



EVOLUTION OF WIRELESS TECHNOLOGY: 5G

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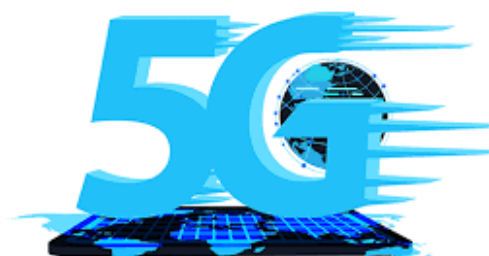
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Abstract: This paper summarizes the main Objectives of the 5G Wireless technology. Here, 5G stands for fifth generation. 5G is the latest technology which evolved from 4G (Fourth Generation). The main aim is to through some light on what 5G: evolution from 4G to 5G, How 5G works, what are the challenges and how to tackle them, benefits etc. 5G is the latest iteration of cellular technology also contains three main features: the higher speed, the lowest idleness and the tendency of connecting lots of devices simultaneously. The expected year of starting the use of 5G technology is 2021.



KEYWORDS: 5G, Evolution from 1G to 5G, Wireless technology.

INTRODUCTION: Through research and innovation, we have seen the growth and advanced significant of wireless technology. Now it's the time when we can simultaneously connect various wireless technologies networks and application. And 5G is the latest technology of wireless system which is the next generation of wireless communication system. 5G is the fifth generation of cellular mobile communications, with evolutionary and revolutionary services, which succeeds the 4G (LTE-A/ WiMAX), 3G (UMTS) and 2G (GMS) system. 5G being the next generation of mobile networking standards, promises to deliver improved end user experience by offering new applications and services through seamless coverage, high data rate, low latency, and significantly improved performance and reliable communications. It will increase energy efficiency, spectrum efficiency, network efficiency also as efficiency of other systems. 5G

enhances the variety & scope of the use cases that LTE is able to minimally address today, and brings new revenue streams to operators by leveraging new solutions that LTE was not able to serve.

Overview of 5G:

- 5G is a chance for policy-makers to empower citizens and businesses. 5G will play a key role in supporting governments and policy-makers in transforming their cities into smart cities, allowing citizens and communities to understand and participate within the socio-economic benefits delivered by an advanced, data-intensive, digital economy.
- 5G is additionally expected to extend data rates dramatically and reduce latency to below 1ms, suited to mission-critical services where data are time-sensitive. Its high-speed capability means 5G networks can provide a variety of high-speed broadband services and offer an alternate

to last-mile access like FTTH or copper connections.

- 5G provides a way to improve end-user experience by offering new applications and services through speeds of GB, and also gives a improve performance and reliability. Wireless operators have the opportunity to move beyond providing connectivity services, and to develop a rich solutions and services for users and industry across a spread of sectors.
- 5G networks will be more faster, more easy to access and more reliable than current 4G wireless technology. This could cause new applications in several areas, like health, transport and entertainment.
- 5G technologies should be introduced to the market by year 2020, which will significantly improve the quality of service to users from point of view data and the expansion of various smart devices. It is expected that the data transfer rates that would exceed 10 gigabytes per second.

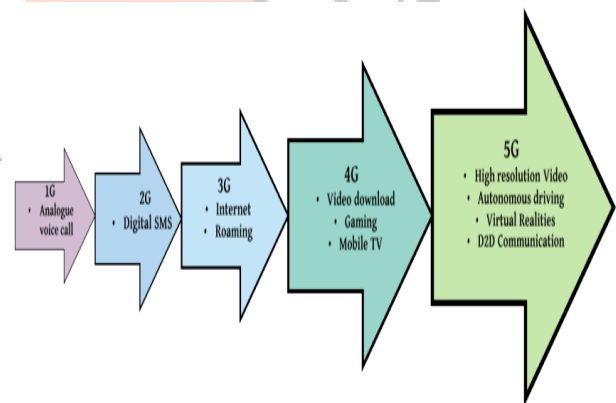
PREVIOUS GENERATIONS:

