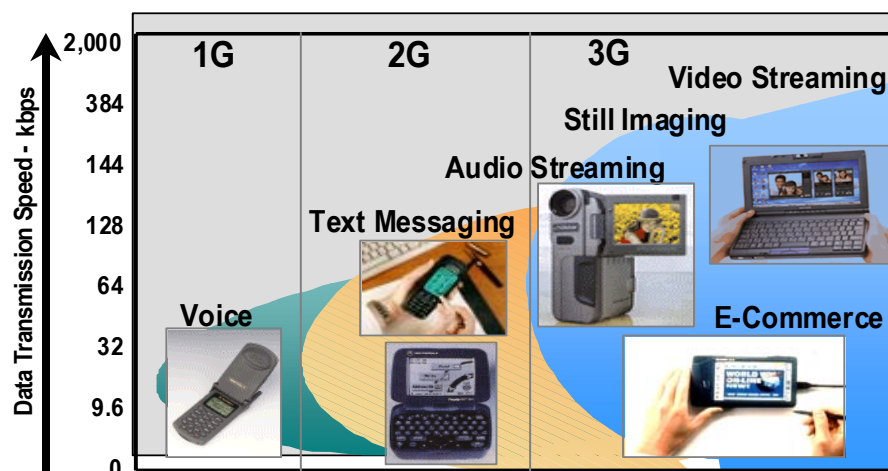


3G VISION



IN THIS ISSUE

- What is 3G Mobile Telecommunication?
- 3G Standards & Band of Operation
- Key 3G Standardisation Bodies
- Migration from 2G to 3G
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- 3G Technology Enablers

Foreword

It has been our endeavor to provide information to our readers on topics related to changing technologies and developments in the field of telecommunications. We are bringing out this issue of TEC Newsletter as a special issue on 3G i.e. 3rd Generation mobile systems. 3G is envisaged as the mobile technology of the future which will provide mobile access to high-speed multi-media services. It is still evolving in terms of technology and standards. An attempt has been made to cover different aspects of 3G in this issue.

I hope you will find it informative and useful.

*N. K. Mangla
Sr. DDG, TEC.*

WHAT IS 3G MOBILE TELECOMMUNICATIONS?

The 'Mobile Communications' and the 'Internet' are today's two extremely high-growth sectors. In fewer than five years, the number of Internet users has grown from 16 million to over 190 million. With more than 500 million worldwide mobile users today (predicted to reach 1 billion users by 2010), it is evident that wireless will become the predominant means of access to global telecommunications in the years to come. Mobile subscribers are increasingly demanding Internet access, while on the move. It is this convergence of the two main technological trends of recent years, the 'Internet' and 'mobile communications', that has led to the development of 3G.

3G Mobile Telecommunications is the generic name for the next-generation of mobile networks that will combine wireless mobile technology with high data rate transmission capabilities. The 1st generation mobile networks provided simple analogue voice telephony. The 2nd generation (current generation) which uses a digital technology in contrast to the 1st generation systems added low rate data services in addition to

basic voice service. The 3rd generation of mobile telecommunications would be capable of providing data rates of up to 2Mbps in addition to conventional voice, fax and data services.

"IMT 2000" is the ITU's terminology to define the 3rd generation of mobile telecommunications.

ITU had earlier coined the term FPLMTS - an acronym for *Future Public Land Mobile Telecommunication Systems* - to define the 3rd generation telecommunications. However since this acronym was difficult to pronounce, it was changed to IMT-2000 which stands for "International Mobile Telecommunications – 2000". '2000' signifies the year 2000 by when the 3rd Generation mobile services were initially scheduled to start.

3G STANDARDS

Though the objective was to develop a single universal standard for 3G air interface and core network, keeping in view the requirements of various countries, ITU has adopted five technologies for 3G air interface as given below:

- IMT-DS, (Direct Spread e.g. WCDMA)
- IMT-MC, (Multi Carrier e.g. cdma-2000)
- IMT-TC, (Time Code e.g. UTRA TDD)
- IMT-SC, (Single Carrier e.g. UWC-136)
- IMT-FT, (Frequency Time e.g. DECT)

BAND OF OPERATION

Spectrum allocations for 3G identified during WARC-92 were:

- 1885-2025 MHz and
- 2110-2200 MHz (3G core band)

Out of above, the portion allocated to the 3G mobile satellite service (MSS) is 1980-2010 MHz and 2170 -2200 MHz.

