

5G - Future of Mobile Internet

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Abstract—To cope with the huge influx of connected devices that will be part of the Internet of Things (IoT), a new level of wireless internet connectivity will be required. Fast forward to year 2020, i.e. five years from now, and hopefully the world of the future, filled with driver-less cars and pilot-less drones, is running smoothly and all of this will be built on one critical piece of technology - 5G. At the moment, most of us are still getting to grips with 4G speeds on their Smartphone's. To start talking about 5G right now might seem a little presumptuous but the impact it could have on our lives could be as big as the transition from 2G to 3G.

Keywords—5G, Mobile Internet, Future Internet, Wireless Internet

I. INTRODUCTION

Even though the deployment of 4th generation mobile networks has not yet been completed, operators and handset manufacturers, as well as leading research teams in the field, have launched a series of R&D initiatives to develop the 5th generation of mobile technology, called 5G, intending to commercialize it by 2020.

5G represents a paradigm shift in the design of mobile networks that revolutionizes this technology to support flow, latency and scalability requirements necessary to meet such extreme use cases as augmented reality or connecting trillions of devices.

The future 5G Networks are going to transform the way we perceive and interact with the world around us. 5G Networks bring a combination of advances that will transform current reality into a “connected reality”, in which all things and every person are interconnected forming a united whole. 5G Networks will allow more than six million million systems to be connected, which includes all the planet's inhabitants, and in addition to that, somewhere in the region of a thousand objects each. Each person will be permanently connected to their doctors, friends, colleagues, clients/suppliers and security services, but what is more, also to their car, their fridge, their favorite bakery, leisure centre, metro, airport, their home and, in short, every object that may be of interest to us. All these objects, in turn, will be connected, in such a way that a pallet, let us say, can “complain” to its source company that its delivery route is incorrect, and our boiler will be able to download software to make its operation more efficient.

The number of connected devices will be complemented by increased network capacity on three orders of magnitude. 5G Networks, therefore, will be capable of carrying 1000 times more mobile data than the 4G networks that are currently beginning to be deployed. Such a massive capability for communications will allow each person to access, send or exchange, quasi instantaneously, the sensations of their

choice. Though research in 5G does not cover multimodal interfaces, the network is being designed so that these can be integrated. Augmented reality devices, brain wave interfaces, or the implantation of interface biochips will allow 5G network users to interact with each other and with all their connected devices, quite naturally, free from external devices, as an extension of their five senses. Such direct exchanges of stereoscopic images, smells, tactile information, or brain waves will be possible from wherever we are. Because, counter posed to what happens with 4G systems, 5G Networks are designed for universal geographic coverage, with the added advantage of a more seamless service with regard to the relative positions of the base station and the edge of the cell.

The heart of this network will be based on the intensive development of current virtualization technologies, converging with “cloud computing” technologies. Thus, software will play a much more important role in 5G networks than in today's networks. Much of the dedicated communications hardware of today will be replaced by general purpose computational platforms that provide the necessary communication services via software. This will allow network control to be much more flexible and economical than at present, and better integrated with the services it supports and with telecommunications operators' business processes. In this way, the time taken to deploy a new service in production will be reduced from the current 90 days to a much shorter term of around 90 minutes. This means that the range of supported services will be considerably more dynamic and tailored to the needs of users, both private and professional.

More economical use of energy is a further key element in 5G Networks. If we were to increase the network capacity by 1000 with today's technology, the energy requirement would be so high that it could not be met. Therefore, energy efficiency is another major criterion in the design of 5G networks, both as regards to terminals as network elements as to the design of the network as a whole. Therefore, when it comes to 5G networks, technologies are being developed that run on just 10% of the energy used at present, in order to reduce the environmental impact derived from 5G.

To sum up, 5G Networks will lead us to a world in which distances cease to exist, and in which our sense of being and perceiving will blend with those of our fellow citizens and of the objects around us.

II. GENERATIONS OF TECHNOLOGY

Every day is the birthday of a new technology which comes with amazing rapidity! And a wireless technology mobile system includes many generations of technologies.

