A REVIEWED APPROACH TO THE 5G MOBILE TECHNOLOGY

Vishal Singh Rathore^{1*}, Alka Chauhan²

^{*1,2}*Electronics and Computers, Dronacharya College of engineering, Gurgaon, India.*

***Corresponding Author: -**

Abstract: -

5G or the 5th generation of mobile technology, is a name used in many research papers and projects to denote the next phase after the upcoming 4G standards. Currently the term 5G is not official. In this generation researches are being made on WORLD WIDE WIRELESS WEB (WWW), DYNAMIC ADHOC WIRELESS NETWORKS (DAWN) and REAL WIRELESS WORLD. New standard technology releases are in development beyond 4G but are not considered as new mobile technologies, because 4G implementation and complaint handling regarding the 4G system are still under development. This paper is focused on network Architecture of 5G Technology and evolution from 1G to 5G. The fifth generation will provide very high speed and affordable broadband wireless connectivity and services like documentation, supporting e-transactions etc.

Keywords- From 1G to 5G, 5G, 5G Architecture, Nanotechnology in 5G Architecture, Cloud Computing, BDMA.

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[1].**INRODUCTION-**

The wireless communication has started in 1970, till then the technical world has evolved a lot. Landlines are like Stone Age things, people use mobile phones instead. They not only connect people but also serves as an entertainment gadget for everyone. They have become basic need for everyone. In between these past four decades the mobile technology has evolved from 1G to 5G. 5G is the phase of mobile technology which is beyond 4G. 5G will provide a very vast bandwidth, even vaster than 4G. A never before experienced data transfer rate. 5G will change the way of using the handsets for most of the users. It will change the user experience of voice reception quality and data trans-reception by taking it to a new level. It all become possible through a voice over internet protocol (VoIP)enabled device. VoIP is a methodology and group of technologies for the delivery of voice communications and multimedia sessions over internet protocol (IP) networks, such as the internet. The VoIP refers to the provisioning of communications services(voice, fax, sms, voice-messaging) over the public internet, rather than via the public switched telephone network(PSTN).With 5G technology mobile phones can directly connect to pc or laptop, to use broadband internet access.

[2].**5G Mobile Network-**

5G network use flat IP concept making the upgrading process from RAN to Single Nano Core Network, easier. Nano technology is used as defensive tool against the security concerns that arises due to flat IP. Flat IP is the key that makes the 5G networks acceptable for all kind of new technologies. Due to flat IP Architecture devices can be identified using symbolic names, unlike in NORMAL IP ARCHITECTURE. Now the mobile operators are relieved due to shift from normal IP architecture to flat IP Architecture. The 5G wireless mobile network is the 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-Wide Band), NETWORK-LMDS (Local Multipoint Distribution Service) and IPv6. With the flat IP Architecture mobile operators can-

- Partially decouple the cost of delivering service from the volume of data transmitted to align infrastructure capabilities with new application requirement.
- Greater flexibility in Network planning and deployment can be achieved due to separate evolution of radio access and packet core networks.
- Lower operation cost and Capital expenditure by reducing the number of elements in data path.
- Enable application with a lower tolerance of delay and minimize system latency.
- To create a competitive platform with respect to wired network in the fields of cost and performance.

[3].**EVOLUTION FROM 1G TO 5G-**

Since past four decades the mobile technology has evolved a lot and this is due to the continuously developing mobile communication technology. The consumers of mobile communications increase readily. Due to this the mobile network technology evolved – 1G, 2G, 3G, 4G and then 5G.

• **First Generation (1G)-**

Analog system are used for mobile communications in the first generation which is during the 1980s. Devices used foe communication during that era are commonly known as CELL phones. Mobile technologies such as MTS (Mobile telephone system), AMTS (Advanced Mobile telephone system), PTT (Push to Talk), and IMTS (Improved Mobile Telephone Service) are introduced that time. The wireless technology of that time uses Analog Signals of 150 MHz frequency. FDMA (Frequency Division Multiple Access) is used for voice call Modulation which has unreliable file sharing, Poor voice quality, and no security at all as the voice calls are played back at the radio control towers of the service providers. It has major risk of eavesdropping by Third Parties.

• **Second Generation (2G)-**

Emerging in the late 1980s the second-generation network was planned mainly for voice transmission with Digital Signals. It also provided the SMS (Short Message Service) that gave it an advantage over the first generation. It uses a Bandwidth of 30-200 KHz. 2.5G is introduced next to 2G, it uses Packet Switched domain and circuit switched domain and provide data rates of 144 kbps. Example- EDGE, CDMA, GPRS. During 2G era the subscribers and value-added services both got increased by a huge number.

