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A Study of Wireless Mobile Technology

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Abstract: Mobile wireless technology is developing in rapid speed with advanced techniques. It is an emerging technology in all the fields of mobile communication such as internet access, location based services, video conferencing system, mobile financial services, mobile entertainment services etc. The users can use these applications at anytime and anywhere through mobile communication. The aim of this survey is to compare the challenges and issues that are involved in each generation and explained how the improvements have been made successfully in mobile communication from earlier generation to modern generation.

Keywords: 1G, 2G, 3G, 4G, AMPS, GSM, GPRS, OWA

I. Introduction

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 Bluetooth, remote control, Hand-held walkie-talkies, personal digital assistant, wireless computer mice and so on.

Blue Tooth: Bluetooth is called as 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 the files, photographs and other data through wireless communication [2].

Walkie-talkie: It is a hand-held, portable, two-way radio transceiver. 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 [2].

Wi-Fi: It provides wireless access to applications and radio across the network.

The first mobile phone system was established in Japan and 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 mobile communication networks.

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 primarily focusing on transmission of voice and data with digital signals. Third Generation (3G) was arrived because of 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 call and 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 solution and customized personal service at higher data rates than previous generations. 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 (WWWW)[7].

II. 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 the mobile phones through the network of distributed transceivers. Analog System was the first mobile wireless communication system used in 1G, which was based on an Advance Mobile Phone Service (AMPS) technology. AMPS system was based on frequency modulation radio system using Frequency Division Multiple Access (FDMA) with 30 KHz as the channel capacity and frequency band was 824-894 MHz it allows only voice calls. Its speed up to 2.4 Kbps[3].

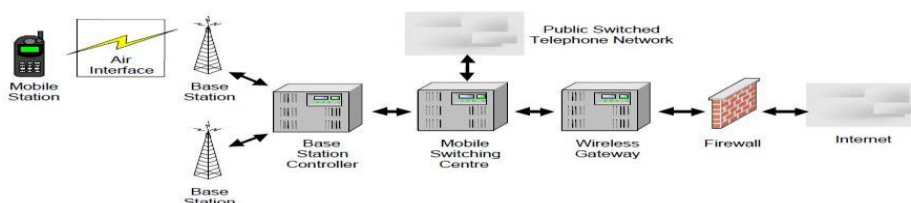


Fig 1 Architecture of Advance Mobile Phone Services (AMPS)

There are few limitations in the 1G Mobile Communication. First of all it does not have data service 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, the 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 simultaneously since the number of calls was limited.



Fig 2 1G Mobile Phone

III. 2G Mobile 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 for voice transmission with digital signals and the speed up to 64 kbps. When compared to 1G, 2G was step ahead by providing services such as short message services, picture message services and Multi Media Message services (MMS). In 2G, two schemes such as Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA) were used. TDMA allows for the 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 enables the mobile subscribers to use the mobile phone connection in different countries of the world to provide better quality and capacity.

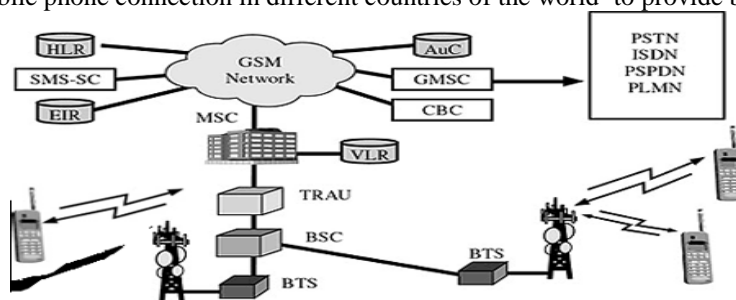


Fig 3 2G GSM Architecture

Limitations of 2G: 1. Strong digital signals are required to make the mobile phones work. 2. Digital signals would be weak if there is no proper network coverage in the specified area. 3. Difficult to handle complex data such as video etc.

A. 2.5G Mobile communication system

2.5G defines that the 2G cellular systems can combine with the General Packet radio Services (GPRS) or other facilities that are not found in 2G or 1G network. In addition to circuit-switched domain, 2.5G implements as packet switched network to make use of 2G system infrastructure. It can have a data rate up to 144 kbps and the 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, Take a time of 6-9 minutes to download a 3 mins Mp3 Song.