Subsequently, during WRC 2000, the following additional frequency spectrum was identified for 3G:

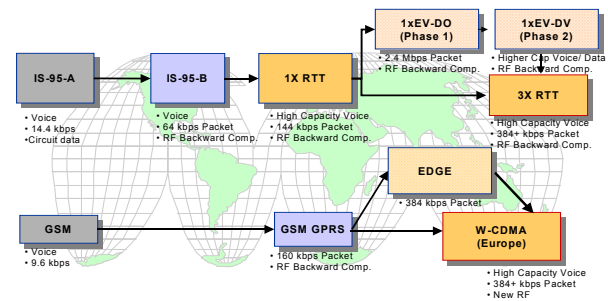
- (i) 806 - 960 MHz
- (ii) 1710 - 1885 MHz
- (iii) 2500 - 2690 MHz.

KEY 3G STANDARDISATION BODIES

1. **3GPP** – This initiative, started in 1998 by the GSM community, is developing standards for WCDMA and CDMA TDD technologies.
2. **3GPP2** – This is another global initiative responsible for defining the CDMA 2000 standards, which build on the 2G CDMA one standard.
3. **UWCC (Universal Wireless Communication Consortium)** – This consortium is broadly developing standards for UWC 136/ IMT-2000 TDMA SC (Single Carrier) technology.
4. **ETSI** – It is developing standards for IMT-2000 FDMA/TDMA technology (DECT).
5. **ITU** – ITU provides an umbrella framework for all the above four standardisation bodies and recognises them for developing the detailed specifications for the 3G technologies. Within ITU-T the lead body is the new Special Study Group (SSG) IMT-2000, while the lead in ITU-R is Working Party 8F.
6. **MWIF (Mobile Wireless Internet Forum)** – It has the mission of “driving the acceptance and adoption of a single mobile wireless and Internet architecture that is independent of the access technology”. The forum’s main aim is to look for synergy between the GSM/UMTS and CDMA/cdma2000 markets.
7. **3G.IP (3G Mobile Internet)** – It has the role of “actively promoting a common IP-based wireless system for third generation mobile communication technology to ensure rapid standards development and take up by operators, vendors and application developers”.
8. **IETF (Internet Engineering Task Force)** – It is becoming more and more involved in mobile standards issues as IP technology is introduced into mobile networks. Key working groups for 3G mobile are MOBILEIP (for mobility) , SIP (for IP-based call control) and SIGTRAN (for signaling transmission).
9. **WAP Forum** – This forum was born with the objective of defining a standard micro browser to run on mobile handsets and a suite of protocols, which allow that micro browser to interact with network server. The broad objective is basically to convert Internet content into a more compact format for transmission over bandwidth - limited mobile data channels.

MIGRATION FROM 2G TO 3G

The proposed migration path for the existing 2G technologies namely **GSM** (being used by the cellular mobile operators) and **CDMA IS95A** (being used for WLL applications by fixed service providers) is as follows:



(a) GSM

GSM (2G) → High Speed Circuit Switched Data (HSCSD) → General Packet Radio Service (GPRS) → Enhanced Data rates for GSM Evolution (EDGE) and finally → UMTS (W-CDMA).

Thus the currently available data rates of 9.6 Kbps provided by GSM can be enhanced to 115 Kbps provided by GPRS. It shall be possible to evolve smoothly to higher data rates of 384 Kbps on EDGE and later to 2Mbps on UMTS.

No additional spectrum is required for migrating from GSM to GPRS. Thus within the existing allotted spectrum the CMTS licensees would be in a position to offer GPRS based enhanced services. These services are popularly being referred to as 2.5G services.

