



# Introduction to Information Technology

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CSC109

2019

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## Knowledge base

# Unshielded Twisted Pair (UTP)

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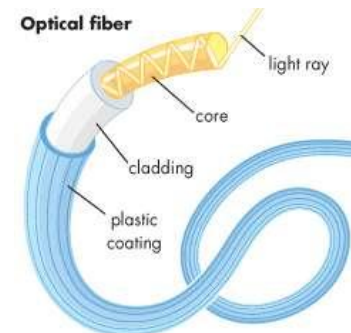
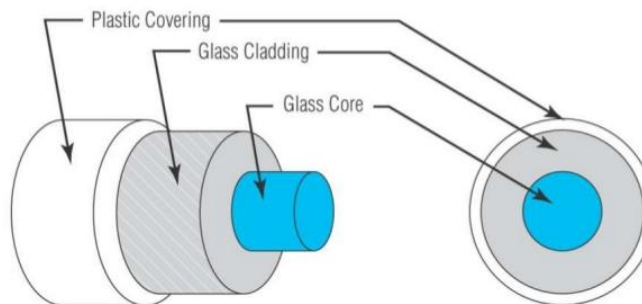
- UTP comes in several categories that are based on the number of twists in the wires, the diameter of the wires and the material used in the wires.
- **Category 3** is the wiring used primarily for telephone connections.
- **Category 5e** and **Category 6** are currently the most common Ethernet cables used.

# Categories of UTP

CAT 3	CAT 4	CAT 5	CAT 5e	CAT 6
16 Mhz Bandwidth	20 MHz Bandwidth	100 MHz Bandwidth	150 MHz Bandwidth	250 MHz Bandwidth
11.5 dB Attenuation	7.5 dB Attenuation	24.0 dB Attenuation	24.0 dB Attenuation	19.8 dB Attenuation
100 ohms Impedance	100 ohms Impedance	100 ohms Impedance	100 ohms Impedance	100 ohms Impedance
voice applications	Data Transmission	high-speed data transmission	Transmits high- speed data	Transmits high- speed data
& 10baseT (10Mbps) Ethernet	Used in 10baseT (10Mbps) Ethernet	10BaseT (10 Mbps) Ethernet & Fast Ethernet (100 Mbps)	Used in Fast Ethernet (100 Mbps), Gigabit Ethernet (1000 Mbps) & 155 Mbps ATM	Used in Gigabit Ethernet (1000 Mbps) & 10 Gig Ethernet (10000 Mbps)

# Fiber Optics/Optical Fiber

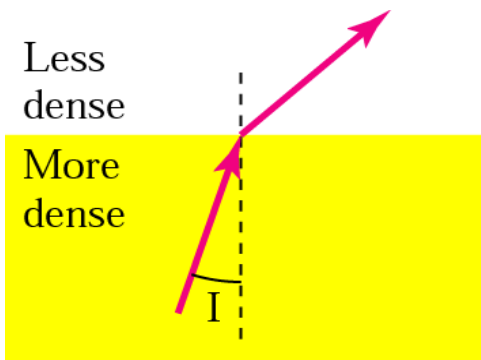
- Optical fibers use light to send information through the optical medium.
- It uses the principal of total internal reflection.
- Modulated light transmissions are used to transmit the signal.
- It consist of
  - 1) **Core** : optical fiber conductor (glass) that transmits light
  - 2) **Cladding**: an optical material that surrounds the core to prevent any light from escaping the core
  - 3) **Jacket**: outer covering made of plastic to protect the fiber from damage.



