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Analyzing the Various Generations of Mobile Cellular Technology: A Review

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Abstract – Wireless communication is the transfer of information over a distance without the use of enhanced electrical conductors or "wires". The distances involved may be short (a few meters as in television remote control) or long (thousands or millions of kilometers for radio communications).When the context is clear, the term is often Shortened to "wireless". It encompasses various types of fixed, mobile, and portable two-way radios, cellular telephones, Personal Digital Assistants (PDAs), and wireless networking. In this paper we will throw light on the evolution and development of various generations of mobile wireless technology along with their significance and advantages of one over the other. In the past few decades, mobile wireless technologies have experience 4 or 5 generations of technology revolution and evolution, namely from 0G to 4G.Current research in mobile wireless technology concentrates on advance implementation of 4G technology and 5G technology. Currently 5G term is not officially used. In 5G researches are being made on development of World Wide Wireless Web (WWWW), Dynamic Adhoc Wireless Networks (DAWN) and Real Wireless World.

This paper investigates different methods of mobile technology. A comprehensive list of references is reported and comparisons of various methods such as 1G, 2G, 3G,4G is reported.Wireless communications networks have become much more pervasive than anyone could have imagined. The wide spread success of cellular has led to the development of newer wireless systems and standards for many other types of tele-communication traffic besides mobile voice telephone calls. Nowadays, a rapid growth in mobile technology has satisfied the customer needs to a great extent but it is still developing to a great height which makes the people's life easier.

The growth in telecommunication industry is very sharp during last little decades. The main contribution in this growth of industry is wireless mobile communication industry. The growth of this industry has experienced several generations. These generations are 1G, 2G, 3G, and 4G. Each generation have some standards, capacities, techniques and new features which differentiate it from previous generations. Due to these new features, the number of mobile phone subscribers is increasing day by day.

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INTRODUCTION

The today's market of wireless communications is developed at a very rapid growth. This development causes due to the increasing number of subscribers. This development in cellular wireless systems is started when the "cellular concept" came in picture. In today's life the mobile phone is very essential tool for every man. The mobile phone technology is evolved from cellular concept; therefore the mobile phone is also referred to as "Cell-phone" or simply "cell". In past years, the pagers are used in place of mobile phone for transmitting information from one place to another. But this communication only contains data signals and not a single voice signal.

Since the mid 1990's the cellular communication industry has witnessed explosive growth. Wireless communication networks have become much more pervasive than anyone could have imagined when the cellular concept was first developed in the 1960's and 1970's. Increasing demand in wireless communication necessitates the rapid growth of cellular network for fulfilling the customers need and also for the competitor service providers.

The wireless communication is a robust, viable voice and data transport mechanism. The cellular systems should be able to support the higher data traffic as well as higher spectrum efficiency.

Mobile wireless industry has begun its technology creation, revolution and development since right on time 1970s. In the previous not many decades, mobile wireless technologies have experience 4 or 5 generations of technology revolution and

development, in particular from 0g to 4g. The cellular thought was presented in the 1G technology which made the expansive scale mobile wireless communication conceivable. Digital communication has traded the similarity technology in the 2G which altogether made strides the wireless communication quality. Information communication, notwithstanding the voice communication, has been the fundamental center in the 3G technologies and a focalized network for both voice and information communication is developing. With proceeded R&d, there are numerous executioner provision chances for the 4g and additionally innovative challenges.

First of all, today models are situated by the International Telecommunication Union or Itu for short. There particular organization of the United Nations, where established in 1865, which is answerable for the communication and information technologies. The Itu co-ordinates imparted the worldwide utilization of radio range, it work for development of a framework tele-Communication foundation and built the identified worldwide telecommunication models.

In 1895, Guglielmo Marconi opened the path for up to date wireless communications by transmitting the three-spot Morse code for the letter "S" over a separation of three kilometres utilizing electromagnetic waves. From this starting, wireless communications has advanced into a key component of up to date social order. Wireless communications have some unique attributes that have roused specialised studies. To begin with, wireless communications depends on a rare asset – in particular, radio range state. So as to cultivate the improvement of wireless communications (counting telephony and Television) those stakes were privatised. Second, utilization of range for wireless communications needed the advancement of key correlative technologies; particularly those that permitted higher frequencies to be utilised more effectively. At long last, on account of its unique nature, the effective utilization of range needed the composed improvement of guidelines.

