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Study of 5G Technology

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Abstract: The objective of this paper is comprehensive studyrelated to 5G technology of mobile communication.The main purpose behind the fifth generation of wireless networks (5G) is planned to design the best network in the world which is beyond limitations and bug free than earlier generations, 5G technology will change the way most high bandwidth user access their Mobile Radio Communication (MRC), and this gives their users an edge over earlier generation networks. 5G holds the promise of applications with high social and economic value, leading to a 'hyper-connected society' in which mobile will play an ever more important role in people's lives. 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. 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.

Keywords:- WLAN, WWWWW, DAWN, MAN, 5G.

I. INTRODUCTION

Mobile wireless industry has started its technology creation, revolution and evolution since early 1970s. In the past few decades, mobile wireless technologies have experience 4 or 5 generations of technology revolution and evolution. The telecommunication service in World had a great leap within last few years. 6 billion people own mobile phones so we are going to analyze the various generations of cellular systems as studied in the evolution of mobile communications from 1st generation to 5th generation. We can analyze that this could be due to increase in the telecom customers day by day. In the present time, there are four generations in the mobile industry. These are respectively 1G- the first generation, 2G- the second generation, 3G- the third generation, and then the 4G- the forth generation,5G-the fifth second generation. 5G will also provide wireless connectivity for a wide range of new applications and use cases, including wearables, smart homes, traffic safety/control, and critical infrastructure and industry applications, as well as for very-high-speed media delivery.

In contrast to earlier generations, 5G wireless access should not be seen as a specific radio-access technology. Rather, it is an overall wireless-access solution addressing the demands and requirements of mobile communication beyond 2020. LTE will continue to develop in a backwards-compatible way and will be an important part of the 5G wireless-access solution for frequency bands below 6GHz. Around 2020, there will be massive deployments of LTE providing services to an enormous number of devices in these bands. For operators with limited spectrum resources, the possibility to introduce 5G capabilities in a backwards-compatible way, thereby allowing legacy devices to continue to be served on the same carrier, is highly beneficial and, in some cases, even vital.

In parallel, new radio-access technology (RAT) without backwards-compatibility requirements will emerge, at least initially targeting new spectrum for which backwards compatibility is not relevant. In the longer-term perspective, the new non-backwards-compatible technology may also migrate into existing spectrum.

II. EVOLUTION OF WIRELESS OLD MOBILE TECHNOLOGY

This section mentions in short the evolution of wireless and cellular systems based on the four main key aspects: radio access, data rates, bandwidth and switching schemes

Review of previous four generation system:

First generation system(1G): First generation wireless mobile communication system is not digital technology, but analog cellular telephone system which was used for voice service only during the early 1980s. This Advanced Mobile Phone System (AMPS) was a frequency modulated analog mobile radio system using Frequency Division Multiple Access (FDMA) with 30kHz channels occupying the 824MHz − 894MHz frequency band and a first commercial cellular system deployed until the early 1990's.

Second generation system(2G): 2G cellular telecom networks were commercially launched on the GSM standard in Finland by Radio in 1991. 2G technologies enabled the

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various mobile phone networks to provide the services such as text messages, 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.

Third generation(3G): It uses Wide Brand Wireless Network with which clarity is increased. The data are sent through the technology called Packet Switching. Voice calls are interpreted through Circuit Switching. Along with verbal communication it includes data services, access to television/video, new services like Global Roaming. It operates at a range of 2100MHz and has a bandwidth of 15-20MHz used for High-speed internet service, video chatting.3G uses Wide Band Voice Channel that is by this the world has been contracted to a little village because a person can contact with other person located in any part of the world and can even send messages too.

Fourth generation(4G): is an abbreviation for Fourth-Generation, is a term used to describe the next complete evolution in wireless communications. The approaching 4G (fourth generation) mobile communication systems are projected to solve still remaining problems of 3G (third generation) systems and to provide a wide variety of new services, from high-quality voice to high-definition video to high data-rate wireless channels. The term 4G is used broadly to include several types of broadband wireless access communication systems, not only cellular telephone systems. One of the terms used to describe 4G is MAGIC—Mobile multimedia, anytime anywhere, Global mobility support, integrated wireless solution, and customized personal service.