The migration path from GPRS to EDGE is still not clearly defined. Some of the manufacturers are already considering directly migrating from GPRS (2.5G) to W-CDMA (3G) bypassing EDGE that is sometimes referred to as 2.75G services. **The minimum spectrum required for W-CDMA is 5 MHz.**

(b) CDMA (IS 95 A)

IS 95 A → IS 95 B → CDMA 2000-1X → CDMA 2000-1XEV → CDMA 2000-3X (3G)

Since the standards for CDMA 2000-1X technology are finalized and the technology is currently being field tried and the first commercial deployments are

expected by middle of this year, most of the manufacturers are considering to directly migrate from IS 95 A to CDMA 2000-1X bypassing the IS 95 B. The data rates supported by IS 95 A i.e. 14.4 Kbps can be enhanced to 144 Kbps using CDMA 2000- 1X which in turn can be enhanced to 2.4 Mbps using CDMA 2000-1XEV.

No additional spectrum is required for migrating from IS 95 A to CDMA 2000- 1XEV. However migrating from CDMA 2000-1XEV to CDMA 2000-3X would require a minimum spectrum of 5 MHz. Some of the manufacturers are of the view that data rates achieved by CDMA 2000 - 1XEV are equal to the data rates defined by ITU for IMT-2000 (3G) and hence there may not be a need to migrate to CDMA 2000-3X in the initial stages, thereby implying **that 3G type of data rates are possible even within the existing spectrum of 1.25 MHz required for IS 95 A.**

It is clear from the above that the migration path from 2G to 3G in both the cases i.e. GSM as well as CDMA (IS95A) is dynamically changing and the manufacturers may not implement all the 'steps' from 2G to 3G.

3G APPLICATIONS

Some typical 3G applications are given below:

1.Unified Messaging: Unified messaging uses a single mailbox for all messages, including voice mail, faxes, e-mail, short message service (SMS), and pager messages. With the various mailboxes in one place, unified messaging systems then allow for a variety of access methods to recover messages of different types. This essentially gives user a single point of administration for all messages and aims to simplify working life by putting the user in control of all communications.

2.M-commerce: M-commerce is carrying out business on the Internet using a mobile device.

The following three stages of M-commerce exist:

- i) Internet- extension commerce, in the pull-centric* environment of today where users search for information and then make a transaction.
- ii) Location-based commerce which takes a user 's location and user profile into account and then pushes (push-centric*) coupons and offers to interested consumers using this data.

- iii) Short-range commerce using either Bluetooth or other short-range technologies that would allow users to pay for goods at a store using an account set up via their wireless carrier.

3.Location-Based Services: Location-based services provide the ability to link push or pull* information services with a user's location. Examples include hotel and restaurant finders, roadside assistance, and city-specific news and information.

4.Vertical Applications: In the mobile environment, vertical applications apply to systems utilizing mobile architecture to support the carrying out of specific tasks within the value chain of company, such as Parcel delivery, Fleet management, Sales support etc.

5.Advertising: Advertising services may be offered as a push* type information service for e.g. a location sensitive advertising where, for example, a user entering a mall would receive advertising specific to the stores in that mall.

6.Infotainment (Information + Entertainment): A few examples are: Offering access to breaking news or sports snippets in real-time; streaming of cartoons to mobile phones; TV and radio over mobile terminals; delivery of music (MP3 audio files) to mobile terminals; previewing of film clips by potential movie-goers on their mobile phones before selecting a movie etc.

7.Games: The global mobile gaming market in 1999 was valued at 2.9 billion U.S. dollars according to industry analysts. By 2005, it is expected that 4 out of 5 mobile phones will play wireless games.

8.Machine-to-Machine Communication: NTT DoCoMo, Japan's largest Internet service provider says that by 2010, only 120 million of its 360 million subscribers will be humans. The rest will be cars, bicycles, PCs, machines and even pets. A few examples of some of these applications are: The vending machine will automatically ring up the delivery van to refill it with Coke; Refrigerator will automatically ring up the grocer to deliver the food items once they run out of stock inside the refrigerator, Truck fleets will stay linked to headquarters etc..

