Computer Communication Networks I

Dr. Himal A. Suraweera

Lecture 3

Properties of media and digital transmission systems

Transmission Media

Transmission medium is the physical path between transmitter and receiver.

• Repeaters or amplifiers may be used to extend the length of the medium.

• Communication of electromagnetic waves is guided or unguided.

- Guided media - waves are guided along a physical path (example: twisted pair, coaxial cable and optical fiber).

- Unguided media - means for transmitting but not guiding electromagnetic waves (e.g., the atmosphere and outer space).

Transmission media choices

- Twisted pair
- Coaxial cable
- Optical fiber
- Wireless communications

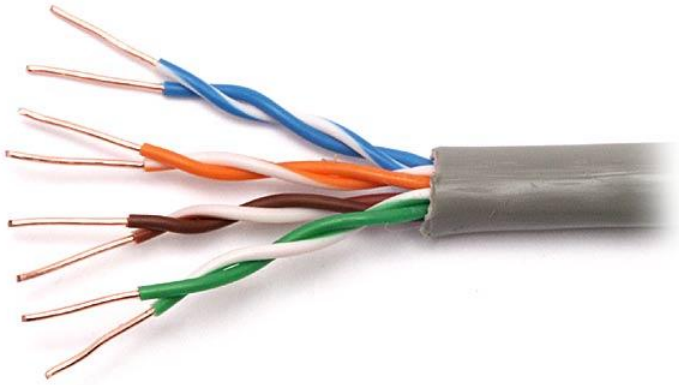
Twisted Pair

- Two insulated wires arranged in a spiral pattern (Copper or steel coated with copper)

- The signal is transmitted through one wire and a ground reference is transmitted in the other wire.
- Typically twisted pair is installed in building telephone wiring.

- Local loop connection to central telephone exchange is twisted pair.

- Limited in distance, bandwidth and data rate due to problems with attenuation, noise.



Twisted pair

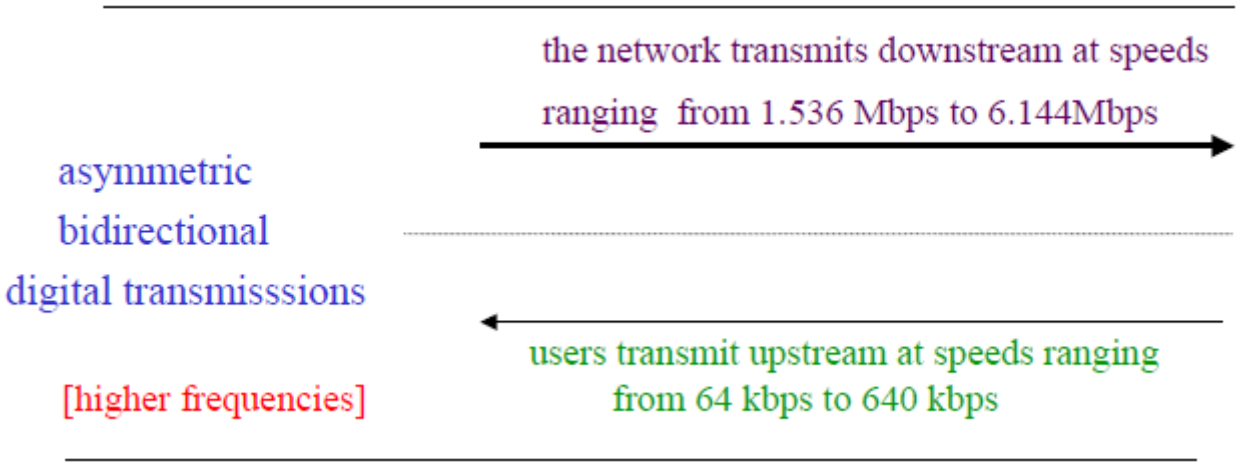
Digital Subscriber Line (DSL)

- Digital subscriber line (DSL, originally digital subscriber loop) is a family of technologies that provide Internet access by transmitting digital data over the wires of a local telephone network.

