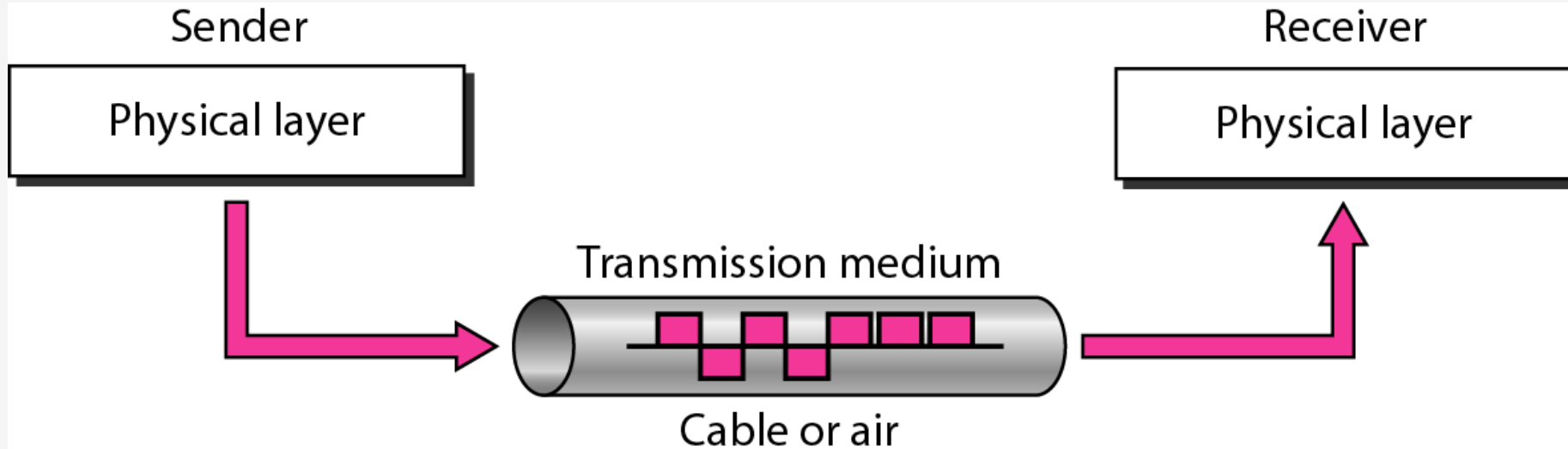


NETWORK TRANSMISSION MEDIA

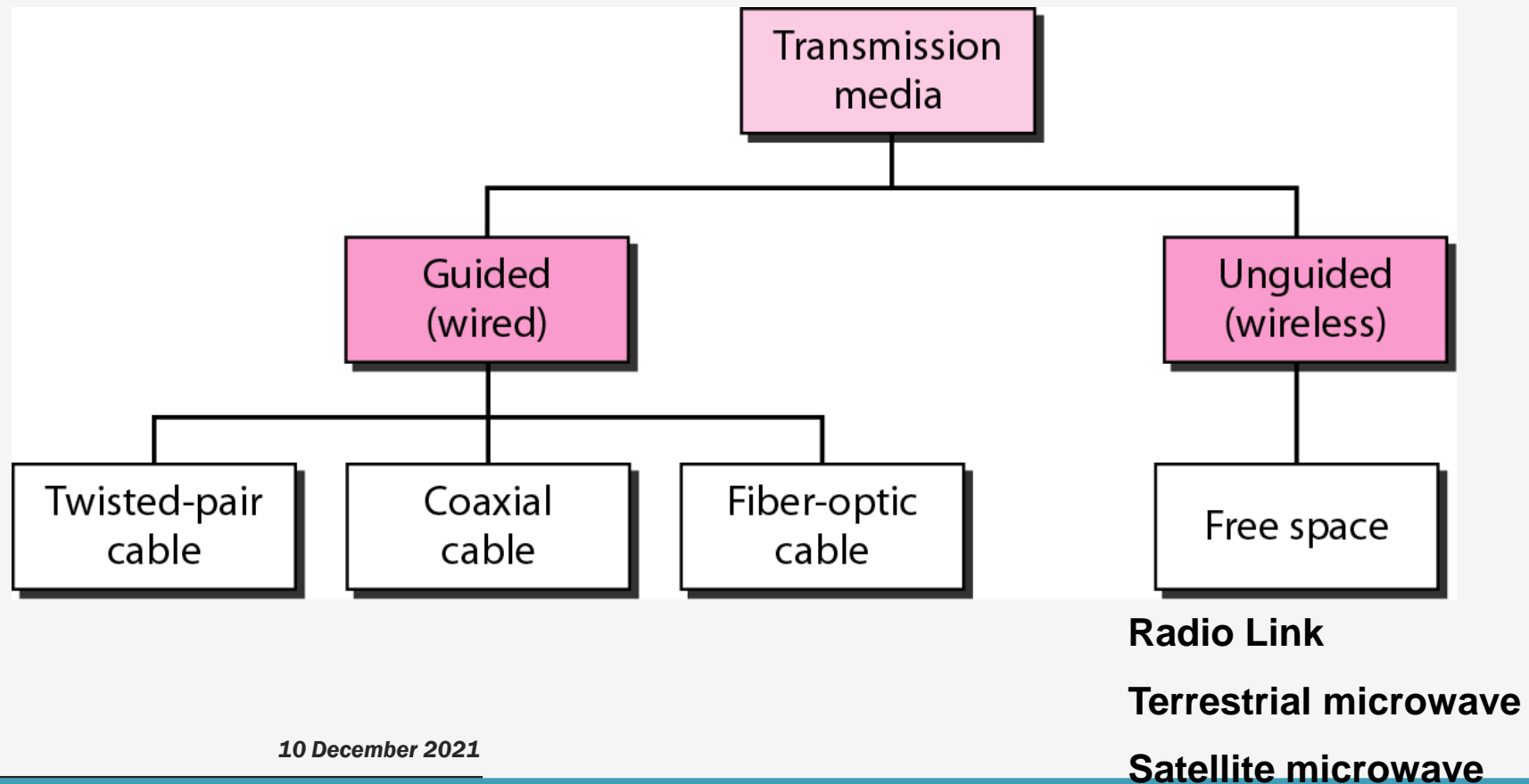
Transmission medium and physical layer



Carries information in its raw form Electrical, Optical or radio signals.

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Classes of transmission media



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NETWORK MEDIA

Media choices

- Twisted-pair cable Coaxial cable
- Fiber-optic cable Wireless

Situational elements include:

- Cost Distance limitations Number of nodes.

How do you plan a network for your Organisation ?

- Which is appropriate ? Peer – Peer or Server based
- What are the issues related to ?
- Which topology is right for you ?
- What is the media for network ?

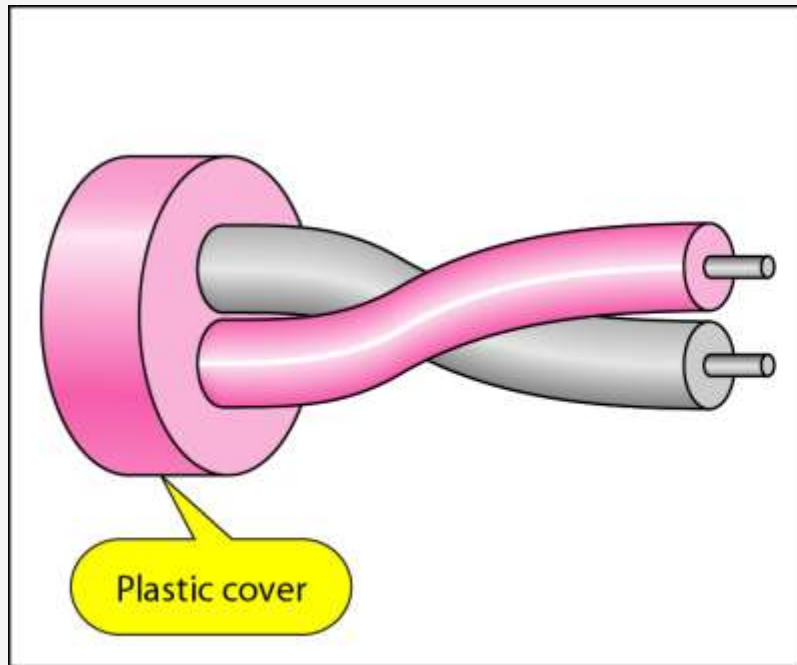
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Twisted-pair cable

