Research Survey On 5g Wireless Technology

Harshita Vijayvargiya[1], Parveen Kr. Goyal[2]

[1]School of Computer Application, Career Point University, Kota, India,
Email K21545@cpur.edu.in
[2]Assistant Professor School of Computer Application, Career Point University, Kota, India

Abstract- Due to revolutionary development in electronic and communication, mobile and handheld devices become the part of our daily life. As an outcome, the volume of data traffic on the Internet is increasing on a daily basis. The 5G network technology has emerged to provide these devices with infinite, unrestricted, and content-rich services. 5G is an abbreviation for fifth generation wireless technology. As the most recent global wireless standard, 5G replaces the 1G, 2G, 3G, and 4G networks. The 5G wireless technology is briefly discussed in this study.

Keywords: - 5G, Brief of 5G, Evolution of 5G, Need of 5G, Application of 5G

I. INTRODUCTION

Wireless communication first appeared in the early 1970s. In order to survive in the world where in every second the speed changes and where we urge for more and more technology, here comes the fifth generation technology known as 5G. This replaces the 1G, 2G, 3G, and 4G networks as the most recent worldwide wireless standard. With the help of 5G, a brand-new network may be created that connects almost everyone and everything, including machines, objects, and devices.

South Korea already has the first nationwide commercial 5G wireless network in the world thanks to KT Corporation. The nations that are setting the global standard for 5G technology development and deployment are South Korea, China, and the United States. In India, Prime Minister Narendra Modi introduced 5G services on October 1 at the sixth India Mobile Congress (IMC), 2022.

Fourth-generation technologies are the foundation of fifth generation. Most businesses consider potential future demands, innovations, and services that could improve humankind's quality of life. Considering this, 5G plans were developed a decade ago, even before 4G technology was available. The fifth wireless mobile internet networks will support LASCDMA (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. Instead of focusing on faster Internet connection speeds, 5G aims to be more capable than current 4G LTE, supporting more mobile broadband users per area unit and data consumption in gigabytes per second.

II. LITERATURE REVIEW

Sunil Rai (November 2015): - "In this paper, an attempt has been made to review various existing

generations of mobile wireless technology in terms of their portals, performance, advantages and disadvantages."

Ramraj Dangi, Praveen lalwani, Gaurav Chaudhary, Ilsun You, Giovanni Pau (December 2021):
- "In this paper, evaluations in the field of mobile communication technology are presented. In each evolution, multiple challenges were faced that were captured with the help of next-generation mobile networks."

Rupendra Nath Mitra, Dharam P. Agarwal (December 2015): - "This paper provides an inclusive and comprehensive analysis of recent developmental endeavors toward 5G. It highlights salient features, i.e., flexibility, accessibility, and cloud-based service offerings, those are going to ensure the futuristic mobile communication technology as the dominant protocol for global communication."

Mr. Vinayak Pujari, Dr. Rajendra Patil, Mr. Kajima Tambe (April 2021): - "Future 5G wireless networks will aspect new contests, as well as growing claim on network capacity to support a huge number of devices running application necessitating high data rates and always-on connectivity".

Ganesh R. Patil (October 2014): - "The paper throws light on network architecture of fifth generation technology. Currently 5G term is not officially used. The main features in 5G mobile network is that user can simultaneously connect to the multiple wireless technologies and can switch between them."

III. OBJECTIVE

This research is mainly classified into following sections:
1.   Evolution of generation 1G to 5G
2.   How 5G Work?
3.   Application of 5G
4.   Features of 5G
5.   How 5G Better than 4G?
6.   Disadvantages of 5G
7.   Research Group of 5G

IV. METHODOLOGY

A. EVOLUTION OF 1G TO 5G
This section contains a quick review of the various wireless generations.

A.   **First Generation Networks (1G):** Based on analogue technology and functioning identically like a landline phone, the 1G cell phone was introduced between the 1970s and 1980s. In 1G, modulation is performed at higher frequencies, often 150 MHz and above. Since voice calls were played back in radio towers, making them vulnerable to uninvited third-party eavesdropping, it had a low capacity, unstablehandoff, bad voice connectivity, and no security at all.

B.   **Second Generation Networks (2G):** The first digital system for 2G, which offered an improvement over 1G in mobile voice communication, was made available in 1991. In addition, Code-Division Multiple Access (CDMA) and Global System for Mobile (GSM) concepts were also discussed. In 2G,the maximum achievable speed was 1 Mpbs.

