CSE3151

COMPUTER NETWORKS

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PHYSICAL LAYER

- Transmission medium
- Switching
  - Circuit switching
  - Packet Switching

TRANSMISSION MEDIUM

- **Guided Transmission Medium**
  - Magnetic Media or removable media
  - Twisted Pair
  - Coaxial Cable
  - Fiber Optics
- **Unguided Transmission Medium (wireless transmission)**
  - Radio
  - Infrared
  - Ultrasound
  - …

TRANSMISSION MEDIUM

- MAGNETIC MEDIA OR REMOVABLE MEDIA
  - SSD
  - DVD
  - HDD – few TB
- TWISTED PAIR
  - UTP (Unshielded Twisted Pair)
  - Cat 6 – Gbps
  - Full Duplex
  - Half-Duplex
  - Simplex

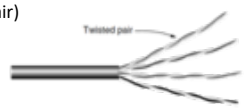
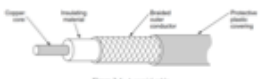


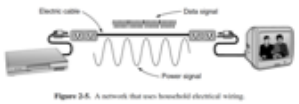
Figure 2-3. Category 5 UTP cable with four twisted pairs.

TRANSMISSION MEDIUM

- Coaxial Cable



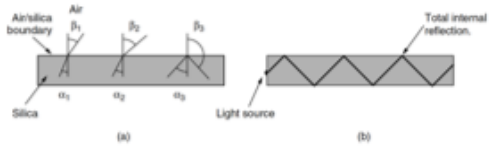
- Power Lines



❖ Some Issues
- Power 50-60 Hz &Data MHz range
- Switch on-off – data bounce
- Power Line works as Antenna

TRANSMISSION MEDIUM

- Fiber optics:
  - High speed communication medium
  - Up to 50,000 Gbps
  - Long Range
  - Using Light



Transmission Medium

- Multimode fiber.

- Single mode fiber…

  - available single-mode fibers can transmit data at 100 Gbps for 100 km without amplification

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Transmission Medium

- Fiber Cable:

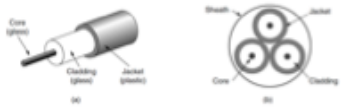

Figure 2-8. (a) Side view of a single fiber. (b) End view of a sheath with three fibers.

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Fiber vs Copper Media

- **Bandwidth**
  - Fiber it can handle much higher bandwidths than copper. This alone would
- **Repeater distance**
  - 50 km vs 5 km
- **Environmental issue**
  - Fiber …not being affected by power surges, electromagnetic interference, or power failures.
- **Resale value**
  - Fiber has no/less resale value but copper has
- **Weight**
- **Maintenance Cost**
- **Security**

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Transmission Medium

- Unguided – Wireless transmission Medium
- When electrons move, they create electromagnetic waves that can propagate through space (even in a vacuum).
- The speed, usually called the speed of light, c, is approximately 3 x 10^8m/sec, or about 1 foot (30 cm) per nanosecond.
- In copper or fiber slows down 2/3 of this value.

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Transmission Medium

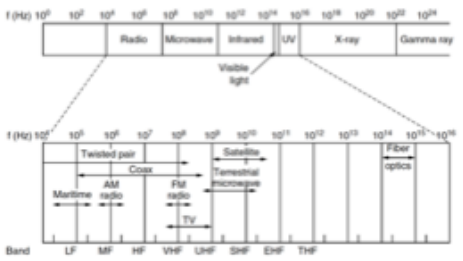

Figure 2-10. The electromagnetic spectrum and its uses for communication.

Incredibly, Astonishingly, and Prodigiously High Frequency (IHF, AHF, and PHF)

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Radio Transmission

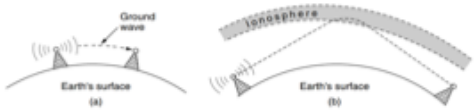

Figure 2-12. (a) In the VLF, LF, and MF bands, radio waves follow the curvature of the earth. (b) In the HF band, they bounce off the ionosphere.

- a layer of charged particles circling the earth at a height of **100 to 500 km**, are refracted by it and sent back to earth,

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MICROWAVE TRANSMISSION

- Above 100 MHz, the waves travel in nearly straight lines and can therefore be narrowly focused
- The **distance between repeaters** goes up very roughly with the square root of the tower height.
  - For 100-meter-high towers, repeaters can be 80 km apart
- microwaves do not pass through buildings.
- Antennas needed to be aligned

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INFRARED TRANSMISSION

- Widely used for short-range communication.
- The remote controls used for televisions, VCRs, and stereos all use infrared communication
- **major drawback:** they do not pass through solid object

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LIGHT TRANSMISSION

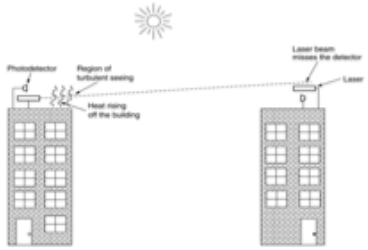

Figure 2-14. Convection currents can interfere with laser communication systems. A bidirectional system with two lasers is pictured here.

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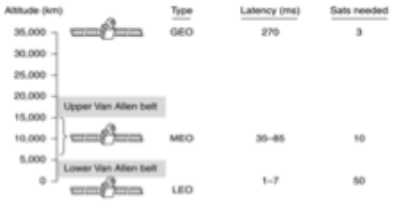
COMMUNICATION SATELLITE



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COMMUNICATION SATELLITE

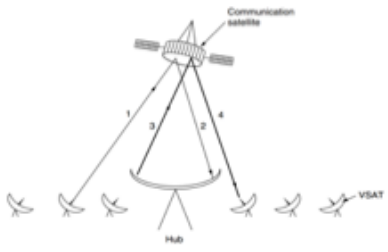

Figure 2-17. VSATs using a hub.

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COMMUNICATION SATELLITE

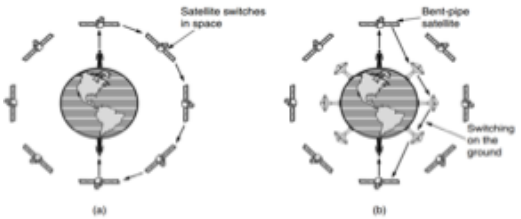

Figure 2-19. (a) Relaying in space. (b) Relaying on the ground.

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