IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

FOG COMPUTING: THE FUTURE OF IOT

[1]Bahubali Ashok Kurali, [2]Dr. Mohan Aradhya

[1]PG Student, [2]Assistant Professor,

[1,2]Department of MCA,

[1,2]RV College of Engineering, Bangalore, India.

Abstract: *Fog Computing is a paradigm that expands Distributed computing (cloud computing) and administrations to the edge of the network. Comparable to Cloud, Fog gives information, process, stockpiling, and application administrations to end-clients. The inspiration of Fog processing lies in an arrangement of genuine situations, like Smart Grid, keen traffic signals in vehicular networks and programming characterized networks. Nowadays usage of cloud computing has increased broadly but there are some issues which have not been solved due to inherent problems of cloud computing like unreliable latency, no mobility support and location awareness. Fog computing is also known as edge computing . This can resolve all those problems by providing elastic resources and services to the end users. This paper discusses the definition of fog computing and its applications in IOT (Internet of Things). It also gives some advantages and challenges of fog computing.*

Keywords: Fog computing, Edge computing, IOT (Internet of Things), Cloud computing

I. INTRODUCTION

Fog Computing is a profoundly virtualized stage that is supportive of computing, storage, and systems administration (network) benefits between end gadgets and conventional Cloud Computing Data Centre, normally, however not exactly situated at the edge of the network. Figure 1 presents the glorified data and processing design supporting the future IoT applications, and illustrates the job of Fog Computing. Fog computing utilizes the concept of "fog nodes". These fog nodes (computing devices) are very close to the data sources. Fog nodes also have higher capacity to process and store enormous generated data from the IOT devices. Fog nodes process all data quicker instead of sending data to cloud servers for decentralized computing / processing. Cloud is getting litter day by day because a huge number of devices are connected to the internet and exchanging data. Cloud computing is not capable of working successfully in some cases, it's necessary to use fog computing for Internet of Things (IOT) devices. It can process huge data that's generated by these devices. Fog computing has several advantages over cloud computing. Fog computing can boost usability and accessibility in various computing environments. Soon, cloud computing for IoT may fade out but fog computing will take over. IoT is seeing a formidable rate of growth then it needs a special infrastructure base that may handle all its requirements. Fog computing is the key to accomplish this critical work.

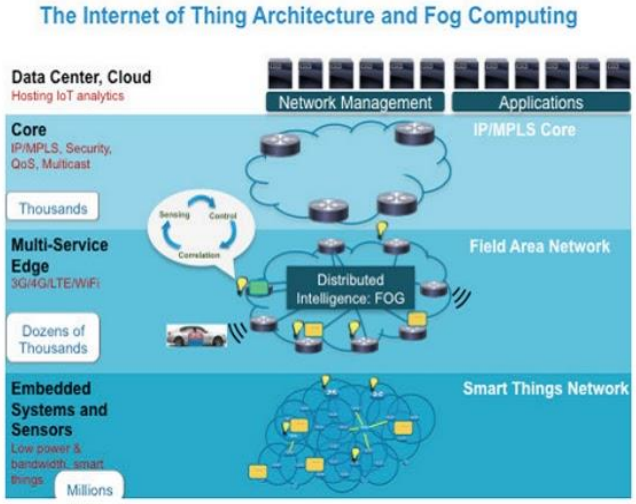

fig 1. IOT and fog computing

II. RELATED WORK

This paper [1] focuses on limitations of cloud computing. How fog computing extends cloud computing and improves QOS (Quality of services). It discusses cloud computing becoming litter and reasons for that. Since there are inherent problems in cloud computing like unreliable latency, location awareness etc. Fog computing has the ability to reduce the time sensitive internet of things services request with less traffic congestion and bandwidth. Fog computing aim is to reduce the load on the data centres. Fog computing is not a replacement for cloud computing but extends some features from cloud computing to the edge of the IOT network.

This work [2] concentrates on the future potential of the emerging era of fog in IOT, big data analytics and storage. It discusses existing technologies like computing, communication and storage, also gives fog computing can be more intelligent with deployment of existing key technologies.

Paper gives key characteristics of fog computing [3] which is the platform that supports Fog services. The most effective platform to serve a rich portfolio of recent services and applications at the sting of the network. We envision the Fog to be a unifying platform, well enough to provide this new breed of emerging services and enable the event of recent applications.

