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5G: A Step Further in Telecommunication

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ABSTRACT: Over the past centuries world had seen 3 industrial revolutions, which changed the course of humanity, and made the world a better place for living, and now the world is on a verge of another revolution, which would change the course of humanity forever! Imagine, if your smart watch could talk to your coffee maker and tell it to start brewing your coffee as so as you get out of bed; it is not longer a science fiction scene but a potential future, and it is all possible due to wonder of 5G.

5G is a new development in a new development in communication technology. The future of 5G is not only limited to the providing high speed net with low latency period, but 5G open a new gateway for world. The application of 5g involves IoT (Internet of Things), which means to create a network between machines so that they can communicate to one another without human monitoring them. 5G could provide human the first smart cities.

Even though, the 5G had arrived in USA, South Korea and some other countries but it is yet to come in India. India is hosting its first 5g auction this year and it is expected to arrive in between 2020 - 22.

The objective of this paper is to provide basis information about 5G; clearing some common misconceptions about 5G, and looking the scope of 5G in India and world.

KEYWORDS: 5G, India, IoT, latency, bandwidth, speed, future, generation, telecom, revolution.

I. INTRODUCTION

As seen in figure 2 the global data is expanding day by day. If some steps are not taken to control this flow of data it will cause data traffic ;which will cause in low internet speed and high latency period.

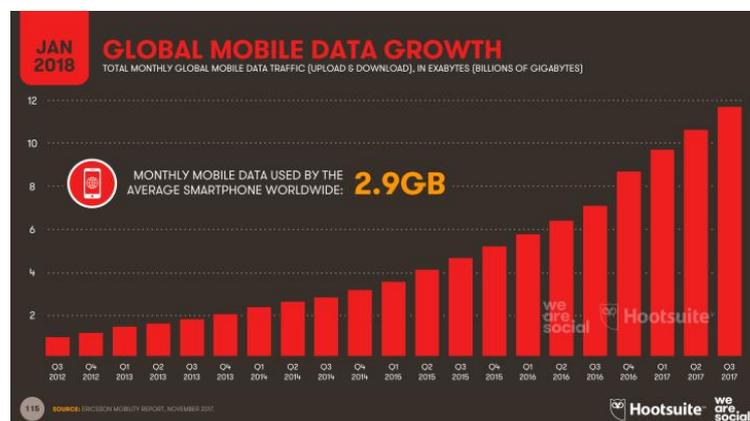


Figure 2: Statistics showing global mobile data growth



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5G provides an alternate solution to that by opening new bandwidth to the network which had never been used before. But to understand 5G as merely as a new generation of wireless which increase bandwidth (30 to 300 GHz) and provide high speed (4.5 GB/s according to ‘The New York Times’) with low latency period is a mistake. 5G is a revolution in itself! 5G open doorway for future technological revolution, and it could give us our first smart cities with the help of IoT, and understanding how 5G could one also had to understand what 5G problems are and approach to them.

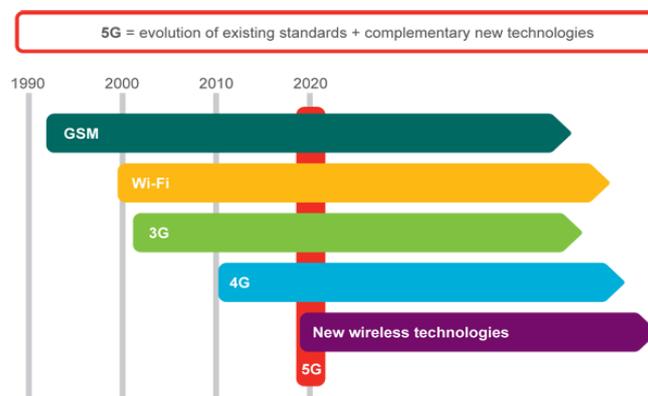


Figure 3: Years with its respective telecom technology

II. HISTORY OF WIRELESS CONDUCTIVITY

Since the creation of 1G the world had encounter a new generation of wireless approx every decade and 5G continues the trend. Although this paper not deals with previous generation, it is essential to have some knowledge of previous generation of technology.