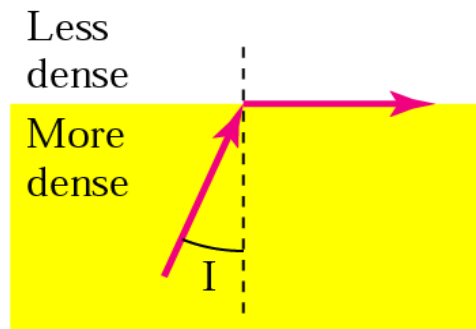
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# Total Internal Reflection

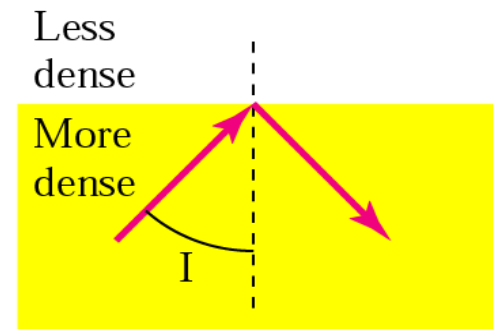
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$I < \text{critical angle,}$   
refraction



$I = \text{critical angle,}$   
refraction



$I > \text{critical angle,}$   
reflection

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- Light travels through the optical media by the way of total internal reflection.
  - Modulation scheme used is intensity modulation.
  - Two types of Fiber media :
    - Multimode
    - Singlemode
  - Multimode Fiber can support less bandwidth than Singlemode Fiber.
  - Singlemode Fiber has a very small core and carry only one beam of light. It can support Gbps data rates over > 100 Km without using repeaters.

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- The bandwidth of the fiber is limited due to the dispersion effect.
  - Distance Bandwidth product of a fiber is almost a constant.
  - Fiber optic cables consist of multiple fibers packed inside protective covering.
  - 62.5/125  $\mu\text{m}$  (850/1310 nm) multimode fiber
  - 50/125  $\mu\text{m}$  (850/1310 nm) multimode fiber
  - 10  $\mu\text{m}$  (1310 nm) single-mode fiber

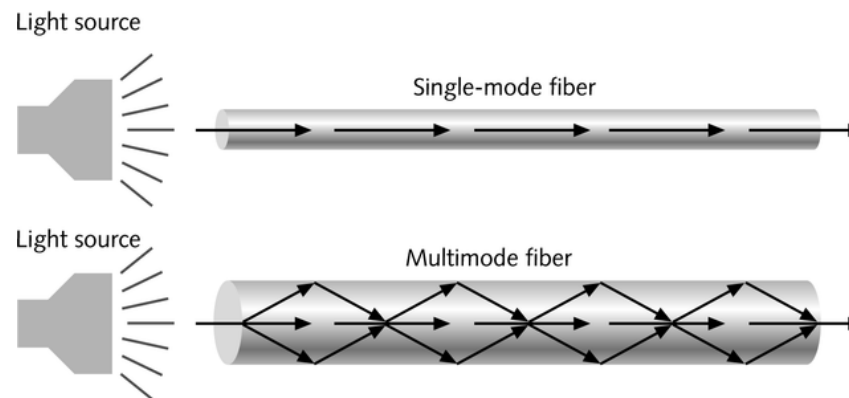
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➤ Single-mode fiber

