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Fog Computing

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Abstract

Managing the knowledge generated by the Internet of Things (IoT) sensors and actuators is one of the most important. Challenges in introducing IoT systems. Traditional cloud-based IoT systems We challenged the large scale, non-uniformity, and high latency observed in some cloud ecosystems. One solution is to decentralize applications, management, and data analytics within the network itself. Use of distributed and integrated computing models. This approach is called the nebula Calculate. This document introduces a conceptual model of fog and mist computing. They refer to the cloud-based computing model of the IoT. This document shows further features Key characteristics and aspects of fog computing, including service models and deployments It provides a baseline of what strategy and fog computing are, and how to use them.

1. Introduction

Fog computing is a distributed computing paradigm that acts as an intermediate. The layer between the cloud data canter and IoT devices/sensors. Provides computing, networking, and storage capabilities to more tightly scale cloud-based services IoT devices / sensors [1]. The concept of fog computing is Cisco will address the challenges of traditional cloud IoT applications in 2012 Calculate. IoT devices/sensors are highly distributed at the edge of the network with real-time delay-sensitive service requirements. Cloud data centre are geographically centralized and often cannot handle the storage and processing demands of billions of geographically dispersed IoT devices/sensors. As a result, the network becomes overloaded, service provisioning delays increase, and quality of service (QoS) deteriorates. Experienced

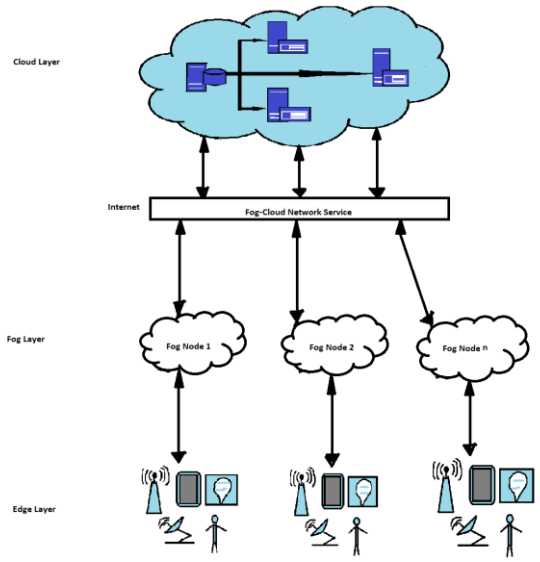

Figure 1.1 Architecture FOG Computing

Fog computing is designed to improve efficiency and reduce the amount of data transferred to the cloud for processing, analysis, and storage. This is often done to improve efficiency, but it can also be used for security and compliance reasons. The word "nebula" refers to its cloud-like properties, but it is closer to the "ground," or IoT device. Rather than many of these devices generating large amounts of raw data (from sensors, etc.) and sending all that data to cloud-based servers for processing, the idea behind fog computing is data generation. Because it is co-located with the device, it can transfer processed data rather than raw data, reducing bandwidth requirements.

1.2 History / Development

Cisco created the phrase fog computing in January 2014.. this can be because fog is named the cloud near the bottom, even as fog computing is related to nodes near the node between the host and also the cloud. This was intended to bring the computing capabilities of the system closer to the host machine. After this gained some popularity, IBM coined an analogous term in 2015 called "edge computing." In both small and medium-sized businesses and huge businesses, the way personal and business information is stored and accessed has undergone a serious revolution.

The transmission of information on physical devices has become obsolete, and with the ascension of worldwide web networks, users can virtually hook up with any data accessible from anywhere within the world. during this article, we'll understand how cloud computing emerged and evolved to satisfy the strain of speed, security, efficiency, and reliability

1.3 Requirements

As more fog computing applications are developed, the fog platform may need to deploy more middleware systems (in the form of Foggaras services) to support simple application development. The following shows the most commonly used types of middleware.

The data stream processing system was originally developed by the big data community. However, several authors are also aware of their interest in

fog computing environments that have the potential to reduce data transfer between IoT devices and the cloud. Several systems have been developed and there are some variations in the functionality they provide.

Function as a Service supports the development of event-driven serverless applications. Allows you to develop, execute, and manage parts of a function or code without having to deploy or manage a server. Fog computing aims to take advantage of the potential of using IoT devices in a serverless architecture, a type of service feature. This is essentially an extension of cloud services to the edge where IoT and mobile devices, web browsers, and other computing devices are at the edge.

A web application server is a software framework that provides an environment in which an application can run regardless of what it does. They usually include a wide range of service layers, each addressing an individual concern. A typical application server running in the cloud provides web pages, provides container models or services for applications, adheres to industry-managed specifications, distributes requests across multiple physical servers, and manages them. We can provide tools and development tools. Fog computing enhances application server capabilities to simplify the management and programming of computing, network, and storage services between data centres and end devices. reliability.

1.4 Necessity/Significance

Cloud computing is still included in the scenario, but when it comes to IoT applications, it loses its importance as computing has emerged as the most promising viable option for the following reasons:

♣ Provides better security, Fog nodes can use the same security and policies, and have lower cost of ownership.

♣ Data is processed by fog nodes before being sent to the cloud. This reduces bandwidth consumption and facilitates the IoT's most important thing: the data obtained by analytics can be run on this type of model.

♣ IoT devices are implemented on several safety-critical platforms. An industry where safety is paramount. Therefore, in such cases, it should be processed quickly and the data should be processed very quickly by the acquisition of the sensor.

♣ To enhance data protection, industries can analyze data locally and store sensitive data on local servers, or send this data to the cloud for sharing.

