

Key Concepts and Network Architecture for 5G Mobile Technology

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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. The ultimate goal of 5G is to design a real wireless world that is free from obstacles of the earlier generations. This requires an integration of networks.

This paper represents, introduction to 5G technologies, Key concepts of 5G, Features of 5G networks technology, applications, hardware and software for 5G technologies and network architecture for 5G wireless technologies and last section conclude the paper.

Keywords—5G, www, UWB, DAWN, IP, Wi-Fi

I. INTRODUCTION

5G Technology stands for 5th Generation Mobile technology. 5G technology has changed the means to use cell phones within very high bandwidth. 5G is a packet switched wireless system with wide area coverage and high throughput. 5G wireless uses OFDM and millimeter wireless that enables data rate of 20 mbps and frequency band of 2-8 GHz. 5G is going to be a packed based network . The 5G communication system is envisioned as the real wireless network, capable of supporting wireless World Wide Web (www) applications in 2010 to 2015 time frame.

There are two views of 5G systems: evolutionary and revolutionary. In the evolutionary view the 5G (or beyond 4G) systems will be capable of supporting www allowing a highly flexible network such as a

Dynamic Adhoc Wireless Network (DAWN). In this view advanced technologies including intelligent antenna and flexible modulation are keys to optimize the adhoc wireless networks. In revolutionary view 5G systems should be an intelligent technology capable of interconnecting the entire world without limits. An example application could be a robot with built-in wireless communication with artificial intelligence. 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. Amazing isn't it such a huge collection of technology being integrated into a small device. The 5G technology provides the mobile phone users more features and efficiency than the 1000 lunar module. A user of mobile phone can easily hook their 5G technology gadget with laptops or tablets to acquire broadband internet connectivity. Up till now following features of the 5G technology have come to surface- High resolution is offered by 5G for extreme mobile users, it also offers bi-directional huge bandwidth.- 5G technology's excellent quality service is based on Policy in order to evade errors.- It provides transporter class type gateway that has unequalled steadiness.- The 5G technology's billing interface is highly advanced making it efficient and appealing.- It offers huge quantity of broadcasting data, which is in Giga Bytes, sustaining more than 60,000 connections.- This technology also provides remote diagnostic feature.- Provides up to 25 megabytes per second connectivity. Also it supports the private virtual networks.

II. KEY CONCEPTS OF 5G

The key concepts discussing 5G and beyond 4G wireless communications are:

- 1) Real wireless world with no more limitation with access and zone issues.
- 2) Wearable devices with AI capabilities.
- 3) Internet protocol version 6(IPv6), where a visiting care-of mobile IP address is assigned according to location and connected network.

- 4) One unified global standard.
- 5) 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.
- 6) 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.
- 7) High altitude stratospheric platform station (HAPS) systems. The radio interface of 5G communication systems is suggested in a Korean research and development program to be based on beam division multiple access (BDMA) and group cooperative relay techniques.



FIG.1. 5G Mobile Phone Concept

III. FEATURES OF 5G NETWORKS 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) 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.
- 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.
- 14) The 5G technology network offering enhanced and available connectivity just about the world

IV. APPLICATIONS

How could be it?

- 1) If you can able to feel yours kid stroke when she/he is in her mother's wombs.
- 2) If you can able to charge your mobile using your own heart beat.
- 3) If you can able to perceive your grandmother sugar level with your mobile.
- 4) If you can able to know the exact time of your child birth that too In Nano seconds.
- 5) If your mobile rings according to your mood.
- 6) If you can Vote from your mobile.
- 7) If you can get an alert from your mobile when some once opens your intelligent car.
- 8) If you can able to view your residence in your mobile when someone enters.
- 9) If you can able to locate your child when she/he is unfortunately missed.
- 10) If you can able to pay all your bills in a single payment with your mobile.
- 11) If you can able to sense Tsunami/earthquake before it occurs.
- 12) If you can able to visualize lively all planets and Universe.

