



# A STUDY ON CELLULAR CDMA-BASED FOR NEW GENERATION MOBILE RADIO SYSTEM

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## ABSTRACT

As the networks improve and new demands for rapid data transfer rates and multimedia services grow, operators are seeking new cellular communication solutions based on technologies like GSM, 3GSM and CDMA2000 to cater to these requirements. The paper points out that the increasing popularity of the GSM equipments globally is driving manufacturers to bring phones to market faster with competitive enhancements increased the quality of service and reduced costs. The paper relates that CDMA, Code Division Multiple Access, alternatively signifies a more powerful digital air interface standard, equating about eight to fifteen times the capacity of conventional analog cellular systems.

**Keyword:** *Cellular Communication, CDMA, 3GSM*

## 1. INTRODUCTION

There exists a revolutionary change and growth in the telecommunication industry in the present era. The cellular technology has reformed the way people interact with each other. It has ensured their true mobility and to remain in touch. Presently, the industry is further expanded with this technology and is now providing the benefits to assist people, machines and systems that all interact [12]. Presently amidst cutthroat competition in the market of mobile technology, the operators around the world are aiming at maximization of their infrastructural investment while exploiting the best solutions for introducing technologies that entail the innovative services to the subscribers. The wireless business has

conventionally passed on to the incumbent vendors, because of this the first entrants into the market have availed maximum market share benefits. However, as the networks improve and new demands for rapid data transfer rates and multimedia services grew, operators are to find out the new cellular communication solutions based on technologies like GSM, 3GSM and CDMA2000 to cater their requirements. The mobile industry is really getting some momentum in this direction [7].

## 2. PROTOCOLS

The Global System for Mobile communications - GSM liability was shifted to the European Telecommunication Standards Institute (ETSI) in



1989 and the publication of the phase I of the GSM specifications were made in 1990. The commercialization of the services were initiated during 1991 and by the year 1993 there were 36 GSM networks in 22 countries with 25 additional countries having already selected or considering GSM. Besides, Europe, South Africa, Australia and many Middle and Far East countries have selected to implement GSM. It was anticipated that there would be 1.3 million global subscribers by the end of 1994. The GSM presently implies to the Global System for Mobile Telecommunications. Since its inception the designers needed its suitability in services offered and regulate the signaling used. The radio link made some confinements obligatory, since it was not possible to achieve the standard ISDN bit rate of 64 Kbps (CDMA & GSM Cellular Technology: Wireless Communication Protocols and Standards).

The increasing popularity of the GSM equipments globally is compelling the manufacturers to view for the solutions that use to bring phones to market faster. [15] The enhancement in the competitions is expected to increase the quality of service and reduce the costs. The interactions of specific forces like increased capacity of the prevailing analog systems, the quantity invested in the prevailing analog technology and the competitive atmosphere of the country will influence the nation's initiatives for acceptance of GSM technology [14]. The CDMA stands for Code Division Multiple Access alternatively signifies a digital air interface standard, more powerful equating about eight to fifteen times the capacity of conventional analog cellular systems. It

involves commercial application of a military spread-spectrum technology. It extends necessarily the similar services and qualities as that of wired service involving the spread spectrum theory. The elementary difference is that access to the local exchange carrier (LEC) is established through a wireless phone. Irrespective of the fact that the CDMA application in cellular telephony is comparatively of recent origin, it is not regarded as a new technology [5].

The CDMA is diverted from other cellular wireless technologies in the way the information is transmitted over the air. The CDMA utilizes the specific coding for each telephone call or data session that allows the mobile equipment to ignore other transmissions on the same frequency. The CDMA gives access to all in the vicinity that utilizes the same piece of the spectrum and isolates the calls by providing each of them the specific identification codes. The CDMA data transmission is similarized with an international cocktail party, where a group of people are sitting and talking in different languages that are not meaningful to a particular person. However, speech on his own language allows him to understand by tuning his brain to decipher the code amidst all the shouting [17].

