



*Your complimentary
use period has ended.
Thank you for using
PDF Complete.*

[Click Here to upgrade to
Unlimited Pages and Expanded Features](#)

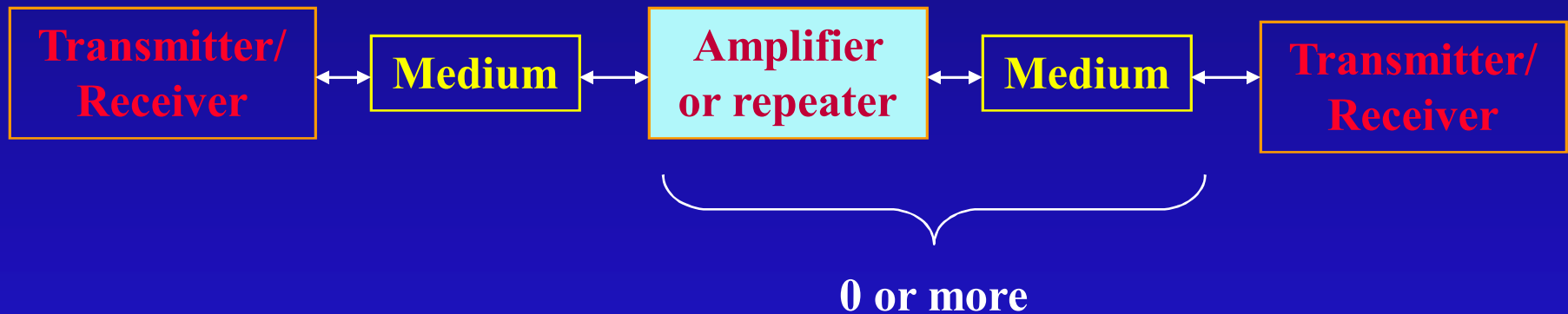
Transmission Media

Sadiq M. Sait

Transmission Medium

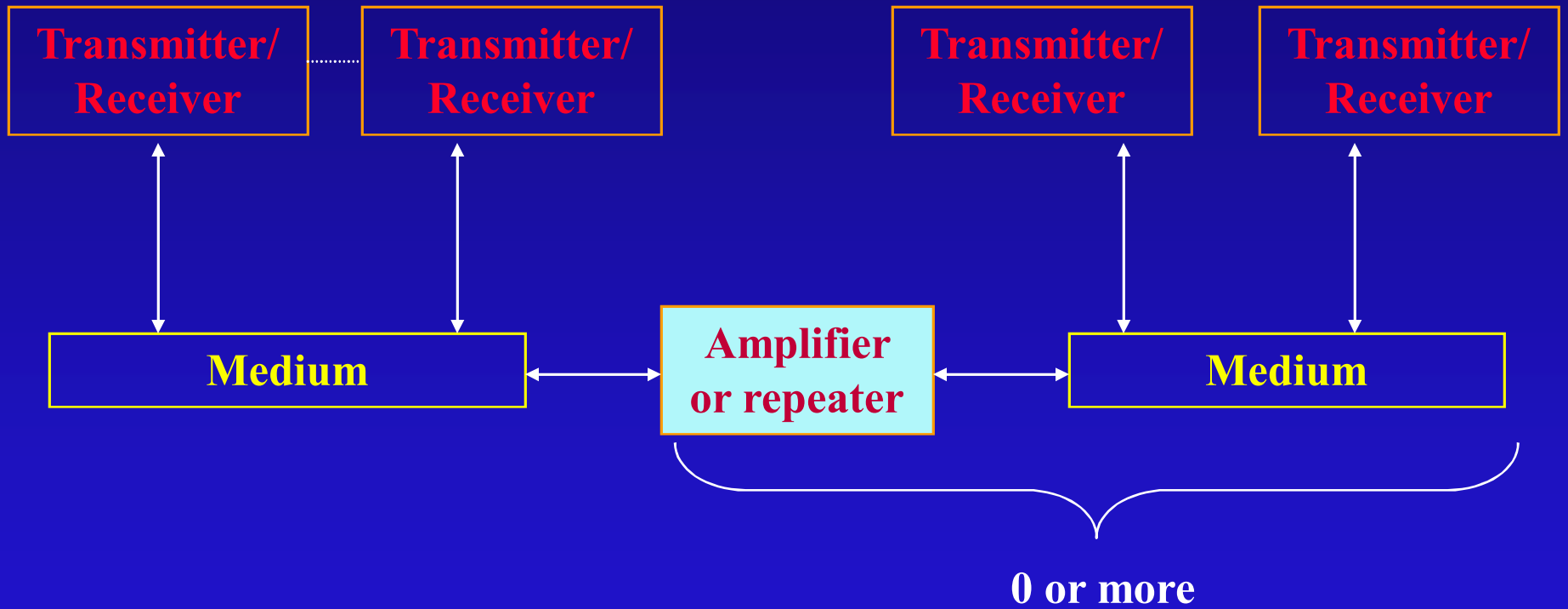
- Guided (P-T-P, Multipoint)
 - » Twisted Pair
 - » Coaxial Cable
 - » Optical Fiber
- Unguided
 - » Air
 - » Vacuum
 - » Seawater
- Simplex (Signal One direction)
- Half Duplex (1 Station at a time)
- Full-Duplex (2 Stations TX & RX)
 - ** ITU Simplex = ANSI HD
 - Duplex = ANSI HD

