

Survey on 5G Technology-Evolution and Revolution

T.Padmavathy¹, E.Abirami²

¹Assistant Professor, CSE, S.A.Engineering College, Chennai .

² Assistant Professor, CSE, S.A.Engineering College, Chennai .

Abstract : A review on various existing generations of mobile wireless technology in terms of their portals, performance, advantages and disadvantages has been made. The paper focuses on the growth and improvement of various generations of mobile wireless technology along with their significance and advantages of one over the other. Present research in mobile wireless technology concentrates on advance implementation of 4G technology and 5G technology. In 5G research is being made on development of world wide wireless web (WWW), Dynamic Adhoc Wireless Network (DAWN) and Real wireless world. This paper proposed novel network architecture for next generation 5G mobile networks. The architecture contains mobile terminal which has the possibility to change the Radio Access Technology

Keywords : Evolution from 1G-5G, 5G Network Architecture, Need of 5G

I. INTRODUCTION

Wireless communication technology inside cell phones and other mobile devices has evolved over several decades. Dozens of different wireless connection and data transfer methods have been developed over the years - for improved speed, reach and/or reliability - although many are now obsolete. The communications industry has classified these mobile network technologies into families spanning multiple generations. Networks based on the second, third and fourth generations have been widely adopted across the world and are named 2G, 3G and 4G, respectively. These names are commonly referenced by Internet providers, the press, and companies selling various mobile network products. Unfortunately, the dividing lines between each generation of mobile networking have been blurred repeatedly and perhaps intentionally by different parties in the industry, resulting in much confusion over terminology. Regarding the 4G, its focus is towards seamless integration of cellular networks such as GSM, 3G, WLAN and Bluetooth. Multimode user terminals are seen as must have for 4G, but different security mechanisms and different QoS support in different wireless technologies remain a challenge. 5G is being developed to accommodate the QoS and rate requirements set by forthcoming applications like wireless broadband access, Multimedia Messaging Service (MMS), HDTV content,

Digital Video Broadcasting (DVB), minimal services like voice and data, and other services that utilize bandwidth. The definition of 5G is to provide adequate RF coverage,

more bits/Hz and to interconnect all wireless heterogeneous networks to provide seamless, consistent telecom experience to user.

II. EVOLUTION

Wireless telephone started with what you might call 0G if you can remember back that far. The great ancestor is the mobile telephone service that became available just after World War II. Technologies used in 0G systems included PTT (Push to Talk), MTS (Mobile Telephone System), IMTS (Improved Mobile Telephone Service), AMTS (Advanced Mobile Telephone System), OLT (Norwegian for Offentlig Landmobil Telefoni). 0G vision proved wrong when the GSM concretely came to life in 1990-91 in Finland. 1G was old analog system and supported the 1st generation of analog cellphones speed up to 2.4kbps. Advance mobile phones system (AMPS) was first launched by the US and is a 1G mobile system. It allows users to make voice calls in one country. 1G technology replaced 0G technology, which featured mobile radio telephones and such technologies as Mobile Telephone System (MTS), Advanced Mobile Telephone System (AMTS), Improved Mobile Telephone Service (IMTS), and Push to Talk (PTT). No one called them 1G systems at the time, but still they represented the first generation of mobile networks.

A.2G

2G cellular telecom networks were commercially launched on the GSM standard. 2G technologies enabled the various mobile phone networks to provide the services such as text messages, picture messages and MMS (multimedia messages). 2G technology is more efficient. It was planned for voice transmission with digital signal and the speeds up to 64kbps. 2G technology holds sufficient security for both the sender and the receiver. All text messages are digitally encrypted. This digital encryption allows for the transfer of data in such a way that only the intended receiver can receive and read it. Second generation technologies are either time division multiple access (TDMA) or code division multiple access (CDMA). TDMA allows for the division of signal into time slots. CDMA allocates each user a special code to communicate over a multiplex physical channel. Different TDMA technologies are GSM, PDC, iDEN, IS-136. CDMA technology is IS-95. GSM has its origin from the Group special Mobile, in Europe. GSM is also stands for Global system for mobile communication. Now GSM is used in more than 212 countries in the world. GSM technology was

the first one to help establish international roaming. In comparison to 1G's analog signals, 2G's digital signals are very reliant on location and proximity.

