International Journal of Scientific Research & Engineering Trends
Volume 5, Issue 6, Nov-Dec-2019, ISSN (Online): 2395-566X

Role of Fog Computing in the Internet of Things

Narendra Rao Tadapaneni
Own Research A.P.,India

***Abstract*– Fog computing locates certain resources and transactions at the edge of a network. Therefore, locating resources closer to the devices, it allows internet users to aggregate bandwidth at access points. This reduces the overall need for bandwidth since less data is being transmitted away from data centres. Therefore, Fog computing is new technology to the edge of the network which has led to the implementation of a new breed of applications and services [1]. This research paper will present the characteristics of Fog computing and its role in the Internet of Things.**

Keywords- Computing Power, Fog Computing, Internet of Things, IoT

I.INTRODUCTION

Into today's world of growing technology, scientists have created cloud computing models that are currently being used in many companies for numerous IoT systems. A few months ago, everything was handled in the cloud. Still, today Fog computing is slowly becoming popular since it is related to how efficiently data is being stored and accessed. Basically, the technology of storing and retrieving data from an offsite location is referred to as cloud computing. Take an example of how phones are developed, and they do not have a built-in space of IoT to store information that is needed to access application and services. All the data is transferred to and from the cloud in order to provide services needed by a mobile user. One of the common limitations of Internet of Things is that it requires mobility support and location awareness of the devices [2]. Therefore, a new platform that will meet these limitations is required. The new suggested cloud computing paradigm is Fog computing.

Fog computing emerged due to some physical limitations associated with cloud computing technology. Fog computing will allow devices to process physically closer to where data has been collected instead of sending data to the cloud. This technology is being adopted in many fields due to the evolution of the internet of things that has been enhancing wireless connection when physical devices are transmitting and receiving data. Therefore, Fog computing attempts to resolve problems by storing data to where it was collected, e.g. storing in a local computer rather than routing the data to the cloud through a centralized DC. It also allows new application and services that lead to the fruitful interplay between the cloud and Fog, especially during data management processes. The top pioneers of Fog computing include IBM, Dell and Cisco who have representing the architectural change as well as pushing intelligence from the cloud to the edge.

II. FOG COMPUTING PLATFORM

Fog computing is a paradigm with limited capabilities such as storing, networking and computing services that are in a distributed state between classic cloud computing

and different end devices. That is, the infrastructure of Fog computing is a decentralized one since data, applications, and storage are located somewhere between the cloud and the data source. Applications and processes are concentrated in IoT devices and the network edges, therefore, data can be locally processed in IoT devices rather than being transmitted to the cloud for processing [3]. Therefore, Fog computing is a platform that is designed to deal with the demand for an ever-increasing number of IoT devices. Such devices create a lot of data which requires high demand on bandwidth as well as a considerable amount of time when transmitting data to the cloud. Therefore, in most cases, IoT devices suffer from latency, and the embracement of Fog would take much of the processing on ground devices such as a router rather than transmitting the data from the cloud. Processing data directly on the network; for example, network routers make this paradigm to lessen the amount of data being transmitted, enhance security and can improve efficiency.

III. FOG COMPUTING CHARACTERISTICS

Fog computing platform facilitates computing, networking and storage services between end devices and traditional cloud computing data centre located at the edge of networks. The networking, computing and storage resources in this virtualized platforms are the building blocks of both the Fog and the cloud [4]. Fog paradigm can be characterized by the following; low latency, location awareness, edge location, interoperability, real-time interaction, support for online interplay with the cloud. On edge location, low latency and location awareness, Fog computing supports endpoints with finest services at the edge of the network. Also, it facilitates geographical distribution where application and services of the Fog are widely distributed; for example, some applications provide high-quality streaming services to moving vehicles through access points found on tracks and highways.

