

Chapter-6

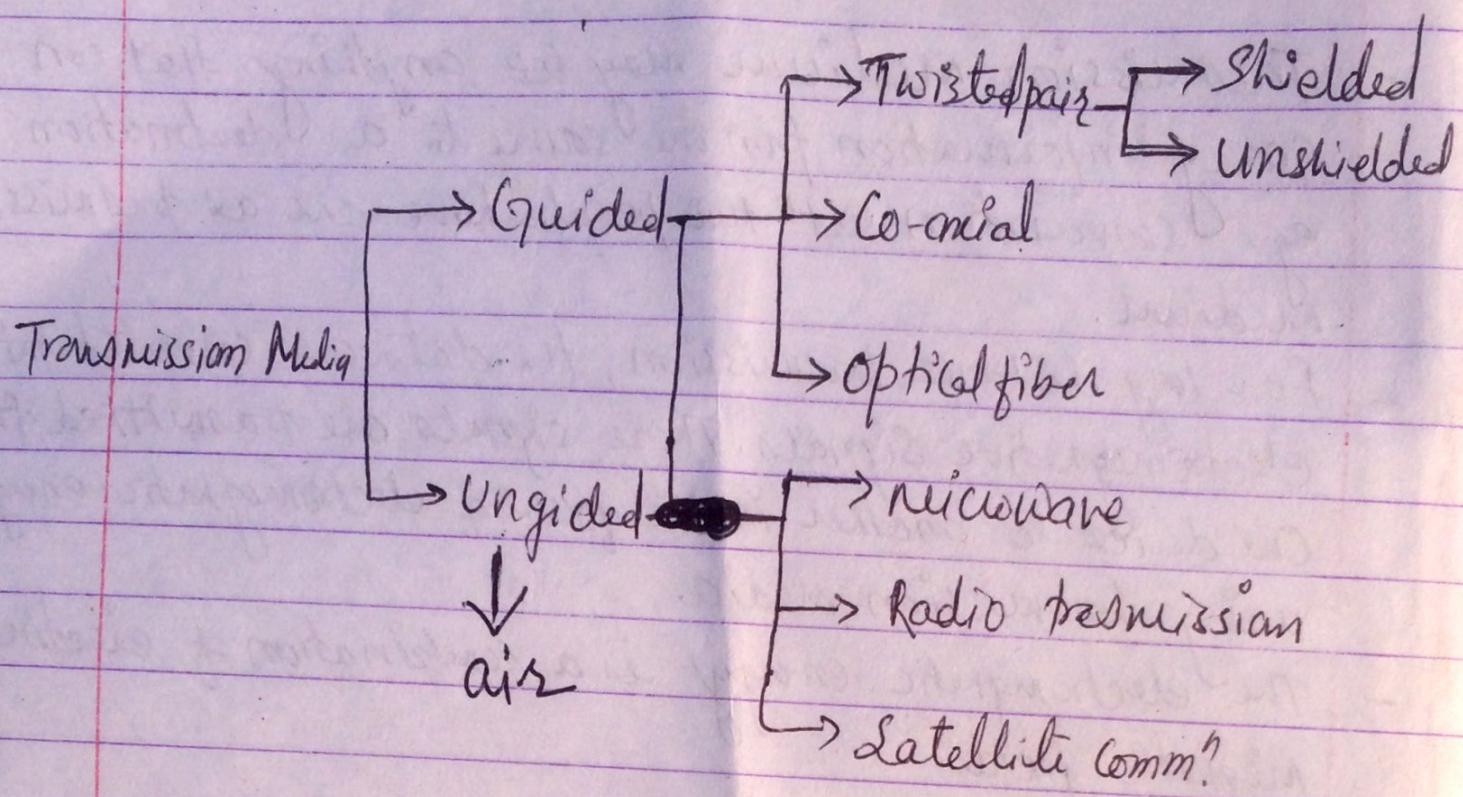
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Transmission Media

- Transmission medium may be anything that can carry information from one source to a destination eg. Conversation b/w two people have air as transmission medium.
- For long distance transmission, the data are converted into electromagnetic signals. These signals are transmitted from one device to another in the form of electromagnetic energy using transmission media.
- The electromagnetic energy is a combination of electric & magnetic fields.
- In Telecommunication, currently usable electromagnetic spectrums are as.

