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ROLE OF INTERNET TECHNOLOGY IN FUTURE MOBILE DATA SYSTEMS

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ABSTRACT
Mobile wireless technology is developing in rapid speed with advanced techniques. Due to the increase in demand for speed, multimedia support and other resources, the wireless world is looking forward for a new generation technology. The paper presents 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. The fifth generation wireless 5G development initiative is based upon 4G, which at present is struggling to meet its performance goals. An ideal 5G model to accommodate the challenges and shortfalls of 3G and 4G deployments is discussed as well as the significant system improvements on the earlier wireless technologies improvements on the earlier wireless technologies.
Keywords: 3G,4G,5G, Data rate, Data speed

I. INTRODUCTION

The Internet is undoubtedly expanding. This takes place both in the physical sense (increasingaccess to it in various parts of the globe) and in terms of its content, which is constantlyincreased by new information Froma collection of text filled web sites it has evolved into a multimedia database of information anda powerful tool for communication between people from all over the world.

Wireless mobile communication started from1970s and it was continuously upgraded from1G to 5G. The First Generation (1G) mobile phone networks uses analogsignals 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 looking 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.
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).
2. EVOLUTION

Wireless mobile communication system has become more popular due to rapid changes in mobile technology. Fast development of wireless communication systems are due to very high increase in telecoms customers. The revolution of mobile communications as shown in Fig 1 is from 1G-the first generation, 2G-the second generation, 3G-the third generation, 4G-the fourth generation, 5G-the fifth generation.

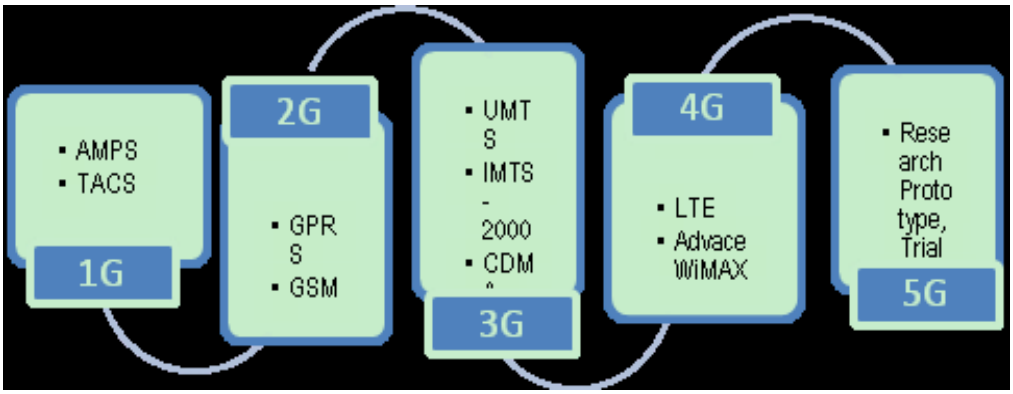

Fig. 1.Development of different generation of mobile technologies.

2.1 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. 1G network use analog signal, which was based on an Advance Mobile Phone Service (AMPS) technology. AMPS system shown in Fig2 was based on frequency modulation radio system using Frequency Division Multiple Access (FDM) 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..

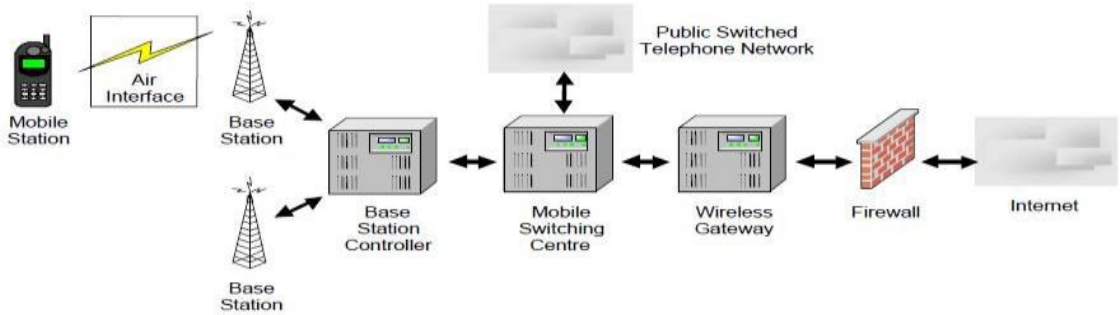

Fig 2 Architecture of Advance Mobile Phone Services (AMPS)

There are some **drawbacks**in the 1G Mobile Communication. 1G uses **analogsignals ratherthan digital signals.**Global Roaming Service was not possible. It has low capacity, unreliable hand off, Poor Voice Quality because in 1G, the data can be carried by only one channel from source to destination .This means that the two callers are not able to hear each other simultaneously.

