

Introduction About 5G Mobile Technology

Asst. Prof. Bhavika Patel
Computer Engineering Department
Mahavir Swami College of Engineering and Technology
Vesu, Surat, Gujarat

Mr. Mehul Patel
Electronics and Communication Engineering
Mahavir Swami College of Engineering and Technology
Vesu, Surat, Gujarat

Abstract— 5G technologies will change the way most high-bandwidth users access their phones. With 5G pushed over a VOIP-enabled device, people will experience a level of call volume and data transmission never experienced before. 5G technology is offering the services in Product Engineering, Documentation, supporting electronic transactions (e-Payments, e-transactions) etc. As the customer becomes more and more aware of the mobile phone technology, he or she will look for a decent package all together, including all the advanced features a cellular phone can have. Hence the search for new technology is always the main motive of the leading cell phone giants to out innovate their competitors. Recently apple has produced shivers all around the electronic world by launching its new handset, the I-phone. Features that are getting embedded in such a small piece of electronics are huge.

I. INTRODUCTION

Mobile and wireless networks have made tremendous growth in the last fifteen years. Nowadays many mobile phones have also a WLAN adapter. One may suppose that near soon many mobile phones will have WiMAX adapter too, besides their 3G, 2G, WLAN, Bluetooth etc. adapters. Using IP for both, 2.5G or 3G Public Land Mobile Networks (PLMN) on one side and WLAN on the other, raised research on their integration. Regarding the 4G, its focus is towards seamless integration of cellular networks such as GSM and 3G. 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. However, integration among different wireless networks (e.g. PLMN and WLAN) is functioning in practice even today. But, different wireless networks from a single terminal are used exclusively, that is, there is no combining of different wireless access technologies for a same session (e.g., FTP download). The proposed Open Wireless Architecture (OWA) in is targeted to provide open baseband processing modules with open interface parameters to support different existing as well as future wireless communication standards. The OWA is targeted to MAC/PHY layers of future (4G) mobile terminals. The referenced work above provides a ground for definition of a concept for beyond 4G mobile networks, referred in this paper as 5G mobile networks. . In the proposed concept the mobile user is on the top of all. The 5G terminals will have software defined radios and modulation scheme as well as new error-control schemes can be downloaded from the Internet on the run. The development is seen towards the user terminals as a focus of the 5G mobile networks. The terminals will have access to different wireless technologies at the same time and the terminal should be able to combine different flows from different technologies. 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. The paper also proposes intelligent Internet phone concept where the mobile phone can choose the best connections by selected constraints and dynamically change them during a single end-to-end connection.

II. EVOLUTION FROM 1G TO 5G

Cell phones are used millions and billions of users worldwide. How many of us know the technology behind cell phones that is used for our communication? I have also intrigued about the type of technology used in my phone. What are 1G, 2G, and 3G and 4G technologies?

1G, 2G, 3G & 4G ("G" stands for "Generation") are the generations of wireless telecom connectivity. 1G (Time Division Multiple Access and Frequency Division Multiple Access) was the initial wireless telecom network system. It's out-dated now. The analog "brick phones" and "bag phones" are under 1G technology. Cell phones era began with 1G.

The next era, 2G has taken its place of 1G. Cell phones received their first major upgrade when they went from 1G to 2G. This leap effectively took cell phones from analog to digital. 2G and 2.5G were versions of the GSM and CDMA connections. And GSM is still the most popular technology, but with no internet. Fortunately, GPRS, an additional service, is provided over GSM for the purpose of internet access. GPRS has been developed and thus, EGPRS was created. It's more secure and faster than GPRS.

Then 3G came, the new Wireless CDMA technology. It is the first wireless telecom technology that provides broadband-speed internet connection on mobile phones. It has been specially made for the demand of internet on smart phones. Further development led to the creation of 3.5G, which provides blazing fast internet connection on phones, up to the speed of 7.2 MBPS. A smart phone can be connected to a PC to share its internet connection and 3G and 3.5G are ideal for this. But, as this WCDMA technology is not available in all regions, it's not as popular as GSM yet. Before making the major leap from 2G to 3G wireless networks, the lesser-known 2.5G was an interim standard that bridged the gap. Following 2.5G, 3G ushered in faster data-transmission speeds so you could use your cell phone in more data-demanding ways. This has meant streaming video (i.e. movie trailers and television), audio and much more. Cell phone companies today are spending a lot of money to brand to you the importance of their 3G network. The above systems and radio interfaces are based on kindred spread spectrum radio transmission technology. While the GSM EDGE standard ("2.9G"), DECT cordless phones and Mobile Wi-MAX standards formally also fulfill the IMT-2000

requirements and are approved as 3G standards by ITU, these are typically not branded 3G, and are based on completely different technologies.

