Fog Computing - A Quick Review

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Abstract- **Fog computing is a new paradigm that spread the Cloud computing and services to the edges of a networking similar to computing. Fog computing is a model in which data, processing and applications were concentrated in devices at the network edge rather than existing almost in the cloud. This new computing paradigm could be seen as an extension to cloud computing. Main aim of fog computing is to reduce the load on cloud by gathering workloads, services, applications and huge data to near network edge. The features makes Fog platform highly suitable for time and location-sensitive applications. Fog is a budding architecture for computing, storage, control, and networking. Fog includes both mobile and wired network. As an architecture, it supports a wide variety of applications, including Internet of Things (IoT), Fifth-Generation (5G) wireless systems, and Artificial Intelligence (AI). It also determines the outcome of those security issues and possible solutions, providing future security-relevant directions to those responsible for designing, developing, and maintaining Fog systems. Some of the popular fog computing applications are smart buildings, smart city, smart grid, software-defined networks, and vehicle networks**.

KEYWORDS: Fog computing, Internet of Things, 5G, Cloud computing.

I.INTRODUCTION

In the data world, cloud computing is the significant part. The storage and security level is undefined in the cloud. Cloud computing provided the easiest way to store data and access it anywhere and anytime. The CISCO introduced the new buzzword that is fog computing, it is also called fog computing or fogging or edge computing. Fog computing extends the cloud computing but can't be replaced it. Fog is to deliver data and place it closer to the user at the edge of the network, it is the main task. **Fog** is a kind of **cloud** that touches the ground. **Fog** forms when the air near the ground cool enough to turn its watervapor into liquid water or ice.Fog computing is a new technology in which mobile device interact with one another.

According to Markets and Markets, the Cloud High Performance Computing (HPC) market is to evaluate or develop to $10.83 billion by 2020, from $4.37 billion in 2015. At the same time, over the course of next five years, it is predicted that nearly $6 trillion will be spent on IoT solutions (according to Business Insider), it is clear that with these number, investment in fog computing will stay a hot topic amongst investors and businesses.

II.CLOUD COMPUTING

What is a cloud computing?

Cloud computing is a data technology paradigm that allows access to shared pools of configurable system resources. Cloud Computing, is defined as a set of computers and servers linked together over the Internet to form a network. The number of cloud storage providers online seem to grow every day. Hence reducing the overhead cost of maintaining hardware and infrastructure. These days businesses run all kinds of apps with web or mobile on the cloud.

The cloud computing permit to avoid or minimize the value of IT infrastructure. The cloud aims to chop prices, and helps the users concentrate on their core business rather than being obstructed by IT interference. The main facultative technology for cloud computing is virtualization. Private, public and hybrid clouds area unit preparation model in cloud computing. Today, as many enterprises and large organizations started to adopt the Internet of Things, want for large amounts of data to be accessed more quickly, and locally, is ever-growing. So the concept of "Fog Computing" came to play.

Merits:

Easy implementation:

Cloud hosting permits business to retain the constant application and process without dealing with the backend technicalities. It can be accessed by enterprises simply and expensive

Accessibility:

Access the data at anyplace and anytime. An internet cloud infrastructure maximize enterprise productivity and potency by making certain application are always accessible.

Cost:

In cloud hosting services, the price are kept at a minimum, enabling business to use the additional time.

Flexibility for growth:

The cloud is easily scalable. So companies can add and subtract the resources that supported their wants.

Efficient recovery:

Cloud delivers quicker and correct retrieval of data and application with less period.

Demerits:

No longer in control:

When moving services to the cloud, it turnover the information and data.

May not get all the features:

All cloud services were not the same. Some cloud tend to provide restricted versions and modify the most popular features only.

No redundancy:

A cloud server is not redundant neither backup. Although its additional price, in most cases it will be worthwhile.

Technologies related to cloud computing:

The related technologies are,

- Client–server model
- Computer bureau
- Grid computing
- Fog computing
- Mainframe computer
- Utility computing
- Peer-to-peer
- Cloud sandbox

III.FOG COMPUTING

What is fog computing?

