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Why Do We Need 6G?: Main Motivation and Driving Forces of Sixth Generation Mobile Communication Networks

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***Abstract*—Mobile communication has been one of the prime disruptors of the modern times. Since the 1980s, the world has witnessed new generation of mobile communication technologies every decade. Each new incoming generation is better than the previous one in several ways. The recently arrived fifth generation (5G) has several advanced features when compared with its predecessor. However, it is clear that there will be several shortcomings in this generation when compared with the other advanced contemporary information and communication technologies (ICTs). These shortcomings of 5G are going to be the main motivation for the next new mobile generation. According to the existing trends in ICTs, the new incoming version will be known as the Sixth Generation of Mobile Communication (6G). In this article, we show the main driving forces behind 6G, its expected features and key enabling technologies. The market potentials and disrupting features have also been discussed.**

***Index Terms*—6G, 6G features, motivation for 6G, deployment timeline of 6G, the G-race**

I. Introduction

IN the recent decades, we have come across several disrupting technologies which have changed the course and trends of the societies. Cellular mobile communication is one of them. Mobile cellular communications were started in the early 1980s, but the popularity was achieved in the early 1990s. Since then, every decade the world has witnessed new generations of mobile communication technologies with much improved features and performances. According to the observed trends, a new generation arrives each ten years with their incremental versions found in between. For instance, 2G came to the markets in the early 1990s, 3G in the early 2000s, 4G in early 2010s, and now the initial versions of 5G came to the markets in 2020. In between these generations, we observe several incremental versions. These intermediate incremental versions are observed in the forms of ***A***.b**G** which are normally better than ***A*G** and inferior than (***A+1***)**G** [1]. In this notation, **A** is a positive integer which ranges from 1 and 6 (currently, this is the case, as we have 5G already available in some countries and its next generation is in plan for 2030 roll out), and b is an integer smaller than 10 [1]. For instance, we have already seen 2.5G and 2.9G in the past. In the recent past, we have also witnessed 4.5G, which is commonly known as Long Term Evolution (LTE) Advanced Pro in the Third Generation Partnership Project (3GPP) terminologies.

The Sixth Generation (6G) is a recent subject and its research is very much at its infancy. Some literatures are available on this topic. The common patterns of new mobile generations are discussed in [1]. The technical specifications and performance metrics of 4.5G (LTE Advanced Pro) have been presented and compared with the 5G specifications of ITU [1]. Several intermediate versions of different mobile generations and the observed trends have been presented in this article. It shows the intensity of current competition for better mobile access in the recent years. David and Berndt (2018) discussed beyond 5G networks [2]. In this paper, the main vision and requirements for 6G have been presented in brief. There are several possibilities beyond 5G in terms of new networks and services. Several flexible radio access technologies beyond 5G have been analyzed in [3]. Specifically, the waveforms, frame design strategies and numerology of the beyond 5G radio technologies have been emphasized in this paper. It shows several improvements are possible in beyond 5G networks [3]. High throughput satellites have generated a lot of interest in the recent years. A flexibility analysis model for high throughput satellites has been presented in [4] which promise a lot of utilities for the future generation applications. Appropriate satellite mobile integration can improve the availability and reliability of the wireless networks. Consumer electronics driven global trends of communications have been presented in [5]. It shows the scale and pace of changes happening in information and communication technologies (ICT) these days. It shows that the developing countries have already overcome the developed countries in terms of number of subscribers in mobile communication. The net revenue of ICT sectors of developing countries has also exceeded that of

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the developed countries. The future ICT networks and their potentials have been predicted from the Bell lab's visions in [6]. It shows that the networks of the future will be very advanced and efficient. Many features of those networks will be much beyond the current predictions. Some visions and the potential techniques of 6G are presented in [7]. In this work, it is predicted that 6G will use new spectrum and its energy efficiency will be better than that of 5G. It will have better security and flexibility.

Optical communication is the trend setter in the high speed regime since the 1970s [8]. The trends of highest available speeds through optical fiber are explained using Keck's law. The ways to maintain the high speed trends of Keck's law have been presented in this work. This indicates that there is no real competitors for optical fibers as far as the data rates are concerned. 6G will borrow several aspects of optical communications.