- Carries light pulses along single path
- Uses Laser Light Source

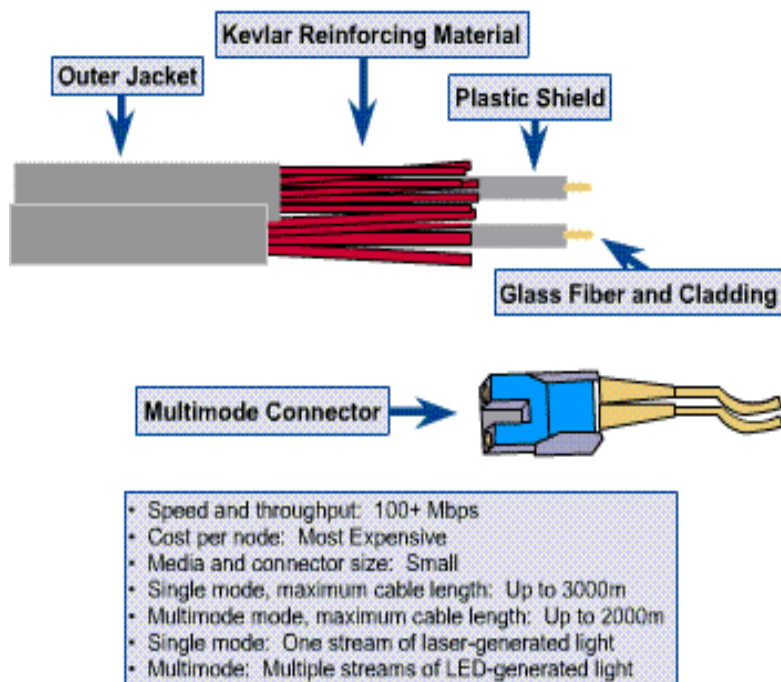
➤ Multimode fiber

- Many pulses of light generated by LED travel at different angles





FO Cable may have 1 to over 1000 fibers at its core



# Advantages/Disadvantages

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1.

2.

3.

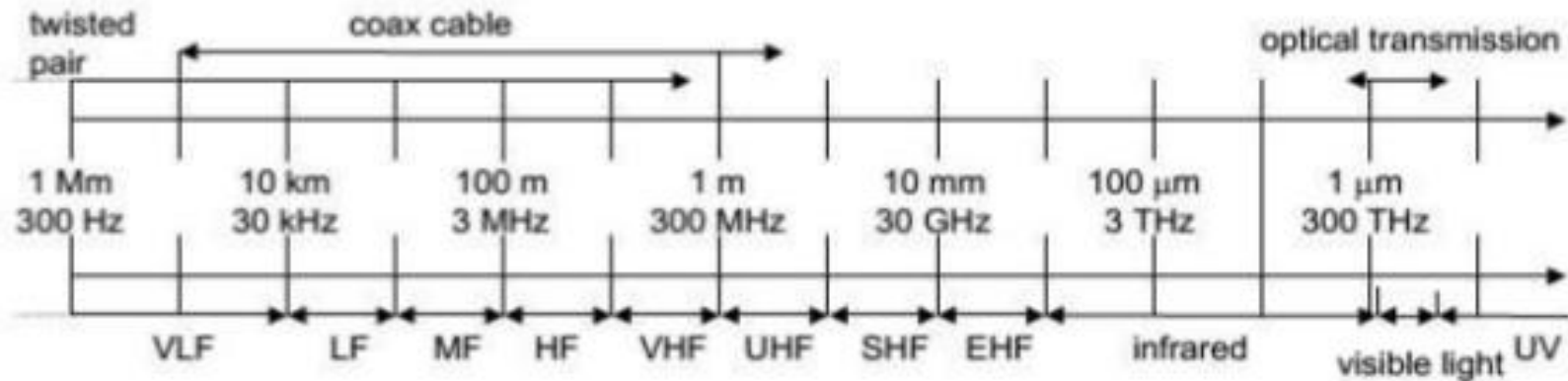
4.

1.

2.

3.

# Radio Transmission



VLF = Very Low Frequency  
 LF = Low Frequency  
 MF = Medium Frequency  
 HF = High Frequency  
 VHF = Very High Frequency

UHF = Ultra High Frequency  
 SHF = Super High Frequency  
 EHF = Extra High Frequency  
 UV = Ultraviolet Light

Frequency and wave length:

$$\lambda = c/f$$

wave length  $\lambda$ , speed of light  $c \cong 3 \times 10^8 \text{ m/s}$ , frequency  $f$



For Traditional wired Network

- ✓ Freq up to Several kHz are used for distance up to some km with twisted pair copper
- ✓ Freq of Several MHz are used with Coaxial Cable
- ✓ Fiber Optics are use freq ranges from Several Hundred THz

Radio Transmission Starts from Several kHz (**VLF**)