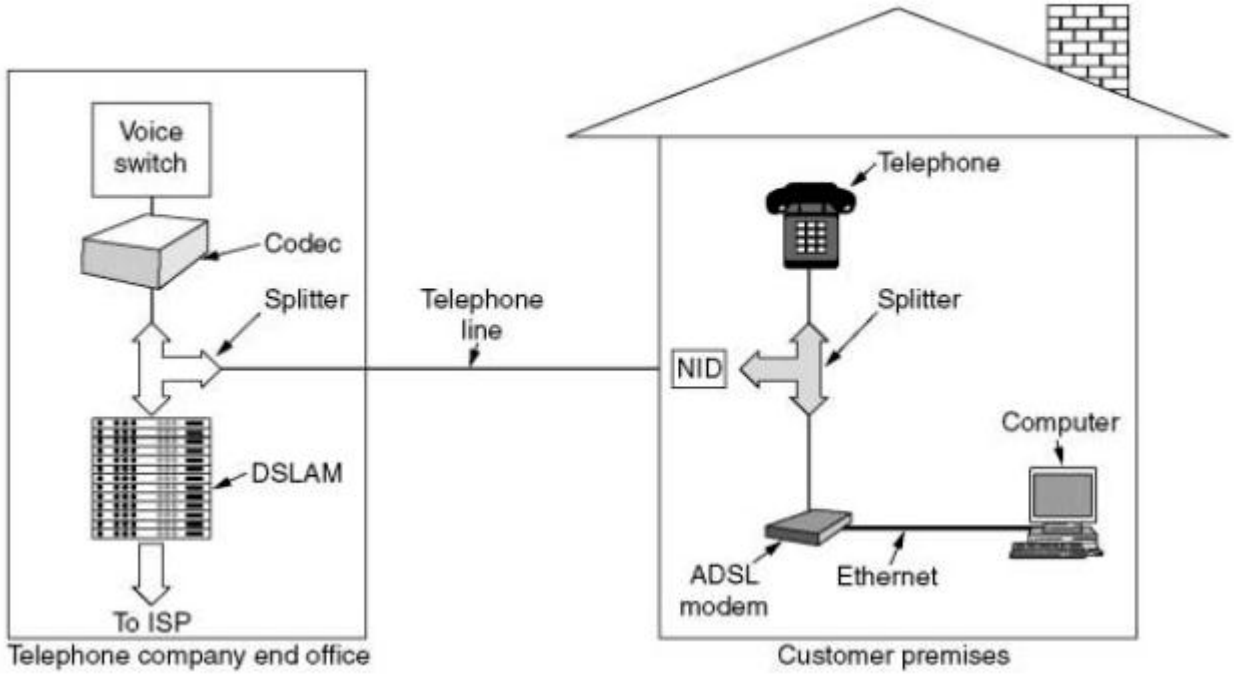
- Telephone companies originally transmitted within the 0 to 4 kHz range.

- Loading coils were added within the subscriber loop to provide a flatter transfer function to further improve voice transmission within the 3 kHz band while increasing attenuation at the higher frequencies.

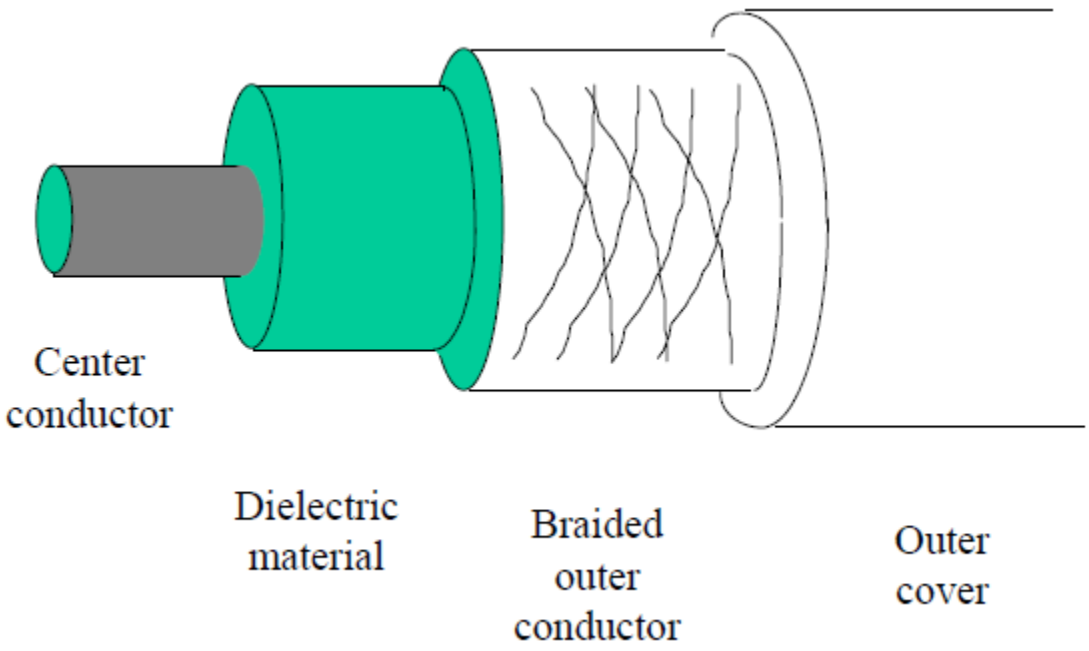
- ADSL (Asymmetric Digital Subscriber Line) - uses existing twisted pair lines to provide higher bit rates that are possible with unloaded twisted pairs (i.e., no loading coils on subscriber loop.)