** Two terms that are frequently used with respect to the delivery of data applications are push and pull, as defined below:*

- *Push refers to the transmission of data at a predetermined time, or under predetermined conditions. It could also apply to the unsolicited supply of advertising (for example, delivery of news as it occurs, or stock values when they fall below a preset value).*
- *Pull refers to the demanding of data in real time by user (for example, requesting stock quotes or daily news headlines).*

3G LICENSING STATUS AT A GLANCE

Country	Year	Completed	Mode of Licensing	Licenses Awarded	Period of Validity
Finland	03/1999	Yes	Beauty Contest	4	20 years
Spain	03/2000	Yes	Beauty Contest	4	20 years
UK	04/2000	Yes	Auction	5 (\$35.25 billion)	25 years
Japan	06/2000	Yes	Beauty Contest	3	
Netherlands	07/2000	Yes	Auction	5 (\$2.5 billion)	16 years
New Zealand	07/2000	No	Auction	4	20 years
Germany	08/2000	Yes	Auction	6 (\$45.85 billion)	20 years
France	06/2001	No	Beauty Contest	2 out of 4	15 years
Austria	11/2000	Yes	Auction	6	20 years
Norway	11/2000	Yes	Beauty Contest	4	12 years
Switzerland	12/2000	Yes	Auction	4	15 years
Sweden	12/2000	Yes	Beauty Contest	4	15 years
Italy	10/2000	Yes	Hybrid Solution	4 (\$10 billion)	15 years
Portugal	12/2000	No	Beauty Contest	4	15 years
Belgium	03/2001	No	Auction	3 out of 4	20 years
Greece	07/2001	No	Auction	4	
Ireland	05/2001	No	Beauty Contest	4	15 years
South Korea	12/2000	No	Beauty Contest & fixed fee	2 out of 3	
Singapore	12/2000	No	Auction	3 out of 4	
Australia	01/2001	No	Auction	6	15 years
Denmark	10/2001	No	Auction	4	15-20 years
USA	09/2002	No	Auction		

3G TECHNOLOGY ENABLERS

Some of the technologies that are likely to become 3G enablers are:

- IPv6
- Mobile IP
- Smart Antenna Techniques
- Software Defined Radio

IPv6

Internet today is based on IPv4, which has a 32 bit addressing scheme. With the total number of fixed and mobile devices connected to the Internet expected to exceed the world's population in just a few years' time, IPv4 will run out of addresses. IPv6, the new standard by IETF, increases this address space from 32 bits to 128 bits, creating a much greater pool of available addresses. Currently, IP addresses are assigned to each device or user for only as long as they are needed – much like providing hotel room numbers. The allocation of a unique address, permanently assigned to every mobile device, would eliminate the need to dynamically administer the address. This would speed up the registration process.

Smart Antenna Techniques

The rapid growth in the number of users of mobile communications means that new ways would have to be found to increase the capacity of the networks.

A Smart Antenna System combines multiple antenna elements with a digital signal-processing capacity to optimize its radiation and/or reception pattern automatically in response to the signal environment. This can dramatically increase the performance characteristics (such as capacity) of a wireless system. Unlike conventional cellular antennas, which broadcast energy over the entire cell, adaptive antennas are antenna arrays that confine the broadcast energy to a narrow beam. The advantages of directing the broadcast energy into a narrow beam are increased signal gain, greater range of the signal path, reduced multi-path reflection, improved spectral efficiency, and increased network capacity. There are also some difficulties in implementation, the main one being the need to continuously track the angular position of mobile terminals in the cell.

Mobile IP

The proposed new standard on mobile IP as defined by IETF (as RFC 2002) provides for ubiquitous

internet connectivity to users while on the move irrespective of whether they are located within their own network or another network. Mobile IP enables a host to be identified by a single IP address, even while the device physically moves its point of attachment from one network to another. Movement from one point of attachment to another is seamlessly achieved without the intervention or the knowledge of the user.

Software Defined Radio

Software Defined Radio (SDR) is a collection of hardware and software technologies that enable reconfigurable system architectures for wireless networks and user-terminals. SDR-enables devices (e.g. mobile terminal) and equipment (e.g. wireless network infrastructure) can be dynamically programmed in software to reconfigure the characteristics of the equipment. In other words, the same piece of 'hardware' can be modified to perform different functions at different times. SDR, thus, provides an efficient and comparatively inexpensive solution to the problem of building multi-mode, multi-band, multi-functional wireless devices that can be enhanced using software upgrades.