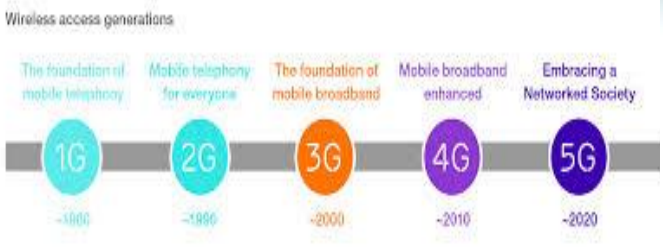

Fig 1 Evolution of moble technology

III. FIFTH GENERATION(5G) ARCHITECTURE

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 accessspecific 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.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.

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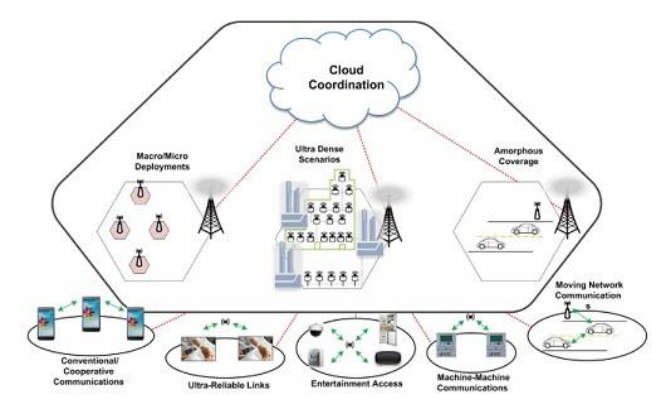

Fig 2 Functional architecture for 5G mobile network

Flat IP network: Certainly Flat IP network is the key concept to make 5G acceptable for all kind of technologies. To meet customer demand for real-time data applications delivered over mobile broadband networks, wireless operators are turning to flat IP network architectures. Flat IP architecture provides a way to identify devices using symbolic names, unlike the hierarchical architecture such as that used in "normal" IP address. 5G networks make use of this flat IP

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concept to make it easier for different RAN to upgrade in to a single NanoCore network. Our 5G network uses Nanotechnology as defensive tool for security concern that arises due to flat IP.

Application Layer	Application(Service)
Presentation layer	
Session Layer	Open Transport Protocol
Transport Layer	
Network Layer	Upper network layer
	Lower network layer
Datalink Layer	Open Wireless Architecture
Physical Layer	

Table1:OSI Layer in 5G mobile

Physical/MAC layer:

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

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.[3] 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) 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. Fig 3 shows the 5G network layer.

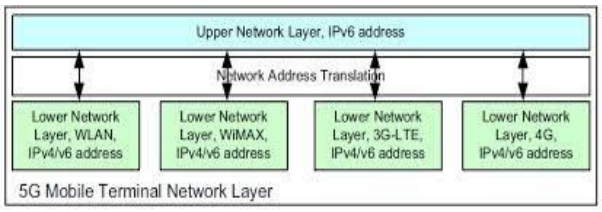

Fig 3 5G Mobile Terminal Network Layer

Open Transport Protocol Layer(OTP):

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.

Application Layer:

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

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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.

IV. WHY IS 5G REQUIRED

The major difference, from a user point of view, between current generations and expected 5G techniques must be something else than increased maximum throughput; other requirements include:

• Lower out age probability; better coverage and high data rates available at cell edge.
• Lower battery consumption.
• Multiple concurrent data transfer paths.
• Around 1Gbps data rate in mobility.
• More secure; better cognitive radio/SDR Security.
• Higher system level spectral efficiency.
• World Wide wireless web (WWWW).
• More applications combined with artificial intelligent (AI) as human life will be surrounded by artificial sensors which could be communicating with mobile phones. Not harmful to human health. •Cheaper traffic fees due to low infra structure deployment costs.

V. TECHNOLOGY COMPONENTS

Beyond extending operation to higher frequencies, there are several other key technology components relevant for the evolution to 5G wireless access.

1.Multi-Antenna Transmission: Multi-antenna transmission already plays an important role for current generations of mobile communication and will play an even more important role in the 5G era. Especially for operation at higher frequencies, the use of multiple antennas for beam-forming at the transmitter and/or receiver site is a critical component to counter the worse propagation conditions at higher frequencies.

