

3G – A Review of the World Scenario



T V Ramachandran, Director General, COAI
April 30, 2005 @ Bangalore

What Is 3G ?

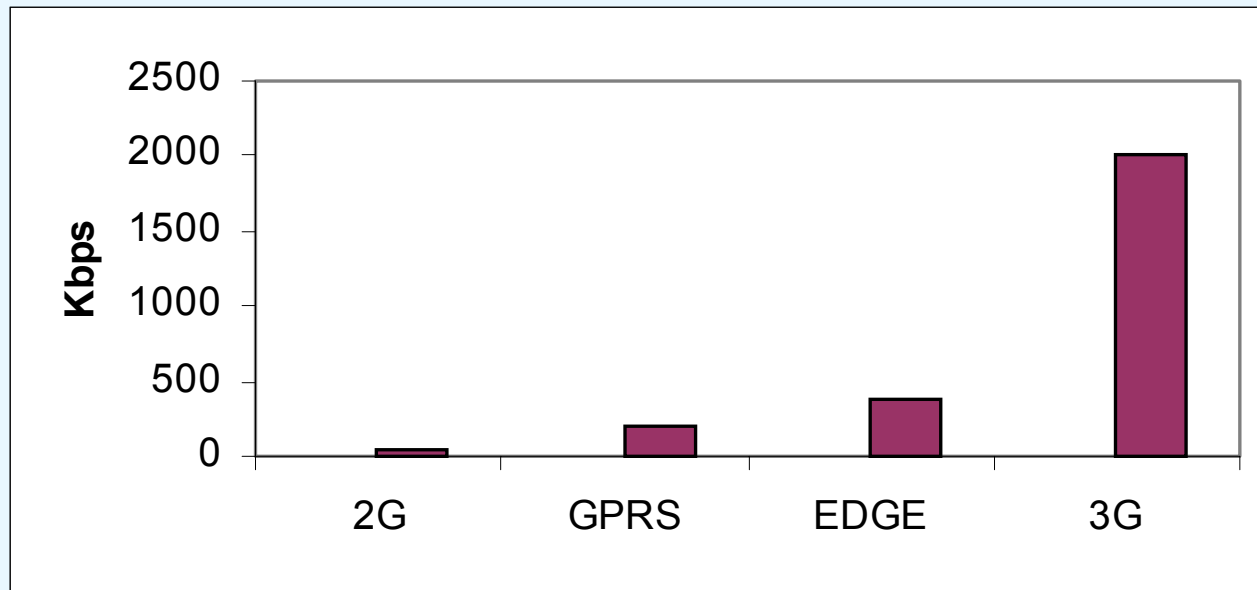
” The 3G device will function as a phone, a computer, a television, a pager, a videoconferencing center, a newspaper, a diary and even a credit card... it will support not only voice communications but also real-time video and full-scale multimedia. It will automatically search the Internet for relevant news and information on pre-selected subjects, books your next holiday for you online and download a bed time story for your child, complete with moving pictures. It will even be able to pay for goods when you shop via wireless electronic funds transfer. In short, the new mobile handset will become the single, indispensable ‘life tool’ carried everywhere, just like a wallet or purse is today. ” - ITU

How Fast is 3G ?



3G provides data speeds of:

- ❖ 2Mbps in fixed or in building environments,
- ❖ 384Kbps in pedestrian or urban environments
- ❖ 144Kbps in wide area mobile environments



Source-3G today

3G is considerably faster than 2G and 2.5G technology.



3GSM Speed Eminently Satisfies User Acceptance

Transfer Time

Service Data Volume	2G-GSM	GPRS	PSTN/ISDN	3G UMTS		
	9.6kbps	50kbps	64kbps	128kbps	384kbps	2Mbps
E-mail 5KB	8 sec	1.7 sec	1.6 sec	1.2 sec	0.5 sec	0.5 sec
SMS with Photo 5KB (JPEG)	8 sec	1.7 sec	1.6 sec	1.2 sec	0.5 sec	0.5 sec
Web Page 20 KB	20 sec	4.5 sec	4 sec	2.4 sec	0.8 sec	0.5 sec
Document 100 KB	2 min	35 sec	25 sec	12 sec	4 sec	1 sec
3-min audio CD 2MB (MP3)	40 min	9 min	6.5 min	3 min	---- ^a	---- ^a
10s video clip 600 KB (MPEG-4)	10 min	2.5 min	1.5 min	45 sec	15 sec ^b	

