

5G Wireless Mobile Technologies

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Abstract: The 4G technology has been deployed in so many countries but have some issues related to spectrum & energy consumption. 5G is the name being to the next generation (4G) of the wireless network which can solve the issues like spectrum & energy consumption. 5G gives faster data rate. It is very useful in various consumer & industrial applications. Standardization of 5G network is a great challenge in front of many cellular networks nowadays. There are already multiple groups working to come up with standards around interoperability, backward compatibility with older technologies (4G, 3G). The main features in 5G mobile network is that user can simultaneously connect to the multiple wireless technologies and can switch between them. Radio technologies have evidenced a rapid & multidirectional evolution with the launch of the analogue cellular systems in 1980s. Thereafter, digital wireless communication systems in 1980s with the commencement of TDMA & FDMA Cellular Networks.

Keywords: 5G Architecture, Evolution from AMPS to LTE, Comparison of all Generations wireless communication standards, the Bridge between 4G & 5G, Need for 5 G.

I. Introduction

In the coming four decades mobile network uses 1G to 5G technology. The 5th generation technology offer very high bandwidth that user never experienced before. Compared to the 4th generation, the 5th generation wireless technology having advantage like system capacity, spectral efficiency, energy efficiency & data rate. The 5G technology have some additional features like due to which they can support software & consultancy. The high connectivity in 5G technology can be achieved using the router & the switch. All wireless and mobile networks implements all- IP principle, it means that the transfer of data takes place via IP (Internet Protocol) on network layer. Some more additional features are also in 5th Generation technology like camera, MP3 recording, video player, large phone memory, audio player etc. The fifth generation wireless mobile multimedia internet networks can be completely wireless communication without limitation that makes the perfect wireless real world (WWW). The 5th generation is based on the previous technology i.e. 4G technology. The 5 G wireless mobile internet networks are real wireless world which is dependent on LAS CDMA, OFDM (Orthogonal frequency division multiplexing).

II. Evolution

In the recent few years the mobile technology becomes the most popular & this is possible due to the huge number of customers in telecom. Now we will discuss the 1G to 5G technology revolution.

A. First Generation(1G)

1G cellular system which is also known as AMPS was a completely analog cellular system. It introduces mobile technologies such as Mobile Telephone System (MTS), Advanced Mobile Telephone System (AMTS), Improved The The analog radio signal are used by IMTS & PTT for 150 MHz, & the voice call modulation is done using a technique called Frequency-Division Multiple Access (FDMA). It has low capacity, unreliable handoff, poor voice links, and no security at all since voice calls were played back in radio towers, making these calls susceptible to unwanted eavesdropping by third parties [3].

B. Second Generation(2G)

Second generation is based on the GSM. In Finland it was launched in 1991 & it is based on the digital signal. Its speed is about 64 kbps. In 2G the following features are included, like text, picture, MMS. It provides better quality and capacity. Combined with 3G it can also be known as Cellular technology. It is sometimes described as

2G Cellular

C. Third Generation(3G)

The third generation 3G Technologies was introduced in year 2000. Compare to the 2G technology in 3G, data speed increases to 144 kbps to 2 mbps. Again its bandwidth increases as compared to the 2G technology.

D. Fourth Generation(4G)

Fourth generation 4G has additional features like increased data rate upto 20 mbps in order to achieve the current standards. Multicarrier code division multiple access, Ultra wide band, Network, local multi point distribution service, and IP version 6. The 5th generation technology gives a very high data capabilities & unrestricted voice call, & unlimited data broadcast together within the latest mobile technology. Fifth generation should make an important difference and add more services and benefits to the world over 4G. The 5th generation technology is the most intelligent technology that connects the whole world without any conditions. We are expecting 5G around 2020. The entire world can access the information without any interruption.

III. 5G Network Architecture

Fifth generation mobile systems model is all-IP based model for wireless and mobile networks interoperability. AIPN uses packet switching and its continuous evolution provides optimized performance and cost. In fifth generation Network Architecture consist of a user terminal (which has a crucial role in the new architecture) and a number of independent, autonomous radio access technologies (RAT)[1]. In 5G Network Architecture all IP based mobile applications and services such as Mobile portals, Mobile commerce, Mobile health care, Mobile government, Mobile banking and others, are offered via Cloud Computing Resources (CCR). Cloud computing is a model for convenient on-demand network access to configurable computing resources (e.g., networks, servers, storage, applications, and services). Cloud computing lead consumers to use applications without installation and Access their personal data at any computer with internet access. CCR links the Reconfigurable Multi Technology Core (RMTC) with remote reconfiguration data from RRD attached to Reconfiguration Data models (RDM). The main challenge for a RMTC is to deal with increasing different radio access technologies. The core is a convergence of the nanotechnology, cloud computing and radio, and based on All IP Platform. Core changes its communication functions depending on status of the network and/or user demands. RMTC is connected to different radio access technologies ranging from 2G/GERAN to 3G/UTRAN and 4G/EUTRAN in addition to 802.11x WLAN and 802.16x WMAN. Other standards are also enabled such as IS/95, EV- DO, CDMA2000 etc. Interoperability process- criteria and mechanisms enable both terminal and RMTC to select from heterogeneous access systems [6].