• **Third Generation (3G)-**

It is widely used Mobile Technology at this time, it introduced the smartphones. During the third Generation Wide Brand Wireless Networks are used. Due to this the voice clarity got a huge boost and the conversations seems to be realistic. The data transmission is through Packet Switching and the call interpretation through circuit switching. 3G network provides voice communication, data services, and access to television/videos. It operates at a range of 2100 MHz and has a bandwidth of 15-20 MHz

3G introduced many services for example Global Roaming. Anyone can send or receive any message or video call anyone, at any location in the world. It provides a minimum 2 mbps to maximum 28 mbps data transfer rate.

Later versions are 3.5G and 3.75G, they provide mobile broadband access of severalmbps to smartphones and mobile modems in laptop computers. This ensures it can be applied to wireless voice telephony, mobile internet access, video calls and mobile TV technologies.

• Fourth Generation (4G)-

This is the latest mobile technology up to date. It provides a downloading speed of 100 mbps. All the features of 3G and additional features such as multi-media newspapers, mobile TV with real TV like voice clarity and without buffering of videos.

3.1 Comparison –

Following chart displays the comparison between the 5 technologies.

Figure 3.1 comparison between 1G, 2G, 2.5G and 3G

Technology → Features ↓	1G	2G	3G	4G	5G
Start/Deployment	1970-1980	1990-2004	2004-2010	Now	Soon(probably 2020)
Data Bandwidth	2kbps	64kbps	2Mbps	2Gbps	Higher than 1Gbps
Technology	Analog Cellular Technology	Digital Cellular Technology	CDMA 2000(1x RTT EVDO), UMTS, EDGE	WiMax LTE Wi-Fi	WWWW(Coming Soon)
Service	Mobile Telephony(Voice)	Digital Voice, SMS, Higher Capacity Packetized Data	Integrated High Quality Audio, Video and Data	Dynamic Information Access, Wearable Devices	Dynamic information Access, Wearable devices with AI capabilities
Multiplexing	FDMA	TDMA, CDMA	CDMA	CDMA	CDMA
Switching	Circuit	Circuit, Packet	Packet	All packet	All packet
Core Network	PSTN	PSTN	Packet N/W	Internet	Internet

Table 3.1 comparison between the mobile technologies.

[4].5G Network Architecture-

The 5G model is All-IP based model for wireless and mobile networks interoperability. The AIPN (All-IP Network) is a common access for all radio technologies. AIPN uses packet switching and its development leads to optimized performance and cost. In 5G Architecture consist of a user terminal and a number of autonomous RAT (Radio Access Technologies). In this architecture All-IP based mobile applications and services (Mobile Commerce, Mobile Portals, Mobile health care, Mobile banking and others) are offered via cloud computing resources (CCR). Cloud computing allow the use of applications without installing them or accessing personal data. Reconfigurable Multi Technology Core (RMTC) and Remote configuration data are linked through CCR from RRD attached to Reconfiguration Data Module (RDM). The core is of Nanotechnology and cloud computing, based on ALL-IP platform. RMTC is connected to different radio technologies from 2G/GERAN to 3G/UTRAN and 4G/EUTRAN, 802.11x WLAN and 802.16x WMAN. Terminal and RMTC are enabled by interoperability process- criteria and mechanism and are being selected from heterogeneous access system.

Figure 4.1 5G network Architecture

4.1 Nano core of 5G Architecture -

Figure 4.1.1 5G Architecture- the Nano core.

The 5G Nano Core is a convergence of:

- Nano Technology
- Cloud Computing
- All-IP platform

• Nano Technology-

The term Nano Technology was introduced in 1974 by Nori Taniguchi at Tokyo International Conference on Production Engineering. In this Technology Nano science is implemented in control process, the scale used is Nano meter scale (i.e. 0.1 to 100nm). Nano technology is used in both the network architecture as well as the core structure of the mobile phone body. It is changing the fields of the communication technology a lot by making the mobile phones more compact and the network more robust. Day by day it is finding many more usage in this field of communication.

