5G Technology of Mobile Communications: A Review

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Abstract – **The overall demand growth in both user data rates and network capacity is the main driver for mobile communication evolution. In 5G, researches are related to the development of World Wide Wireless Web (WWWW), Dynamic Adhoc Wireless Networks (DAWN) and Real Wireless Communication. The technologies used for 5G are 802.11 wireless local area network (WLAN) and 802.16 wireless metropolitan area network (WMAN). New mobile generations are typically assigned new frequency bands and wider spectral bandwidth per frequency channel like up to 30 kHz for 1G, 200 kHz for 2G, 20 MHz for 3G, and 100 MHz for 4G however the frequency bandwidth for 5 G is yet to be decided but it is expected to be nearly 5GHz.**

Keywords: WLAN; 5G; GSM; WWWW; WMAN; DAWN

I. INTRODUCTION

MOBILE and wireless networks have made significant developments in the last few years. Currently, many mobile phones have also a WLAN adapter. One may expect that very soon, many mobile phones will have Wax adapter too, besides their 3G, 2G, WLAN, Bluetooth adapters. We are using IP for generations, 2.5G or 3G Public Land Mobile Networks (PLMN) on one side and WLAN on the other, raised study on their integration. Concerning the 4G, its focus is towards flawless incorporation of cellular networks such as GSM and 3G. Multi mode consumer terminals are seen as must have for 4G, but special security mechanisms and special operating system support in special wireless technologies remain a test. Nevertheless, integration among different wireless networks (*e.g.* PLMN and WLAN) is implemented in practice even nowadays. The anticipated Open Wireless Architecture (OWA) is targeted to offer open baseband processing modules with open interface parameters. The OWA is related to MAC/PHY layers of future (4G) mobiles.The 5G terminals will have software defined radios and modulation scheme and new error-control schemes can be downloaded from the Internet. The 5G terminal will make the ultimate selection among different mobile access network providers for a specified service. The paper gives the concept of intelligent Internet phone where the mobile can prefer the finest connections.

II. FROM 1G TO 5G

Earlier and even today low speed data services are provided by 2G system which do not meet our future needs. This gave rise to demand for a new system called 3G, which promised to provide high speed data services. Recently (4G) mobile communications system LTE was developed to provide high capacity and highest rate data service for mobile multimedia which is still to run in most of the countries. The description of 1G to 4G is given in Fig.1.

1G	Voice Services
2G	Improved voice and text messaging
3G	Integrated voice and affordable mobile Internet
4G	High capacity mobile multimedia and LTE

Figure 1. Features available in 1G to 4 G.

III. NEED OF 5G

The next generation mobile communications system will not be used for human interaction alone. There will be a huge growth in machine type communications, the devices will also not only be remotely controlled and managed by people, but will also communicate with one another and all this will require more reliable communication links and also lower transmission delays. Machines which can process information much faster are needed.

Connectivity (Wireless/Wired)
High Speed
Low Cost, Low latency
Power saving systems

Figure 2. Need of 5G.

3G and 4G provide data to be downloaded in term of Mbps but we need to think towards Gbps now. Even though data is downloaded in Mbps but it does not meet our needs. The future is in gigabytes and even in terabytes. “Gigabit” means data reception and transmission speeds of Gigabits per second to users and machines. Again, this does not mean providing high-capacity networks everywhere, but the centres of big cit-

ies will be the first places where the demand for a new system will be felt. The overall demand growth in both user data rates and network capacity is still the main driver for technological evolution. Higher capacities of networks will require better performance, cell densification and access to new, broader carriers in new spectrum. The capacity growth can of course be met with existing systems, but after 4-5 years, limits will be reached and 5G technologies will be needed.

IV. CHALLENGES IN MIGRATION FROM 4G

Multimode user terminals: For 5G networks, there will be a need to design single user terminals to operate in different wireless networks. The other problem is device size, its cost and power consumption. The problem can be solved by software called radio approach.

New types of connected devices: From electricity bills to car, household appliances to shopping malls and many more will be supported by future mobile networks. There will be wide range of new services which will run on them.

Reliability: It's really important to maintain reliability between networks when we talk about future communication. Reliability requirements are very tough in industrial communication applications and for societal functions such as smart-city management and traffic safety. There will be a need to modify broadband system that is in use today.

Availability of spectrum: By 2020 there will be a need of more spectrum. Higher frequency ranges will be needed then to improve the quality of service and network. Larger bandwidths will be needed enabling extremely high service levels for special scenarios.

Security: On account of various wireless networks and their complexity, one needs to adopt adaptive and lightweight security methods.

Bugs: There is one thing which is to be guaranteed in 5G that is bugs. These may be found in new applications and they need to be fixed at that time.

Overlapping: Overlapping occurs when transmitter is sending some kind of signal at same frequency which affects a GPS signal.

Hacking of signals: There are many fake signals being sent out by GPS. There are some fake signals in which GPS thinks that they are sent by satellite and calculates the wrong coordinate. The techniques are known as spoofing. Normally the criminals and hackers use this technique.