■ = User Acceptance 15 sec

Source : Huber & Huber on "UMTS & Mobile Computing

a-Optimal CD quality streaming=128 Kbps

b- Video streaming



3G Evolution

- ❖ Two major paths for 3G evolution are:
 - WCDMA (3GSM)
 - CDMA 2000 EVDO
- ❖ More than 75% of the world's cellular subscribers are on GSM – forms a ripe base for migration to 3G.
- ❖ WCDMA (3GSM) & CDMA 2000 EVDO use the same spread spectrum technology, wider band of WCDMA (3GSM) signal offers inherent advantages.
- ❖ WCDMA (3GSM) has a much higher voice capacity.
- ❖ From deployment point of view, wider acceptance of WCDMA (3GSM) technology means significant economies of scale for the suppliers in the long run.
- ❖ The wide (5MHz) carrier bandwidth of WCDMA (3GSM) radio channels supports high user data rates and brings performance benefits such as multi-path diversity.



Technical Details of WCDMA (3GSM)

- ❖ Carrier spacing - 5 MHz
- ❖ Frequency reuse factor - 1
- ❖ Power control frequency - 1500 Hz
- ❖ Quality control - Radio resource management algorithms
- ❖ Frequency diversity - 5 MHz bandwidth gives multipath diversity with rake receiver
- ❖ Packet data - Load based packet scheduling
- ❖ Downlink transmit diversity - Supported for improving downlink capacity
- ❖ Calls per base station - 80
- ❖ Spreading - Direct sequence
- ❖ Channelization - Orthogonal code
- ❖ Chip rate - 3.84 Mcps
- ❖ Pilot structure - Pilot symbols + pilot code channel



Technical Details of WCDMA (3GSM)

- ❖ Modulation - QPSK (DL), BPSK (UL)
- ❖ Channel rates - UL: 15 Kbps – 960 Kbps
DL: 15Kbps – 1920 Kbps
- ❖ MS Synchronization - MS searches synchronization channel through structured code
- ❖ CS radio resource control - Pilot control and soft handover
- ❖ PS radio resource control - Soft handover
- ❖ Data handling - Variable spreading gain
- ❖ Retransmission - ARQ
- ❖ Diversity - Transmit diversity: space time coded
- ❖ Receive diversity: soft combine in rake receiver
- ❖ Core network signalling - GSM-MAP

WCDMA (3GSM) is considered the most mature and widely supported standard.