<u>Band.</u>	<u>Range</u>	<u>Propagation</u>	<u>Application</u>
① VLF (very low freq.)	3-30kHz	Ground	long range radio navigation
② LF (low freq.)	30-300kHz	Ground	Radio system beacon
③ MF (medium freq.)	300k-3MHz	Sky	AM radio
④ HF (high freq.)	3-30MHz	Sky	Aircraft comm.
⑤ VHF (very " ")	30-300MHz	Sky & LOS	FM & TV. broadcast
⑥ UHF (ultra " ")	300M-3GHz	LOS	cellular phone, satellite
⑦ SHF (super " ")	3-30GHz	LOS	Satellite comm.
⑧ EHF (extra " ")	30-300GHz	LOS	Radar, satellite.

Types

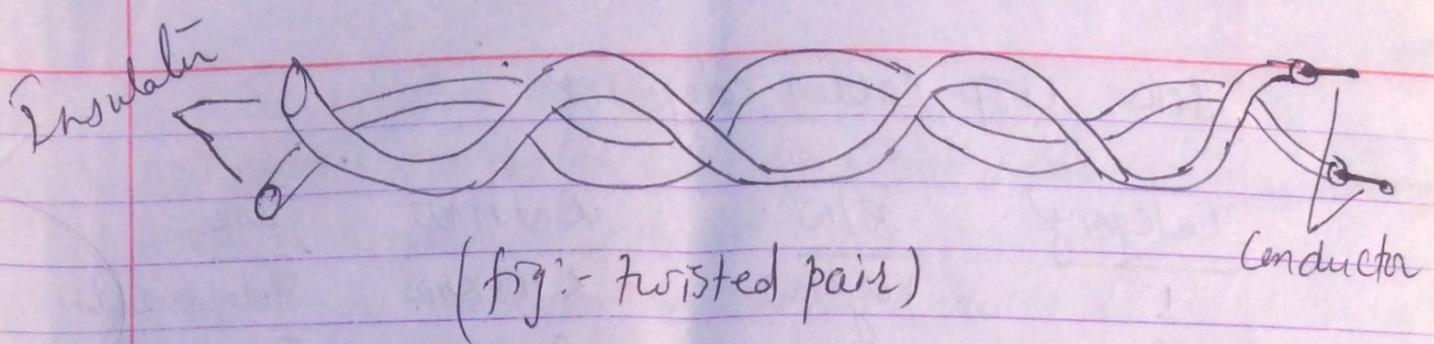


Guided media

- Guided media is a wired transmission media
- For guided transmission medium the transmission capacity i.e. data rate & BW, depends critically on the distance & on whether the medium is point to point or multipoint.

① Twisted pair:

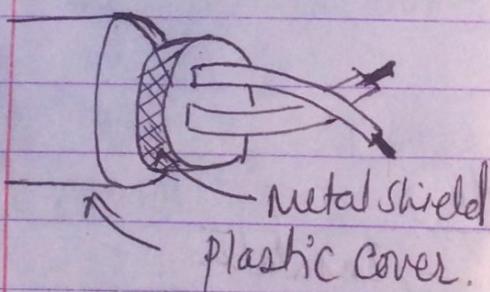
- It consists of two insulated copper wires arranged in a regular spiral pattern.
- A wire pair acts as a single comm? link. Typically no. of these pairs are bundled together into a cable by wrapping them into a tough protective sheath
- The twisting tends to decrease the cross talk interference b/w the adjacent pair in a cable.



