

Chapter 1

Overview of 5G

Technology

ABSTRACT

The advent of 5G marks a significant shift in mobile telecommunications, offering unmatched speed, low latency, and scalability. As the fifth generation of wireless networks, 5G introduces network slicing, enhanced mobile broadband (eMBB), and ultra-reliable low-latency communication (URLLC). These innovations enable customized connectivity for sectors such as healthcare, manufacturing, and public safety. 5G supports applications that require fast data transfer, low latency, and large-scale device connectivity. It drives digital transformation across smart cities, autonomous vehicles, and advanced IoT systems. Industries benefit from real-time data exchange, remote control, and immersive tech.

INTRODUCTION

The advent of fifth-generation (5G) technology marks a transformative era in global telecommunications. It builds on the foundations of its predecessors—1G, 2G, 3 G, and 4 G. As the first wireless standard tailored to the digital age, Engineers designed 5G to revolutionize connectivity by integrating advanced intelligence, mobility, and diverse technologies. With capabilities far surpassing those of fourth-generation (4G) systems, 5G offers unprecedented enhancements in bandwidth, ultra-low latency, and machine-to-machine communication. It enables seamless connectivity for countless devices, creating a unified system supporting emerging innovations such as the Internet of Things (IoT), smart cities, and autonomous vehicles (Egea-Roca et al, 2022)

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OVERVIEW AND DEFINITION

To fully grasp the significance of 5G, it is essential to contextualize its evolution within the broader history of wireless communication. From the analog 1G networks of the 1980s, which facilitated basic phone calls, to the digital breakthroughs of 2G and the internet-enabled capabilities of 3G and 4G, each generation has laid the groundwork for the unparalleled advancements of 5G. As the cornerstone of future telecommunications, 5G redefines connectivity, fueling innovation across industries and reshaping global digital ecosystems.

Definition

5G is a new global wireless standard that follows 1G, 2G, 3G, and 4G networks. It enables a brand-new system to link practically everything and everyone, including devices, objects, and machines.

In telecommunications, 5G is the 5th generation technology standard for cellular networks. Cellular telephone companies began deploying globally in 2019, the planned successor to the 4G networks that provide connectivity to most existing cell phones.

5G networks are cellular networks structured into small geographical areas, known as cells. Radio waves from a local antenna link most 5G wireless devices in a cell to the Internet and the telephone system (Henley Business School, 2021).

The brand-new networks' main benefit is their larger bandwidth, which provides high download speeds and, ultimately, as many as ten gigabits per second (Gbit/s) (ITU-R, 2017)

Context and Stakeholders

Fifth-generation (5G) technology is the first in the digital era, where different networks converge to form a single program (Osseiran et al., 2014). *The 5G networks significantly enhance performance compared to the current fourth-generation (4G) system, supporting increased bandwidth, low latency, and machine-type communications.* They also provide seamless connectivity to several devices, integrating various technologies, intelligence, and mobility.

The 5G ecosystem comprises various actors, each playing a critical role in deploying, operating, and adopting this next-generation technology. These include operators who build and manage networks, service providers that enable functionalities, equipment suppliers who develop infrastructure, and end-users who consume the services. To better understand this complex ecosystem, a summary table is provided below for quick reference.

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