4G, which is also known as “beyond 3G” or “fourth-generation” cell phone technology, refers to the entirely new evolution. Developers are now going for 4G (OFDMA), which will provide internet up to the speed of 1 GBPS! It is said to be able to overcome the problems of weak network strength and should provide a much wider network, making sure that the users get high-speed connectivity anytime anywhere. No doubt, 4G will open new doors of revolutionary internet technologies, but for now, 3G and 3.5G are the best. 4G will allow for speeds of up to 100Mbps. 4G promises voice, data and high-quality multimedia in real-time from all the time and anywhere.

III. 5G TECHNOLOGY

A. What is 5G technology?

5G Technology stands for 5th Generation Mobile technology. 5G technology has changed the means to use cell phones within very high bandwidth. User never experienced ever before such a high value technology. Nowadays mobile users have much awareness of the cell phone (mobile) technology. The 5G technologies include all type of advanced features which makes 5G technology most powerful and in huge demand in near future.

The gigantic array of innovative technology being built into new cell phones is stunning. 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, dialling speed, audio player and much more you never imagine. For children rocking fun Bluetooth technology and Pico nets has become in market.

B. What 5G Technology Offers?

5G technology going to be a new mobile revolution in mobile market. Through 5G technology now you can use worldwide cellular phones and this technology also strike the China mobile market and a user being proficient to get access to Germany phone as a local phone. With the coming out of cell phone alike to PDA now your whole office in your finger tips or in your phone. 5G technology has extraordinary data capabilities and has ability to tie together unrestricted call volumes and infinite data broadcast within latest mobile operating system. 5G technology has a bright future because it can handle best technologies and offer priceless handset to their customers. May be in coming days 5G technology takes over the world market. 5G Technologies have an extraordinary capability to support Software and Consultancy. The Router and switch technology used in 5G network providing high connectivity. The 5G technology distributes internet access to nodes within the building and can be deployed with union of wired or wireless network connections. The current trend of 5G technology has a glowing future.

IV. CONCEPTS FOR 5G MOBILE NETWORKS

The 5G terminals will have software defined radios and modulation schemes as well as new error-control schemes that can be downloaded from the Internet. The development is seen towards the user terminals as a focus of the 5G mobile networks. The terminals will have access to different wireless technologies at the same time and the terminal should be able to combine different flows from different technologies. The vertical handovers should be avoided, because they are not feasible in a case when there are many technologies and many operators and service providers. 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.



Fig1. 5G Mobile Phone Concept

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1) 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.

2) Network layer

The network layer will be IP (Internet Protocol), because there is no competition today on this level. The IPv4 (version 4) is worldwide spread and it has several problems such as limited address space and has no real possibility for

TABLE 1: Layers in 5G Architecture

OSI Layer	5G Network Layer
Application Layer	
Presentation Layer	Application (Services)
Session layer	
Transport Layer	Open Transport Protocol
Network layer	Upper network layer
	Lower network Layer
Data link Layer	
Physical Layer	Open Wireless Architecture

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 multi-wireless network environment. For this purpose there should be separation of network layer into two sub-layers in 5G mobiles (TABLE. 1) 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 (TABLE 1) shall maintain address translation from Upper network address (IPv6) to different Lower network IP addresses (IPv4 or IPv6), and vice versa.

1) *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 will be 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.

2) *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. The fourth generation promises to fulfill the goal of PCC (personal computing and communication)—a vision that affordably provides high data rates everywhere over a wireless network. In the future wireless networks there must be a low complexity of implementation and an efficient means of negotiation between the end users and the wireless infrastructure. The Internet is the driving force for higher data rates and high speed access for mobile wireless users. This will be the motivation for an all mobile IP based core network evolution.

