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A PRAGMATIC SURVEY ON 3G TECHNOLOGIES AND PROMINENCE

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1 INTRODUCTION

3G (Third Generation), this 3G is in context of mobile telecommunications technology. Before 3G there was 2G (Second Generation), before 2G there was GSM. Early GSM was restricted to voice calls only. But up gradation was the demand of time and along with voice people demanded data to be get transferred. So, to let this get happened mobile operators came up with new technologies. Therefore 2G and 3G are result of that demand. Main difference between 2G and 3G is of speed and addition of some new services. 3G telecommunication networks support services that offer an information transfer rate of a minimum of 200 Kbits/s. However, several services publicized as 3G offer higher speed than the minimum technical necessities for a 3G service. Recent 3G releases - 3.5G and 3.75G. 3G is a collection of standards used for mobile



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devices and mobile telecommunication services and networks that adjust to the International Mobile Telecommunications-2000 (IMT-2000) specifications by the International Telecommunication Union. 3G finds application in wireless voice telecommunication, mobile net access, mounted wireless net access, video calls and mobile TV. Several telecommunication firms market wireless mobile net services as 3G, indicating that the publicized service is provided over a 3G wireless network. Services publicized as 3G are needed to satisfy IMT-2000 technical standards, as well as standards for liableness and speed (voice and data transfer rates). To satisfy the IMT-2000 standards, a system is needed to produce peak information rates of a minimum of 200 Kbits/s (about 0.2 M.bits/s). Third-generation digital-phone networks can have a nominal most rate of 2Mbits/s, which might handle streaming video, two-way vocalization science, and net content with high-quality graphics and plug-ins to a wireless phone. Along with this high speed of voice and data, people avail the services effectively, as a result of that more and more data are transferred. And as because of globalization, roaming became a normal word while talking about mobile technology. So, maintain authentication and centralized database is a concern. According to Ericsson, 3G may be a generic term that really describes completely different flavors of wireless. When talking about mobile subscriber base, we have a very huge subscriber base in India as well as in world

3G Subscribers in India



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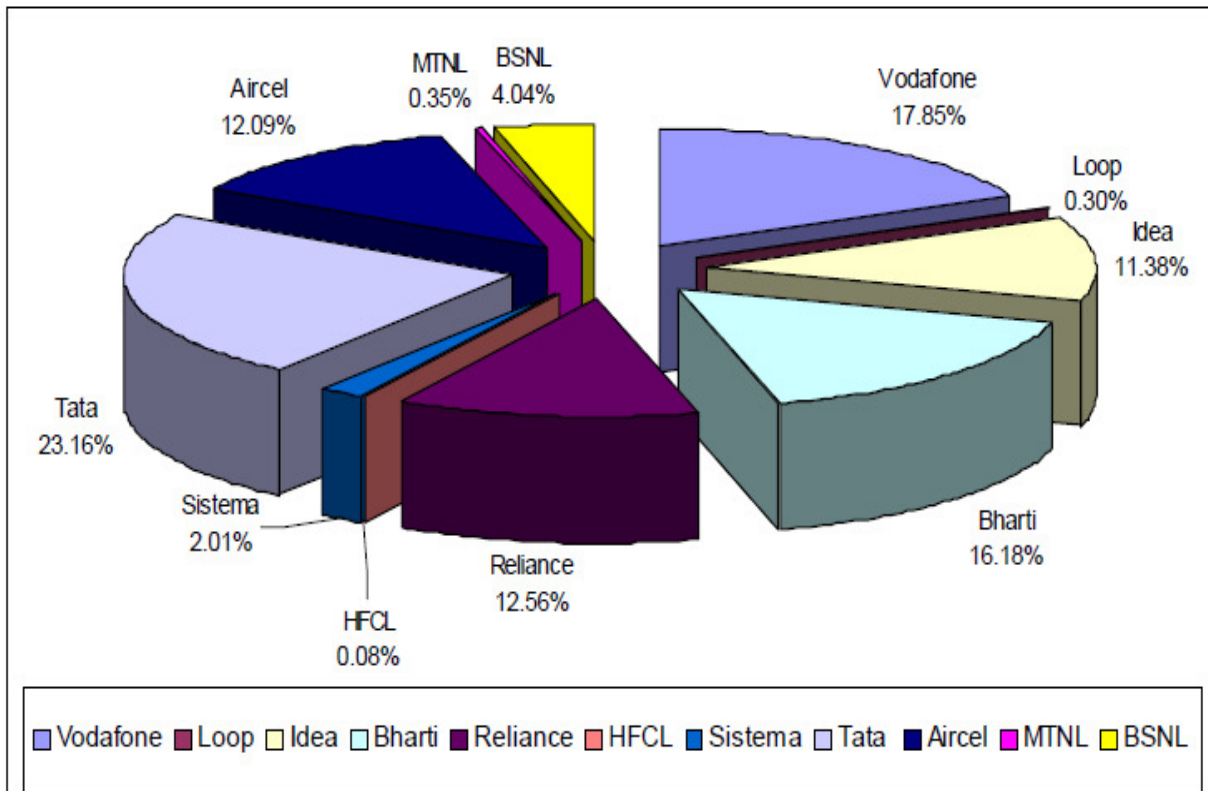