**LF** use by submirines they can penetrate the water

**MF and HF** are used by Radio Stations, (AM, FM, SW) control by country regulatory

**Some VHF and Some UHF** used by TV broadcasting Digital and Analog both

**UHF** is also used by Mobile phones

**SHF** used by Microwave radio( K-Band) and Satellite communication ( C-Band, Ku-Band, Ka-Band)

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

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Radio is the transmission of Signals through free space by modulation of electromagnetic waves with frequencies below those of visible light

Radio Frequency (RF) Waves are easy to generate

It can travel long distance, can penetrate buildings

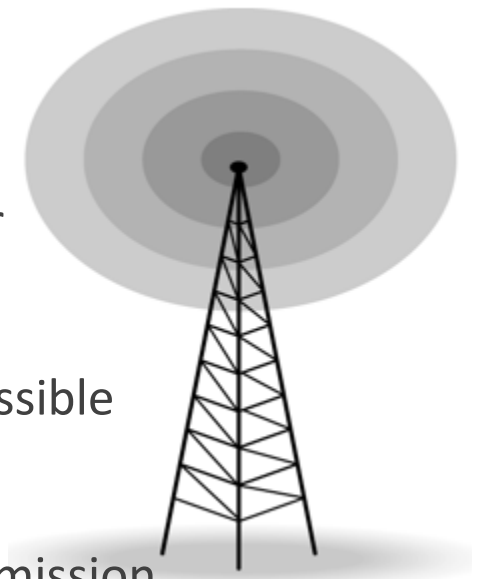
Widely used for communication, both indoor and outdoor

Omnidirectional, so Tx and Rx doesn't have to aligned

Very useful in difficult terrain where cable laying is not possible

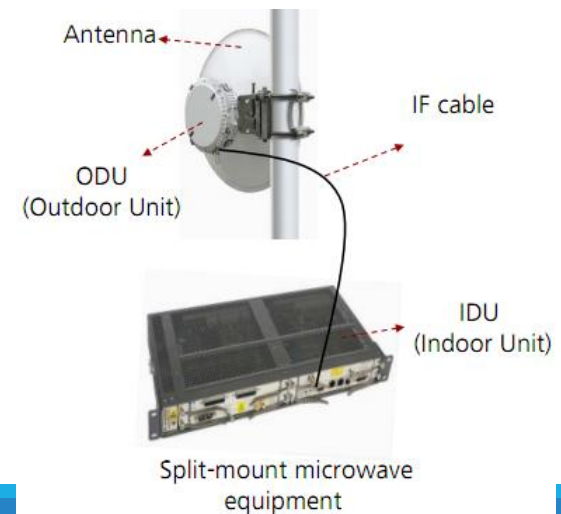
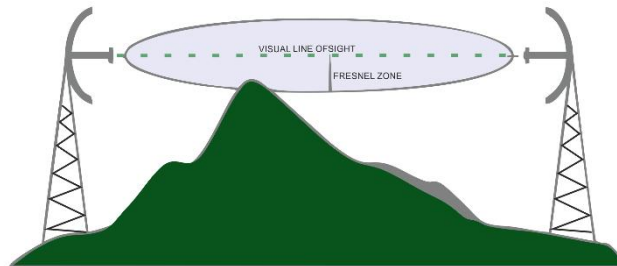
Provides mobility to communication nodes.