B. 3G

International Mobile Telecommunications-2000 (IMT-2000), better known as 3G, is a generation of standards for mobile phones and mobile telecommunications services fulfilling specifications by the International Telecommunication Union. The use of 3G technology is also able to transmit packet switch data efficiently at better and increased bandwidth. Transmission speeds from 125kbps to 2Mbps. In 2005, 3G is ready to live up to its performance in computer networking (WCDMA, WLAN and Bluetooth) and mobile devices area (cell phone and GPS). Voice calls are interpreted using circuit switching. Access to Global Roaming and Clarity in voice calls. Fast Communication, Internet, Mobile T.V, Video Conferencing, Video Calls, Multi Media Messaging Service (MMS), 3D gaming, Multi-Gaming etc. are also available with 3G phones

C. 4G

The basic feature of 3G Technology is fast data transfer rates. However this feature is not currently working properly because, ITU 200 is still making decision to fix the data rates. Network authentication has won the trust of users, because the user can rely on its network as a reliable source of transferring data. 4G is a conceptual framework and a discussion point to address future needs of a high speed wireless network. 4G offers a downloading speed of 100Mbps. 4G provides same feature as 3G and additional services like Multi-Media Newspapers, to watch T.V programs with more clarity and send Data much faster than previous generations. LTE (Long Term Evolution) is considered as 4G technology. 4G is being developed to accommodate the QoS and rate requirements set by forthcoming applications like wireless broadband access, Multimedia Messaging Service (MMS), video chat, mobile TV, HDTV content, Digital Video Broadcasting (DVB), minimal services like voice and data, and other services that utilize bandwidth.

D. 5G

5G technology has changed the means to use cell phones within very high bandwidth. User never experienced ever before such a high value technology. The 5G technologies include all type of advanced features which makes 5G technology most powerful and in huge demand in near future. 5G technologies which are on hand held phone offering more power and features than at least 1000 lunar modules. A user can also hook their 5G technology cell phone with their Laptop to get broadband internet access. 5G technology including camera, MP3 recording, video player, large phone memory, dialing speed, audio player and much more you never imagine. For children rocking fun Bluetooth technology and Pico nets has become in market.

III. 5G NETWORKS

5G network is very fast and reliable. The concept of hand held devices is going to be revolutionized with the advent of 5G. Now all the services and applications are going to be accessed by single IP as telephony, gaming and many other multimedia applications. As it is not a new thing in market and there are millions of users all over the world who have experienced the wireless services wireless technology. It is not easy for them to shrink from using this new 5G network technology. There is only need to make it accessible so that a common man can easily afford the profitable packs offered by the companies so that 5G network could hold the authentic place. There is need to win the customer trust to build fair long term relation to make a reliable position in the telecommunication field. To complete with the preceding wireless technologies in the market 5G network has to tender something reliable something more pioneering. All the features like telephony, camera, mp3 player, are coming in new mobile phone models. 4G is providing all these utility in mobile phone. By seeing the features of 4G one can get a rough idea about what 5G Networks could offer. There is messenger, photo gallery, and multimedia applications that are also going to be the part of 5G. There would be no difference between a PC and a mobile phone rather both would act vice versa.

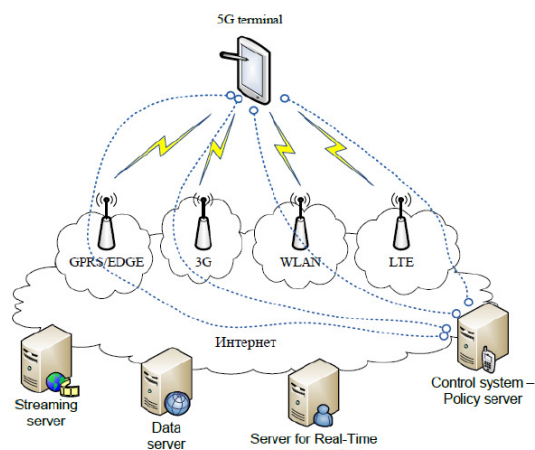


Figure 1: 5G Mobile Network Architecture

In 5G, each network will be responsible for handling user mobility, 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. Now, we will go through all OSI layers (Table. 1) in the 5G mobile terminal design (Fig. 1).

