



A Review on Future Mobile Technologies and 4G, 5G, 6G, 7G

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Abstract: From past year wireless technology makes tremendous growth. Evolution and revolution of wireless technology is reached at seven.5G. Wireless technology FG (Future Generation) mobile communications can have higher knowledge transmission rates than 6G and 7G. Wireless technology is unceasingly one among the most well liked areas that square measure developing at a high speed, with advanced techniques rising in all the fields of mobile and wireless communications. Current times square measure simply the beginning for deploying 5G mobile communication systems. at the moment we've got many technologies every capable of playacting functions like supporting voice traffic mistreatment vox information processing (VoIP), broadband knowledge access in mobile atmosphere etc., however there's an excellent want of deploying such technologies which will integrate all these systems into one unified system. 8G presents an answer of this downside as it is all regarding seamlessly desegregation the terminals, networks and applications. In this paper an effort has been created to supply a study of various cellular technologies particularly 4G, 5G, 6G, 7G, and FG severally and detail comparison among them.

Keywords: Network; communication, Mobile Technology, Cellular Generation

I. INTRODUCTION

The mobile communication systems and also the wireless communication technologies are proving in no time day by day. Wireless communication is that the transfer of data over a distance while not the employment of increased electrical conductors or "wires" once the context is obvious, the term is commonly shortened to "wireless" It encompasses numerous sorts of mounted, mobile, and portable two-way radios, cellular telephones, Personal Digital Assistants (PDAs), and wireless networking . within the past few decades, the mobile wireless technologies have expertise of various generations of technology revolution and evolution, namely from 0G to 4G. presently and on future, we have a tendency to area unit exposing to new cellular generations specifically 5G, 6G, 7G, 8G and etc.

Consumers area unit exacting a lot of advanced and helpful applications. every generation has somestandards, capacities, techniques and new options that differentiate it from previous generations. thanks to these new options, the amount of mobile phone subscribers is increasing day by day. Hence, there's would like of capability enhancements in wireless communications. The 4G integrates 3G with mounted web to support wireless mobile Internet, that is Associate in Nursing evolution beat the constraints of 3G and conjointly raises the QoS, will increase the information measure and reduces the cost of resources. The 5G brings forward a true wireless world Wireless World-Wide internet (WWW) whereas 6G is projected to integrate 5G with satellite networks for international coverage.

7G deals with house roaming. The vellum is arrange in 5 parts followed by conclusion, recommendation, acknowledgement and references. Section II describes concerning 4G cellular technologies in detail. Section III provides a close clarification concerning 5G cellular networks. Section IV and V talks concerning 6G and 7G cellular technologies severally and section VI provides a close consideration of 4G, 5G, 6G, and 7G of wireless telegraphy.

II. 4G CELLULAR TECHNOLOGY

T4G is Associate in Nursing IP-based technology that uses spoken communication. LGPP, 4G Mobile Communication Technology and the IEEE 802.16 (WiMAX) square measure thought-about to be 4G standards.



| Network | Peak value of Download | Peak value of Upload |
|--------------|------------------------|----------------------|
| LTE | 100 Mbit/s | 50Mbit/s |
| LTE Advanced | 1000Mbps | 500Mbps |
| WiMAX | 128Mbit/s | 56Mbit/s |

Table 1:- Components of haplotypic variation and paired FST worth for the thirty eight complete ordering sequences of SARS-COV-2 from South America. Cell phone network entrance, IP receiver, diversion facility, tall naturally (HD) mobile TV, video conferencing, and 3D tv are the applications of 4G cellular networks. The first unleash of LTE (Long Term Evolution) ancient has been commercially deployed in 4G doesn't support circuit-switched networks however it's associate IP-based network system. 4G networks are the pillars as a results of it integrates many radio access networks with mounted Internet network .

