Chapter 13
Opportunistic Edge Computing Architecture for Smart Healthcare Systems

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ABSTRACT

Some of the largest global industries that is driving smart city environments are anywhere and anytime health monitoring applications. Smart healthcare systems need to be more preventive and responsive as they deal with sensitive data. Even though cloud computing provides solutions to the smart healthcare applications, the major challenge imposed on cloud computing is how could the centralized traditional cloud computing handle voluminous data. The existing models may encounter problems related to network resource utilization, overheads in network response time, and communication latency. As a solution to these problems, edge-oriented computing has emerged as a new computing paradigm through localized computing. Edge computing expands the compute, storage, and networking capabilities to the edge of the network which will respond to the above-mentioned issues. Based on cloud computing and edge computing, in this chapter an opportunistic edge computing architecture is introduced for smart provisioning of healthcare data.

1. INTRODUCTION

The evolution of the Internet of Things and technology has led to the unbelievable growth in the deployment of smart sensors, actuators, and low power consuming hardware chips, smart devices in various fields like telecommunication, manufacturing, aerospace, smart homes, smart city etc .Smart health care systems are one of the important fields that are witnessing this change (Sodhro, Pirbhulal, & Sangaiah, 2018). This development of smart environment creates a great burden on the network due to the enor-

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mous data transmission. This creates a challenge for the existing cloud infrastructure to provide timely service to the end users(Zhang et al., 2015). The burden that is put on the data processing and analytics on the cloud computing paved the way for the development of new computing paradigm that brings the compute, storage, and processing to the edge of the network that are closer to the user premises. The method of computing at the edge of the network is called "Edge Computing" (Yu et al., 2017).

According to the predictions that are made by (Koop et al., 2008), the present hospital-based health care systems will take a drift to hospital and home balanced by the year of 2020 and will eventually lead to home-based by the year 2030. To make this happen new architectures, technologies and new computing paradigms should be developed specifically to health care domain. Sending the data for computation to the cloud involves latency delay and health care applications are not tolerant of this delay. Hence Edge computing will provide solutions to this data intensive health monitoring system by reducing the network communication for data transfer, storage issues and latency. This chapter demonstrates the use of Edge computing wherein, the real-time data can be monitored, stored and later can be sent to other storages or clouds if required

Contribution of Edge Computing To Data Science and Analytics

Data science and analytics uses various methods, algorithms, and machine learning models to gain knowledge about the data that are analysed. Edge Computing has evolved to overcome many challenges and issues of cloud computing. They provide a way to make analysis and computation at the IOT domain level and at a level that are one step next to the IOT plane. Edge computing enables different stake holders and systems to perform analytics near to the users with the available resources. Developing various analytics and machine learning models at the edge level may reduce the computation time, response time, latency, bandwidth consumption and improve the quality of service.

Role of Edge Computing in Health Care Domain

The technology advancement in today world has created a need for anywhere and anytime responsive service to the end users. The health care monitoring systems are in no way less and be the most needed of the hour. Now a days the health care monitoring systems enable the humans to wear smart watches and trackers that are in charge of continuously monitoring the human health in terms of heart beat, blood pressure, diabetic, body temperature, footsteps covered, calories of food consumed etc. These data are continuously streamed to the cloud storage where data analytics and processing are done to make inferences and predict the health conditions of the individuals. These health care data are data intensive and they are sensitive in nature.

(i) The health care monitoring systems should be quick, responsive as they deal with intensive data. Any delayed response to the end users of these services might lead to fatal situations. For example, a delayed alert generated for a patient whose heart beats are abnormal might give a delayed assistance to the patient and increase the complexity.
(ii) Data gathered and analysed from e-health records, sensor equipment's, medical sensors, devices, and smartphones are analysed over the edge computing. This analysis enhances the decision-making power of healthcare professionals, and helps patients have an active role in managing their personal health. The health care monitoring systems should be reliable and trustworthy to handle the data