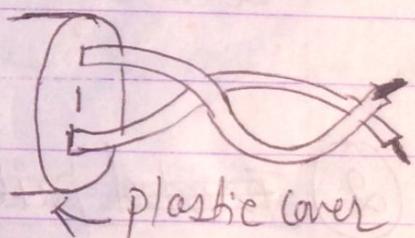
(fig:- Twisted pair)

- For long distance commⁿ, hundreds of pair cables are used.
- It is least expensive & most widely used guided transmission medium.
- Most commonly used in telephone n/w.
- It has limited B/W & data rate & distance.
- It is divided into two types.

Shielded twisted pair (STP)



Unshielded twisted pair (UTP)



- Provides better performance at higher data rate.
- The metallic sheathing reduces external noise & interference.
- More expensive & difficult to use.

- Susceptible to external noise & Interference.
- no metallic sheathing
- least expensive & easy to use.

Some UTP cables categorised

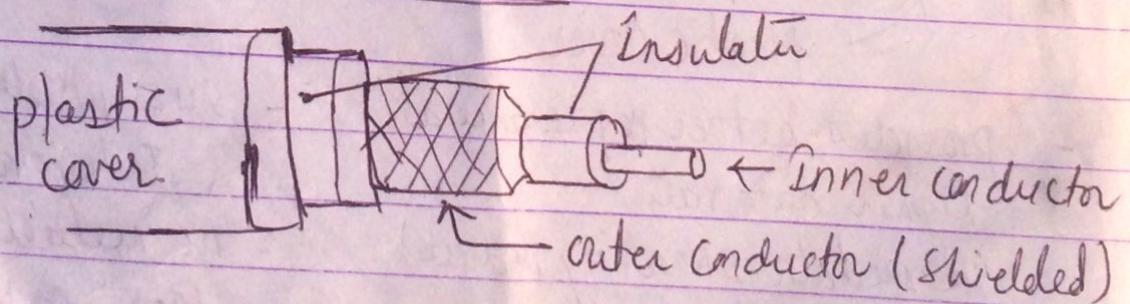
Category	B/W	Data rate	use
1	Very low	< 100 kbps	Telephone line
2	< 2 MHz	2 mbps	T1 - lines
3	16 MHz	10 mbps	LANs
4	20 MHz	20 mbps	"
5	100 MHz	100 mbps	"
6	200 MHz	200 mbps.	"

Application

- Telephone N/w (Btw house & local exchange)
- Private Branch exchange
- Local area N/w's.

②

Twisted pair Co-axial cable



(fig:- Co-axial cable)

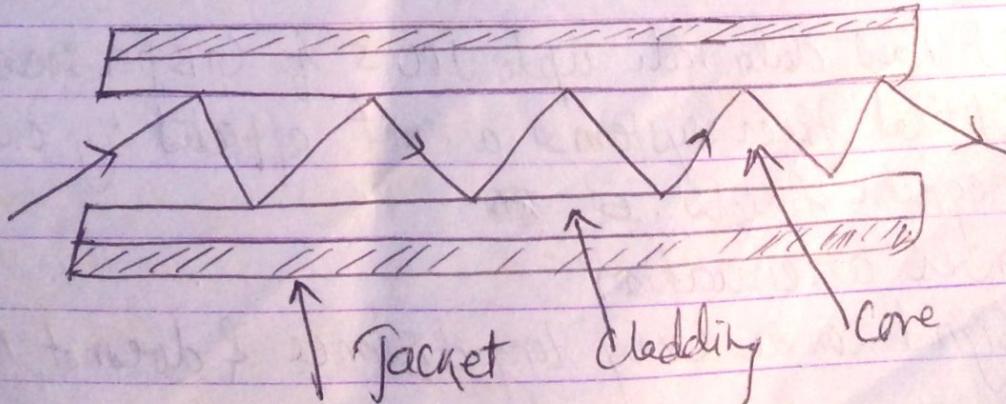
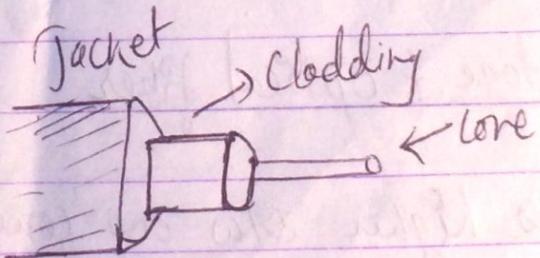
- Co-axial cable, like twisted pair, consists of two conductor but constructed differently to permit it to operate over a

