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5G Technology of Mobile Communication: A Survey

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ABSTRACT- The objective of this paper is comprehensive study related to 5G technology of mobile communication. Existing research work in mobile communication is related to 5G technology. In 5G, researches are related to the development of World Wide Wireless Web (WWWW), Dynamic Adhoc Wireless Networks (DAWN) and Real Wireless Communication. The most important technologies for 5G technologies are 802.11 Wireless Local Area Networks (WLAN) and 802.16 Wireless Metropolitan Area Networks (WMAN), Ad-hoc Wireless Personal Area Network (WPAN) and Wireless networks for digital communication. 4G technology will include several standards under a common umbrella, similar to 3G, but with IEEE 802.xx wireless mobile networks integrated from the commencement. The major contribution of this paper is the key provisions of 5G (Fifth Generation) technology of mobile communication, Which is seen as consumer oriented? In 5G technology, the mobile consumer has given utmost priority compared to others. 5G Technology stands for 5th Generation Mobile Technology. 5G technology is to make use of mobile phones within very high bandwidth. The consumer never experienced the utmost valued technology as 5G.The 5G technologies include all types of advanced features which make 5G technology most dominant technology in near future.

Keywords- *WLAN; 5G; GSM; WWWW; WMAN; DAWN*

I. INTRODUCTION

Mobile and wireless networks have made remarkable development in the last few years. At the present time many mobile phones have also a WLAN adapter. One may expect that near soon many mobile phones will have Wax adapter too, besides their 3G, 2G, WLAN, Bluetooth etc. adapters. We are using IP for both 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. Although, different wireless networks from a sole terminal are used absolutely, that is, there is no combining of different wireless access technologies for a same

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session (e.g., FTP download). The anticipated Open Wireless Architecture (OWA) in is targeted to offer open baseband processing modules with open interface parameters. The OWA is related to MAC/PHY layers of future (4G) mobiles.[3] The 5G terminals will have software defined radios and modulation scheme and new error-control schemes can be downloaded from the Internet The enhancement is seen towards the consumer terminals as a focus on the 5G mobile networks. The 5G mobile terminals will have access to different wireless technologies at the same time. The 5G mobile terminal should be capable to merge special flows from different technologies. The network will be dependable for managing user-mobility. 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. CHALLENGES IN MIGRATION FROM 4G

A. Multi mode user terminals

By means of 4G, there will be a necessity to design a single user terminal that can operate in different wireless networks and conquer the design troubles such as restrictions on the size of the device, its cost and power utilization. This trouble can be solved by using software radio approach.

B. Choice among various wireless systems.

Every wireless system has its distinctive characteristics and roles. The choice of most appropriate technology for a specific service at a specific place and at specific time. This will be applied by making the choice according to the best possible fit of consumer QoS (Quality of Service) requirements.

C. Security

Reconfigurable, adaptive and lightweight protection Mechanisms should be designed.

D. Network infrastructure and QoS support

Integrating the current non-IP and IP-based systems and providing QoS assurance for end-to-end services that engage different systems is a challenge.

E. Charging and Billing

It is hard to accumulate, handle and accumulate the
Consumers account information from many service providers. In the same way Consumers' billing is also a difficult task.

F. Attacks on Application Level

Software applications which will offer an new feature to the consumer but will commence new bugs.

G. Jamming and spoofing

Spoofing is fake GPS signals being sent out, in which case the GPS receiver considers that the signals arrives from a satellite and computes the wrong coordinates. Criminals can make use of such techniques. Jamming occurs when a transmitter sending out signals at the same frequency shifts a GPS signal.

H. Data Encryption

If a GPS receiver will communicate with the main transmitter then the communication link

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between these two is not tough to break and consumer must use encrypted data.

III. THEORETICAL FRAMEWORK

5G Technology is a name used in various research papers and projects to indicate the next most important stage of mobile communication standards beyond the 4G standards Presently, 5G is not a term officially used for any particular specifications. 3GPP standard release beyond 4G and LTE. The implementation of standards under a 5G umbrella would likely be around the year of 2020.

Key terms of 5G Technology:

1. 5G is a completed wireless communication with almost no limitation; somehow people called it REAL wireless world
2.Additional features such as Multimedia Newspapers, also to watch T.V programs with the clarity as to that of an HD T.V.

Application Layer	Application(Services)
Presentation Layer	
Session layer	Open Transport Protocol(OTP)
Transport Layer	
Network layer	Upper network layer
	Lower network Layer
Data link Layer(MAC)	Open Wireless Architecture(OWA)
Physical Layer	

3.We can send Data much faster than that of the previous generations.
4.5G will bring almost perfect real world wireless or called "WWWW: World Wide Wireless Web
5.Real wireless world with no more limitation to access and zone issues.
6. Wearable devices with AI capabilities.
7. Internet protocol version 6 (IPv6), where a visiting care-of mobile IP address is assigned according to location and the connected network.
8. One unified global standard.
9.Pervasive networks providing ubiquitous computing: The user can simultaneously be connected to several wireless access technologies and seamlessly move between them (See Media independent handover or vertical handover, IEEE 802.21, also expected to be provided by future 4G releases). These access technologies can be a 2.5G, 3G, 4G or 5G mobile networks, Wi-Fi, PAN or any other future access technology. [9] In 5G, the concept may be further developed into multiple concurrent data transfer paths.
10. Cognitive radio technology, also known as smartradio: 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. See also the IEEE 802.22 standard for Wireless Regional Area Networks.
11. High altitude stratospheric platform station (HAPS) systems.