Fig 1.1 3G users in India

Fig 1.1 shows the number of 3G users who are attached to different operators in India. According to TRAI in India total subscribers till December 2012 were 906.6 million, out of which 699 are active, and according to World Bank total population of India is 1241 million. So 73.1%



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population is having mobile phone subscription. As there are number of operators and people of different region opt to different operators according to their needs and services provided by operators in particular region. It was 11 December 2008 when India entered in the arena of 3G. Mahanagar Telephone Nigam Ltd (MTNL) was the first service provider to launch 3G, first in Delhi and later in Mumbai. On 22 Feb 2009, Bharat Sanchar Nigam Ltd. (BSNL) launched 3G services in Chennai and later launches Nationwide. And all other private operators came with 3G services after 1 September 2010, after the allocation of 3G spectrum.



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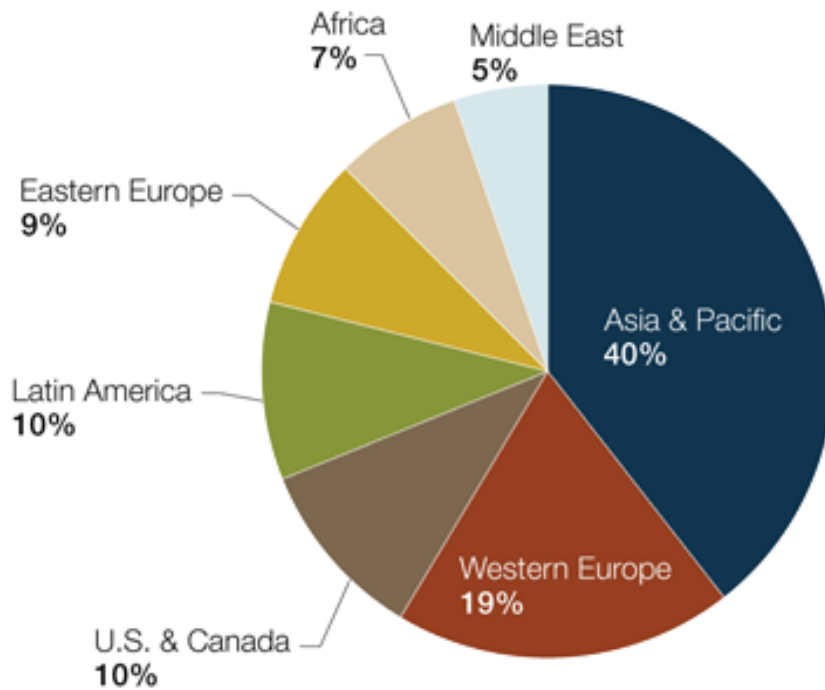


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3G Subscribers by Region, 2013



Source: TeleGeography

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Fig 1.2 3G users in World



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3G services are provided worldwide. There are countries which are enjoying services of 3G before the time when 3G came to India. Fig 1.2 shows the distribution of users worldwide. In India first mobile telephone service started on 15 August 1995 on non-commercial bases. It was the starting of mobile telephony; infrastructure was too small at this time and limited to urban areas of metropolitan cities. This start of mobile telephony was like a race towards globalization. This race was slow at the beginning, because of limited service providers, limited services, and limited users. But with the demand of the time this race got a pace and with time new service providers came in market with new services. As time passed number of users also increased and their demand for services also increased. Till now this race is not near any end, it is going on full pace. Following are the technologies which took birth with time:

The Universal Mobile Telecommunications System (UMTS) system, initial offered in 2001, standardized by 3GPP, used primarily in Europe, Japan, China (however with a special radio interface) and different regions predominated by GSM 2G system infrastructure. The cell phones are generally UMTS and GSM hybrids. Many radio interfaces are offered, sharing an equivalent infrastructure: The original and most widespread radio interface is named W-CDMA.