- **0G Technology:** The first generation of technology is a mobile radio telephone called 0 (Zero) Generation. This telephone system includes transceiver, dial, display and handset. It is also called Radio Common Carrier (RCC). The Motorola with Bell system is a great example of this device.
- **1G Technology:** In 1980, the analog telecommunication system was included in telephone technology which was introduced as 1G technology. This technology has just an analog system with bandwidth up to 30kHz. The first 1G cellular system was launched in Japan by NTT organization.
- **2G Technology:** The digital communication system came into the market with 2G technology which makes spectral bandwidth possible up to 200kHz and SMS services among cellular phone users. GSM and CDMA are two systems of 2G technology. They are different types of multiplexing systems. The text messaging service is the best part of 2G technology.
- **2.5G Technology:** This technology includes a GPRS system with a packet data internet service. The MMS and mobile internet with WAP (Wireless Application Protocol) are the new features of 2.5G technology.
- **2.75G Technology:** The GPRS system with EDGE (Enhanced Data rates for GSM Evolution) feature was possible because of 2.75 Technology that starts the advance technology in GSM internet system.
- **3G Technology:** High speed internet on mobile, video calls and mobile TV are new features of 3G technology. 3GPP is a group of CDMA2000 and UMTS which broadcast internet speed up to 2 MBPS with high data rate. 3.5G and 3.75G technologies are something like 3G technology and includes features similar to a 3G system.
- **4G Technology:** It's the latest technology system used in the current mobile phone market. The mobile ultra-broadband internet access, video conference, 3D television and LTE (Long Term Evolution) are new features of 4G technology. 4G-LTE is a completely new technology that makes possible data transfer capacity up to 100MBPS and spectral bandwidth up to 40 MHz.
- **Basics about 5G Technology:** 5G technology has not been officially launched but it will definitely come with all major features of 4G mobile technology and IMT-Advanced system. It will completely change the global mobile system with new technology and lots of amazing features. 5G technology may include new concepts of multiple paths for the concurrent

data transfer. However, the perfect data transfer rate is not confirmed for 5G technology.

III. FEATURES OF 5G

Main features of 5G Network technology are as follows:

- A. 5G technology offer high resolution for crazy cell phone user and bi-directional large bandwidth shaping.
- B. The advanced billing interfaces of 5G technology makes it more attractive and effective.
- C. 5G technology also providing subscriber supervision tools for fast action.
- D. The high quality services of 5G technology based on Policy to avoid error.
- E. 5G technology is providing large broadcasting of data in Gigabit which supporting almost 65,000 connections.
- F. 5G technology offer transporter class gateway with unparalleled consistency.
- G. The traffic statistics by 5G technology makes it more accurate.
- H. Through remote management offered by 5G technology a user can get better and fast solution.
- I. The remote diagnostics also a great feature of 5G technology.
- J. The 5G technology is providing up to 25 Mbps connectivity speed.
- K. The 5G technology also support virtual private network.
- L. The new 5G technology will take all delivery service out of business prospect
- M. The uploading and downloading speed of 5G technology touching the peak.
- N. The 5G technology network offering enhanced and available connectivity just about the world

IV. IMPROVEMENTS OF THE 5G

According to some observations of the experts in the wireless industry, there are three quite different visions of the future mobile wireless networks. Three different views on the 5G are:

- Super fast mobile network
- Super efficient mobile network
- Convergence of fiber and wireless network

The super fast mobile network will be consisting of lots of small cells. They will be densely distributed in the 5G wireless network with contiguous coverage. The frequency spectrum would be below 4GHz.

5G will be super efficient mobile network. The mobile network operators will get much better performance for lower cost. The 5G technology will offer a much higher number of simultaneously connected mobile devices. What is maybe most important, especially for the end users, higher speeds in larger areas, lower battery consumption, lower latency, better quality and reliability of mobile connection.

One vision of the new wireless standard is going to be a convergence of fiber and wireless network. The 5G wireless internet will include short wireless links at the end of the optical cables. With very high frequencies (20-60 GHz) it will enable speeds up to 10 Gbps. This kind of networks would be more like local Wi-Fi networks than today's wide area mobile networks – 3G and 4G.

V. 5G AND THE INTERNET OF THINGS

Historically, mobile data was something that human-controlled devices, not autonomous machines, consumed, and it was designed accordingly to cater to the usage patterns for phones, and later laptops and tablets. Now, the mobile industry is trying to work out how machines, not least those latency-loathing autonomous cars, will want to consume data. That means getting vertical companies involved in the standardization process — companies who have historically never had to take an interest in networking and whose core competencies don't involve mobility.

It's another way 5G represents a break from previous mobile standards. "All these different use cases put very different diverse requirements [on 5G]. It's not that elements of these didn't exist before, but we never had one technology or one element that had such extreme use cases — ranging from IoT to having a good experience, to wearable's, and even cars".