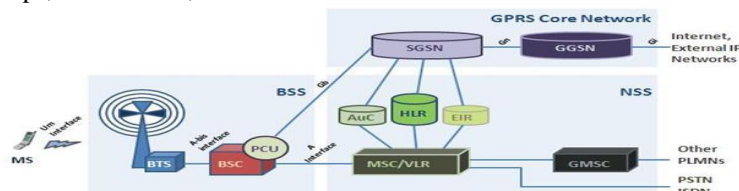


Fig 4 GPRS Architecture



Fig 5 2G Mobile Phone

IV. 3G Mobile Communication System.

3G denotes the third generation of mobile communication system which was introduced in the year 2000. 3G networks were offered to eradicate many problems tackled by 2G and 2.5G networks particularly the low speed and incompatible technologies such as Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA). The speed of 3G technology is from 125Kbps-2Mbps.

The important feature of 3G technology is that it provides higher data transmission rates and increased speed of capability. 3G uses 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 greater data rate and bandwidth 3G mobile phones offers multimedia applications and mobile internet access[1]. 3G delivers more new features such as Web browsing, e-mail, TV streaming, video conferencing, paging, 11sec-1.5min time to download a 3min Mp3 song, fax and navigational maps. 3G technology is more flexible because it sustenance 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

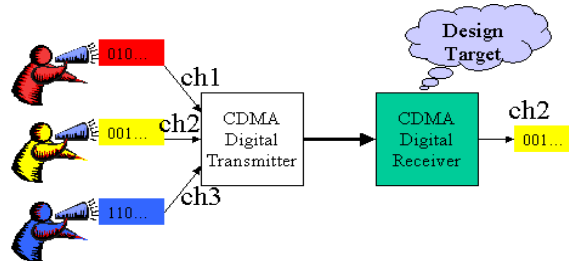


Fig 6 CDMA Architecture

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.



Fig 7 3G Mobile Phone

V. 4G Mobile Communication System

4G denotes the fourth generation of mobile communication system which was introduced in the year 2010. 4G is the IP-based mobile system that provides access through a collection of radio interfaces.

It has the capability to provide speed of 100 Mbps – 1Gbps and has high QoS (Quality of service) and security. It also offers various kind of service at any time as per user requirements at anywhere[5]. The significant features of 4G technology are video conferencing, location based services, tele-medicine, high security, speed, capacity and low cost per bit. The term MAGIC indicates in 4G as

- M= mobile multimedia
- A= any time any where
- G= global mobility support
- I= integrated wireless solution
- C= customized personal service



Fig 8 4G Mobile Communication System

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.



Fig 9 4G Mobile Phone

There are few limitations in 4G. 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.

VI. 5G Mobile Communication System

The 5G 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. The 5G is called as Real world wireless or www worldwide wireless web because it does not require limitations.

Physical layer and data link layer defines the wireless technology in 5G. These two layers indicate that 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 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 the 5G technology is higher big rate. The big rate is controlled by using Open Control Protocol (OTP)[7].This OTP is supported by transport layer and session layer in 5G networks. The application layer is for quality of service management over different type of networks. 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.

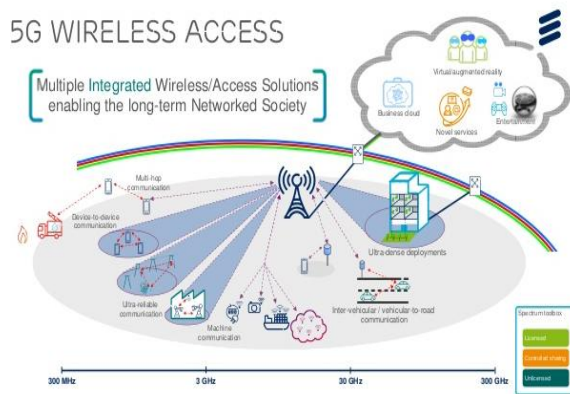


Fig 10 Open Wireless Architecture



Fig 11 5G Mobile Phone

Table1: Comparison of All Generations

Generation Features	1G	2G	3G	4G	5G
Years	1980s	1990s	2000s	2010s	2020s
Data Bandwidth	2kbps	64kbps	2Mbps	200Mbps	1Gbps
Standards	AMPS	TDMA, CDMA,GSM, GPRS	WCDMA	Single unified standards	Single unified standards
Technology	Analog	Digital Cellular	Broadband with	Unified IP &	Unified IP & Seamless

	cellular		CDMA, IP Technology	Seamless combination of broadband, LAN,WAN & WLAN	combination of broadband, LAN,WAN & WLAN,WWW
Services	Mobile technology (voice)	Digital Voice, SMS, Higher Capacity Packetized	Integrated high quality audio, video & data	Dynamic information access, wearable Devices	Dynamic information access, wearable Devices with AI capabilities
Multiplexing	FDMA	TDMA,CDMA	CDMA	CDMA	CDMA
Switching	Circuit	Circuit & Packet	Packet	All Packet	All Packet

B. Technologies applicable to all the mobiles are:

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

VII. Conclusion

Mobiles have become very essential part of our everyday 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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