

CSE3151 COMPUTER NETWORKS



DR. ASIF ZAMAN
ASSOCIATE PROFESSOR, CSE, RU

March 13, 2018

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 3×10^8 m/sec, or about 1 foot (30 cm) per nanosecond.
- In copper or fiber slows down 2/3 of this value.

2 of 13

TRANSMISSION MEDIUM

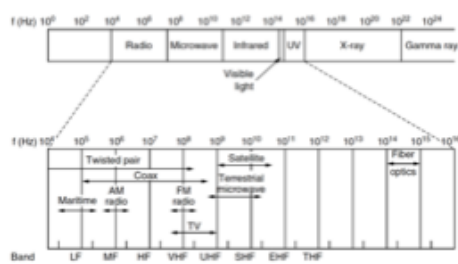


Figure 2-16. The electromagnetic spectrum and its uses for communication.

Incredibly, Astonishingly, and Prodigiously High Frequency (IHF, AHF, and PHF) 3 of 13

RADIO TRANSMISSION

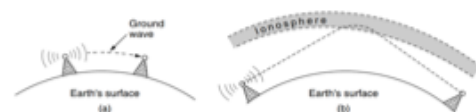


Figure 2-12. (a) In the VLF, LF, and MF bands, radio waves follow the curvature of the earth. (b) In the HF band, they bounce off the ionosphere.

- 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,

4 of 13

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

5 of 13

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

6 of 13

LIGHT TRANSMISSION

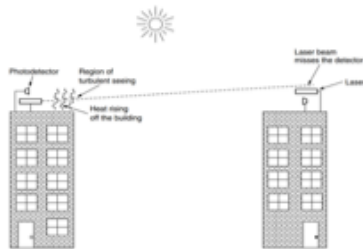


Figure 2-14. Convection currents can interfere with laser communication systems. A bidirectional system with two lasers is pictured here.

7 of 13

COMMUNICATION SATELLITE

Altitude (km)	Type	Latency (ms)	Sats needed
35,000	GEO	270	3
10,000 - 20,000	MEO	30-65	10
0 - 10,000	LEO	1-7	50

- GEO (Geostationary Earth Orbit) satellites
- MEO (Medium-Earth Orbit)
- LEO (Low-Earth Orbit)

8 of 13

COMMUNICATION SATELLITE

VSATs (Very Small Aperture Terminals) (Abramson, 2000).

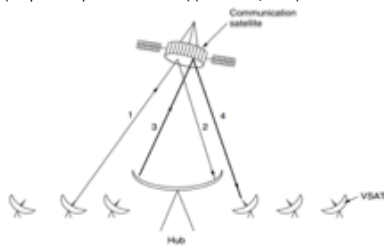


Figure 2-47. VSATs using a hub.

9 of 13

COMMUNICATION SATELLITE

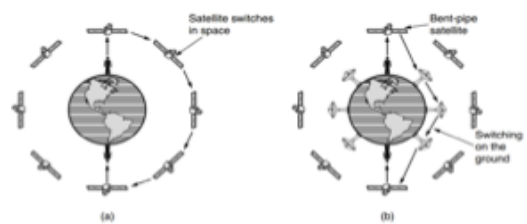


Figure 2-19. (a) Relaying in space. (b) Relaying on the ground.

10 of 13

SWITCHING

- Switching is the practice of directing a signal or data element toward a particular hardware destination.
- Two types:
 - Circuit switching
 - Packet Switching

11 of 13

SWITCHING

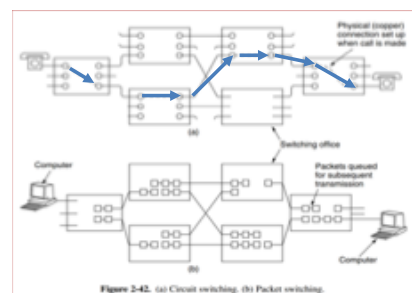


Figure 2-42. (a) Circuit switching. (b) Packet switching.

12 of 13

SWITCHING

- SWITCHING COMPARISON
 - Circuit switching vs Packet Switching

13 of 13