• Nano Equipment (NE)-

The mobile phones having the 5G core are considered as the Nano Equipment because they are having Nano technology in their Hardware components. The main focus of communication through mobile technology is to provide communication and services that are ready to serve the customer any time anywhere in a more intelligent and effective manner. The uses of Nano technology resulted in the following changes:

1. **Self-powered-** Mobile phones can now recharge themselves from sustainable energy sources like SUN, also wireless charges which uses E-M waves.
2. **Sensors-** Now mobiles phones can sense gravity, acceleration, proximity, temperature, light, altitude, longitude etc.

3. **Flexibility-** Nano materials are discovered which have flexible strength. They bend but do not break, these materials are used in many mobile phones.
4. **Self-cleaning-** Mobile phones can now cleanse its dirt prone areas like speakers or microphones by the use of Nano technology.

- **Cloud Computing-**

Cloud computing uses internet to provide services to user without installing them and access their personal files at any computer. Internet and central remote server are used to maintain application in cloud computing technique. In 5G mobile technology the central remote server will be the mobile company or any other computer that provides the content. This cloud computing concept will be used in the Nano core where the user will be able to access the account using a global service provider through internet, and these files are stored in the cloud. In the Nano core cloud computing has three main segments:

- [1]. **Applications-** it comprises of, on demand software services. These on demand software services are variable depending on their prices and the delivery of software to its end user. End user will be able to purchase a server that can be accessed by the end user.
- [2]. **Platform-** This segment contain the products that are used to deploy internet. Applications that can be accessed by centralized servers are developed by leading companies like Google, Microsoft, and Amazon. Google, Sales force, Amazon.com are some of the active companies right now that provide cloud storage.
- [3]. **Infrastructure-** It is the backbone of the entire concept. Companies like Google allow users to build applications and also provide cloud storage such as Google drive, Microsoft has its own cloud storage named ONE DRIVE.

- **All IP-Network-**

It is evolved 3GPP system. AIPN is primary focused on enhancement of packet switched technology. It provides an optimized system concept to provide a competitive edge in terms of cost and performance. Its benefits are;

- Lower cost.
- Improved user experience.
- Reduced system latency.
- Lower cost.

5. Beam Division Multiple Access (BDMA)-

The goal of mobile system is to provide better and improved services at lower cost. This is the main challenge they are facing and to meet this challenge these companies have to change their multiple access techniques. Some of them are:

- FDMA- frequency is divided and then given to mobile stations to give multiple access.
- CDMA- orthogonal codes are given to the mobile stations to give multiple access.
- OFDMA- it divides and allots orthogonal frequency resource to maximize resource utilization.
- TDMA- in this time resources are divided to give multiple access.

Figure 5.1 multiple access technology.

- **BDMA concept-**

The present BDMA technique divides an antenna beam according to the location of mobile stations hence giving them multiple access, and also increase the capacity of the system. Mobile station and base station are in LOC (line of sight), when they know exact position of each other they can transmit beams which direct to each other's position to communicate. BDMA concept-

- When mobile station and the base station are at different angle, then the base station transmits beam to different angle to simultaneously transmit data to multiple mobile stations.
- Same frequency/time resources and orthogonal resources are divided by the mobile stations sharing the same beam.
- Any single beam is not exclusive to a single mobile station, instead of these mobile stations which are positioned at same angle share the same beam.
- Direction, number of beams, width of beam is not fixed for a specific station. It can change these parameters to meet the needs of that area consumers.
- Initially mobile station and the base station do not know about the exact position of each other. The mobile station detects the position and speed that is required to transmit data at that point, and then transmit this information to the

base station.

- Based on this information from the mobile station, the base station calculates the direction and width of the downlink beam and transmit it to the mobile station.
- The mobile station, after receiving this downlink beam information, calculates an uplink beam direction and width. Then it transmits the uplink beam in this direction.
- After this uplink beam setup is done then the mobile station and base station continuously update these calculations for uplink and downlink.
- The difference between FDD-BDMA and TDD-BDMA is initial mobile station information slot is allocated by dividing a frequency resource.
- Korean research and development has suggested BDMA as a radio interface for 5G.

6. Conclusion-

Technology is changing every minute in this fast-moving world, 5G will be the best technology up to date when it comes in play. 5G term is not made official yet by confirming any documents. Though data traffic has tremendous growth potential, under 4G's existing voice centric hierarchies will be moving flat IP architectures where base stations will be directly connected to media gateways. 5G will promote concept of super core, comprising Nano core, cloud computing, ALL-IP network and BDMA. There all network operators are connected to one single core and one infrastructure. 5G technology will include all type of advanced feature which will make 5G most powerful technology in the near future.

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