Chapter 130
EdgeCloud:
A Distributed Management System for Resource Continuity in Edge to Cloud Computing Environment

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ABSTRACT

In the recent years, edge/fog computing is gaining greater importance and has led to the deployment of many smart devices and application frameworks which support real-time data processing. Edge computing is an extension to existing cloud computing environment and focuses on improving the reliability, scalability, and resource efficiency of cloud by abolishing the need for processing all the data at one time and thus increasing the bandwidth of a network. Edge computing can complement cloud computing in a way leading to a novel architecture which can benefit from both edge and cloud resources. This kind of resource architecture may require resource continuity provided that the selection of resources for executing a service in cloud is independent of physical location. Hence, this research work proposes a novel architecture called "EdgeCloud," which is a distributed management system for resource continuity in edge to cloud computing environment. The performance of the system is evaluated by considering a traffic management service example mapped into the proposed layered framework.

INTRODUCTION

In the past few years we notice that there is a tremendous increase in the number of devices getting connected to the network. The raise in number of devices are concerned with two main resources i.e. the user devices and the sensors/actuators. The researchers from Cisco Company extensively report that there will be approximately 50 billion devices that will be connected to the network by the year 2020 (Evans, 2011). Today in the developing countries there is a major growth in the number of devices used by the people in terms of mobile phones, tablets etc. But very soon the usage of these devices will be

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over passed by the myriad of sensing/acting devices placed virtually everywhere (the so called Internet of Things, IoT, and pervasive sensor networks).

The new innovations such as the concept of Smart Cities(Nam & Pardo, 2011), Wearable Computing Devices such as smart watches and glasses, the Smart Metering Devices for monitoring energy consumption at homes, Visual Sensor Networks, Self Driving Vehicles with smart meters are such applications which are driving the ubiquitous computing to the next level of usage witnessing the presence of smart devices everywhere around us. This kind of technical achievements (i.e. invention of Smart devices) by the researchers is made possible by the usage of widely used technology called the Edge Computing or Fog Computing.

In the recent times Cloud Computing is slowly migrating towards the edge of network facilitating the routers to form an efficient virtualization infrastructure to support real-time data processing. This evolution of cloud to edge is labelled as Edge Computing or Fog Computing. Edge Computing is a scenario where in large number of heterogeneous devices (may be wireless or autonomous), ubiquitous devices and decentralized devices combine together in a cooperative manner to perform tasks such as storage and processing without any intervention of third party devices. The tasks performed are in nature of support for some network functioning or application interference or to provide new services in the sandboxed environment. They are generally fast since the operations take place at the edge of the network.

The main focus of Fog Computing is on improving the reliability, scalability and resource efficiency of cloud by abolishing the need for processing all the data at one time and thus increasing the bandwidth of a network (Vaquero & Rodero-Merino, 2014). Edge or Fog Computing provides wide range of benefits which is listed below:

- **Network Traffic Reduction:** There are billions of devices connected to the network world wide today. Amongst which the smart phones and tablets are in greater numbers being used by the people. These devices generally send, receive and generate data in such a way that the computing capabilities are related to the physical location nearest to the devices rather than being communicating with the data centres directly. Based on the frequency range configured for the devices, the sensor embedded in them collect the necessary data every few seconds. Therefore, it is neither necessary nor advisable to send all of the raw data to the cloud. Hence Edge Computing is very beneficial here by providing a platform for data collection, data filtering and data analysis at the edge of the cloud without being sent all the data at one time but perhaps sends only the absolutely necessary data for providing services (i.e. local data view). This in turn reduces the network traffic to greater extent.
- **Best Suitable for IoT Queries and Tasking**: As we know that the usage of smart devices and applications are increasing day by day. These smart devices are usually designed to collect the surrounding information and retrieve the information to the end user based on their service request. Most of the applications today use Edge Computing where in they serve the request without communicating with the global data present in the cloud. For Example, the applications such as Google Map is used for keeping track of surrounding information.
- **Low Latency Requirement:** Today most of the applications require real-time processing in order to quicken the tasks. One of the best examples is Cloud Robotics, which is a mission critical application where in we need to control the motion of the robot. Here the motion control depends on the data collected from the sensors and the processing is done based on the feedback control system designed. If in case the data necessary for the processing is present in the cloud then most of the