Key aspects of device to device communication (D2DC) in 6G have been studied in [9]. Several bottlenecks of 5G based D2DC will be overcome in 6G. Each device in 6G will remain interconnected with several other devices in its surroundings. Energy efficiency is a prime goal in the new mobile communication networks [10]. 5G has much better improvements over the previous 4G mobile communication systems when it comes to energy efficiency. In fact, 5G is much more advanced than the previous generations/versions of mobile communications in terms of the energy spent per bit [10]. Several advanced networks are envisioned for the future Internet. Light can be used for fast communications in the access area which is now known as Light Fidelity (LiFi). It has the potential to communicate at speeds of 100 Gb/s and beyond [11].

There are several access technologies available which are faster than 5G, such as terabit passive optical network (PON), and wireless optical communication networks. Terabit PON is among the fastest access technologies currently known [12]. Recently, terabit digital subscriber lines (DSLs) have been proposed for cheap and fast local area connections [13]. These are better service providers in the static conditions than the 5G.

Several changing trends of optical communications are presented with examples in [14]. It shows that both the wireless and optical communications improve very fast. Optical communication is readily adapting to the advanced techniques of wireless communication [14]. In 6G, these advanced networks will be used for faster data rates. New initiatives for 6G research in USA are presented in [15]. It shows the market prospects of 5G in the coming years. Several new features and applications of 5G are presented with future outlook by Qualcomm 5G in [16]. It also shows that there will be several shortcomings in 5G which are going to open the roads for 6G.

In 6G, many advanced features will be added which will make it ready for the future tasks. Several papers describe a myriad of recent developments in 4.5G and 5G [17] – [19]. These trends show that the scientists and engineers involved with 5G progress steadily towards the IMT 2020 specifications of ITU. In [20], the natural evolution of 5G to 6G has been presented while highlighting the shortcomings of 5G. The authors provided and industry focused 5G scenario to justify the 6G requirements and the future steps.
Global restructuring of the telecommunications sector due to the recent developments are highlighted in [21]. It also shows the overall impact of the recent disruptions on the economy and the society as a whole. Energy efficiency in the cellular communications has been improved significantly. In [22], the continuous improvement in the energy efficiency in 4G and 5G shows that 6G will be more energy efficient than the previous mobile generations. The 6G vision and its potential technological impacts have been discussed in [23]. The authors have also predicted the potential techniques for 6G which are based on the recent research trends [23]. In [24], a similar kind of predictive study has been conducted on the vision, requirements, enabling technologies, and the architectural issues of 6G. In [25], uses of artificial intelligence (AI) and machine learning (ML) for common and advanced applications in 6G have been studied. It shows that 6G will have extensive AI and ML applications for wide range of tasks and services. In [26], main attractive features of 6G networks and how the AI is going to affect its performances have been analyzed. In [27], potential new initiatives in 6G have been predicted based on the recent observations. Several challenges in the development of 6G have been predicted considering the technological roadmap.

The nature and scale of IoT in 6G have been presented in [28] using the projected technology trends in massive machine type communications (mMTC). In this context, the authors have highlighted six main features of mMTC in 6G.

In this article, we study the main motivations for 6G. We analyze the main driving forces behind 6G and how it will affect the mobile communication markets. We study the development of the past mobile generations and correlate them with the 6G driving forces. We also compare the 6G wireless communication developments with the different computing generations driven by the microprocessors.

The remainder of this article is organized in four sections. In section II, we present the main motivation for 6G. In the section III, we show the general trends of mobile generations which explain the genesis of new generations in the past. In the section IV, we predict the nature, timeline and the social significance of 6G. In section V, we conclude this article with the main points.

