Fog Computing

Pankaj Kumar, Sharan Kumar
Department of Computer Science
SET- Jain University
Bangalore

Abstract

Fog Computing is a paradigm that extends Cloud computing and services to the edge of the network. Similar to Cloud, Fog provides data, compute, storage, and application services to end-users. As these two technologies start getting deployed on a larger scale, the need to decrease the data transferred between the actual devices and the cloud systems have come into picture. Fog computing uses the concept of collecting all the data from similar devices in the same unit and then sending it to a local computing device which can process the large amounts of data. After the processing is complete, only the required data is sent to the cloud for further use. This helps us avoid a lot of work and also saves a lot of bandwidth needed to send all the unprocessed data to the Cloud Computing today which is based on various smart devices, computers, networks of computers, and high performance computers who benefits of various middleware to efficiently provide fastest, dependable and secure services

1. Introduction

In this current world of fast moving technology, there are many ideas and concepts that promise to make the future a simpler place to live in. Amongst those, the most promising seem to Cloud Computing and Internet of Things (IoT). Cloud Computing is the concept of sharing resources to decrease the costs involved while focusing on maximizing the effectiveness of these resources. The Internet of Things (IoT) is a scenario in which objects, animals or people are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. In IoTs, literally anything can be part of it, whether it is sensor nodes or dumb objects, so very diverse types of services can be produced. The amount of data IoTs are going to generate would not be possible for standalone power-constrained IoTs to handle. Cloud computing comes into play here. Integration of IoTs with cloud computing, termed as Cloud of Things (CoT) can help achieve the goals of envisioned IoT and future Internet. This IoT-Cloud computing integration is not straight-forward. It involves many challenges. One of those challenges is data trimming. Because unnecessary communication not only burdens the core networks, but also the data center in the cloud. For this purpose, data can be preprocessed and trimmed before sending to the cloud. This can be done through a Smart Gateway, accompanied with a Smart Network or Fog Computing.

Definition: Fog computing is a model in which data, processing and applications are concentrated in devices at the network edge rather than existing almost entirely in the cloud. That concentration means that data can be processed locally in smart devices rather than being sent to the cloud for processing. Fog computing is one approach to dealing with the demands of the ever-increasing number of Internet-connected devices (IoT).

The **Internet of Things (IoT)** represents a new world of information and communication technologies (**ICTs**) from anytime, anyplace connectivity for anyone. All Things in Internet of things or IoT are uniquely addressable and are connected using standard communication protocols. It will consist of connections that will multiply and create entirely new dynamic network of networks. In this, objects or things are made as smart so that they will become knowledgeable and their properties such as transformation, interactions will allow them to actively interact in environment.

Characteristics of fog computing:-

1 Low latency and Location awareness.

2. Wide-spread geographical distribution.

3. Mobility.

4. Very large number of nodes,

5. Predominant role of wireless access,

6. Strong presence of streaming and real time applications,

.

Difference between Cloud Computing & Fog Computing

Cloud Computing:

- Local storage & computing is not a feature of Cloud.
- Services are hosted in virtual servers, over the internet & not in your hard drive.
- It supports servers hardware & applications and almost any type of data
- All data is centralized in one or more data centers

Fog Computing:

- Local storage & computing is a feature of Fog Computing.
- Services are hosted at the network edge or end devices like set-up boxes or access points.
- It supports IoT applications that demand real-time or predictable latency.
- It is based on the principle of isolation of user data that lives on the edge

What are use cases of fog computing?

Seamless integration with the cloud and other services

The fog should not replace the cloud. Based on fog services the cloud should be enhanced by isolating the user data which are exclusively located at the edge of a network. From there it should allow administrators to connect analytical applications, security functions and more services directly to the cloud. The infrastructure is still based entirely on the cloud concept, but extends to the edge with fog computing.

Services to set vertical on top of the cloud

Many companies and various services already using the ideas of fog computing by delivering extensive content target-oriented to their customer. This includes among others webshops or provider of media content. A good example for this is Netflix, who is able to reach its numerous globally distributed customers.

With the data management in one or two central data centers, the delivery of video-on-demand service would otherwise not be efficiently enough. Fog computing thus allows providing very large amounts of streamed data by delivering the data directly preferment into the vicinity of the customer.

