6G: Beyond

6G: Más allá

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The next step in telecommunication platforms is 6G technology, which focuses on mobile services and is projected to surpass the capabilities of 5G far. It is expected to offer speeds of up to 1 Tbps, with negligible latencies (less than 1 ms) and tight integration with emerging technologies such as Artificial Intelligence (AI) and quantum computing. Leading institutions, including the 6G Flagship consortium in Finland, and companies such as Samsung, Huawei, and Nokia, intensified research and pilot tests to lay the foundation for this new generation of networks [1]. In addition to technical improvements, 6G seeks an architectural transformation of networks through technologies such as Software Defined Networking (SDN), Network Function Virtualization (NFV), and the use of frequencies in the terahertz (THz) spectrum [2].

6G applications range from augmented reality environments and real-time holography to remote control of vehicles and medical systems, utilizing ultra-low latency and high-reliability networks. This generation will enable the development of fully automated smart cities, digital twin networks, and large-scale support of the metaverse [3]. Cyber-physical systems, such as distributed sensors and decentralized neural networks, will benefit significantly from the instantaneous and ubiquitous connectivity that 6G can offer [4].

However, the technical, economic, and social challenges of 6G are still significant. At the technological level, utilizing THz frequencies entails high attenuation levels and necessitates the development of new materials and low-power devices. Economically, the cost of deploying ultra-dense infrastructures is high, while ethically and legally, privacy and security concerns in hyper-connected networks persist [5]. Additionally, global standardization of 6G had not been achieved by 2023, which could exacerbate the digital divide between developed and developing countries [1].

6G research is already exploring concepts that could give rise to 7G or even new non-traditional network architectures. These future technologies point toward self-evolving networks, driven by Artificial General Intelligence (AGI), quantum communications, and brain-computer links. It is envisioned that future generations will enable direct connectivity between implantable human devices and digital systems, ushering in an era of the Internet of Things (IoT) [6], [7]. Additionally, the use of interplanetary networks and communications based on quantum physics is envisioned to ensure absolute security and virtually zero latency in data transmission. Although these technologies are still theoretical or experimental, they influence 6G design and standards decisions by paving the way for ubiquitous, cognitive, and universal connectivity.

However, the development and deployment of 6G present significant challenges. One of them is the use of frequencies in the terahertz (THz) spectrum, which, while allowing higher speeds, has a shorter range and greater susceptibility to interference [8]. In addition, it will be necessary to redesign more flexible and distributed network architectures that incorporate technologies such as artificial intelligence to optimize resource management and ensure energy efficiency in the context of high data consumption [9].

6G will establish global standards that ensure interoperability and security in a hyperconnected environment. Cybersecurity will be critical, as the increased density of devices and the transmission of sensitive data will expand the attack surface [10]. Close collaboration between governments, industry, academia, and international organizations will be essential in the next decade to meet these challenges.

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