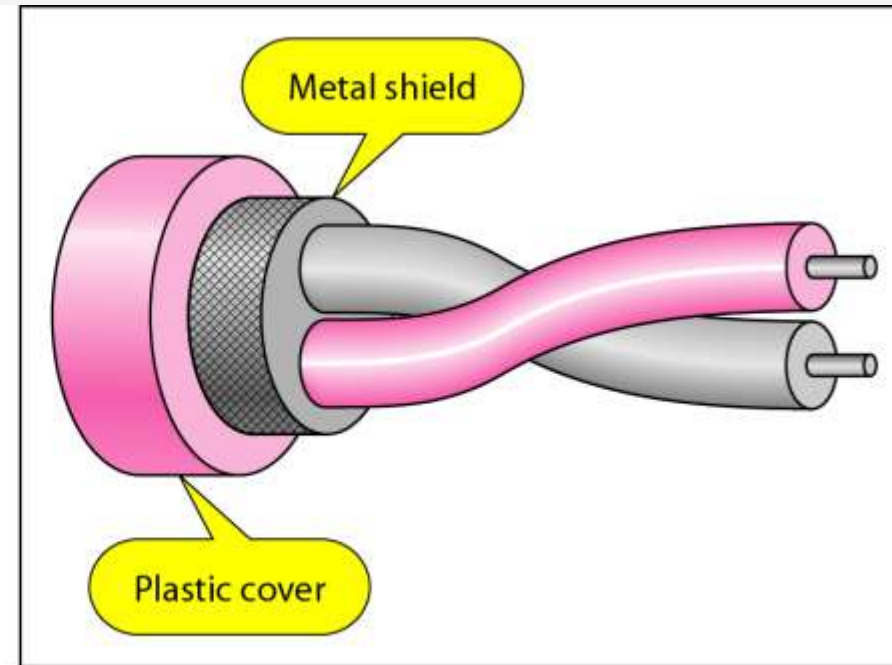


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UTP and STP cables



a. UTP



b. STP

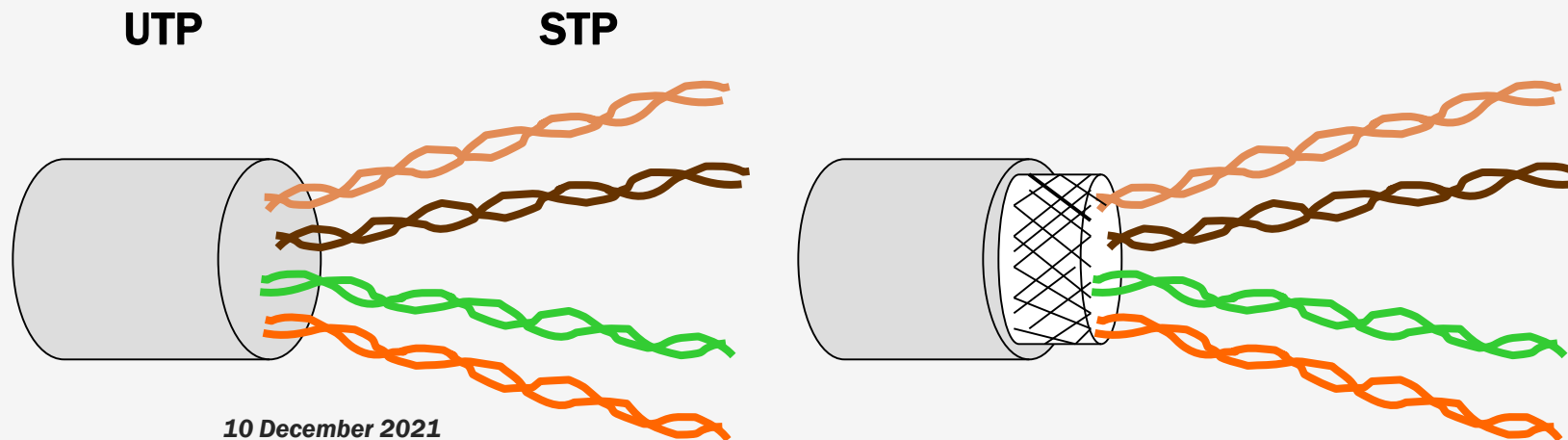
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Categories of unshielded twisted-pair cables

<i>Category</i>	<i>Specification</i>	<i>Data Rate (Mbps)</i>	<i>Use</i>
1	Unshielded twisted-pair used in telephone	< 0.1	Telephone
2	Unshielded twisted-pair originally used in T-lines	2	T-1 lines
3	Improved CAT 2 used in LANs	10	LANs
4	Improved CAT 3 used in Token Ring networks	20	LANs
5	Cable wire is normally 24 AWG with a jacket and outside sheath	100	LANs
5E	An extension to category 5 that includes extra features to minimize the crosstalk and electromagnetic interference	125	LANs
6	A new category with matched components coming from the same manufacturer. The cable must be tested at a 200-Mbps data rate.	200	LANs
7	Sometimes called SSTP (shielded screen twisted-pair). Each pair is individually wrapped in a helical metallic foil followed by a metallic foil shield in addition to the outside sheath. The shield decreases the effect of crosstalk and increases the data rate.	600	LANs

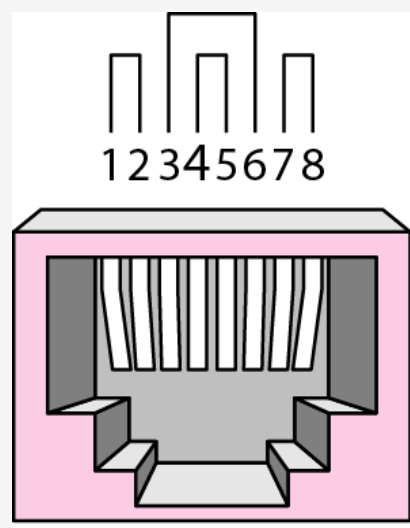
4-PAIR TWISTED PAIR CABLE

- Two insulated wires arranged in a spiral
- +A number of pairs can be bundled together
- +Shielded or Unshielded
- +More susceptible to noise (especially unshielded variety)
- +Economical compared to coaxial cable
- +Used in Ethernet token ring, telephony.

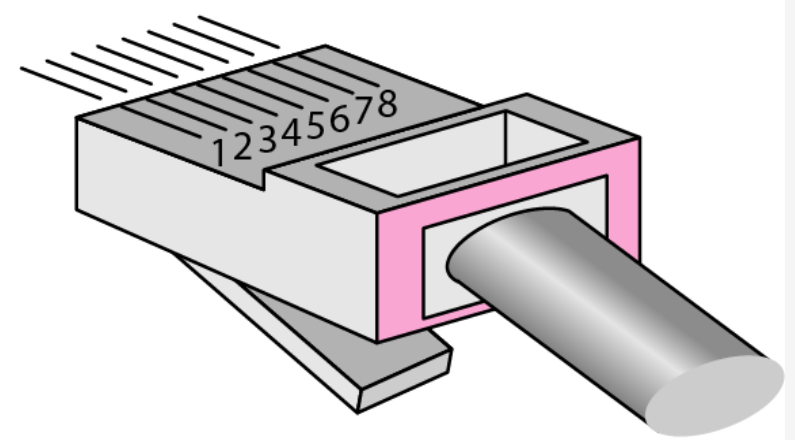


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UTP connector



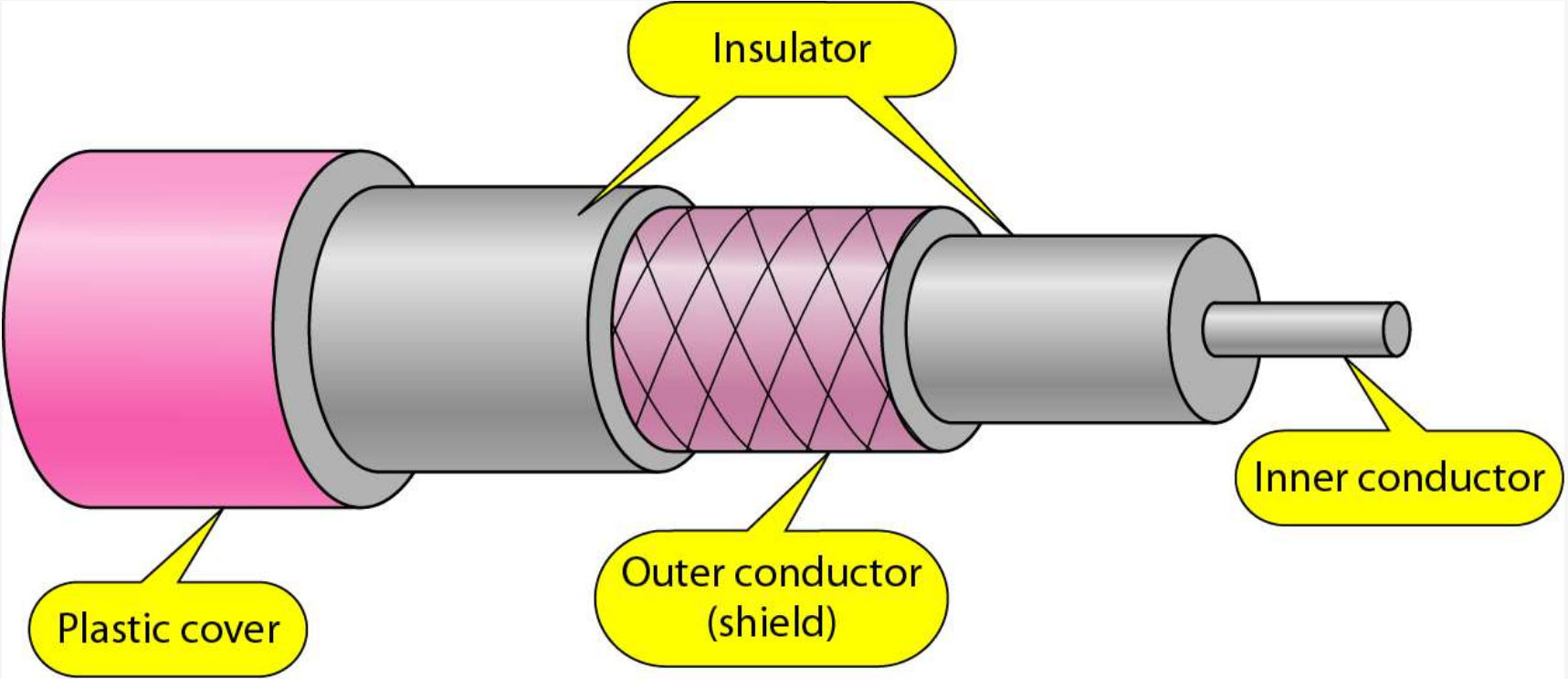
RJ-45 Female



RJ-45 Male

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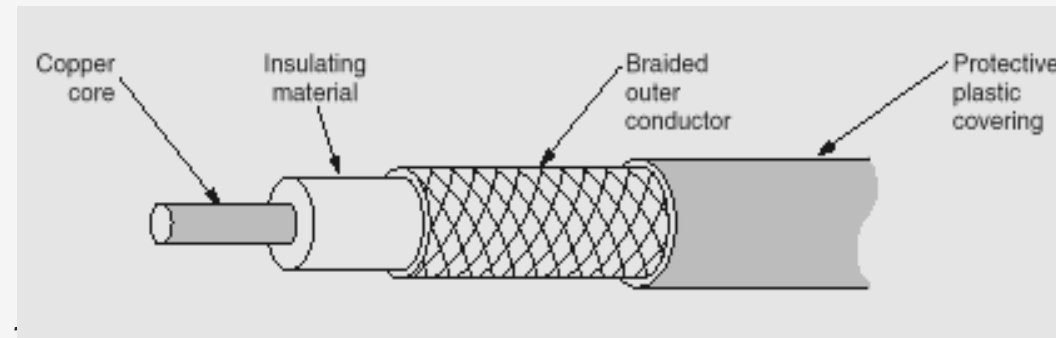
Coaxial cable



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COAXIAL CABLE

- ▶ Two concentric cylindrical conductors separated by insulation
- ▶ Used in Ethernet cable TV
- ▶ **10 Base 5 Ethernet cable**
- ▶ 2.17 mm dia, 50 Ohm resistance, maximum length: 500m
- ▶ **10 Base 2 Ethernet cable**
- ▶ 0.9 mm dia, 50 ohm resistance, maximum length: 180m



Ethernet Technologies

Name	Cable	Max. segment	Nodes/seg.	Advantages
10Base5	Thick coax	500 m	100	Good for backbones
10Base2	Thin coax	200 m	30	Cheapest system
10Base-T	Twisted pair	100 m	1024	Easy maintenance
10Base-F	Fiber optics	2000 m	1024	Best between buildings

The most common kinds of baseband 802.3 LANs.

