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Fog Computing: A platform for Internet of Things (IOT)

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Abstract: **- Fog computing extends the cloud computing paradigm to the edge of the network thus enabling a new breed of applications and services. Fog computing is the appropriate platform for a number of critical Internet of Things namely connected vehicle, smart grid, smart cities, wireless sensors and actuators networks(WSANs).**

Keywords**: Fog computing ,cloud computing, IOT,WSAN.**

I. INTRODUCTION

Fog computing is a paradigm which extends cloud computing paradigm to the edge of the network.Similar to cloud,fog provides data,compute storage and application services to end-users.This enables a new breed of applications and services[1].The internet of things represents a new world of information and communication technologies from anytime,anyplace connectivity for anyone.All things in internet of things are uniquely addressable and are connected using standard communication protocols.Here the 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[2].Fog is an architecture that distributes computation,communication,control and storage closer to the end users along the cloud to things continuum[3].The relevance of fog/edge is rooted in both the inadequacy of the traditional cloud and the emergence of new opportunities for the internet of things[4].An emerging wave of internet deployments,most notably the internet of things(IOTs),requires mobility support and geo-distribution in addition to location awareness and low latency[5].So, a new platform is needed to meet these requirements a platform we call fog computing.

II RELATED WORK

[1]Fog computing for the internet of things:security and privacy issues,author Arwa Alwaris discussed the further development of fog computing could help the IOT reach its vast potential.
[2]Fog and IOT:An overview of research opportunities,author Mung Chiang investigated and discussed how fog is starting to reshape the future landscape of multiple industries,driving innovation across various industries.
[3]On security and private issues of fog computing suppoted environment , author Kanghyo discussed how to explore sensor,a fog node and cloud which combine to form a fog computing.
[4]The fog computing paradigm: scenarios and security issues,Sheng wen discussed about the fog computing advantages for services in several domains.
[5]Fog computing and its role in internet of things,author Flavio Bonomi discussed about the Fog computing platform,rich enough to deliver this new breed of emerging services.
[6]Fog computing to protect real and sensitive information in cloud, author Mrs Anuradha S G discussed and investigated that Fog computing is a platform to deliver a rich portfolio of new services and applications to the edge of the network.

III ORGANIZATION OF PAPER

Section IV describes about the fog computing architecture, section V describes about the fog computing applications, section VI discusses about the IOT challenges,section VII describes about the characteristics of fog computing,section VIII describes about the advantages and disadvantages of fog computing and section IX describes about the use case study on fog computing.

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IV.FOG COMPUTING ARCHITECTURE

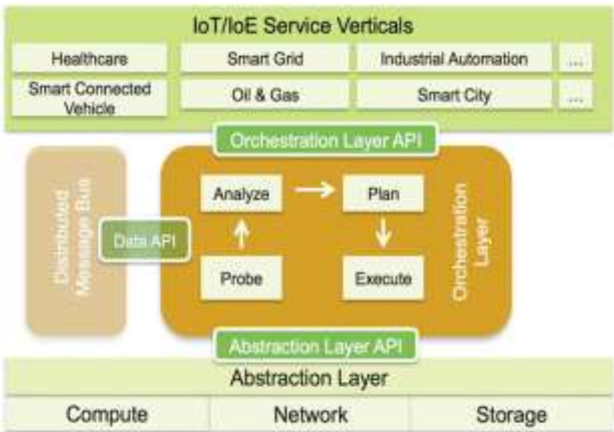

Figure1: Components in fog architecture

- Fog nodes are heterogeneous in nature and deployed in variety of environments including core, edge, access networks and endpoints. The fog architecture should facilitate seamless resource management across the diverse set of platform.
- The fog platform hosts diverse set of applications belonging to various verticals-smart connected vehicles to smart cities ,oil and gas, smart grid etc. Fog architecture should expose generic APIs that can be used by the diverse set of applications to leverage fog

A. Fog abstraction layer:

The fog abstraction layer hides the platform heterogeneity and exposes a uniform and programmable interface for seamless resource management and control.

The layer platform.provides generic APIs for monitoring,provisioning and controlling physical resources such as cpu,memory,network and energy.

Compute : requires the selection of hypervisors in order to virtualize both the computing and I/O resources

Network: requires the appropriate network virtualization infrastructure

Storage : requires a virtual file system

B.Orchestration layer:

The orchestration layer provides dynamic,policy based life cycle management of fog services.Ex:-Policies to specify thresholds for load balancing such as maximum number of users,connections,cpu load etc.

C.Distributed database:

The distributed database provides faster storage and retrieval of data.The database is used to store both application data and necessary meta-data to aid in fog service orchestration.