Code Division Multiple Access 2000 (CDMA2000)

CDMA2000, conjointly referred to as IS-136 and IMT-CDMA Multi-Carrier (1X/3X) may be a radio transmission technology for the evolution of narrowband cdma1/IS-95 to 3rd-generation adding up multiple carriers. CDMA 2000 is going to be deployed in 2 phases.



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General Packet Radio Service (GPRS)

A packet-linked technology that allows high-speed (115 kilobit per second) wireless net and alternative knowledge communications. GPRS can provide a denary increase in knowledge turnout rates, from 9.6kbit/s to 115kbit/s. employing a packet knowledge service; subscribers are invariably connected and invariably on-line.

Wideband Code Division Multiple Access (WCDMA)

A technology for broadband digital radio communications of net, multimedia, video and alternative capacity-demanding applications. WCDMA, developed by Ericsson et al from CDMA, has been elite for the third generation of mobile telephone systems in Europe, Japan and therefore the u. s.. WCDMA uses variable rate techniques in digital process and might bring home the bacon multi-rate transmissions. WCDMA has been adopted as a regular by the ITU below the name IMT-2000 direct unfold.

Enhanced knowledge rates for world Evolution (EDGE)

A technology that provides GSM and TDMA the capability to handle services for the third generation of mobile telephone. EDGE was developed to modify the transmission of enormous amounts of knowledge at a high speed, 384 kb/s. EDGE uses a similar TDMA (Time Division



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Multiple Access) frame structure, logic channel and 200 kHz carrier information measure as today's GSM networks, that permits existing cell plans to stay intact.

3G technology is that the results of ground-breaking analysis and development work distributed by the International Telecommunication Union (ITU) within the early Nineteen Eighties. 3G specifications and standards were developed once fifteen years of persistence and labor. The technical specifications were created accessible to the general public below the name IMT-2000. The communication spectrum between 400 Mc to 3 giga cycle per second was allotted for 3G. Each the government and communication firms nominee contradicente approved the 3G normal. The primary pre-commercial 3G network was launched by NTT DoCoMo in Japan in 1998, branded as FOMA. it absolutely was initial accessible in might 2001 as a pre-release (test) of W-CDMA technology. The primary industrial launch of 3G was additionally by NTT DoCoMo in Japan on one October 2001, though it absolutely was at first somewhat restricted in scope; broader handiness of the system was delayed by apparent issues over its liableness.

2. EVOLUTION OF 3G

It was not that work on 3G started 1-2 months or 1-2 years back before the launch of it. It took so many years, there are so many efforts which led to this fruitful result of 3G Throughout 1999 3G radio interface standardization passed off, and initial 3G live technical demonstrations of infrastructure and thought terminals shown 2000 Continuing standardization with network architectures, terminal necessities and elaborate standards. In May 2000 the formal approval of



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the IMT-2000 Recommendations are created at the ITU Radio communication Assembly in early 2000. 3G licenses for section one spectrum are awarded by governments around Europe and Asia. In 2000 WRC a pair of Spectrum Review of 3G section 2 spectrums. In 2001 3G trials and integration begin. In 2001 3G launched in Japan (by NTT DoCoMo and others). In summer of 2001 First industrial preparation of 3G services become accessible in Europe. During Start of 2000 basic 3G capable terminals begin to be accessible in industrial quantities. Throughout 2002 Network operators launch 3G services commercially and roll out 3G.-Vertical market and govt. 3G early adopters begin mistreatment 3G frequently for non-voice mobile communications. 2002/3 new 3G specific applications, bigger network capability solutions, a lot of capable terminals become accessible, fuelling 3G usage. In 2004 3G can have arrived commercially and reached essential mass in each company and shopper sectors. In 2005 3G section a pair of spectrum expected to be accessible, subject to WRC 2000 selections.

The first European pre-commercial network was An UMTS network on the islet of Man by Manx medium, the operator then closely-held by British medium, and therefore the initial industrial network (also UMTS based mostly W-CDMA) in Europe was opened for business by Telenor in Dec 2001 with no industrial handsets and so no paying customers.

The first network to travel commercially live was by SK medium in South Korea on the CDMA-based 1xEV-DO technology in Gregorian calendar month 2002. By 2002 the second South



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Korean 3G network was by KT on EV-DO and so the Koreans were the primary to examine competition among 3G operators.