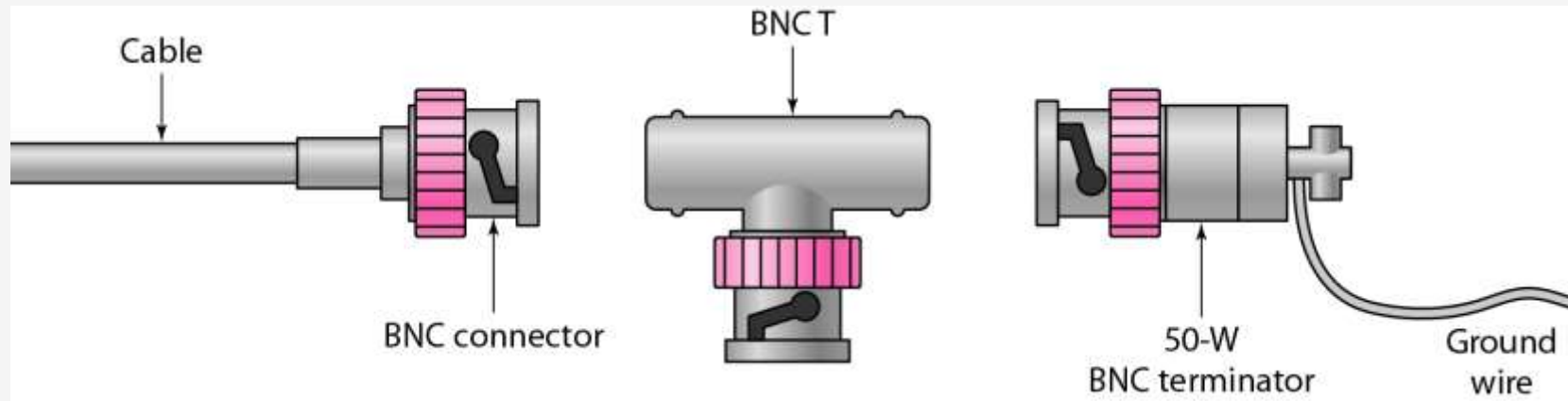
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Categories of coaxial cables

<i>Category</i>	<i>Impedance</i>	<i>Use</i>
RG-59	75 Ω	Cable TV
RG-58	50 Ω	Thin Ethernet
RG-11	50 Ω	Thick Ethernet

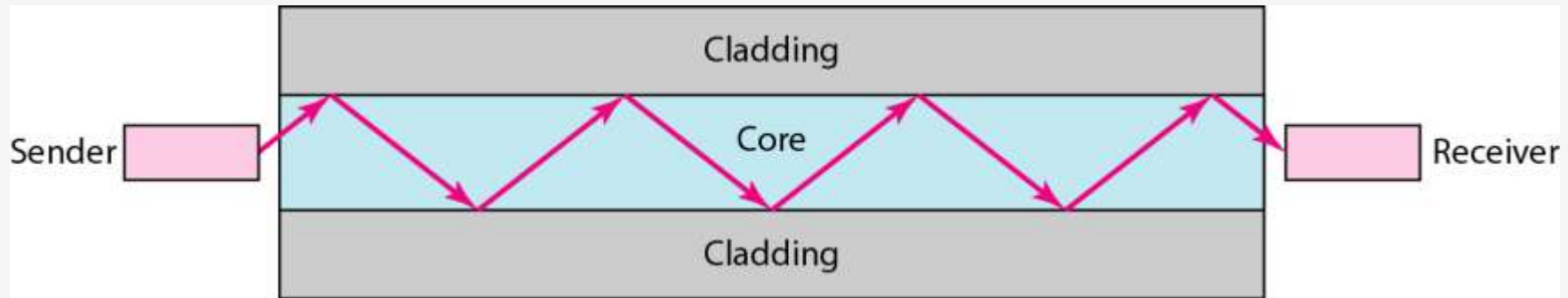
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BNC connectors



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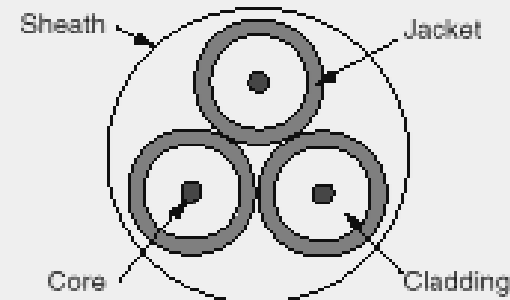
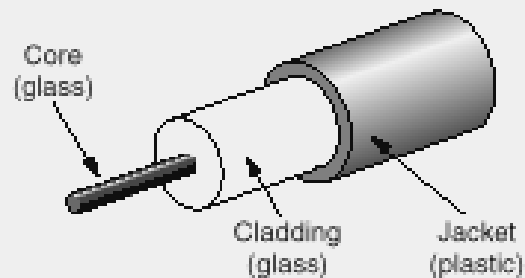
Optical fiber



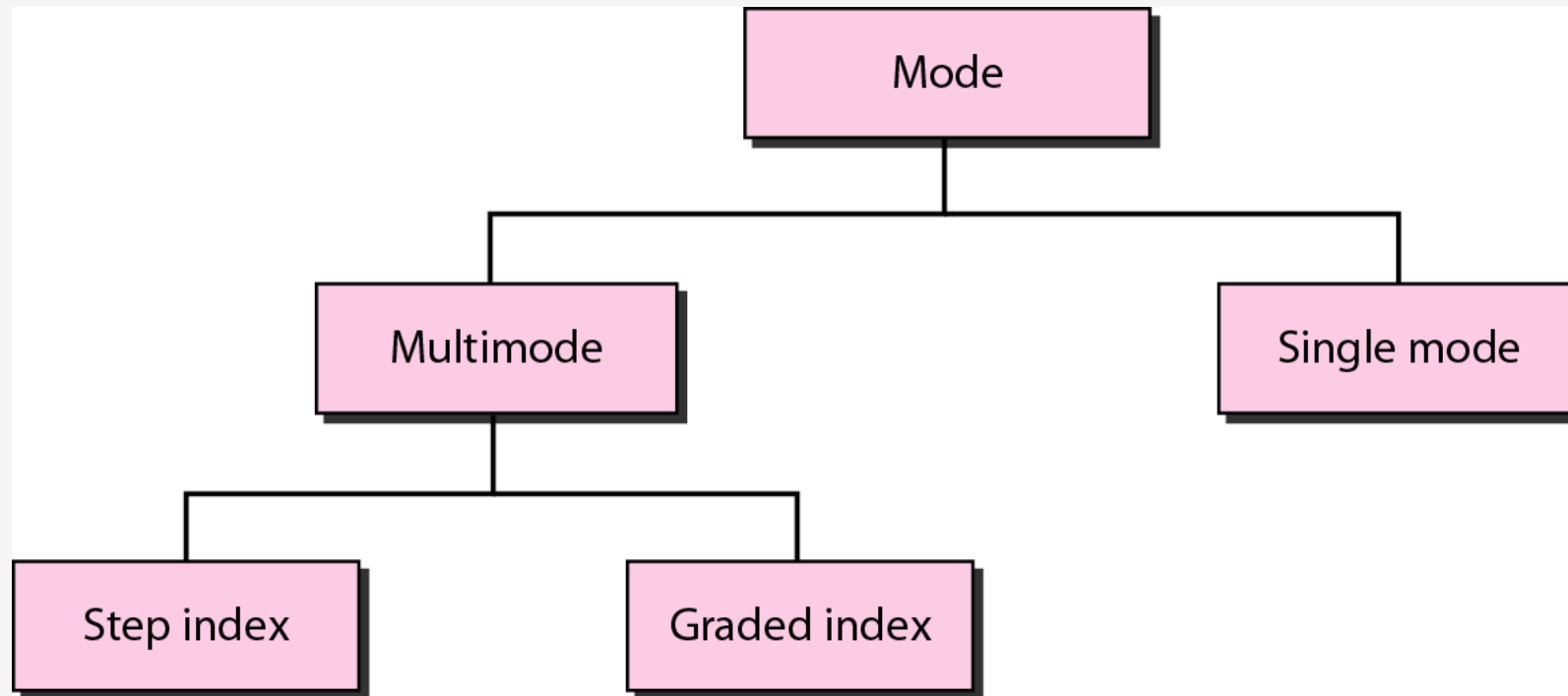
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OPTICAL FIBER

- ♦ Very thin glass or plastic medium in which optical ray can pass
- ♦ Very high bandwidth
- ♦ Only for point to point connection
- ♦ **Single mode or Multimode**
- ♦ In singlemode, one ray passes through very small core
- ♦ In multimode, the radius is more, and multiple rays can pass through, less expensive and less bandwidth
- ♦ Used in long distance communication

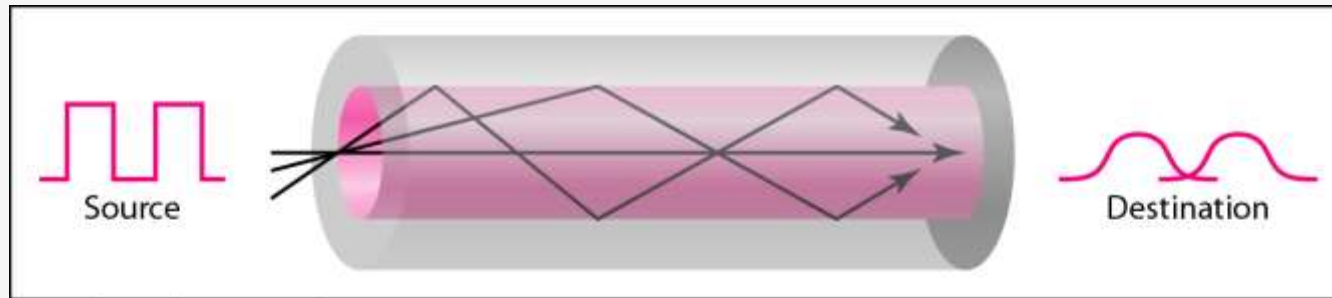


Propagation modes

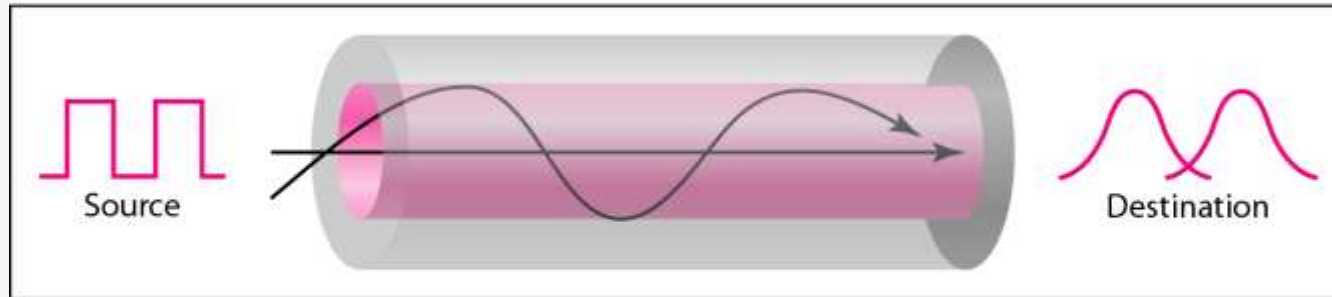


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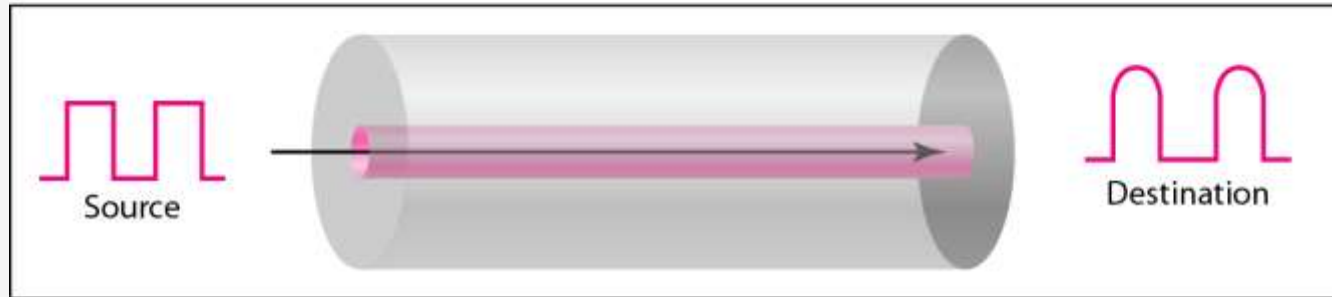
Modes