In 2009, the ITU-R organization nominal the IMT-Advanced (International Mobile Telecommunications Advanced) requirements for 4G standards, setting peak speed needs for 4G service at a hundred Mbit/sec for top quality communication (such as from train and car) and one Gbit/sec calibre transmission (such as pedestrians and stationary users). One of the key technologies for 4G and on the approach aspect is termed Open Wireless Construction (OWA), supporting multiple wireless air interfaces in an open vogue platform. 4G is employed as well code written Radio (SDR) reciprocally of its technologies. SDR is employed to piece or outline the radio and make a customary platform which may be used across choice of areas. And, it'll develop a multi-band, multi-standard base stations and terminals. In future, the terminal can adapt the air interface to the accessible radio access technology, at this time this is done by the infrastructure. The high-level specification of LTE is comprised of following 3 main components: the User instrumentality (UE), The Evolved Packet Core (EPC) severally. The evolved packet core communicates with packet data networks at intervals the surface world a bit like the net, personal company networks or the IP transmission theme. The interfaces between the numerous parts of the system square measure denoted Uu, S1, and SGi .

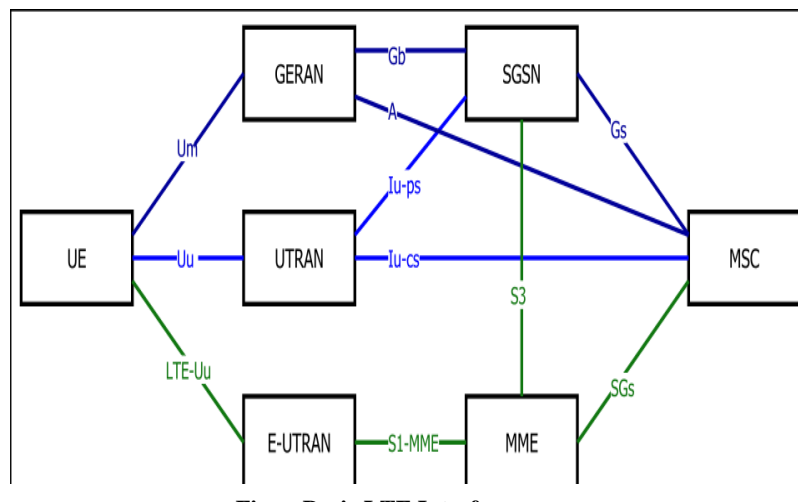


Fig:- Basic LTE Interface

(A) The User Equipment (UE)

The internal design of the user instrumentation for LTE is identical to the one employed by UMTS and GSM that is really a Mobile instrumentation (ME). The mobile instrumentation comprised of the following necessary modules:

- Mobile Termination (MT): This arm all the transmission functions.
- Terminal instrumentation (TE): These terminals the information streams.
- Universal microcircuit Card (UICC): this can be additionally referred to as the SIM card for LTE instrumentation.

It runs AN application celebrated as the Universal Subscriber Identity Module (USIM).

A USIM stores user-specific knowledge terribly kind of like 3G SIM card. This keeps information regarding the user's signalling home network identity and security keys etc.



(B) The E-UTRAN (The access network)

The design of evolved UMTS Terrestrial Radio Access Network (E-UTRAN) has been illustrated in Figure.

The E-UTRAN grasp the proportion transmission in the middle of the mobile and so the evolved packet core and easily has one half, the evolved foundation stop, mention to as eNodeB or eNB. each eNB might be a foundation stop that sway the cell phone in one or additionally cells. The base station that is act with a mobile is known as its serving EnBW. LTE cell phone transmission with just one foundation stop and one cell at a time and there are following a pair of main functions supported by eNB:

- The EbN sends and receives radio transmissions to any or all or any themobiles victimization the analogue and digital signal method functionsof the LTE air interface.
- The eNB sway the lower-level functioning of all its mobiles, by sending them signal messages like relinquishing commands.

Each EbN connects with the EPC by suggests that of the S1 interface and it's going to even be connected to close base stations by the X2 interface, that's primarily used for signal and packet forwarding during relinquishing. A home eNB (HeNB) might be a base station that has been buy by a user to give home base station coverage at intervals the home. A accommodation eNB be into a shut supporter bunch and would possibly alone be accessed by mobiles with a USIM that together belongs to the closed subscriber cluster.