II. Main Motivation for 6G

Analyzing the past generations and their motivation factors, we find a lot of common factors which push generation ***A*G** into generation **(*A+1*)G**. Typically, motivation for every new mobile generation comes from the shortcomings of the previous generation [1]. In case of 6G too, this is going to be the major reason. 5G has been specified with several advanced features which are shown in Table I. All these features are not

available yet. The current testing achievements in the laboratory are also shown in Table I. Those features will be improved over time in the coming years. It shows that despite having all those advanced features, 5G will not be the perfect technology to meet all the user demands in terms of quality and quantity. Those shortcomings will be addressed in 6G.
Over the years, ICT restructuring has been observed to be an endless process. It is very much clear that ICT restructuring is a continuous process [21]. It happens at every company and country level. As a part of restructuring, technology and management related changes are always added to the service provisioning [17]. It provides strategic edges to an operator over its rivals. Therefore, irrespective of the state of the technologies, ICT restructuring will keep on adding advanced features to their services.

Recently, 5G has been deployed in the non-standalone mode at several places. Once the 5G is rolled out in the major cities around the world its performances can be measured directly. Then the user experiences and 5G utilities in the real world can be measured directly. This is expected to happen around 2025. It is true that all the ITU specifications of 5G will not be available to the users in the near future. Only the incremental advances will be observed. The full potential of 5G can only be achieved after several years of its initial deployment.

5G developments have several drawbacks in achieving the ITU specifications. For instance, software defined networking (SDN) is an integral part of 5G [18]. It would work through network function virtualization (NFV). SDN would slice or segregate different types of service allocations in to different slices. These slicing mechanisms would slowdown the speed or in other words the data rates will be affected by SDN. Similarly, clouds and fogs will have enhanced roles in 5G. Too many transactions or computing in clouds would inherently increase the latency. So, the latency reduction will be affected through the intense cloudification of 5G. All these drawbacks of 5G will take time to be solved. That is how a new generation would be brought in to improve the performances of 5G mobile communication and computing.

Inherently, there are several drawbacks in the 5G development process in achieving the ITU specifications. In Fig. 1, we illustrate the ITU specifications of 5G and the current 5G non-standalone performance parameters. It shows that the gaps are significant and it would take several years to achieve the full ITU specifications. Security aspects in 5G are still not very strong and this is currently a big problem for 5G which is expected to be significantly improved in 6G.

From the performances of the previous instances, it has been observed that the mobile generations are not the overall best access technologies of their times. Some of their contemporary technologies outperform them. It is also true in case of 5G. By 2025, the standalone version of 5G is expected to be deployed widely. At that time there would be several better access technologies. From the current technology trends, we can easily predict a few technologies in the access area which are better than the 5G. In section IV, we show some of these advanced technologies. These technologies would motivate for a better next generation cellular communication networks. This is the direct indication of a better technology that could move beyond 5G.

III. General Trends of Mobile Communications

The general trends of mobile technologies development follow a specific pattern. In order to understand any new generation, we should go through the genesis of the past generations. It provides logical reasons behind the development of any new version or generation.

Initial wireless mobile communications were tried in the early eighties as analog communication. However, it was not successful. The real mobile communications started as a digital technology in the mid-1980s and its commercial popularity around the world came in the early 1990s. This was the second generation (2G) mobile communication. The 2G services were basically voice based services. Gradually, new features were added to it such as the SMS service through global packet radio services (GPRS) which is also known as 2.5G. Basically, GPRS was a value addition to the 2G services. Gradually, the data rate demands were on the rise. It was not possible in the typical 2G framework of that time. Therefore, there was a demand for faster communication of voice, data and videos. Thus a new version/generation was required. Mobile companies around the world joined hands for this. They formed a new group which is well known as 3GPP LTE for the future long term evolution of mobile technologies. This 3GPP initiative streamlined the development of future

TABLE I
ITU Technical Specification for 5G (Performance Indicators, their ranges, and their Proposed Technologies) along with their Proposed Practical Values and the Proposed Technologies for Deployment

#	5G Attributes	Range	Current Achievement in Test	Special Conditions
1	Data rate	0.1 – 20 Gbps [10]	10 Gbps [16]	Maximum download speed under favourable conditions
2	Spectral Efficiency	4.5 [10]	4 [17]	Using Massive MIMO and large QAM constellations
3	Data Processing	10 Mb/s/m^2 [10]	3 Mb/s/m^2 [10]	This is based on the recent estimated cases in 2020
4	Device Density	1 million/km^2 [10]	5000 /km^2 [18]	This is based on the recent estimated cases in urban areas in 2020
5	Mobility	Up to 500 km/h [10]	350 km/h [19]	Speed fluctuates, and it degrades performances
6	Transmission Delay	1 ms [10]	10 ms [19]	Several constraints are there at multiple stages
7	Energy Consumption	1 µJ per 100 bits [10]	10 µJ per 100 bits [10]	This is the estimated value based on several instances