Digital Subscriber Lines



Co-axial cable



- Two basic categories for co-axial cables used in LANs:
  - 50-ohm cable [baseband]
  - 75-ohm cable [broadband or single channel baseband]
- In general, coaxial cable has better noise immunity for higher frequencies than twisted pair.
- Coaxial cable provides much higher bandwidth than twisted pair.

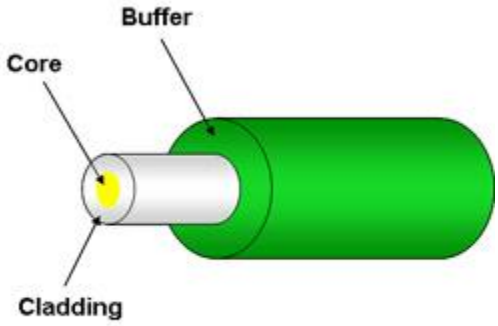
Optical Fiber

- Optical fiber is a thin flexible medium capable of conducting optical rays.
- Optical fiber consists of a very fine cylinder of glass (core) surrounded by concentric layers of glass (cladding).

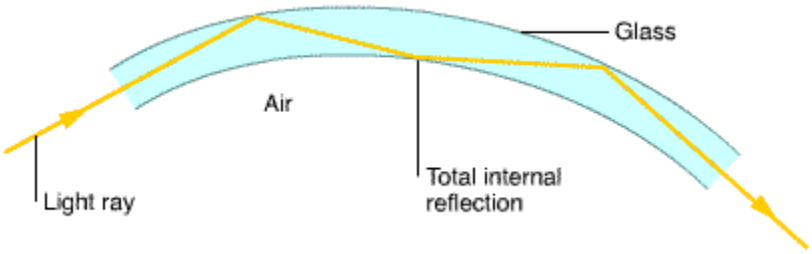
- A signal-encoded beam of light (a fluctuating beam) is transmitted by total internal reflection.

- Total internal reflection occurs in the core because it has a higher optical density (index of refraction) than the cladding.

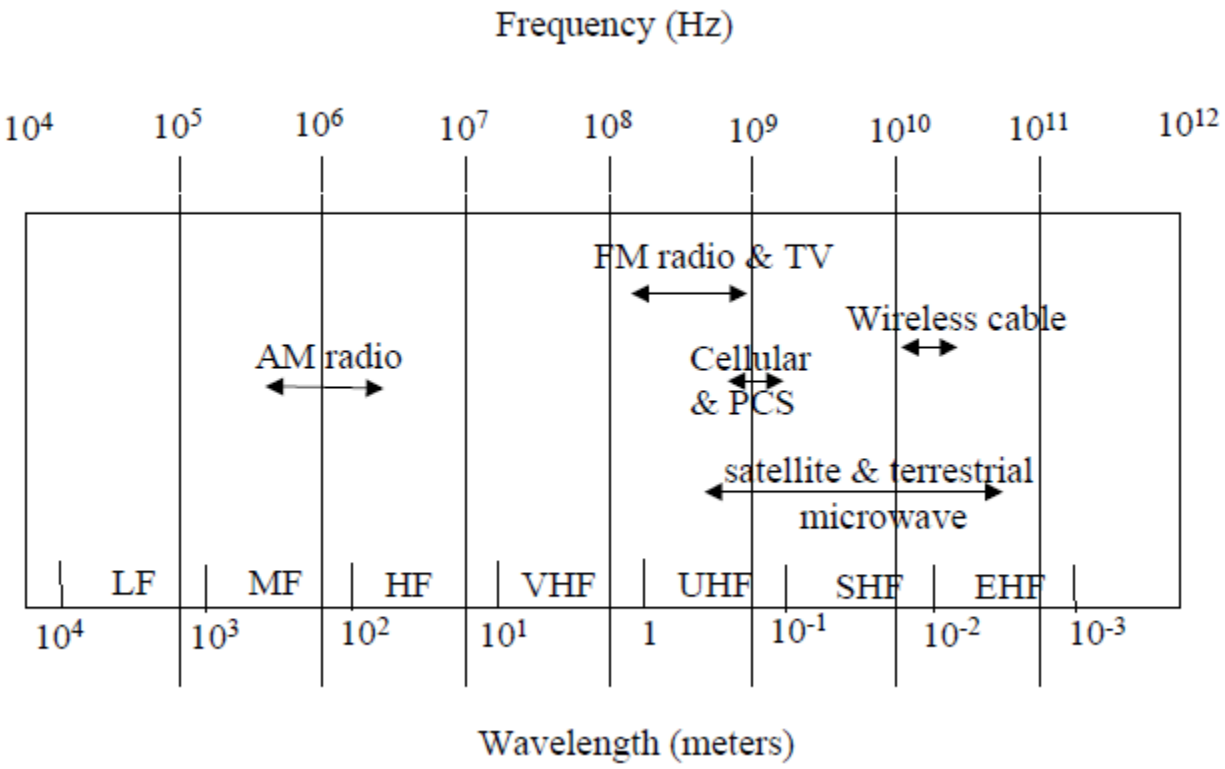
- Attenuation in the fiber can be kept low by controlling the impurities in the glass.

