Chapter 5
High-Speed Connectivity:
Potential Impact on the Quality of Life

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ABSTRACT

Since the early 1990s, there has been a lot of enthusiasm for using high-speed connectivity to develop local community links through education, employment possibilities, fostering community events, and enhancing overall sociability within a local region. 5G is the 5th iteration of a broadband network operating on cellular systems. 5G is not only for mobile phones, but it is also the foundation for virtual reality (VR); the internet of things (IoT); and autonomous transport, immersive services, and public infrastructure; and connecting many electronic devices to the internet. In this chapter, first, the authors have discussed the evolution of 1G network to 6G networks by focussing on its potential impact on the quality of life. Further, 5G applications in IoT, autonomous transport, immersive services, and public infrastructure have been discussed. Then the chapter discusses popular advantages, limitations in the current technologies, implementations, and future perspective.

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INTRODUCTION

Today's standard of high-speed connectivity is 5G, the 5th iteration of a broadband network operating on cellular systems (Hossain, 2013). Similar to what came before it, 5G works mainly in small geographical areas known as cells (Zhang, Dong, Cheng, Hossain, & Leung, 2016). The transmission medium throughout the various compartments is radio waves that travel through the air, used to send or receive Internet and telephony packets (Capozzi, Piro, Grieco, Boggia, & Camarda, 2013). These duplicate packets are sent (or received) via Antennas located in every cell, depending on their contents. Telephone data (made up of sounds and images) is transmitted as a stream of bits and converted using a converter found in Antennas (Steinmetz, 2012). Internet packets sent over high-bandwidth fibre optic cable other than wireless medium. Speeds of 5G promised to go up to 10GB/s, the bandwidth being shared amongst users of a cell. Realistically, the typical end-user will more or less benefit from a speed between 50 and 100MB/s on wireless devices. It is statistically proven, wired devices are bound to make better use of the total available bandwidth due to less resistance in their connection. This depends on the infrastructure as it will require specific cabling to be made available to homes (Wey & Zhang, 2019). When moving from one geographical area to another, a user's device is automatically handed over without any intervention needed (Lei, Zhong, Lin, & Shen, 2012). 5G can cater for up to 1 million devices/square km., as opposed to 4G, which can only support a tenth of this. Most devices nowadays operate on wireless networks (or Wi-Fi), and recently launched smartphones, for example, can already boast the availability of a 5G-capable network unit (Rommer et al., 2019).

To truly understand the background behind network connectivity, it is necessary to plot the evolution of wireless connectivity. It was starting from the first generation (1G) to the sixth generation (6G) (Anju & Gawas, 2015; Pereira & Sousa, 2004). The first generation (1G) was launched by Nippon Telegraph and Telephone (NTT) in Tokyo around 1979. Although it was a big hit, it suffered from various limitations such as low coverage and poor sound quality. The second-generation (2G) was launched in Finland in 1991 (Bhalla & Bhalla, 2010). This brought about improvements upon the previous generation, including encrypted and digital voice calls with less background static noise. This generation also allowed text messages and picture messages to be sent and received on their phone. Then came the third-generation (3G), also known as the 'Packet-Switching' generation (Chiussi, Khotimsky, & Krishnan, 2002). Launched by NTT DoCoMo in 2001, its primary goal was to allow users to access data from anywhere with a connection that made international roaming services possible. Through this, video conferencing and VoIP were introduced. After that, the fourth generation (4G) was launched in Sweden, Stockholm and Norway in 2009 as LTE (Cox, 2012; Shikhare, G., & Shaikh, 2014). This generation has also brought about the streaming era as it was introduced globally and made high-quality video streaming accessible for many people. The only problem with this is that mobile phones need to be designed to support 4G connectivity, whereas the switch from 2G to 3G only required a change of SIM card. Although 4G is currently the standard for most countries, some countries still experience network patchiness. This comes about due to the higher frequency required for faster speeds. Now we are entering into the Internet of Things Era, the fifth generation (5G) (Anju & Gawas, 2015; Eze, N. O. Sadiku, & M. Musa, 2018). This network has been years in the making; in 2008, NASA launched the technology required to support 5G speeds, and in the same year, South Korea started a 5G R&D program. Finally, carriers in South Korea have rolled out 5G services in December of 2019. With 4G experiencing limitations in terms of coverage due to the high frequency. Why is 5G being implemented already with even higher frequencies? The far superior speeds and latency offered by 5G can transform industries such as banking and healthcare(Latif, Qadir,