C. **Third Generation Networks (3G):** Then, came the introduction of 3rd generation which was established in late 2000. The primary goal of the third generation (3G) system was to successfully combine high-speed mobile access with services based on the Internet Protocol (IP). Wireless web base access, multimedia services, email, and video conferencing are among the key components of 3G technology. Packet switching technology is used to send the data. Depending on mobility/velocity, 3G systems offer high data rates up to 2 Mbps, over 5 MHz channel carrier width, and great spectrum efficiency.

D. **Fourth Generation Networks (4G):** Wireless networks' Fourth Generation (4G) was standardized in 2010**.** The successor to the 3G and 2G standards is sometimes referred to as the Fourth Generation (4G). LTE Advanced is currently being standardized by the 3GPP as the next-generation 4G technology.

   A download speed of 100Mbps is available on 4G. The same functionality as 3G is offered by 4G, along with extra services like Multi-Media Newspapers, clearer TV viewing, and faster data transmission than in earlier generations.

E. **Fifth Generation Networks (5G):** It is Launched in 2020. Faster and reliable than 4G. It is a major phase of mobile telecommunication and wireless system. Expected speed up to 1Gbps and 10 times more capacity than other.

B. HOW 5G WORKS?

The 5G network architecture shows how 5G and 4G may coexist, with local and central servers offering customers quicker content and low latency apps.

The "Radio Access Network" and the "Core Network" are the two fundamental parts of a mobile network.

The Radio Access Network – It consists of a variety of structures, such as tiny cells, towers, masts, and specialized inside-building and domestic systems, which link wireless devices and mobile users to the main core network. Small cells will be a major feature of 5G networks particularly at the new millimeter wave (mm Wave) frequencies where the connection range is very short. To provide a continuous connection, small cells will be distributed in clusters depending on where users require connection which will complement the macro network that provides wide-area coverage.

Multiple input, multiple output antennas, which feature many elements or connections, will be used by 5G macro cells to send and receive more data concurrently. The ability to connect many users to the network at once while maintaining high throughput is advantageous to users.

The Core Network - The mobile exchange and data network is responsible for overseeing all mobile voice, data, and internet connections. The "core network" for 5G is being modified to better interface with the internet and cloud-based applications. Distributed servers are also being added to the network to improve response times (reducing latency).

Network Slicing – It allows for a clever segmentation of the network for a specific sector, business, or application. For instance, emergency services might function separately from ordinary users on a

network slice.

Network Function Virtualization (NVF) - It is the capacity to instantly invoke network operations in the operator's cloud platform at any chosen location. Network operations that previously required specialized hardware, such as a firewall and encryption at commercial locations, can now be performed by software on a virtual machine. NVF is a key technology for a 5G ready core and is essential to enabling the speed, efficiency, and agility to support new commercial applications.
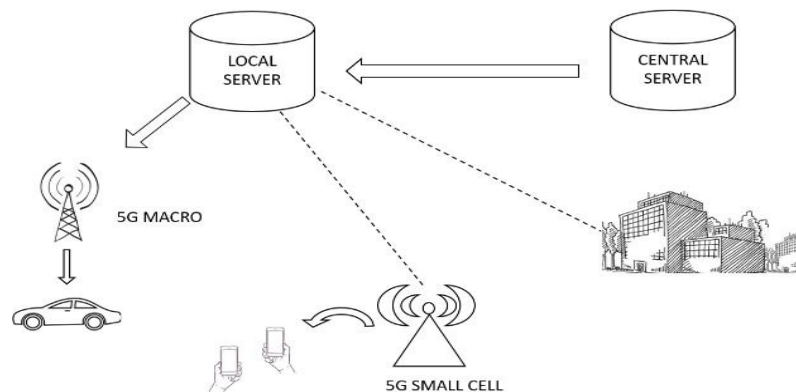
Figure:1 5G NETWORK ARCHITECTURE

The three separate network types that make up the 5G networking architecture will collaborate, but the three tiers of radio transmissions each have unique properties;

Low Band 5G: - Low-frequency spectrum, the best way to think of 5G is as a broad coverage layer. It will be a standard kind of 5G. One low band 5G tower, which transmits on the same frequency originally used for TV broadcasts, can provide service to users over an area of hundreds of square miles, including more remote areas.

