A Survey On Fog Computing

Sandeep Sharma,

Research Scholar, NIMS University, Jaipur, India

ABSTRACT

The recent advancement in Internet of things has bring down the cloud computing paradigm to the knees. To support the demand of real time applications of IoT, a modern paradigm named "Fog computing" has been introduced. This paper provides an overview on a new state-of-the-art fog computing and its role in IOT with applications. This paper also focuses on architecture and certain challenges faced by fog computing.

Keyword: - *Internet of Things, Cloud computing, Edge computing* .

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1. INTRODUCTION

Fog computing or fogging, as an emerging technology, has overcome the cons of cloud computing. It is well known for better capabilities than cloud by proving it in making computing and many real time applications. The term fog computing was coined by Cisco and made its remarkable entry in the market in 2012. It is a platform that expands the services provided by the cloud to the edge devices. Edge devices are the entry points into enterprise's network like switches, routers, etc. Basically, it's a cloud which is closer to the ground because it acts as an interface between cloud and edge. It allows the computation, storage and communication closer to the IoT devices, where data is generated and acted upon.

2. CHALLENGES OF CLOUD COMPUTING

Cloud is a metaphor to describe web as a space where computing has been pre installed and exist as a service; data, operating systems, applications, storage and processing power exist on the web ready to be shared. [1].The combination of cloud and IoT has so many benefits. For example, it provides user to access as many files from any device having internet, simplifies the flow of data, complex data processing and deployment. But there are some issues due to the inherent problems of cloud computing such as dependency on the internet creating latency constraints, delays due to limited bandwidth and security issues due to failing data protection mechanisms. In addition, this centralized cloud approach is not suitable for an environment that has poor internet

connectivity. Therefore, an advanced computing paradigm is required to address all these problems. This new paradigm is “fog computing”. Multiple numbers of devices can be easily accessible using IoT technology through immense connectivity of internet [2]. Cloud computing can provide infinite computing resources on demand due to its high scalability in nature, whicheliminates the needs for Cloud service providers to plan far ahead on hardware provisioning [3].

3. DEFINITION

Fog computing is a paradigm that has the capability of computation and storage. It gives a wider geographical distribution of the communication and other networking services for the end users. In 2018, National Institute of Standards and Technology released a publication of fog computing in which it is stated as “a layered model that facilitates the deployment of distributed applications and consists of fog nodes (physical or virtual) residing between smart end devices and centralized cloud services”.

4. ARCHITECTURE

Fog computing model consists of *fog nodes* that are context aware and provides a common system for data management and communication. Fog nodes are placed all over the network in clusters. Fog nodes like switches, routers, cameras, etc. can be deployed on any device such as car or washing machine. These nodes processes data generated by IoT device instead of cloud. The fundamental difference between cloud computing and fog computing is that the former provides centralized access whereas the latter provides decentralized local access to the resources

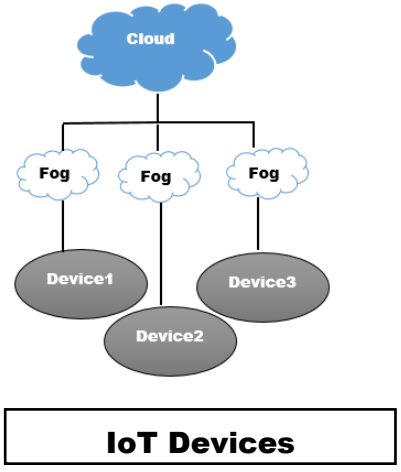

Fig. 1 Architecture of fog computing

A. Fog to Cloud

Fog and Cloud communication is important to support functionalities like supervision of cloud for some functions at fog, transfer of data, availability of cloud services through fog to end users, allocation of the services on demand.

B. Fog to Fog

Fog nodes must have pool resource functionality so thatthey can share their data, computing and processing capabilities with other nodes for one or several users.

C. Fog to IoT

IoT devices or end-users can take the advantage of fog computing services in an easy and friendly environment and resource efficient way.

5. CHARACTERISTICS

A. Multitasking

It helps compute, store, and network features between end devices and Cloud Computing. Fog nodes can be sent to multiple locations

B. End location

It provides proper working end points to get the best results as output.

C. Support for mobility

It has ability to be connected with mobile device directly and that is why it can also disconnect the host and location id also.

D. Geographical distribution

As compared to cloud, the fog services and applications are categorized and can be installed anywhere easily.

E. Large number of nodes

There are scalable number of end nodes to be used with data source and make the access secure

F. Interoperability

Working with multiple components and devices at multiple platforms and domains along with different service providers is one of the major features of fog computing.

G. Real time interactions

Multiple fog components can interact with each other rather than dependant on other mediums**.**

6. FOG COMPUTING VS EDGE COMPUTING

Sometimes, fog computing is confused with edge computing but there are key differences between two concepts

- In fog computing, data is send to the LAN level and processing is done through the fog nodes.While in edge computing, data is handled by the processing devices itself.
- Fog computing manage applications in multi-layer architecture that separates the hardware and software solutions. Edge computing manage specific applications in a fixed location.

Fog computing is hierarchical whereas edge computing is limited to a small number of devices.

7. BENEFITS

- It works on a network edge that's why it's much faster.
- It provides node to node connections.
- It consumes less time to send the data packets to destination.
- Development and deployment can be quick using fog computing which means higher business productivity.
- It supports network management.
- It supports large-scale IoT networks.
- It can save large bandwidth by processing selected data locally.

8. CHALLENGES

There are many issues that needs to be solved in order to make fog computing applicable in each and every place needed. There are some challenges as follows:

A. Detection/Synchronization
Some applications are unknown from their origin and have low storage capacity.

B. Compute/Storage Limit
Improvement needs to be done to make devices work more efficiently and give final results effectively.

C. Resource Management
Besides proper working of small fog components, the centralized fog is still not stable in terms of working and remains untested.so it needs to be soon corrected to gain faster results and improved services.

D. Dynamicity
IoT devices have the capability to dynamically alter their workflow composition. So, fog nodes need to be automated and intelligent for reconfiguration.

E. Standardization
There is no medium to allow fog components and network to communicate to other networks and inform about the vacant members so that it could be available to waiting software components and they could send them networks to work upon it.

F. Complexity
Sometimes software components and devices are designed with high security which increases the complexity of the system and make the configuration very complicated, especially with different software and hardware configurations.

G. Energy consumption
A large number of fog devices are involved in fogging so it can be less energy efficient than centralized cloud computing. Therefore, it's an important challenge to minimize the energy consumption.

H. Security& Privacy

1) Trust &Authentication
This is an important issue for security of fog computing as large scale end users are given the services by fog nodes. Fog service providers can be internet service provider, cloud service provider or end users. This flexibility confuses the trust situation of fog network.
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9. CONCLUSION

Fog computing helps the cloud to handle the larger set of informationproduced every day from IoT. Being closer to the user, solves challenges of blowing data velocity, variety, and volume. This facilitates the awareness and faster response to events. It also guardthe sensitive IoT data by processing it inside the company. Eventually, the enterprises that acquires fog computing get deeper insights, greater business agility, better safety and higher service level.

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10. REFERENCES

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