Base band co-axial - carry single signal of fixed freq?
Broad band " - carry multiple signals over large area

wider range of frequencies

- It consists of a hollow outer cylindrical conductor that surrounds a single inner wire conductor
- The inner insulating rings or dielectric material is held in place by either regularly spaced insulating rings or dielectric material.
- The outer conductor is covered with a jacket
- In this cable all the part insulator & conductor are in the same axis so the cable is popularly known as Co-axial Cable.
- Depending on the outermost plastic cover, if that cover is thin the cable carry signal up to 185m & thick carry upto 500m.
- The main application in Cable networking in TV long distance Telephone, traditional LAN.

③ Optical fiber



EMI - Electromotive Isolation

- An optical fiber is a thin (2 to 125 μm), flexible medium for guiding an optical ray.
- It has cylindrical shapes & consists of three sections i.e core, cladding and jacket.
- Jacket : - It is outermost covering.
 - It has no technical significance
 - used for providing strength to fiber and for identification.

Cladding :

- It is 2nd covering part for core
- It helps to total internal reflection & protection from external light. Its diameter is 125 μm.

Core :

- It is the pathway for light signal to travel.
- Light travels via total internal reflection.
- It has higher refractive index than cladding.
- It has diameter from 8 to 50 μm

Advantage of optical fiber

- ① It has higher BW as compare to twisted & coaxial cable.
- ② It has data rate upto 100's of Gbps per second. (10 Gbps)
- ③ Optical fiber systems are not affected by external electro-magnetic fields. i.e ~~no~~
- ④ lower attenuation
- ⑤ Signal can be carry long distance & doesn't need re-generation

- (6) smaller in size & light in weight
- (7) Fiber has high degree of security.

But

- it is expensive (components)
- damaged by mice
- Difficult to fault finding.
- Unidirectional light propagation

Types of fiber

- (1) Plastics
 - (2) Glass
 - (3) Monomode
 - (4) Multimode
 - (5) Step Index
 - (6) Graded Index
- } on the basis of material.
- } on the basis of no. of modes.
- } on the basis of reflection index.

Application

- (1) Long distance Telecommunication.
- (2) Military Application.

Unguided media :

- In guided media transmission & reception achieved by means of an antenna.
- An antenna is defined as an electrical conductor or system of conductors used either for radiating electromagnetic energy or for collecting electromagnetic energy.
- At transmitting side there is a transmitter to transmits certain ~~to~~ signal and at receiver side there is a receiver to receive that signal, travelling through the space.

Types of unguided transmission.

- ① Terrestrial microwave
- ② Radio transmission.
- ③ Satellite comm? (microwave)

① Terrestrial Microwave :

- Microwave use the line of sight (LOS) method of propagation where the signal does not travel along the surface of the earth, so the two antennas (parabolic) dishes must be in the line of sight (LOS) i.e. able to look each other without any obstacle bet' them.

- Microwave antennas are usually located at substantial height above the ground level for easy transmission.
- Generally microwave signal travel one direction at a time, for two way comm? in a telephony two frequencies needed at end ~~trans~~receivers. Which is a combination of transmitter & receiver together operating at two different frequencies.
- The data rate is 1 Mbps to 10 Gbps.