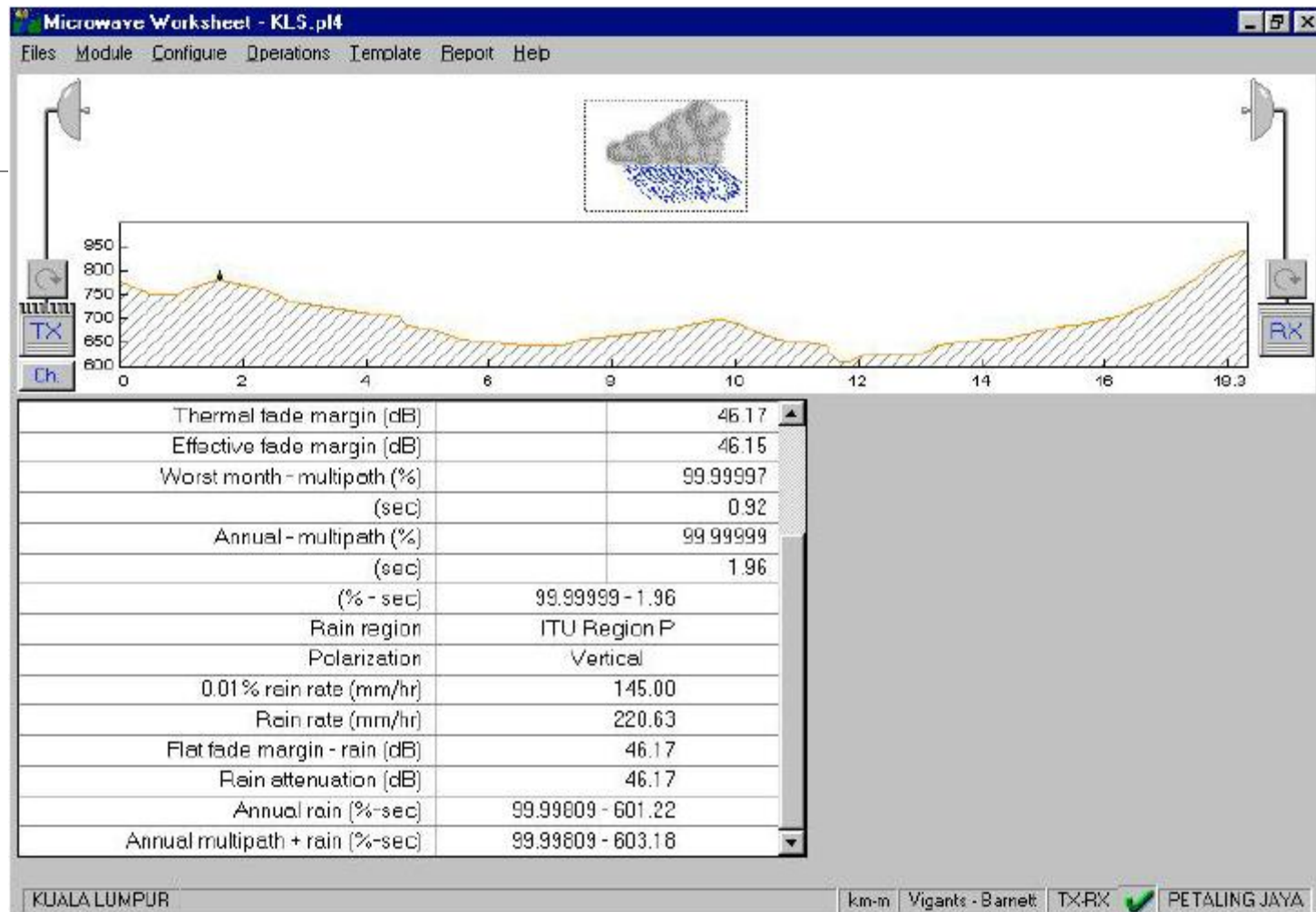
Subjectable to interference with weather, objects in transmission path