♣ Business agility also enhances Fog applications that can be easily developed according to available tools that can be deployed anywhere according to customer needs. Fog nodes support mobility because they can join and leave the network at any time

2. Technology/Methodology

This study is based on a review of the literature describing a particular fog computing application. The goal is not to provide a complete list of all the applications proposed for fog computing, but to identify a representative sample of typical applications for fog computing technology. Since fog computing is still a new technology, we have included a description of both the actual implemented fog application and the proposed future application. Papers were selected based on the following criteria:

Detailed application description. We searched for papers that provided a detailed technical description of the proposed application and discarded the paper that suggested the idea without further technical details.

Publication venue. We sought papers that were published in peer reviewed international conferences and journals. and, we also included white papers published by reputable corporations such as Cisco or organizations such as E.U. projects and the Open Fog Consortium1.

Economic sectors. We aimed at identifying applications that cover a broad range of economic sectors such as transportation healthcare, entertainment, smart cities, supply chain management, smart factories, robotics, agriculture, and security.

There is no duplication. To keep the list of applications short, I avoided including some applications that are too similar to each other. In such cases, I kept the most detailed description in the list and discarded other similar apps.

3. Applications

This study is based on a review of the literature describing a particular fog computing application. The goal is not to provide a complete list of all the applications proposed for fog computing, but to identify a representative sample of typical applications for fog computing technology.

- ♣ Connected car.
- ♣ Smart grids and smart cities
- ♣ Realtime analysis

Connected cars

Self-driving cars or self-driving cars are on the market and are generating large amounts of data. Data needs to be quickly analysed and processed based on information such as traffic conditions, driving conditions, and climate. All this data is processed quickly using fog computing. Other data such as vehicle maintenance and tracking is sent directly to the manufacturer. Both edge communication and endpoint communication are possible with the help of connected cars.

Smart grid and smart city

Utility system use real-time data to effectively run the system. It is important to process the remote data near the source. Data can also be generated by many sensors. Fog computing aims to solve both problems.

Real-time Analytics

data can be transferred from one location to another using Fog Computing Deployment. Fog computing is used for Realtime analysis, and data is sent from the manufacturing system to financial institutions that use Realtime data.

Intelligent grid is the best example of grid computing. Today`s power grids are intelligent and dynamic. Higher responsiveness while reducing productivity and power consumption. Fog computing is ideal for situations where data is generated from a remote location and can be processed there instead of being transferred to the data canter. Some data can be generated and processed by individual sensors or groups of sensors to avoid cloud overload. A good example of this is an electricity meter.

4. **Security & privacy in fog computing**

- Authentication at different levels of gateways.
- Smart meters installed in the consumer's home.
- Public Key Infrastructure (PKI) which involve multicast Authentication.
- Intrusions can be detected using signature based method.
- Intrusion can also be captured by using an anomaly-based method.

5. Top Challenges & Opportunities

Success is a multi-vendor Fog computing ecosystem that addresses the technical, societal and business needs of the software-defined world.

Products and solutions will win if they are:

- **Secure**-support security from the SoC to the SW.
- **Scalable** address the scenario and can easily expand to address changing requirements.
- **Open-Multi-vendor** is a requirement for many customers.
- **Autonomous-Process** data and provide insights (to biz problems)
- **RAS**-Your system must be manageable.
- **Agility**-Turn data into wisdom at the appropriate level in a hierarchy.
- **Hierarchy**-Support cloud and multiple tiers.
- **Programmable**-Ability to scale a solution framework to multiple market opportunities.

6. Security Preeminent Issue in IOT & Fog Computing

Concerns

- **Massive IOT-based Security Attacks**

- DDoS Attack at Dyn on Oct 21 from cameras & printers.
- Launched via 10 smart home devices using Mirai
- Exploited factory default username s& passwords
- Brought down Twitter, Reddit, Etsy, GitHub, Spotify
- Affected PayPal, New York Times, BBC

➢ **Security Hurdles in IOT-FOG Interoperation**

- Legacy devices embedded in critical infrastructures
- Heterogeneous protocols & operating procedures
- Constrained computation & communication resources

➢ **IOT + Open Fog: Pervasive Multi-tier Computing Paris**

- Multiple tenants around highly connected Fog Nodes
- Exposed hardware, open software
- Elaborate meshed-up: Devices /Fog/Cloud

➢ **Ideas, Preliminary**

[Open Fog Sec/Comms/SW WGs]

❖ Core Service Framework

- Service & Support Layers
- Software Backplane
- Monitoring & Management

❖ Collaborative Security Practice

- Secure info /computing offload
- Security-as-a-Service (SECaaS)

7. Conclusion

Fog computing applications are quite diverse, and fog computing platforms developed to serve them must meet a wide range of needs. While the current general-purpose fog platform does not meet all of these needs, this study provides insight into what future platform designers will and will not support, as well as the types of applications that will be valuable. The goal is to be able to make well-informed decisions.

8. Future Scope/Trends in IT industry

Fog computing plays a crucial role in reducing latency and improving the user experience as the use of data and cloud services grows. It's now separating the data plane, allowing advanced services to be delivered at the edge. Administrators may deliver rich material to users faster, more efficiently, and - most importantly – more affordably this way. This will result in greater data access, more corporate analytics capabilities, and an overall better computing experience for end users. Fog computing was coined by Ginny Nichols of Cisco. The analogy arises from the fact that fog is a cloud that is near to the ground, similar to how fog computing focuses on processing at the network's edge. Fog

computing, according to Cisco, spans from the edge to the cloud.

"Fog has the potential to relieve network congestion. It won't make sense to handle everything in the cloud as the world's 50 billion items become connected by 2020. Edge computing devices and distributed apps require distributed resources. The data is filtered by fog, which allows computation to take place. "Low-power devices on the network's edge can enable real-time response," said Rodolfo Milito, technical leader and one of Cisco's fog computing ideology leaders.

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