Application

- The main use of terrestrial microwave in telecommunication services
- Microwave is commonly used in both voice & video transmission.
- Used in cellular telephony

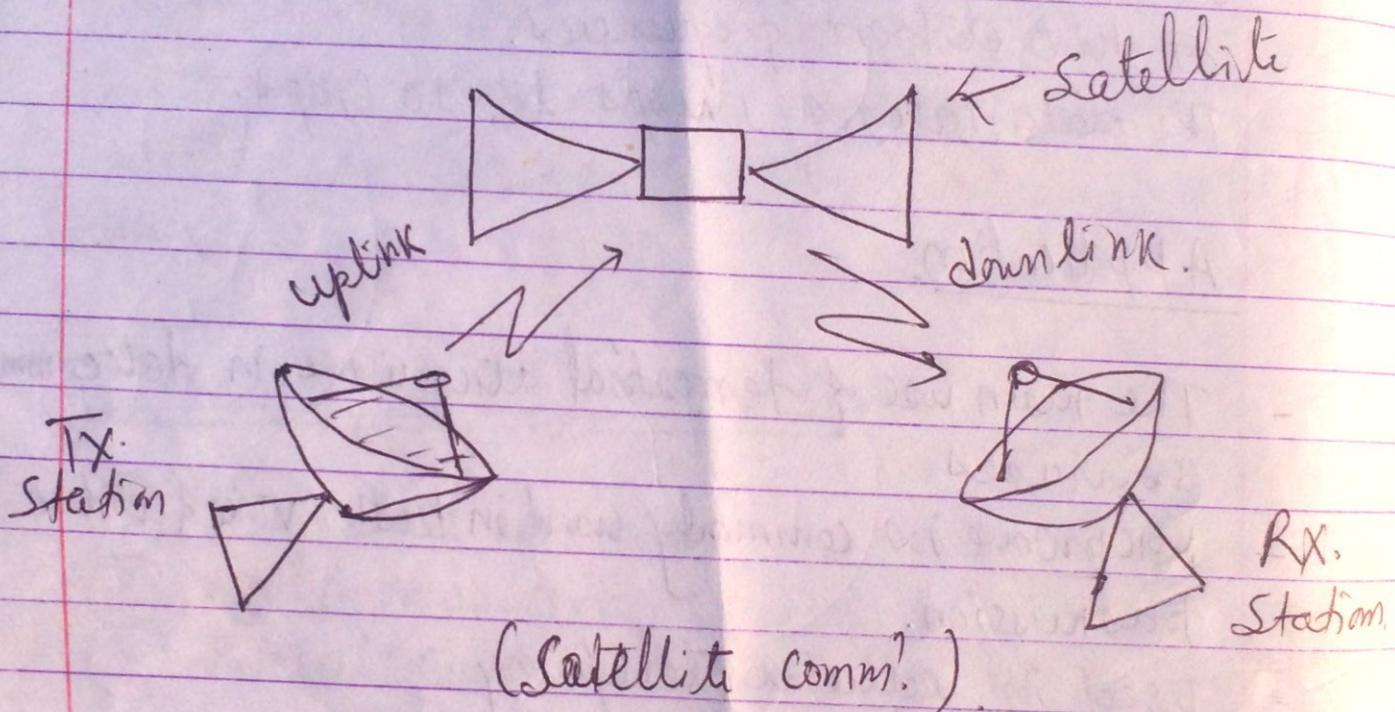
② Radio Transmission :

- In radio transmission system only one transmitter can transmit signal from station.
- The used antenna in this transmission is omni-directional i.e. signal can be transmitted all the directions equally in the free space
- These signals can travel along the surface

Application

- It covers the VHF & UHF band and used in FM radio and Television.
- Also used in ~~data~~ no. of data networking application

③ Satellite microwave (Commⁿ).



- A satellite commⁿ is a microwave relay station.
- It is used to link two or more ground based microwave transmitter/receiver.
- A satellite receives transmitted signal on one freq-
ie uplink & it transmits signal using another freq-
ie downlink.

- If the satellite communicate ¹⁶ one transmitter & one receiver ~~is used than~~ so the comm. is called point to point comm?
- If only one earth station transmits & multiple ground stations receives the signal then it is called multiple satellite comm?