Fog computing or fog networking, otherwise called fogging. Cisco system introduced a new term "fog computing" to make the data transfer easy, wireless and distributed environment. The fog is nothing but the cloud that is closer to the ground. Hence cloud computing carried out closer to the end users' networks is thus identified as *fog computing*. Fog networking consists of two types a control plane and a data plane. Fog networking supports the Internet of Things (IoT) concept, in which most of the devices used by human on a daily basis can be connected to each other for example phone.

Fog computing offer storage, applications, and information to end-users. Fog computing is extending a cloud computing not replaced, to the edge of an enterprise's network. The fog computing is a bridge between cloud and IoT. It is easy to understand Fog Computing by its literal meaning. Fog stays or lies

somewhere between Earth and Cloud. What has happened now is that, the number of devices has exploded many times (in billions) and huge number of applications were hosted on cloud. To reduce some of the load and consider the use cases the fog is introduced. Fog computing is a creation of virtualized platform that is located between cloud data center hosted within the Internet and end user devices. Fog computing can provide better QOS in terms of, Energy consumption, delay reduced data traffic over the internet etc.

Why do we need fog computing?

In Earlier, Business Insider reported that nearly $6 trillion will be spent on IoT solutions over the course of the next five years and by 2020, 34 billion devices will be connected to the Internet, 24 billion of which will be IoT devices. With a growing demand for IoT solutions in enterprises, the need for data to be processed quickly, substantialy on-site is essential. This is where “Fog Computing” comes in.

Fog computing extends the cloud computing paradigm to the edge of the network. Fog computing keeps data right where the IoT needs it. While fog and cloud use the same resources and share many of the same mechanism and attributes. Fog computing was developed to address applications and services that do not fit the paradigm of cloud. In cloud, the latency, security, bandwidth etc., are limited. To overcome these problems introduced the fog computing concept to extend the cloud computing.

Where does fog computing work best?

"The ideal use cases need intelligence close the edge wherever ultralow latency is vital, run in geographically distributed areas where connectivity can be irregular, or produce terabytes of information that are not practical to stream to the cloud and back". Fog computing works well in a cloud-based control plane to produce management and broader insight across a vast numbers of nodes. These include transportation, agriculture, wind energy, police investigation, smart cities and buildings."

How Does Fog Computing Work?

The devices where the data is generated and collected do not have the computation power or the storage resources in order to perform all kind of advanced analytical calculation nor machine learning tasks. As a result, fogging came to play because it works on the edge and is able to bring the cloud closer in a sense. Cloud servers have all of the power necessary to do these things and they are typically too far away and really helps in a timely fashion. Because fogging connect the endpoints closer, it is capable of bringing out great results. In a fog environment, all of the processing generally takes place within a specific smart device or particular gateway. As a result, all of the data requirements, what is being sent to the cloud is effectively reduced.

Cloud vs fog computing:

s.no	Cloud computing	Fog computing
1.	The latency and delay jitter of the cloud is high	The fog is very low
2.	Location services of cloud is within the internet	Fog computing is at the edge of the local network
3.	Cloud cannot define their security	In fog computing security can be defined
4.	Multiple hope distance are used between server and client	Only one hope distance are used between server and client
5.	There is an high probability of attack on data in cloud	There is an very low probability of attack on data in fog
6.	Geo-distribution is centralized	Geo-distributed is distributed
7.	Slow response time and scalability problem	It is possible to avoid response time and scalability issues

IV.ARCHITECTURE IN FOG COMPUTING:

The key parts of fog design are divided in to three layers: Heterogeneous Physical Resources, Fog Abstraction Layer and Fog Service Orchestration Layer.

a. **Heterogeneous Physical Resources**:

Heterogeneous in nature, starting from high-speed links connecting enterprise information centers and also core to multiple wireless access technologies towards the edge. 3G/4G, LTE, Wi-Fi etc.

b. **Fog Abstraction Layer**:

An identical and programmable interface for seamless resource management and management. The layer provides generic APIs for monitoring, provisioning and controlling physical resources like CPU, memory, network and energy.