© 2019 IJSRET

It supports mobility using LISP protocol which enables Fog devices to provide mobility technique such as the decouple host identity to location identity. Therefore, many Fog application in a distributed directory system can directly communicate with mobile devices. It also facilitates real-time interactions that support speedy services, thus discouraging batch processing. On interoperability, the paradigm is able to inter-operate in order to provide a wide range of services. It has many nodes in a wide geo-distribution environment as well as large scale sensor network used in monitoring the environment, for example, the smart grid [5].

IV. FOG COMPUTING AND THE INTERNET OF THINGS

Cloud computing has faced a number of problems, especially in sustaining the demand for IoT applications. There is a lack of support for some of the trending apps such as live video streaming apps and some gaming apps. Cloud computing is always centrally located; therefore, it lacks location awareness. And due to the increase in the efficiency of IoT applications, there is a need to apply Fog computing so as it can help in analyzing the generated data in real-time. Fog computing operates under the cloud where it is present in large servers, and it helps in solving or addressing the challenges as well as bridging the gap between cloud computing services and IoT devices [7].

This research paper will demonstrate the role of Fog computing in three scenarios that is in; smart grid, connected vehicles, and wireless sensors and actuators networks. Connected vehicles rely on connectivity and interaction between various devices and network points, for example, cars to cars, access points and access points, and cars to access points, e.g. 3G, WI-FI, LTE, smart traffic lights etc. The characteristics of Fog computing such as mobility, location awareness, heterogeneity, low latency, support for real-time interaction, and geo-distribution along with the cities and towns, makes it an ideal paradigm to deliver SCV services such as safety, trace support, analytics and opportunities like cloud computing [6]. To illustrate these scenarios, take an example of smart trace light where various nodes tend to interact with a number of sensors. These interaction helps the vehicle detect the presence of bikers and pedestrians, as well as measuring the speed and distance of approaching cars. Also, the green trace wave is coordinated by smart trace light through the interaction with the neighboring lights. From this information, signals are sent to the approaching cars by the smart light, and then it creates its own cycle by providing modes at which it will prevent accidents. Therefore, Fog has a chest ration layer where re-coordinating with the neighboring STLs follows any medication of the cycle. STLs collects data that is used for real-time processing analytics, such as changing the cycles' timing in response to the conditions of the smart trace. Then later, the smart lights clusters send their data to the cloud for long term analytics.Wireless sensors and actuator networks were designed and developed to extend the life of the battery or to make the energy harvesting feasible. Mostly, wireless sensor networks are associated with low energy, low bandwidth, and small memory motes, in a unidirectional fashion. Sensor networks are responsible for simple processing, forwarding data to the static sink, and sensing the environment, these are models cloud computing [10]. Motes helps in collecting environmental data.

For energy-constrained wireless sensor networks to meet the demand of new applications, several advancements were proposed, including mobile sensors, multiple sinks, multiple mobile sinks, and mobile sinks. Although this advancement goes beyond tracking and sensing, it is necessary to use actuators to exert physical actions such as move, focus, deploy sensors, open, and close. Actuators are used in sensor networks to bring new dimensions by controlling the system or measuring the processes. The information is always bi-directional that is, it moves from the sensor to sink, and from the controller node to actuators. Also, smart traffic light systems use Fog computing by reducing traffic jams and preventing accidents by changing its signals based on surveillance of incoming traffic. Then afterwards, the data is transferred to the cloud for future analysis [9].

V. FOG COMPUTING SOLUTIONS TO THE INTERNET OF THINGS

1. Low Latency

Common functions performed under the Fog server include managing and analysing data and are located close to the end-users. Therefore, having a low latency will make IoT devices and IoT users to work efficiently, faster, and generate real-time data.

2. Managing Network Bandwidth

The gap between IoT devices and cloud is bridged by hierarchical data processing of Fog computing devices. Therefore, it enables applications to process data whenever it is needed. Whenever an application repetitively requests data, inflow and outflow processes will require bandwidth. Therefore, the presence of Fog computing reduces data traffic sent to the cloud, eventually saving the network bandwidth.