- **EVOLUTION FROM 1G TO 4G:-** Due to rapid changes in wireless communication it becomes more popular in previous couple of years. This revolution is from 1G-2G, 3G- 4G now looking forward to fifth generation of cellular communication.
- **1G- First Generation:-** 1G was deployed in 1980. First generation was based on analogue system which was known for telecommunication. It introduced cellular technologies like Mobile Telephone System & Advanced Mobile Telephone System (FDMA) Frequency Division Multiple Access technique, at a frequency rate of 150MHZ voice calls were transmitted and between two radio frequency towers works was done
- **2G- Second Generation :-** 2G was invoked in late 1980s. and digital services were used in 2G telecommunication . speed of 2G were 64kbp . the benefits of 2G over 1G cellular communication were devices batteries consumes less power, voice quality was better, data and voice calling was safe. 2G mobile Network system uses Bandwidth between 30 KHz to 200 KHz .

- **3G- Third Generation:-** In 3G ,Packet switching technology were used, Voice calls use to interpret through Circuit Switching. 3G functions at an assortment of 2100x106b b/sec and bandwidth of 15-20x106 b/sec. 3G has the tendency to transfer data in both Voice & Non-Voice over the same network. The Main aim of 3G is to allow for more coverage with minimum investment.

- **4G- Fourth Generation:-** 4G users are enjoying speed of downloading around 100Mbps to 1Gbps. 4G & 3G have almost same features like Online streaming Data which is much faster than previous generations. 4G networks are consider as LTE. The main moto for developing 4G network is to achieve high speed data rate for home internet connections. Important features of 4G : High network capacity, Huge Data rate, and High quality of service, security & privacy .

- **5G-Fifth Generation:-** 4G faces some challenges which are not resolved by it; like spectrum crisis and high energy consumption. This gives the reason for 5G research , which will support IPv6. There have been drastic improvements from 1G, 2G, 3G, and 4G to 5G



Comparative Analysis between different Generations:- Here in this tables we have compare the past, present and future wireless technology with respect to several attributes.

Table 1 shows all the characteristics of comparisons:-

Technology Feature	1G	2G	3G	4G	5G
Start/Deployment	1970-1980	1990-2004	2004-2010	Now	Soon (Probably by 2020)
Data Bandwidth	2kbps	64 kbps	2Mbps	1Gbps	More than 1Gbps
Technology	Analog Cellular Technology	Digital Cellular Technology	CDMA 2000, UMTS, EDGE	WiMAX, LTE	
Service	Mobile Technology (Voice)	Digital Voice, SMS, Higher Capacity	High Quality Audio	Dynamic information Access	
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

How 5G Works

Like other network, 5G networks will also consist of cells, which are divided into sectors and data will send through radio waves. Each cell is connected to a network backbone with the help of a wired or wireless connection. 5G may transmit data over the unlicensed frequencies currently used for Wi-Fi. It provides a smarter, faster, and efficient network. The goal of 5G is to have a much higher speeds in compare to current 4G network, at higher capacity per sec, and at far lower latency than current 4G network. For increasing network efficiency, the cell is divided into two sub micro and pico cells .5G will become a new mobile revolution as it is expected to give gigabit-per-second data rates always. In a 5G wireless network phone will have an IPv6 address depending on the location and network which are being used. 5G uses user-centric network concept World Wide Wireless Web (WWW) instead of operator- centric as in 3G network or service-centric as in 4G network. WWW will be capable of supporting applications and services and interconnected the whole world. 5G also contain the latest

technologies such cognitive radio, Internet of things, nanotechnology, and cloud computing.

ADVANTAGES:-

5G technology has the following advanced features:-

- Architecture of 5G will be device-centric, distributed,
- programmable, and cloud-based
- 5G may Have High data rates
- 5G may have One to 10 Gaps connections to end points
- One millisecond end-to-end round trip delay
- 5G will consume low battery.
- Will have Better connectivity irrespective of location
- Supporting Larger number of devices
- Have Lower cost of infrastructure development

Major technologies enabling 5G include:-

- Direct connectively is achieved by device-to-device (D2D) technology. 5G network will implement D2D mm wave communication technology for providing the high speed data rate, improved coverage, and offer peer-to-peer services.
- As D2D communication targets mobile phone radios, machine-to-machine (M2M) expands the scope and facilitates ubiquitous connectivity among every devices. It is estimated that there will be over 100 billion connecting devices which is using M2M communications in 5G network backbone.
- Multiple-input-multiple-output (MIMO) technology plays an important role in 4G and is expected to play an important function in 5G also. Massive MIMO extracts the benefits of Multiple-input-multiple-output (MIMO) on a large scale by increasing the throughput and spectrum efficiency.
- Other enabling technologies of 5G network also include mmWave communication, ultra-dense network (UDN), all-spectrum access (ASA), OFDM (orthogonal frequency division multiplexing), and Internet of things.