Added Transmission Configurations



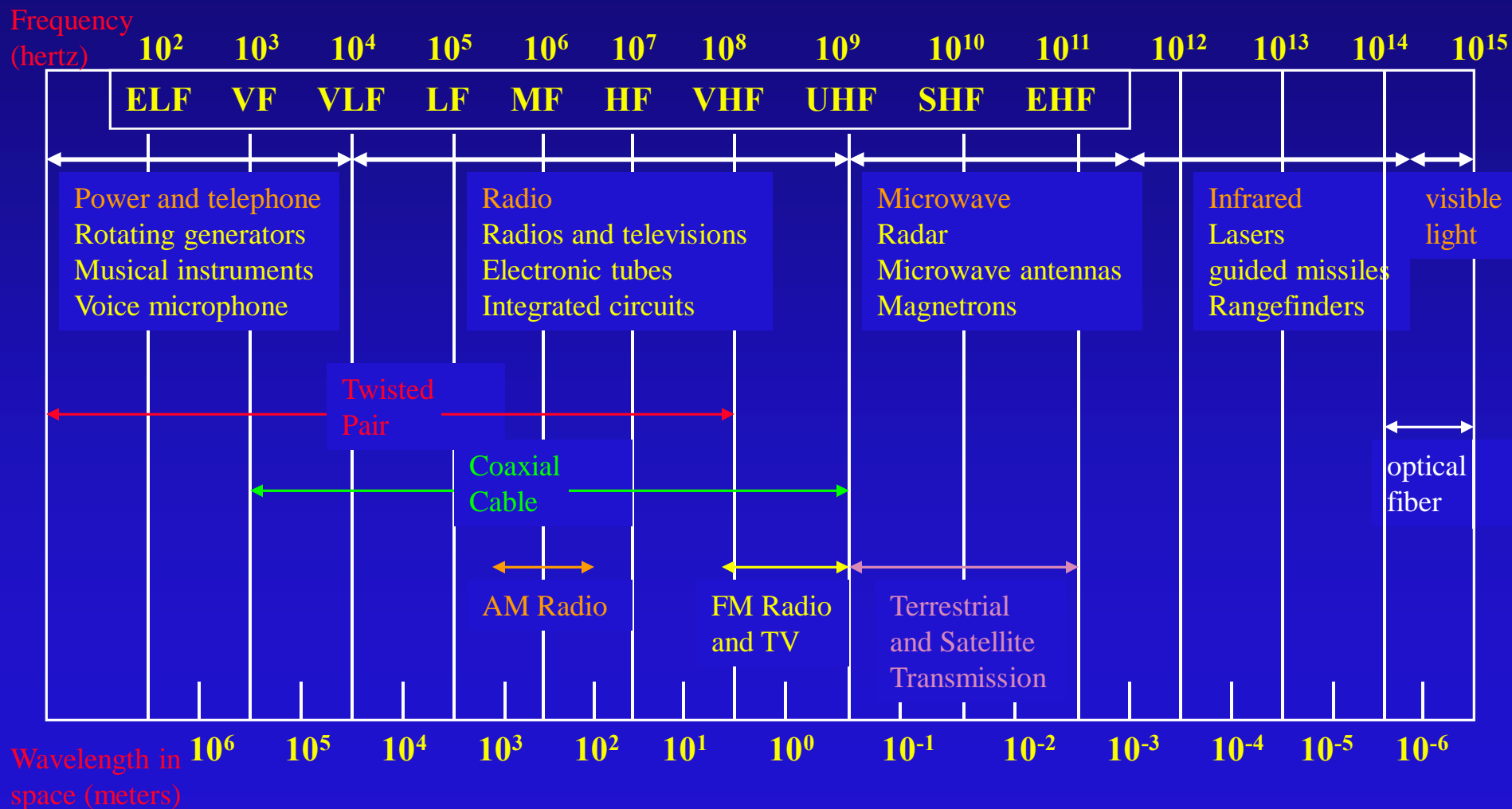
Point-to-Point

Added Transmission Configurations



Multipoint

Magnetic spectrum for telecommunications



Point-to-point transmission characteristics of guided media

Transmission medium	Total data rate	Bandwidth	Repeater spacing
Twisted pair	4 Mbps	3 MHz	2 to 10 km
Coaxial Cable	500 Mbps	350 MHz	1 to 10 km
Optical fiber	2 Gbps	2 GHz	10 to 100 km

- The medium itself is more important than other factors in determining transmission limitations
- For unguided media, range of frequencies is of more importance.