2.2. Second Generation (2G)

2G mobile communication system is a digital system. Second generation enabled to provide the services such as text messages, picture messages and Multimedia messages (MMS) for various mobile phone networks. The second generation telecommunication networks were commercially launched on

the Global system for Mobile communications (GSM) standard in 1991.GSM shown in Fig 3was one of the main attractive sides of 2G and it introduced the conceptof SIM (Subscriber Identity Module) cards. GSM technology enables the mobile subscribers to use the mobile phoneconnection in different countries of the world to provide better quality and capacity.

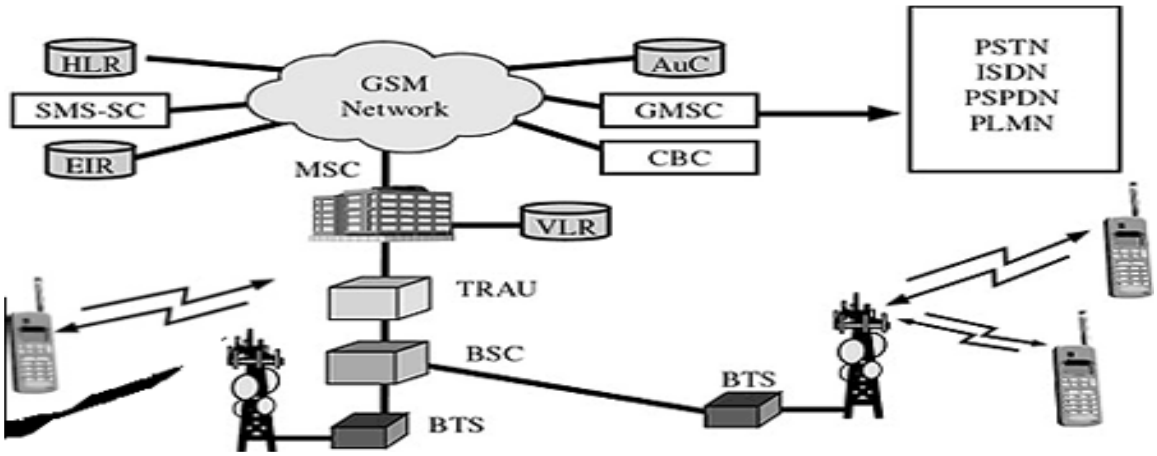

Fig 3 2G GSM Architecture

The advantage of 2G networks over the 1G was that phone conversations were digitally encrypted In this generation two digital modulation schemes are used; one is time division multiple access (TDMA) and the other is code division multiple access (CDMA) .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.The frequency band is 850-1900 MHz.

The family of this generation includes of 2G, 2.5G and 2.75G [2].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 144kbps 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

There are few disadvantages in the 2G Mobile Communication. First Strong digital signals are required to make the mobile phones work.2.Digital signals would be week if there is no proper network coverage in the specified area.3.Difficult to handle complex data such as video etc.

2.3. Third Generation (3G)

Third generation technology is carried out by the International Telecommunication Union (ITU) in the year 1980.The aim of the 3G technology was to address the growing needs of mobile and Internet application on a cell phone. 3G technologies allow mobile operators to offer more service options to their users, including mobile broadband.3G uses both circuit switching and packet switching strategies.

The main access technologies are CDMA (Code Division Multiple Access),WCDMA(Wideband CDMA)and TSCDMA (Time Division Synchronous CDMA). Additionally it uses HSDPA (high speed down link packet data access) and EUL (Enhanced up link) [14]. The maximum speed of 3G is estimated to be around 2 Mbps. This generation was the first wireless technology to support services which were only available on wired networks such as VPN, VOIP, video conferencing etc... The purpose of the 3G is to provide more data with less cost.

Some Limitations of 3G are it requires higher bandwidth and the Cost for the 3G mobile phone is high. The Size of the phone is large. It is hard to build the infrastructure for 3G.

