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5G WIRELESS TECHNOLOGY

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Abstract: Everybody loves speed and speedy internet, so it's no surprise that every major telecom in the world is working to make it even faster. Smartphones, watches, homes, and cars are increasingly requiring stable internet connections. To survive in a world wherein every second the speed changes and where we urge for more and more technology, here comes the fifth generation technology: 5G. In the future, i.e., a world beyond 4G, some of the prime objectives that need to be fulfilled are increased capacity, improved data rate, decreased latency, and quality service. To meet these demands, large-scale improvement in the cellular architecture of 5G is required. This paper emphasizes the 5th generation i.e. 5G cellular network architecture and some of the essential emerging technologies that can prove fruitful in humanizing the architecture and summiting the demands of users. This paper is contented with the details related to 5g with the prime focus on the massive multiple inputs multiple output technology and device-to- device communication (D2D). A general credible 5G cellular network architecture is being proposed with the guideline taken from the internet books and by the detailed study of the topic.

INTRODUCTION

The G in 5G stands for generation. and 5 is the advancement denoted through a number. Wireless phone technology technically entered with 1G, and in the early 1990s, it upgraded to 2G when companies enabled people to send text messages between two cellular devices which fascinated the world. Eventually, the world moved on to 3G, which imparted the liberation of making phone calls, send text messages, and browse the internet at excellent speed.4G enhanced many of the capabilities that were made possible only with the third generation of wireless. People could browse the web at lights speed, send text messages, and can make phone calls, and they could even download and upload large video files without any issues and long waiting. Then companies added LTE, abbr. for long-term evolution, to 4G connectivity. LTE became the fastest and most consistent variety of 4G and it started competing with the technologies like WiMax in the market. Both technologies resulted in similar outcomes, but it was vital to create a standard for everyone to use. LTE did just that, by making 4G technology even faster and this laid the foundation of 5G. 5G will make it easier for people to download and upload Ultra HD and 3D video. So we can say that there is advancement in the speed of living. It would be fascinating to imagine upgrading your data connection from a backyard hose
to a flames hose. The difference will be noticeable and worth appreciable.

The next-generation mobile network alliances define the following pre-requisite for 5G networks:

- Increased Data rates
- 1 Gb per second simultaneously to many workers on the same office floor
- SPECTRAL efficiency more enhanced as compared to 4G
- Coverage speed
- Signaling efficiency enhanced
- Legacy reduced significantly compared to LTE

A new-fangled mobile generation has appeared roughly every 10 years since the first 1G system was introduced, the Nordic mobile telephone in 1982. The first '2G' system commercially came into being in 1992, and the 3G system was started in the year 2001. 4G systems fully compliant with IMT Advanced were first made identical in 2012. The

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development of the 2G (GSM) and 3G (IMT-2000 and UMTS) standards took an extended time of about 10 years from the official initiative of the R&D projects, and thus the development of 4G systems began in 2001 or 2002... The evolution of wireless has been shown in Fig. 1. It depicts the embryonic generations of wireless technologies in provisions of data rate, mobility, network coverage, and spectral competency. As wireless technologies are emerging at a thick range, the data rate, mobility, coverage, and spectral efficiency increase. Even it shows that the 1G and 2G technologies use circuit switching while 2.5G and 3G use together circuit and packet switching whereas the next generations from 3.5G to till now i.e. 5G are using packet switching. Along with these factors, it also clears out the difference between licensed spectrum and unlicensed spectrum. All the budding generations make use of licensed spectrum while Wi-Fi, Bluetooth, and WiMax are using the unlicensed spectrum.

