Chapter 7
Realizing a Ultra-Low Latency M-CORD Model for Real-Time Traffic Settings in Smart Cities

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ABSTRACT

At present, the need for an ultra-high speed and efficient communication through mobile and wireless devices is gaining significant popularity. The users are expecting their network to offer real-time streaming without much latency. In turn, this will result in a considerable rise in network bandwidth utilization. The live streaming has to reach the end users mobile devices after traveling through the base station nodes, core network, routers, switches, and other equipment. Further, this will lead to a scenario of content latency and thereby causing the rejection of the mobile devices users' request due to congestion of the network and mobile service providers' core network witnessing an extreme load. In order to overcome such problems in the contemporary 5G mobile networks, an architectural framework is essential, which offers instantaneous, ultra-low latency, high-bandwidth access to applications that are available at the network edge and also making the task processing in close proximity with the mobile device user.

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INTRODUCTION

The present-day consumer electronics gadgets like smartphones, intelligent mobile devices, and smart televisions and so on, have extraordinary demand for real-time streaming of videos (Guo, Liu, & Zhang, 2018). The multi-access edge computing (MEC) provides the solution to such problems by moving the computation and data processing of services and applications nearer to the mobile gadget user. Rather than processing the data in the cloud, the analyses, processing and storing of data is done at the edge of the network. Moreover, the computing is done with the deployment of petite edge servers at the network edge instead of the centralized servers in the conventional architecture. The data related to applications and services are analyzed, processed and stored closer to the user equipment (UE), thereby minimizing the network traffic and improving the overall efficiency and performance. Further, MEC offers high-scalability, high-flexibility, and high-availability besides leading to the growth of novice applications and tailored network services provided to the consumers. Also, this specific technology offers an extraordinary quality of experience (QoE) and extraordinary quality of service (QoS). Due to the latest progress in the MEC, it has become easy for consumer Electronic devices and gadgets for implementing and using several real-time applications in virtual reality, augmented reality, mixed reality, Internet-of-Things (IoT) and other emerging technological fields in comparison with conventional technologies.

In the 5G communication technologies, it can be witnessed that the virtual platform is built using the MEC architecture by amalgamating the essential concepts of the software-defined networking (SDN) with the network function virtualization (NFV) (Golestan, Mahmoudi-Nejad, & Moradi, 2019). Also, the point to be noted is that the 5G communication networks can be easily programmed and the virtualization can be done with ease leading to superior evolution of technologies. Besides, the features like automation, maximum throughput, ultra-low latency is possible with the MEC enabled 5G edge computing networks. Furthermore, MEC architecture is highly-scalable due to the decentralization of the network core, which aids to address the demands of real-time and high-speed applications and services (Sabella, Vaillant, Kuure, Rauschenbach, & Giust, 2016).

The NFV provides a novel direction for devising, implementing and handling the network traffic and services. The multi-access edge computing technology makes use of the NFV for virtualizing the network functions and executing them at the network edge. Further, the networking needs of the NFV and the MEC are more or less analogous. Hence the NFV's infrastructure services and management shall be re-used for designing a significant proportion of the MEC's architecture. Subsequently, it might lead to the scenario, where, in a separate virtual platform the network service providers/ operators will be hosting applications and services involving the NFV and the multi-access edge computing technology (Srinivasan & Agrawal, 2018). This paradigm might lead to the possibility of achieving minimal capital expenditure (CAPEX) and operational expenditure (OPEX) for the network service providers (M-CORD, 2020)

Recently, it could be observed that the total amount of smart gadgets and consumer electronic devices connected to the internet have increased several manifolds. The business organization IHS Market's investigation establishes the fact that the amount of IoT gadgets and devices around the globe will rise from 31 billion in 2018 to 125 billion in 2030 (Markit, 2017). Also, several IoT gadgets, devices and applications might demand instantaneous, high throughput, high-speed data transmission with ultra-low latency (Srinivasan, Agrawal, Cherukuri, & Pounjeba, 2018). Hence, the MEC technology along with the NFV paradigm would enable a large number of connected IoT gadgets and devices with superior Quality of Experience.