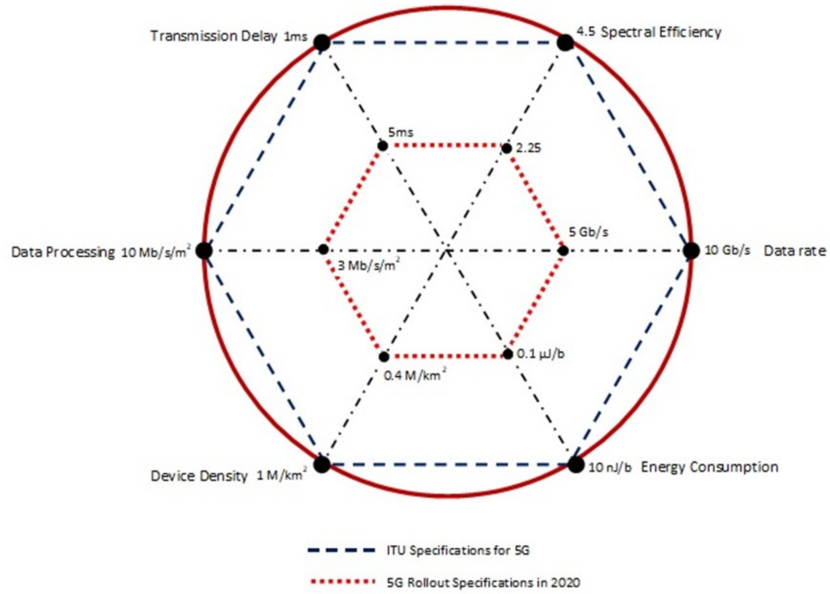

Fig. 1. ITU Specifications of the main parameters of 5G vs. the best practically possible specifications of 5G in 2021. The initial 5G non-standalone specifications in 2020 are much inferior to the ITU specifications of 5G.

mobile generations.

The 2G difficulties for faster (i.e., higher data rates) communication resulted in the planning for the 3G. However, the 3G planning and specifications were not achieved in a short time which resulted in several sub-3G versions such as 2.8G and 2.9G. Gradually, these intermediate versions led toward the 3G specifications. Finally, 3G emerged as the technology for data communication over the mobile platforms.

Initial 3G data rates were very low. However, the 3G initiatives for data transfer became very popular as there was no other alternative available in the early 2000s. Mainly, the Internet access over the mobile phones was a very attractive feature for the users. Internet penetration after the arrival of 3G increased significantly.

Two to three years post-launching, the major demerits of 3G came to light. The users and the operators realized that the communication speed over 3G are not realistic as the other contemporary technologies such as WiFi and WiMAX were much better than 3G when it comes to the data rates. WiFi was easily accessible in the static environment and was also cheaper when compared with the cellular services. It was widely adopted in offices, universities, and residential areas.

WiMAX was much better than 3G in both static and mobile conditions. This was the main motivation for the 3GPP to look beyond 3G. Therefore, 4G was proposed whose performances were several times better than the 3G.

The proposed performance specifications of 4G were several times better than 3G. Nevertheless, all those specifications were not achievable in a short span of time such as six months or one year. Thus incremental versions of 3G appeared in the market. They were better than 3G and inferior to 4G.

Finally, 4G rolling out was started in 2009, but only in a few cities. The widespread 4G deployment was achieved only in the second half of 2010s. The performances of 4G were way better than the 3G services. However, drawbacks of 4G came to light very fast. Again, WiFi and several other access technologies used to outperform 4G. Thus the next advanced version of 4G was planned by 3GPP. However, this time the plan was much more different. It was a giant leap over the previous versions. The fifth generation was proposed to be much superior to 4G in several aspects.