WHY NEED OF 5G?

The 5G technology having some additional features due to which we need the 5G. The features are like- Provide high resolution & bidirectional bandwidth.

Advanced billing interfaces.

Provide subscriber supervision tools for fast action. The 5G technology provides up to 25 MBPS speed. It provides the remote diagnostics.

Another example was given to us by EE's Sutton, who said that 5G's prospective ultra-low-latency could range between 1ms and 10ms

LTE-Advanced: The Bridge between 4 G and 5 G

LTE Advanced or LTE-A is the evolution of the original LTE technology toward even higher bandwidths. LTE-A promises nearly three times greater speed than the basic LTE network and comprises of the following five building blocks:

1. Carrier Aggregation
2. Massive MIMO
3. CDMA and SC-FDMA access
4. Peak data rates
5. Heterogeneous Network or HetNet

Here, it's worth noting that while LTE-A standard creates a bridge between 4G and 5G worlds, in many ways, the notion of HetNet is serving as glue between LTE-A and 5G worlds. That's why many wireless industry observers call 5G wireless an enhanced form of LTE-A. That makes sense because the main concept behind 5G systems is to expand the idea of small cell network to a whole new level and create a super dense network that will put tiny cells in every room.

Enter 5G

The Next Generation Mobile Networks (NGMN) Alliance defines 5G as below:

We are expecting 5G to come by 2020 but many companies are investing to prepare for the new mobile standards.

Essentially, LTE-A is the foundation of the 5G radio access network (RAN) below 6 GHz while the frequencies from 6 GHz to 100 GHz will explore new technologies in parallel. Take MIMO, for instance, where 5G raises the bar to Massive MIMO technology, a large array of radiating elements that extends the antenna matrix to a new level— 16×16 to 256×256 MIMO—and takes a leap of faith in wireless network speed and coverage.

The All-IP Network (AIPN) is capable to take care of the increasing demands of today's mobile subscriber to avail the available radio spectrum. It is commonly used radio access technology these days.

5G technology offers Global access and service portability. It offers the high quality services due to high error tolerance.

It is providing large broadcasting capacity up to Gigabit which supporting almost 65,000 connections at a time.

