FDMA→TV
TDMA

Multiplexing → single channel k through multiple messages transmit krna.

## Module - III

### IMT 2000/UMTS

International comm. union created a project in 1998 for a common world wide cellular standard under the name International mobile telephone 2000. It is also referred as universal mobile telecomm. comm. system (UMTS) in europe.

IMT 2000 is based on TDMA/FDD and GMSK modulation is used.

UMTS is based on CDMA/FDD and modulation scheme is QPSK.

### features of 3G

① With 3G, info. is divided into separate but related packets before transmission and reassemble at the receiving end (Packet Switched Data)

② Info. and other resources are being stored in remote web servers which serve the various needs of human beings through web browser at their end.

③ Speed of upto 2mbps are achievable at 3G. The data transmission rates will depend upon the environment.

### 3G air interface technologies

IMT 2000 standards accept 5 possible radio interfaces based on 3 multiple access technologies. (FDMA, TDMA and CDMA)

The 5 3G air interface tech. are as follows -

1. WCDMA
2. CDMA-2000
3. TD-SCDMA
4. UWC 136 (Universal wireless comm.)
5. DECT IFD-TDMA (Indoor)

# NOTE

Overall infrastructure of 3G mostly includes WCDMA and CDMA techniques in terms of applicability & future potential.

## 3G spectrum

1. Paired Spectrum
2. Unpaired spectrum

The 3G identifies paired and unpaired parts of spectrum.

1. Paired Spectrum.
Radio spectrum is generally organised as paired spectrum with some lower frequency bands and some upper frequency bands. Paired spectrum is specified in the form 2×15 MHz. i.e. 15MHz in lower bands (downlink) and 15MHz in upper band (uplink).
For paired spectrum, the bands for uplink & downlink are identified for frequency division duplex (FDD).

2. Unpaired Spectrum
The unpaired bands, for eg, used for TDD (Time division duplex) operation. TDCDMA is a TDD technique. In this, uplink and down link transmissions are carried over

by the same frequency band by using synchronized time intervals. Thus, time slots in a physical channel are divided into transmission and reception part.

## Limitations of 3G

① There are multiple standards for 3G, making it difficult to roam and inter-operate across networks. we need global mobility and service portibility.

② 3G systems are based on wide area concept. We need hybrid plus that utilise WLAN concept (Hot-spot) and base station wide area network design.

③ We need wider bandwidth.

④ Efficient modulation schemes

⑤ we need all digital packets networks that utilise IP in its fullest form with converged voice and data capability.

## QOS in 3G (Quality of Services in 3G)

→ The term QOS designate simply a set of service requirements to be fulfilled by the network while transporting a traffic stream from source to destination.

→ The QOS attributes are usually specified in terms of bit error rate or packet error rate, transfer delay and so on.

→ In QOS approach, a set of QOS classes is defined.

→ A QOS class is composition of set of admission control rules and set of condition traffic rules.

→ In UMTS, 4 QOS classes are defined based on their ability to tolerate PER (Packet error rate) and transfer delay.

→ Conversational and streaming classes preserve time relation b/w info entities of the stream. They are suitable to carry real time traffic since they define an upper limit on transfer delay within their QOS profiles (VOIP, video conferencing)

Interactive and Background classes are mainly intended to represent conventional internet applications and also SMS and MMS services.

## W-CDMA

The two standards of 3G techn. that are most popular in the world are WCDMA (3GPP) and CDMA-2000

## Salient Features of W-CDMA

① WCDMA uses a new spectrum with a 5MHz carrier and uses the DS-CDMA (Direct Sequence) radio access technology. It provides 50 times higher data rate than in present GSM network and 10 times higher than GPRS n/w.

② W-CDMA is a technology for wide band digital radio comm. of internet, multimedia video and other capacity demanding applications.

③ It provides higher capacity of voice or data at higher data rates.

④ The wider band makes it possible to divide and combine fading reception signal propagated through multipath fading channels into more multipath components which helps to improve the reception quality through rake time diversity.

⑤ It can accomodate a greater no. of users who communicate at high speed.

⑥ The wide bandwidth of WCDMA gives an inherent performance gain over the previous cellular systems and it reduces the fading of the radio signal.