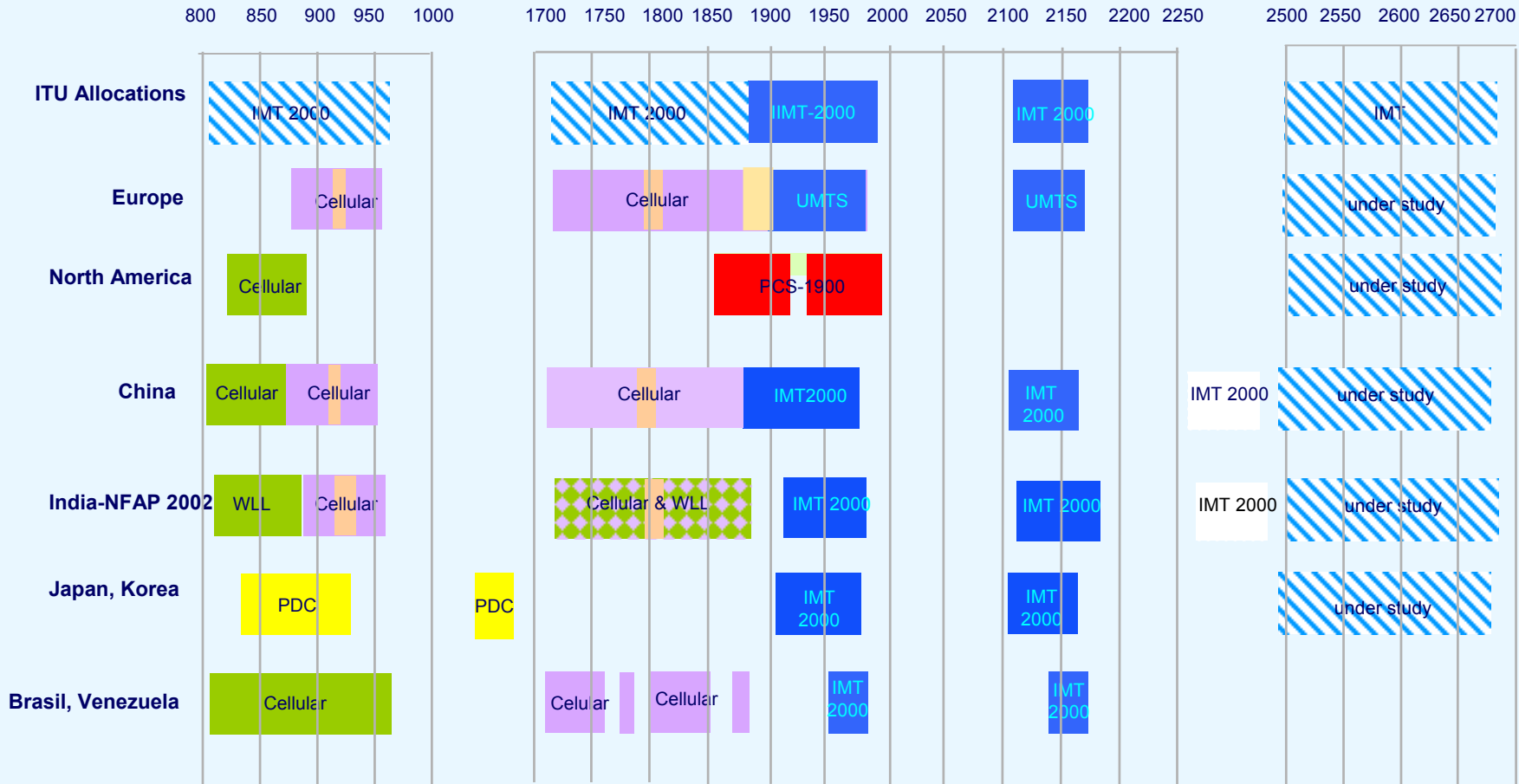
Spectrum for 3G

- ❖ Spectrum is the key raw material to provide cellular mobile services.
- ❖ Delivery of cellular mobile requires duplex frequency arrangements i.e a separate frequency for the uplink signal and for the downlink signal.
- ❖ Spectrum for 3G services is identified by ITU.
- ❖ In **WARC-92**, ITU identified the following bands for 3G
 - 1885-2025MHz and
 - 2110-2200 MHz
- ❖ Of the above, the Band of 1920-1980MHz p/w 2110-2170MHz (also known as 2.1GHz) was identified as the Core Band for development for 3G use.
- ❖ The WARC-92 Core Band represents the international consensus band for the harmonious evolution of both GSM & CDMA operators to 3G.
- ❖ Global adoption & harmonized use of 3G spectrum facilitates interference-free operations, Optimal utilization of spectrum, Global roaming, economies of scale, interoperability, etc

ITU permits flexibility to National Administrations to choose their route to 3G. However, this decision must be taken by countries based on their respective wireless environments.



SPECTRUM ARRANGEMENTS FOR MOBILE TELECOM



All above Countries / Regions except North America are following the WARC-92 identified spectrum for their 3G services

IMT-2000 – WARC-92 identified ITU Band allocated / used by countries to offer 3G services

UMTS – Universal Mobile Telephone Services – 3G services offered on GSM platform in the WARC-92 identified Band

PCS 1900 MHz – Personal Communication Services – Band used in North America

Cellular – 800MHz, 900MHz & 1800MHz Bands used for Cellular Mobile

WLL – Wireless Local Loop – In India 800MHz was used for WLL, now after unified access licensing it is also used for cellular