V FOG COMPUTING APPLICATIONS

A. Smart grid:

The smart grid is an electricity distribution network,with smart meters deployed at various locations to measure the real time status information.

Figure 2: Fog in smart grid

B. Connected cars:

Connected vehicle deployment display a rich scenario of connectivity and interactions: cars to cars cars to access points (wifi,3G,roadside units)and access points to access points.

Figure 3: Fog in connected vehicles

The fog has a number of attributes that make it the ideal platform to deliver services in infotainment,safety,traffic support throughout cities and along roads.

C.Smart home:

It involves the control and automation of lighting,heating,ventilation and air conditions.Fog computing can provide home security applications,for example,a motion sensor detects a suspicious motion in a certain room,then a cleaning robot with video camera will be commanded to check out the exact location.

Figure 4: Fog in smart home

D.Smart traffic lights:

The smart traffic light node interacts locally with a number of sensors,which detects the presence of pedestrians and bikes and measures the distance and speed of approaching vehicles.

Figure 5: Fog in smart traffic light

It also interacts with neighboring lights to coordinate the green traffic wave.Based on this information the smart light sends warning signals to approaching vehicles and even modifies its own cycle to prevent accidents.

VI FOG PROVIDES EFFECTIVE WAYS TO ADDRESS IOT CHALLENGES

IOT CHALLENGES HOW FOG CAN HELP

Latency constraints Fog,performing data analytics,control and other time sensitive tasks close to end users,is the ideal and often the only option to meet the stringent timing requirements of many IOT systems.

Network Bandwidth Constraints Fog enables hierarchical data processing along the cloud to things continuum,allowing processing to be performed where it can balance between application requirements and available networking and computing resources.This also reduces the amount of data that needs to be sent to the cloud.

Resource Constrained Devices Fog can carry out resource-intensive tasks on behalf of resource-constrained devices when such tasks cannot be moved to the cloud due to any reason,hence reducing these devices complexity,lifecycle costs,and energy consumption.

Uninterrupted Services with Intermittent Connectivity to the cloud A local fog system can operate autonomously to ensure non-interrupted services even when it has intermittent network connectivity to the cloud.

New IOT Security Challenges A fog system can, for example,1)act as the proxies for resource-constrained devices to help manage and update the security credentials and software on these devices

2)monitor the security status of nearby devices,and 3)take advantage of local information and context to detect threats on a timely manner.

VII FOG COMPUTINGCHARACTERISTICS

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VIII ADVANTAGES AND DISADVANTAGES

ADVANTAGES

Sl no	Characteristic features	Description
1	**Edge location,location awareness, and low latency**	The origins of fog can be traced to early proposals to support endpoints with rich services at the edge of the network,including applications with low latency requirements(e.g. gaming,video streaming etc)
2	**Geographical distribution**	Compared to the services provided by the centralized cloud,the services and applications targeted by the fog demand widely distributed deployment.Large scale sensor network to monitor the environment and smart grid are examples.
3	**Support for mobility**	It is essential for many fog applications to communicate directly with mobile devices and therefore support mobility techniques, such as the LISP protocol,that decouple host identity and require a distributed directory system.
4	**Interoperability and federation**	Seamless support of certain services(ex:streaming)requires the cooperation of different providers.Hence fog components must be able to interoperate and services must be federated across domains.
5	**Real time interactions**	Important fog applications involve real time interactions rather than batch processing.
6	**Heterogeneity**	Fog node come in different factors,and will be deployed in a wide variety of environments.

IX ILLUSTRATIVE USE CASE TO DERIVE FOG COMPUTING REQUIREMENTS

Use case study on:"TASK BASED LANGUAGE LEARNING FOR YOUNG CHILDREN USING IOT AND WEARABLE TECHNOLOGIES"

- The learning environment for children has to be filled with fun to enhance their learning experience and also improve retention.
- This will improve a childs physical,emotional,cognitive,reflective,communication skills and social development.

- Task based learning mainly focuses on the task carried out by the students in the world.
- This approach is significantly relevant in the rural areas where the young children need to be introduced to English language.

Figure 6:System architecture

The organization of classroom is classified into two sectors
[1]Context sector
[2]Group sector

- The architecture sets the basis for defining the features and utilization of the wearable devices.
- The architecture allows us to specify the interface between the students and the system .

X. CONCLUSION

It is estimated that by 2020,there will be 50 billion connected devices.The data these devices will generate is going to be really huge. The speed with which data can be collected and processed has to definitely increase. By using the concept of fog computing,if the same device can be used for these kind of processing,data generated can be put to immediate use and deliver a much better user experience. Thus fog computing is going to play a big role in IOT application.

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