2.Ultra-Lean Design: Ultra-lean radio-access design is important to achieve high efficiency in future wireless-access networks. The basic principle of ultra-lean design can be expressed as: minimize any transmissions not directly related to the delivery of user data. Ultra-lean design is especially important for dense deployments with a large number of network nodes and highly variable traffic conditions. However, lean transmission is beneficial for all kinds of deployments, including macro deployments.

3.User/Control Separation: The separation of user data delivery and system control functionality should be possible to extend over multiple frequency bands and RATs. As an example, the system control functionality for a dense layer based on new high-frequency radio access could be provided by means of an overlaid LTE layer. User/control separation is also an important component for future radio-access deployments relying heavily on beam-forming for user data delivery. Combining ultra-lean design with a logical separation of user-plane data delivery and basic system connectivity functionality will enable a much higher degree of device-centric network optimization of the active radio links in the network.

4.Direct Device-to-Device Communication: The possibility for limited direct device-to-device (D2D) communication has recently been introduced as an extension to the LTE specifications. In the 5G era, support for D2D as part of the overall wireless-access solution should be considered from the start. This includes peer-to-peer user-data communication directly between devices but also, for example, the use of mobile devices as relays to extend network coverage.

D2D communication in the context of 5G should be an integral part of the overall wireless-access solution rather than a stand-alone solution. The possibility for direct D2D communication should extend the capabilities and enhance the overall efficiency of the wireless-access network.

5.Flexible Spectrum Usage: mobile communication has relied on spectrum licensed on a per-operator basis within a geographical area This will remain the foundation for mobile communication in the 5G era, allowing operators to provide high-quality connectivity in a controlled-interference environment. Deviating from conventional per-operator spectrum licensing will mainly be relevant in frequency bands above 10GHz.

In high-frequency bands, the focus will be on very wide transmission bandwidths. It may be difficult to find sufficiently large spectrum blocks to allow for per-operator-dedicated spectrum supporting such bandwidths for multiple operators.

VI. FEATURES OF 5G

According to some research papers on 5G technology, the main features the technology might have are as follows:

- High speed, high capacity, and low cost per bit. It Support interactive multimedia, voice, streaming video, Internet, and other broadband services, more effective and more attractive, Bidirectional, accurate traffic statistics.
- Introduction of a new radio system is possible in which different radio technologies will share the same spectrum. This can be done by finding unused spectrum and then adapting to the technology of the radio technology with which the spectrum is being shared.

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- Every mobile in a 5G network will have an IP address (IPV6) according to the location and network being used.
- The technology is expected to support virtual private networks and advanced billing interfaces.
- With 5G Enabled phone, you might be able to connect your phone to your laptop to get access to broadband.
- 5G technology is providing large broadcasting of data in Giga bit which supporting almost 65,000 connections.
- The traffic statistics by 5G technology makes it more accurate and it also support virtual private network.

VII. CHARACTERISTRICS OF 5G TECHNOLOGY

• The technology 5G presents the high resolution for sharp, passionate cell phone every day and give consumers well shape and fast Internet access.
• The 5G technology provides billing limits in advance that the more beautiful and successful of the modern era. • The 5G technology also allows users of mobile phones, cell phone records for printing operations.
• The 5G technology for large volume data distribution in Gigabit, which also maintains close ties to almost 65,000.
• The technology gives you 5G carrier distribution gateways to unprecedented maximum stability without delay.
• The information from the data transfer technology 5G organize a more accurate and reliable results.
• Using remote control technology to get the consumer can also get a 5G comfort and relax by having a better speed and clarity in less time alone. • The 5G technology also support virtual private network.
• The uploading and downloading speed of 5G technology touching the peak.
• The 5G technology network offering enhanced and available connectivity just about the world.
• 5G network is very fast and reliable.

VIII. 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. 5G wireless access will be realized by the evolution of LTE for existing spectrum in combination with new RAT primarily targeting new spectrum. Key technology components of 5G wireless access include extension to higher frequency bands, advanced multi-antenna transmission, lean design, user/control separation, flexible spectrum usage, device-to-device communication. 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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