News about 3G roll out

1. In October 2000, Korea's SK Telecom (SKT), launched the world's first commercial 3G network (using CDMA 2000 1x technology) in its currently occupied 800 MHz spectrum.
2. Japan's NTT DoCoMo has post-poned the commercial launch of its 3G Network from May to October, 2001. However a trial service has been launched with about 4000 subscribers.
3. NTT DoCoMo has named its 3G service as "FOMA" (an acronym for Freedom Of Multi media Access).
4. According to 12th annual Price Water House Coopers Technology Forecast released recently "To be successful, the mobile Internet, will need to find its own 'killer applications'- it won't just be the conventional Internet delivery on a hand held device."

Source - www.cellular-news.com

3G roll out news of British Telecom

BT wireless - through its wholly owned subsidiary, Manx Telecom - has taken a step closer to delivering its UMTS based 3G network on the Isle of Man with a successful public demonstration of mobile video-telephony on June 28, 2001. Earlier the first public voice call was made over 3G network on May 15, 2001. The licence for 3G services was awarded to Manx Telecom in April 1999.

Source - www.worldsfirst3g.com

DoT INITIATIVE

Department of Telecommunications (DoT) has taken up the following steps with respect to 3G Services in India:

A "Focus Action Group (FAG) on IMT-2000" has been constituted by Chairman, Telecom Commission under the chairmanship of Member (T), Telecom Commission for co-ordination of various issues involved in implementation of IMT-2000 such as technology, services, licensing, spectrum management etc.

For implementation of IMT-2000, the first task is to identify the radio spectrum available in the core band of 1885-2025 MHz and 2110-2200 MHz. Presently 1800-2000 MHz band is with Defence and 2000-2200 MHz is used by BSNL for point to point microwave links. WPC has initiated steps for getting these bands vacated by the existing users.

In addition to above, the following licensing issues are to be considered for providing IMT-2000 services:

- a) Minimum spectrum per operator
- b) Number of operators
- c) Service area of operation
- d) Licensing Method: Auction or beauty contest

In the next Issue

- Broadband Satellite
- Centrex
- Next Generation Networks
- Signalling Aspects of Charging
- 'Voice-loop back' Problem in OCB-283

- e) Technology
- f) Interconnection arrangements
- g) Appropriate time for issuing licenses

The FAG - after studying the various aspects related to above issues, the world scene and interacting with industry through a series of presentations - had submitted its report to the Telecom Commission. This report is currently under examination by the Group of Advisors, in the Telecom Commission Headquarters.

IMPORTANT ACTIVITIES OF TEC DURING THE FIRST QUARTER OF 2001 - 2002

A. Preparation of GRs/IRs and Technical documents

Following were finalised:

- GR for 3.8 m Earth Station Antenna operating in C band.
- GR for E-Commerce.
- GR for Intermediate Frequency Combiner/Divider.
- GR for Multi Service ATM Access Multiplexer.
- GR for RF Power combiner in C and Ku band.
- GR for RF Power divider in C and Ku band.
- GR for Remote station (subscriber terminal) based on CDMA systems.
- GR for V.92 Modem.
- IR on V.92 Modem.
- Standard on Bluetooth Enabled Terminal.
- Standard on Requirements of Subscriber End Equipment connected to 2_W Cable plant.
- Revised GR for 1.2 m and 1.8 m Earth Station Antenna System operating in Ku band.
- Revised GR for 7m Earth Station System operating in C band.
- Revised GR for 11m Earth Station Antenna System operating in C band.
- Revised GR for Dense Wavelength Division Multiplexing Equipment.