A sequential summary of all the generations has been given below :

1G

1G (or 1-G) refers to the very first generation of wireless telephone technology (mobile telecommunication). The 1st generation was announced in the initial 1980s. With a data rate up to 2.4kbps. The subscribers were Advanced Mobile Phone System (AMPS), Nordic Mobile Telephone (NMT), and Total Access Communication System (TACS). The setbacks of the first generation were below par capacity, reckless handoff, inferior accent associations, and with no safety measures, since audio calls were accumulated and played in radio towers due to which weakness of these calls from not so needed connections
i.e. noises from the third party increases. The main difference between the two mobile network systems (1G and 2G), is the medium of encoders i.e. The radio signals which 1G networks use are analog, while 2G networks are digital. We are aware of the fact that both the systems use digital signaling to connect the radio towers (which pay attention to the handsets) to the rest of the telephonic networks, the tone of the voice itself during a call is programmed to digital signals in 2G whereas when we are talking about 1G, its modulation is done and that too on a higher frequency, classically 150 MHz and up. This inherited advantage of digital over that of analog resulted in the replacement of 1G over 2G

2G

2G (or 2-G) is short-term for second-generation wireless telephone technology. The three key benefits of 2G networks over their predecessor's generations were that:

- phone conversations were digitally encrypted;
- 2G systems were considerably more competent on the spectrum allowing greater mobile phone penetration levels.
- 2G introduced data services and gave rise to SMS text messages.

2G technologies enabled the various mobile phone networks with the services such as picture messages, text messages, and MMS (multimedia messages) All text messages sent over 2G are digitally encrypted as said above, allowing for the transfer of data in such a way that only the intended receiver can receive and read it i.e. more advanced than the 1G in terms of privacy.

2.5G

It is generally a 2nd generation cellular system subscription combined with General Packet Radio Services i.e. GPRS and other amenities which doesn't commonly endow in 2G or 1G network. It can get high with a data rate of up to 144kbps system frameworks, but it applies both packet switching and circuit switching. GPRS, Enhanced Data Rate for GSM Evolution mainly known as EDGE, and Code Division Multiple Access i.e. CDMA 2000 were the man 2.5G technologies.

3G

Then, came the introduction of the 3rd generation which was established in late 2000. It imparts the world with a transmission rate of up to 2Mbps. The main purpose of the Third generation (3G) system was to merge high-speed mobile access to services based on Internet Protocol (IP) and it was accomplished. Aside from transmission rate, avant-garde improvement was made for maintaining QoS. Supplementary facilities like global roaming and improved audio quality made 3G a noteworthy and qualitative generation. The major annoyance for 3G handsets is that they grab more

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power than most 2G models. Looking from the market point of view, 3G network plans are more expensive than 2G. 3G involves the utilization of Wideband Code Division Multiple Access i.e. WCDMA, Universal Mobile Telecommunications Systems (UMTS), and Code Division Multiple Access (CDMA) 2000 technologies, along with the introduction of the evolving technologies like High-Speed Uplink/Downlink Packet Access (HSUPA/HSDPA) and Evolution-Data Optimized (EVDO) which has made intermediate wireless. 3G telecommunication networks prop up services that offer an information transfer rate of at least 200 kb/sec. The generation between 3G and 4G named 3.5G provides an improved data rate of 5-30 Mbps

3.75G

Long-Term Evolution technology (LTE) and Fixed Worldwide Interoperability for Microwave Access (WiMAX) is the outlook of mobile data services. LTE and Fixed WiMAX have the potential to complement the capability of the network. It also provides a substantial number of users, the facility to access a broad range of high-speed services approximating on stipulate video, peer-to-peer le sharing, and fused Web services.

4G

4G is the fourth generation (4th) of wireless mobile telecommunication technology, succeeding 3G and even more fascinating. A 4G system must provide capabilities defined by ITU in IMT. Advance 4G is generally referred to as the progeny of the 3G and 2G standards. Presently, the standardization of Long Term Evolution (LTE) advanced as forthcoming 4G standards along with Mobile Worldwide Interoperability for Microwave Access commonly called WIMAX is done by 3rd generation partnership project (3GPP). A 4G system improves the customary communication networks by imparting complete and reliable solutions based on IP. Facilities like voice, data, and multimedia will be given to the users every time and everywhere basis and at quite elevated data charge as related to earlier generations. Applications that use a 4G network are Multimedia Messaging Service (MMS), Digital Video Broadcasting (DVB), and video chat, High Definition TV content, and mobile TV.