PDC – Personal Digital Cellular – used in Japan

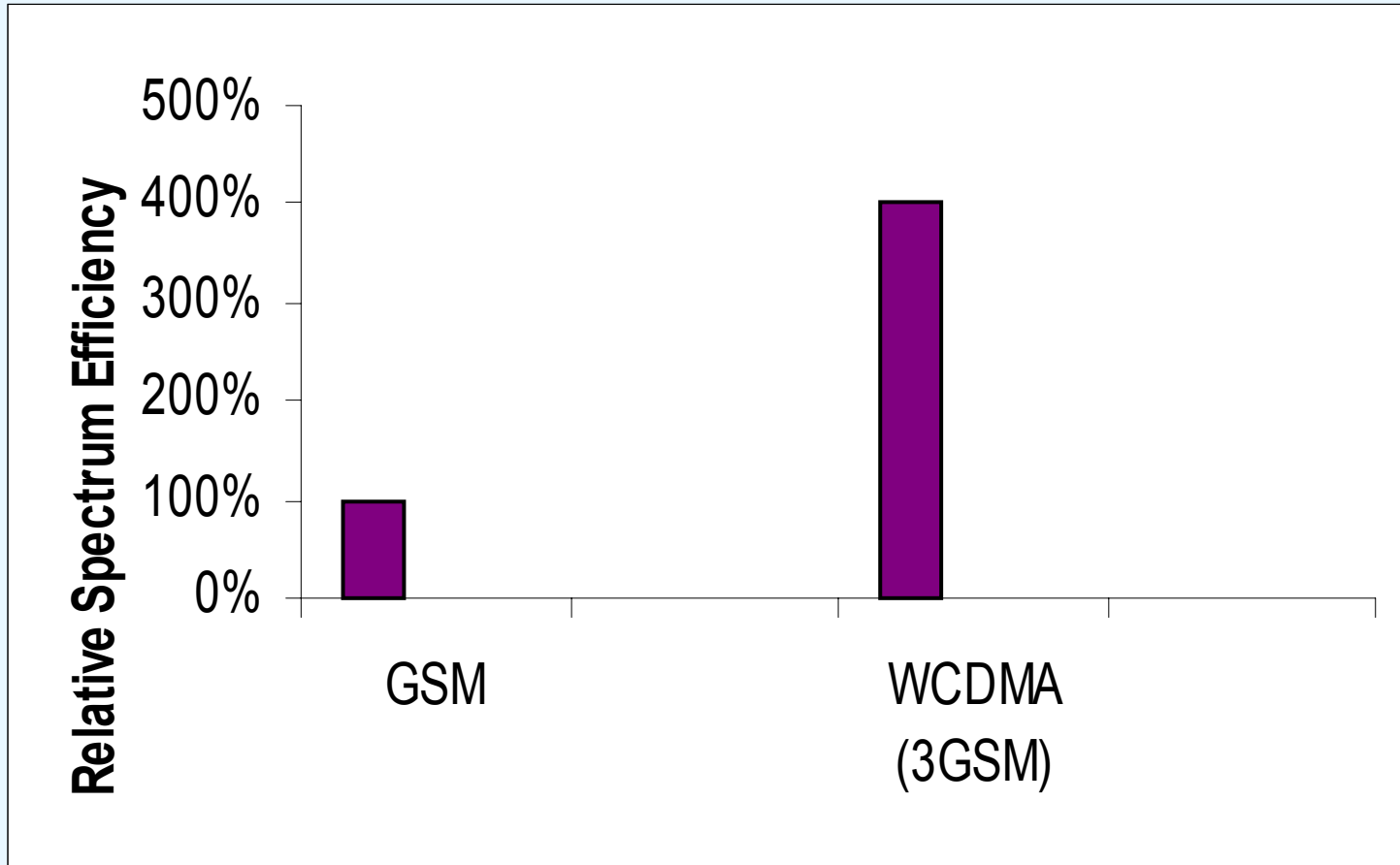


3G Spectrum for India

- ❖ In India, Government Policy on Spectrum is contained in National Frequency Allocation Plan 2002 (NFAP-2002)
- ❖ The National Frequency Allocation Plan 2002 has reserved the WARC-92 identified band of 1920-1980MHz paired with 2110-2170MHz for 3G services / applications.
- ❖ This band is technology neutral and 3G equipment is available in this band for both GSM as well as CDMA technologies.
- ❖ Adoption of this band will ensure the harmonious evolution of both GSM as well as CDMA operators to 3G.

Quick and appropriate allocation of spectrum would prove successful for early rollout of 3G in India and would also help cater to Indian subscriber needs.