a. Multimode, step index



b. Multimode, graded index



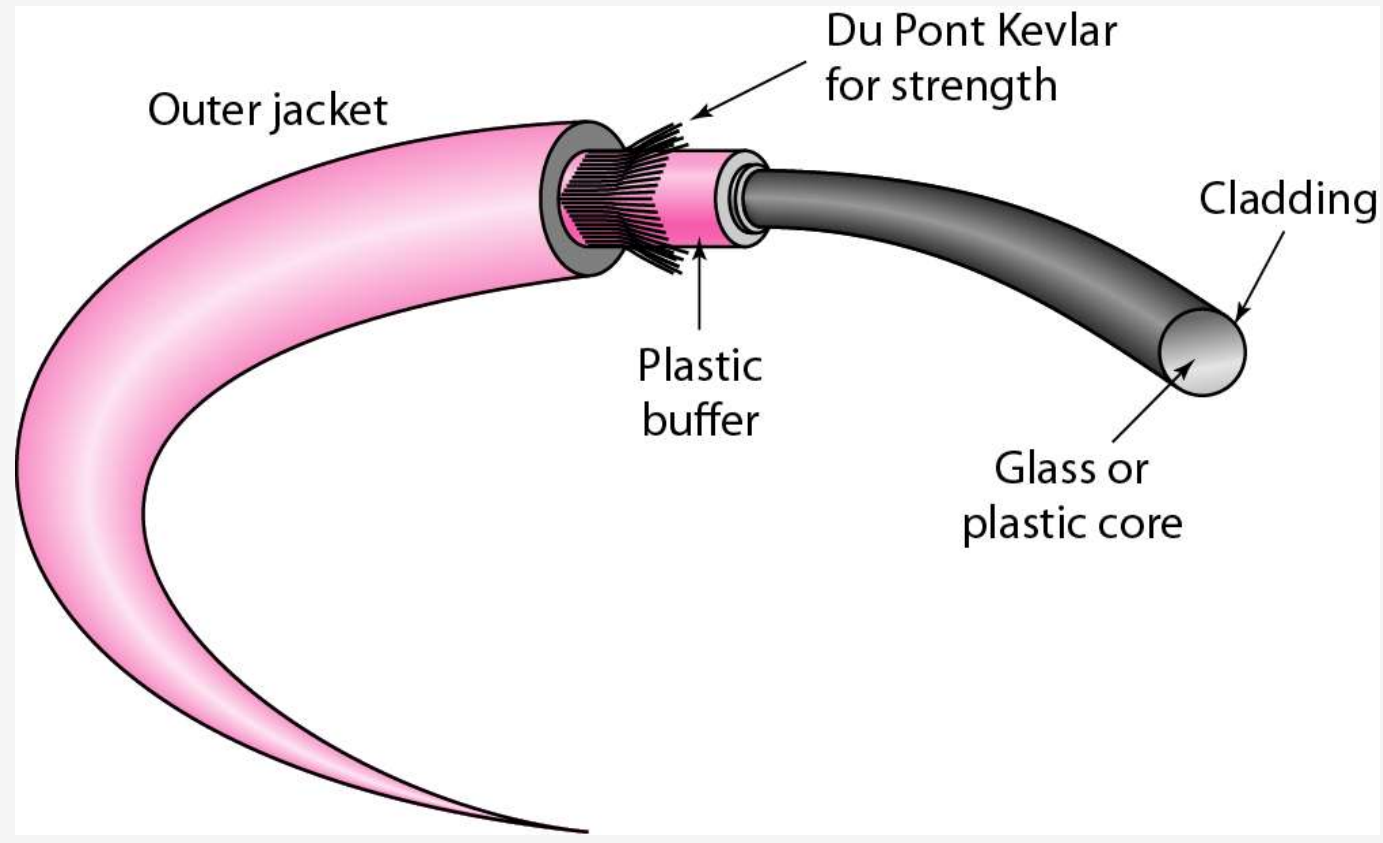
c. Single mode

Fiber types

<i>Type</i>	<i>Core (μm)</i>	<i>Cladding (μm)</i>	<i>Mode</i>
50/125	50.0	125	Multimode, graded index
62.5/125	62.5	125	Multimode, graded index
100/125	100.0	125	Multimode, graded index
7/125	7.0	125	Single mode

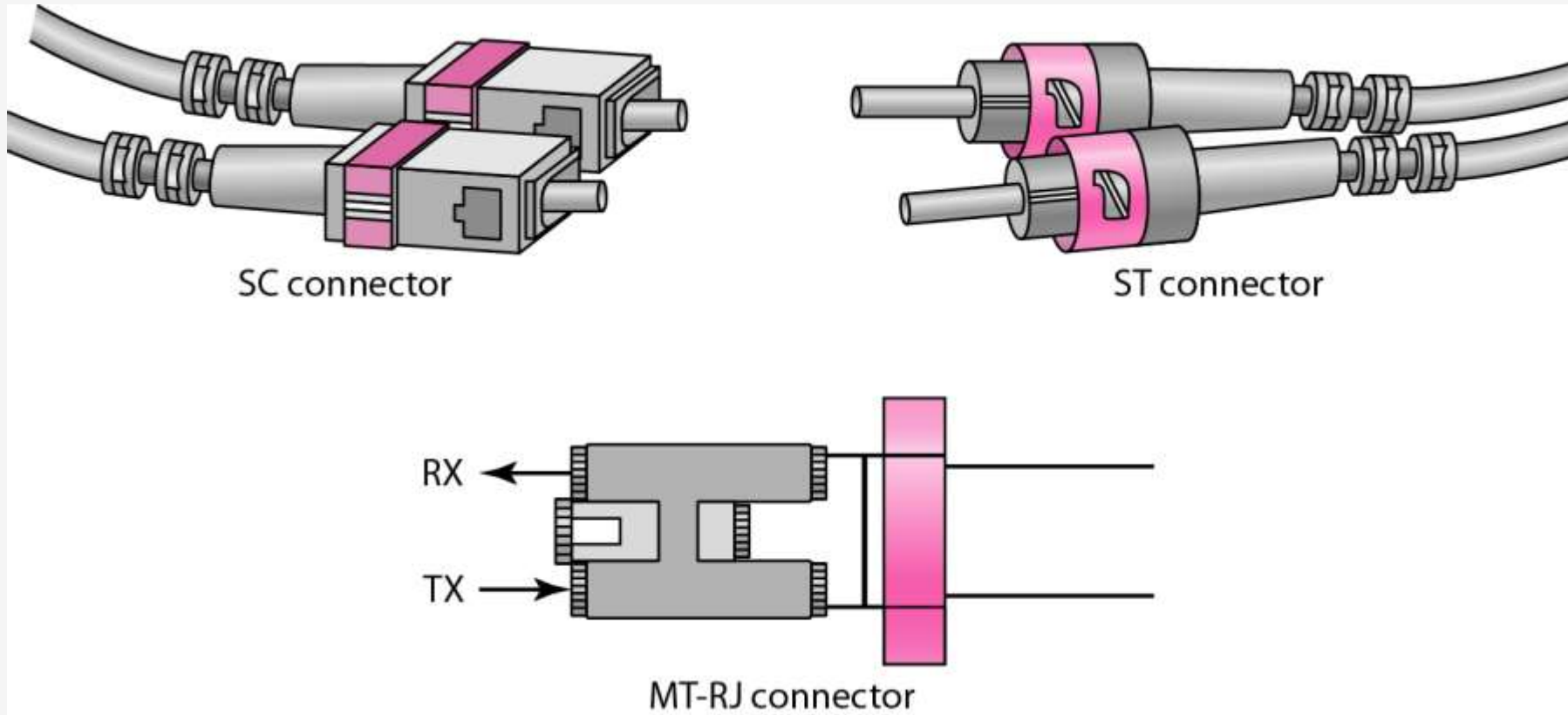
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Fiber construction



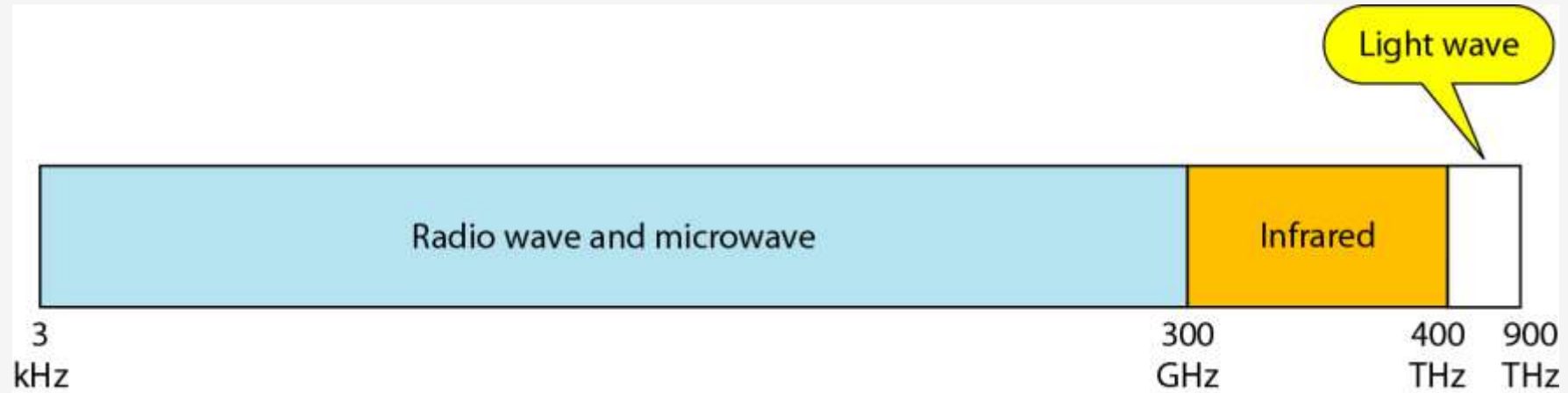
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Fiber-optic cable connectors



