

# Network Media

COMP476

## Goals

- Be able to calculate how long it will take to transfer data across a network.
- Be able to select an appropriate network media for a given situation.

## Calculating Hints

- Watch your bits and bytes
  - Make sure all units are compatible
  - There are 8 bits per byte or octet
- If your units do not work, the answer is wrong
- Be mindful of significant digits

## Moving Energy

- Communications requires moving energy (usually light or electricity)
- The speed of light is the maximum speed data can travel.
  - $3 \times 10^8$  m/sec in a vacuum (299,792,458 m/s)
  - $2 \times 10^8$  m/sec in glass
  - $2 \times 10^8$  m/sec electrical propagation in a copper wire

## Time to Send Information

- There are two components that determine how long it takes to send X bytes.
- **Transmission time** – the time required to send the bits out the transmitter. Different systems can send bits at different rates.
- **Propagation delay** – the time required for the signal to flow down the wire or through the air.

## Total Transmission Time

- Time to transmit X bytes D meters through wire or fiber with a transmission rate of B.

$$\text{Time} = \frac{X\text{bytes} * 8\text{bits/byte}}{B\text{bits/sec}} + \frac{Dm}{2.0 * 10^8 m/s}$$

## Example

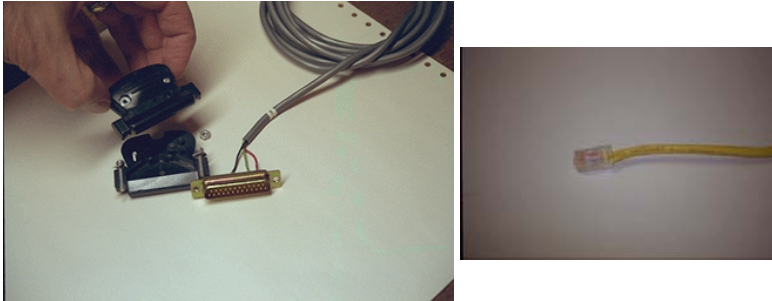
- How long does it take to send a 30 KB file over a 10 Mbit/sec line to a server located 20 meters down the hall?

## Considerations for media

- cost
- ease of installation and repair
- attenuation
- interference
- security
- ability to cross public land
- mobility

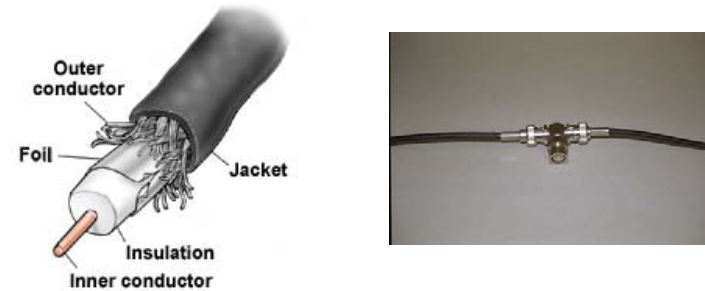
## Twisted Pair

- Pairs of copper wires twisted together.
- Used for telephones and Ethernet



## Coax Cable

- Used for cable TV and older Ethernet



## Fiber Optics

- Data is transmitted as light through thin fibers of glass.
- There are two types of fiber: multimode and single mode.



## Infrared

- Used by TV remote controls



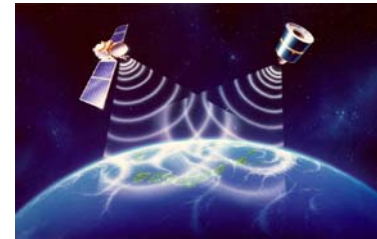
## Radio

- Long wave (low frequency) will bend around objects
- Short wave (high frequency) is more line of sight.



## Satellites

- Radio transmission to a geosynchronous satellite 36,000 km above the earth.



## Satellite Timing

- How long does it take to send a 125 KB file to another computer over a 1 GB/sec satellite link?
  - The other computer is about 72,000 Km (or 72 Mm) away

## Comparison

	twisted pair	coax	fiber	Infrared	long radio	short radio	satellite
cost	5	4	4	5	3	2	1
ease of installation / repair	5	4	3/1	5	3	2	1
attenuation	3	4	5	2	3	4	5
interference	3	4	5	3	1	2	2
security	3	4	5	2	1	2	1
ability to cross public land	1	1	1	2	5	5	5
mobility	1	1	1	4	5	3	5