Application

- Television distribution
- Long distance telephone transmission.
- private business Networks.

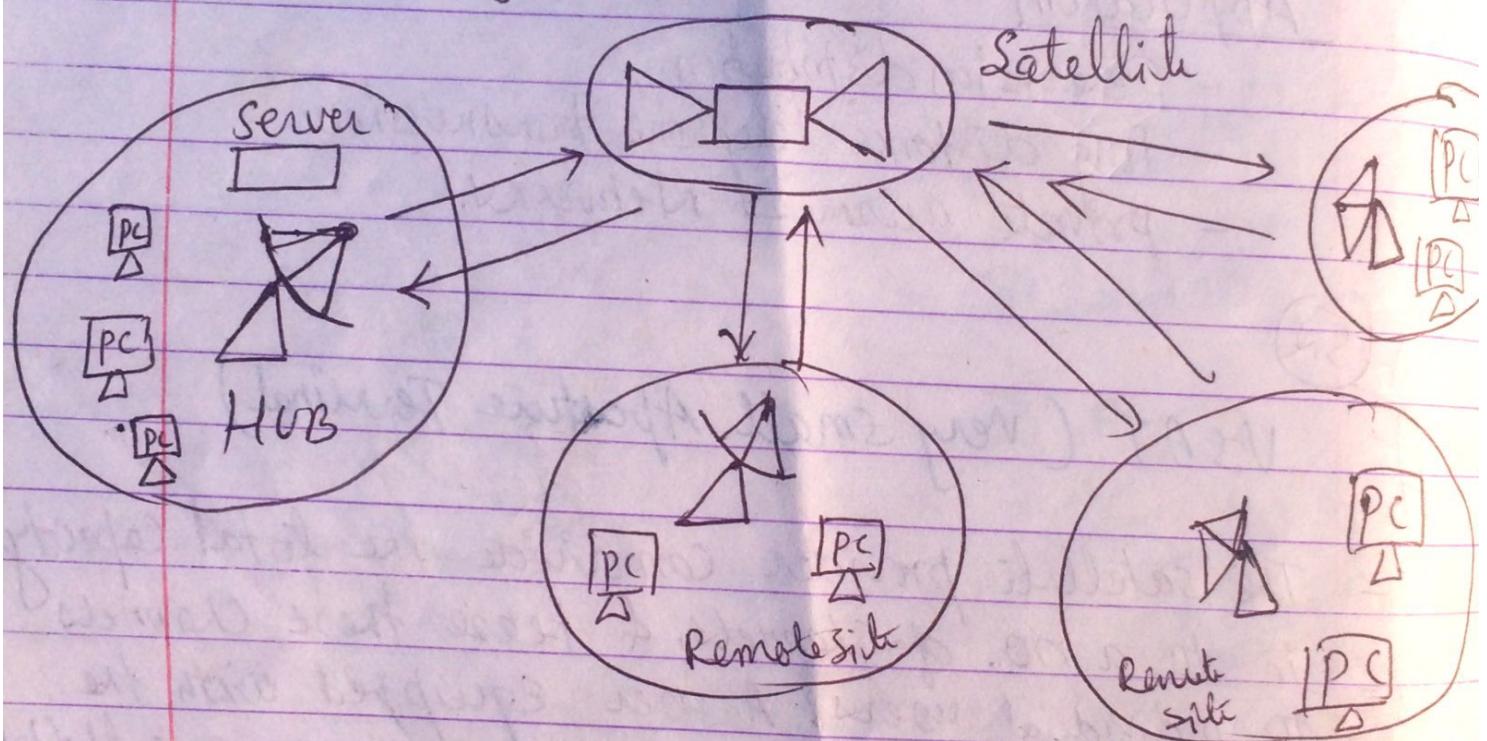
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VSAT (Very small Aperture Terminal)

- The satellite provider can divide the total capacity in to a no. of channels, & lease these channels to individual users. A user equipped with the antennas, at a no. of sites can be use a satellite channel for a private n/w.
- VSAT system provide the facility of division of total ~~to~~ capacity of single satellite to multiple private user.
- VSAT is a low cost & small terminals
- It provides direct comm. bet. a central ~~ab~~ point

and the large no. of remote points or both
remote terminal via a central hub.

