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Advanced Feature & Future of Wireless Networks - 5G

Elayaraja Ponram[1], Ramakrishna Naidu[2]

Consultant[1&2]

Microsoft[1], Capgemini[2]

Hyderabad-India

ABSTRACT

This paper presents about the advanced futures of Wireless Networks called 5th Generation Network. 5G is the evolution of existing standards and complementary of new technologies. Also this paper describes about the history of existing generation of networks and what are all the research and development process going for the next generation of Network communications. 5G system will not be a single technology but rather a combination of integrated RATs [radio access technologies], including evolved versions of LTE and HSPA [high-speed packet access], as well as specialized RATs for specific use cases." Mobile communication has become more popular in last few years due to fast revolution in mobile technology. This revolution is due to very high increase in telecoms customers. This revolution is from 1G- the first generation, 2G- the second generation, 3G- the third generation, and then the 4G- the fourth generation,5G-the fifth second generation.

Keywords:- 5G, 4G, LTE, HSPA+, 3G, Network, Data Transfer

I. INTRODUCTION

The current bandwidth of network features is not enough for the current trends and technology. As per **Wikipedia Information,** 5th generation mobile networks or 5th generation wireless systems denotes the next major phase of mobile telecommunications standards beyond the current 4G/IMT-Advanced standards. 5G is also referred to as beyond 2020 mobile communications technologies. 5G does not describe any particular specification in any official document published by any telecommunication standardization body. Although updated standards that define capabilities beyond those defined in the current 4G standards are under consideration, those new capabilities are still being grouped under the current ITU-T 4G standards.

Based on the above observations, some sources suggest that a new generation of 5G standards may be introduced approximately in the early 2020s. However, still no international 5G development projects have officially been launched, and there is still a large extent of debate on what 5G is exactly about. Prior to 2012, some industry representatives have expressed scepticism towards 5G but later took a positive stand. [Citation needed]

New mobile generations are typically assigned new frequency bands and wider spectral bandwidth per frequency channel (1G up to 30 kHz, 2G up to 200 kHz, 3G up to 20 MHz, and 4G up to 100 MHz), but sceptics argue that there is little room for larger channel bandwidths and new frequency bands suitable for land-mobile radio. From users' point of view, previous mobile generations have implied substantial increase in peak bitrate (i.e. physical layer net bitrates for short-distance communication), up to 1 Gb it/s to be offered by 4G.

Fig 1. Current Network

II. CURRENT NETWORK

The most obvious advantage of the 4G mobile network is its amazing speed. Increased bandwidth leads to much faster data transfer speed, which is especially advantageous for mobile devices. Users of the 4G network get the advantage of superior, uninterrupted connectivity, especially for advanced tasks such as video chats and conferences. Considering the younger generation of mobile device users, they can stream music, videos and movies at a much faster rate than ever before and can also easily share information online.

Internet connectivity on mobile devices is now more of a necessity than a luxury. More and more mobile device users are constantly using their gadgets to connect to the Internet and stay online for very long periods of time. Considering this scenario, the latest 4G mobile network seems to be the answer for every mobile device owner. However, 4G connectivity is not without its downsides.

4G Drawbacks:

Though the concept of 4G mobile networks is steadily gaining popularity, connectivity is still limited to certain specified carriers and regions. Of course, the number of cities that have 4G coverage is increasing by the day. However, it would take its own time for this network to be available in all the major cities of the world.

Though the hardware compatible with 4G networks is available at much cheaper rates today than earlier,

the fact remains that this new equipment would necessarily have to be installed in order to supply these services. This would prove to be a cumbersome process for most mobile carriers planning to launch these services.

Since 4G mobile technology is still fairly new, it will most likely have its initial glitches and bugs, which could be quite annoying for the user. Needless to say, these teething troubles would be sorted out in due course of time, as well as with increase in network coverage.

4G mobile networks use multiple antennae and transmitters and hence, users would experience much poorer battery life on their mobile devices, while on this network. This would mean that they would have to use larger mobile devices with more battery power, in order to be able to stay online for longer periods of time.

Users would be forced to make do with 3G or WiFi connectivity in the areas that do not yet have 4G mobile network coverage. While this is a problem in itself, the worse issue is that they would still have to pay the same amount as specified by the 4G network plan. This loophole has already resulted in many disgruntled customers. This situation can only be resolved once mobile carriers expand their 4G network coverage to include more regions.

