



# Network Nodes

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




# Communications Protocols

- 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.

# Communications Protocols

- 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.