3GSM is Greatly Spectrum Efficient



Source: Bridging the Wireless Generation Gap – Thomas Weisel Partners

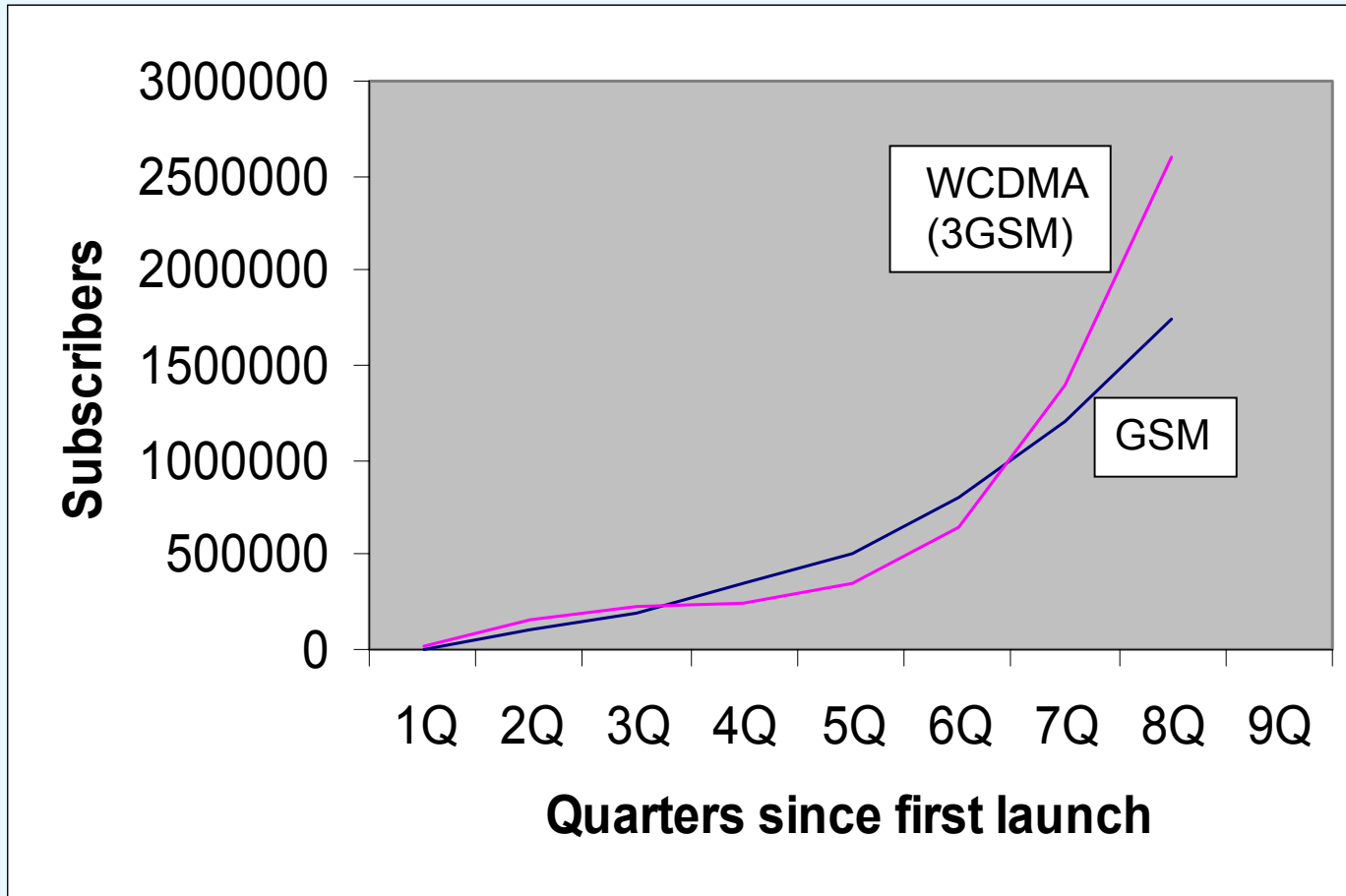


Present Status of 3G

- ❖ In 2004, 3G proved itself- both technically and as an enabler of popular new services .
- ❖ The number of commercial WCDMA (3GSM) networks stands at 67 in 31 countries, serving 21.4 million subscribers (end March 2005).
- ❖ Rollout started in Japan and now has already taken place in Korea, North America & Europe.
- ❖ Developing countries are in the process.
- ❖ China already carried out 3G trials.
- ❖ In India, MTNL has floated a tender for supply of their initial 3G systems for Mumbai and Delhi, BSNL has started with Pilot Projects and Bharti Televentures has announced an investment of \$ 1bn in 3G.

3G rollout has picked up steam all around the world.