Mid Band 5G: - Mid band 5G, which is approximately six times faster than 4G LTE, is probably going to be more prevalent in large American metropolises. In comparison to low band 5G, mid band 5G delivers service in smaller areas, and because mid band allows carriers to utilize more resources, data speeds are faster than for low band 5G.

In terms of performance and proximity to a tower, mid band 5G may prove to be the perfect tier for regular users.

mmWave High Band 5G: - Millimeter wave (mmWave) 5G networks, which are characterized by extremely low latency and are around 10 times quicker than 4G LTE networks, allow messages to transmit practically quickly, although they need to be close to a tower.

Higher data transfer capacities are made possible by 5G networks' usage of broader spectrum bandwidth and higher mmWave frequencies. Additionally, more devices may connect and operate more quickly the larger the spectrum is.

Even at its most fundamental level, 5G can provide faster downloads, better communications, and easier access to information, increasing company efficiency and powering applications in a variety of fields including education, smart cities, and car technology.

V. RESULT & IMPLEMENTATION

A. APPLICATION OF 5G

The applications of 5G are:

1. Wearable Devices with AI Capabilities.
2. Global Network.
3. Voice Over IP (VoIP) Enables Devices.
4. Media Independent Handover.
5. Radio Resources Management.
6. With 6th Sense Technology.

B. FEATURES OF 5G

The features of 5G technology are:

1. High Resolution for Crazy Cell Phone Users.
2. Bi-Directional Large BW.
3. Less Traffic.
4. Downloading Speed of 5G Touching the Peek.
5. Better and Fast Solution.
6. Support Virtual Private Network.
7. More Attractive and Effective

C. HOW 5G BETTER THAN 4G?

There are several reasons that 5G will be better than 4G:

1. Compared to 4G, 5G is substantially quicker.
2. Over 4G, 5G has higher capacity.
3. Compared to 4G, 5G has much less latency.
4. A unified platform with more capabilities than 4G is 5G.
5. 5G uses specialized radio frequencies to accomplish what 4G networks are unable to.

D. DISADVANTAGES OF 5G

Limited Coverage: - The biggest drawback of 5G is that it only has local availability and has patchy worldwide coverage. Only urban areas will see significant benefits from the 5G network, and rural areas may not experience coverage for several years. Furthermore, compared to other networks, the costs associated with installing tower stations are significant.

Week Upload Speed: - Users of mobile phones may guarantee fast download rates thanks to 5G technologies. In contrast, compared to 4G, the upload rates are not greater than 100 Mbps. Better battery technology is also required for mobile phones when using a 5G connection. Many smart

phone users claim that when using 5G, their gadgets get hotter.

Cyber Security Risk: - Another negative aspect of 5G technology is that it makes cybersecurity more vulnerable to attack. The increase in bandwidth makes it simple for thieves to grab the database. Additionally, the software it employs makes it subject to attacks. Attacks are quite likely when 5G connects to more devices**.**

E. RESEARCH GROUP OF 5G

Various research teams are developing 5G standards. These organizations are looking at various technical and standardization-related elements of 5G. Some of the groups are:

METIS: - METIS stands for Mobile and wireless communications Enablers for Twenty-twenty (2020)Information Society). Their research area is "Working 5G Framework".

In order to analyze data rates during peak hours, traffic load per region, traffic volume per user, and actual client data rates, METIS concentrated on RAN architecture. They designed RAN architecture using the findings of simulations, and they published an article on METIS in February 2015.

ETRI: - ETRI stands for Electronics and Telecommunication Research Institute. Their research area is"Device-to-device communication, MHN protocol stack".

ETRI is a Korean research organisation that focuses on enhancing the device-to-device communication,MHN protocol stack, and 5G network stability.

NYU: - NYU stands for New York University Wireless. Their research area is "Millimeter Wave". Research on wireless communication, sensing, networking, and devices is being done at NYU Wireless. New York University is concentrating on creating more compact, lighter antennas with directional beamforming to offer dependable wireless connectivity.

EMPhAtiC: - EMPhAtiC stands for Enhanced Multicarrier Technology for Professional Ad-Hoc and Cell-Based Communications. Their research area is "MIMO Transmission".