➤ 1G:

1G (first generation of wireless) was launched in early 1980's. It provides us with first analogues phones, and with speed of 2.4 kbps.

Problems:

- Poor quality of vice call
- Less battery backup
- Large phone size
- Low security

➤ 2G (2.5G and 2.75G included)

2G (Second Generation of Wireless) was launched in late 1980's to early 1990's. It uses the digital technology for the first time, and introduces the SMS, MMS and picture transfer services with speed of 64 kbps. It uses Bandwidth of 30 to 200 KHz.

2.5G comes as an amendment in technology which increases the speed of internet up to 144kbps, along with www and e-mail.

2.75G increase the speed up to 384 kbps.

Problems:

- Videos and other complex file transfer not possible
- Required strong digital signals



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➤ **3G (including 3.5G and 3.75G)**

3G (Third Generation of Wireless) was launch in 2000. It provides video call, GPS, mobile television and many more. It increase speed up to 2 Mbps. It has bandwidth of 15-20MHz. 3.5G increase speed to 7.2 Mbps, and 3.75G up to 14.4 Mbps.

Problems:

- Expansive plan
- Advanced infrastructure needs

➤ **4G:**

4G (Forth Generation of Wireless) was launched in early 2010's and it enhanced the speed to 128 Mbps with high security and low cost per Mb.

Problems:

- Required high battery
- Complex hardware



Figure 1: Evolution from 1G to 4G

III. SCOPE OF 5G

The 5G give us a faster internet at an economical rate with large bandwidth which makes it 5G is a major stepping stone for IoT. How? Due to this features we can install the chips or program things of daily needs with this network which would allow them to talk to each other and give us an interconnected network without or minimum user interference.



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It could be use for 2 ways:

Industrial use: In a factory the machine could be connected and program to cooperate with each other to make manufacture process error less and reduce the need of men work. In the same way, 5G could expand in various fields such as agriculture (controlling water level in soil), Health and welfare (robotic surgeries), and many more.

Commercial use: In a society the 5G could be available commercial by not only making our internet faster but by also satisfying our daily need like self driven cars or order groceries.

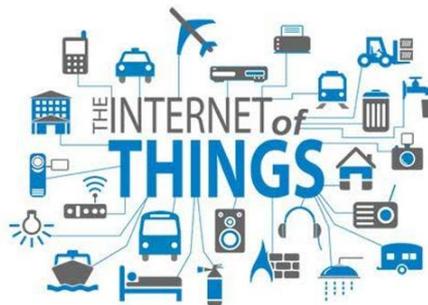


Figure 4: IoT, Internet of Things

IV. COMMON QUESTIONS AND PROBLEMS WITH 5G

➤ Is 5G dangerous to health?

False.

It had been long debate about if 5G is dangerous to health and generate cancer. The evidence from WHO (world health organization), IEEE with several other research proven that the 3G, 4G, and 5G's waves are non ionizing and non harmful

Where 5G fits in the electromagnetic spectrum

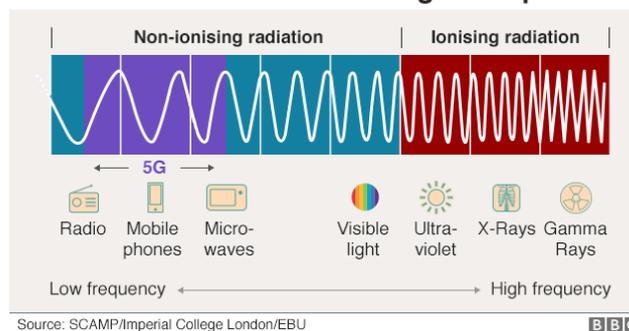


Figure 5: Relation between 5G and radiation

➤ What are millimeter waves?

Millimeter wave are of frequency of 30 to 300 gigahertz. Unlike 4G, 5G uses the millimeter waves to reduce internet traffic and open a new range of spectrum.

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➤ How could waves of high bandwidth penetrate from walls?

Small cells.

Millimeter waves used in 5G are larger in size and could not penetrate from the walls, or any other obstacle. It means if you go inside a building or a blocked by a tree you would not receives signal. Small cell are none less that small antennas we can put some meters distance places and bypass object.