III. 5G R&D PROJECTS

- In 2008, the South Korean IT R&D program of "5G mobile communication systems based on beam-division multiple access and relays with group cooperation" was formed.
- In 2012 the UK Government announced the setting up of a 5G Innovation Centre at the University of Surrey – the world's first research Centre set up specifically for 5G mobile research
- In Europe, Neelie Kroes, the European Commissioner, committed in 2013 50 million euros for research to deliver 5G mobile technology by 2020. In particular, The METIS 2020 Project is driven by a car

manufacturer and several telecommunications companies, and aims at reaching world-wide consensus on the future global mobile and wireless communications system. The METIS overall technical goal is to provide a system concept that supports 1000 times' higher mobile system spectral efficiency as compared with current LTE deployments. In addition, in 2013 another project has started, called 5GrEEn, linked to project METIS and focusing on the design of Green 5G Mobile networks. Here the goal is to develop guidelines for the definition of new generation network with particular care of energy efficiency, sustainability and affordability aspects.

- On 8 October 2012, the UK's University of Surrey secured £35M for new 5G research Centre, joint funded between the British government's UK Research Partnership Investment Fund (UKRPIF) and a consortium of key international mobile operators and infrastructure providers –including Huawei, Samsung, Telefonica Europe, Fujitsu Laboratories Europe, Rohde & Schwarz, and Aircom International– it will offer testing facilities to mobile operators keen to develop a mobile standard that uses less energy and radio spectrum whilst delivering faster than current 4G speeds, with aspirations for the new technology to be ready within a decade.
- On 1 November 2012, the EU project "Mobile and wireless communications Enablers for the Twenty-twenty Information Society" (METIS) starts its activity towards the definition of 5G. METIS intends to ensure an early global consensus on these systems. In this sense, METIS will play an important role of building consensus among other external major stakeholders prior to global standardization activities. This will be done by initiating and addressing work in relevant global fora (e.g. ITU-R), as well as in national and regional regulatory bodies.
- In February 2013, ITU-R Working Party 5D (WP 5D) started two study items: (1) Study on IMT Vision for 2020 and beyond, and; Study

on future technology trends for terrestrial IMT systems. Both aiming at having a better understanding of future technical aspects of mobile communications towards the definition of the next generation mobile.[citation needed]

- On 12 May 2013, Samsung Electronics stated that they have developed the world's first "5G" system. The core technology has a maximum speed of tens of Gbit/s (gigabits per second). In testing, the transfer speeds for the "5G" network sent data at 1.056 Gbit/s to a distance of up to 2 kilometres. With the use of an 8*8 MIMO.
- In July 2013, India and Israel have agreed to work jointly on development of fifth generation (5G) telecom technologies.
- On 1 October 2013, NTT (Nippon Telegraph and Telephone), the same company to launch world first 5G network in Japan, wins Minister of Internal Affairs and Communications Award at CEATEC for 5G R&D efforts
- On 6 November 2013, Huawei announced plans to invest a minimum of $600 million into R&D for next generation 5G networks capable of speeds 100 times faster than modern LTE networks.[34]
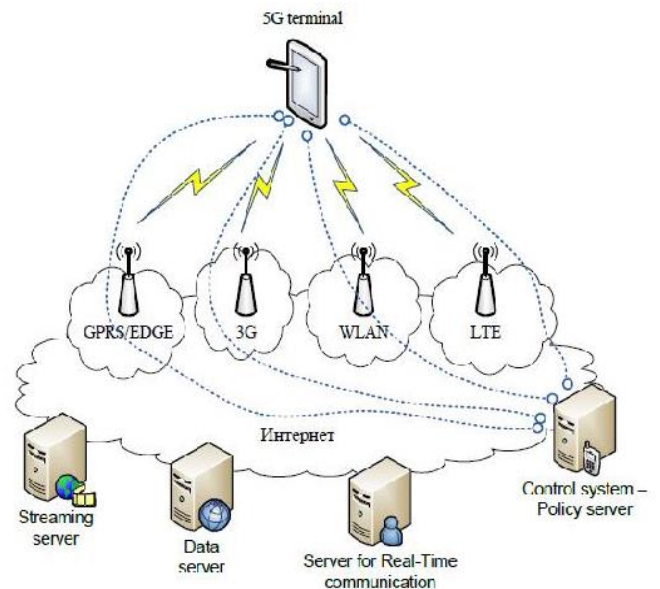
IV. 5G ARCHITECTURE

Fig 2. 5G Architecture

5G OSI Layers:

Fig 3. 5G Architecture OSI Layers

V. EVOLUTION OF NETWORK GENERATION:

Fig 4. Evolutions of Network 1G to 5G

Right now, there are no 5G phones and devices to use the new technology, although manufacturers like Samsung, LG, and HTC are experimenting with new designs. No one knows for sure what features a 5G phone or device will have. In addition, companies like Netflix will have to decide whether they want to make their data available at 5G speeds, so there are a lot of variables affecting the future of mobile technology.

