

Wireless and Mobile Communications

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Abstract—The aim of this Research paper is to compare the challenges and issues that are involved in each generation and explained how the improvements have been made successfully in Wireless and mobile communications from earlier generation to modern generation. As a subscriber becomes more aware of the mobile phone technology, he/she will seek for an appropriate package all together that including all the advanced features of a cellular phone can have. However, The search for new technology is always the main intention of the prime cell phone giants to out innovate their competitors. Wireless and mobile communications encompasses various types of fixed, mobile and portable applications including Cellular telephones, personal digital assistants, GPS units, Wireless headphones, Headsets, Satellite television & Broadcasts. Hence, this paper represents great evolution of 1G (First Generation), 2G, 3G, 4G and the 5G Master Core technology. Mobile wireless technology is developing in rapid speed with the advanced techniques. It is an emerging technology in which all fields of mobile communications such as internet access, location based services, video conferencing system, mobile financial services, mobile entertainment services etc. The users can be use these applications at anytime and anywhere through mobile communication.

1. INTRODUCTION

The field of Wireless and Mobile communications technology is currently undergoing a fundamental transformation from the era of personal computers and Internet services to a new paradigm based on portable devices connecting wirelessly to the emerging mobile Internet. The mobile Internet represents the second wave of the wireless revolution which started with the remarkable adoption of the cellular phones estimated to exceed four billion users worldwide at the time of this writing in 2011. Cellular technology started migrating towards data and Internet services enabling a wide range of new anytime/anywhere computing and multimedia applications ranging from navigation and search to mobile video streaming. Actually, Mobile data services are currently experiencing rapid growth because of the popularity of Internet applications on mass-market mobile platforms including smart phones, net-books, and laptops. An authoritative industry report predicts that mobile generated traffic will exceed that from fixed personal computers (PCs) by 2015, underscoring the fact that most ICT services may be expected to migrate to mobile devices over the next few years. In particular, large-scale delivery of Internet applications on mobile devices will require faster radio access bit rates, significantly improved

spectrum efficiency, higher access system capacity, seamless protocol integration with the Internet, robustness in the presence of wireless channel impairments and disconnection, improved security for the open radio medium, and many others.

2. WIRELESS COMMUNICATIONS

Wireless Communication is the process of transmitting radio waves or micro waves over a distance between the two points without any physical wire attachment. It encompasses various types of devices such as like Bluetooth, remote control, Hand-held walkie-talkies, personal digital assistant, wireless computer mice and so on.

- 1. Blue Tooth:** Bluetooth refers to short-range radio frequency (RF) technology because it consists a distance of 2.4 GHz and has the efficient transmitting voice and data. For eg: sharing files, photographs and other data through wireless communication.
- 2. Walkie-talkie:** It is the hand-held, portable, two-way radio transceiver. Additionally, Talking distance between the two transmitters is 5 miles. If there are no obstructions in the line of sight can use the walkie-talkie up to a maximum distance of 35 miles .
- 3. Wi-Fi:** It provides the wireless access to applications and radio across the network. The first mobile phone system was established in Japan. Weather, the launch for first mobile system was occurred in Sweden, Norway, Denmark and Finland. After these progress, the generations for mobile wireless communication starts. In this research work, we presented the detailed survey of different generations of the mobile communication networks.

3. MOBILE COMMUNICATIONS

The First Generation (1G) mobile phone networks uses analog signals to transmit the voice calls only between the two transmitters. Second Generation (2G) mobile network is the next stage in the development of wireless technology to overcome the limitations of 1G by focusing on transmission of

voice and data with digital signals. Third Generation (3G) was arrived because of the low speed and incompatible technologies used on previous generations. The main features of 3G is that it allows higher data transmission rates and increased capacity for traditional voice calling and the high speed data applications such as Global Roaming ,internet, mobile, video conferencing, video calls and 3D gaming. 4G is known as beyond 3G, stands as an acronym for fourth generation communication system which describes the next step in wireless communication. 4G is called as MAGIC because the users can use the mobile multimedia at anytime anywhere with global mobility support on integrated wireless solutions and customized personal service at higher data rates than previous generations. Wherever, Fifth Generation (5G) is a packet switched wireless mobile communication system with extensive area coverage and high through put. Hence it is called as Real World Wireless or wireless World Wide Web (WWW)

1) 1G Communication System

1G Mobile Communication System 1G refers to the first generation of mobile communication system which was started in 1974 and completed in 1984. 1G was developed on earlier stage to communicate with mobile phones through the network of distributed transceivers. Additionally, Analog System was the first mobile wireless communication system used in 1G, which was based on an Advance Mobile Phone Service technology. AMPS system was based on frequency modulation radio system using Frequency Division Multiple Access (FDM) with 30 KHz as channel capacity and the frequency band was 824-894 MHz it allows only voice calls. Its speed up to 2.4 Kbps.



