Chapter 2
Fog Computing and Its Challenges

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ABSTRACT

In recent times, the number of internet of things (IoT) devices/sensors increased tremendously. To support the computational demand of real-time latency-sensitive applications of largely geo-distributed IoT devices/sensors, a new computing paradigm named fog computing has been introduced. In this chapter, the authors will introduce fog computing, its difference in comparison to cloud computing, and issues related to fog. Among the three issues (i.e. service, structural, and security issues), this chapter scrutinizes and comprehensively discusses the service and structural issues also providing the service level objectives of the fog. They next provide various algorithms for computing in fog, the challenges faced, and future research directions. Among the various uses of fog, two scenarios are put to use.

INTRODUCTION

In recent times the number of internet of things has increased rapidly in such a way the use of "Cloud Computing" is not sufficient. Due to the increasing need for real-time latency-sensitive applications of geo-distributed devises a new computing paradigm called "Fog Computing" has been introduced. Generally, Fog extends the services of the cloud-based computing, storage and networking facilities as the fog resides closer to the Internet of Things (IOT) devices. Fog computing is a distributed computing paradigm that acts as an intermediate layer in between Cloud data centres and IoT devices/sensors. Fog computing was introduced by Cisco in

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2012 to resolve the challenges faced by cloud computing. Since cloud computing is geo-centric, it often fails to deal with storage and processing demands of billions of geo-centered IoT devices. Fog datacentres are distributed at the edge of the network along with latency-sensitive requirements. However, fog computing does not substitute cloud computing, rather these two complement each other which allows the users to experience a new breed of computing technology that provides the advantages of both the paradigms (Haruna, Abdu, Manis, Francisca, Oladipo, Ezendu, & Ariwa, 2017).

In simple words, computation done at the network's edge is referred to as fog computing, with its purpose to provide computing, storage and connectivity services to the users at the network edge. It's a supporting computer paradigm for the internet of things and will also boost the development of IOT applications (Makwana, 2017). This paper scrutinizes the challenges related to Fog computing, ways to overcome them and future research directions.

DIFFERENCE BETWEEN FOG AND CLOUD

Cloud computing is usually a model for enabling convenient, on-demand network use of a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that may be rapidly provisioned and released with minimal management effort or vendor interaction. Cloud is located within the network with various topologies, speeds and no central control due to which there are a few qualities of service factors unresolved. One such issue is latency, as many applications require real time data processing, and services provided by the cloud cannot satisfy these requirements. Another such a problem is security and privacy. In the internet today, the applications are located far off from the service providers and so depending on the number of intermediate nodes the data moves through public cloud thus compromising confidentiality and integrity of the data as specified in Figure 1.

Fog computing was introduced by CiscoSystems as new a model to ease wireless data transfer to distributed devices in the Internet of Things (IoT) network paradigm. Fog Computing acts as a paradigm that extends Cloud computing and brings its related services to the network edge. Fog, similar to Cloud, provides data, compute, storage, and application services to end-users. The characteristics distinguishing Fog are its dense geographical distribution, its proximity to end-users, and its support for mobility. By doing so, it improves QoS and also reduces latency, increases its mobility which supports the internet of everything (IoE). Thanks to its wide geographical distribution the Fog paradigm is well positioned for real time big data and real time analytics. Fog supports densely distributed data collection points,

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