The term is utilized to portray current wireless associations for example those in cellular networks and wireless broadband web, primarily utilizing radio waves. The Mobile wireless industry has begun its technology creation, revolution & advancement since promptly 1970s. In the previous not many decades, mobile wireless technologies have been ordered consistent with their generation, which to a great extent indicates the sort of administrations and the information exchange speeds of every class of technologies.

GENERATIONS : AN OVERVIEW

FIRST GENERATION - The first generation mobile systems are based on analog technology. The first technology uses frequency modulation (FM) and frequency division duplexing (FDD), frequency division multiple access (FDMA). The common signalling channels were used in first generation cellular systems. Due to the use of analog technology the analog speech signals are provided by the first generation wireless systems. The data transmission between base station and mobile user was insufficient and the low data rate necessitates the next generation cellular systems. The first generation systems are relies on analog systems therefore, the transmission is not secure whereas the second generation systems uses digital modulation so, provides secure transmission of data.

SECOND GENERATION - The second generation mobile technology is a successor of first generation mobile technology. Due to the analog speech signals, low data rate and insufficient data communication there is a emerging demand of the next generation wireless system that provides high speed data communication as well as voice transmission . Thus, the analog technology in first generation is replaced by digital technology in 2G wireless systems. Instead of analog frequency modulation(FM) technique the digital modulation techniques are used in second generation. The access techniques used in second generation are TDMA(time division multiple access) and CDMA(code division multiple access) along with the frequency division duplexing(FDD) technique. By using the second generation technologies the system capacity is three times greater than the first generation analog systems. Due to the increase in spectrum efficiency is three times compared to the first generation analog systems.

THIRD GENERATION - The third generation (3G) wireless systems provides backward compatibility for 2G and 2.5G. The 3G technology is originally designed for higher speed internet access and various types of web browsing applications. The 3G standard provides various attractive services one of it is video conferencing which enables multiple called parties that can communicate face to face though they are at a long distance. This service is very useful in case of business industries where various conferences are performed by video conferencing. The 3G also provides multimedia services, video calling, gaming services and internet access at a very high data rate .

FOURTH GENERATION - The fourth generation mobile communication system is developed after the third generation (3G) mobile phone standards. A fourth generation system (4G) provides various features which are not involved in Third generation standards or any other generation before 3G (i.e. first generation and second generation). The features included in 4G are Video conferencing, gaming services, IP telephony, high definition (HD) mobile TV. It also provides Internet access facility at a very rapid speed which is known as mobile ultra-broadband internet access.

The fourth generation mobile systems uses orthogonal frequency division multiplexing (OFDM),

Multiple input multiple output (MIMO), software defined radio (SDR) technologies. The OFDM technology is similar technology as FDM (Frequency division multiplexing) technology but a technological difference is that in OFDM the subcarriers are orthogonally spaced to each other to reduce the interference. It also reduces the Frequency selective fading which affects severely the transmitted signal at a channel. Due to the orthogonal arrangement of subcarriers the cross-talk between sub channels is eliminated. One advantages of OFDM is that intercarriers guard bands are not necessary.

WHY WE USE WIRELESS TRANSMISSION

There are some sorts of wireless technologies; the principle distinction being their extent. Some offer connectivity over an range as substantial as your desktop whilst others can blanket a medium-measured office space. Our most recognizable wireless network, the mobile telephone, spreads entire landmasses. Wireless technology can offer organizations more adaptable and economical approaches to send and gain information.

The four key profits of wireless technology are:

1. Expanded proficiency - enhanced communications accelerates quicker exchange of information inside organizations and between partners/customers.

2. You are once in a while withdrawn - you don't have to convey links or connectors with a specific end goal to enter office networks.

3. More excellent adaptability and versatility for clients - officebased wireless specialists could be networked without sitting at committed Pcs.

4. Lessened expenses - with respect to 'wired', wireless networks are, by and large, shabbier to institute and administer.