IV. CONCEPT OF 5G TECHNOLOGIES

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Fig 1. Protocol stack for 5G

A. Physical/MAC layers

Physical and Medium Access Control layers i.e. OSI layer 1 and OSI layer 2, define the wireless technology and shown in Fig.1. 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 (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 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.[16] 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 (Fig. 3) 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 (Fig. 1) shall maintain address translation from Upper network address (IPv6) to different Lower network IP addresses (IPv4 or IPv6), and vice versa. Fig.2 shows the 5G network layer.

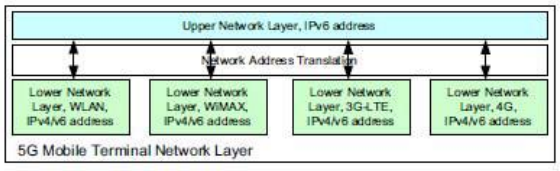

Fig. 2 5G mobile terminal network layer

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 network 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.

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D. Application layer

Regarding the applications, the ultimate request from the 5G mobile terminal is to provide intelligent QoS management over a 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 a 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 the 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.

FEATURES

1. 5G technology offers high resolution for crazy cell phone user and bi- directional large bandwidth shaping.
2. The advanced billing interfaces of 5G technology
make 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 offers a 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 a better and faster solution.
9. The remote diagnostics also a great feature of 5G technology.
10. The 5G technology is providing up to 25 Mbps connectivity speed.

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11. The 5G technology also supports virtual private network.
12. The new 5G technology will take all delivery services out of business prospect
13. The uploading and downloading speed of 5G technology touching the peak.

V. 5G ARCHITECTURE

Fig. 3 5G mobile phone design

Fig.3 shows 5G mobile phone design. 5G 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),[18] 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 the user.

A. Evolved Packet Core (EPC)

Evolved Packet Core is the IP-based core network defined by 3GPP (Telecom standard) for use with LTE and other access technologies. The goal of the EPC is to provide simplified all IP core network architectures to efficiently give access to various services such as the ones provided by IMS (IP Multimedia Subsystem). EPC consists essentially of a Mobility Management Entity (MME) & access agnostic gateway foe routing of user datagram. EPC will be a completely new architecture for wireless operators, one that emulates the IP world of data Communication rather than the voice- centric world of wireless. EPC is based on flat IP network theory. Fig. 4 shows flat IP Architecture

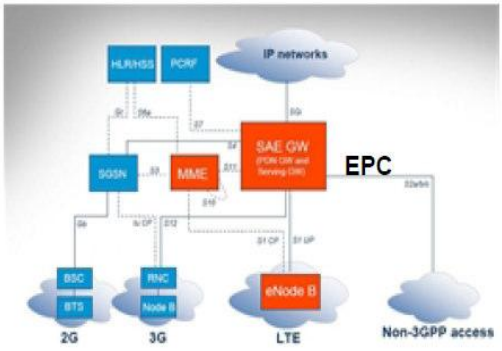

Fig.4 Flat IP Architecture

Mobile networks have been designed up to this point for circuit- switched voice. Wireless networks were designed in a hierarchal fashion to aggregate, authenticate, manage and direct calls. A

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BSC aggregates calls from multiple base stations, allocates radio channels, enables handoffs between base stations and passes on calls to an even more centralized mobile switching center. As packet data networks emerged, they were overlaid on the existing voice-centric architecture, using the BSC for the same mobility management functions and adding the SGSN and GGSN in the case of GSM/UMTS and a PDSN in the case of CDMA to route and manage data sessions, as well as to connect to the Internet or appropriate IP network. As data traffic is increasing rapidly, this voice centric architecture has become cumbersome and harder to manage with too many network entities. Flat network architecture removes that voice-centric hierarchy from the network. Instead of overlaying a packet data core on the voice network, separate and much-simplified data architecture can be implemented that removes the multiple elements of the network chain. BSC functions are divided between Base station and media gateway router. The base station will communicate directly via 3GDT (3G direct tunnel) with media gateway over WAN (Carrier Ethernet, MW, DWDM etc.). Some of the functions of BSC/RNC such as Radio resource management, Radio Bearer Control, and Dynamic allocations of resources will be handled by base stations, while functions such as Distribution of paging messages, Security will be functional by mobility manager, located in Gateway router. This approach has clearly visible advantages. It will save a significant amount of Capex and Opex as, service provider will have little hopes and fewer network entities. By reducing the number of hops in the network, data travels faster between end points, greatly reducing the network latency to help support real-time applications such as voice over IP (VoIP), gaming and videoconferencing. The flat IP architectures have emerged with WiMAX, and future LTE networks will be flat by definition. [10,11,15]

VI. CONCLUSION AND FUTURE SCOPES/PERSPECTIVES

In this paper we have surveyed 5G technology for mobile communication. The 5G technology is designed as an open platform on different layers, from the physical layer up to the application. Presently, the current work is in the modules that shall offer the best Operating System and lowest cost for a specified service using one or more than one wireless technology at the same time from the 5G mobile. 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 affected. There are lots of improvements from 1G, 2G, 3G, and 4G to 5G in the world of mobile communication. The new coming 5G technology is available in the market at inexpensive rates, high peak expectations and much reliability than its foregoing technologies. 5G network technology will release a novel age in mobile communication. The 5G mobiles will have access to different wireless technologies at the identical time and the terminal should 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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