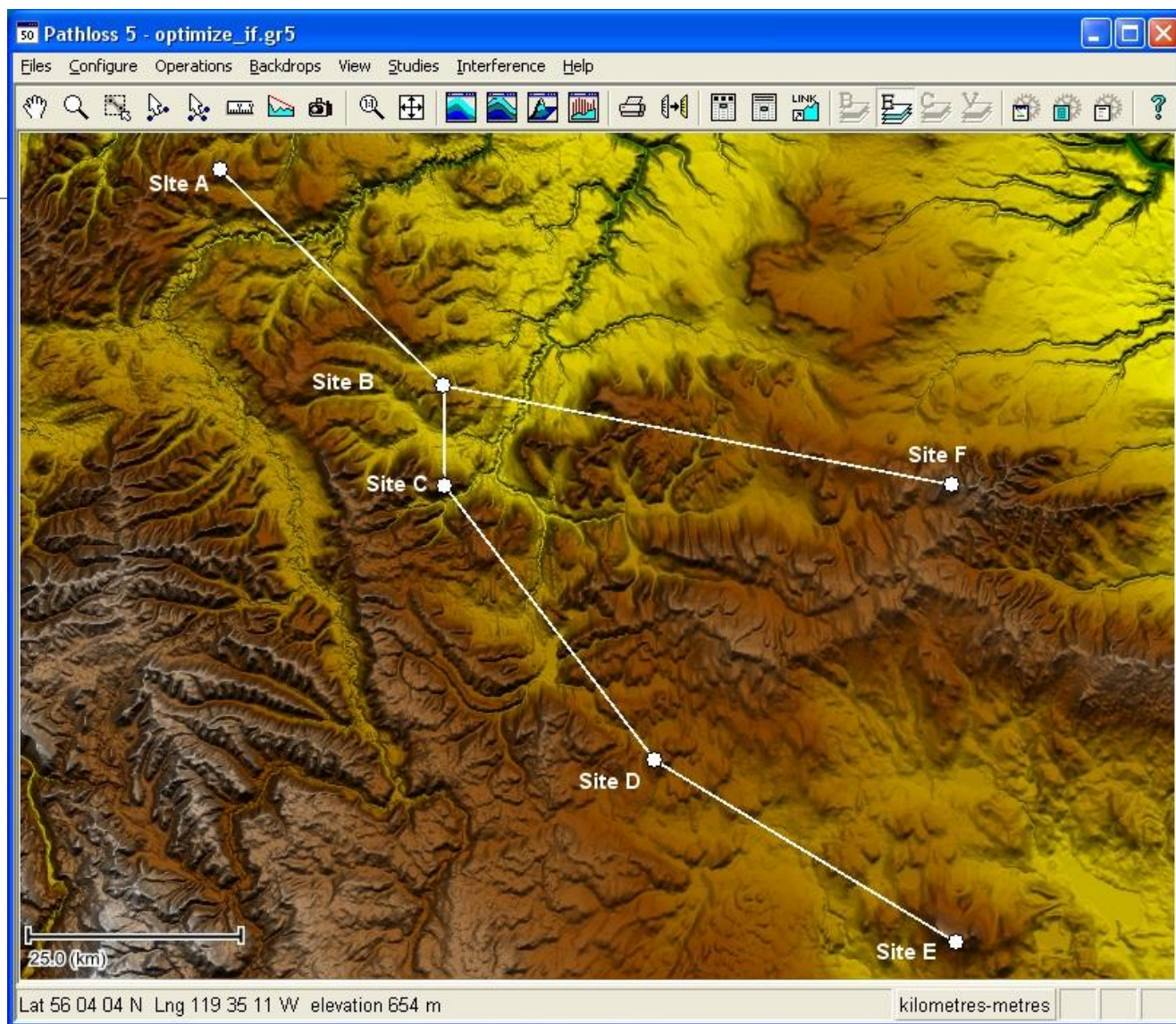
# Microwave Transmission

- Microwaves do not follow the curvature of earth
- Line-of-Sight transmission
- Height allows the signal to travel farther
- Two frequencies for two way communication
- Repeater is used to increase the distance Hop-by-Hop