The 5G specifications were mainly imitating the performances of optical access technologies. PONs can provide hundreds of Gbps data rates. Even as early as 2011, terabit PONs were tested in the laboratories. When compared with the PONs, wireless communications were far behind. One of the main aims of 5G development group was to provide fiber-like experience in the wireless domain.

IV. What 6G will be?

It is really very difficult to predict what exactly 6G will be. For instance, the research on 5G started around 2009 [1]. However, the exact features of 5G were defined by the ITU in collaboration with other standardization bodies much later in 2015 [10]. Similar uncertainties were also observed for the predictions over 3G and 4G at the time of their inception. Unless the complete standards are agreed by the expert participating groups around the world, it is not possible to know its exact features. However, from the past experiences of the previous mobile generations, we predict the following features of 6G.

1. 6G will be better than 5G in all performance related aspects [1]. This is the trend observed in all the previous generations in the past [1]. Therefore, it is very much clear from the past instances that 6G has to be better than 5G in all the main performance related aspects.
2. The peak data rate proposed for 5G is 20 Gbps and the peak data rate of 6G will be around 100 Gbps [20]. However, it is noteworthy that the peak data rates are not the operational data rates. The average data rates are those that are used in day to day operations. These average data rates are much lower than the peak data rates.
3. The 5G latency of 1 ms would be further reduced in some select applications [20] in 6G. There are several emerging applications in the recent years which demand very low latency. By 2030, these applications will be high in number and the device densities will also be proportionately high. Thus ultra low latency in 6G will be provided using several new technologies [29].
4. In 6G, device densities and IoT connectivity will be denser than the 5G [20]. In recent years, IoT and other mMTC technologies have become very popular in almost all the technology sectors. Even in the homes and offices we have seen the widespread presence of IoT devices. In 2030, it will be more widespread. An enhanced IoT application in 6G is presented in [29] which indicate the extent and scale of IoT in 6G.
5. Energy efficiency in 6G will be certainly better than 5G and new energy saving mechanisms will be added to 6G [10]. Energy efficiency is essential for high speed wireless communication technologies. In 5G, the energy efficiency has been improved significantly in comparison to 4G. In 6G, it will be further improved and the energy per bit will be much less than what we see in 5G.
6. Spectral efficiency in 6G will be better than that of 5G [17]. MIMO provides wonderful ways to improve the spectral efficiency in 5G using beamforming. In 6G, spectral efficiency will be improved using advanced signal processing and large modulation constellations.
7. More artificial intelligence (AI) and machine learning (ML) applications will find their ways in 6G [25]. In the recent years, we have witnessed widespread applications of AI and ML in several applications. Both in industrial and non-industrial applications these technologies are popular. In businesses, these technologies are used for optimal use of resources.
8. Bigger roles are expected for optical networking in 6G [22]. In every new mobile generation, we have witnessed increased usage of the optical communications. In 5G, optical networks are extended till the last mile. In 6G, high speed optical links will be used more frequently to handle the demand for data and device connectivity.
9. More complex device to device communications will be observed in 6G [9]. From the recent projections on the IoT devices and the emerging applications of mMTC, it is clear that the device densities will grow many times. In order to provide better connectivity and ease of communication several new techniques will be used for sharing the data.
10. 6G will have the ability to operate over new frequency bands [26]. New bands are predicted to be used in 6G. Especially, the terahertz frequency bands are being tested in the laboratories for cellular applications. Hopefully, by 2030 it will be ready for applications in 6G.
11. Satellite cellular connectivity will get better through the 6G framework [4]. Several new applications such as the commercial and research communications at the remote areas where human civilization does not exist are very poorly served. Currently, used cellular technologies are not suitable for those applications. Therefore, satellite integration with the cellular networks is essential to fill this void.

Application-wise 6G may not be used by individuals to a large extent in its initial years. Rather it will be suitable for business applications and mobile computing demands. 6G would be a very complex system where the hybridization of optical wireless communications will be very much intertwined.