The CDMA is being used in many military functions like Anti-jamming, since it is hard to jam or meddle with a CDMA signal due to its spread signal; ranging that is measuring the distance of the transmission to become aware of when it will be received; secure communications since the spread spectrum signal is very hard to detect. The CDMA is a spread spectrum technology, which implies that it spreads the



information raised in a particular signal of interest over a much broader bandwidth than the original signal. The subscribers are identified with unique digital codes in CDMA instead of separate RF frequencies or channels. The codes are used by the mobile stations as well as the base station and are known as pseudo-random code sequences. Since each subscriber is differentiated by a separate code, it is possible for using the same frequency band by all the users. It extends many exclusive benefits to the CDMA technique over other RF techniques in cellular communication. The CDMA is considered to be a digital multiple access technique and this feature of the protocol is demarcated by the Telecommunication Industry Association-TIA as IS-95. The BSSAP in CDMA is spitted up into the DTAP and BSMAP [5].

### 3. CELLULAR COMMUNICATIONS STANDARDS AND TECHNOLOGIES

This section will discuss the features, services and implementations of cellular communications: GSM, 3GSM, and CDMA2000.

#### A. GSM

The digital quality of the GSM technology facilitates transportation of both synchronous and asynchronous data as a carrier to or from an ISDN terminal. The GSM is compatible with data rates of 300 bps, 600 bps, 1200 bps, 2400 bps and 9600 bps. Among the GSM services, the fundamental one is GSM telephony. The distinct feature of GSM that is not available in conventional analog systems is the Short Message Service-SMS. The additional services are extended under the telecommunication services or carrier services that involve features like international roaming, call

forwarding, call waiting, multiparty conversations and checking of outgoing international calls etc [5].

Irrespective of the fact that the business community were considered to be the initial users of mobile telephony and GSM exploiting its roaming capabilities, no significant effort appears to have been made in fully integrating the mobiles with corporate communications. Therefore, the GSM phone, even though is considered an essential business instrument, it is quite separated from the company LAN or company PBX. Since the business community was the first to spread mobile communications, this is regarded as the community that really constituted the essence behind the development of GSM as their wide utilization ensured the desired cash flow to the operators with crucial cash flow and the real-world deployment experience. As many of the service providers have extensively avoided the provision of integrated service amidst the competition to extend the services to increasing number of subscribers, some have insisted on its advantages [3].

To illustrate Orange launched its Wirefree Extension in UK during October 1998 collaboratively with its Premicell, ensuring low-cost office-to-mobile calls. The Orange Wirefree Extension permits the larger corporate to expand their telephone network to incorporate the mobile extensions so as to have easy accessibility between the office and mobile staff. The Premicell product extends cheaper 'on-net' calls linking the office phones and the mobile personnel. However, the communications environment is progressing rapidly and the remote connection for data



applications is gradually more significant than the interconnection of voice services. GSM is considered more stable with extended data rates of 9.6kbits/s and more with emergence of the new technologies like GPRS and therefore successfully applied in the field of remote access to e-mails. With its high value, low technical barriers and market demand, the remote access it is considered the first widely accepted wireless data applications evolved much prior to the applications like wireless e-commerce [3].

One specific benefit that it entails in the field of proprietary applications is quite solicited within corporate circumstances without actually depending on the spelling out of the industry wide standards. The 'Corporate GSM' with provisions for linking a mobile device to a PBX and to an IP LAN, is considered a remote access approach for business customers. The essence of the application flows from easy transition from the office desk to a mobile environment using the same mobile phone and same number incorporating all the PBX features. The application ensures all the remote calls to come through PBX systems entailing the company savings in the airtime charges and higher tariff wireless remote calls. Since the Corporate GSM is also connected to the data network of the company, the subscribers also are linked to the LAN applications effectively ensuring much security than being connected from a public GSM connection. The services that are compatible to WAP include unified messaging, advanced teleconferencing and data recovery. The utilization of the GSM data is considered to be increasingly significant in the global transition towards 3G [3].

With the global approval of GSM the producers of the mobile handsets find it advantageous in amidst the growing economies of scale and thereby reduce the prices and allow the networks operators for digital conversion more economically. [9] The wireless service provides prevalent in US are taking advantages of their initial investments in GSM permitting them to avail significantly enhanced network capacity with integration of voice and data with provisions of quick data transmission services, and open international roaming to mobile customers and personnel of multi-national companies. The carriers throughout the America are extended to adopt the GSM/GPRS technology through the successful implementations. Actually, AT & T Wireless, Cingular and T-Mobile the three topmost wireless service providers in the United States have devoted to this technology and its further evolution to EDGE and capture about 42% of the total customers of wireless in the country [16].