FUTURE GENERATIONS OF MOBILE COMMUNICATION

5G Mobile Technology - Wireless communication has started in early 1970s. In next four decades, a mobile wireless technology has evolved from 1G to 5G generations. Fifth generation technology offer very high bandwidth that user never experienced before. The Fifth generation technologies offer various new advanced features which makes it most powerful and in huge demand in the future. Now days different wireless and mobile technologies are present such as third generation mobile networks (UMTS- Universal Mobile Telecommunication System, cdma2000), LTE (Long Term Evolution), WiFi (IEEE 802.11 wireless networks), WiMAX (IEEE 802.16 wireless and mobile networks), as well as sensor networks, or personal area networks (e.g. Bluetooth, ZigBee). Mobile terminals include variety of interfaces like GSM which are based on circuit switching. All wireless and mobile networks implements all-IP principle, that means all data and signaling will be transferred via IP (Internet Protocol) on network layer. Fifth generation technology provide facilities like camera, MP3 recording, video player, large phone memory, audio player etc. that user never imagine and for children rocking fun with Bluetooth technology and Piconets. The fifth generation wireless mobile multimedia internet networks can be completely wireless communication without limitation, which makes perfect wireless real world – World Wide Wireless Web (WWWW). Fifth generation is based on 4G technologies. The 5th wireless mobile internet networks are real wireless world which shall be supported by LAS-CDMA(Large Area Synchronized Code-Division Multiple Access),OFDM(Orthogonal frequency-division multiplexing), MCCDMA(Multi-Carrier Code Division Multiple Access), UWB(Ultra-wideband), Network-LMDS(Local Multipoint Distribution Service), and IPv6. Fifth generation technologies offers tremendous data capabilities and unrestricted call volumes and infinite data broadcast together within latest mobile operating system. Fifth generation should make an important difference and add more services and benefits to the world over 4G. Fifth generation should be more intelligent technology that interconnects the entire world without limits. This generation is expected to be released around 2020. The world of universal, uninterrupted access to information, entertainment and communication will open new dimension to our lives and change our life style significantly.

Fifth generation mobile systems model is all-IP based model for wireless and mobile networks interoperability. The All-IP Network (AIPN) is capable to fulfill increasing demands of the cellular communications market. It is a common platform for all radio access technologies. The AIPN uses packet switching and its continuous evolution provides optimized performance and cost. In fifth generation Network Architecture consist of a user terminal (which has a crucial role in the new architecture) and a number of independent, autonomous radio access technologies (RAT). In 5G Network Architecture all IP based mobile applications and services such as Mobile portals, Mobile commerce, Mobile health care, Mobile government, Mobile banking and others, are offered via Cloud Computing Resources (CCR). Cloud computing is a model for convenient on-demand network access to configurable computing resources (e.g., networks, servers, storage, applications, and services).

6G Mobile communication system - The 6G mobile system for the global coverage will integrate 5G wireless mobile system and satellite network. These

satellite networks consist of telecommunication satellite network, Earth imaging satellite network and navigation satellite network. The telecommunication satellite is used for voice, data, internet, and video broadcasting; the earth imaging satellite networks is for weather and environmental information collection; and the navigational satellite network is for global positional system (GPS). The four different countries which developed these satellite systems are; the GPS by USA, the COMPASS system developed by China. The Galileo system by EU, and the GLONASS system developed by Russia.

In 6G handoff and roaming will be the big issue because these satellite systems are different networks and 6G has four different standards. So the handoff and roaming must take place between these 4 networks but how it will occur is still a question.

7G Mobile communication system - In wireless radio interface the higher bit rate is a big loss; in 5G this loss is controlled by using open transport protocol (OTP). The transport layer and session layer in 5G network sport this protocol. The application layer is for quality of service management over different type of networks.

The important features of 5G technology includes bidirectional larger bandwidth, less traffic, equally availability of network across the world, 25Mbps connectivity speed, data bandwidth higher than 1GB and low-cost.

