CHAPTER 6

An Adaptive Interoperability Framework for IoT over 5G

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6.1 INTRODUCTION

The increasing number of supporting technologies has modified the Internet's capabilities from human connectivity to things. A network of smart things is named the Internet of Things (IoT) (Chander et al., 2022). IoT connectivity enables devices to be accessed remotely. They provide various new services in different areas (Eom et al., 2022).

IoT brings its own challenges, such as accommodating the increasing number of connected devices, management of traffic generation by connected devices, and performance requirements such as latency, throughput, minimum security overhead, demand modifications in telecommunication features like bandwidth, modulation schemes, protocols, and antenna design (Vaezi et al., 2022). IoT management issues require reliable and consistent network technology. 5G is emerging as a viable solution that can accommodate IoT demands and expectations (Modesta et al., 2019).

5G expected data rate greater than 1Gbps (Minopoulos & Psannis, 2022). 5G is the combination of multiple enabling technologies to be implemented at different layers of TCP/IP protocol suite; some of these technologies are open wireless architecture, IPv6 addressing scheme with mobile IP standard, open transport protocol, promising Quality of Service (QoS) for multiple networks, multi-Radio Access Technology (multi-

RAT), massive Multiple-Input Multiple-Output (MIMO), and millimetre Wave.

Due to the increasing data traffic growth, 5G is expected to fulfil all the desired requirements. One of many challenges of 5G is IoT with greater data rates, less than one-millisecond ultra-low latency, broader coverage, massive connectivity, minimum energy consumption, and reduced cost of deployment. Moreover, some advanced requirements such as defined infrastructure, higher frequency bands, many times more system capacity to accommodate billions of connected devices, and high-density networks are challenges for 5G (Ji et al., 2022).

IoT and 5G are essential to the future (Painuly et al., 2021). IoT's objective is to ease human lifestyle. Technologies such as smart homes with smart and intelligent home appliances, healthcare connected smart devices along with wearable devices sending and receiving reports to the expert system in real-time to avoid emergencies, multimedia streams experience and Ultra-High Definition (UHD) streaming, virtual reality, augmented reality, online games, online education, virtual reality video service, etc., are considered as the beginning of lifestyle changes. Remote access to thousand miles distant devices, heavy industrial equipment, and discovering unrevealed parts of the planet are possible only through IoT and 5G (Arzo et al., 2022).

To tackle the massive number of IoT devices and fulfil the unique demands of network resources from IoT devices requires a reliable framework to accommodate these challenges to interoperate among these devices. This work presents an adaptive framework for IoT on 5G. The challenge of multiple heterogeneous IoT devices requires interoperability, which can be achieved by layered structure. All necessary functions for device connectivity are grouped and assigned to different layers. The proposed work is a layered framework consisting of a sensing layer, network layer, middle or storage layer, application layer, and orchestration layer; this layered design of network system will allow the connectivity of all types of smart devices

also known as heterogeneous devices regardless of their underlying architecture that will make the system adaptable.

This chapter is organized by related work in Section 6.2. The proposed layered framework is detailed in Section 6.3, whereas the experimental setup and results are discussed in Section 6.4. Finally, the chapter conclusion is provided in Section 6.6

6.2 RELATED WORKS

5G network with its highest transmission features is predicted to be the most promising technology for IoT requirements like higher data rate, low latency, improved security, power efficiency, and mobility for the number of devices. The absolute power of 5G networks to fulfil the requirements of various use cases can be realized by combining enabling technologies with 5G. (Mohamed & Zemouri, 2022) present a framework, requirements, and the challenges of combining 5G, artificial intelligence, and cloud computing technologies in a smart building use case. Technologies like Software-Defined Network (SDN), Network Function Virtualization (NFV), NFV chaining, intelligent traffic steering, and network slicing are defined and then explained in their support to enhanced Mobile Broadband (eMBB), massive Machine Type Communications (mMTC) and Ultra Reliable Low Latency Communications (URLLC) on the same infrastructure. The framework uses virtualized infrastructure implemented on the edge network. Layer is responsible for organizing functions of underlying layers in 5G. Implementation of cloud services can provide dynamic resource sharing and allocation according to traffic variations. Finally, the role of artificial intelligence is incorporated with resource sharing and video analytics to support intelligent anomaly. Object detection and behavioural monitoring in smart buildings are achieved. However, the framework lacks orchestration between different modules in the framework.