While the specifics are unclear, the 5G concept is mind-boggling and complex. Once implemented worldwide, mobile industry experts say the network will have space for over 7 trillion connected devices in the coming decade—and each individual will have at least 10 connections, including smartphones, tablets and smart appliances. The 2G network focused on voice, 3G on data, and 4G on video; the new 5G network will be all about connections.
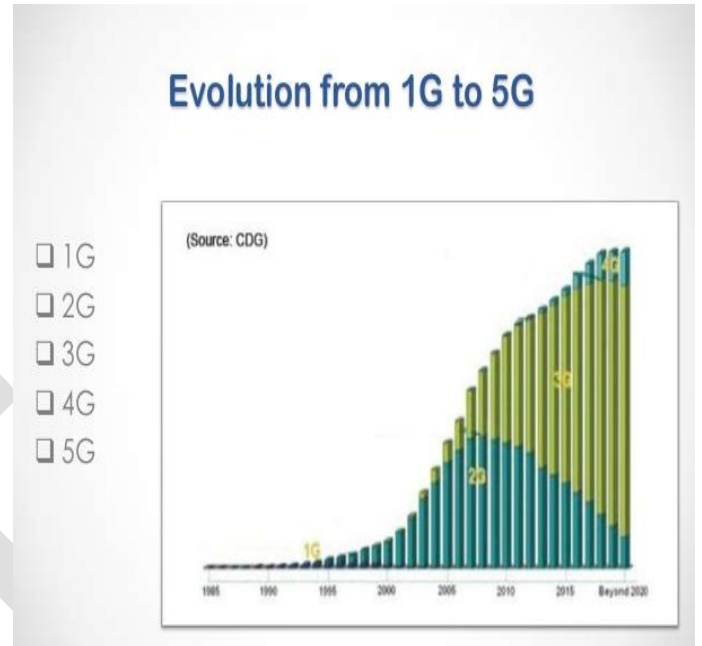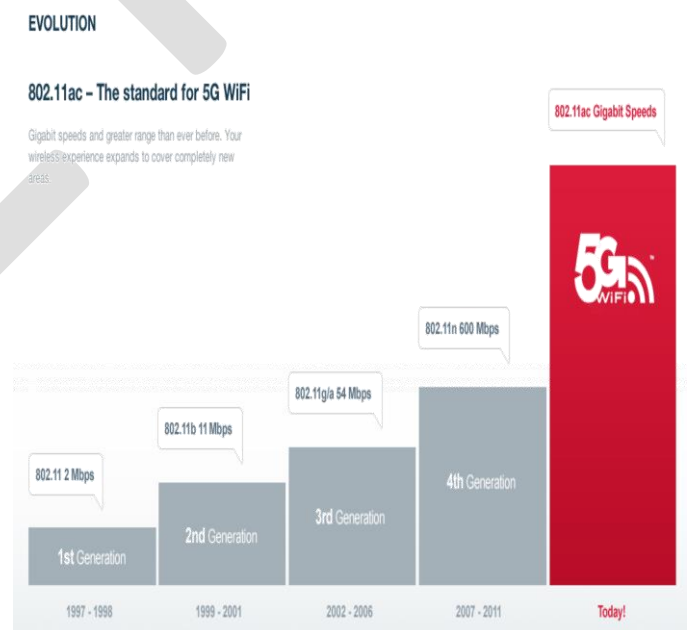
1G	2G	3G	4G	5G
• Developed in 1980s and completed in early 1990s	• Developed in 1980s and completed in late1990s	• Developed between late 1990s & early present today	• Developed in 2010	• Next Major Phase of mobile telecommunication and mobile system
• it is based on analog system	• It is based on digital system	• Transmission speed from 125 kbps to Superior voice Quality	• Faster and more reliable	• 10 time more capacity than others
• Speed up to 2.4 kbps	• Speed up to 64 kbps	• Good clarity in video conference	• Speed up to 100 Mbps	• Expected speed up to 1GBps
• Allows user to make voice calls in 1 country	• 2G are the handset	• E-mail, PDA, Information Surfing, Online Shopping/Banking, Games, etc.	• High performance	• More faster and reliable than 4G
	• we were using earlier, with 2.5G having more capabilities		• Easy Roaming	• Lower cost than previous generation
			• Low cost	