A. Limitations of 5G

6G will borrow the ideas and techniques which are better than 5G in terms of performance. Currently, there are some technologies which perform better than the proposed 5G specifications. We provide a list of commonly identified access technologies in the following paragraph. It includes both the wired and wireless access technologies whose performances have already been tested. They are:

1. PONs which provide higher data rates, lower latency and better reliability [14]; even terabit PONs are available which can carry gigantic amounts of data [12];
2. 400 Gigabit Ethernet which has already been used since last few years [8];
3. 800 Gigabit Ethernet is now available for deployment in core and access networks [8];
4. High throughput satellites are capable of dealing with higher data rates than 5G [4];
5. Several private satellite operators are planning to provide high speed Internet services through satellites and high altitude platforms [7];
6. LiFi provides very high data rates in the line-of-sight communication channels [11];
7. Twisted copper wires provide very high data rates (more than 100 Gbps) in the short range [13].

It is expected that 6G would be associated with all these technologies. It may incorporate several of these technologies in the access devices through software applications or similar tools when deployed. Therefore, both in the static and moving conditions it would provide the best possible services.

B. Who are Interested in 6G?

Not everyone is a fan of new mobile generations. There are special interest groups who want the new mobile generations. There are several types of interest groups. First of all, the telecommunication vendors are the ones who benefit the most from the new mobile generations [17]. They are the experts who design and develop the networks for these new generations. Without the advances of the mobile generations, their businesses do not grow very fast. So, it is always a win-win condition for the telecom vendors to roll out a new technology. The new technologies come with new techniques and equipments which are the direct source of revenue for these vendors. These vendors also play main roles in the research and development of the new mobile generations.

The next beneficiaries are the telecom operators. Operators make money from their services. New generations come with new services and thus new income sources emerge for them. Of course it is true that some of the old services also become obsolete or do not produce revenue. However, in the competitive business arena the operators want to defeat their rivals through advanced technologies. Governments also want new technologies to earn new taxes and revenues.

In addition to these stake holders there are also the pure research and innovation teams and companies who get direct benefits from the new generations.

C. Timeline for 6G Development

The timeline for 6G is expected to follow the previous timeline patterns of previous generations. We observed a time gap of almost 10 years between two mobile generations starting from 2G to 5G. A similar time gap is expected in order to reach a preliminary version of 6G.

As expected, 5G will not be rolled out all over the world in 2021. Actually, only some cities across the world will have it. Around 2025, 5G will be used widely across the world. Rural deployment in the developing countries may take even longer. Thus, the incremental versions of 5G will be developed after 2025 which are expected to be better than 5G and inferior to 6G. This gradual process of innovation would make 6G ready for deployment around 2030.

As it happened with the previous generations, large scale deployment of 6G will not be immediate; rather it is expected that 6G will be adopted gradually. It is also true that 6G may not be attractive for many developing countries as 5G itself would be too advanced for them. The individual communication demands can be easily met by the 5G specifications. Thus 6G and its subsequent versions may remain limited only to the business and high performance applications.

D. Impact of 6G on Society and Business

It is very difficult to predict how an advanced technology would affect the society. In the last two decades, we have witnessed several disruptions through mobile technologies. Similar disruptions are equally possible through 6G. However, 5G is likely to cause a lot of changes in the society. Therefore the arrival of 6G may not be a surprise for several social activities.

AI and ML are going to play some key roles in 5G. However, that will not be very mature in just one decade. Therefore, 6G is envisioned as the true AI powered version of mobile communication. Several new cognitive applications are expected in 6G.

Coupling between the satellites and mobile cellular networks is an advanced form of communication which has the capability to enhance the performances of several communication systems. Satellite coupling with cellular infrastructure is not quite feasible at the moment. In 5G regime too this may not be achieved to its full potential. It is expected that in 6G satellite and mobile infrastructure will be very much compatible. Through satellite conjugation the true ubiquitous communication will be possible. IoT networks too will get a boost through the satellite connectivity. It will provide better availability and reliability for the IoT based services. Similarly, quantum communication and other advanced techniques are expected to be parts of 6G. Therefore, 6G is perhaps the right mobile technology to bring all these new applications and possibilities together.