Limitations of 1G

There are few limitations in 1G Mobile Communication. First of all it does not have data services to convert the voice into digital signals. Secondly, Global Roaming Service was not possible, low capacity, unreliable hand off, Poor Voice Quality because in 1G, data can be carried by only one channel from source (one caller) to destination (another). This means that the two callers are not able to hear each other since the number of calls was limited. First-Generation Systems (1G) The 1st generation was pioneered for voice service in early 1980's, where almost all of them were analog systems

using the frequency modulation technique for radio transmission using frequency division multiple access (FDMA) with channel capacity of 30 KHz and frequency band was 824-894 MHz that was based on a technology known as Advance Mobile Phone Service (AMPS).

2) 2G Communication System

2G denotes the second generation of mobile networks which were the next stage in the development of mobile communication after 1G. 2G was started at 1980's and completed at 1990's which were mainly used for voice transmission with digital signals and the speed up to 64 kbps. When compared to 1G, 2G was step ahead by providing the services such as short message services, picture message services and Multi Media Message services (MMS). In 2G , there are two schemes such as Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA) were used . TDMA allows for division of signals into time slots and a special code generated by a CDMA for each user in order to communicate over a multiplex physical channel. GSM (Global System for Mobile Communication) technology which enables the mobile subscribers to use the mobile phone connection in different countries of the world to provide better quality and capacity. Actually, The 2nd generation was accomplished in the later 1990's. The 2G mobile communication system is a digital system, this system is still mostly used in different parts of the world. This generation mainly used for voice communication also offered the additional services such as SMS and e-mail. In this generation two digital modulation schemes are used; one is time division multiple access (TDMA) and 2nd is code division multiple access (CDMA) and frequency band is 850-1900 MHz. In 2G, GSM technology uses eight channels per carrier with the gross data rate of 22.8 kbps (a net rate of 13 kbps) in full rate channel and a frame of 4.6 milliseconds (ms) duration. The family of this generation includes 2G, 2.5G and 2.75G.

Limitations of 2G

1. Strong digital signals are required to make the mobile phones properly work.
2. Digital signals would be weak if there is no proper network coverage define in the specified area.
3. Difficult to handle complex data such as video, large files etc.
4. A 2.5G Mobile communication system 2.5G defines that the 2G cellular systems can combined with the General Packet radio Services (GPRS) or other facilities that are not found in 2G or 1G network.
5. In addition to circuit- switched domain, 2.5G implements as like packet switched network to make use of 2G system infrastructure. It can have a data rate up to 144kbps and technologies used in 2.5G are GPRS, EDGE, & CDMA 2000. The major features are Camera Phones, Web Browsing Send/Receive E-Mail Messages, Speed 64-144

kbps, Phone Calls and Take a time of 6-9 minutes to download a 3 mins Mp3 Song.



3) 3G Mobile Communication System

3G Mobile Communication System denotes the Third generation (3G) services to combine high speed mobile access with Internet Protocol (IP)-based services. The main features of 3G technology include the wireless web base access, multimedia services, email, and video conferencing. The 3G W-CDMA air interface standard had been designed for always-on packet-based wireless service, computer, entertainment devices and telephones may all share the same wireless network and be connected internet anytime, anywhere. 3G system offer high data rates up to 2Mbps, over 5MHz channel carrier width, depending on the mobility/velocity and high spectrum efficiency. The data rate supported by 3G networks depends also on the environment the call is being made in, 144 kbps from satellite and rural outdoor, 384 kbps in urban outdoor and 2Mbps in indoor and low range outdoor. The frequency band is 1.8 - 2.5 GHz. 3G denotes third generation of mobile communication system which was introduced in the year 2000. However, 3G networks were offered to eradicate many problems tackled by 2G and 2.5G networks are of low speed and incompatible technologies such as Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA). The speed of 3G technology is lie from 125Kbps-2Mbps. The important feature of 3G technology is provides the higher data transmission rates and increased speed of capability. 3G uses the packet-switching technology, which is more effective and faster than the earlier circuit-switched systems, but it requires a changed infrastructure to the 2G systems. Because of the greater data rate and bandwidth 3G mobile phones offers multimedia applications and mobile internet access. 3G delivers more new features such as , e-mail, Web browsing, TV streaming, video conferencing, paging , 11sec-1.5min time to download a 3min Mp3 song, whether fax and navigational maps.3G technology is more flexible because it sustained the 5 main radio technologies. These radio technologies functions beneath CDMA, TDMA and FDMA. The purpose of the 3G is to provide more coverage and evolution with lowest investment.