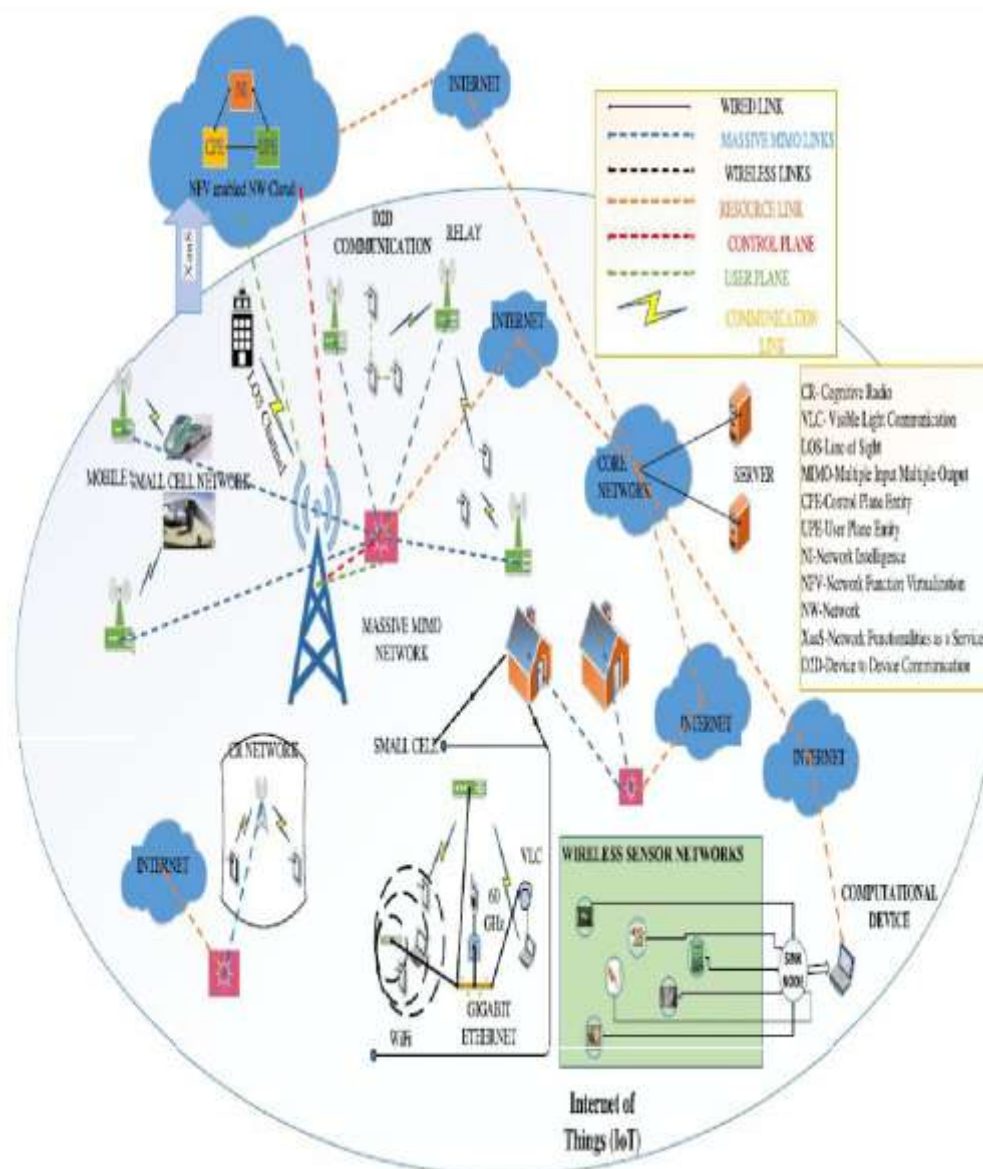
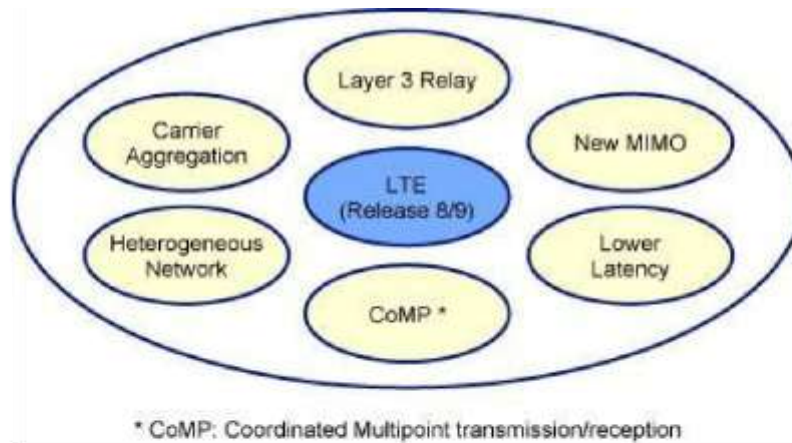


Fig. 1 5G Network Architecture

Technology Features	1G	2G	3G	4G	5G
Start/ Deployment	1970 – 1984	1980 - 1991	1990-2002	2000-2006	Coming Soon
Data Bandwidth	2kbps	14.4-64kbps	2Mbps	200 Mbps-1 Gbps	Higher than 1Gbps
Technology	Analog Cellular Technology	Digital Cellular Technology	Digital Broadband Packet data	Unified IP & seamless combination of Broadband	WWWW(coming soon)
Service	Mobile Telephony (Voice)	Digital service, SMS, increased capacity packet	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	PSTN & Packet N/W	PSTN & Packet N/W	Internet

IV. Conclusion

The development of the mobile and wireless networks is going towards higher data rates and all-IP principle. To meet the need of the power hungry devices and demand for a higher data rate 5G has proved to be a boon to the mobile technology with the implementation of SDR, Cognitive radio, Nanotechnology,

Cloud Computing based on internet protocol platform. Thus eliminating the hardware implementations we are now able to provide all the required demands with the help of 5G cellular systems. Looking forward for mm waves 6G technology would prove to bring a charismatic change in the telecommunication world.

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