- VSAT are fixed terminals so they are considered to a fixed satellite service
- The central hub can communicate with the small term.
- In this way Comm? can possible in remote areas.

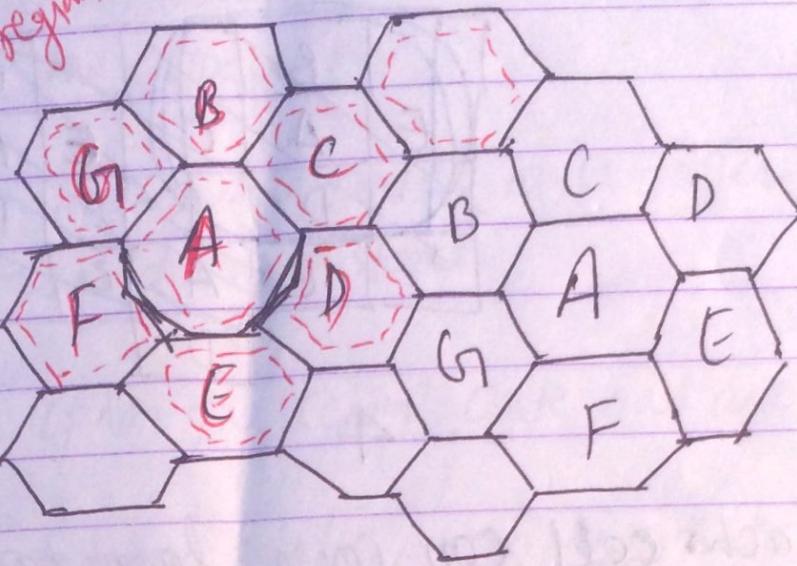


(VSAT Configuration)

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Cellular Telephony

It is the communication in a certain geographical region & region to region namely cell.

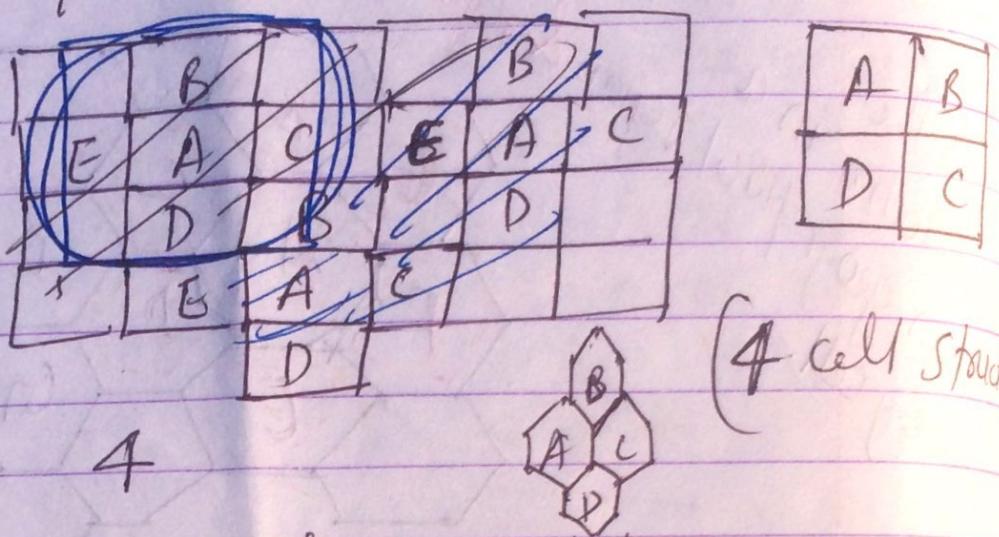


(fig:- Cellular N/W)