Twisted-Pair Cables

- The least expensive media (unshielded)
- Capable of handling up to 100 Mbps
- May be used with voice and data
 - » Private Automatic Branch eXchange (PABX)
- Unshielded Twisted Pair (UTP)
 - » Data capacity grades defined by EIA/TIA 568
 - » Categories that can be used for data
 - . Category 3 to 10 Mbps
 - . Category 4 to 20 Mbps
 - . Category 5 to 100 Mbps
 - » Characteristic impedance of 100 to 120 ohms

Twisted-Pair Cables (cont.)

- Shielded Twisted Pair (STP)
 - » Primarily used by IBM
 - » Should be better than UTP
 - . Shields prevent interference from outside signals
 - . Also prevent interference to outside signals
- Token Ring environments may include a mix of UTP and STP cabling

Coaxial Cables

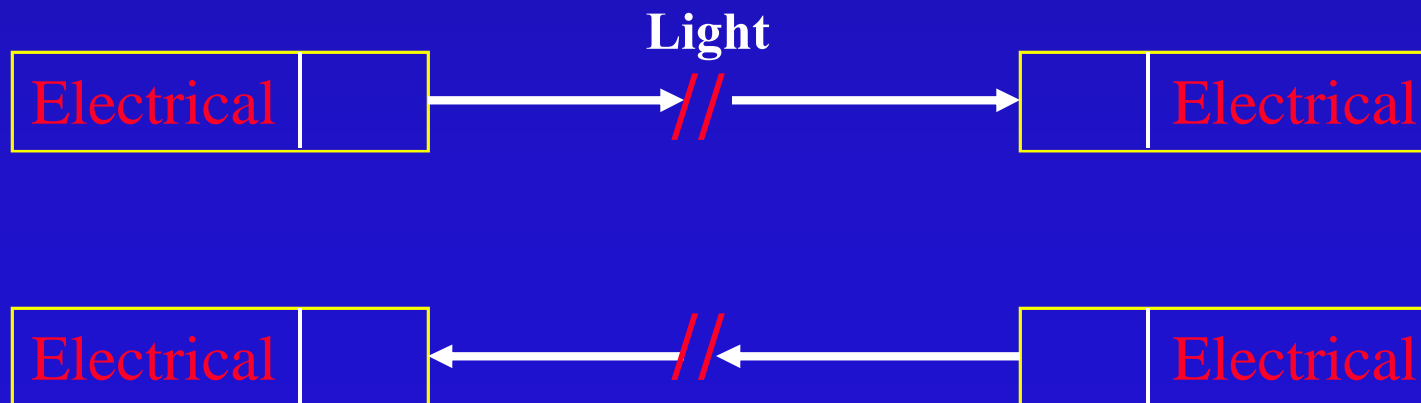
- Very high cable bandwidth
 - » Up to 400 MHz
- Low noise (low bit error rate)
- Used in a variety of networking applications
 - » In IBM networks (e.g., cluster controllers)
 - » In Ethernets (10Base2 and 10 Base5)
 - » In cable television (used in broadband LANs)
- Termination resistance (impedance)
 - » 50 ohms for Ethernet cables
 - » 75 ohms for broadband LANs
 - » 93 ohms in some other cables

Baluns

- Baluns provide a BALanced-to-Unbalanced interconnect
- Balanced cables typically are twisted pairs
- Unbalanced cables typically are coaxial cables
- Baluns are often used to allow twisted pairs to replace more expensive coaxial cables
- Impedance match
- Connector match

Fiber-Optic Cables

- Extremely high data rates
 - » More than 100 Mbps for LAN uses
 - » More than 10 times that for telephone company links
- Usage is typically in unidirectional links, with one fiber in each direction
- Convert electrical to light and back to electrical



Fiber-Optic Cables

- Very small size
 - » Hair-like fiber-optic strand (125-micron outer diameter)
 - » Light-conducting core size of typically 62.5 micron
 - » Called 62.5/125-micron+fiber
 - » Other sizes are also used
 - May use 50/125 (especially in Europe)
- Many different types of connectors are available
- LAN usage is usually multimode+, graded index+
 - » Multimode supports different light modes, which may travel at different speeds
 - » Graded index resists pulse spreading due to different transmission speeds

Fiber-Optic Cables

- Approximately the same cost as good-quality coaxial cable
 - » Optical interfaces are the most expensive component
 - » Transmission by Light Emitting Diodes (LEDs) or laser diodes
 - » Reception by Positive Intrinsic Negative (PIN) diodes or avalanche diodes
- Best available communications media
 - » Excellent electrical noise immunity
 - » Difficult to tap (security)
 - » Lightweight
 - » Small size (frequency fits in existing cable trays)