- Revised GR for Electronic Push Button Telephone Instruments with Calling Line Identification Presentation (CLIP) facility.
- Revised GR for High Bit Rate Digital Subscriber Line, 2 pair system & High Bit Rate Digital Subscriber Line 3 pair System.
- Revised GR for Patch Panel Antenna (824-894 MHz & 1880-1900 MHz).
- Revised GR for Suppression of Electromagnetic Interface for power equipment.
- Test schedule for 1.2 m and 1.8 m Earth Station Antenna System operating in Ku band.
- Test Schedule for 7m Earth Station System operating in C band.
- Test Schedule for 11m Earth Station Antenna System operating in C band.
- Test Schedule for Asynchronous Transfer Mode (ATM) Core Switch.
- Test Schedule for Asymmetric Digital Subscriber Line.
- Test Schedule for Copper Pair Tester.
- Test Schedule for Electronic Push Button Telephone Instruments with Calling Line Identification Presentation (CLIP) facility.
- Test Schedule for Fibre Distribution Management System for Optical Fibre Cable.
- Test Schedule for Intermediate Frequency Combiner/Divider.
- Test Schedule for Inverter (1 to 15 KVA) with amendment no. 1.
- Test Schedule for RF Power Combiner in C and Ku band.
- Test Schedule for RF Power Divider in C and Ku band.
- Test Schedule for Multi Service ATM Access Multiplexer.
- Revised test Schedule for Patch Panel Antenna for 800 & 1900 MHz.

B. Tests and Field trials

Tests have been carried out for:

- Load test for CDOT MSC.

Approvals issued by TEC during the period April 2001 to June 2001

Type Approvals.....	232
Interface Approvals.....	119
Service Test Certificates.....	52
Total	403

Approvals issued by TEC upto 30.06.2001

Type Approvals.....	4975
Interface Approvals.....	3048
Service Test Certificates.....	1249
Grand Total	9272

- TDI-8 Card of C-DOT.
- IMPCS (CDOT) Load test of MSC at Kolkata.
- Duplex unit of MSC at Kolkata.
- CCS7 and ISDN supplementary service testing in OCB-283 and RSU exchange at Kolkata.
- 800 MHz 12 dBi Gain Antenna of M/s ARM.
- Testing of Software version R24 of OCB-283 System.
- Field trial for Software version IN 56 of AXE-10 System in progress.
- Testing of Software version 13.1 of 5ESS completed.

C. Other Activities

- Manufacturer Forum conducted for:
 - Digital Wireless Access with Internet Access.
 - Dense Wavelength Division Multiplexing Equipment.
- Attended 112th meeting of Technical Advisory Group (TAG).
- Participated in frequency coordination meeting of INTELSAT with Indian Administration.
- Participated in the meeting of working parties 4A and 4B of ITU-R Study Group 4 dealing with fixed Satellite services at Seattel, Washington (USA).
- Comments provided on:
 - Coordination of KOREASAT-1 MOD 3 and MOD4 (116 °K) Satellite Network of Korea.
 - Coordination of INFOSAT-C (116 °K) Satellite Network of Korea.
 - Coordination of GENESIS-6 (63 °K) Satellite Network of Administration of Germany.
 - 9 new and 3 revised draft Recommendation sent by ITU-R study group 4.
 - Proposal to grant infrastructure status of GMPCS services.
- A study paper released on LMDS.

The 3G Terminology

1. 2G - Second Generation, generic name for second generation of digital mobile networks (such as GSM, IS 95 A and so on).
2. 3G – Third Generation, generic name for next-generation mobile networks such as UMTS, IMT-2000 and so on.
3. 3GPP/3GPP2 – Third Generation (3G) Partnership Project.
4. Node B – Terminology used in the 3GPP standardization work to denote the BTS.
5. UMTS – Universal Mobile Telecommunications System.
6. WCDMA – Wide-band Code Division Multiple Access.
7. EDGE – Enhanced Data Rates for GSM and TDMA/136 evolution (Upgrade to GPRS systems that require new BS and claims to increase data rates to 384 kbps).
8. GPRS – General Packet Radio Services. (Upgrade to existing 2G GSM based mobile networks to provide higher speed data services).
9. UTRA – UMTS Terrestrial Radio Access.
10. UTRAN – UTRA Network.
11. OHG – Operators' Harmonization Group.
12. VHE – Virtual Home Environment.
13. GGSN – Gateway GPRS Support Node.
14. SGSN – Serving GPRS Support Node.



NEWSLETTER

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