7G mobile network is like the 6G for global coverage but it will also define the satellite functions for mobile communication. In satellite system, the telecommunication satellite will be for voice and multimedia communication; navigational satellite will be for global positional system (GPS) and earth image satellite for some extra information like weather update. The 6G mobile wireless network will support local voice coverage and other services. The 7G will be the most advance generation in mobile communication but there will be some research on demanding issues like the use of mobile phone during moving condition from one country to another country, because satellite is also moving in constant speed and in specific orbit, the standards and protocols for cellular to satellite system and for satellite to satellite communication system. The dream of 7G can only be true when all standards and protocols are defined. May be this is possible in next generation after 7G and can be named as 7.5G.

CONCLUSION

Nowadays, the wireless technology is getting popular and important in the network and in Internet field. In this paper that we briefly introduced the history background of 2G to 5G, compared the differences of 2G and 3G, and illustrated how 4G may work for more convenient and powerful in the future. 4G was just right started from 2002 and there are many standards and their technologies, which are still in developing the process. Therefore no one can really sure what the future 4G will look like and what services it will offer to people. However, we can get general idea about 4G from academic research; 4G is the evolution based on 3G"s limitations and it will fulfills the amount of an idea that is WWWW, World Wide Wireless Web, offering more services and smooth global roaming with inexpensive cost. A new revolution of a 5G technology is about to begin because 5G technology is going to give tough competition to normal computer and laptops. There are lots of improvements from 1G, 2G, 3G, and 4G to 5G in the world of telecommunications. In the novel impending 5G technology is available in the market in affordable rates, and high peak future and much reliability than its preceding technologies.

Mobiles have come to be extremely fundamental part of our regular life. Their present improvement is the result of different generations. In this paper we survey the different generations of mobile wireless technology, their entries, performance, points of interest also hindrances of one generation over other.

This paper presented a detailed survey of development of mobile technologies and the journey from 1G to 4G. From all above discussion it can be revealed that mobile technologies are developed at very rapid growth. The 1G mobile systems gives a start up to the cellular concept while, 2G systems provides various features to the users. The 3G mobile systems provides various attractive multimedia services. 4G system increases the data rates to a great extent. It also has high spectrum utilization ratio and low transmitting power.

The development of the mobile and wireless networks is going towards higher data rates and all-IP principle. Mobile terminals are obtaining each year more processing power, more memory on board, and longer battery life for the same applications. 5g include latest technologies such as cognitive radio, SDR, nanotechnology, cloud computing and based on All IP Platform. It is expected that the initial Internet philosophy of keeping the network simple as possible, and giving more functionalities to the end nodes, will become reality in the future generation of mobile networks, here referred to as 5G.

REFERENCES

- Amos Edward Joel (Bell Labs), “Cellular Mobile Communication System.”
- Arogayaswami Paulraj, Rohit Nabar, Dhananjay Gore, Introduction To Space Time Wireless Communications, Prentice Hall of India

- B. G. Evans and K. Baughan, "Visions of 4G," Electronics and Communication Engineering Journal, Dec. 2002.
- Douglas Fougnies et al. (Freedom Wireless) 1998, “Security cellular telecommunications system”
- Fumiyuki Adachi, “Wireless past and Future: Evolving Mobile Communication Systems”. IEICE Trans. Findamental, Vol. E84-A, No.1, January 2001.
- Goldsmith, Andrea (2005), “Wireless Communications. Cambridge University”
- H. Huomo, Nokia, "Fourth Generation Mobile," presented at ACTS Mobile Summit99, Sorrento, Italy, June 1999.
- J. Winters, J. Salz, and R. D. Gitlin, “The impact of antenna diversity on the capacity of wireless communication systems,” IEEE Trans. Communication.
- Martin Cooper et al. (Motorola)(2002), “Radio Telephone System (Dyna-Tac)”.
- Moray Rumney, "IMT-Advanced: 4G Wireless Takes Shape in an Olympic Year", Agilent Measurement Journal, September 2008
- Noah Schmitz (March 2005). "The Path To 4G Will Take Many Turns". Wireless Systems Design.
- Siegmund M. Redl, Matthias K. Weber, Malcolm W. Oliphant (March 1995): "An Introduction to GSM".
- Vasari Bande, Mounika Marepalli,Leepika Gudur “Evolution of 4G Research Directions Towards Fourth Generation Wireless Communication”, “ International Journal of Computer Science and Information Technologies”, Vol. 2 (3) , 2011, 1087-1095.