The first industrial 3G network was by painter Mobile Networks, on CDMA2000 1x EV-DO technology, however this network supplier later close up operations. The second 3G network operator within the USA was Verizon Wireless in Gregorian calendar month 2002 additionally on CDMA2000 1x EV-DO. AT&T quality is additionally a real 3G UMTS network, having completed its upgrade of the 3G network to HSUPA.

The first pre-commercial demonstration network within the hemisphere was in-built state capital, Australian state by m.Net Corporation in Gregorian calendar month a pair of 002 mistreatment UMTS on 2,100 MHz This was an illustration network for the 2002 IT World Congress. The primary industrial 3G network was launched by Hutchison Telecommunications branded as 3 or "3" in June 2003. By June 2007, the two hundred millionth 3G subscriber had been connected. This can be solely half dozen.7% of the three billion mobile subscriptions worldwide. Within the countries wherever 3G was launched initial – Japan and South Korea – 3G penetration is over seventieth. In Europe the leading country for 3G penetrations is Italian Republic with a 3rd of its subscribers migrated to 3G. Different leading countries for 3G uses embrace Great Britain, Austria, Australia and Singapore at the two hundredth migration level. A confusing data point is numeration CDMA2000 1x RTT customers as if they were 3G customers. If mistreatment this definition, then the overall 3G subscriber base would be 475 million at June 2007 and fifteen.8%



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of all subscribers worldwide. 3G was comparatively slow to be adopted globally. In some instances, 3G networks don't use an equivalent radio frequencies as 2G thus mobile operators should build entirely new networks and license entirely new frequencies, particularly thus to realize high information transmission rates. Different delays were attributable to the expenses of upgrading transmission hardware, particularly for UMTS, whose preparation needed the replacement of most broadcast towers. Attributable to these problems and difficulties with preparation, several carriers weren't able to or delayed acquisition of those updated capabilities. In Dec 2007, one hundred ninety 3G networks were operative in forty countries and 154 HSDPA networks were operative in seventy one countries, consistent with the worldwide Mobile Suppliers Association (GSA). In Asia, Europe, North American country and therefore the USA, telecommunication firms use W-CDMA technology with the support of around one hundred terminal styles to work 3G mobile networks. Roll-out of 3G networks was delayed in some countries by the large prices of extra spectrum licensing fees. The license fees in some European countries were particularly high, bolstered by government auctions of a restricted range of licenses and sealed bid auctions, and initial excitement over 3G's potential. The 3G is probably documented attributable to an enormous growth of the mobile communications market post-2G and advances of the buyer. A particularly notable development throughout now is that the Smartphone (for example, the iPhone, and therefore the mechanical man family), combining the skills of a PDA with a mobile, resulting in widespread demand for mobile net property. 3G has additionally introduced the term "mobile broadband" as a result of its speed and capability build



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it a viable various for net browsing, and USB Modems connecting to 3G networks are getting more and more common. It has been calculable that there are nearly 8,000 patents declared essential (FRAND) associated with the 483 technical specifications that are kind of 3GPP and 3GPP2 standards. Twelve firms accounted in 2004 for ninetieth of the patents (Qualcomm, Ericsson, Nokia, Motorola, Philips, NTT DoCoMo, Siemens, Mitsubishi, Fujitsu, Hitachi, InterDigital, and Matsushita). Even then, some patents essential to 3G might need not been declared by their patent holders. It's believed that Nortel and luminous have covert patents essential to those standards. Furthermore, the present 3G Patent Platform Partnership pool has very little impact on FRAND protection, as a result of it excludes the four largest patents homeowners for 3G. Third-generation wireless technology is that the advanced wireless technology. This technology enhances the options that were accessible in second generation and adds additional advanced options. This technology is wide employed in mobile phones and information cards. Evolution of 3G describes change cellular telecommunications network round the world to use 3G technologies. Japan was the primary country to commercially launch 3G in 2001. The transition to 3G was completed throughout 2005/2006 in Japan. In 2005, there have been twenty three networks worldwide, operative 3G technology. Some are just for check use and a few operators are providing services to shoppers. The main reason for the evolution of 3G was attributable to the restricted capability of the 2G networks. 2G networks were engineered for voice calls and slow information transmission. However these services were unable to satisfy the wants of gift wireless revolution. International Telecommunication Union (ITU) has outlined

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the demand for 3G within the International Mobile Telecommunication (IMT)-2000 standards to facilitate growth, increase information measure, and support various applications. The development like a pair of .5G or GPRS (General Packet Radio Service) and a couple of .75G or EDGE (Enhanced information rates for GSM Evolution) technologies resulted within the transition to 3G. These technologies act like bridge between 2G and 3G.