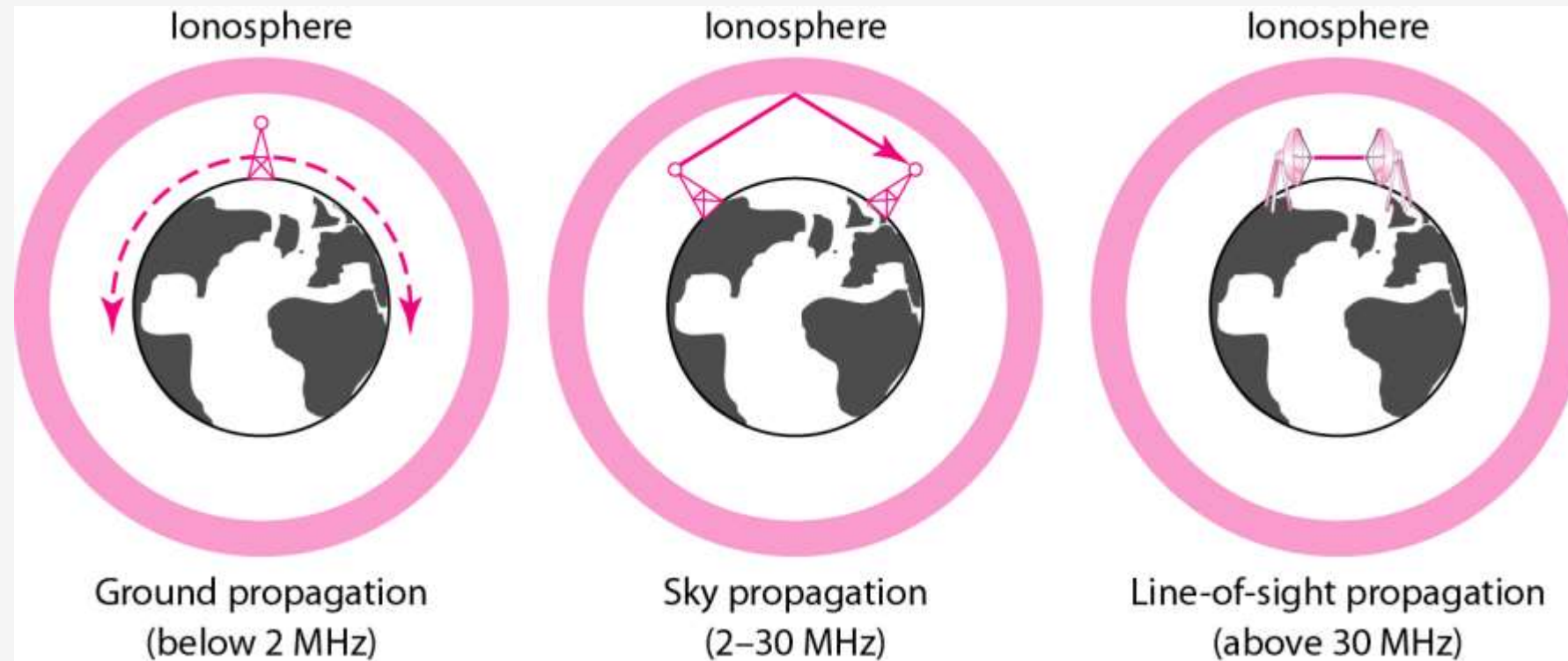
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Electromagnetic spectrum for wireless communication



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Propagation methods



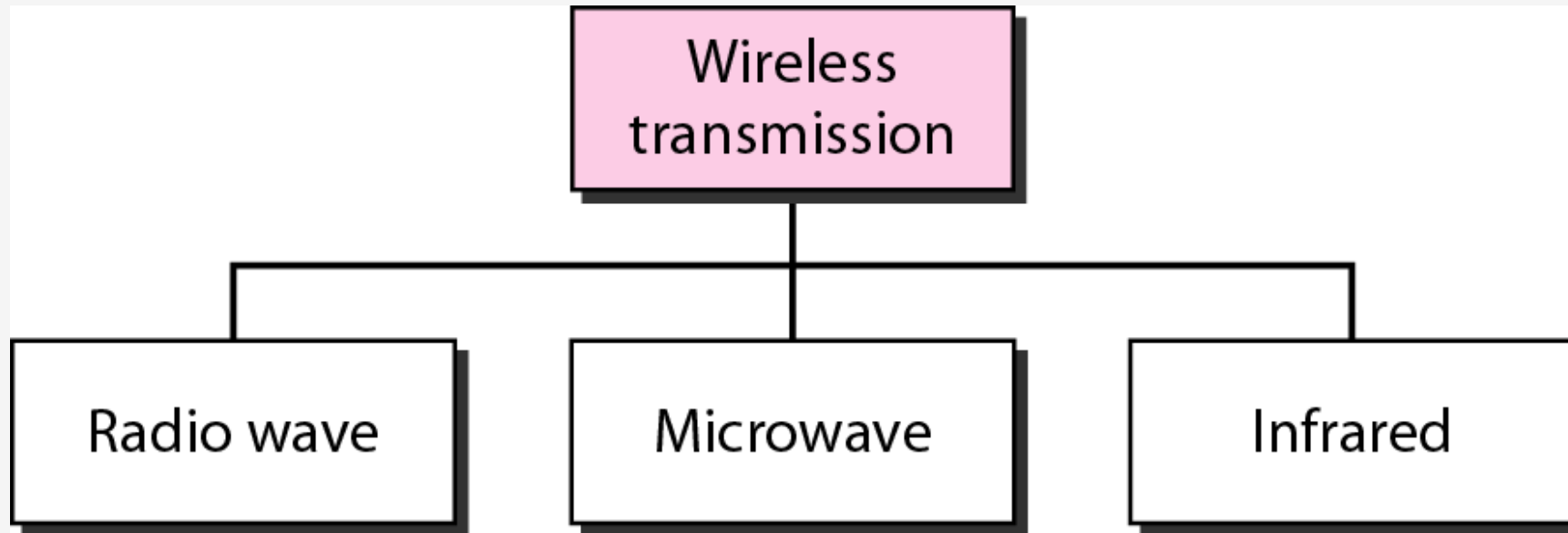
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Bands of EM Spectrum

<i>Band</i>	<i>Range</i>	<i>Propagation</i>	<i>Application</i>
VLF (very low frequency)	3–30 kHz	Ground	Long-range radio navigation
LF (low frequency)	30–300 kHz	Ground	Radio beacons and navigational locators
MF (middle frequency)	300 kHz–3 MHz	Sky	AM radio
HF (high frequency)	3–30 MHz	Sky	Citizens band (CB), ship/aircraft communication
VHF (very high frequency)	30–300 MHz	Sky and line-of-sight	VHF TV, FM radio
UHF (ultrahigh frequency)	300 MHz–3 GHz	Line-of-sight	UHF TV, cellular phones, paging, satellite
SHF (superhigh frequency)	3–30 GHz	Line-of-sight	Satellite communication
EHF (extremely high frequency)	30–300 GHz	Line-of-sight	Radar, satellite

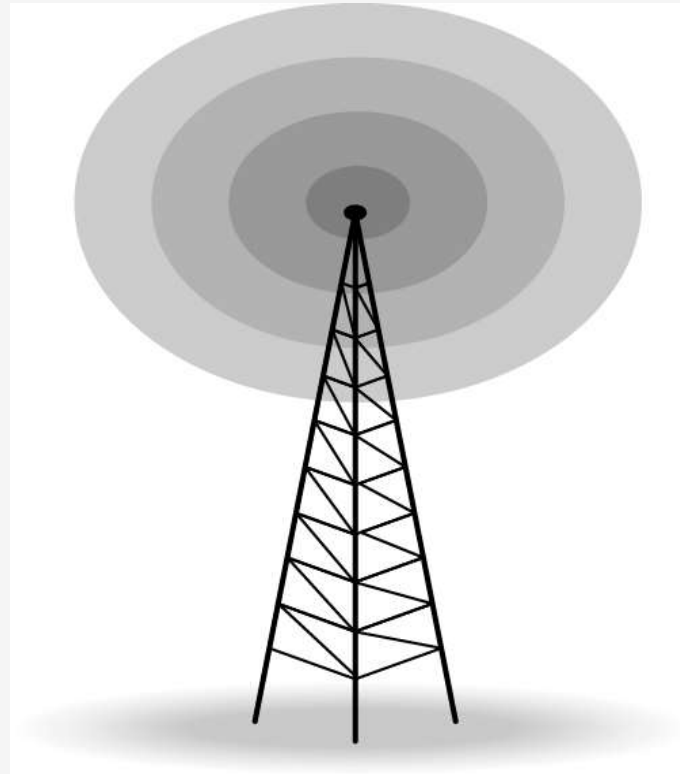
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Wireless transmission waves



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Omnidirectional antenna



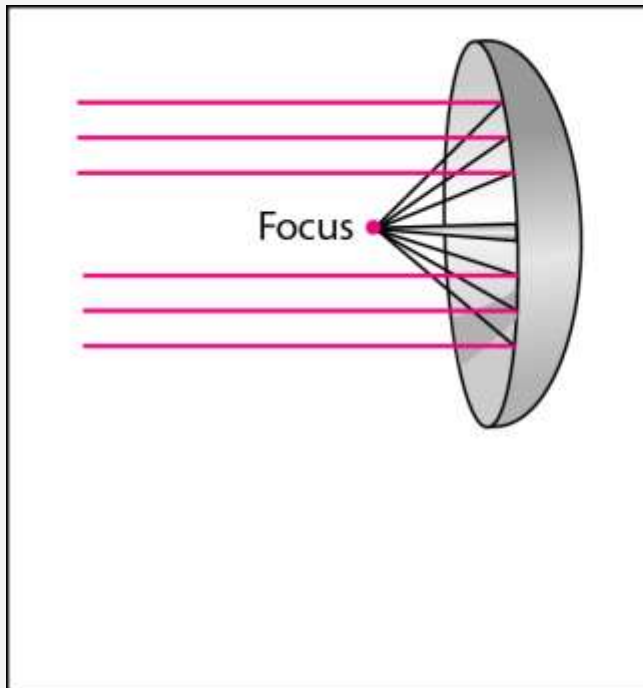
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**Note**