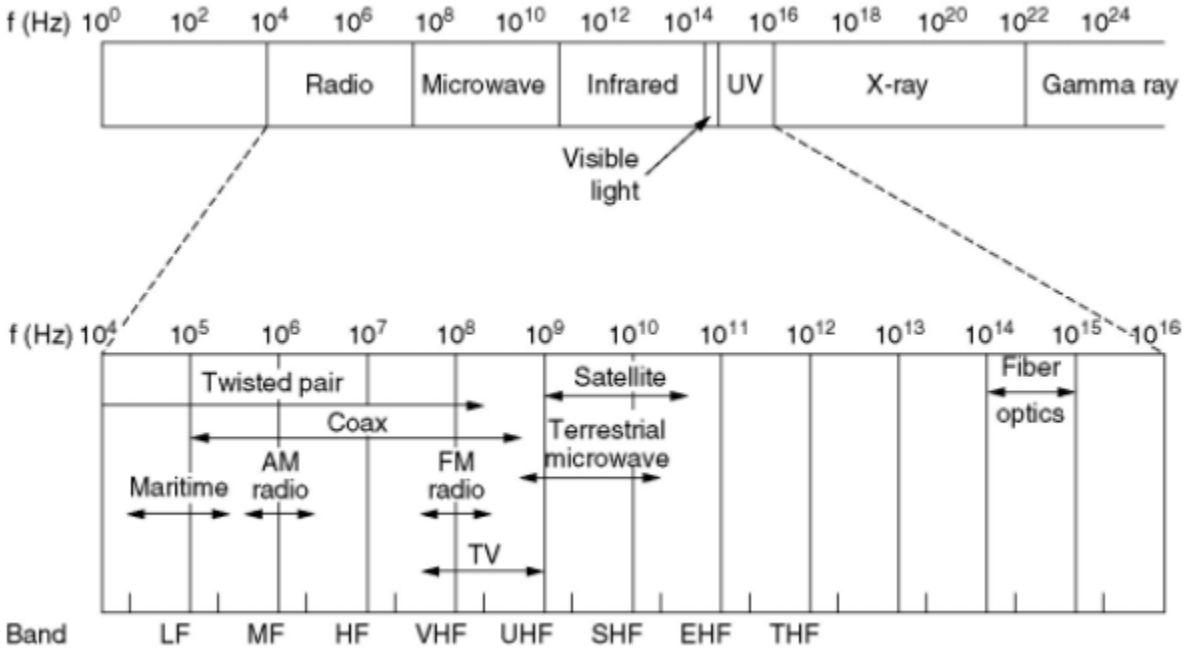


Optical Fibre



Electromagnetic spectrum





The electromagnetic spectrum and its use for communication systems

Wireless Local Area Networks

- An application of wireless communications is to provide high-speed communications among several computers located in close proximity.

- Wireless LANs have become popular in the home/commercial offices due to ease of installation

- Most modern WLANs are based on IEEE 802.11 standards (orthogonal frequency division multiplexing (OFDM), marketed under the Wi-Fi brand name.

- Wireless LANs operate in the 2.4 GHz and 5 GHz bands.

WLAN systems