- In cellular Telephony system each cell has BTS ie (Base Transceiver Station) ie Antenna.
- The BTS can transmit and receive the signal so called as transceiver. A cell is a small geographical region having range (1 - 5km.)
- The main purpose of cellular N/W, for comm. b/w two moving ~~per~~ users. so This system is also called Mobile Comm. system.
- The architecture of cellular N/W is shown above where, A, B, C, D, E, F & G are cells of hexagonal shape, it ~~is due to~~
- Generally cellular N/W is 7 cell or 4 cell structure of this structure is called cluster.

- so that cell structure must be hexagonal in 7 cell structure & ~~or~~ square in 4 cell structure.

- Landauer
freq. reuse



+ Each cell can cover large population, depending on population the cell size can be designed for signal coverage.

- In city area cell size is small but in ~~near~~ ^{near} village area its size is large.

- All cell has different frequency, ~~to~~ in one 7 cell structure, this is for ~~no~~ interference occurrence of interference, crosstalk.

- And these frequency ~~can~~ used, such that ~~no~~ there is no overlapping or nearby to the other freq. ~~but~~ technique is called frequency re-use.

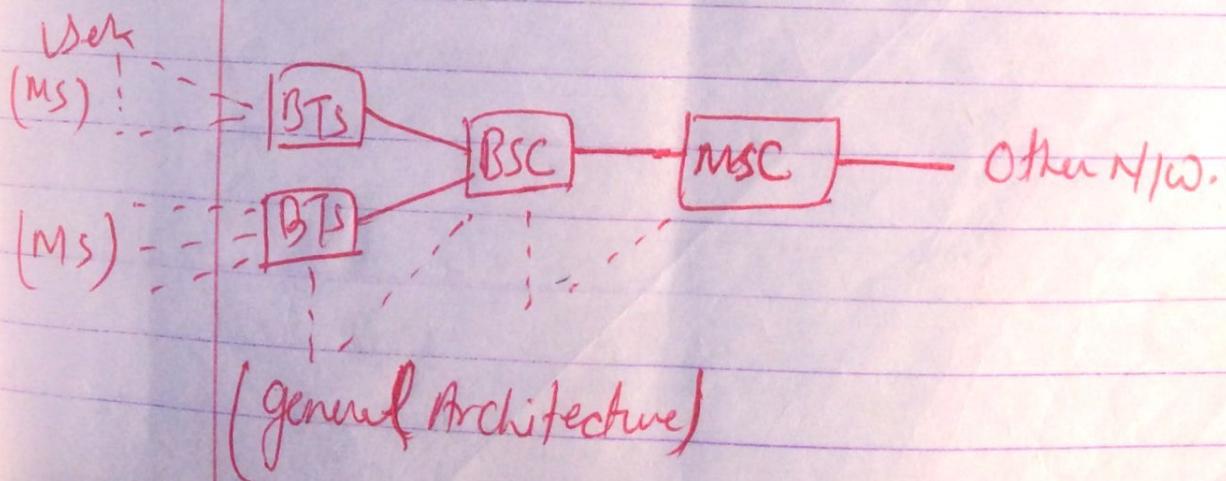
Antenna :-

- It is the device which transmit or receive the signal from the space.
- Antennas are always mounted on a tower, so for easy to transmit long distance.
- Depending upon the comm' antennas are.

(1) Isotopic antenna : It is an hypothetical antenna which radiates equally in all direction. It is not physically realizable.

(2) Omni directional antenna : It can radiate signal around it in all direction, so its shape is cylindrical.

(3) Directional Antenna : It radiate or receive the signal in a particular direction.



Types of Propagation

(Q. Explain the various types of propagation of electromagnetic waves.)

2013 F

1) Ground wave propagation.

2) Sky wave propagation.

3) Space Wave " (LOS)

4) Duct propagation.