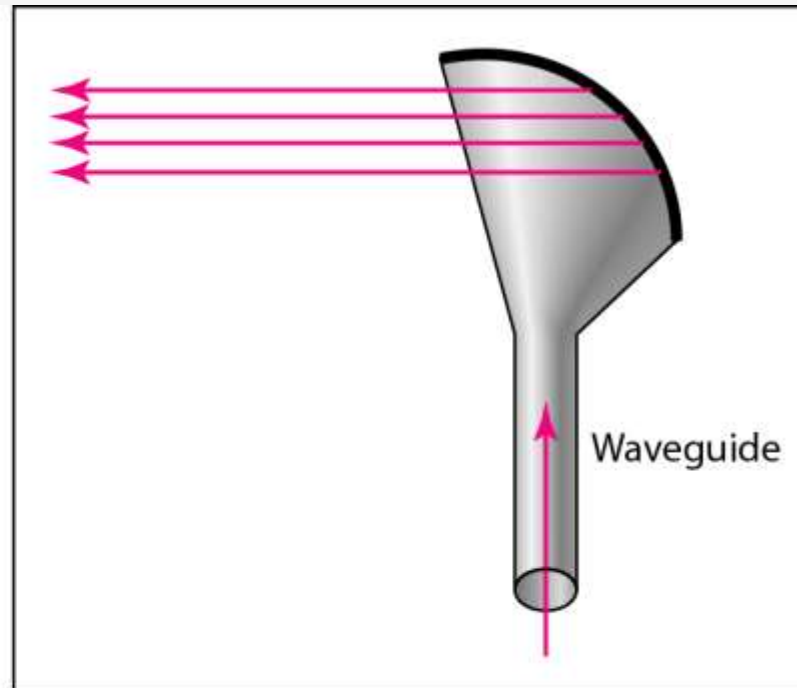
Radio waves are used for multicast communications, such as radio and television, and paging systems.

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Unidirectional antennas



a. Dish antenna



b. Horn antenna

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Note

Microwaves are used for unicast communication such as cellular telephones, satellite networks, and wireless LANs.

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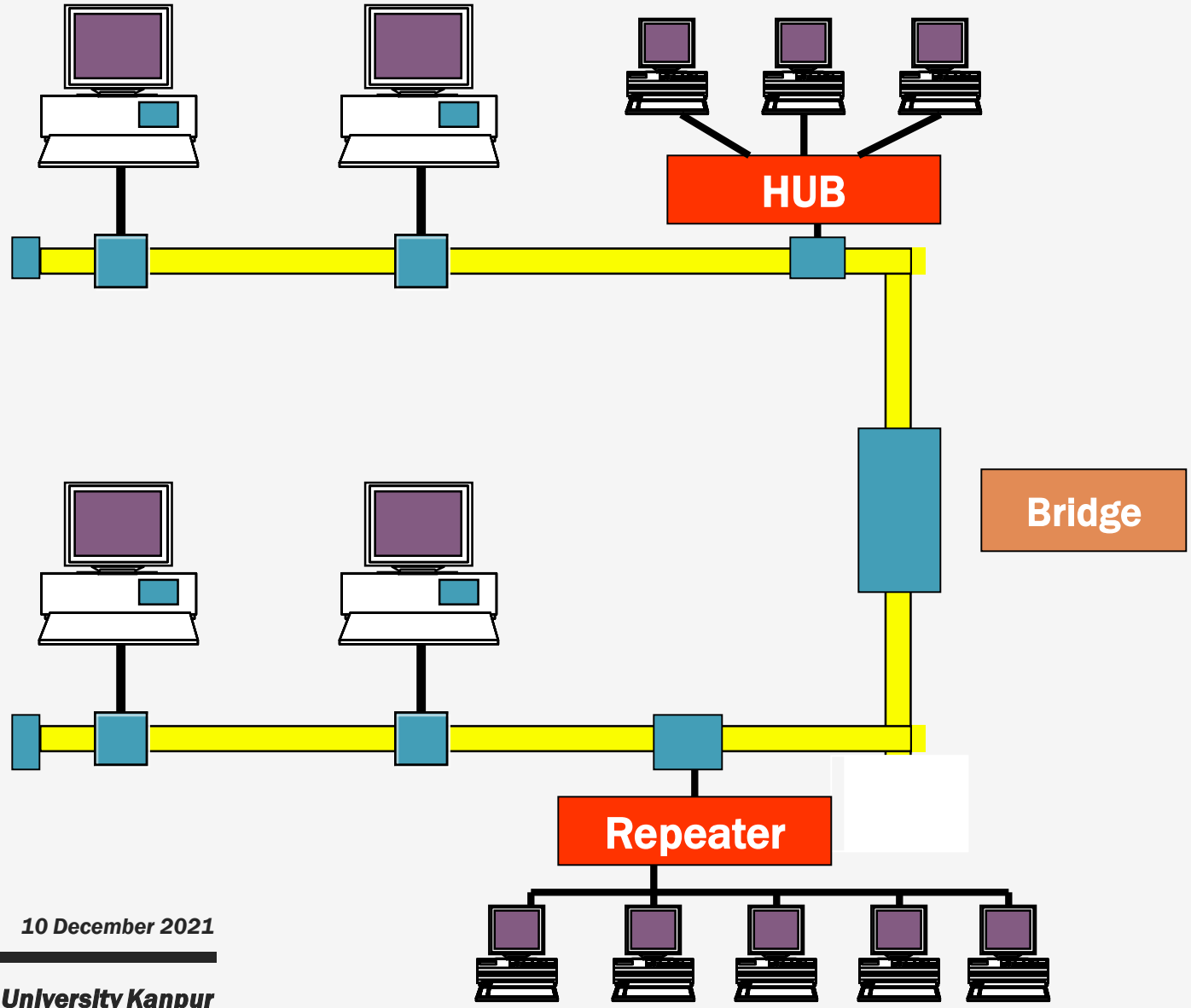


Note

Infrared signals can be used for short-range communication in a closed area using line-of-sight propagation.

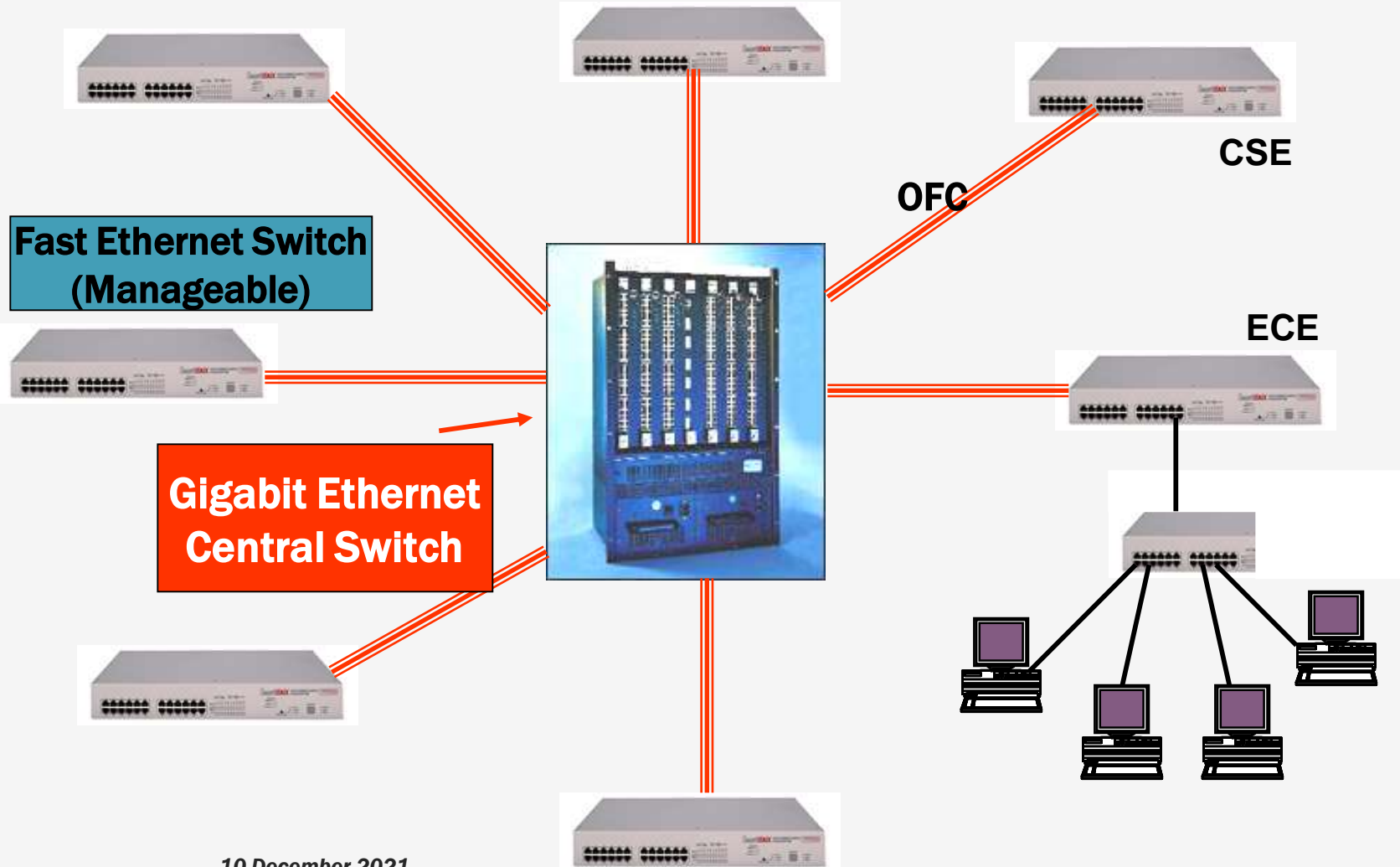
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RECW Campus LAN (Old)



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NITW's Gigabit Ethernet LAN (Latest)



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WIRELESS MEDIA

Packet Radio:

Signal travels in all directions
Used for LANs (upto a few KMs)
wireless Ethernet Home RF, Bluetooth

Data over cellular networks:

CDPD Cellular Digital Packet Data
GPRS General packet Radio Service.