⑦ Packet access can be optimised for max. throughput.

⑧ The advance form of WDMA is high speed downlink package access, i.e. HSDPA.

CDMA 2000

CDMA 2000 based on the inherent advantages of CDMA technologies and introduces other enhancements such as orthogonal frequency division multiplexing (OFDM) and (OFDMA). Advance control and signalling mechanism, improve interference management techniques, end to end QOS and new antenna techniques such as MIMO (multiple i/p multiple o/p) and space division multiple access to increase data throughput rate and QOS (significantly improving n/w capacity and reducing deliver cost).

## Key Features of CDMA 2000

① CDMA 2000 performance in terms of data speed, voice capacity and latencies continue to out perform in commercial deployments.

② CDMA 2000 technologies offers the highest voice capacity and data throughput using the least amount of spectrum and cost of delivery is also very low for operators.

③ CDMA 2000 provide support for advanced mobile services such as high performance VOIP, video - telephony, multi-media messaging, multi casting, online - gaming with 3D graphics.

④ CDMA 2000 offers a broad selection of devices and has a significant cost advantage.

⑤ CDMA 2000 has a solid and long - term evolution path which is built on the principale of backward & fwd compatibility and support hybrid n/w config.

⑥ CDMA 2000 system have been designed for urban as well as remote rural areas for fixed wireless, wireless local loop, limited mobility and full mobility applications in multiple spectrum bands including 450, 800, 1700, 1900 and 2100 MHz.

# CDMA 2000 Advantages

1. Superior voice clarity
2. High speed broadband data connectivity
3. Low end-to-end latency / delay
4. Increased voice and data throughput capacity.
5. Differentiated value added services (VAS), such as VOIP, multicasting, position-location etc.
6. Flexible network architecture.
7. Application, user and flow-based quality of service
8. Flexible spectrum allocation with excellent propagation characteristics.
9. Robust link budget for extended coverage and increased data throughput at the cell edge.
10. Multimode, multiband, global roaming
11. Improve security and privacy
12. Lower total cost of ownership.

## Comparison of WCDMA and CDMA 2000

| W-CDMA | CDMA 2000 |
|---|---|
| ① No backward compatibility. | ① Backward compatibility |
| ② Cell site not synchronised. | ② Synchronised with GPS timing. |
| ③ Each cell site with different scrambling code for spreading | ③ Adjacent cell sites use different time of set of same scrambling code for spreading |
| ④ Complex code 38400 chips, frame of 10 milliseconds. | ④ PN sequence of length of $2^n - 1$, $n = 15$. Period of 26.67 m/$\mu$sec. Different site offset of 64 chips. |
| ⑤ OVSF codes | ⑤ Walsh codes. |

Carrier spacing

⑥    5 MHz

⑥    3.75 MHz

⑦ Chip rate is 3.84 Mcps

⑦ Chiprate is 1.2888 Mcps

⑧ Modulation used is
   BPSK

⑧ Modulation used is —
   ① FW – QPSK
   ② RV – BPSK

⑨ Frame Duration is
   10 ms

⑨ Frame Duration is 20ms
   (or it may vary).

⑩ Coding Scheme –
   Turbo and convolutional

⑩ Coding Scheme
   Turbo and convolutional

## WLL (Wireless Local Loop)

→ WLL is the use of radio to provide a telephone connection to home. Traditionally, provision of voice & data comm. services to the end subscribers over the subscriber loop has been provided by wired systems (twisted – pair cables), co-axial cables and optical fibre cable).

→ WLL is a system that provides a wireless connection b/w subscribers and the local telephone station. It is also called as radio in the loop (RITL), fixed radio access (FRA)

→ WLL systems are suggested for voice data, internet access, TV and other new applications.

→ WLL has no. of advantageous over a wide approach –
① WLL are less expensive than wired systems.
② WLL systems can be installed rapidly.

③ Subscriber radio units are installed, for those willing subscribers only who want the service at a given time.

④ Cellular systems are quite expensive & don't provide sufficient facilities to act as a realistic alternative to broadband WLL.

⑤ A major advantage of WLL over the cellular mobile system is that the fixed subscriber can use a directional antenna pointed at the Base station antenna, provided improved signal quality.