2.4. Fourth Generation (4G)

The Fourth generation of networking, which was released in 2008, is 4G. It supports mobile web access like 3G does and also gaming services, HD mobile TV, video conferencing, 3D TV, and other features that demand high speeds.The main distinguishing factors between 3G and 4G are the data rates, services, transmission ways, access technology to the Internet, the compatibility to interface with wire-line backbone network, quality of service and security. 4G can support at least 100 Mbps peak rates in full-mobility wide area coverage and 1Gbps in low-mobility local area coverage [5]. The speeds of 3G can be up to 2Mbps, which is much slower than the speeds of 4G [9].

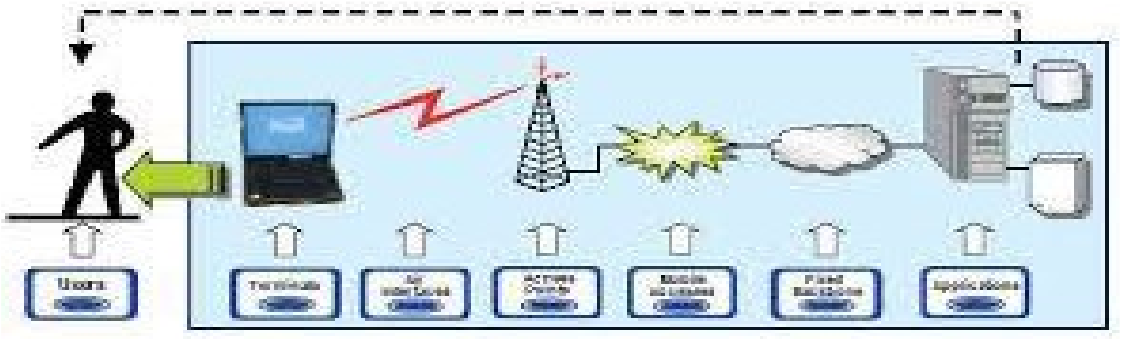

Fig 4. 4G Mobile Communication System

4G LTE (long term evolution) is another generation of the mobile system which was introduced following to 3G and is apredecessor of 5G. 4G providing services of the usual voiceand other 3G services also provides even more high data ratesfor packet data access. At the core of 4G, OFDM accesstechnology is used [7]. The use OFDM enables 4G toefficiently use the acquired signal spectrum by orthogonallydividing the signals and signal overlapping [7]. 4G networkcould provide services in the same capacity as of wirednetwork that are VOIP, VPN, high definition mobile TV,good downloading and uploading speed etc...4G also has its disadvantages. The disadvantage on thesubscriber point of view is that it will be not supported by 2Gor 3G mobile phones, so a new mobile phone is required for4G connection. The infrastructure is complex hence being costly [12].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.

There are few limitations in 4G. Asthe usage of battery in 4G mobile phone is more, also its
Implementation of hardware is difficult, complicated hardware is necessary and exclusive network is compulsory to implement the above generation network.

2.5. FifthGeneration (5G)

5G is a not-yet-implemented wireless technology that's intended to improve on 4G. 5G promises significantly faster data rates, higher connection density, much lower latency, and energy savings, among other improvements. The anticipated theoretical speed of 5G connections is up to 20 Gbps per second.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 wwww 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 controlled by using Open Control Protocol (OTP)[18].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.In 5G, each network will be responsible for handling user-mobility [9], while the terminal will make the final choice among different wireless/mobile access network providers for a given service. Such choice will be based on open intelligent middleware in the mobile phone.

2.5.1 Features

5G technology offer high resolution for cell phone users and bi-directional large bandwidth. The advanced billing interfaces of 5G technology makes it more attractive and effective. 5G technology also provides subscriber supervision tools for fast action. The high quality services of 5G technology based on Policy to avoid error. 5G technology is providing large broadcasting of data in Gigabit which will support almost 65,000 connections. The traffic statistics by 5G technology makes it more accurate. Through remote management offered by 5G technology a user can get better and fast solution. The uploading and downloading speed of 5G technology touching the peak.