This paper is talking about the utilization of fog computing for faster analysis of sensor data [4]. Aim of this work is to employ a smart mobile as a sensor to stay track of all the generated data of health care patients. Also compares the disadvantages of using cloud computing and the way cloud computing can be the simplest way for faster analysis of information

Much research in cloud computing security has concentrated on ways of securing data from unauthorized access on cloud with developing access control and encrypted algorithms. But all these techniques have not worked. This paper discusses [5] how to secure cloud data by using algorithms like SHA1 and Naive Bayes having high accuracy.

Focuses on intelligent management of healthcare data at fog node for a real time health care monitoring system. In real time healthcare data can be created from various ways

like body temperature, heart beat monitoring, oxygen level in body etc. [6] Paper tells How we can manage all this data using fog computing techniques.

This paper [7] discusses latency of fog computing and cloud computing. What are the components of the network which causes latency? [8] How to extract useful features from massive amounts of heterogeneous data generated by various edge devices in IOT.

Paper [9] depicts integration of fog computing in healthcare domain. It discusses what all the possible issues can be solved by applying fog computing technology and design future of the health fog reduces successfully the extra communication cost that is usually found in cloud computing.

[10] Paper gives idea about web optimization within fog computing context. By using existing technology for web optimisation in a best manner, such that these methods of web optimization can be merge with unique information that is only present at the edge (Fog) nodes.

While cloud computing [11] becomes well established services for applications like IOT, Big data analytics and machine learning. In fog computing applications process takes place on edge devices and cloud also intermediate fog nodes. Now fog computing becomes a virtually unexplored technology that provides numerous numbers of services.

[12] Paper depicts combination of IOT and fog computing, this paper takes one of the fog computing IOT based model and talks about the various layers. Papers used genetic algorithm and it finds distance between fog nodes and the end users. By analysing through this model papers talks 38% of the users are near to fog nodes.

Paper depicts about numerous limitations or breaches of fog computing [13] which might give problem in security and privacy. Paper classified various problems-based layers and discussed about the problems in the broad sense. Paper made survey on existing methods to protect and find security methods for earth solutions.

There are numerous applications that can be model using fog computing [14], paper talks about definitions of fog computing and similar concepts and also gives representatives models which will promote fog computing.

[15] In IOT there will be millions of devices connected to fog computing and all devices gives tremendous amount of data from various domain like health, traffic, agriculture etc. All these dt can be easily compromised by some unauthorized parties. These fake data can mislead the health users and even may cause problems for people lives.

Fog computing will be allowing to compute all the IOT devices data to third party software or hardware [16]. Which may cause affect to users' data directly or indirectly so the best method to overcome from these problems are usage of sha-1 and AES algorithms.

Paper depicts [17] fog computing combines cloud and on the spot computing with all the automatic management authorization. With all the automatic management is basically present within the cloud only. Also identifies crucial challenges that may cause for IOT preparation.

The study [18] concludes that use of home hospitalizations is increasing day by day using IOT, cloud and fog computing. This increases the quality of services for the patients. Study also talks about integrating cloud and fog computing helps in the time of covid 19, so patient can get accurate health monitoring data by accessing from anywhere.

[19] As per the study of this paper many patients are afraid to go out from the house because it might be risk and infections may affect to people very fast. Therefore, usage of smart health care system can be easy to employ patient's data in the time of covid-19 situation.

The study [20] reported that smart health care system is more convenient for all patients, because of its cost effective less, reliability and safety. The doctors can easily give prescribe and access patients health information. Due to this it also reduces the chance of infections from covid-19 situation.

