

Chapter 6

Evolution of Mobile Telecommunications With 5G

ABSTRACT

Spectrum allocation is vital to 5G deployment, impacting coverage, capacity, and performance. It requires balancing low (sub-1 GHz), mid (1–6 GHz), and high-frequency (above 6 GHz) bands. Low bands offer wide rural coverage, while high-frequency millimeter waves deliver ultra-fast speeds for urban and industrial applications like AR and autonomous vehicles. Global regulators, including the ITU-R, shape spectrum frameworks—especially in the 24–86 GHz range—to support varied use cases. Their focus includes fair access, efficient allocation, and enabling both mobile operators and new industry-specific players to deploy 5G effectively.

INTRODUCTION

The evolution of mobile telecommunications has reached a pivotal milestone with the introduction of Fifth-Generation (5G) technology, marking a transformative chapter in global connectivity. The 5G technology represents a significant leap from previous generations, enabling faster, more reliable, and scalable communication networks. The evolution of 5G-compatible devices is accelerating, with Ericsson projecting substantial growth in the number and diversity of devices supporting advanced features such as standalone 5G and network slicing (Ericsson, 2024a).

As a result of extensive research into emerging demands and evolving market trends, 5G marks a significant advancement over previous generations by meeting the increasing need for faster, more reliable, and highly scalable communication networks.

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This breakthrough goes beyond a simple upgrade, representing a transformative shift that unlocks new opportunities across industries and reshapes the fabric of modern society. Odida (2024) presents 5G as a transformative leap in mobile communication, characterized by ultra-fast data transfer, minimal latency, and the integration of advanced applications such as IoT, augmented reality, and autonomous vehicles—all of which require improved spectrum use and higher quality of service.

This chapter explores the evolution of mobile telecommunications, emphasizing the technological advancements and market trends that have shaped the emergence of 5G. By examining its capabilities, applications, and transformative potential, this section highlights how 5G redefines modern telecommunications and sets a new standard for global connectivity.

NETWORK SLICING

At the heart of 5G innovation lies network slicing—a groundbreaking technique that enables multiple virtual networks to coexist on a single physical infrastructure. This approach provides exceptional flexibility and efficiency, allowing each slice to be tailored to the unique needs of individual users, applications, or industries. The result is a robust and adaptable framework that supports various applications, from smart cities and autonomous vehicles to advanced Internet of Things (IoT) ecosystems and mission-critical operations.

5G enhances the capabilities of autonomous robots in industrial environments. For example, Lagorio et al. (2023) argue that 5G technology has the potential to shape the logistics sector by facilitating real-time data exchange, automation, and enhanced system integration. Nevertheless, they emphasize that the successful adoption of 5G in this context depends on addressing significant challenges, including high implementation costs, substantial infrastructure requirements, and persistent data security concerns.

The implications of 5G extend beyond improved speed and connectivity; they redefine the role of telecommunications as the foundation for digital transformation. By enabling previously unattainable applications, 5G unlocks new opportunities for innovation across various sectors, including manufacturing, logistics, healthcare, and entertainment. From powering real-time analytics and remote surgeries to enhancing augmented reality experiences, 5G sets the stage for a brighter, more interconnected world.

The intense advancement of the Fifth-Generation Mobile Communications method (also known as 5G) is underway worldwide, marking a significant improvement over current mobile communication methods, based on extensive investigations into future demands and market trends for mobile communication in the 2020s.

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