**The Road Towards 6G**

Muhammad Umar

UET Peshawar

**ABSTRACT:**

As of today, the fifth generation (5G) mobile communication system has been rolled out in many countries and the number of 5G subscribers already reaches a very large scale. It is time for academia and industry to shift their attention towards the next generation. At this crossroad, an overview of the current state of the art and a vision of future communications are definitely of interest. This article thus aims to provide a comprehensive survey to draw a picture of the sixth generation (6G) system in

terms of drivers, use cases, usage scenarios, requirements, key performance indicators, architecture, and enabling technologies. First, we attempt to answer the question of “Is there any need for 6G?” by shedding light on its key driving factors, in which we predict the explosive growth of mobile traffic until 2030, and envision potential use cases and usage scenarios. Second, the technical requirements of 6G are discussed and compared with those of 5G with respect to a set of KPIs in a quantitative manner. Third, the state-of-the-art 6G research efforts and activities from representative institutions and countries are summarized, and a tentative roadmap of definition, specification, standardization, and regulation is projected. Then, we identify a dozen of potential technologies and introduce their principles, advantages, challenges, and open research issues. Finally, the conclusions are drawn to paint a picture of “What 6G may look like?.” This survey is intended to serve as an enlightening guideline to spur interests and further

investigations for subsequent research and development of 6G communications systems.

**INTRODUCTION:**

The mobile telecommunication industry stems from the first generation (1G) analog cellular systems represented by Advanced Mobile Phone System in the United States and Nordic Mobile Telephone in Europe, which firstly offered mobile voice-calling service around the year 1980. Since then, a new generation of mobile communications was introduced to market nearly every ten years. The 1G analog systems

were replaced by the second generation digital cellular networks in around 1990. Despite of several competing systems, the Global System for Mobile Communications known as GSM achieved a great commercial success and allowed more than one billion of the world’s population to enjoy the convenience brought by mobile voice, short texting, and low-rate data services. Exploiting a revolutionary technology named Code-Division Multiple Access (CDMA), the third generation (3G) systems represented by WCDMA, CDMA2000, and TD-SCDMA, were developed and firstly deployed in 2001 to support high-speed data access with a rate of several megabits per second. In December 2009, the commercial Long Term Evolution (LTE) networks were launched in the Scandinavian capitals Stockholm and Oslo, providing the world’s first fourth generation (4G) mobile broadband service. The 4G system that is empowered by a genius combination of multi-input multi-output (MIMO) and orthogonal frequency-division multiplexing (OFDM) spurs the proliferation of smart phones, fostering the mobile Internet industry that is worth trillions of dollars a year. In April 2019, when South Korea’s three mobile operators and U.S. Verizon were arguing with each other about who is the world’s first provider of the fifth generation (5G) communication services, we stepped into the era of 5G. In the past two years, the term of 5G has been remaining one of the hottest buzzwords in the media, attracting unprecedented attention from the whole society. It even went beyond the sphere of technology and economy, becoming the focal point of geopolitical tension. Unlike the previous generations that focused merely on improving network capacities, 5G expands mobile communication services from human to things, and also from consumers to vertical industries. The potential scale of mobile subscription is substantially enlarged from merely billions of the world’s population to almost countless inter-connectivity among humans, machines, and things. It enables a wide variety of services from traditional mobile broadband to Industry 4.0, virtual reality (VR), Internet of Things (IoT), and automatic driving.

**CONCLUSION:**

This article provided a comprehensive survey on the drivers, requirements, efforts, and enablers for the next-generation mobile system beyond 5G. It can be concluded that the traditional evolution of a new generation every decade will not terminate at 5G and the first 6G network is expected to be deployed in 2030 or even earlier taking into account great passions of developing 6G from both academia and industry. 6G will accommodate the use cases and applications introduced in 5G such as IoT, Industry 4.0, virtual reality, and automatic driving with better quality of experience in a more cost-efficient, energy-efficient, and resource-efficient manner. Meanwhile, it will enable unprecedented use cases that cannot be supported by 5G, e.g., holographic-type communications, pervasive intelligence, and global ubiquitous connect ability, as well as other disruptive applications that we are unable to yet imagine. The trend of mobile communication services expanded from only human centric to connecting also machines and things, started when MTC and IoT were introduced in the age of 5G will continue, and

Internet-of-Everything will be realized when 6G comes. The 6G system has to meet extremely stringent requirements on latency, reliability, mobility, and security, as well as provisioning

a substantial boost of coverage, peak data rate, user experienced rate, system capacity, and connectivity density, gaining KPIs generally 10 to 100 times better in comparison with 5G.

**REFERENCES:**

[1] J. D. Vriendt, P. Laine, C. Lerouge, and X. Xu, “Mobile network

evolution: A revolution on the move,” IEEE Commun. Mag., vol. 40,

no. 4, pp. 104–111, Apr. 2002.

[2] E. Dahlman, B. Gudmundson, M. Nilsson, and A. Skold,

“UMTS/IMT-2000 based on wideband CDMA,”