Evolution of 5G and Different Mobile Network

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ABSTRACT: With every passing there is the number of improvements are taken in the mobile technology. It also helpful for our work, interaction and learning process. Wireless technology plays a major role in the modern time. As day -by -day, use of internet for various activities (Nimediya & Gulhane 2022) are increasing rapidly every individual demand for a high speed internet. To survive in a world where speed keeps (Patil & Achar 2021) changing every second and we seek more and more technology, here comes the fifth generation technology. 5G is new invented wireless technology after 1G, 2G, 3G and 4G. Networks with various features like high speed, cheaper reliability, fast network capacity and low latency to enable next generation user experiences to users. This paper describes the detailed information of the fifth generation technologies.

Keywords: 5G, Evaluation from 1G to 5G, Architecture etc.

INTRODUCTION

The wireless communication has started in earlier 1970's. Mobile communication is the use of technology that allows us to communicate with others in different locations without use of physical connection. The fifth generation of the mobile network provides us to deliver high multi- Gbps data speeds, low latency and the massive capacity. It can make internet of things possible. The main objective of 5G is to create the best wireless communication, free of the limitations and obstacles of the previous generations. It makes our life easier, saves time and effort, communicate with each other in any location, easy accessibility to the remote area.
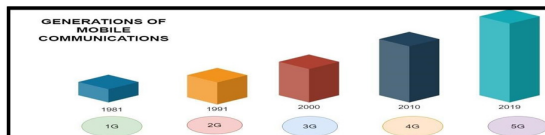
(Source: https://app.diagrams.net/)
Mobile generations.

OBJECTIVES

1. Overview of 5G network.
2. Evolution of different mobile network generations.
3. Core architecture of 5G.
4. Applications of 5G network and future scope.

EVALUATION OF GENERATIONS: (Roddam, 2020)

1G (1980-1991): It is the first generation of wireless mobile communication where analog signals were used to transmit data. It was designed for voice communication introduced in US in 1980. It has the speed of 2.4 Kbps. The disadvantages of that was the poor voice quality, having no data security, large phones with limited battery.

2G (1991-2001): It is the second generation of the wireless technology in which we

Used the digital signals. It was introduced in Finland in 1991.It uses the global system for mobile communication having a speed of 0.1 Mbps. The main advantages of the 2G technology is that the text and multimedia messaging possible. It is the advanced version of 1G and provides a better quality.

2.5G: In the second generation when we add the new feature that is the GPRS (General packet radio service) technology was introduced. It enabled web browsing, e-mail, secure and fast download speed. 2.5G based on packet switching process.

3G (2001-2009): The third generation began in late 2001 having a speed of 144kbps to

2mbps. it is mainly based on the telecommunication technology. The fundamental goal of the third generation was the enabled high speed of web browsing, running web based applications like video conferencing, multimedia etc. It becomes easy to transfer of audio and video files. The drawback of the third generation was the trained person required for infrastructure setup, high infrastructure cost and the expensive mobile phones.

3.75G: It is the advanced version of the 3G technology. It provides facility of the mobile internet access, wireless voice calls, mobile TV technology. The speed of the 3.75G up to 14.4 MB/s. High speed packet access protocol will be used in this generation.

4G (2010-2019): In the fourth generation, the main consideration were taken in the LTE Long term evolution).

Enhancing up the trend of the new mobile technology every decade, it was introduced in 2011. The main characteristics of this generation having a speed of 100mbps to 1gbps, mobile web access, to watch the

T.V programs with more clarity, high data rate than previous generation, used in cloud computing etc.

5G (2019): The latest generation of mobile network is 5G which is came into force on 2020.

It is the complete wireless communication with almost no limitations. It provides a global wireless standard after various generations and designed to connect virtually everything together including devices, objects and machines. It is 30 times faster than 4G, having more flexibility in the network. The main advantages of 5G will be high data rate about 1Gbps, packet and message switching, faster connectivity, more secure, data latency low, massive network capacity, uniform user experience to different users. The main focus of 5G is to setup Wireless World Wide Web (WWWW). It has large phone memory, clarity in audio/video and the fast dialling speed.

GENERATIONS	INTRODUCED IN	SPEED	SWITCHING	TECHNOLOGY USED
1G	1984	14.4 Kbps	Circuit	AMPS,TACS,NMT
2G	1993	64 Kbps	circuit,packet	CDMA,TDMA
3G	2001	2 Mbps	Packet	CDMA2000
4G	2009	100 Mbps	All Packet	LTE,WI-FI
5G	2020	1 Gbps	Internet	Advanced LTE schemes

EVOLUTION OF WIRELESS TECHNOLOGY 1G TO 5G

ARCHITECTURE OF 5G NETWORK: (Jain, 2022) The 5G system contains the 5G core network (CN), 5G access network (AN) and the user equipment (UE) systems. In the 5G access network having the two components used as 3GPP next generation radio access network (NGRAN) and the Non – 3GPP access network. 3GPP has specified both reference point and service based architecture for the 5G system. The user equipment (UE) helps us to connect with the 5G networks. The reference based system architecture is based upon the set of network elements which uses the point to point interface to connect those set of elements. There is the static relationship between the network components. It makes it rigid, fixed having less flexibility for changes or updates signalling procedure are specified for each point to point interface. It leads to repetition within the specification if the same signalling procedure is used across multiple interfaces. It is less modular because modifying one part of the system impact on the other part. The main function included in the service based architecture (Jain, 2022) is NF (network function). It gave a capability to network function service in service based interface to an NF to transfer data with one authorized NF to other. It helps us to do number of services manages the different number of procedures. The main functions included in the service based system are:

1. PCF (Policy Control Function): As the name indicates it helps us to control the function and implement the different policies. It provides the different service configurations, policy configurations. Policy rules are used for the data flow detection. PCF plays an important role for slicing. It is designed using the cloud native principles.