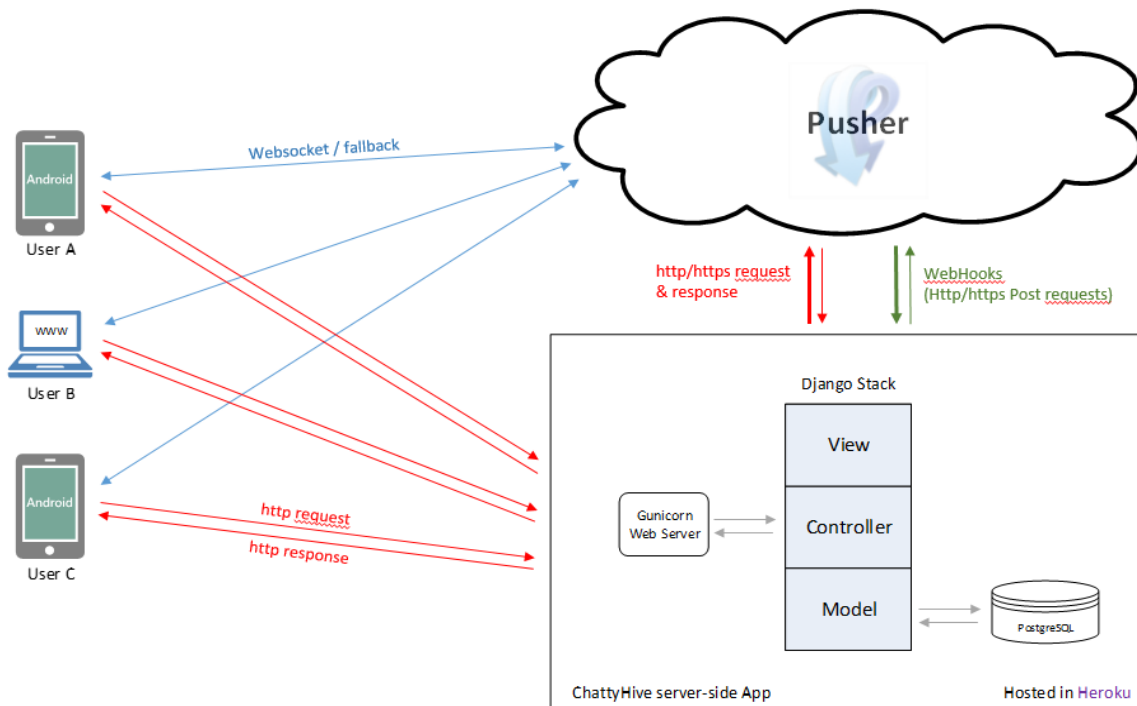


Fig:- The E-UTRAN Architecture

(C) The Evolved Packet Core (EPC-The core network)

The design of Evolved Packet Core (EPC) has been illustrated below. There area unit few additional elements that haven't been shown within the diagram to stay it straightforward. These elements area unit like the Earthquake and moving ridge Warning System (ETWS), the Equipment Identity Register (EIR) and Policy management and Charging Rules perform (PCRF). There is a short description of every of the elements shown in the on top of architecture:

- The house Subscriber Server (HSS) element has been carried forward from UMTS and GSM and could be a central info that contains info concerning all the network operator's subscribers.



