A Survey of Fog Computing: Applications

Mohit Jain[1], Lucky Rajput[2]

1MCA, Teerthanker Mahaveer University, Moradabad

[2]Assistant Professor, Teerthanker Mahaveer University, Moradabad

[1]mohitjain3743@gmail.com

[2]lucky06jpn@gmail.com

Abstract – **This Fog computing is basically a concept which extends cloud computing theory to the edge of the network. Fog provides data, compute storage and application services to the end-user. This facilitates new variety of application and services. The Internet of Things represents a new age of information and communication technologies from anytime, anyplace connectivity for anybody. Application of fog computing platform is well thought-out as suitable platform for IOTs services and applications are not restricted to the connected vehicles, smart grid and smart cities. Response time and scalability plays an important role in machine to machine communication. The edge computing platform solves this problem by locating small type server namely edge server and devices over the surrounding area of the users and passing to the some of the load of central server and/or user devices.**

Keywords – Fog Computing, Applications, IOTs, Smart city.

I. INTRODUCTION

Fog computing is extends cloud computing. Fog computing is a growing technology .Fog computing fetches data and services from the network center to the network edge. Similarly to Cloud fog computing provides data, compute storage and application services to the end-user. Fog computing is basically a distributed computing model that fetches centralized located data storage, processing and application and transmitted to the network edge devices i.e. Set top box, access point Fog computing is basically a technique that is locally hosted where the user uses the services. To be simplified fog computing is a model that provides IOT data processing, storage as an alternative to sending to cloud it is locally processed in smart devices. Both Cloud and Fog structure are for computing, storage and networking resources. In the fog computing data collected by sensors are not sent to the cloud server as an alternative, it is sent to devices like network edge or set top box, routers, access points for processing by minimizing the traffic due to low bandwidth. Fog computing improves the quality of service and reduces latency. Small computing works are locally processed and responses are sent. [1]

II. HOW DOES FOG WORK?

Many times sensitive data is analyzed on the near fog node to generate data in Cisco smart grid distribution network. For example, the most urgent requirement is to verify that the protection and the control loops are working properly or not. Therefore, fog nodes are close to them. Look for this particular sign problem and then prevent them by sending rescue (control) commands to that

A) The data that needs seconds or minutes to do action is passed through the cluster node for analysis and action. In the smart grid example, each substation may have its own cluster node that tracks and reports the downstream feeder of the operational status.

B) Data that is less time sensitive (Historical analysis, big data analytics, and long term storage). [2]

III. WHAT IS THE NEED OF FOG COMPUTING?

Fog Computing extends the cloud computing pattern to the edge of the network. While fog and cloud both use the same resources (networking, compute, and storage) and share many of the same mechanisms and attributes (virtualization, multi-tenancy), the extension is a non-trivial one that stemming some fundamental differences. From the reason that fog computing was developed: to address applications and services that do not fit the paradigm of the cloud. [2]

IV. DIFFERENCE BETWEEN CLOUD AND FOG COMPUTING

Requirement	**Cloud Computing**	**Fog Computing**
Latency	High	Low
Delay Jitter	High	Very low
Location Of server Nodes	Within the Internet	At the edge Of the local network
Distance between The client and The server.	Multiple hops	One hop
Security	Undefined	Can be defined
Attackon data Enroute	High probability	Very Low probability
Location awareness	No	Yes
Geographical distribution.	Centralized	Distributed
Number Of server nodes	Few	Very large
Support for mobility	Limited	Supported
Real time interactions	Supported	Supported
Type of last mile connectivity.	Leased line	Wireless

[3]

V. APPLICATIONS

Fog Computing in Smart Cities: Fog computing will be able to obtain sensor data on all levels of activities of cities and integrate all the mutually independent network entities within. The applications of this scenario are facilitated by wireless sensors deployed to measure temperature, humidity, or levels of different gases in the building environment. In this case, information can be exchanged among all sensors in a floor, and their readings are reliable measurements forming to be combined. Sensors will use distributed decision making and activation at Fog The system components may then work together to reduce the temperature, inject fresh air or open windows. Air Conditioners Sensors can also trace and react to movements (e.g., by turning light on or off). Fog devices could be assigned to each floor and could have a higher level of actuation. With Fog computing applied in this scenario, smart buildings can maintain their fabric, external and internal environments to conserve energy, water and other resources. [4]

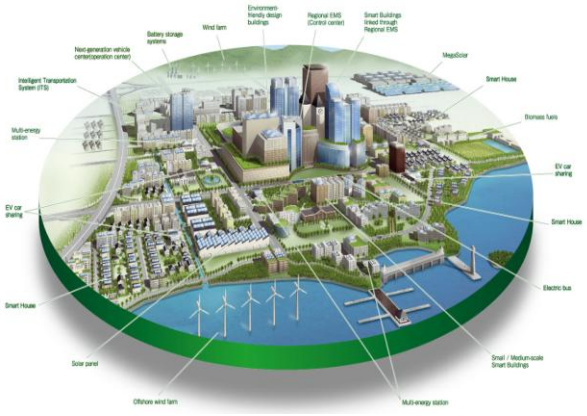

Fig 1.Fog Computing in Smart Cities

1. *Fog Computing in Vehicle Network:* Fog computing is ideal for the connected vehicles (CVs) because real time interactions will make communication between cars, access points and traffic lights as safe and efficient as possible. Video camera that senses an ambulance flashing lights can automatically change street lights to open traffic. Smart street lights interact locally with sensors and detectors of pedestrian and bikers. As shown in Figure, intelligent lighting turns on

once a sensor movement and switches off as traffic passes. Neighboring smart lights are available for traffic Wireless access points like Wi-Fi, 3G, road-side units and smart traffic lights Vehicles to Vehicle, vehicle to access points, and access points to access points. [5]