- 13) If you can able to navigate a Train for which you are waiting.
- 14) If you can get the share value lively.
- 15) If you can lock your Laptop, car, Bike using your mobile when you forgot to do so.
- 16) If you're mobile can share your work load.
- 17) If you're mobile can identify the best server.
- 18) If you're mobile can perform Radio resource management.
- 19) If your mobile can intimate you before the call drops.
- 20) If your mobile phone get cleaned by its own.
- 21) If you can able to fold your mobile as per your desire.
- 22) If you can able to expand your coverage using your mobile phones.
- 23) If you can able identify your stolen mobile with nanoseconds.
- 24) If you can able to access your office desktop by being at your bedroom.

V. HARDWARE AND SOFTWARE

A. 5G HARDWARE

- 1) UWB Networks: higher bandwidth at low energy levels. This short-range radio technology is ideal for wireless personal area networks (WPANs). UWB complements existing longer range radio technologies – such as Wi-Fi,* WiMAX, and cellular wide area communications – that bring in data and communications from the outside world. UWB provides the needed cost-effective, power-efficient, high bandwidth solution for relaying data from host devices to devices in the immediate area (up to 10 meters or 30 feet).
- 2) Bandwidth: 4000 megabits per second, which is 400 times faster than today's wireless networks.
- 3) Smart antennas-
 - a. Switched Beam Antennas: Switched Beam Antennas support radio positioning via Angle of Arrival (AOA) information collected from nearby devices.
 - b. Adaptive Array Antennas: The use of adaptive antenna arrays is one area that shows promise for improving capacity of wireless systems and providing improved safety through position location capabilities. These arrays can be used for interference rejection through spatial _altering, position location through direction _ending measurements, and developing improved channel models through angle of arrival channel sounding measurements.

- 4) Multiplexing: CDMA (Code Division Multiple Access) CDMA employs analog-to-digital conversion (ADC) in combination with spread spectrum technology. Audio input is first digitized into binary elements. The frequency of the transmitted signal is then made to vary according to a defined pattern (code), so it can be intercepted only by a receiver whose frequency response is programmed with the same code, so it follows exactly along with the transmitter frequency. There are trillions of possible frequency-sequencing codes, which enhance privacy and makes cloning difficult.

B. 5G SOFTWARE

- 1) 5G will be single unified standard of different wireless networks, including wireless technologies (e.g. IEEE 802.11), LAN/WAN/ PAN and WWW, unified IP and seamless combination of broad band.
- 2) Software Defined Radio, Packet layer, implementation of packets, encryption, flexibility etc.

VI. 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.

VII. 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. Applications and servers somewhere on the Internet. Routing of packets should be carried out in accordance with established policies of the user.

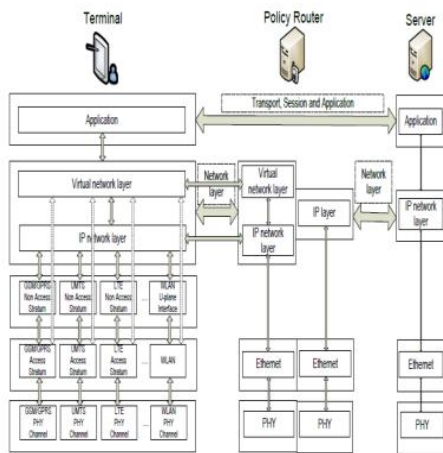
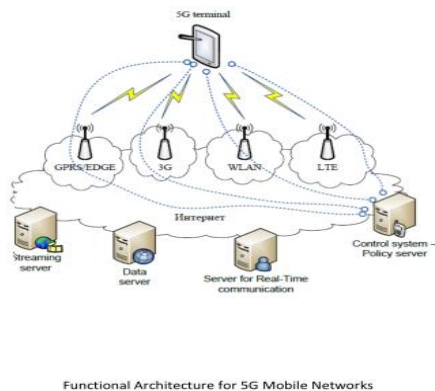