Limitations of 3G are

1. Requires higher bandwidth.
2. Cost for the 3G mobile phone is high.
3. Size of the phone is large.
4. Difficult to build the infrastructure for 3G.
5. The amount is high for 3G Licenses Services.

4) 4G Mobile Communication System

4G Mobile Communication System 4G denotes the fourth generation mobile communication system which was introduced in the year 2010. Additionally, 4G is the IP-based mobile system that provides access through a collection of radio interfaces. It has capability to provide the speed of 100 Mbps – 1Gbps and has high QoS (Quality of service) and security. It also offers various kind of services at any time as per as user requirements at anywhere. The significant features of 4G technology are video conferencing, location based services, telemedicine, high security, speed, capacity and low cost per bit. The term MAGIC indicates in 4G as like:

M= mobile multimedia

A= any time any where

G= global mobility support

I= integrated wireless solution

C= customized personal service.



4G usually refers to the successor of the 3G and 2G standards. In fact, the 3GPP is recently standardizing LTE Advanced as future 4G standard. A 4G system may upgrade existing communication networks and is expected to provide a comprehensive and secure IP based solution where facilities such as voice, streamed multimedia and data will be provided

to users on an "Anytime, Anywhere" basis and at much higher data rates compared to previous generations. One common characteristic of the new services to be provided by 4G is their demanding requirements in terms of QoS. Applications such as wireless broadband access, Multimedia Messaging Service (MMS), video chat, mobile TV, HDTV content and Digital Video Broadcasting (DVB) are being developed to use a 4G network. 4G Wireless technology is combined together with the existing and the proposed wireless network technology (e.g. OFDM, MC-CDMA, LAS-CDMA) in order to avoid the faultless roaming from one technology to another. LTE (Long Term Evolution) and Wi-MAX (Worldwide Interoperability for Microwave Access) technologies are used for fourth generation.

There are few limitations in 4G are

1. The usage of battery in 4G mobile phone is more.
2. Implementation of hardware is difficult.
3. Complicated hardware is necessary .
4. Exclusive network is compulsory to implement the following generation network.

5) 5G Wireless Communication System

5G Wireless Communication System is not deployed now. The big challenge for the design and deployment of 5G wireless system can be faced easily as proposed features and architecture (mentioned below) that will increase system capacity and quality within the limited available frequency spectrum, whose frequency band & Data Bandwidth will be 3-300GHz and 1Gbps & higher (as demand) successively. The remarkable issue, there don't have any type of limitations in 5G as respect to user demands in the next 200 years. The 5G also implies the whole wireless world interconnection (WISDOM—Wireless Innovative System for Dynamic Operating Mega communications concept) together with very high data rates impement for Quality of Service (QoS) applications. The 5G or fifth generation of wireless mobile communication system is the wireless internet network which is maintained by OFDM, MC-CDMA, LAS-CDMA, UWB, Network-LMDS and IPv6. Additionally, The 5G is called as Real world wireless or www worldwide wireless web because it does not require limitations. However, Physical layer and data link layer defines the wireless technology in 5G. These two layers indicates the 5G technology is like Open Wireless Architecture (OWA) and the virtual multi-wireless network are also maintained in the 5G technology mobile phones. To perform this, the network layer is sub divided into upper network layer for upper terminal and the lower network layer for interface and where all the routing is based in IP addresses and that should be different for each IP network in world wide. The main disadvantage of 5G technology is the higher big rate. The big rate is controlled by use of Open Control Protocol (OTP).The OTP is supported by transport layer and the session layer in 5G networks. The application

layer is used for quality of service management over different type of networks.

Hence, Bidirectional bandwidths, less traffic, equally availability of network across the world, 25Mbps connectivity speed, data bandwidth higher than 1GB and low cost are the main features of 5G technology.



4. ADVANTAGES OF WIRELESS AND MOBILE COMMUNICATIONS

1. **Mobility:** It allows the users to access or to transfer the information beyond their desk.
2. **Reachability:** It allows the users for better connection and reachable without any limitations of any location.
3. **Simplicity:** Wireless systems are easier and fast to deploy when compared to wired network.
4. **Maintainability:** Though the system is wireless, no need to spend too much amount of time to uphold a wireless network setup.
5. **Roaming Services:** Since the system is wireless, one can provide service any time any where including train, buses, aero planes etc.

5. CONCLUSION

Mobiles have become very essential part of our life. The current development is the outcome of various generations. In this paper we reviewed the various generations of mobile wireless technology, their portals, performance, advantages and disadvantages of one generation over other. In future the research work is on real wireless world with no more limitations, wired devices with artificial intelligence capabilities, Pervasive Networks provides universal computing: The operator can instantaneously linked to numerous wireless access technologies and faultlessly move between them.

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