# Module - II

Multiplexing

* process of transmitting multiple signals Simultanouply through a single path by combaining them.
* path refers to the physical link b/e device
* A path can hue many channels which is a portion of path that can carry transmission b/e a pair of devices.
* A multiplexer (mux) combeines multiple data streams into a single stream (many to 1)
* A D-multipler (DEMUX) splits the combines streams into different signals/streams. (1 to many)
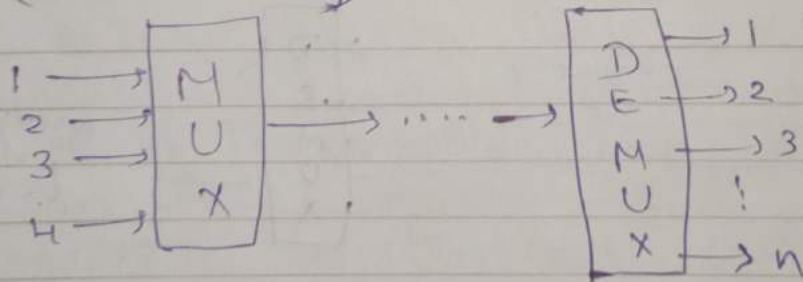
* There are 3 MUX techniques →
1) freq - division MUX (FDM)
2) wave - " " (WDM)
3) Time - " " (TDM)

i) FDM (freq -division MUX) =

* Availlelele bandwidth of single transmission mediums is divided into multiple

encode
Mux
Start
decode
D Mux
(End).
classmate
Date
Page

channels, each freq channel is given to diffⁿ devices.

* FDM is an analog technique that can be applied when the bandwidth of a link is > than the combined bandwidths of the signals to be transmitted.
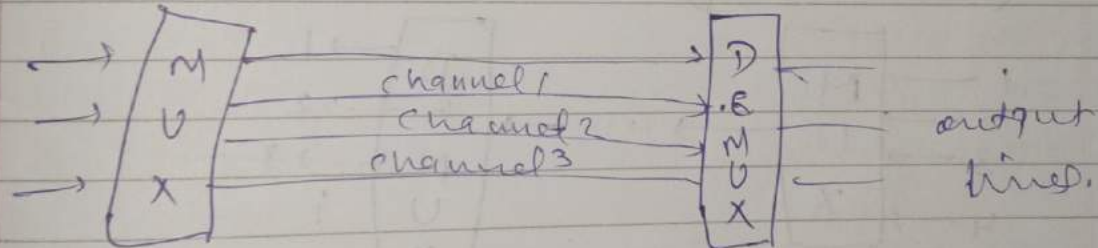
* Signals from diffⁿ devices modulates [modifies carrier wave to encode info] diffⁿ carries freq.

* Modulated signals are combined & transmitted through single link

* channels are seperated by unused bandwidth → Guard bands.

(bandwidth → Bw of connection → sum of max data.)

ley input lines

input lines

channel 1
channel 2
channel 3

output lines.

adv * less expensive
* used for analog signals
* High reliability

disadv * used only when a few less speed channels are desired.
* needs a career wave / career signal.
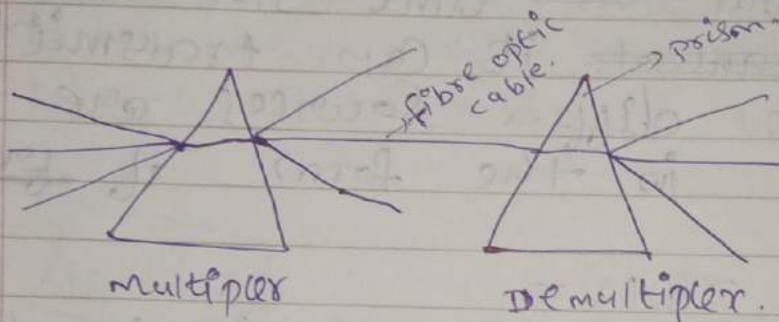* full band width of a channel cannot be used in FDM channel must have a
* communication

very large bandwidth.
* FDM system extremely expensive.

appli * used in TV ntwrk
* used for FM & AM radio broad cast.