Companies are witnessing the advantages of the increased voice and data capacities of GSM/GPRS along with the increasing economies of scale worldwide. The AT & T wireless has expressed about 50 percent decline in the equipment costs to produce an incremental minute of use, a decline in 10 to 15 percent in the costs is estimated in the production of GSM/GPRS wireless phones in comparison to that of other technologies. In respect of equipments, AT & T Wireless also developed about 40 GSM/GPRS multi-band devices anticipated to be available in 2003 and can be used in over 80 countries around the world. The company asserted that the GSM is fruitfully favoring the objective of accomplishing the two



cent-a-minute unit cost for implementing a call. The GSM is supporting more significantly the voice and data capability while developing cost effective equipment as a result of high global demands. This implies for a great business experience in respect of operators and value for their customers [16].

### **B. 3GSM**

3GSM is the advanced version of the GSM technology. The 3GSM refers to the third generation mobile multimedia services worldwide. The 3GSM concentrates on the idealistic communications in multiple ways. It is about the new idealistic methods in which people will communicate and the specific idealistic goal of the GSM community that concentrates on the future requirement of the subscribers. The technology on which the 3GSM services are offered is constructed on the basis of a core GSM network with a Wideband-CDMA air interface that has been developed as an open paradigm by operators in combination with the 3GPP standards development organization. More than 85% of the global network operators have preferred 3GSM technology involving the technological platform to offer the innovative third generation applications. [17] The 3GSM is considered to be a crucial factor in the sphere of GSM wireless revolution. UMTS is a form of third generation GSM collaboratively developed for the United States, Japan, Korea, China and Europe[2].

3GSM has established it self to be the global 3G paradigm having about more than forty operators providing advanced mobile services to subscribers in 22 countries and territories across Asia, the Middle East and Europe. [11] The market expands

into USA in order to cater to the increased economies of scale worldwide, drive competition and innovation, and generate further growth all of which bring terrific benefits for customers. The 3GSM caters to the need of the global telephony by integrating the high-speed data and multimedia capabilities of 3GSM with prevailing unparalleled international roaming capacity of GSM. Japan and Korea are both deploying 3GSM to interconnect with the global GSM community in order to deliver. Deployment of 3GSM in Japan and Korea are aiming at linking the global GSM community in order to provide roaming facilities to their own subscribers and travelers to their countries. The international roaming and suitable data and multimedia services are becoming progressively reachable to the international tourists (America Embraces 3GSM).

Extending a wide variety of new inventive services to subscribers like video on demand, high-speed multimedia and mobile Internet Access, the 3GSM technology embraces the latent content rich information and communication globally. The 3GSM also entails significant enhancement in capacity, quality and speed of data transmission. 3G-upgradation for GSM was evolved by including a radio interface based on Wideband-CDMA developed with joint collaboration of standard bodies from China, Korea, Japan and the United States and the European Union. The 3-GSM was preferred technically by the 98 percent of operators worldwide those have been permitted to use the spectrum in 2 GHz band selected by the International Telecommunications Union for 3G [11].



As the 3GSM is spreading though worldwide, the subscribers of Japan, Korea, Hong Kong and Australia have already benefited from its advantages. Singapore, Malaysia and Taiwan are adopting the same during this year. Besides, the Indonesia and New Zealand are also inclined to launch the same. The increase in subscriber base is anticipated to hike from the prevailing base of more than five million. The GSM has its own exclusiveness in the prevailing technologies in terms of clearly spelled out advantages like international roaming. The roaming entails an order among the operators and the service providers to be compatible to the open paradigms, and encouraging inter-operability and creating economies of scale that benefits the end-users. The 3 GSM is constructed on this tradition. The 3 GSM is revolutionizing the mobile world. The users will be advantageous from the improved roaming services since their deployment of 3GSM entails them into the GSM community. There will also be broad economic advantages with the greater disclosure of their manufactures to the global GSM/3GSM markets [11].