5G

Huge consortiums of major global telecoms are already working to create worldwide values around 5G. Although most of those standards don't get solidified, experts yet expect it to be more compatible (with 4G and 3G) in addition to having some interoperability across the world. With an increment, in the demand of the users exponentially, 4G can now be easily replaced with 5G with a new advanced access technology named Beam Division Multiple Access i.e. BDMA and or Filter Bank multi-carrier abbr. as FBMC multiple access. The concept behind BDMA techniques can be explained by considering the case of the base station communicating with the mobile stations. An orthogonal beam is owed to each mobile station and by BDMA technique we can split that antenna beam according to locations of the mobile stations for openhanded multiple accesses to the mobile stations, which likewise increase the competency of the system and thus is the main process of this communication. An idea to swing towards 5G is based on present drifts; it is commonly assumed that 5G cellular networks can tackle six obstacles that are not well addressed by 4G i.e.

1: Higher capacity, 2: data rate higher,

3: End to End latency has been lowered, 4: connectivity to the massive device,

5: reduced cost

6: consistent Quality

5G Technology stands for 5th generation mobile technology. 5G denotes the next major phase of mobile telecommunication standards beyond the upcoming 4G standards. 5G technology is offering the service in Product Engineering, Documentation, supporting electronic transactions, etc. As the customer becomes more and more aware of the mobile phone technology, he or she will look for a decent package all together including all the advanced features a cellular phone can have. Hence the search for new technology always the main motive of the leading cell phone giants to out-innovate their competitors. Thegoal of a 5 G-based telecommunication network would ideally answer the challenges that a 4G model would present once it has entered widespread use.

Wireless systems using orthogonal frequency division multiplexing (OFDM) with wide area coverage, high throughput at millimeter waves (10 mm to 1 mm) covering a frequency range of 30 GHz to 300 GHz, and enabling a 20 Mbps data

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rate to distances up to 2 km. The millimeter-wave band is the most effective solution to the recent surge in wireless Internet usage. These specifications are capable of providing wireless world wide web (WWWW) applications.

The WWWW allows a highly flexible network (flexible channel bandwidth between 5 and 20 MHz, optimally up to 40 MHz), and a dynamic ad-hoc wireless network (DAWN). This technique employs intelligent antennae (e.g., switched beam antennae and adaptive array antennae) and the flexible modulation method, which helps in obtaining bidirectional high bandwidth, i.e., transfer of a large volume of broadcasting data in gigabytes, sustaining more than 60,000 connections and providing 25 Mbps connectivity. Users of 5G technology can download an entire film to their tablets or laptops, including 3D movies; they can download games and avail of remote medical services. With the advent of 5G, Piconet and Bluetooth technologies will become outdated. The 5G mobile phones would be akin to tablet PCs, where you

could watch TV channels at HD clarity without any interruption.

FEATURES

Features of 5G Technology:

- 5G technology offer a high resolution for crazy cell phone user and bi-directional large bandwidth
- Shaping
- The advanced billing interfaces of 5G technology make it more attractive and effective.
- 5G technology also providing subscriber supervision tools for fast action.
- The high-quality services of 5G technology based on Policy to avoid an error.
- 5G technology is providing large broadcasting of data in Gigabit which supporting almost 65,000
- 5G technology offers a transporter class gateway with unparalleled consistency.
- The traffic statistics by 5G technology makes it more accurate.
- Through remote management offered by 5G technology, a user can get a better and fast solution.
- Remote diagnostics also a great feature of 5G technology.
- The 5G technology is providing up to 25 Mbps connectivity speed.
- The 5G technology also support virtual private network.
- The new 5G technology will take all delivery service out of the business prospect
- The uploading and downloading speed of 5G technology touching the peak.