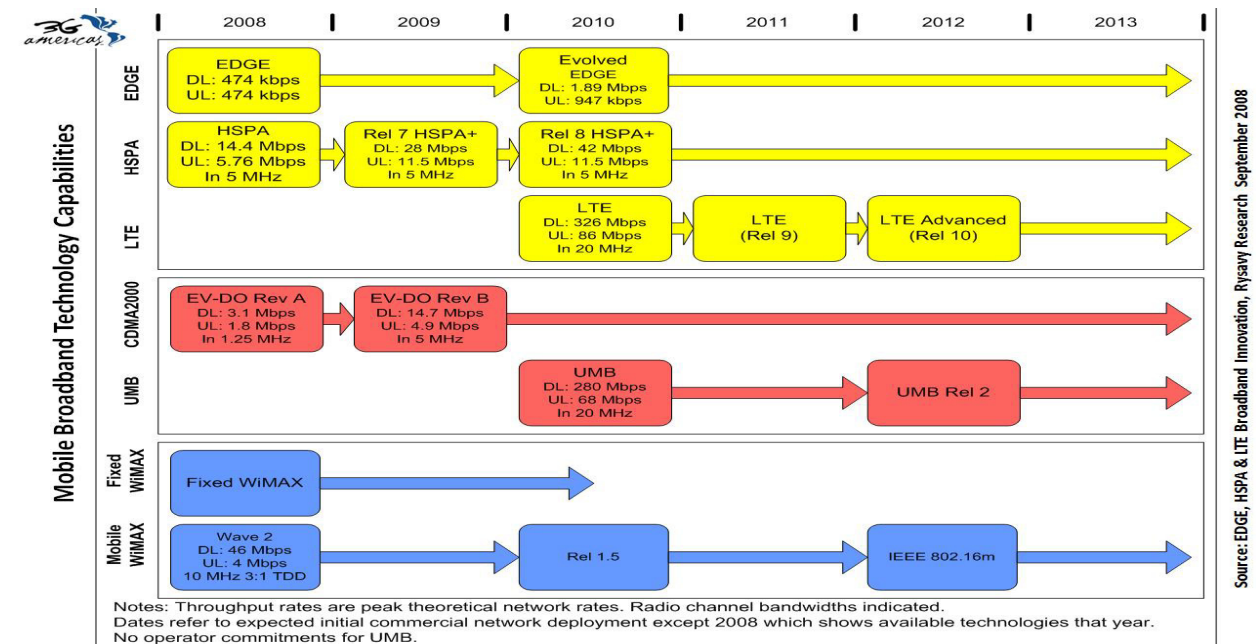


Fig 1.11 evolution of 3G wireless network



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The third generation of mobile cellular systems is supposed to unify the various systems. We have a tendency to see these days into a seamless radio infrastructure capable of providing a good vary of services in numerous radio environments, with the standard we've return to expect from wire line communication networks. Since the mid-80's, studies on 3G systems are distributed inside the International Telecommunication Union (ITU), wherever it absolutely was referred to as Future Public Land Mobile Telecommunication Systems (FPLMTS), recently renamed International Mobile Telecommunicatons-2000 (IMT-2000). In Europe analysis and development on 3G technology, is usually cited because the Universal Mobile telecommunication equipment (UMTS) and Mobile Broadband System (MBS), are conducted below the eu Community analysis into Advanced Communications in Europe (RACE) and Advanced Communication Technologies and Services (ACTS) programs. With support from activities in Europe, U.S, Japan and developing countries, World body Radio Conference (WARC) of ITU known world bands 1885-2025 MHz and 2110-2200 MHz for IMT-2000 as well as 1980-2010 MHz and 2170-2200 MHz for the mobile satellite part.

Key components within the definition of 3G systems are the radio access system and Radio Transmission Technology (RTT). As a locality of the standardization activities, a proper request by the ITU-Radio communication standardization sector (ITU-R) for submission of candidate RTTs for IMT-2000 has been distributed by the ITU. In response to the present ten proposals were submitted. Most of the proposals use CDMA or WCDMA as their multiple access



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technique. Thus during this seminar we have a tendency to be presenting the common options of WCDMA based mostly 3G standards.