### C. CDMA2000

CDMA technology is also known as IS-95 or cdmaOne. IS-95 refers to an Interim Standard (IS) of the Telecommunication Industry Association (TIA), and cdmaOne is the brand name of Qualcomm Wireless Telecommunications Research and Development Company (Wikipedia, 2005). CDMA is a spread spectrum technology that uses a multiple access method that does not require dividing the channel by time. It also allows several radios to share the same frequencies in a given band or space (International Engineering

Consortium, 2005). Since the users are isolated by code sequences (bipolar sequences) and they can share the same frequency, it also eliminates the frequency reuse problem that is encountered with AMPS and DAMPS (International Engineering Consortium, 2005). Furthermore, CDMA can provide more reliable and secure transmission due to its effective blocking of interference from conflicting signals (Littman, 2002).

The CDMA2000 is considered the 3rd Generation way out built based on IS-95. It is differentiated from the 3G standards based on its evolution from an existing wireless standard. The CDMA2000 is compatible to 3G services in consonance with the prescriptions of International Telecommunications Union -ITU for IMT-2000. The 3G networks will provide the wireless services with better performance, greater cost-effectiveness and significantly more content. The objective is to provide easy reach to all the services from everywhere at every time from a single terminal under the caption true converged, mobile services. The CDMA 2000 is put forth as one of the way out for wireless operators desirous of being benefited from the new market scenario strengthen with mobility and the Web. The CDMA2000 is considered to have both an air interface and a core network solution for catering to the services that the customers are necessitating presently. These services are presently regarded as 3G. The CDMA2000 and 3G are being used interchangeably [6].

The CDMA2000 is considered to be a mode of the Radio Access 'Family' of Air interfaces approved by the Operators Harmonization Group for developing and facilitating integration of third



generation-3G networks. One objective of such harmonization is to extend unlimited international roaming world wide between the different modes of 3rd Generation CDMA i.e. CDMA2000 and WCDMA. The use of common core technologies by Ericsson enables us to make compatible for the whole family of 3G CDMA modes. The CDMA Systems Ericsson Business Unit established in San Diego is considered to be the premier unit of Ericsson for devising the CDMA2000-compatible 3G infrastructure products. The CDMA 2000 is structured to reduce risks, safeguard investments and to extend significant performance boosts to operators as they extend their networks to offer 3G services. The CDMA2000 networks are also supportive to the CDMA-one applications, safeguarding the investment of operators in CDMA-one based networks and extending simple and cheaper transition to the next generation technology. Besides the CDMA2000 networks also ensures enhancement in the voice quality and voice capacity that is supportive for high speed and multimedia data services [6].

The technology extends the ability to attain the increased data transfer rates and enhanced spectrum efficiency utilizing a 1.25MHz carrier and a 3.75MHz carrier. This will be serious to the carriers implementing 5MHz of spectrum or less and desirous of extending wideband data speeds and improvement in overall system-calling capacities. It is compatible in three modes in respect of the pilot channels: those are common pilot, pilot per traffic channel and pilot per spot beam ensuring higher efficiency. The technology is compatible to the integration in the base station transceiver in order to keep the subscriber unit

costs to a minimum. CDMA2000 is compatible to an adequate number of Walsh codes required to cater to wireless-local-loop applications supplementing the mobile systems. It is supportive of both GSM-MAP and IS-41 networks. The CDMA2000 is also compatible to a consistent reverse link for enhanced capacity. It also provides for a varied rate vocoder design for improved voice quality and capacity in CDMA networks [4].

#### 4. CONCLUSION

To conclude, the present day fluctuating business environment is generating intense competition among the corporations. The markets are fluctuating more rapidly presently than that in any other time. New and new products are being entering into the market within short span of time and old ones are equally outdated this throws the business community to global cutthroat competition. The employees are necessitated to spend more time with their customers so as make their organizations more competitive. This necessitates them to be detached from their land phones. The market conditions presently thus necessitate the entrepreneurs to assess the mobile technology as a substitute to the conventional landline telecommunications services to make their corporations more competitive. The modern cellular technology incorporating GSM, CDMA and 3GSM extends the limits of the capabilities that the existing communication infrastructure extends [13].



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