"This diversity really puts in a lot of different tension," said Keddy. "For example, a good M2M solution has to be low cost, cheap and high range, which is a very different thing from what I want in my high end phone. Those are the diverse requirements that are at play." This need to include more companies is yet another challenge on the way to standardization — a process that's known for being fraught with disagreements and geographies jockeying for the upper hand at the best of times.

Traditionally, mobile standards vary from continent to continent as different operators around the world opt for the version of the technology that suits them best. While the number of variants has been falling with each generation of mobile standard, it's hoped there will be just one single version of 5G used around the world.

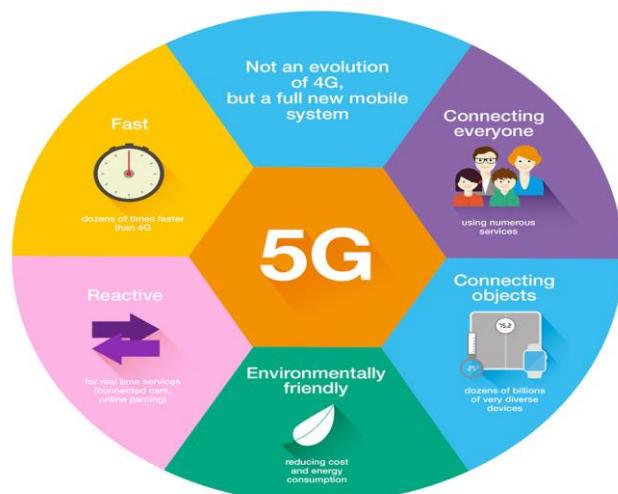


Fig. 1. 5G in infographic

VI. THE CHALLENGES TO BE FACED BY 5G

The specifications for 5G are more extensive than those of pre-existing technologies. Although specific features are still being developed, we already know that they will need to address several major issues:

- 1) *5G will need to handle considerable growth in demand.*

This growth is related both to the increase in customer numbers, as well as to uses that are proliferating (video, online games, etc.). This is why 5G will be likely to expand into new frequency bands.

- 2) *Going ever faster:*

Although 4G currently already offers speeds of several megabits per second, 5G will need to make even higher speeds available. It is estimated that it may reach scales that are 10 to 100 times faster.

- 3) *Facing up to the challenge of the Internet of Things:*

In the future we will see an exponential increase in the number of connected objects. Not only will there be billions of these across the planet but they will also be developed from systems that are different from each other. One of the issues 5G will face is that of facilitating their integration and interoperability, in order to obtain flexible communication between very different objects (e.g. a digital watch, an electricity meter, a connected car, etc.).

- 4) *Addressing a major economic and ecological issue:*

5G will need to offer a low cost per megabyte, both for traditional use (such as "watching a video") as well as professional use, such as connecting every kind of meter (water, gas, electricity, etc.). Behind this economic challenge there also emerges an issue of sustainable development. The automated integration of all the data coming from disparate meters will allow energy expenditure to be rationalized and energy savings to be made, contributing to the "green" effort. So 5G is expected to be able to connect battery-powered equipment with a lifetime of between 5 and 10 years.

- 5) *Ensuring responsiveness:*

Translated into technical terms, this is what is known as the "latency" issue. This refers to the time required for digital information to be propagated. 5G is working to minimize this latency. An example of its immediate use is the development of connected vehicles, and, if we want to avoid all risks of collision, the shortest possible response time must be guaranteed between automated commands and sensors.

VII. THE NEW RISKS WITH 5G

5G makes all sorts of technologies possible - but also raises the stakes. If your car is being operated via a cloud-based autonomous driving system over 5G, you don't want to lose

the signal right at the precise moment it's about to tell your vehicle to slam on the brakes. Operators and technology companies know that (and are perhaps considering the insurance implications). So they are aiming to cut network latency to make sure such an event doesn't happen.

The need for low latency will have a profound effect on how networks are developed, according to Huawei's head of wireless research, Dr. Wen Tong. Packet error rates will need sorting out.



Fig. 2. *Self-driving cars will demand the low latency that 5G promises.*

VIII. CONCLUSION

Mobile devices will come as a 5G supported device. 5G makes it possible to access high speed internet on a laptop or computer with mobile internet connection. The browsing on laptops and computers will get affected by 5G mobile technology because every person will want to use internet on a mobile. Software and website development will greatly benefit through high speed internet connection. Above all, internet businesses for internet marketing, web design, website development and social media sites will need to effect many changes in their strategies. 5G technologies will thus greatly alter current mobile wireless technology and usher in lots of novel features for mobile and internet users.

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