Chapter 8
Unique Taxonomy for Evaluating Fog Computing Services

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ABSTRACT

Cloud computing has slowly but surely become the foremost service provider for information technology applications and platform delivery. However, Cloud issues continue to exist, like cyberattacks, slow last mile latency, and clouds lack client-centric and location-aware applications to process real time data for efficient and customized application delivery. As an alternative, Fog Computing has the potential to resolve these issues by extending the Cloud service provider's reach to the edge of the Cloud network model, right up to the Cloud service consumer. This enables a whole new state of applications and services which increases the security, enhances the cloud experience and keeps the data close to the user. This research article presents a review on the academic literature research work on Fog Computing, introduces a novel taxonomy to classify cloud products based on Fog computing elements and then determine the best fit Fog Computing product to choose for the Cloud service consumer.

1. INTRODUCTION

The primary objective of Fog computing is to ensure the user data stays as close to the user by employing geographically distributed computing infrastructure at the edge of the cloud-user network. This involves virtualized platforms, smart devices, sensors and nodes that provide storage, computing and network services located at the edge of the cloud network. Yet Fog computing is not a replacement for Cloud computing. Cloud Computing, Internet of Things and Fog Computing are discussed in this section. Cloud Computing organizes a pool of shared infrastructure of hardware and software stack hosted inside

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a centralized data center for delivering service layers over the Internet. These performs compute, storage and networking functions to receive, process and respond to user requests. Cloud computing services are related to applications, platforms and infrastructure, delivered to the Cloud service consumers. The hosted resources are shared by the Cloud service consumers as per different commercial models. Current market examples include Google Docs, Sales Force, Microsoft Office 365 and Amazon Web Services.

Fog Computing refers to a distributed, decentralized system level architecture that extends the reach of Cloud computing, storage, networking and access control right up to the edge of the network near the user and devices involved. This involves the use of intelligence down to local area network level on the smart devices, nodes, data hub and sensors configured as near to IoT data collection point. Transporting data from nodes to the cloud involves several steps.

Edge Computing is an older expression for Fog Computing and actually simplifies the communication chain by reducing points of failure and network architecture complexities. This pushes the processing capabilities like node intelligence, memory and data communication of an edge gateway appliance directly to programmable device controllers.

IoT data is processed by a smart hub locally, as close to the sensor that is generating the data, unlike Cloud architecture which is has centralized computing. E.g. in Healthcare domain, wearable fitness tracking devices, medial home appliances to collecting Electrocardiogram signals with 4Kbps bandwidth channel to an IoT sensor processing node. Automation applications also utilize IoT in motors, bulbs, pumps, generators, relays. Fog Computing empowers the smart hub and nodes to carry out computing and processing functions which otherwise would be performed at a far off centralized data center as Local data processing, Low latency with better QoS, Cache data management, Edge node analytics, Dense geographical distribution and resource pool.

Internet of Things or IoT is an internetworked connection of physical devices, buildings, vehicles and smart systems. These are implanted with sensors, actuators over existing network to act as nodes for collecting and exchanging real time data (Chung-Sheng et al., 2018). Examples of IoT include Kolibree Smart Toothbrush, Samsung Smart Things Hub, Nest Smart Thermostat and WeMo Switch Smart Plug. Fog network works at two basic levels – data level and control level. The data level plans for data management, processing and configuration of the computing resource device nodes. This leads to low latency, faster, efficient management for collaboration and accessibility with edge node devices

Figure 1. Cloud Computing, Fog Computing and Internet of Things architecture