2.5.2 5G System Architecture

The system model that proposes the design of network architecture for 5G wireless systems, which is all-IP based model for wireless and mobile networks interoperability is as shown in Fig.5. The system consists of a user terminal and a number of independent, autonomous radio access technologies. Within each of the terminals, each of the radio access technologies is seen as the IP link to the outside internet world. However, there will be different radio interface for each Radio Access Technology (RAT) in the terminal. For example, if we want to have access to four different RATs, we need to have four different access specific interfaces in the terminal, and to have all of them active at the same time, with aim to have this architecture to be functional [1,13,15].Application connections are realized between clients and servers in the Internet via sockets. Internet sockets are endpoints for data communication flows. Each socket of the web is a unified and unique combination of local IP address and appropriate local transport communications port, target IP address and target appropriate communication port, and type of transport protocol. Considering that, the establishment of communication from end to end between the client and server using the Internet protocol is necessary to raise the appropriate Internet socket uniquely determined by the application of the client and the server. This means that in case of interoperability between heterogeneous networks and for the vertical handover between the respective radio technologies, the local IP address and destination IP address will be fixed and unchanged. Fixing of these two parameters will ensure handover transparency to the Internet connection end-to-end, when there is a mobile user at least on one end of such connection. In order to preserve the proper layout of the packets and to reduce or prevent packets losses, routing to the target destination and vice versa will be uniquely using the same path [16,17].

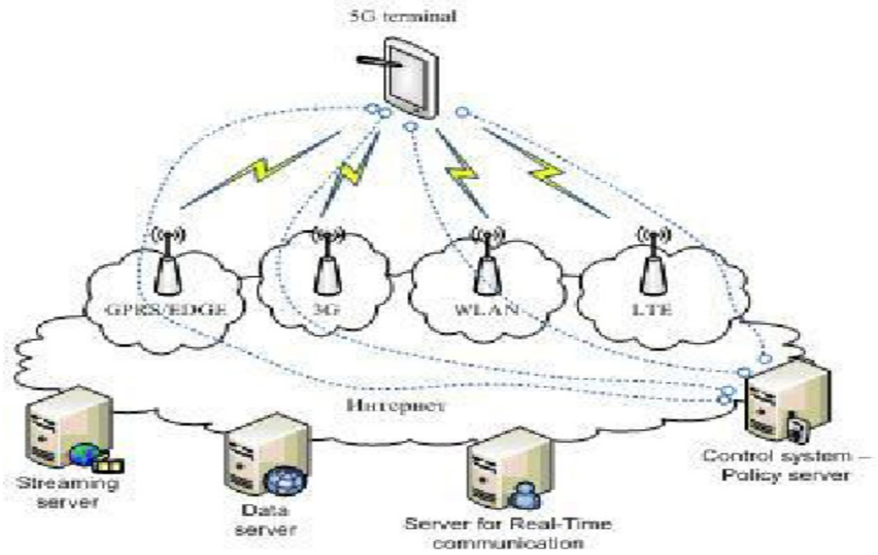

Figure 5.Functional Architecture for 5G Systems

Each radio access technology that is available to the user in achieving connectivity with the relevant radio access is presented with appropriate IP interface. Each IP interface in the terminal is characterized by its IP address and net mask and parameters associated with the routing of IP packets across the network. In regular inter-system handover the change of access technology (i.e., vertical handover) would mean changing the local IP address. Then, change of any of the parameters of the socket means closing the socket and opening a new one. This means, ending the connection and starting a new one. This approach is not-flexible, and it is based on today's Internet communication. To enable the functions of the applied transparency and control or direct routing of packets through the most appropriate radio access technology, in the proposed architecture, a control system is introduced in the functional architecture of the networks, which works in complete coordination with the user terminal and provides a network abstraction functions and routing of packets based on defined policies. At the same time this control system is an essential element through which it can determine the quality of service for each transmission technology. It is on the Internet side of the proposed architecture, and as such represents an ideal system to test the qualitative characteristics of the access technologies, as well as to obtain a realistic picture regarding the quality that can be expected from applications of the user towards a given server in Internet (or peer).

2.5.3. Advantages of 5G communication systems as a future preferred network

I. User personalization
II. Terminal and Network heterogeneity
III. High Performance
IV. Interoperability:

3. CONCLUSION

Mobiles play the vital role in our everyday life. The current development is the outcome of various generations. In this paper we examined the various generations of mobile wireless technology, their performance, benefits and limitations of one generation over other. The advent of 5G will transform the field of communication domain, bringing wireless experience to a completely new level. This

technology helps to raise stronger links between people working in different fields creating future concepts of mobile communication, internet service, cloud computing and nanotechnology.

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