- The Packet knowledge Network (PDN) entree (P-GW) communicates with the surface world i.e.. Packet knowledge networks PDN, using SGi interface. every packet knowledge network is known by associate access point name (APN). The PDN entree has an equivalent role because the GPRS support node (GGSN) and therefore the serving GPRS support node (SGSN) with UMTS and GSM.
- The serving entree (S-GW) acts as a router, and forwards knowledge between the bottom station and therefore the PDN entree.
- The Policy management and Charging Rules operate (PCRF) could be a component that isn't shown within the on top of diagram however it's responsible for policy management decision-making, similarly as for controlling the flow based charging functionalities within the Policy Control social control operate (PCEF), that resides within the P-GW. The interface between the serving and PDN gateways is understood as S5/S8. This has 2 slightly completely different implementations, namely S5 if the 2 devices area unit within the same network, and S8 if they're in different network

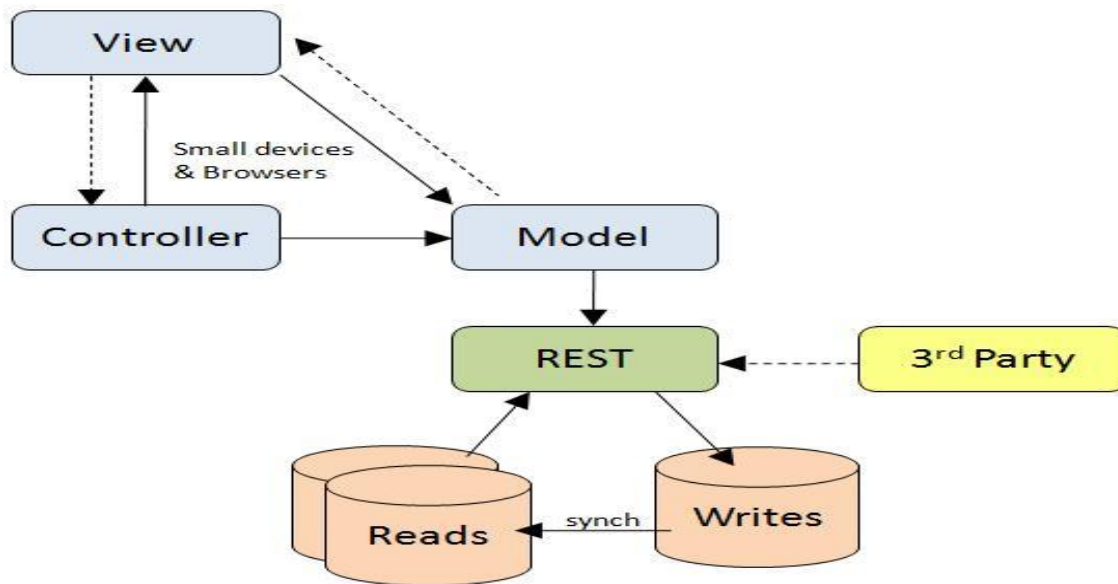


Fig:- Evolved packet core architecture

III. 5G CELLULAR TECHNOLOGY

5G mobile network is progressive version of this 4G/ IMT-Advanced standards since 2011. 5G (5th generation mobile networks or fifth generation wireless systems) could be a name that used to denote successive major part of mobile telecommunications standards. 5G isn't a term formally used for any specific specification or in any legal instrument nevertheless created public by telecommunication corporations or standardization bodies like 3GPP, WiMAX Forum, or ITU-R. Moreover, new commonplace releases beyond 4G area unit ongoing by standardization bodies, but are at this not thought-about as new mobile generations however below the 4G umbrella.

The capability of the 5G is aimed to be abundant on top of current 4G. Higher capability would permit higher density of mobile users, ultra reliableness and big communications. Also, research that is occurring 5G aims at lower suspension and low battery consumption. 5G is meant for WWW (World Wide Wireless Web) and IPv6 is a elementary protocol accustomed 4G and 5G cellular networks but since IPv6 assigns any IP address to any mobile node primarily based on location management; so, this may cause wastage of 5G resources. in line with the resources, 5G would get implemented round the year 2020.