E. Key Challenges on the Way to 6G

As we have seen in the previous sections, the main goal of 6G development is to fill the gaps left over in 5G and to enhance certain performance aspects of 5G. These gaps in 5G are the main motivations and also the key challenges for the 6G development groups. In this sub-section, we show some of the main challenges 6G will come across. There are several challenges predicted for 6G development and roll out. In the following paragraph, we present some of the key challenges in the initial years of 6G deployment.

In 6G, the satellite cellular integration is one of the main challenges. In 5G and its previous legacy systems it was clear that network coverage voids are commonly found despite good cellular coverage planning. In 6G, this problem is expected to be handled through the satellites and other high altitude platforms. However, the costs of these services may not be a positive aspect for the cellular network operators. Therefore, a cost effective solution is the main challenge for ubiquitous network availability in 6G.

Generally, it is expected that the latency in 6G has to be smaller than the latency observed in 5G. The main problem in 6G is that it will be very much softwarized. The SDN based networking and network slicing like operations increase the latency. In 6G, perfect compromise between the low latency technologies and the softwarized options is essential to provide low latency communications.

Terahertz frequencies are being planned for use in 6G [6]. There are a lot of challenges in this frequency bands. It will be a big challenge for the 6G developer to use terahertz bands for practical cellular communications.

Device capacities are projected to increase almost exponentially every year. This is going to be a big challenge for the cellular networks to provide proper management, control and monitoring of the connected devices [26]. Edge computing facilities are essential for the end communications among the devices and the data management facilities. The

IoT and mMTC services heavily rely on the edge computing infrastructure. The increasing number of end devices is certainly a big challenge for the edge facilities. Device to device connectivity in the 6G framework will be very crowded as the IoT devices and other mMTC applications are projected to increase manyfold. Increasing number of devices is going to pose bigger security challenges. In 6G, good security will remain a challenge for the operators and the end users.

F. The G-Race

Since the 1980s, we see a race in the digital communication innovation to bring a new mobile generation every decade. It is now clear that 5G will be rolled out for several cities around world by 2022. By 2025, this technology will become mature and almost half of the world should be using it according to the Gartner predictions. Based on these observed trends we are going to witness the arrival of 6G in early 2030s or a little before 2030 as mentioned in the deployment timeline. However, the G-race may not be very intense as we have seen it in the previous cases of 3G, 4G and 5G. That is mainly due to the advances achieved up to 5G. We can compare this with the different generations of computer processors.

Initially, when the microprocessors came in the 1970s it was a revolution altogether. Then the second generation came in the early 1980s, followed by third generation in the late 1980s. The fourth generation of Pentium processors brought a lot of aura in the computing world. Then arrived the fifth generation of multi-core processors. Since then, processors are being updated to make them faster and better. However, the craze and aura is no more observed like it was in the previous generations. We no longer observe the acute generation races in the microprocessor innovation. That is mainly due to the speed of the microprocessors achieved in the fifth generation. The speed of microprocessors from the fourth generation onwards is good enough to carry out most of the common personal and office works. The faster processors are required only for the special projects or advanced computing applications. Therefore, the craze for the faster new processors is no longer like the ones seen in the 1990s. A similar saturation like effect is going to be seen in the mobile ICTs. After 5G, the common users will not be looking for any faster communication systems. However, just like the case of computer processors, some special purpose communication tasks may need speeds higher than that of 5G.

Overall, the G-race in mobile communication is expected to be irrelevant after 5G. Though the new mobile technologies may be developed under the G-hierarchy, they will not get the big attention from the public as they got till 5G and its previous legacy generations. However, it is possible that the ICT may develop in a whole new direction through the empowerment of AI and machine learning.

V. Conclusion

In this paper, we presented the potential driving forces behind the development of 6G. The major short comings of 5G will lead the path to the next generation of mobile ICT. Computing and communication capabilities of the 6G devices will be better than those of 5G. AI and ML applications will have a strong presence in 6G. It is expected that the deployment of 6G would start around 2030. 6G will be very much energy and bandwidth efficient when compared with 5G. The new dimensions in ICT such as quantum communication and cellular satellite integration are likely to find places in the 6G ambit. The G-race in mobile communications is found to be saturated with 5G. Only some technological voids and a select performance related aspects will be improved in the future mobile generations. Therefore 6G and other future generations will not create the craze and aura like the previous ones.

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