## **MEMORANDUM**

TO: David Honig, President Emeritus of the Multicultural Media Telecom, and Internet Council (MMTC)
FROM: Adaeze Uche, MMTC Spring 2022 Fellow
DATE: April 17, 2022
RE: The Future of 6G Technology

Sixth-generation (6G) wireless technology is the successor to fifth-generation wireless (5G) cellular technology. Once developed, 6G wireless networks will be able to use higher frequencies than 5G networks and provide substantially higher capacity and much lower latency. One of the goals of 6G internet will be to support one microsecond-latency communication.<sup>i</sup> Even though 5G networks are not completely developed, wireless communication companies have already started thinking about the next mobile network to come. And although 6G does not exist yet, it could end up being various things, building on current network and technology trends to help make a completely new type of internet.<sup>ii</sup>

Currently, 5G mobile networks already offers speeds 10 times faster than 4G. However, the 6G network is expected to offer speeds 100 times higher than those of 5G because of the use of terahertz waves. The frequencies allocated to 6G are between 100 GHz and 30 THz.<sup>iii</sup> However, these very high frequencies pose several problems research laboratories are currently attempting to resolve. In telecommunications, the lower the frequency, the further it carries and the lower the throughput. A higher frequency does not carry as far, but with a better bandwidth. Therefore, we need to find a way to boost the power of 6G to improve its performance over distance while maintaining high bandwidth.<sup>iv</sup>

Furthermore, next-generation communication systems strive to accomplish high spectral and energy efficiency, low latency, and large connectivity because of substantial growth in the number of Internet-of-Things (IoT) devices. These IoT devices will help provide advanced services such as smart traffic, environment monitoring and control, virtual reality, telemedicine, digital sensing, high definition, and full high-definition video transmission in connected drones and robots. <sup>v</sup> IoT devices are predicted to reach 25 billion by the year 2025, so it is very difficult for the existing multiple access techniques to accommodate such a massive number of devices. Even the 5G communication systems that are currently being deployed cannot support such a high number of IoT devices. Third generation partnership project is working on the development of 5G standard and has identified enormous machine type communication, ultra-reliable and low latency communication, and enhanced mobile broad band as three main use cases for 5G in its Release 13.<sup>vi</sup>

Additionally, there are various ways individuals will utilize 6G technology in the future. For example, fully autonomous vehicles, which are currently being developed in the initial phase, will offer many benefits to our daily lives, and transform the way we travel, run errands, and commute from school and work. Holographic technologies and augmented reality will break the barrier of distances. And soon mobile devices may acquire the capability to bring 3D imagery and many other applications that we never imagined directly to our finger tips.<sup>vii</sup>

Further, the Metaverse is another way in which 6G technology could be used. It is one of the 5G use cases, which promises to disrupt both traditional and digital spaces. With 6G, the Metaverse would not just evolve into a final model but is also likely to join with the physical world with the help of artificial intelligence and machine learning. <sup>viii</sup> Arguably, one of the most remarkable aspects of 6G would be its ability to sense the environment, people and objects. The

2

6G network's sensing ability combined with artificial intelligence and machine learning will make the network more cognitive and make the metaverse a reality.<sup>ix</sup>

Moreover, 6G technology will transform our business environments by creating truly virtual meetings and interactions with people. There could be a possibility of having high-resolution holograms at the touch of a button, potentially removing the need for long-distance business travel and massive in-person conferences. 6G technology can be largely transformative in closing the gap in access to medical care, enabling faster emergency responses across wider coverage areas and diagnosing and prescribing treatment across the world.<sup>x</sup>

The previously mentioned scenarios will be achievable because of 6G's immense leap forward in performance, even in comparison to 5G networks. This is a mobile network that will be 50 times faster than 5G, 100 times more reliable, with wider coverage supporting ten times more devices per square kilometer. <sup>xi</sup> 6G technology may also include optimizations that improve network design and overcome the current limitations of mobile devices. Advanced edge computing and powerful AI systems will leverage 6G's lightning-fast speed and instantaneous latency to coordinate complex systems like road traffic and stock markets, and even advance space exploration.<sup>xii</sup>

With 5G, the focus has been on the enterprise. But while the enterprise is likely to still be the priority with 6G, one significant consumer use case that benefits from ultra-low latency communications is gaming. With the speed of 6G, online games and competitions can be transformed into immersive extended reality experiences, complete with smart wearables, headsets, and even implants.<sup>xiii</sup>

3

Lastly, 6G technology will have significant implications for many government and industry approaches to public safety and critical asset protection such as threat detection, health monitoring, facial recognition, decision-making in the criminal justice and social credit systems, air quality measurements, and gas and toxicity sensing. Improvements in these fields will benefit mobile technology, as well as emerging technologies such as smart cities, autonomous vehicles, virtual reality and augmented reality.<sup>xiv</sup>

In short, it will likely be another several years before 5G technologies achieve their full potential. Future applications for 6G technology are speculative as research is still in its infancy, and 5G is still several years away from being fully deployed. At this point, 6G is just a myriad of ideas. It is hard to say what 6G will look like exactly, but it will likely involve an advanced level of automation and connectivity in cars, drones, mobile devices, homes, and industries. It will also incorporate technology like artificial intelligence and advanced edge computing to make networks more sophisticated, harnessing record-fast internet speeds and instantaneous latency to coordinate complex systems like road traffic and stock markets. Accordingly, there is a lot of interest in 6G networks and technology from companies and governments all around the world. 6G technology offers substantially more benefits than previous iterations, and it will be an exciting prospect if any 6G applications come to fruition.

<sup>iii</sup> Caulier, Sophy, 6G promises to merge the human and digital worlds (2022), available at <u>https://www.polytechnique-insights.com/en/braincamps/digital/5g-6g/6g-promises-to-merge-the-human-and-digital-worlds/</u> (last visited June 22, 2022).

<sup>&</sup>lt;sup>i</sup> Kranz, Garry, What is 6G? Overview of 6G networks & technology (2021), available at <u>https://kyroninnovativetechnologies.com/what-is-6g-overview-of-6g-networks-technology/</u> (last visited June 22, 2022).

<sup>&</sup>lt;sup>ii</sup> Holsin, Peter, What Is 6G Internet and What Will It Look Like? (2021), available at <u>https://www.highspeedinternet.com/resources/6g-internet</u> (last visited June 22, 2022).

<sup>&</sup>lt;sup>iv</sup> Id.

<sup>&</sup>lt;sup>v</sup> Muhammad Waseem Akhtar, et al., The shift to 6G communications: Vision and Requirements (2020), available at <u>https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2</u> (last visited June 22, 2022). <sup>vi</sup> *Id*.

vii Id.

<sup>x</sup> Gowan, Jeff, Guest Editorial: The Future of a 6G-Enabled World, available at

https://www.6gworld.com/exclusives/guest-editorial-the-future-of-a-6g-enabled-world/ (last visited June 22, 2022). <sup>xi</sup> Id.

<sup>xiv</sup> Kranz, *supra* note 1.

<sup>&</sup>lt;sup>viii</sup> Anzar, Khalid, What is 6G technology? What are its potentials?, available at <u>https://www.business-</u>

standard.com/podcast/technology/what-is-6g-technology-what-are-its-potentials-121121700025 1.html (last visited June 22, 2022).

<sup>&</sup>lt;sup>ix</sup> Id.

<sup>&</sup>lt;sup>xii</sup> Id. <sup>xiii</sup> Id.