Fog Computing help to overcome the boundaries of Cloud Computing

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***Abstract*— Fog computing is an advance technology after cloud computing. Idea of fog computing is to reduce the load on cloud by assembly workloads, services, applications and massive data to near network edge. In this survey paper, we will discuss main characteristics of the Fog computing that are: 1.Mobility, 2.Location awareness, 3.Low latency, 4.Huge number of nodes, 5.Extensive geographical distribution, 6.Various real time applications and we explore the advantages and motivation of Fog computing, and analyze its applications for IoT.**

***Index Terms*— Fog Computing, Cloud Computing, IoT.**

I. INTRODUCTION

In layman term fog means that the water particles are very close to the ground level. Due to increase in IoTs the number of devices has increased multiple times and a superset of application is hosted on the cloud. Which try to communicate with each other over the internet which later leads to overload on the cloud infrastructure. Therefore to reduce such workload from cloud where all the data is not needed to be fetch in such circumstances Fog Computing can play a vital role.

Cloud computing is not a new technology as it gives a simple idea of computing as utility. Cloud computing is a pool of resources. Where everything is available on the internet and the location of the resources is not known to users. It requires internet connections to use the services as the distance between user and the server.

II. FOG COMPUTING

Fog computing – a term originally coined by Cisco — is in many ways synonymous with edge computing [7] [10]. As edge computing is used to analyze and process the data to make logical decisions to trigger an event over a network edge. As fog computing will work on the edge of the network so we need to process less data, thus it requires less bandwidth as it is location dependent. Fog computing is very useful to handle the real time applications problem with maximum accuracy [5].

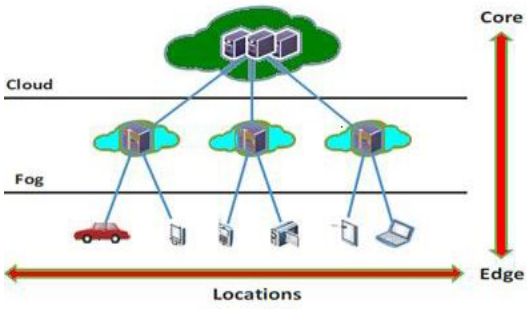

Figure: 1 Cloud and Fog comparison on Edge [3]

III. BENEFITS OF FOG COMPUTING

Security: Data is more secured over fog as fog computing uses encryption technique for data transmission.

Encapsulation: It hides the complexity of the system by encapsulating its logical and physical layer.

Storage blocks: Data is stored in a small or medium storage blocks which requires low bandwidth.

QoS: Low latency over the network improves the user experience and provides the QoS.

MaaS: Its aim to provide MaaS (machine as a service) to user with no human intervention to handle any real time issues.

IV. APPLICATION AREA OF FOG COMPUTING

Wireless Sensor and Actuator Networks: In previous wireless sensor networks various applications are difficult for sensing and tracking because of their complex physical actions. For this, in this scenario, actuators allocated as Fog devices can control the measurement process itself, oscillatory behaviors and the stability by creating a closed-loop system [3].

Smart Grid: Network edge devices, such as micro-grids and smart meters works for Energy load balancing applications [3].

Smart Traffic Lights and Connected Vehicles: The presence of pedestrians and bikers can be detected by the smart street light to interact locally with sensors and they can measure the Nearby smart lights serving as Fog devices coordinate to create green traffic wave and send warning signals to approaching vehicles [2].

Fog and IOT: IOT is a kind of network that can be considered as interconnection of the ordinary physical or

daily life object to the technology. Fog computing helps the concept of IoT by using edge networking.

V. RESTRICTION AND CHALLENGES OF CLOUD COMPUTING

Security and Privacy: Data security is major issues related with personal data and confidential data of organizations. User has to completely depend upon the cloud service provider for their data privacy and security.

Technical Issues: High speed internet connectivity requirement makes the system complex. Various technical issues arise during high load.

Data lock-in: The lack of standard APIs restricts the migration of applications and services between clouds. With the rise of cloud the problems of Data portability, migration and vendor lock-in situation will increase.

Data segregation: Mostly Data segregation problem arises in the multi-tenant usage mode, where the different users' virtual machines are co-located on the same hard disks or same server. Here the risks includes to properly separate storage or memory between different users.

Data location: The geographic location of the data is also very important to secure the data and information of client. Rules and regulation for certain types of data is different in the different countries.

Recovery and back-up: Data protection and recovery is an important aspect of cloud .some times in disaster situations recovery process is quite slow.

VI. FOG COMPUTING VS CLOUD COMPUTING

The concept of Fog computing is very much similar to cloud computing. But following few parameters shows the difference between these two close concepts. Table 1 summarizes comparison between cloud and fog computing. [2]

Parameters	Fog Computing	Cloud Computing
Response Time	Milliseconds to sub second	Minutes, days, weeks
How long IoT data is stored	Transient	Months or years
Geographic coverage	Very local: for example, one city block	Global
Latency	Low	High
Security	Defined	Undefined
Geo-Distribution	Distributed	Centralized
No. Of Server nodes	Very Large	Few
Distance between client and server	One hop	Multiple hops
Application examples	M2M communication Haptics2 , including	Big data analytics Graphical dashboards
	telemedicine and training	

Table1. Comparisons of cloud and Fog on different parameters

CONCLUSION

On the basis of above survey, we can conclude that Fog computing is extension of cloud with some extra features for service provider and end user. Fog Computing is not a replacement for Cloud Computing. Fog Computing gives the cloud a comparison to handle two Exabyte of data generated on daily basis by "IOTs". Since data processing is fast in fog computing so it solves the challenges of different dimensions of data Le "Volume, Variety and Velocity". It analyzes the cloud data and triggers the event in real time and saves the cost for bandwidth additions. It helps to analyze the IOT data within the organization and hence improve the privacy and confidentiality and that's why it is reliable.

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