5th generation technology offers a wide range of features, which are beneficial for all groups of people including, students, professionals (doctors, engineers, teachers, governing bodies, administrative bodies, etc.), and even for the common man.

IMPORTANT ADVANTAGES

- High resolution and bi-directional large bandwidth shaping.
- Technology to gather all networks on one platform.

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- More effective and efficient.
- Technology to facilitate subscriber supervision tools for quick action.
- Most likely, will provide huge broadcasting data (in Gigabit), which will support more than 60,000 connections.
- Easily manageable with the previous generations.
- Technological sound to support heterogeneous services (including private network).
- Possible to provide uniform, uninterrupted, and consistent connectivity across the world.

5G CELLULAR NETWORK ARCHITECTURE.

There are several obstacles in the way for 5G designers. One of the most vital challenges is the physical paucity of radio frequency (RF) spectra owed for cellular communications. Moreover, these frequency spectra have been profoundly used, and there is no more auxiliary in the existing cellular bands. A further challenge is the operation of advanced wireless technologies comes at the tag of high energy consumption. Toting up to environmental concerns, it has been seen and reported by cellular operators that the energy which is consumed by the base stations contributes to over 70% of their electricity bill. To study the 5G network in the market now, it is clear that the multiple access techniques in the network are almost at a halt and requires sudden upgrading. Current technologies like OFDMA are reported to work at least for the next 50 years. Furthermore, there is no need for technology change. The wireless setup had come about from 1G to 4G. Alternatively, the addition of an application, or we can say amelioration done at the elementary network for pleasing the user requirements is provoking the package providers to drift for a 5G network as soon as 4G is commercially set up. However, there was a wide agreement on the fact that as compared to the 4G network, the 5G network should achieve the below benefits over it:

- 1000 times the system capacity
- 10 times the spectral efficiency
- Energy efficiency
- Data rate.
- 25 times the average cell throughput.

EMERGING TECHNOLOGIES FOR 5G WIRELESS NETWORKS:

In the next decade, it is expected that mobile and wireless traffic volume will increase a thousand-fold and this eventually will be obsessed by the anticipated 50 billion or much more connected devices connected to the cloud by 2020. Improving energy efficiency, increasing capacity, cost, and spectrum utilization as well as offering better stability and scalability for handling the escalating number of connected devices are the remedial measures taken against various challenges when there is a rapid increase in the number of connected devices. Today the world is upgrading at the lights speed and we rely more and more on technology through which we can communicate speedily and for this, the overall technical aim is to provide a system idea that supports:

- ❖ Increment in data volume per area by 1000 times
- ❖ The number of connected devices should beincreased by10 to 100 times
- ❖ 10 to 100 times increased typical user data rate

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- extended battery life up to 10 times for low power Massive Machine Communication i.e. MMC devices

- Also, 5 times reduced End-to-End i.e. E2E latency

CONCLUSION

In this paper, a comprehensive review has been done on the recital necessities of 5th Generation wireless cellular communication systems that have been denied in requisites of data rate, spectral efficiency, latency, capacity, energy efficiency, and Quality of service. In this paper, 5G wireless network architecture has been detailed along with massive MIMO technology, network function virtualization (NFV) cloud, and device-to-device communication. In terms of better quality in future and increased data rate for the inside users and at the corresponding time reduces the pressure from the outside base station, certain short-range communication technologies, like Wi-Fi, Small cell, Visible light communication (VLC), and millimeter-wave communication (MVC) technologies, has been explained. Some key promising technologies and the upcoming generation step by step have also been discussed fully the credible routine desires, like huge MIMO and Device to Device communication (D2D) is fastidious and intervention management, multi-radio access technology ultra-dense networks, full-duplex radios, millimeter-wave communication (MVC) and Cloud Technologies in general with radio access networks, spectrum allocation with cognitive radio and software-defined networks.

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