Connected cars: Fog computing is ideal for Connected Vehicles (CV) because real-time interactions will make communications between cars, access points and traffic lights as safe and efficient as possible

Fig 2. Fog Computing in Vehicle Network

2. *Smart Traffic lights:* Fog enables traffic signals to open lanes on observing flashing lights of the ambulance. It determines the existence of bikers and pedestrian, and evaluates the distance and speed of the nearest vehicles. Sensor light turns on, on detecting movements and vice-versa. Smart lights support as fog devices The communication between vehicle and access points are improved with 3G, Wi Fi, road side units and smart traffic lights. [1]
3. *Self Maintaining Train:* Another application of fog computing is self managing trains. A train ball-bearing monitoring sensor will observe the changes in the temperature and any disorder will automatically alert the train operator and build maintenance. So we can neglect dangerous disasters. Wireless Sensor and Actuator Networks (WSAN): The real Wireless Sensor Nodes (WSNs), were intended to increase battery life by working at predominantly low power. Actuators work as Fog devices which manage the measurement mechanism itself, the consistency and the oscillatory nature by generating a closed-loop system. For instance, in the lifesaving air vents sensors on vents monitor air scenarios flowing in and out of mines and automatic change airflow if conditions miners to harmful Most of these WSNs mean less energy, less bandwidth, very low processing power, operating as a unidirectional manner. [1]
4. *Decentralized Smart Building Control:* In decentralized smart building control wireless sensors are set up to evaluate the humidity, temperature, or levels of several gaseous components in the building environment. Hence information can be exchanged between all sensors in the floor and the reading. Utilizing distributed decision making The air, temperature and output moisture from the air or increase humidity. Sensors reply to the movements by switching off or on the lights. Observance of the outlook the fog computing are used for smart buildings which can manage basic requirements of conserving internal and external energy. [1]
5. *Health Care:* The cloud computing market for health care is measured by $ 5.4 billion by 2017, according to Markets and Markets report and fogging would permit this on a more confined level. [1]
6. *IoT and Cyber-Physical Systems (CPSs):* Fog computing has an important role in CPSs and IoT. IoT is a network that can interlink normal physical objects with identified address employing telecommunication and internet. The feature of CPSs is the integration of system's physical and computational elements. The

combination of IoT and CPSs will change the world with communication and computer-based control systems, physical reality and engineered systems. Fog computing is made on the embedded system concept in which computers and software programs embedded.Examples are linked vehicles, medical devices etc. The object is to combine the precision and concept of software and networking with the uncertain and vibrant environment. With the increasing cyber physical systems we will be capable to develop smart buildings, intelligent medical devices, agricultural and robotic systems.

7. *Software Defined Networks (SDN):* SDN is an increasing networking and computing concept. SDN concept integrated with fog computing will eliminate the main problems in vehicular networks irregular collisions, connectivity and high packet loss rate. SDN provides support to vehicle to-vehicle with vehicle-to-infrastructure communications and main control. It separates control and communication layer, control is performed by central server and server selects the communication route for nodes.[1]

VI. CONCLUSION AND FUTURE SCOPE

This review paper discusses fog computing with similar concepts, offers representative applications in smart cities, which will promote fog computing. [6]

Future work will expand on the fog computing paradigm in many other application areas. Smart Grid in the concept Self-regulating Fog devices consult directly with the Cloud for periodic updates on charges and demands, while connected Fog devices may check each other, and create coalitions for further enhancements. Fog devices are geographically distributed over divers platforms. Service Mobility across platforms. [7]

REFERENCES

[1] F. BONOMI. CONNECTED VEHICLES, THE INTERNET OF THINGS, AND FOG COMPUTING. VANET 2011, 2011.

[2] G. Forman. An extensive empirical study of feature selection metrics for text classi_cation. J. Mach. Learn. Res., 3:1289{1305, Mar. 2003.

[3] M. Bowman, S. K. Debray, and L. L. Peterson. Reasoning about naming systems. ACM Trans.Program. Lang. Syst., 15(5):795{825, November 1993.

[4] Ivan Stojmenovic SIT, Deakin University, Burwood,

[5] **Australia and SEECS, University of Ottawa, Canada,"** The **Fog Computing Paradigm: Scenarios and Security Issues"**. M. J. Sannella. Constraint satisfaction and debugging for interactive user interfaces. 2003. F. Bonomi, R. **Milito, J. Zhu, and S. Addepalli, "Fog computing and its role in the internet of things," in** Proceedings of the First Edition of the MCC Workshop on Mobile Cloud Computing, ser. MC**C'12. ACM, 2012, pp.** 13–16.

[6] www.google.com/fog computing-Thoughts On Cloud. Cisco, **"Cisco delivers vision of fog computing to accelerate value from billions of connected devices," Cisco,** Tech. Rep., Jan. 2014.

[7] **L. Atzori, A. Iera, and G. Morabito, "The internet of things: A survey," Comp**ute. Netw., vol. 54, no. 15, pp. 2787–2805, Oct. 2010.

[8] I. Stojmenovic and S. Wen, "The Fog Computing Paradigm: Scenarios **and Security Issues," in Proceedings** of FedCSIS, 2014.

[9] www.google.com/What is Internet of Things(IOT)-

[10] Definition from WhatIs.com [12] K. Liu, J. Ng, V. Lee, S. **Son, and I. Stojmenovic, "Cooperative data dissemination** in hybrid vehicular networks: Vanet as a software defined **network," Submitted for publication, 2014.**