5G Performance:

It's impossible to know yet how 5G technology will affect mobile phone and data rates, but South Korea's Minister of Engineering, Science and Technology estimates that private companies will spend over \$300 billion in 5G infrastructure and technology over the coming decade to take 5G worldwide, and competition will be fierce. Data prices have continuously fallen over the past decade, from about 46 cents per megabyte in 2008 to between 2 and 3 cents currently. Industry watchers say that a successful 5G network would provide 50 gigabytes of data per person per month.

Developing 5G Networks:

South Korea recently announced a \$1.5 billion investment in 5G infrastructure upgrades, and intends to roll out a limited trial network by 2017, with full availability by 2020. South Korea is an ideal testing ground for mobile technology, given its dense, compact geography and mobile phone usage: Nearly 80 percent of the general population – including 97.7 percent of 18-24 year olds — use smartphones. The United States, Japan, and the EU are also testing 5G technology, but South Korea's investment and commitment dwarfs other efforts.

A super-efficient mobile network that delivers a better performing network for lower investment cost. It addresses the mobile network operators pressing need to see the unit cost of data transport falling at roughly the same rate as the volume of data demand is rising. It would be a leap forward in efficiency based on the IET Demand Attentive Network (DAN) philosophy

A super-fast mobile network comprising the next generation of small cells densely clustered together to give a continuous coverage over at least urban areas and gets the world to the final frontier for true "wide area mobility". It would require access to spectrum under 4 GHz perhaps via the world's first global implementation of Dynamic Spectrum Access.

A converged fibber-wireless network that uses, for the first time for wireless Internet access, the millimetre wave bands (20 – 60 GHz) so as to allow very wide bandwidth radio channels able to support data access speeds of up to 10 Gb/s. The connection

essentially comprises "short" wireless links on the end of local fibber optic cable. It would be more a "nomadic" service (like Wi-Fi) rather than a wide area "mobile" service.

VI.   COMPARISON OF ALL GENERATIONS OF MOBILE TECHNOLOGIES

Technology → Features ↓	1G	2G	3G	4G	5G
Start/ Deployment	1970 – 1980	1990 - 2004	2004-2010	Now	Soon (probably 2020)
Data Bandwidth	2kbps	64kbps	2Mbps	1 Gbps	Higher than 1Gbps
Technology	Analog Cellular Technology	Digital Cellular Technology	CDMA 2000 (1xRTT, 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

Features of 5G Technology:

- 5G technology offer high resolution for crazy cell phone user and bi-directional large bandwidth
- Shaping
- The advanced billing interfaces of 5G technology makes 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 error.
- 5G technology is providing large broadcasting of data in Gigabit which supporting almost 65,000
- Connections.
- 5G technology offer 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 better and fast solution.
- The 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 business prospect
- The uploading and downloading speed of 5G technology touching the peak.
- The 5G technology network offering enhanced and available connectivity just about the world

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VII. CONCLUSION

4G mobile networks, though advantageous, also comes with its disadvantages. While this technology is evolving speedily, it would still take its time to emerge as the most popular network. Mobile carriers and users interested in investing in 4G would do well to analyse and understand its pros and cons before adopting in this new technology.

Ultimately, 5G is about the way networks interrelate and the customer experience they deliver. To that end, a network must be designed with the future in mind, as a loosely affiliated grouping of provider partners whose hardware can be dynamically utilized through virtualization technologies, which is why a holistic software-defined networking (SDN) strategy is paramount. Similarly, heterogeneous networks, or HetNets, must be fully ironed out, and new access technologies like Wi-Fi and satellite must be carrier grade. By making the correct investments now, mobile service providers can both roll out 4G LTE and pave the way for the 5G future.

3G- Operation Centric, 4G-Service Centric whereas 5G-Useer Centric. we have proposed 5g

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wireless concept designed as an open platform on different layers The new coming 5G technology will be available in the market at affordable rates, high peak future & much reliability than preceding technologies

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