In order to build secure communication methods with a synchronicity based on a configurable filter bank and multihop, EMPhAtiC is working on MIMO transmission. Additionally, MIMO-based trans- receiver technology with frequency-selective channels for Filter Bank Multi-Carrier was recently introduced (FBMC).

5G PPP: - Stands for 5G Infrastructure Public Private Partnership. Their research area is "Next generation mobile network communication, high speed Connectivity".

A combined venture by two groups launched the fifth generation infrastructure public partnership initiative (European Commission and European ICT industry). In the future decade, 5G-PPP will offer a variety of standardized designs, solutions, and technologies for the next generation of mobile networks. The fundamental idea behind 5G-PPP is that the European Commission(hopes to contribute to smart cities, e-health, intelligent transportation, education, entertainment, and media through this project.

VI. CONCLUSION

The present and upcoming generations of wireless mobile communication have been covered in this paper. Mobile, fixed, and enterprise wireless applications can all be used using 5G wireless technology, which is a multipurpose wireless network. It has all kinds of cutting-edge features that make it strong and in high demand in the near future. The next-generation wireless mobile internet networks, known as real wireless world, will support 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.

Before 5G is implemented, numerous testing and trials must be carried out. 5G include latest technologies such as cognitive radio, SDR, nanotechnology, cloud computing and based on all IP Platform. The development of 5G technology is still ongoing.

VII. REFERENCES

[1] Sunil Rai, "5G WIRELESS TECHNOLOGY", November 2015 | IJIRT | Volume 2 Issue 6 | ISSN: 2349-6002

[2] Ramraj Dangi, Praveen Lalwani, Gaurav Choudhary, Ilsun You, and Giovanni Pau, "Study and Investigation on 5G Technology: A Systematic Review", National Library of Medicine | 2021 Dec22 | doi: 10.3390/s22010026

[3] Rupendra Math Mitra, Dharam P. Agarwal, "5G mobile technology : A Survey", ICT EXPRESS|Volume 1, Issue 3, December 2015| Pages 132-137

[4] Kelechi G. Eze, Matthew N. O. Sadiku, Sarhan M. Musa, "5G technology: A Primer", IJSET Volume No. 7, Issue No. 7, PP: 62-64

[5] Ganesh R. Patil, "5G Wireless Technology", IJCSMC| Vol. 3, Issue. 10, October 2014| pg.203 – 207

[6] Rohit Mehta in Digital Mehta, "Pros and cons of 5G technology", November 12, 2021, 9:53 PMIST, Tech, TOI

[7] Dr. Amit Sharma. 4g wireless technology and its standards taking consideration evolution of 4g technology. National Journal of Multidisciplinary Research and Development, Volume 3, Issue 1, 2018, Pages 1102-1105

[8] Dr. Amit Sharma. Development of android application services at Arokia and its architecture. National Journal of Multidisciplinary Research and Development, Volume 3, Issue 1, 2018, Pages 1072-1075

[9] Vijay Malav, Dr. Amit Sharma. Effect and benefits of deploying Hadoop in private cloud. National Journal of Multidisciplinary Research and Development, Volume 3, Issue 1, 2018, Pages 1057-1062

[10] Dr. Amit Sharma. Implementing the design of service oriented architecture. National Journal of Multidisciplinary Research and Development, Volume 3, Issue 1, 2018, Pages 1027-1030

[11] L.Dhanabal, Dr. S.P. Shantharajah, "A Study on NSL-KDD Dataset for Intrusion Detection System Based on Classification Algorithms", 2016, International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 6

[12] Wathiq Laftah Al-Yaseen, Zulaiha Ali Othmana, Mohd Zakree Ahmad Nazri, "Multi-Level Hybrid Support Vector Machine and Extreme Learning Machine Based on Modified K-means for Intrusion Detection System", 2015, Expert Systems With Applications

[13] Krishnanjali Magade and Dr. Amit Sharma "Prediction Accuracy On Automating Of Overnight Patient Care" Advanced Engineering Science ISSN: 2096-3246 Volume 54, Issue 02, August, 2022

[14] Mr. Vinayak, Dr. Rajendra Patil, Mr. Kajima Tambe, "Future of 5G wireless system ", Research Gate Special Issues: April 2021.

[15] Mr. Karan Patil, Mrs. Chetna Achar, "THE FUTURE OF 5G WIRELESS SYSTEM", IRJMETS|Volume:04,Issue:5, May-2022