Chapter 5
The Technological Perspective of 5G

ABSTRACT

5G is more than a mobile broadband upgrade, it's a transformative force enabling innovation across industries. With features such as ultra-reliable low-latency communication (URLLC), massive machine-type communication (mMTC), and enhanced mobile broadband (eMBB), 5G addresses the unique needs of sectors including automotive, healthcare, utilities, and finance. eMBB boosts speed, latency, and user density for seamless connectivity. mMTC supports vast networks of low-cost, battery-powered devices, enabling smart meters, IoT sensors, logistics systems, and wearables. 5G empowers both individuals and organizations with next-level connectivity and efficiency.

INTRODUCTION

The fifth generation of wireless, of the 5G technology, is far more than an incremental advancement in mobile broadband—it is a transformative enabler of innovation across industries. With its unparalleled capabilities, 5G represents a technological revolution, empowering individuals and organizations to achieve new levels of connectivity, efficiency, and creativity. Far from being limited to faster speeds, 5G introduces robust features such as ultra-reliable low-latency communications (URLLC), massive machine-type communications (MTC), and enhanced mobile broadband (eMBB), each addressing distinct needs within the digital ecosystem. These features position 5G as a game-changing technology across the automotive, healthcare, public safety, utilities, manufacturing, and finance sectors.

A recent survey revealed that 89% of industry leaders across eight diverse sectors anticipate 5G to revolutionize their respective fields. Enhanced mobile broadband (eMBB) enhances data rates, reduces latency, and increases operator density,

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providing seamless broadband access that scales with rising consumer demands. Meanwhile, mMTC enables connectivity for vast networks of inexpensive, battery-operated devices, making it indispensable for smart meters, IoT sensors, logistics, and wearable technology applications. Finally, URLLC delivers ultra-reliable, low-latency communication, crucial for time-sensitive operations such as remote surgeries, autonomous vehicles, industrial automation, and smart grids. Popovski et al. (2018) state that ultra-reliable low-latency communication (URLLC) in 5G enables critical applications such as autonomous driving and industrial automation.

Partnerships among governments, tech companies, and global institutions are actively addressing these challenges, aiming to expand 5G access to more regions and diverse populations. According to Evercom Communication Technology Co., Ltd., 5G LTE antennas are engineered to support a wide range of frequencies (700 MHz to 3800 MHz), ensuring robust performance across diverse 5G and LTE deployment scenarios, (Evercom, 2025).

The 5G technologies lay the foundation for smarter cities, safer industries, and more efficient global operations by bridging the gap between people, devices, and machines. In this chapter, we will explore the technological aspects of 5 G, the innovations driving its capabilities, and their implications for the future of connectivity and industrial transformation.

Far more than an evolution of mobile broadband, 5G wireless entry will be a crucial enabler of the Internet of Things (IoT), empowering industries and individuals to reach new heights in innovation and efficiency. A recent survey of eight diverse sectors (automotive, media, health care, public safety, utilities, finance, web, and manufacturing) revealed that 89% of respondents expect 5G to become a game-changer in the industry.

5G wireless access gathers several broad categories:

Enhanced mobile broadband internet (eMBB), and robust machine type communications (ultra-reliable low-latency and MMTC) communications (URLLC). Advanced features of 5G, like eMBB, support real-time virtual and augmented reality experiences, (Park et al., 2020).

eMBB enhances information flow, latency, operator density, coverage, and global mobile broadband internet access capacity.

mMTC interacts with inexpensive, massive quantities of battery-driven products to assist users, such as those utilizing intelligent metering strategies and field and body sensors.

Lastly, URLLC facilitates communication between machines and devices by offering ultra-reliability, high availability, and low latency. It is critical for vehicular communication, remote surgery, factory automation, industrial control, innovative grid applications, and public safety.