Introduction To Fog Computing

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Abstract- *Computation close to its data sources, which can reduce the latency and cost of delivering data to a remote cloud. This feature and related advantages are desirable for many Internet-of-Things applications, especially latency sensitive and mission intensive services. With comparisons to other computing technologies, the definition and architecture of FC are presented in this paper. The framework of resource allocation for latency reduction combined with reliability, fault tolerance, privacy, and underlying optimization problems are also discussed. We then investigate an application scenario and conduct resource optimization by formulating the optimization problem and solving it via a genetic algorithm. The resulting analysis generates some important in sights on the scalability of the FC systems*

Keywords- Fog computing, Cloud Computing, mobile computing Internet of Things, optimization,Latency.

I. INTRODUCTION

Fog computing or fog networking, also known as fogging, is an architecture that uses edge devices to carry out a substantial amount of computation, storage, communication locally and routed over the internet backbone. Fog computing is a term created by Cisco that refers to extending cloud computing to the edge of an enterprise's network. Also known as Edge Computing or fogging, fog computing facilitates the operation of compute, storage and networking services between end devices and cloud computing data centers.

Fog computing (FC) is an emerging distributed computing platform aimed at bringing

Fog computing is supposed to resolve problems by storing data close to the "ground." In other words, it stores data in local computers and storage devices, rather than routing all the information through a centralized DC in the cloud. Fog or edge computing is a prototype campaigned by a few of the leading IoT technology players, such as Cisco, IBM, and Dell. They are pioneers of

II. THE ROLE OF CLOUD COMPUTING AND FOG COMPUTING IN IOT

A. Cloud Computing and IoT

B. Fog Computing and IoT

A. Cloud Computing and IoT

At a basic level, cloud computing is a way for businesses to use the internet to connect to off-premise storage and compute infrastructure. In the context of the Internet of Things, the cloud provides a scalable way for companies to manage all aspects of an IoT deployment including device location and management, billing, security protocols, data analysis and more.

Cloud services also allow developers to leverage powerful tools to create IoT applications and deliver services quickly. On-demand scalability is key here given the grand vision of IoT; a world saturated with smart, connected objects.

Many major technology players have brought cloud-as-a-service offerings to market for IoT. Microsoft has its Azure suite, Amazon Web Services, a giant in cloud services, has an IoT-specific play, IBM offers access to the Watson platform via its Bluemix cloud, and the list goes on and on.

Regardless of the specific product, the commonality is the ability to access flexible IT resources without having to make big investments into hardware and software and the management that comes with it.

However, for services and applications that require very low latency or have a limited "pipe" through which to pipe data, there are some downsides to the cloud that are better addressed at the edge.

B. Fog Computing and IoT

The OpenFog Consortium was organized to develop a cross-industry approach to enabling end-to-end IoT deployments by creating a reference architecture to drive interoperability in connecting the edge and the cloud. The group has identified numerous IoT use cases that require edge computing including smart buildings, drone-based delivery services, real-time subsurface imaging, traffic congestion management and video surveillanc

III. FOG COMPUTING ARCHITECTURE

Fog computing is the system-level architecture that brings computing, storage, control, and networking functions closer to the data-producing sources along the cloud-to-thing continuum. The Open Fog Reference Architecture is a high-level framework that will lead to industry standards for fog computing

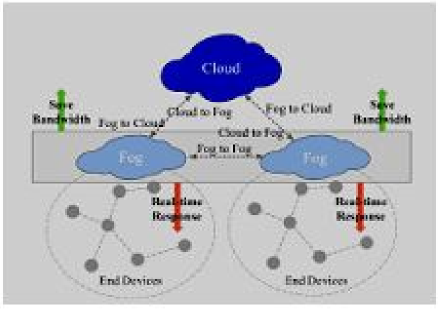

Fig: Fog computing architecture

From geo-distributed view, the "fog" should be positioned at the gateway level. The advantages of using the gateway are discussed as follows. Firstly, its computing power could be better than the terminal can provide. In thousands of IoT applications, the gateway is developed with Advanced RISC Machines (ARM) that have a powerful capacity, even close to PC level. And the terminal device often uses a single chip, e.g., C51, with only an 8 bit microcontroller. Secondly, the gateway often uses consistent electricity for its vital role, which can negate the energy consumption concern when optimizing the performance of computing and networking. Thirdly, unlike a mobile phone, gateways are sometimes deployed for public services and self managed, which means the selflessness and privacy concerns may be partly reduced by a black box mechanism.

IV. FOG COMPUTING ADVANTAGES

- Reduction in data movement across the network resulting in reduced traffic problem
- centralized computing systems
- Improved security of encrypted data as it stays closer to the end use
- Greater Business Agility
- Deeper Insights with Privacy Control
- Edge computing eliminates, or at least deemphasizes, the core computing environment, limiting or removing a major bottleneck and a potential point of failure.
- Consumes less amount of band width.
- The detection of masquerade activity

V. DISADVANTAGES OF FOG COMPUTING

- Nobody is identified when attack is happen.
- It is complex to detect which user is attack.
- We cannot detect which file was hacking

VI. COMPARISON BETWEEN FOG COMPUTING AND CLOUD COMPUTING

Table1: comparison between cloud computing and fog computing

Requirements	Cloud Computing	Fog Computing
Latency	High	Low
Delay Jitter	High	Very Low
Location of service	Within the internet	At the age of Local Network
Distance between client and server	Multiple hops	One hop
Security	Undefined	Can be defined
Location Awareness	No	Yes
Geo-Distribution	Centralized	Distributed
No of Server Nodes	Few	Very large
Support for mobility	Limited	supported
Real time interaction	Supported	Supported
Type of last mile connectivity	Leased Line	Wireless
Attack on data enroute	High portability	Very low probability

VII. NEED OF FOG

In the past few years, Cloud computing has provided many opportunities for enterprises by offering their customers a range of computing services. Current "pay-as-you-go" Cloud computing model becomes an efficient alternative to owning and managing private data centers for customers facing Web applications and batch processing .Cloud computing frees the enterprises and their end users from the specification of many details, such as storage resources, computation limitation and network communication cost. However, this bliss becomes a problem for latency-sensitive applications, which require nodes in the vicinity to meet their delay requirements. When techniques and devices of IoT are getting more involved in people's life, current Cloud computing paradigm can hardly satisfy their requirements of mobility support, location awareness and low latency. Fog computing is proposed to address the above problem.

VIII. CONCLUSION

Fog computing offers cloud computing to handle the larger set of data generated daily from IoT. It helps solve challenges of exploding data velocity, variety, and volume. It also enhances the awareness and response to events by eradicating a round trip to the cloud for analysis.

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