2. NRF (Network Repository Function): In this, all the network functions are centrally stored in network repository system. It is the core element with the help of which we can execute our service baes architecture functions easily.

3. NSSF (Network Slice Selection Function): It is the control plane function within the 5G core network. It is the new function included in 5G, where is not similar node like in 4G. It gave the best slice to the user that they have requested for.

4. SMF (Session Management Function): The primary responsibility of the SMF includes the downlink notification management, IP address allocation, PDU session management, GTP-U Tunnel management. PDU describe a connection between the UE and the exit of a UPF (user plane function) towards a specific area network.

5. BSF (Binding Support Function): It supports the binding function on the diameter routing agent (DRA). It becomes a necessary part to bind up the different function in a particular manner. SCP (Service Communication Proxy): It manages the effective and secure communication proxy of the 5G network. SCP makes IT service mesh and adds crucial capabilities to make the 5G aware. There are also some important functions such as UDM (unified data management), AUSF (authentication server function) etc. These all functions plays an important role to make the robust 5G network technology which is very beneficial to the every user.
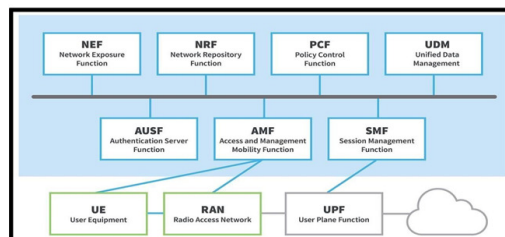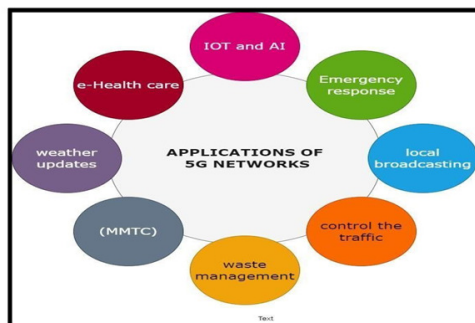

5G Network Architecture

WHY 5G?: When we talk about the previous generations of the mobile networks so we see that there is the different problems that face users in every day. So to make the robust and efficient technology, in 2020, 5G technology came into force. The first 5G networks were launched in (Dhawal, 2023). South Korea by the carrier SK Telecom in April 2019. There are the following features that makes the 5G the core network:

(a) Having the greater speed in the transmissions.
(b) Simultaneously connected a number of devices for implementing the virtual networks.
(c) Low latency.
(d) High performance and improved efficiency.
(e) More reliability.

(a) Used in internet of things and AI.
(b) Used in factory automation.
(c) Local broadcasting.
(d) Gives instant weather updates.
(e) Used in control the traffic.
(f) Used in massive machine type communications (MMTC).
(g) Used in waste management.
(h) Remote surgery.
(i) Street lighting.

FUTURE SCOPE

Fifth generation technology is designed to provide us (Dhawal, 2023) latest mobile operating systems, smooth communication process, security concerns of data, greater high speed , increased productivity, used in real time applications, enabling the new services, cost effective etc. 5G provides the different types of benefits to every user and whole of the world. It provides and easy and faster way to the user to do their work easily. The listed future scopes are:

1. Smooth communication process: When there is the faster speed of data it leads to the smooth communication process on every field such as business etc. It can also help for make the greater coordination between the different organizations.

2. Security concerns of data: 5G gave us the secure reliable network that we can easily use in our business process and the different process also. It can also use the security solutions such as block chain etc.

3. Used in real time applications: In the modern time as we see that the 5G network is used in healthcare,

(f) Much fast download content.
(g) Faster remote working capabilities.
(h) Having the best network slicing.
(i) Enhancing the mobile broadband
(j) There is the massive connectivity between the different networks.

APPLICATONS OF 5G NETWORKS

5G technology is spread all over the world. It will provide a better efficiency to the users. It can make a great impact on the real world. There are various applications of the 5G technology which plays a very major role. Following are some important applications:

industrial internet of things, autonomous vehicles, entertainment etc.

4. High performance: It is faster network than 4G. It helps to give the faster data rates up to 20 gigabits per second (Gbps) and frequencies up to about 100GHz.

CONCLUSION

In this paper, we have discussed about the different mobile technologies and their journey from 1G to 5G. Knowing about the different important points we can conclude that the various mobile technologies can developed at a very faster speed. The 5G provides the different reliable features to the user to do their work smoothly.

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