Enhanced support for mobile devices

With the steadily growth of mobile devices and data administrators gain more control capabilities where the users are located at any time, from where they login and how they access to the information. Besides a faster velocity for the end user this leads to a higher level of security and data privacy by data can be controlled at various edges. Moreover fog computing allows a better integration with several cloud services and thus ensures an optimized distribution across multiple data centers.

Setup a tight geographical distribution

Fog computing extends existing cloud services by spanning up an edge network which consist of many distributed endpoints. This tight geographical distributed infrastructure offers advantages for variety of use cases. This includes a faster elicitation and analysis of big data, a better support for location-based services by the entire WAN links can be better bridged as well as the capabilities to evaluate data massively scalable in real time.

Data is closer to the user

The amount of data caused by cloud services require a caching of the data or other services which take care of this subject. This services are located close to the end user to improve latency and optimize the data access. Instead of storing the data and information centralized in a data center far away from the user the fog ensures the direct proximity.

Internet of Things (IoTs)

Definition: Internet of Things (IoT) is set to become the next big thing after the introduction of Internet itself. Millions and probably billions of 'smart' devices are expected to connect to each other and exchange data and information over the internet. The advocates of the IoT envision nearly all aspects of our life to be covered by these smart devices. The sensors are typical examples of such smart devices. IoT, being the technological revolution, represents the future of connectivity and reachability. In IoT, 'things' refer to any object on the face of the Earth, whether it is communicating device or a non-communicating dumb object. From a smart device to a leaf of a tree or a bottle of beverage, anything can be part of Internet. The objects become communicating nodes over the Internet, through data communication means, primarily through Radio Frequency Identification (RFID) tags. IoT include smart objects as well. Smart objects are those objects which are not only physical entities, but also digital ones and perform some tasks for humans and the environment. This is why IoT is not only hardware and software paradigm, but also include interaction and social aspects as well.

Why Fog Computing for Internet of Things

Cloud services to smart things face latency and intermittent connectivity issues. Fog devices are positioned between cloud and smart devices. Their high speed Internet connection to the cloud, and physical proximity to users, enables real time applications and location based services, and mobility support. Cisco promoted fog computing concept in the areas of smart grid, connected vehicles and wireless sensor and actuator networks. Cloud computing promises to significantly change the way we use computers and access and store our personal and business information. With these new computing and communications paradigms arise new data security challenges. Existing data protection mechanisms such as encryption have failed in preventing data theft attacks, especially those perpetrated by an insider to the cloud provider. We propose a different approach for securing data in the cloud using offensive decoy technology. We monitor data access in the cloud and detect abnormal data access patterns. When unauthorized access is suspected and then verified using challenge questions, we launch a disinformation attack by returning large amounts of decoy information to the attacker. This protects against the misuse of the user's real data. Experiments conducted in a local file setting provide evidence that this approach may provide unprecedented levels of user data security in a Cloud environment.

Conclusion

Since fog as itself a newer concept, implementing this will take a little time but once done, it would Make IoT devices a lot smarter. The extended work on Fog computing & Cloud Computing could be on the impact of heterogeneous storage and overall performance on the basis of diverse applications. This approach makes it easy for the cloud to create better services more efficiently and with Fog computing, Normal communication can be made real-time for delay sensitive applications.

The extended work could be on the impact of heterogeneous storage and overall performance on the basis of diverse applications.

References:

[1]. Ivan Stojmenovic, Sheng Wen : The Fog Computing Paradigm: Scenarios and Security Issues, 978-83-60810-58-3 © 2014, IEEE

[2]. H. Madsen, G. Albeanu : Reliability in the Utility Computing Era: Towards Reliable Fog Computing, 978-1-4799-0944-5 © 2013 IEEE

[3]. Ivan Stojmenovic : Fog computing: A cloud to the ground support for smart things and machine-to-machine networks, 978-1-4799-5044-7 © 2014 IEEE

[4]. Salvatore J. Stolfo, Malek Ben Salem, Angelos D. Keromytis : Fog Computing: Mitigating Insider Data Theft Attacks in the Cloud, © 2012, Salvatore J. Stolfo. Under license to IEEE.

[5]. Mohammad Aazam , Eui-Nam Huh : Fog Computing and Smart Gateway Based Communication for Cloud of Things, 978-1-4799-4357-9/14 © 2014 IEEE DOI 10.1109/FiCloud.2014.83