Fig. 2

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 should be fixed and unchanged. Fixing of these two parameters should 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 should be uniquely and using the same path. 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 and change of the socket, that is, 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. In order to solve this deficiency we propose a new level that will take care of the abstraction levels of network access technologies to higher layers of the protocol stack. This layer is crucial in the new architecture. 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 we introduce a control system 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. He 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). Protocol setup of the new levels within the existing protocol stack, which form the proposed architecture, is presented in Figure (Protocol Layout for the Elements of the Proposed Architecture).

The network abstraction level would be provided by creating IP tunnels over IP interfaces obtained by connection to the terminal via the access technologies available to the terminal (i.e., mobile user). In fact, the tunnels would be established between the user terminal and control system named here as Policy Router, which performs routing based on given policies. In this way the client side will create an appropriate number of tunnels connected to the number of radio access technologies, and the client will only set a local IP address which will be formed with sockets Internet communication of client applications with Internet servers. The way IP packets are routed through tunnels, or choosing the right tunnel, would be served by policies whose rules will be exchanged via the virtual network layer protocol. This way we achieve the required abstraction of the network to the client applications at the mobile terminal. The process of establishing a tunnel to the Policy Router, for routing based on the policies, are carried out immediately after the establishment of IP connectivity across the radio access technology, and it is initiated from the mobile terminal Virtual Network-level Protocol. Establishing tunnel connections as well as maintaining them represents basic functionality of the virtual network level (or network level of abstraction).

VIII. PROGNOSIS

If a 5G family of standards were to be implemented, it would likely be around the year 2020, according to some sources. A new mobile generation has appeared every 10th year since the first 1G system (NMT) was introduced in 1981, including the 2G (GSM) system that started to roll out in 1992, and 3G (W-CDMA/FOMA), which appeared in 2001. The development of the 2G (GSM) and 3G (IMT-2000 and UMTS) standards took about 10 years from the official start of the R&D projects, and development of 4G systems started in 2001 or 2002. However, still no official 5G development projects have currently been launched.

From user's point of view, previous mobile generations have implied substantial increase in peak bit rate (i.e. physical layer net bit rates for short-distance communication). However, no source suggests 5G peak download and upload rates of more than the 1 Gbps to be offered by ITU-R's definition of 4G systems.[2] If 5G appears, and reflects these prognoses, the major difference from a user point of view between 4G and 5G techniques must be something else than increased

maximum throughput; for example lower battery consumption, lower outage probability (better coverage), high bit rates in larger portions of the coverage area, cheaper or no traffic fees due to low infrastructure deployment costs, or higher aggregate capacity for many simultaneous users (i.e. higher system level spectral efficiency).

IX. CONCLUSION

In this paper we have proposed 5G mobile phone concept and architecture which is the main contribution of the paper. The 5G mobile phone is designed as an open platform on different layers, from physical layer up to the application. Currently, the ongoing work is on the modules that shall provide the best QoS and lowest cost for a given service using one or more than one wireless technology at the same time from the 5G mobile phone.

A new revolution of 5G technology is about to begin because 5G technology going to give tough completion to normal computer and laptops whose marketplace value will be effected. There are lots of improvements from 1G, 2G, 3G, and 4G to 5G in the world of telecommunications. The new coming 5G technology is available in the market in affordable rates, high peak future and much reliability than its preceding technologies.

X. FUTURE ENHANCEMENT

5G network technology will open a new era in mobile communication technology. The 5G mobile phones will have access to different wireless technologies at the same time and the terminal should be able to combine different flows from different technologies. 5G technology offer high resolution for crazy cell phone user. We can watch TV channels at HD clarity in our mobile phones without any interruption. The 5G mobile phones will be a tablet PC. Many mobile embedded technologies will evolve.

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