Chapter 123
Novel Taxonomy to Select Fog Products and Challenges Faced in Fog Environments

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ABSTRACT

This article describes how the rise of fog computing to improve cloud computing performance and the acceptance of smart devices is slowly but surely changing our future and shaping the computing environment around us. IoT integrated with advances in low cost computing, storage and power, along with high speed networks and big data, supports distributed computing. However, much like cloud computing, which are under constant security attacks and issues, distributed computing also faces similar challenges and security threats. This can be mitigated to a great extent using fog computing, which extends the limits of Cloud services to the last mile edge near to the nodes and networks, thereby increasing the performance and security levels. Fog computing also helps increase the reach and comes across as a viable solution for distributed computing. This article presents a review of the academic literature research work on the Fog Computing. The authors discuss the challenges in Fog environment and propose a new taxonomy.

1. INTRODUCTION

Cloud computing services are gaining acceptance, with increasing demand and popularity as a low cost, viable IT resource due to the ease of deployment, service reach for user consumption and data computing and storage. Cloud infrastructure is utilized by service providers for real time personal and corporate application services over the Internet. In order to achieve even better operational efficiency and higher performance for small or large businesses are using cloud environments, service providers are moving to distributed computing by using Internet of Things (IoT) and moving the paradigm of Cloud computing and services offered to the edge of the cloud network near the data source. Since such devices can generate a lot of data, it would be a waste of time and resources transferring all of the data to a centralized data center which requires just 1% of this data and then sending back the response back to the edge

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device for the user. E.g. a jet engine may generate 10TB of data in 30 minutes, however only 1-10 MB data may actually be required. Cisco Internet of Things Business Unit has been advocating[1] that some or most of the Cloud processing work be performed as close to the source or the device themselves locally. This is known as Fog computing.

Fog computing is a new breed of application and services using systematic, virtual, secure network integrated platforms running on wireless and networked devices close to the data source. This provides the end users with Fog Nodes which are capable of performing compute, storage, data and application services as close as possible to the data source instead of existing on the centralized Cloud Data Center and also supports thickly distributed data collection node points running IoT. Fog services are thus hosted at the edge of the cloud network which results in computing performed close to the source, which leads to improvement of quality of service, lower latency, which ultimately provides enhanced end-user experience and increased security. Fog computing ensures malicious activity on the cloud network can be detected. Now days Fog applications are built for resolving data theft issues includes a mechanism which includes analysis of user behavior to identify legitimate user access and presents unauthorized data breaches. IoT node devices are available in form of wearable watches, medical devices or mobiles, smart homes devices, smart cities and vehicular traffic to name a few. Figure 1 illustrates the Fog Computing Architecture in form of geographically distributed computing, storage, memory and application resources for each Fog Node connected to Internet of Things (IoT) smart devices at the edge of the network, closer to the end user and data source. Fog Nodes are deployed using embedded systems on home routers and industrial control devices. Wireless access points (WAP) routers are configured as end user devices providing the Fog services. This new paradigm is a far-reaching shift from the centralized concept of Cloud computing in form of Edge computing using distributed architecture.

Figure 1. Fog computing architecture (Referenced Fog Computing and Internet of Things, 2015)

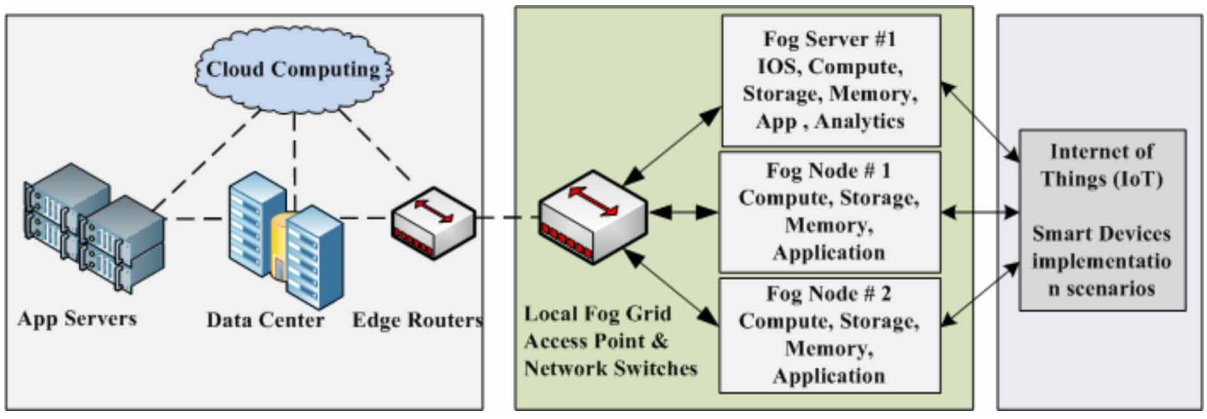

Figure 2 illustrates the different scenarios and Fog components in which Fog Computing interacts with Internet of Things and Cloud computing. Physical end points or object things are IoT enabled. Examples of IoT are Home domestic systems (Fridge, Power panel, and water supply, Air conditioning or even Entry-Exit doors), Airplanes, end user mobiles, Vehicles and Traffic control lights and systems for improving performance and utilization, Delivery and Billing of such services.