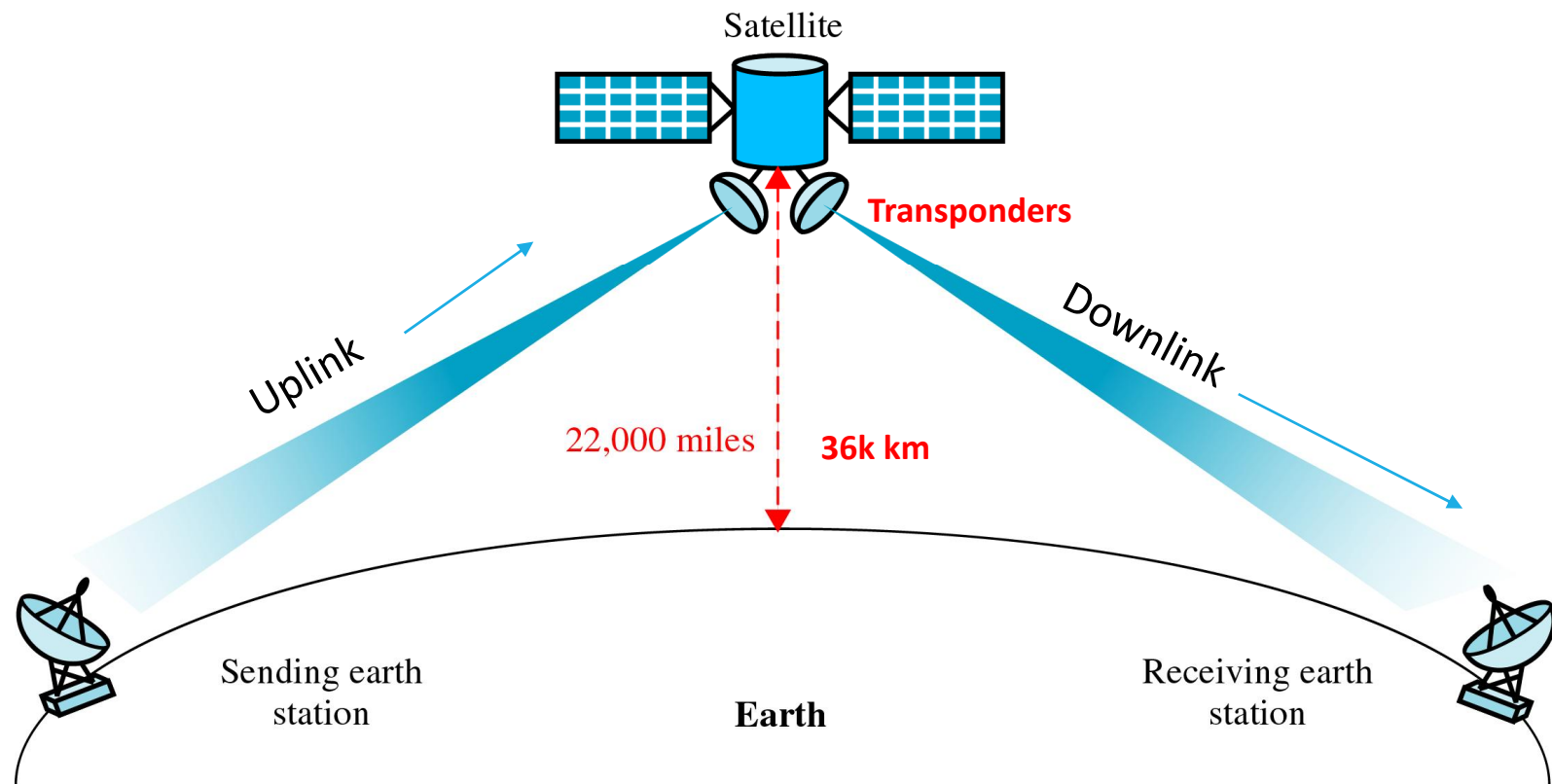






# Satellite Transmission

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- Satellite communication ( C-Band, Ku-Band, Ka-Band)
  - Satellite for communication are placed in GEO Geosynchronous Orbit
  - satellites placed in an orbit synchronized with the rotation of the earth
  - Orbit is 36,000 km above the surface of the earth
  - The satellite consists of transponder that can Rx and Tx signals
  - most feasible transmission medium for Nepal because of its terrain
  - Highly Expensive