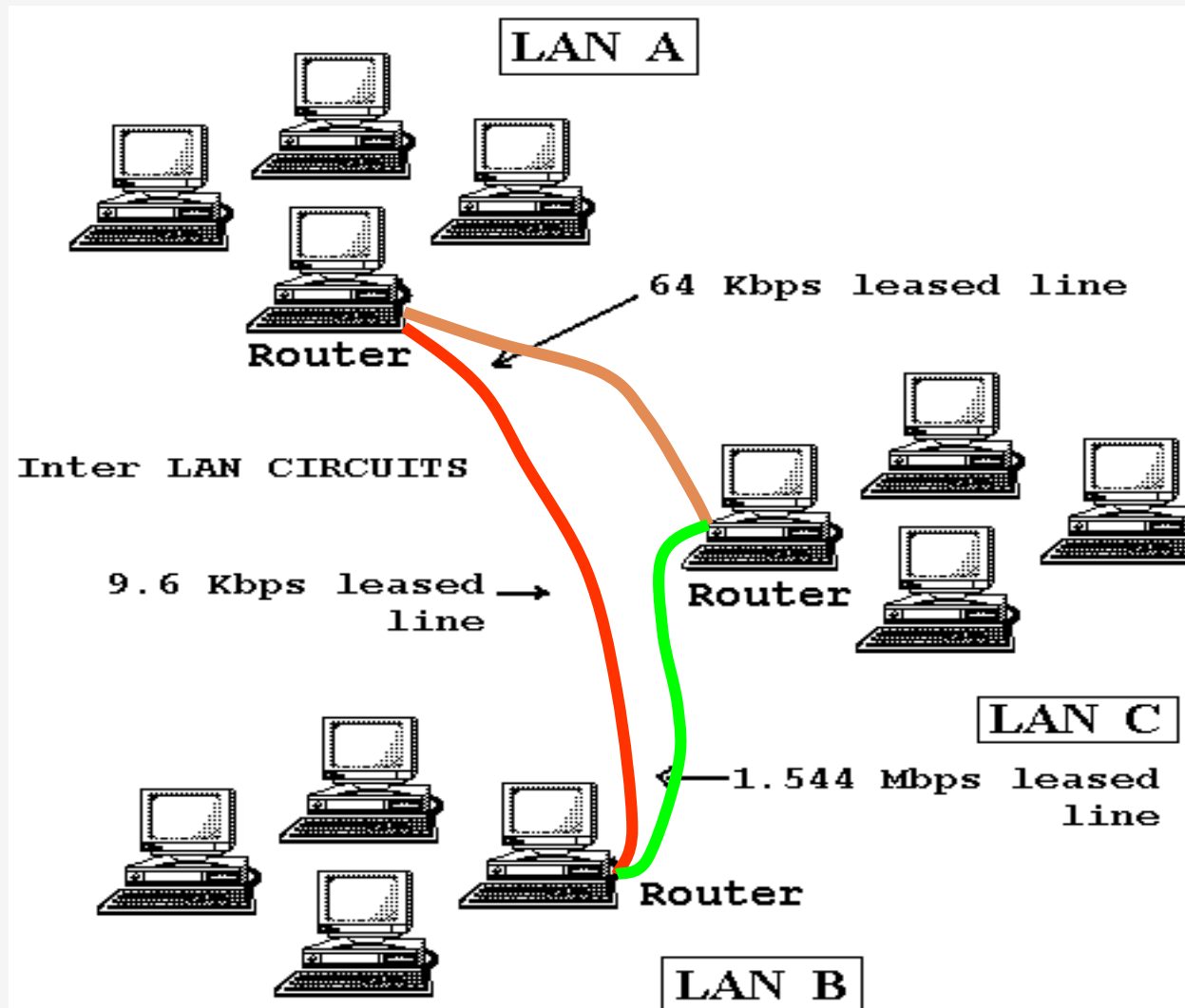
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TRANSMISSION MEDIA FOR WANs

1. PSTNs
2. High Speed, High Bandwidth Dedicated Leased Lines
3. High Speed Fiber Optic Cable
4. Terrestrial Microwave Links
5. Satellite Links (VSATs)
6. INTERNET

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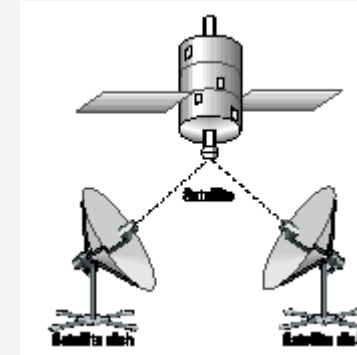
Dedicated Leased Lines



WIRELESS MEDIA

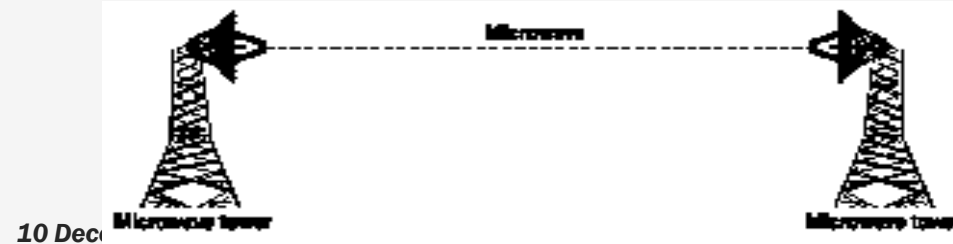
Satellite Microwave

- ▶ Needs transponders at the satellites
- ▶ VSATs and earth stations at the ground
- ▶ several different technologies available

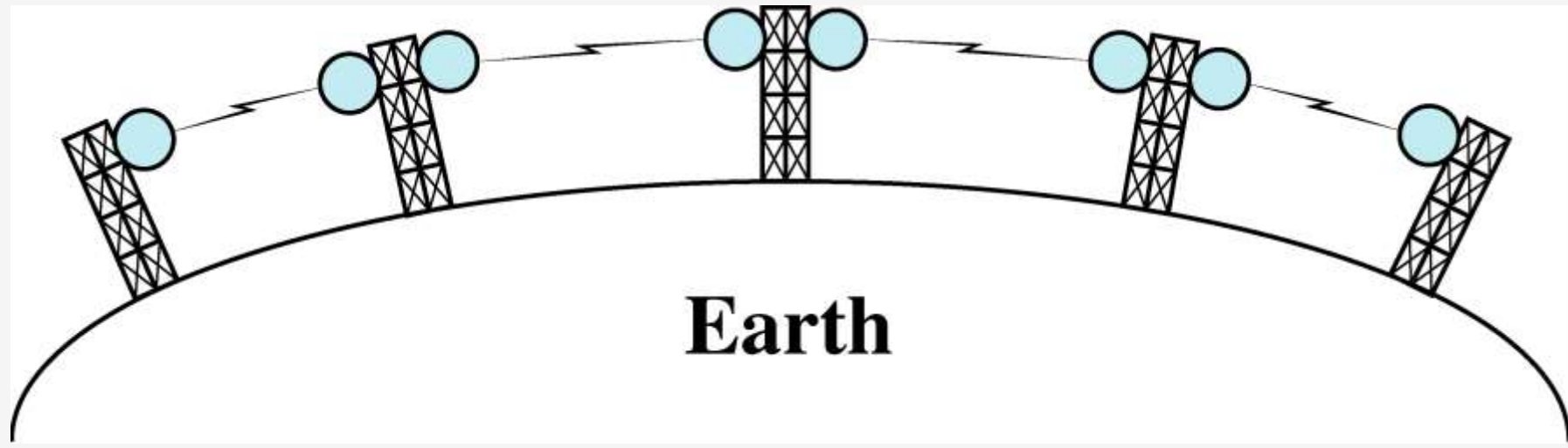


Terrestrial Microwave

- ▶ Ground based
- ▶ signal is highly directional
- ▶ more expensive, but very high bandwidth
- ▶ used for long distance communication



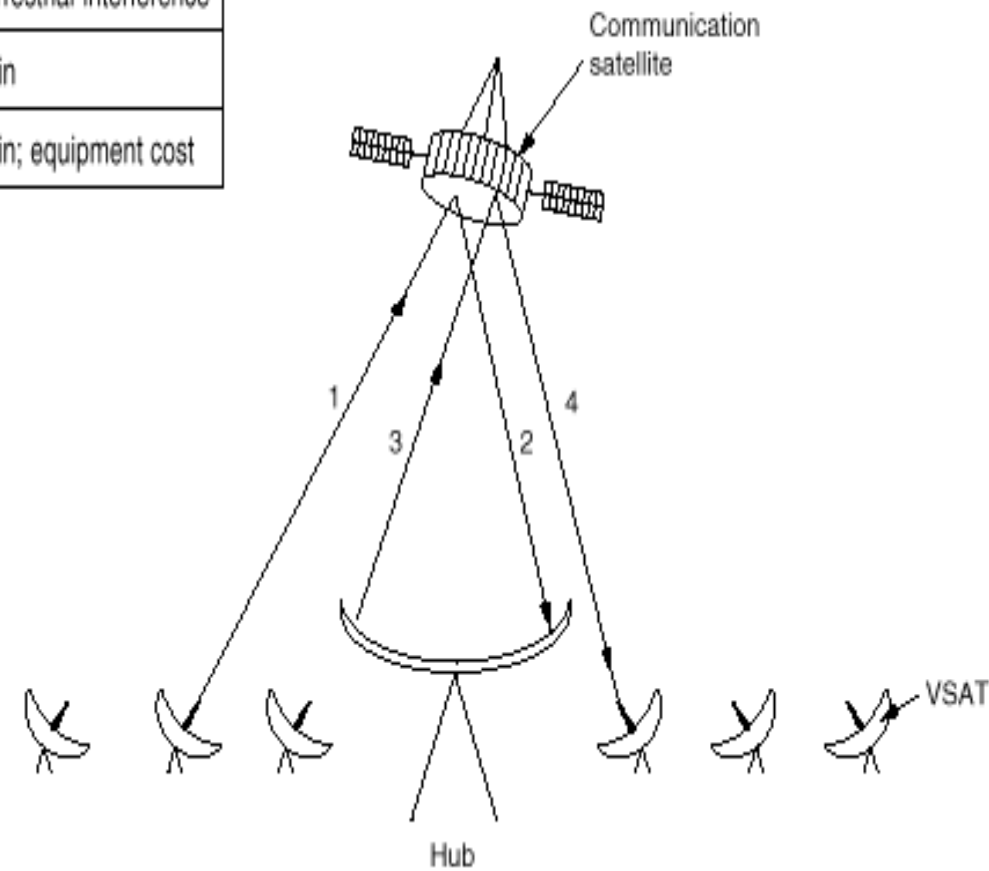
Terrestrial Microwave



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Band	Frequencies	Downlink (GHz)	Uplink (GHz)	Problems
C	4/6	3.7–4.2	5.925–6.425	Terrestrial interference
Ku	11/14	11.7–12.2	14.0–14.5	Rain
Ka	20/30	17.7–21.7	27.5–30.5	Rain; equipment cost