3. Resource-constrained devices

IoT devices that have limited processing capabilities requires Fog computing in order to help in handling operations of devices. Therefore, fog computing will reduce power consumption, costs, and complexities associated with the devices [8].

© 2019 IJSRET

4. Uninterrupted computing services

Fog computing is an independent paradigm that can operate without linking with the cloud since it has its own servers that are located near to where the data is being collected. This helps the user to get continuous and uninterrupted services, especially when there is no network to offer connectivity to the cloud.

5. Securing IoT

Many resource-constrained devices have limited security functions, and therefore they require Fog computing to provide software and security updates to these devices. Also, fog computing can be used to monitor the security status of the devices that are present nearby.

VI. CONCLUSION

In recent years, the IoT has gained popularity and has become an integral part of peoples' lives because of its ability to connect almost everything. However, the presence of traditional centralized cloud has some issues such as failure of the network and high latency. Therefore, Fog computing acts as a unifying paradigm that will help to reduce latency, especially for time-sensitive applications. Also, it will help in delivering a new breed of emerging services, and new applications will be developed as well. Therefore, it would be necessary for companies and businesses that rely on someone else data center for storing their data, to consider Fog computing which an emerging trend.

REFERENCES

The heading of the References section must not be numbered. All reference items must be in 9 pt font. Please use Regular and Italic styles to distinguish different fields as shown in the References section. Number the reference items consecutively in square brackets (e.g. [1]). When referring to a reference item, please simply use the reference number, as in [2]. Do not use "Ref. [3]" or "Reference [3]" except at the beginning of a sentence, e.g. "Reference [3] shows …". Multiple references are each numbered with separate brackets (e.g. [2], [3], [4]–[6]).

[1] Dastjerdi, A., &Buyya, R. (2016). Fog Computing: Helping the Internet of Things Realize Its Potential. Computer, 49(8), 112-116. doi: 10.1109/mc.2016.245

[2] Sun, X., & Ansari, N. (2016). EdgeIoT: Mobile edge computing for the Internet of Things. IEEE Communications Magazine, 54(12), 22-29.

[3] Bonomi, F., Milito, R., Zhu, J., &Addepalli, S. (2012, August). Fog computing and its role in the internet of things. In Proceedings of the first edition of the MCC workshop on Mobile cloud computing (pp. 13-16).

[4] Kaur, P., & Rani, A. (2015). Virtual Machine Migration in Cloud Computing. International Journal Of Grid And Distributed Computing, 8(5), 337-342. doi: 10.14257/ijgdc.2015.8.5.33

[5] Kumar, A. (2016). Sensing and Supervising through IOT. International Journal Of Computer Applications, 152(9), doi: 10.5120/ijca2016911723

[6] Tadapaneni, N. R. (2018). Cloud Computing: Opportunities And Challenges. International Journal of Technical Research and Applications. doi: 10.2139/ssrn.3563342

[7] Hao, Z., Novak, E., Yi, S., & Li, Q. (2016). Challenges and Software Architecture for Fog Computing. IEEE Internet Computing, 21(2), 44-53. doi: 10.1109/mic.2016.26

[8] Alrawais, A., Alhothaily, A., Hu, C., & Cheng, X. (2017). Fog Computing for the Internet of Things: Security and Privacy Issues. IEEE Internet Computing, 21(2), 34-42. doi: 10.1109/mic.2017.37

[9] Salman, O., Elhajj, I., Kayssi, A., & Chehab, A. (2015, December). Edge computing enabling the Internet of Things. In 2015 IEEE 2nd World Forum on Internet of Things (WF-IoT) (pp. 603-608).

[10] Tadapaneni, N. R. (2017). Different Types of Cloud Service Models. Available at SSRN 3614630.

[11] Yousefpour, A., Ishigaki, G., &Jue, J. P. (2017, June). Fog computing: Towards minimizing delay in the internet of things. In 2017 IEEE international conference on edge computing (EDGE) (pp. 17-24).

© 2019 IJSRET