The primary focus of third generation architectures are to try to seamlessly evolve second generation systems to produce high speed information services to support multimedia system applications like internet browsing. The key word is "evolve" - because the challenge to wireless instrumentation makers is to produce existing customers, namely, service suppliers, with a migration path that at the same time satisfies the wants set forth by the International Telecommunications Union (ITU) for 3G wireless services whereas protective client investment in existing wireless infrastructure. The core of today's second generation networks offer the inspiration on that third generation services –3G-are engineered. Next generation services are delivered by a mix of existing and evolving digital equipments. The move to 3G is all regarding high-speed mobile information and informatics traffic. That's why today's wireless networks would require kitchen utensil band dimension and network capability to support third generation services.

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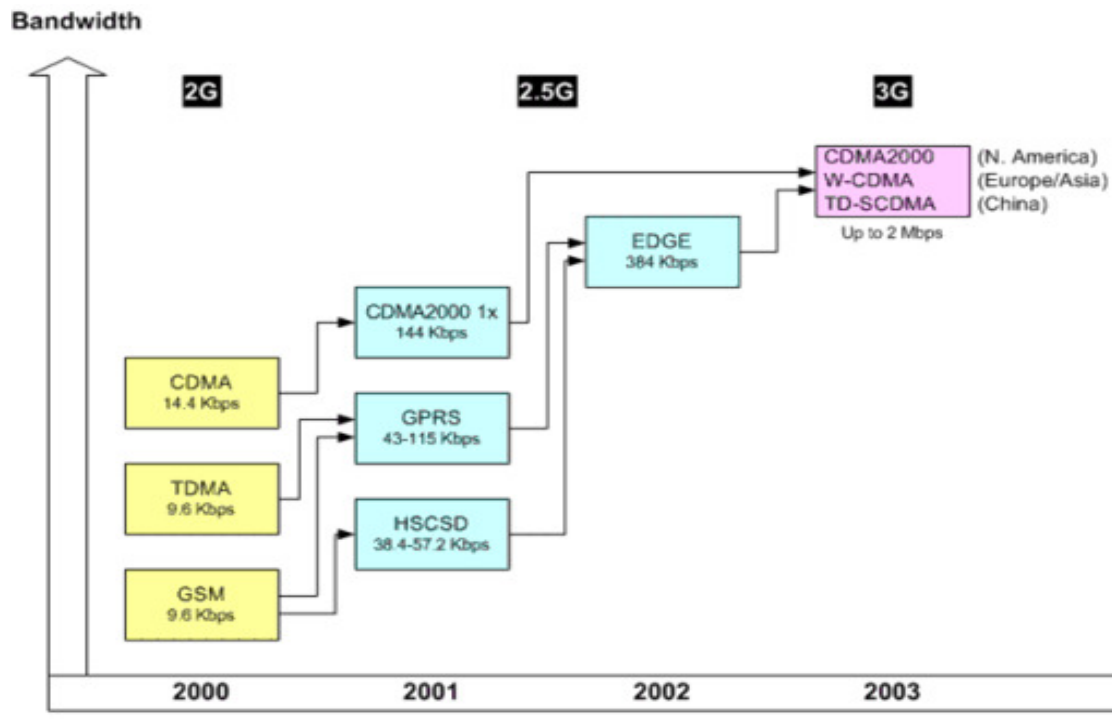


Fig 1.3 evolution to 3G

3. GSM EVOLUTIONS

GSM networks can enhance packet information services primarily in 3 phases. General Packet Radio Services (GPRS) refers to the primary section of GSM specification enhancements that

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permit mobiles to attach to informatics or X.25 based mostly networks. The GSM/GPRS specification can additional evolve to support increased information Rates for GSM Evolution (EDGE) that provides important enhancements over GPRS. Finally, the ETSI/ARIB band CDMA (WCDMA) proposal provides a replacement air interface for GSM networks - supporting higher information rates that may meet or exceed UMTS/IMT-2000 specifications.