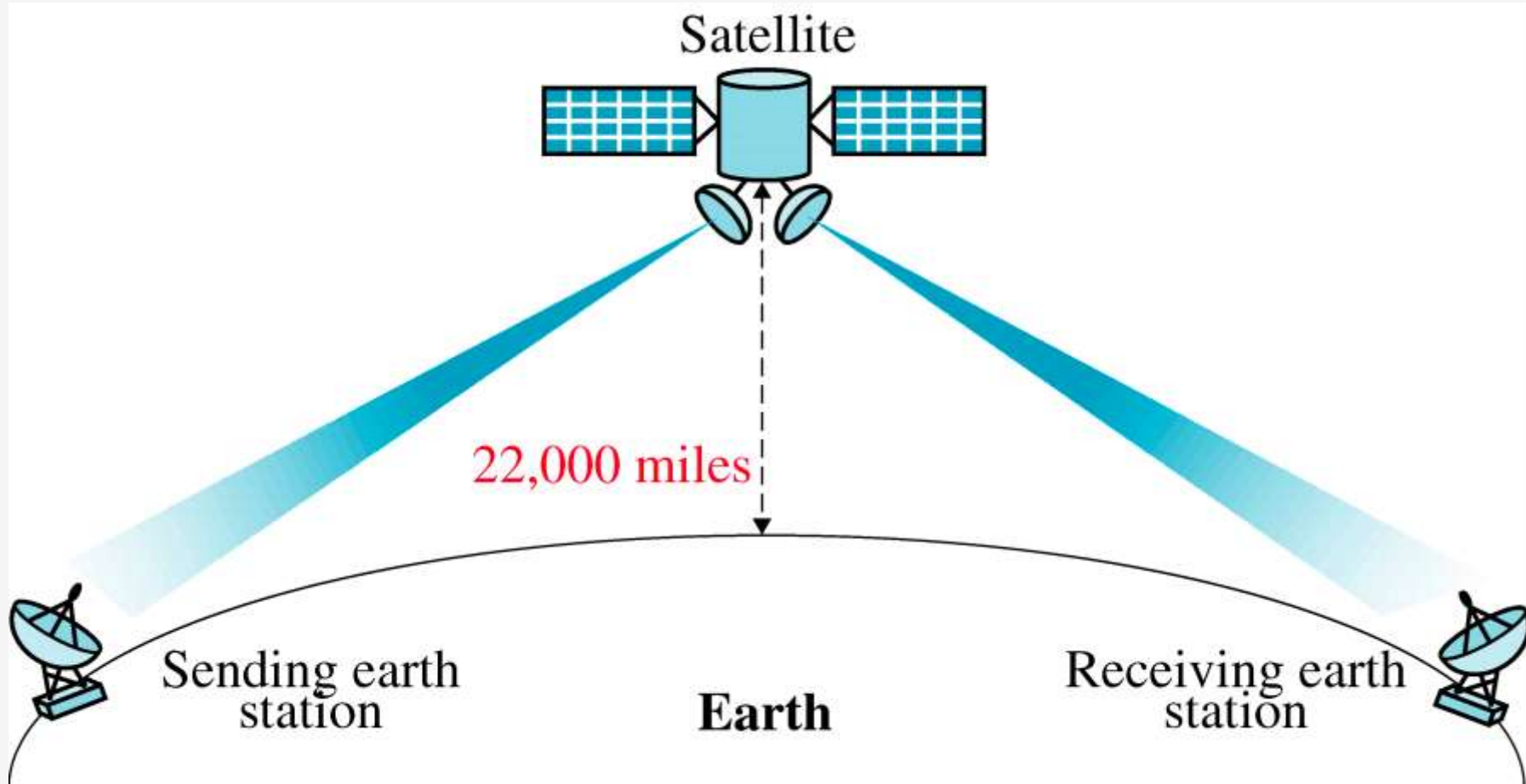
. The principal satellite bands.



VSATs using a hub.

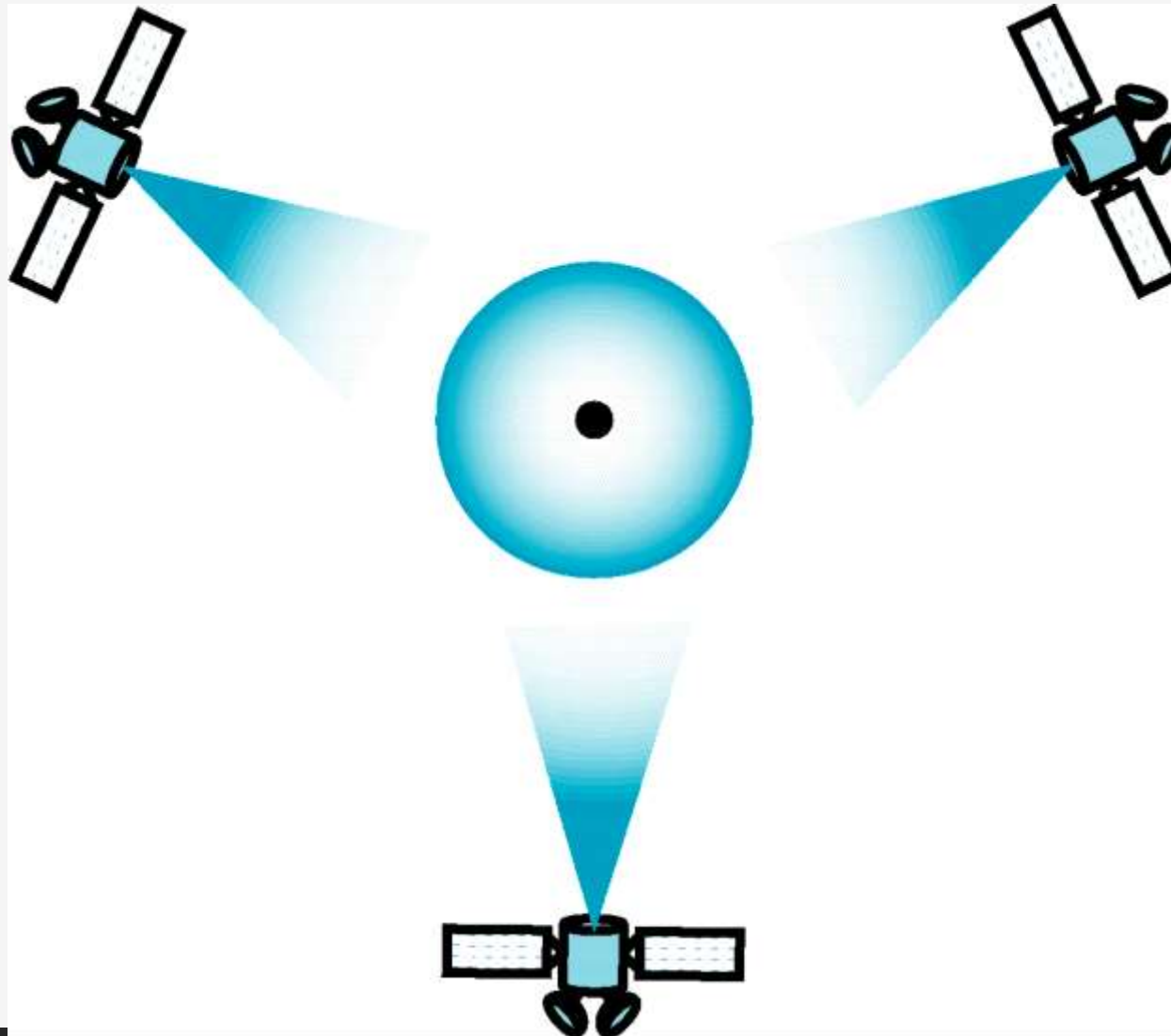
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Satellite Communication

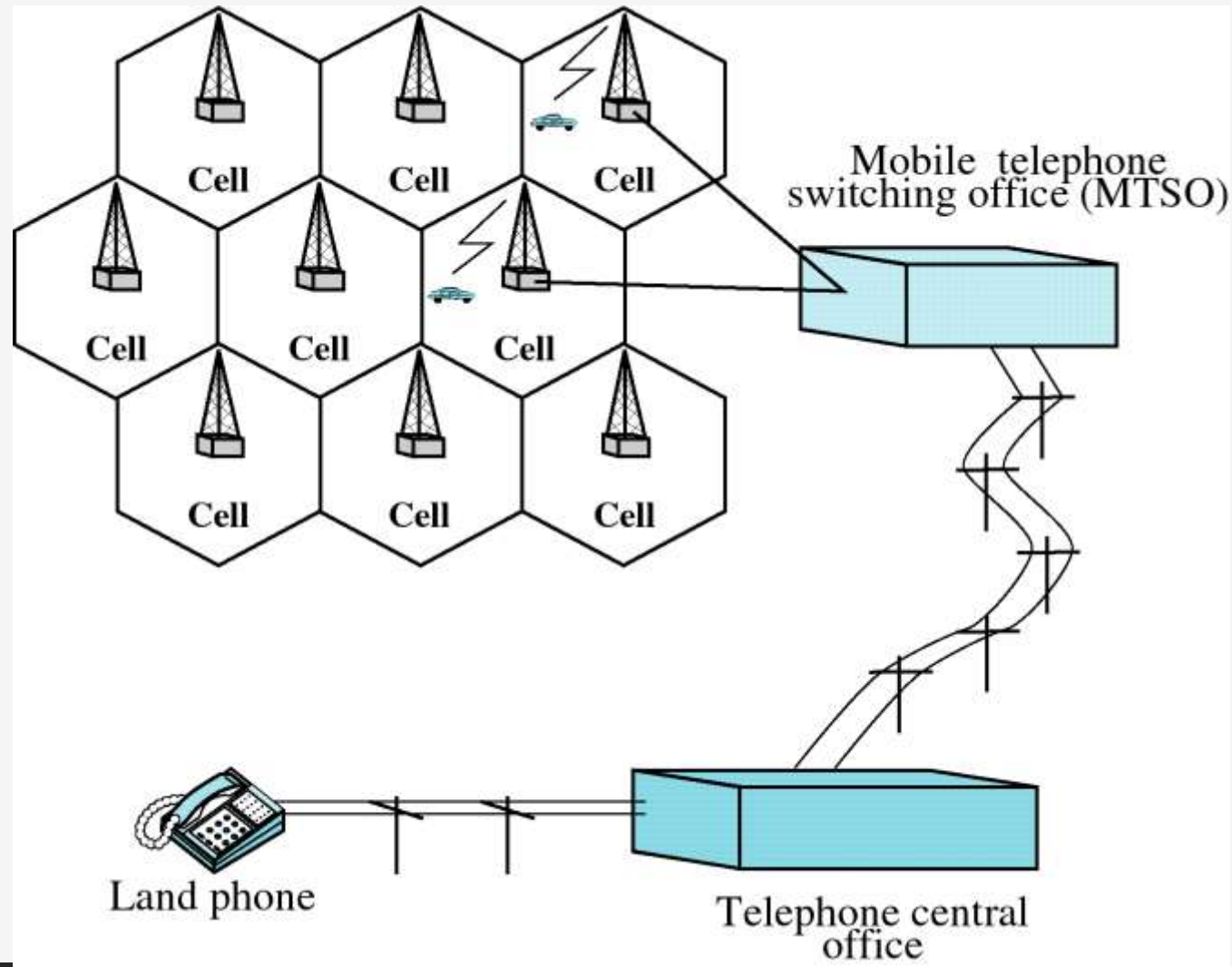


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Geosynchronous Orbit



Cellular System



THANK YOU !!

10 December 2021

BREAK !!



10 December 2021