Chapter 3
Cybertwin-Driven Resource Provisioning for IoE Applications at 6G-Enabled Edge Networks

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ABSTRACT

6G is the latest in wireless communications network technologies supportive for cellular data networks. 6G networks use complex frequencies unlike 5G networks and will empower higher data rates to be achieved and for the 6G network to have a superior global volume. Lower latency levels will almost definitely be a requirement. 6G radio networks will deliver the communication and data congregation essential to accrue data. However, a systems method is mandatory for the 6G technology. It will include data analytics, AI, and next-generation computation abilities using HPC and significant computation.

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1. INTRODUCTION

Recent advances in the Internet of Things (IoT) and sensing devices have accelerated the rise of data-intensive applications across a wide range of application domains, including online gaming, augmented/virtual reality, path navigation, autonomous driving, video streaming, and so on. The pervasiveness of IoT devices connects millions of physical items, allowing for seamless data collection and sharing via improved wireless technologies. The number of IoT devices is growing, and according to a study undertaken by the International Telecommunication Union (ITU), 125 billion IoT devices will be part of our digital eco-system by 2030, creating about 4395 Exabytes of data. 6G technology was introduced in response to increased traffic from various data-intensive applications and for seamless data transfer among faraway computer devices. 6G is a next generation of wireless technology (Adhikari et al 2021).

In recent years, millions of IoT devices and apps have been able to connect to the internet thanks to advancements in network architecture. A lot of data is produced by gadgets like smartphones, RFID tags, smart refrigerators, smartwatches, smart fire alarms, and others (Khan et al 2020). These IoT devices generate enormous volumes of data, necessitating tremendous computational, storage, and processing capabilities. The construction of centralised cloud data centres has made all of these services viable.

Data transport between remote cloud data centres and IoT applications with a variety of service requirements is also made easier with the latest 6G network technology. However, because cloud data centres are located far away from IoT devices, it poses new issues (location unawareness, security, privacy, trustworthiness, and increased network congestion), making it unsuitable for delay-sensitive applications. Cisco invented the phrase fog/edge computing in 2012 to address the limitations of cloud computing. Edge computing reduces the latency of user requests by bringing communication, processing, and caching capabilities to the network edge (Jain et al 2021). Furthermore, the edge-cloud collaborative architecture makes advantage of the features to improve user experience and enhance QoS for delay-sensitive applications.

On the other hand, the limited capabilities of the edge-cloud cooperation framework cannot keep up with the changing resource needs of data-intensive and latency-sensitive IoT applications. Emerging strongly is a new generation of technology called Cybertwin for a 6G-enabled future communication network. Cybertwin is a term used to describe the digital representation of real-time phenomena in virtual space, such as tangible objects or things. It is a notion for next-generation communication systems(Dhiman et al 2022). The underlying network architecture offers scalability, security, accessibility, and resilience when combined with Cybertwin's features.

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