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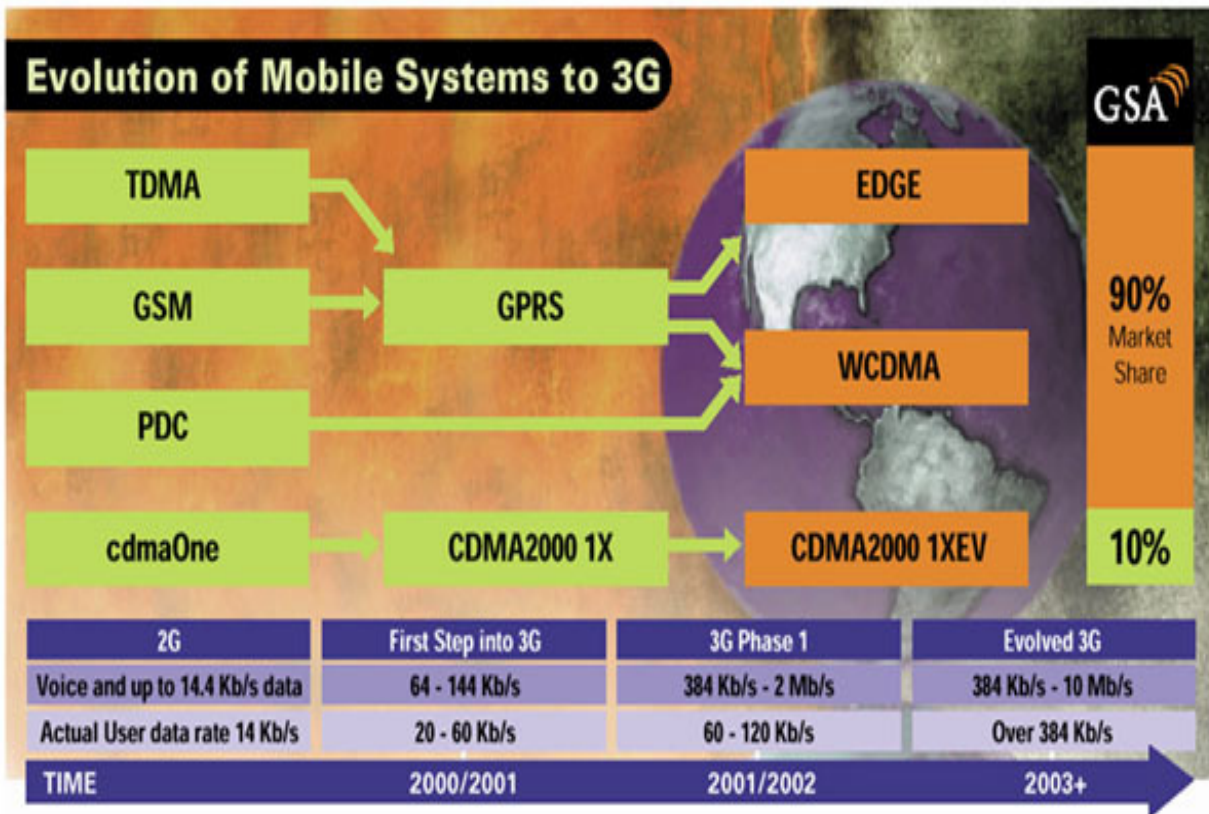


Fig 1.4 Evolution of mobile systems

3.1 EVOLUTION OF IS-136



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IS-136, generally cited as North yank TDMA (NA-TDMA), contains a two- section migration path as outlined by UWC-136. within the initial section, cited as 136+, important improvement are created to permit for improved voice and information over the present thirty kilocycle per second carrier, that uses half dozen time slots per forty ms frame. The second section, cited as 136 High Speed (136HS) can embrace the sting normal (at least in out of doors environments) so as to satisfy the wants of UMTS/IMT-2000.

3.2 IS-95 EVOLUTION

IS-95, generally cited as North yank CDMA (NA-CDMA), contains a 2 section migration path: IS-95B and cdma2000. The key advantage of IS-95B and cdma2000 for existing CDMA operators is simple: preservation of capital investments. Each IS-95B and cdma2000 can offer a swish migration path to IMT-2000 whereas maintaining backward compatibility with existing IS-95 infrastructure. So as to take care of backward compatibility, each IS-95B and cdma2000 are supported synchronous base station operation and can thus still have faith in the GPS to take care of temporal relation. additionally, IS-95B and cdma2000 can still use twenty ms frames and perform control system power management on the reverse link at a rate of 800 times per second. Currently, IS-95 provides circuit switched and packet-switched information at rates of nine.6 kbps or fourteen.4 kbps (depending on the speech coder) employing a 1.25 Mc channel information measure and a chip rate of 1.2288 Mcps.