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c. **Fog Service Orchestration Layer**:
Provides dynamic, policy-based life-cycle management of Fog services. Managing services on a oversized volume of fog nodes with a large vary of capabilities achieved with the following technology and parts

Applications of Fog Computing:

Some of the applications in fog computing are

Smart cities:

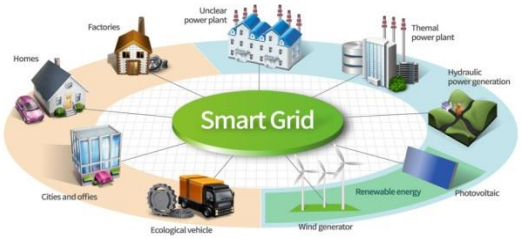
Smart grid is an application used in the fog. Based on demand for energy, its obtained ability and low cost. These smart devices can switch to other energies like solar and winds. Fog supports two tiers momentary storage at the lowest tier and are semi-permanent storage at the highest tier.

Smart building:

Smart building control wireless sensors were installed to measure temperature and humidity in decentralized. Using distributed decision making the fog devices react to data. Fog computing are applied for smart buildings which can maintain basic needs of internal energy and conserving external

Smart grid:

Fog allow fast, machine to machine handshakes and human to machine interaction was work in cooperation with the cloud. Energy load balancing applications may run on network edge devices. In the edge processes the data collected by fog collectors and generate control command to the actuators.



Connected car:

Fog computing could be ideal for connected vehicle, as a result of real time interactions can build communication between cars, access points and traffic lights. Video camera that senses an auto flashing light that can automatically change street light.

Wireless sensor and Actuator network:

It falls short in applications that depart sensing and following, however it refer actuator to exert their physical actions like opening and closing. For example, self-maintaining trains, device observation etc.,

Merits:

- The confusion of the attacker and also the further price incurred to distinguish real from phony data
- Security is improved as encrypted information moves additional, towards the network core
- Cost of The bandwidth required for regularly transmitting decentralized data to centralize location is expensive
- Security and Governance is the less frequent and the less distance that data has to travel, the more secure
- It provides low latency, location awareness and improves quality of service and real time application.

Demerits:

- Fog can be distinguished from cloud by its proximity to end-users.
- The dense geographical distribution, its for quality.
- Nobody is identified when attack was happened.
- It is complicated to detect which user is attacked.
- We cannot detect while file was hacking.

V.CONCLUSION

In conclusion Fog computing, the new conception of the cloud at the edge of the network, is considered the platform for several Internet of Things services and application. Process information nearer to where it is created and require to solve the challenges of exploding information volume, variety, and velocity(v3). It avoids the requirement of pricey bandwidth. Fog computing can grow in facilitate of network paradigms that need quicker processing with less delay and delay jitter. Fog computing will evolve with the rapid development in underlying IoT, edge devices, radio access techniques, SDN, NFV, VM and Mobile cloud. We except fog computing is promising but presently need joint efforts from underlying techniques to converged at “fog computing".

Future work in fog computing:

The current technique shows that fog computing can still to grow in usage and importance as a result of the IoT expands and conquers new grounds. Smart grid is used in future scope of fog computing. Two models can be developed in fog devices which are Independent and Interconnected devices. Sensors that, only the log data could may sometimes become factor of the past.

Reference:

1. F. Bonomi. Connected vehicles, the internet of things, and fog computing. VANET 2011, 2011.
2. F. Bonomi, R. Milito, J. Zhu, and S. Addepalli, "Fog computing and its role in the internet of things," in Proceedings of the First Edition of the MCC Workshop on Mobile Cloud Computing, ser. MCC'12. ACM, 2012, pp.
3. Luis M.Vaquero Hewlett=Packard Labs Bristal, United Kingdom,luis.vaquero@hp.com
4. L.Atzori,A.Iera, and G. Morabitto, "The internet of thing:A Survey," Comput.Network., vol.54,no.15,pp.2787-2805,oct.2010.
5. I.Stojmennovic and S.Wen,"The Fog Computing Paradigm:Scenarios and Security Issues," in proceedings of FedCSIC,2014.