Table 1: OSI Layers in the 5G Mobile Terminal Design

| | |
|--------------------|-------------------------|
| Application Layer | Application (services) |
| Presentation Layer | |
| Session Layer | Open Transport Protocol |
| Transport Layer | |
| Network Layer | Upper Network Layer |
| | Lower Network Layer |

| | |
|------------------------|-----------------------------------|
| Data link Layer | Open Wireless Architecture |
| Physical Layer | |

A. Physical/MAC layers

Physical and Medium Access Control layers i.e. OSI layer 1 and OSI layer 2, define the wireless technology. For these two layers the 5G mobile networks is likely to be based on Open Wireless Architecture.

B. Network layer

The network layer will be IP. The IPv4 (version 4) is worldwide spread and it has several problems such as Limited address space and has no real possibility for QoS support per flow. These issues are solved in IPv6, but traded with significantly bigger packet header. Then, mobility still remains a problem. There is Mobile IP standard on one side as well as many micro-mobility solutions (e.g., Cellular IP, HAWAII etc.). All mobile networks will use Mobile IP in 5G, and each mobile terminal will be FA (Foreign Agent), keeping the CoA (Care of Address) mapping between its fixed IPv6 address and CoA address for the current wireless network. However, a mobile can be attached to several mobile or wireless networks at the same time. In such case, it will maintain different IP addresses for each of the radio interfaces, while each of these IP addresses will be CoA address for the FA placed in the mobile Phone. The fixed IPv6 will be implemented in the mobile phone by 5G phone manufactures. The 5G mobile phone shall maintain virtual multiwirelessnetwork environment. For this purpose there should be separation of network layer into two sub layers in 5G mobiles i.e.: Lower network layer (for each interface) and Upper network layer (for the mobile terminal). This is due to the initial design of the Internet, where all the routing is based on IP addresses which should be different in each IP network world wide. The middleware between the Upper and Lower network layers shall maintain address translation from Upper network address (IPv6) to different Lower network IP addresses (IPv4 or IPv6), and vice versa.

C. Open Transport Protocol (OTA) layer

The mobile and wireless networks differ from wired networks regarding the transport layer. In all TCP versions the assumption is that lost segments are due to network congestion, while in wireless networks losses may occur due to higher bit error ratio in the radio interface. Therefore, TCP modifications and adaptation are proposed for the mobile and wireless networks, which retransmit the lost or damaged TCP segments over the wireless link only. For 5G mobile terminals, it is suitable to have transport layer that is possible to be downloaded and installed. Such mobiles shall have the possibility to download (e.g., TCP, RTP etc. or new transport protocol) version which is targeted to a specific wireless technology installed at the base stations. This is called here Open Transport Protocol - OTP.

D. Application layer

Regarding the applications, the ultimate request from the 5G mobile terminal is to provide intelligent QoS management over variety of networks. Today, in mobile phones the users

manually select the wireless interface for particular Internet service without having the possibility to use QoS history to select the best wireless connection for a given service. The 5G phone shall provide possibility for service quality testing and storage of measurement information in information databases in the mobile terminal. The QoS parameters, such as delay, jitter, losses, bandwidth, reliability, will be stored in a database in the 5G mobile phone with aim to be used by intelligent algorithms running in the mobile terminal as system processes, which at the end shall provide the best wireless connection upon required QoS and personal cost constraints. With 4G, a range of new services and models will be available. These services and models need to be further examined for their interface with the design of 4G systems. The process of IPv4 address exhaustion is expected to be in its final stages by the time that 4G is deployed. Therefore, IPv6 support for 4G is essential in order to support a large no. of wireless-enabled devices. IPv6 removes the need for NAT (Network Address Translation) by increasing the no. of IP addresses. With the available address space and number of addressing bits in IPv6, many innovative coding schemes can be developed for 4G devices and Applications that could help in the deployment of 4G network and services.

APPLICATIONS

5G Technology can be used in all categories of VoIP and wearable devices with Artificial Intelligence capabilities. It plays a major role in pervasive networks to establish communication. 5G can contribute a major part in media independent handover process. 5G is compatible with all previous infrastructures and provide a faster delivery to all users. It also supports interactive multimedia, voice, streaming video, and internet. It provides a faster data transmission rate when compared to other generations.

CONCLUSION

In this paper, we conclude that 5G network is very fast and reliable. 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.

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