3.3 3G OPTIONS



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The telecommunications world is ever-changing because the trends of media convergence, business consolidation, net and informatics technologies and mobile communications collide into one. Important amendments are brought regarding by this speedy evolution in technology, with Third Generation mobile net technology a radical departure from that that came before within the initial and even the second generations of mobile technology. A number of the changes include: People can scrutinize their mobile the maximum amount as they hold it to their ear. As such, 3G are less safe than previous generations- as a result of tv and different multimedia system services tend to draw in attention to themselves- rather than hands-free kits, we are going to would like eyes-free kits! Data (“non-voice”) uses of 3G are as necessary as and really completely different from the standard voice business. Mobile communications are similar in its capability to mounted communications; such many of us can solely have a mobile. The mobile are used as An integral a part of the bulk of people’s lives- it’ll not be one more accent however a core part of however they conduct their daily lives. The mobile can become comparable to a foreign management or magic wand that lets folks do what they require after they want. As with all new technology standards, there's uncertainty and therefore the worry of displacement. Third Generation (3G) mobile is topical and contentious for many reasons: Because the character and style of mobile communications is thus radically modified, many of us don’t perceive the way to build cash within the novice world, and don't perceive their role in it. 3G licenses have started being awarded round the world, necessitating that existing mobile communications firms within the 2G world have confidence and justify their continuing existence. 3G relies on a special



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technology platform- Code Division Multiple Access (CDMA) - that's not like the Time Division Multiple Access (TDMA) technology that's wide employed in the 2G world. GSM (Global System for Mobile Communications) was supported TDMA technology. The US, Japanese and European mobile players all have completely different technology competences and are currently unified during this single standard- the separate wireless evolution methods and European wireless leadership are thereby challenged. Japanese network operators are the primary to implement 3G networks within the year 2001, and Japanese terminal makers, United Nations agency haven't had abundant market share outside their home market, are initial with 3G terminals. Many business Analysts And different pundits have questioned the come back on an investment in 3G technology- questioning whether or not network operators are able to earn an adequate come back on the capital deployed in feat and rolling out a 3G network. Many media And net firms have expressed an interest in bidding for and mistreatment 3G technology as a replacement channel to distribute their content, gap the chance for brand new entrants and new partnerships and price chains

The ITU (International Telecommunication Union) has projected 3G telecommunications standards to produce value economical top quality, wireless multimedia system applications and increased wireless communications. The options of 3G are often divided into 2 classes. One is information rates and therefore the different is security. The main feature of 3G technology is that it supports bigger voice and information capability and high information transmission at low-priced. 3G mobiles will operate 2G and 3G technologies. The second major feature is that



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the security: 3G offers bigger safety features than 2G like Network Access Security, Network Domain Security, User Domain Security, Application Security. This technology provides localized services for accessing traffic and weather updates. Video calls and video conference is another major feature in 3G mobile technology. These options reduce the communication barriers between folks, that weren't pillaged even with mobile phones. Data transfer rates are high and might support even live TV channels over phone. On-line media is another exciting feature in 3G mobiles. 3G mobiles extremely attract the music lovers as they will hear music and watch videos on-line and might transfer Brobdingnagian files with in less time.

The implementation of 3G wireless systems raises many crucial problems, like the prospering backward compatibility to air interfaces likewise on deployed infrastructures. The existence of bequest networks in most regions of the planet highlights the challenge that communications instrumentality makers face once implementing next-generation wireless technology. Compatibility and interworking between the new 3G wireless systems and also the recent bequest networks should be achieved so as to make sure the acceptance of latest 3G wireless technology by service suppliers and end-users. The existing core technology employed in mobile networks relies on ancient circuit-switched technology for delivery of voice services. However, this ancient technology is inefficient for the delivery of multimedia system services. The core switches for next-generation of mobile networks are going to be supported packet-switched technology that is best fitted to knowledge and multimedia system services. Second generation GSM networks accommodates BTS, BSC, MSC/VLR and HLR/AuC/EIR network parts. The



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interfaces between BTS, BSC and MSC/VLR parts are circuit-switched PCM. GPRS technology adds a parallel packet-switched core network. The 2G+ network consists of BSC with packet interfaces to SGSN, GGSN, HLR/AuC/EIR. The interfaces between BSC and SGSN network parts are either Frame Relay and/or ATM therefore on give reliable transport with Quality of Service (QoS).

3G wireless technologies introduce new Radio Access Network (RAN) consisting of Node B and RNC network parts. The 3G Core Network consists of a similar entities as GSM and GPRS: 3G MSC/VLR, GMSC, HLR/AuC/EIR, 3G-SGSN, and GGSN. Science technology is employed end-to-end for multimedia system applications and ATM technology is employed to supply reliable transport with QoS.



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