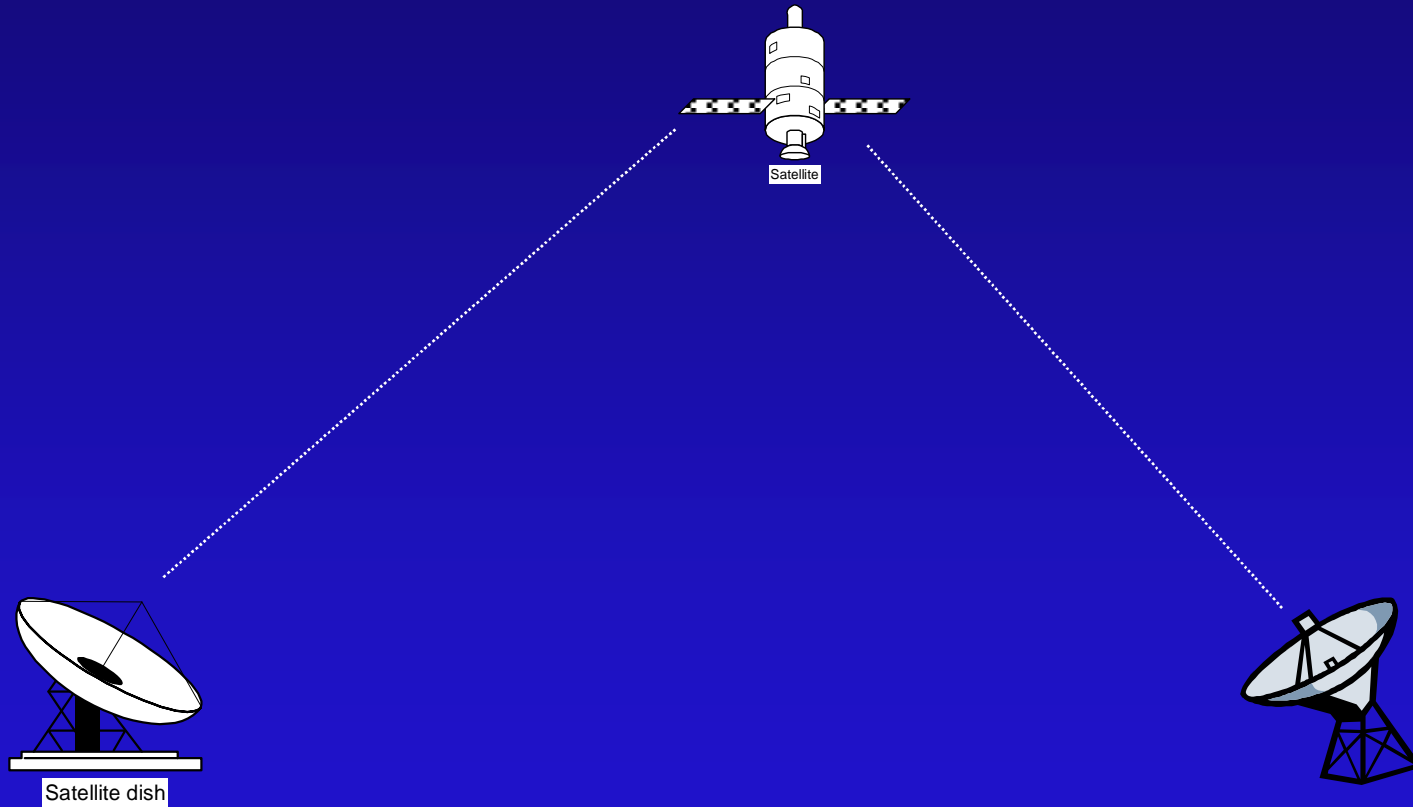
Wireless Communications

- There are several different forms of wireless communications
- Point-to-point microwave
 - » Requires line of sight between antennas
 - » Antennas are often mounted on towers
 - » Requires a license
- Cellular
 - » Uses the frequency range assigned to the cellular telephone
 - » Shares the frequency range with other transmissions

Wireless Communications

- Wireless LANs
 - » Have been used for some time (e.g., in grocery store inventory scanners)
 - » Spread spectrum technology
 - . Standards are being developed (IEEE 802.11)

Satellite Links



Satellite Links

- Potential of
 - » Multiples of 56-to-64 Kbps data rates
 - » Low cost
 - » Large area of reception (broadcast)
 - » Distance-independent charging
- Large propagation delay
 - » 1-nsec/foot (3-nsec/meter) delay (speed of light)
 - » 250-msec one-way delay for geosynchronous orbit
- Moderate-cost earth stations are possible