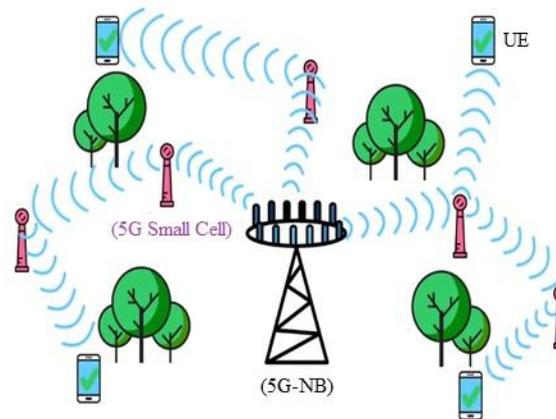


Figure 6: Working of waves in 5G network

➤ How 5G to overcome problems with MIMO?

Beam forming.

A 3G or 4G tower can hold a dozen of antennas, but 5G use the technology of massive MIMO (Multiple Input Multiple Output) which allows it to hold hundred of antennas. But MIMO come with limitation as the large no of antennas what make a large interference. Beamforming only forecast signal in particular direction. We can assume that the 4G's antennas are like a bulb throwing light in all direction, whereas 5G's will act as a torch throwing light at a single direction; hence minimize interferences.



Figure 7: Showcasing beam focusing benefits

V. 5G AND INDIA

India is hosting its first 5G auction in September or October (according to 'The Economic Times'). But the question arises dose it worth it!

➤ Problems with 5G in India

In commercial sector the 5G need large amount of investments and a whole new infrastructure (to place small cell and new tower everywhere), and even after MNC's support 5G would cost fortune to the India. The application of 5G like



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IoT on a large scale is only possible if it gets a large scale support: for instance, self driven cars are only possible if all of other cars on the road are self driven and none other obstacle is on the road.

In industrial sector the 5G will play an important role, especially in manufacturing, by minimizing human effort. This would also mean that it will make many of unskilled labor unemployed in the times where 6.1 % of Indians are jobless which is highest in the 45 years (according to 'The National Sample Survey Office's (NSSO) job survey for 2017-18), so it would mean the GDP as a whole would increase but the standard of living would decrease.

➤ So should India not implement 5G?

5g is a development on a global scale and even if India would not implement the 5G the other countries would which would not only cause the thread to standard of living but to the national GDP as well.

The 5G may pose some challenges but it also opens opportunities, and a world of imagination becoming reality. India should definitely adopt the 5G but also teach its youth about technology. Education had been on sideline for a long time but now we are on the face of new technological revolution, and we could either use it in our advantage or we could let it use us. India has a potential for development and a great amount of youth, but most of them are unskilled which cannot survive in 4th industrial revolution. The only way to protect our country is to make our youth up to date with technology. It had many huddlers in it but it is not an impossible task and if we are able to archive the level of education then we will not only survive the revolution but rule.

We are not the old India, when we do not have the technology to make it possible, the Indian made Chandrayaan- 2's successful launching support neither this, nor we are the lazy India who had no motivation to pull of the major reforms, the success of clean India movement shows this. If we just create our mindset and do a little hard work we could make our development to another level, which world had never seen.

VI. CONCLUSION

5G is a new imariging technology which has capacity to dominate over glabal market and probably chang the face of hemanity forever. It will take over 4G like every advance genration had done in history but every things comes with sime flaws. The expanction of 5G will not only be expansive but also 5G could not be trusted in prospactive of range. The new technology are emargeing day by day for incresing the efficiancy of 5G but this disadvantages rises a question: is implimenting 5G a statigic move in India's prospactive or not. India is a developing country but it is faces challenge like poverty and hunger still it manages to lead in the technological sector, but 5G required a whole new infrastucture and the India will have to cut from important needs to impliment 5G, so should India forget about 5G. The 5G opens many doors for future development and now many people may not feel need to implement 5G but it will more or less take ovet the world and we do not want to left out of the this technological revolution. A sliver line is the India can take money form MNC like Samsung and could bring technology with no impliment on buget.

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