5G core conception would possess 3 technologies:

- Nano technology
- Cloud computing and,
- All flat IP platform

Moreover, to unravel the wasting of 5G resources due to IPv6 operating nature (location management) and 5G aim (WWW supported network access management), the proposed the information measure improvement management protocol and therefore the mix-bandwidth information path for future 5G real wireless world. The Bandwidth improvement management Protocol (BDMP) is enforced in between waterproof layer and TCP/IP layer, that employee to determine the mix-bandwidth New mobile generations area unit generally assigned new frequency bands and wider



spectral information measure per frequency channel (1G up to thirty rate, 2G up to two hundred rate, 3G up to five Mc, and 4G up to 40 MHz), however sceptics argue that there's very little space for brand new frequency bands or larger channel bandwidths. From users' purpose of view, previous mobile generations have understood substantial increase in peak bit-rate (i.e. physical layer internet bit-rates for short-distance communication). However, no supply suggests 5G peak transfer and transfer rates of quite the one Gbps to be offered by ITU-R's definition of 4G systems. If 5G seems, and reflects these prognoses, the foremost distinction from a user purpose of read between 4G and 5G techniques should be one thing else than accumulated most output. for instance lower battery consumption, lower outage chance (better coverage), high bit rates in larger parts of the coverage space, cheaper or no traffic fees because of low infrastructure readying prices, or higher aggregate capability for several concurrent users (i.e., higher system level spectral efficiency).

(A) Pervasive networks

A user will at the same time be connected to many wireless technologies and seamlessly move between them.

(B) Group cooperative relay

To make a high knowledge rates offered over a wider space of the cell. Currently, knowledge rates fall towards the cell edge wherever interference levels square measure higher and signal levels lower.

(C) Cognitive radio technology

The user equipment/handset to seem at the radio landscape in which it's settled and select the optimum radio access network, modulation theme and alternative parameters to set up itself to gain the most effective affiliation and optimum performance.

(D) Wireless mesh networks and dynamic impromptu networking

By employing a sort of completely different access schemes, it'll be potential to link to others close to supply ad-hoc wireless networks for much speedier knowledge flows.

(E) Smart antennas

By victimisation sensible antennas, it'll be potential to alert the beam direction to alter a lot of direct communications, limit. The system comprising of a main user terminal then variety of freelance and autonomous radio access technologies. Each of the radio technologies is taken into account because the IP link for the outside web world. The IP technology is furthermore, to make accessible routing of packets ought to be mounted in accordance with the given policies of the user. The 5G Master Core is convergence purpose for the opposite technologies, that have their own impact on existing wireless network. curiously, its style facilitates Master Core to urge operated into parallel multimode together with all IP network mode and 5G network mode. It controls all network technologies of RAN and completely different Access Networks (DAT). Since, the technology is compatible and, it is more efficient, easier, and additional powerful. WCSM may be a terrific feature of this technology; for instance, if a academic writes on the white board during a country – it may be displayed on another white board in the other a part of the planet besides speech communication and video. Further, new services may be easily added through parallel multimode service.

IV. 6G CELLULAR TECHNOLOGY

6G mobile network/Internet uses degree air fiber technology with create a neighbourhood network capable of delivering extraordinary speeds instead of failing averages. The air fiber combination can be the sole methodology to broadcast abundant secured knowledge from tiers to destinations. 6G's converged network provides local with an extremely all-in-one solution: uploads, downloads, super-fast broadband net, multiple line telephones, CCTV monitoring, video conferencing each telecommunications requirement your business desires are catered for with 6G.

The sixth generation (6G) wireless mobile communication networks shall integrate satellites to urge international coverage. The global coverage systems are developed by four countries. system is developed by China, the stargazer system is developed by EU, that the GLONASS system is developed by Russia. Thus, these independent systems unit issue for house roaming.

6G Internets use a mixture of the newest in radio and fiber optics technology. Which means they don't have to be compelled to believe the copper cable or base our speed on the way to so much your business is far from the exchange. 6G supply quicker, safer and cost-efficient broadband network. The telecommunication satellite is employed for voice,



data, Internet, and video broadcasting; the planet imaging satellite network is for weather and environmental data collection; and the navigational satellite network is for international Position System (GPS).

In 6G hand-off and roaming are going to be the large issue as a result of those satellite systems area unit totally {different|completely different} networks and 6G has four different standards. Thus, the hand-off and roaming should crop up between those four completely different networks however it'll occur is still a matter.