V. 5G MOBILE NETWORK ARCHITECTURE

Below figure shows the system model that proposes design of network architecture for 5G mobile systems, which is all-IP based model for wireless and mobile networks interoperability. The system consists of a user terminal (which has a crucial role in the new architecture) 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 should be different radio

interface for each Radio Access Technology (RAT) in the mobile terminal. For an example, if we want to have access to four different RATs, we need to have four different accesses - specific interfaces in the mobile terminal, and to have all of them active at the same time, with aim to have this architecture to be functional.

be based on beam division multiple access (BDMA) and group cooperative relay techniques.

VII. FEATURES OF 5G TECHNOLOGY

- 1) 5G technology offer high resolution for crazy cell phone user and bi-directional large bandwidth shaping.
- 2) The advanced billing interfaces of 5G technology makes it more attractive and effective[3].
- 3) 5G technology also providing subscriber supervision tools for fast action.
- 4) The high quality services of 5G technology based on Policy to avoid error.
- 5) 5G technology is providing large broadcasting of data in Gigabit which supporting almost 65,000 connections.
- 6) 5G technology offer transporter class gateway with unparalleled consistency[4].
- 7) The traffic statistics by 5G technology makes it more accurate.
- 8) Through remote management offered by 5G technology a user can get better and fast solution.
- 9) The remote diagnostics also a great feature of 5G technology.
- 10) The 5G technology is providing up to 25 Mbps connectivity speed.
- 11) The 5G technology also support virtual private network.
- 12) The new 5G technology will take all delivery service out of business prospect
- 13) The uploading and downloading speed of 5G technology touching the peak . The 5G technology network offering enhanced and available connectivity just about the world.

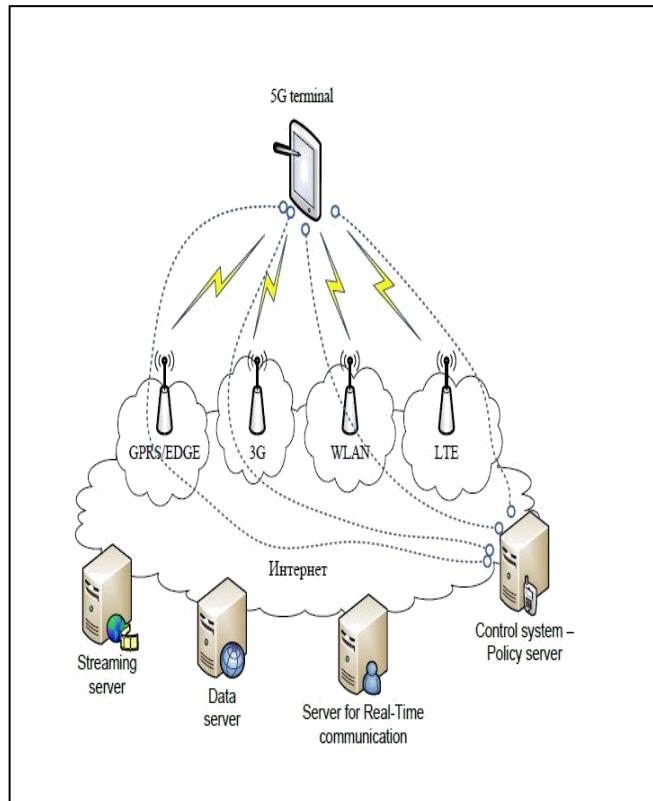


Fig2. 5G Mobile Network Architecture[1]

VI. KEY CONCEPT OF 5G TECHNOLOGY

- 1) Real wireless world with no more limitation with access and zone issues.
- 2) Internet protocol version 6 (IPv6), where a visiting care-of mobile IP address is assigned according to location and connected network.
- 3) One unified global standard
- 4) Pervasive networks providing ubiquitous computing: The user can simultaneously be connected to several wireless access technologies and seamlessly move between them .These access technologies can be a 2.5G, 3G, 4G or 5G mobile networks, Wi-Fi, WPAN or any other future access technology. In 5G, the concept may be further developed into multiple concurrent data transfer paths.
- 5) Cognitive radio technology, also known as smart-radio: allowing Different radio technologies to share the same spectrum efficiently by Adaptively finding unused spectrum and adapting the transmission scheme to the requirements of the technologies currently sharing the spectrum . This dynamic radio resource management is achieved in a distributed fashion, and relies on software defined radio.
- 6) High altitude stratospheric platform station (HAPS) systems .The radio interface of 5G communication systems is suggested in a Korean research and development program to

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