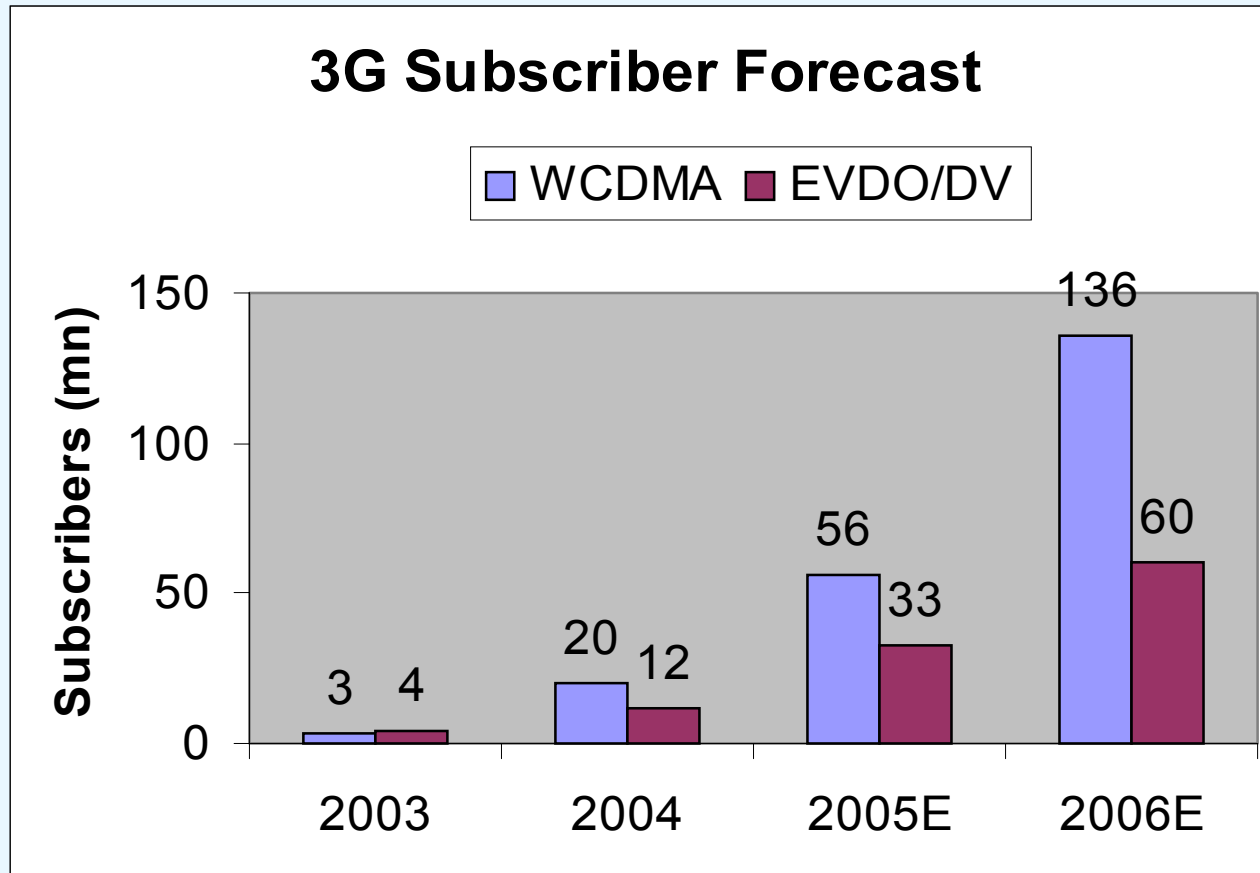
Growth of 3G vs GSM



The progress of 3G from research to implementation has been very fast as compared to GSM.



WCDMA (3GSM) Growth Through the Years



Source: Bridging the Wireless Generation Gap – Thomas Weisel Partners

WCDMA (3GSM) subscribers surpassed the EVDO subscribers in October 2004 and it is expected that the gap would hereafter widen exponentially with the continuing dominant growth of WCDMA (3GSM).

Key Findings for Rollout of 3G

- ❖ Backward interoperability with incumbent 2G/ 2.5G technology is a critical determinant of early success.
- ❖ Handset availability, of the right kind is a must.
- ❖ 3G wireless operators must offer compelling, differentiated applications.
- ❖ Once the service is fully implemented, operators can achieve increased ARPU.

These key findings would result in successful rollout of 3G.