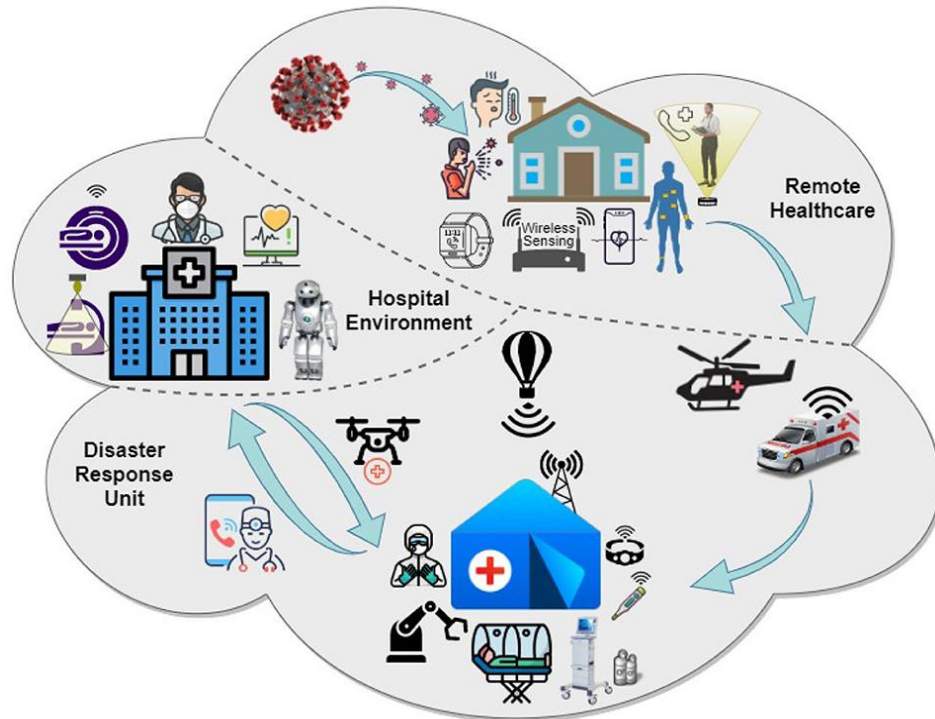


Fig:- 6G Technology

In 6G the price of mobile decision is going to be comparatively high however in 7G/7.5G/8G their downside is going to be reduced and lowerlevel user will take pleasure in them. In 6G, the world are going to be adorned by fly sensors with the assistance of 6G technology. These fly sensors can provide info to their remote observer stations; any these stations can check any activity upon a special space like the activity of terrorists, intruders etc.,

V. 7G CELLULAR TECHNOLOGY

7G mobile network is just like the 6G for world coverage. it'll be the most advance generation in mobile communication however there'll be some researches on difficult problems just like the use of mobile phone throughout moving condition from one country to a different country, as a result of satellite is additionally occupancy constant speed and in. 7G will solely be true once all standards and protocols square measure outlined. could also be this is often potential in next generation after sevenG and might be named as 7.5G or 8G. once 7G can complete all its weak points then there'll be no issue of knowledge capability coverage and hand-off left behind. At that point there'll be solely one demand from user that is that the price of movable decision and its services. This issue can once more begin biological process modification in normal and technology, and can additionally open new horizons for computing analysis. This new revolution in technology for price of mobile phone decision and services are going to be referred to as seven.5G or 8G.

VI. CONCLUSION

The world of mobile wireless communication is chop-chop developing. The previous few years have tough a stimulating growth in wireless trade. tries square measure being created to cut back the number of technologies to one world commonplace ensuing in 5G, 6G and 7G. 5G aims a true wireless world with no limitations while 6G integrates 5G with satellite networks. because of variable technologies and standards, with 6G handoff/roaming are Associate in Nursing issue. This drives the 7G of mobile wireless networks that aims to acquire house roaming. Trials have already started on



5G that may result in its business convenience around 2020. The world is making an attempt to become fully wireless, demanding uninterrupted access to info anytime and anyplace with better quality, high speed, exaggerated information measure and reduction in prices.