V. CONCEPT OF 5G

There is a model called OSI model upon which 5G works. The model has different layers named as Physical layer, Network layer, Open transport protocol and application layer.

<table>
<tr><td>Application Layer</td><td rowspan="2">Application (Services)</td></tr>
<tr><td>Presentation Layer</td></tr>
<tr><td>Session Layer</td><td rowspan="2">Open Transport Protocol (OTP)</td></tr>
<tr><td>Transport Layer</td></tr>
<tr><td rowspan="2">Network Layer</td><td>Upper Network Layer</td></tr>
<tr><td>Lower Network Layer</td></tr>
<tr><td>Data Link Layer</td><td rowspan="2">Open Wireless Architecture (OWA)</td></tr>
<tr><td>Physical Layer</td></tr>
</table>

Figure 3. Protocol stack for 5G.

Physical/MAC layers: Physical and Medium Access Control layers have two parts *i.e*. OSI layer 1 and OSI layer 2, which is for the wireless medium. 5G network in mobile is supposed to be based upon these two layers.

Network layer: The network layer is based on IP (Internet Protocol). Normally there are two types of IP namely, Ipv4 and Ipv6. The Ipv4 (version4) is widely used but on the other hand it has some problems too, such as address space is limited and there is no support for quality of service (QoS). The issues are fixed in Ipv6, but due to trading with larger packet header, mobility is still a problem.

There is Mobile IP standard on one side as well as many micro-mobility solutions (*e.g*., Cellular IP, HAWAII etc.). Different 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. On the other hand, one mobile network will be attached to several other mobile networks or wireless networks at the same time. In this case, mobile network will maintain different IP addresses for each of the interfaces, while each of these IP addresses will be care of address (CoA) for the foreign agent placed in the mobile phone.

Thus fixed Ipv6 will be used in the mobile phone by 5G phone manufactures. The 5G mobile phone will maintain multi-wireless network environment. For this, there will be separation of network layer into two different sub layers in 5G which are named as Lower network layer and Upper network layer. Lower layer network is for each interface and Upper layer network is for the mobile terminal. The middle layer between the Upper and a Lower network layer is to maintain address translation from Upper network address (Ipv6) to different Lower network IP addresses (Ipv4 or Ipv6).

Open Transport Protocol (OTA) layer: OTA layer works differently for wireless networks as compared to wired networks. In all TCP versions, segments are lost and it is assumed that segments are lost due to congestion in network, On the other hand in wireless networks there will be losses due to high bit error ratio in the radio interface. Therefore, TCP are used for the mobile networks as well as wireless networks, through which the lost or damaged TCP segment can be retransmitted over the wireless link. In 5G mobile, terminals will be suitable to have transport layer that is easy and possible to be downloaded and installed. In such mobiles, there is a possibility to download new version which is targeted to a specific wireless technology installed at the base stations.

Application layer: The 5G mobile terminal is to provide excellent quality of services over different and variety of networks. The mobile internet users today manually select the wireless port for different Internet service without having the possibility to use QoS history to select the best wireless connection for a given service. A 5G phone will provide possibility for QoS testing and storage of measured information in the mobile terminal. There are different QoS parameters, such as delay, jitter, losses, bandwidth, reliability that will be stored in a database in the 5G mobile running in the mobile terminal as system processes, which in the end will provide the best suitable wireless connection upon required QoS automatically.

VI. FEATURES OF 5G

- 5G technology offers high resolution for crazy cell phone user and bi-directional large bandwidth shaping.
- The advanced billing interfaces of 5G technology make it more attractive and effective.
- 5G technology also provides subscriber supervision tools for fast action.
- The high quality services of 5G technology are based on policy to avoid error.
- 5G technology is providing large broadcasting of data in Gigabit while supporting almost 65,000 connections.
- 5G technology offers a transporter class gateway with unparalleled consistency.
- The traffic statistics by 5G technology makes it more accurate.
- Through remote management offered by 5G technology, a user can get a better and faster solution.
- The remote diagnostics is also a great feature of 5G technology.
- The 5G technology is providing up to 25 Mbps connectivity speed.
- The 5G technology also supports virtual private network.
- The uploading and downloading speed of 5G technology will be touching the peak.

VII. CONCLUSION

In this paper, authors surveyed 5G technology for mobile communication. The technology is going towards the high data rates. The number of use cases for a next generation mobile communications system will grow rapidly and the scenarios will place much more diverse requirements on the system. We have also defined concept for such 5G mobile networks. The architecture includes two type of networks. One is wired network and the other one is wireless network. We still see improvements and demanding requirements for spectral efficiency in terms of average bit/s/Hz/cell for ultra-dense deployments.

5G network technology will release a novel age in mobile communication. The 5G mobiles will have access to different wireless technologies at the same time and the terminal would be able to merge different flows from different technologies. 5G technology offers high resolution for passionate mobile phone consumer. We can watch an HD TV channel in our mobile phones without any disturbance. The 5G mobile phones will be a tablet PC. Many mobile embedded technologies will develop.

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