Issues Related to 3G

- ❖ **Voice Facility** – 3G can deliver low cost voice call facility as it provides vast amounts of voice capacity (typically 3 times as much as 2G network) at a lower price (typically a quarter of the cost per minute).
- ❖ **Killer Application** – There is no killer application in 3G which reflects the realization that 3G allows operators to offer lots of new services.
- ❖ **Service-oriented Approach** – Operators must make sure that services are easy to get to, user friendly and customizable.
- ❖ **Pricing** – Could be done according to the ease of operators – either going for lower prices or offering bundled products.



Relevance of 3G for India

- ❖ Serve as an ideal platform to deliver low cost voice telephony to Indian consumers.
- ❖ Extremely effective tool in driving penetration of the huge addressable market in the rural areas.
- ❖ Cater to the demand for hi-speed data services in the urban markets.
- ❖ Integrate India & the Indian consumer with the far reaching developments that are taking place across the world.
- ❖ Bring the much needed foreign investments into the country.
- ❖ Enhance India's competitiveness in the BPO segment.



Potential Applications for 3G – Rural

❖ **Telemedicine**

- Remove the lack of doctors in rural areas
- Remove language barriers through Multi-lingual interfaces
- Bridge lack of visual examination through video capability
- Enable prescription service through document transfer

❖ **Education**

- Provide high bandwidth access for e-education courses
- Provide video based Computer Based Trainings (CBTs)

❖ **Governance**

- Remove bureaucracy by providing instant viewing of land records etc.
- Provide government information like policies, forms, schemes
- Centralized initiative, decentralised implementation



Potential Applications for 3G – Urban

- ❖ **Railways**
 - Seat availability, booking & Train status
- ❖ **DGFT (Directorate General of Foreign Trade)**
 - Reduce processing time to a few hours for registrations
- ❖ **Customs**
 - Computerize and make available all export/import declarations
- ❖ **Central Excise**
 - Process and view Service Tax returns etc.
- ❖ **Postal Department**
 - Direct e-credit of Monthly Income Scheme returns into the investors account
- ❖ **Passport**
 - information, screening (at some locations) available over image transfer
 - Status information to individuals
- ❖ **Income Tax, Land registration, Health Card etc.**



Opportunity for India

- ❖ India is poised for an explosive growth in wireless consumers.
- ❖ India has the opportunity to immediately deploy next generation services using mobile Broadband
- ❖ 3G wireless deployment ensures Investment & Coverage can be quickly done
 - Both Govt. & Private Operators
- ❖ 3G Promises Quality & Speed of Deployment & Reach
- ❖ 3G provides Variety & Diversity of Service
- ❖ Higher bandwidth will support Govt's various social initiatives
- ❖ Content rich experience will enable trade and business opportunities for urban and rural prosperity
- ❖ Availability of 3G would also benefit India during the Commonwealth Games in 2010.

Opportune for India to look at the earliest possible introduction of 3G services.



India vs. China

- ❖ In China, 3G trials have taken place and implementation would follow soon.
- ❖ India has already launched EDGE and several GSM operators have also applied for 3G spectrum.
- ❖ If India can introduce 3G before China, subscriber growth will increase exponentially and thus help India to march side by side with China, at least in terms of subscriber growth.
- ❖ If India can introduce 3G before China, it would attract huge foreign investments fuelling the aggressive growth of mobile services in the country.

3G can help Bridge the gap with China

Going Beyond 3G

- ❖ Key requirements and possible solutions of B3G (Beyond 3G) are-
 - Sufficient personalized IP address – to explore IPv6.
 - Dominant service: packet Data – efficient air interface. Best suited for Burst data.
 - Large dynamic range of data: max from 10Kbps to 100Mbps – flexible mechanism for Radio Resource Allocation.
 - High Spectrum Efficiency – to explore MIMO.
 - Low power transmission and high EMC performance – to explore new cell structure.



B3G Characteristics

- ❖ Will integrate high mobility and high rate throughput.
- ❖ Average high-speed transmission rate of 20Mbps
- ❖ Field trials have given D/L – 100Mbps and U/L – 20Mbps.
- ❖ High capacity – 10 times more compared to 3G.
- ❖ Support of Next Generation Internet – (IPv6, QoS, MO-IP).
- ❖ Seamless services between fixed and private networks.
- ❖ Use of microwave bands (3-8 GHz)
- ❖ Low system cost ($1/10^{\text{th}}$ as compared to 3G).

Beyond 3G is expected only after 2010, so the more appropriate technology today is 3/ 3.5G.



Thank You!

tvram@coai.in