CHARACTERISTICS OF 5G TECHNOLOGIES:-

- The 5G technology provides the high resolution for sharp, passionate telephone a day and provides consumers well shape and fast Internet access.
- The 5G technology provides billing limits beforehand that the more beautiful and successful of the fashionable era. • The 5G technology also allows users of mobile phones, telephone records for printing operations.
- The 5G technology for giant 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 at once .
- The knowledge from the info transfer technology 5G organize a more accurate and reliable results.
- Using remote technology to urge the buyer also can get a 5G comfort and relax by having a far better speed and clarity in less time alone.
- Virtual private network is also supported by 5G wireless technology.
- The uploading and downloading speed of 5G technology touching the height.
- The 5G technology network offering enhanced and available connectivity almost the planet.
- 5G network is very fast and reliable.

APPLICATIONS OF 5G TECHNOLOGIES:-

- It have real wireless world with no more limitation with access and zone issues.
- Wearable devices with AI capabilities.
- Internet protocol version 6(IPv6), where a visiting care-of mobile IP address is assigned consistent with location and connected network.
- One unified global standard.
- Pervasive networks provide an ubiquitous computing: The user can simultaneously connected to many wireless access technologies and seamlessly move between them these access technologies

are often a 2.5G,3G, 4G or 5G mobile networks, Wi-Fi, WPAN or the other future access technology. In 5G, the concept could also be further developed into multiple concurrent data transfer paths.

- Virtual reality/augmented reality/tactile Internet
- Autonomous driving/connected cars
- Wireless cloud-based office/multiple-person videoconferencing
- Unified global standard for all
- Network availability anywhere anytime
- Block chain
- 3D and ultra HD videos
- Smart grid
- Smart surgery and remote medical examination
- Mobile security

Benefits of 5G Networks:-

- High Data Rate :(By means of data rate how fast circuit can handle digital information)
- Battery Saving: (Decrease of energy consumption on user end)
- Money Saving: (Will save money by giving high networking facilities)
- Less Congestion: (Less Congestion on Data traffic)
- More Effective: (Have a good Quality of Service)
- Low Latency: (Fast downloading response)
- Supportive High Speed Multimedia: (like HD Video Calling can be made more easily)
- Clarity in Voice and Audio Calling:
- User will get fast and Better solution through 5G Network.
- Large Broadcasting: (Data travels in GB/s)

Challenges:-

The transition from 4G to 5G presents several transformational challenges which must be tackled to completely realize the 5G vision. There are many types of challenges faced by the new technologies enabling 5G. There also are challenges with the mixing of this technology to supply services in several application scenarios. Some have criticized 5G for its high projected cost which it's incompatible with the previous generations. Just as 2G phones couldn't hook up with 3G or 4G networks, 3G and 4G phones won't hook up with a 5G network users are forced to buy a new phone which is likely to be more expensive than 4G/LTE service. To address these

challenges, we need a drastic change in the design of cellular architecture. 5G system performances have requirements such as small cells, stringent latency, network scalability, very long battery life, and green communications. It is a challenge to satisfy these requirements and minimize costs at the same time. **Conclusion:-**

In this paper, we conclude that 5G network is extremely fast and reliable. Fifth generation is based on 4G technologies. The 5th wireless mobile internet networks are real wireless world. The 5G wireless technology is a multipurpose wireless network for mobile, fixed and enterprise wireless applications. It incorporates all sort of advanced features that creates it powerful and in huge demand in future. Many tests and trials got to be conducted before implementing 5G. 5G technology is still in development stage. It has a bright future and will be a revolution in the mobile Main focus for 5G development will be like Services that will use in future mobile network like Video services & services like M2M devices technology that exchange information and perform actions without the necessity of human's assistance.

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