2) wave length division MUX =

multipler   Demultipler.

* Similar to FDM, except optical signals are transmitter through fibre optic cable.
* MUX & DEMUX is done using prism.
* Input beems of light frm diffrnt devices are combines to form a wider band of light with the blp of MUX-er
* DEMUX-er seperates signals & passes to respective destinated devices.
* freq → high.

adv *

* quiet simple technique easier to reconfigure
* provides higher bandwidth
* Allows secure transmission of optical signal
* high security & low cost.
* long distances communication with low signal loss.

* Signals cannot be very close.
* cost of system ↑ses with addition of optical components.

3) <u>TDM</u> = (Time Division MUX)

* Differnt devices have diff~ alloted time intrvaf → time slot at which ~~it cannot~~ it can transmit data.
* Signals from diff~ sources are transmitted in the form of <u>frames</u>
* 2 types →

a) <u>Synchronous TDM</u> =
* MUXer allocates same time slot to each device at all ~~types~~ time ^whn a device doesn't have anything to transmit.
* If the device doesnot hue anything to transmit, then the slot will be enpty
* for n input ~~times~~ ^lines each frame has atleast ~~has~~ n slot.

b) <u>Asynchronous TDM</u> =

* for n input lines, the frame consist of m slot (m<n).
* time slots are not fixed & are allocated to devices that has data to sent.
* Each slot contains an address part that identifies the source of the data.

TDM appli~

a)* Telephone system. — telephone ntwork is a tele commun ntwork used for telephone calls b/s 2/ more parties.
  a) Landline Ntwork.
  b) wireless ntwork (moli)
  c) private ntwork = where closed grp of telephones are connected primarily to each other & use a gate way to reach the outside world.
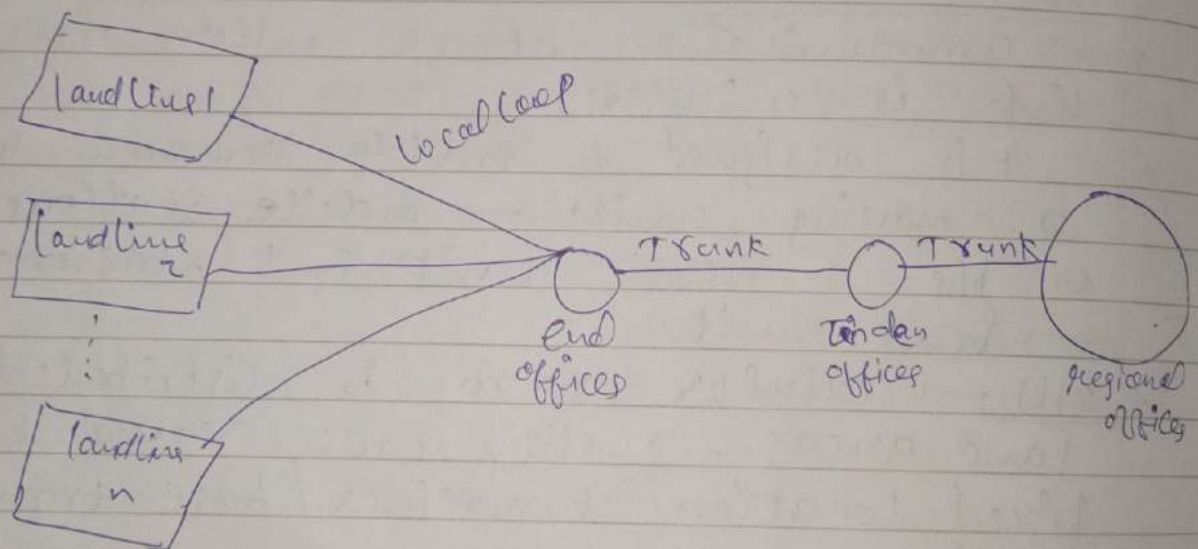
* Local loop = It is a twisted pair cable that connects the subscriber telephone to the nearest end office.
  max bandwidth 4000 Hz. (4 kHz)
* Trunks = Are the transmission media that handle commun n b/s offices.
* Switching offices = A switch connect several local loops / trunks & allows a connection b/s diffrnt subscribers.
  Telephone ntwrk has several levels of switching offices like end offices,