VII. RECOMMENDATIONS

In 5G analysis that's happening its aims at lower suspension and low battery consumption. Besides, information science v6 assigns any IP address to any mobile node supported location management; so, this would cause wastage of 5G resources. In 6G, hand-off and roaming square measure massive problems because of its satellite systems square measure operating in numerous networks and standards. Thus, the hand-off and roaming should turn up between those four different networks however it'll occur remains a matter. The dream of 7G will solely be true once all its standards and protocols square measure outlined. is also this is often potential in next generation after 7G. once 7G can complete all its weak points then there will be no issue of knowledge capability coverage and hand-off left behind. At that point there'll be just one demand from user which is that the price of movable decision and its services. This issue will once more begin organic process amendment in commonplace and technology, and will additionally open new horizons for computing analysis. This new revolution in technology for price of movable decision and services are referred to as seven.5G or 8G. In future, the terminal can adapt the air interface to the available radio access technology, at the present this is often done by the infrastructure. additionally, the most barrier for future technologies success is that the incompetent technological support (old devices) in most elements of the globe. So, all of them need to Parameters Cellular technologies 4G 5G 6G 7G Frequency 2-8 gigahertz 4G Frequency 95GHz-3THz Service Wi-Fi, VoIP, LTE, WiMAX WWW Secured and world cellular services Secured and world cellular services IPv6 but advancements square measure still to be done. All packet Core network net Data rate 100-300 Mbps concerning 100+Mbps concerning eleven Gbps concerning 11+Gbps Pros Speed, high speed hand offs, MIMO tech, global tech Better coverage area, low battery consumption, handiness of multiple data transfer path, energy and spectral efficiency could be a heap of and options a high security Global coverage system No issue of data capability coverage and hand off left behind, low value of call Cons burdensome to implement, complicated hardware required .It is still beneath technique and analysis on its viability goes on, it is difficult to understand as a results of the incompetent technological support in most components of the world, developing infrastructure desires high value, security and privacy issue but to be solved Difficulty for space roaming, high value of mobile call and similar with 5G disadvantages Similar with 5G and 6G disadvantages Location of initial commercialization South Korea Not but Not but Not but Time period presently presumably 2020 presently presumably 2030 presently presumably 2030 be replaced with new one. Generally, 5G, 6G and 7G desires a high value for developing infrastructure what is more as their security and privacy issues but to be re

VIII. ACKNOWLEDGMENTS

This work wouldn't are doable while not the endless support of son of St. Merry, Almighty God, so we have a tendency to praise always the name of him and his mother. additionally, this paper is dedicated for our beloved country, Ethiopia.

REFERENCES

- [1] Tripathi SR (2016) Analysis and survey on past, present and future generation in mobile communication. IOSR J Comput Eng
- [2] Tripathi SM, Prasad R (2013) Spectrum trading in India and 5G purnendu. Journal of ICT Standardization 1: 159-174
- [3] Bhandari N (2017) Evolution of cellular network: from 1G to 5G. Int J Eng Technol 3: 98-105.
- [4] Sucheta P Yadav KP (2013) A Comparative studies of 1G, 2G, 3G and 4G. Int J Adv Eng Res 3: 1-16.
- [5] A Survey Report on Generations of Network: 1G, 2G, 3G, 4G, 5G (2006).
- [6] Khutey R (2015) Future of wireless technology 6G and 7G. Int J Electr Electron Res 3: 583-585.
- [7] Mobile Technology: Evolution from 1G to 4G electronics for you.
- [8] Kachhavay MG Ajay PT (2014) 5G Technology-evolution and revolution. Int J comput Scie Mobile Comput 3: 1080-1087.
- [9] Tutorialspoint LTE Network Architecture (2019).
- [10] Tutorialspoint 5G Network Architecture (2019)