Tandom offices & regional offices.
* End - offices are the local central office
directly connected to the end user at a
distance of 1 - 10 km
* Tandom offices are the switching centres
located within the same local area.
* Regional offices are inter connected non-
hierarchial switching offices for connecting
tandom offices.

b) Cellular network =
* Communication network where the last
link is wireless.
* It is designed to provide commu~ b/w
2 moving units → mobile stations. [MS's]
or b/w 1 mobile unit & 1 stationary unit.
→ land unit.
* cell → cellular network is distributed over
land areas → cells, each served by 1
fixed location transceiver./base transceiver
station.
* Each cell contains an antena & is controlled
by a network station → base station (BS)
* This BS provide the cell with the
network coverage which can be used for
transmission of voice, data, & other
type of cntnt.
* Each base stations intu~ is controlled
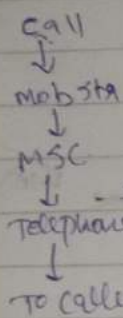by a switching office → Mob Switching
centre (MSC)
* MSC coordinates commu~ b/w All the
base stations & telephone central office

→that is responsible for connecting calls, recording call info & billing.

* features →

a) Transmitting = (இங்க call dial பண்றோம் மாதிரி)

* To place a call from a mob station, the caller enters a call code of 10 digits (phone no.) & presses the send button.
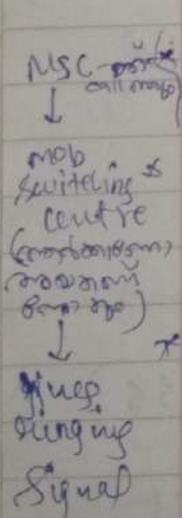
call
↓
mob sta
↓
MSC
↓
Telephone
↓
To caller

* The mob station then scans the band, seeking a setup channel with a strong signal, & sends the data (mob no.) to the closest base station using that channel.

* The base station relays the data to to MSC

* The MSC sends the data onto the telephone central office.

* If the called party is available, a connection is made & the bit is relayed back to the MSC

b) Recieving = (phone ring ஆகுறோம்)

MSC
(call map)
↓
mob switching centre
(மாறோனுறம்)
(மோமோன் தேடும் இடம்)
↓
mob ringing signal

* when a mob phone called telephone central office sends the no. to the MSC.

* MSC searches for the loc of the mob station by sending query signals to each cell, in a process → paging.

* once the mob station is found, MSC transmits a ringing signal, when the mob station answers assigns a voice channel to the call, allowing voice commun. to begin.

SIM → Subscribers identity module.
(మన మొబైల్ సిగ్నల్ weak అయినప్పుడు కమ్యూనికేట్ చేయడానికి)

c) **Hand off** =
* It may hpn that during a conversation the mob station moves from 1 cell to another.
* whn it does the signal may creak

adv 4 **cellular ntwr** =

* Connects both fixed & wireless telephone users
* easy to upgrade equipmnt.
* easy to maintain
* has high capacity.
* Requires less transmission power.
* ~~needs~~ reduced ~~set up timing~~

c) **Mob commyn ntwrk** =

a) **GSM** = (Global System for mob commn).
      used for protocols (2g, 3g, 4g)

b) **Teleservices** =
      video call, voice call, Short txt msg (SMS)

c) **Supplemntry Services** =
      conferencing , call waiting, call hold, call forwarding

d) **GSM architecture** = : Compnents —
      a) mob station (MS)
      b) Base Station Subsystm (BSS)
      c) Mob Switching Centre (MSC)
      d) operating Support Subsystm (OSS)

e) **SIM** = mob itself divided into the hand set & removable chip cnts Subscribers &

account info ⟶ A SIm card.

e8) wireless mode commin =

a) BTS (Base Tranceiver Station) =
* Responsible for wireless commin b/o mob & its relevant ntwrk through a radio interface.
* Several BTS together are controlled I BS Controler (BSC).
* BTS connection + MSC connection ⟶ BSC

f) operations & maintainence (OMC) =
operations & maintnce is connected to all equipmnt in switching systm & to BSC Implemntation of OMC ⟶ OSS.