III. PROPOSED METHOD

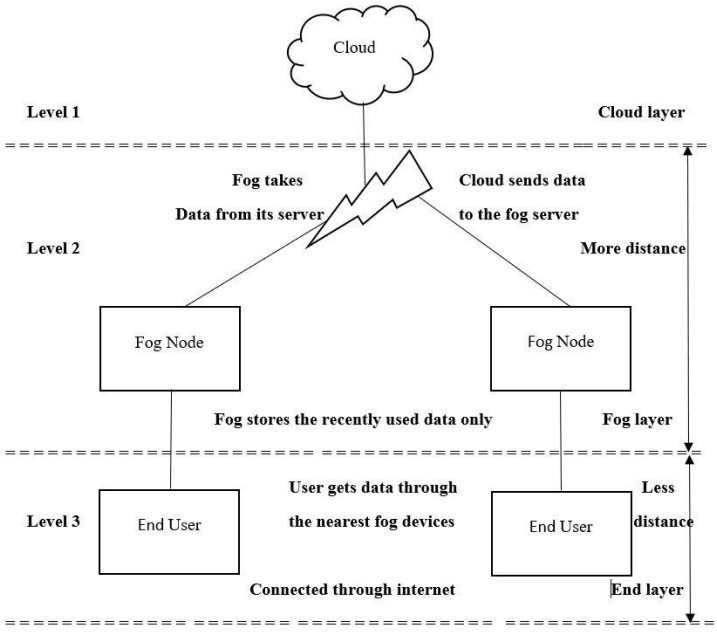

fig 2: architecture diagram

Fig 2 depicts a high level of architecture of fog computing. As shown in the above picture there are three main layers in fog computing. First is the cloud, the fog layer is located in the middle and the third is end users. End users might be sensors or edge devices or other devices which communicate with fog nodes. Middle layer is made up of fog nodes which process data locally and send only extracted data to the cloud. Data producing devices are too simple and the only aim is to produce data. Those devices don't have capacity to analyse data. They just produce data to the cloud and the cloud only has that capacity to process it. But the cloud is too far to pull and process it also late in response time. To avoid this problem fog computing came into picture and provides the best solution to it.

III.I APPLICATIONS

Smart Building: Many buildings are equipped with several IOT sensors to capture suspicious operations of buildings like parking space occupancy, temperature of a building and key card readers. Information from these devices must be watched to find what actions are to be taken; like, triggering a fire alarm if smoke is sensed. Video cameras are utilized in public places, parking lots and residential areas to reinforce safety and security. The bandwidth of visual data collected over a large-scale network makes it impossible to hold the information to the cloud and collect real-time insights. It helps to track real time data, any anomaly detection and collected data over time.

fig 3: smart buildings system

Healthcare: As devices get smaller data gets bigger, providers are still struggling to collect, analyse, visualize and utilize that can make a difference in patient care. Healthcare data generated for various patients from devices like home scales, wearable, blood glucose monitor, oxygen monitor and other sensors. As per research 50 billion of devices that produce 505 zettabytes of data by the end of this decade. To know the meaning of real time analytics, healthcare uses cloud solutions for its storage and analyses. When

data is generated, it's been uploaded to the cloud and processed to extract useful information and again pulled back to the analytics engine. This may take a few minutes to happen but some patient safety cannot wait that long. Fog computing improves clinical decision making, reduces duplication of diagnostic testing, imaging, and history taking, better medication management can be incorporated.

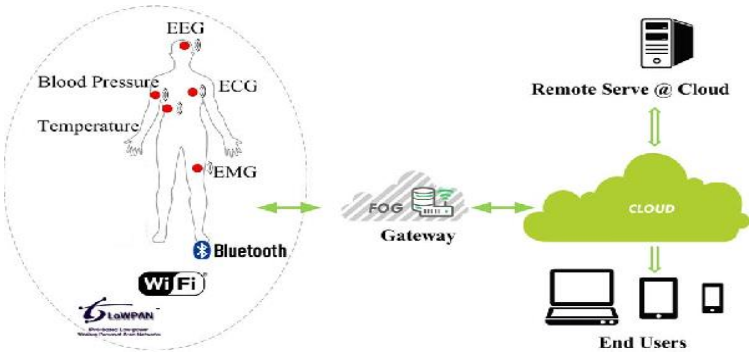

fig 4: healthcare monitoring system

Connected Vehicle (CV): The Connected Vehicle deployment displays an expensive scenario of connectivity and interactions: cars to cars, cars to access points to access points. The Fog has a number of attributes that make it the best platform to give an expensive menu of safety, traffic support, and analytics: geo-distribution (throughout cities and along roads), mobility and placement awareness, low latency, heterogeneity, and support for real-time interactions.
A smart traffic light system reads bikers and pedestrians and calculates distance and speed of arriving vehicles. It also communicates with nearby lights to coordinate the traffic wave. This information sends warning signals to arriving vehicles.

III.II ADVANTAGES AND DISADVANTAGES

ADVANTAGES

Privacy: Fog computing has been used to control privacy of the data. In traditional mechanisms sensitive data is sent to a centralized system and analysed. Through fog computing any sensitive data can be analysed locally instead of sending it to the cloud. Because of this reason it also reduces reliability.

Productivity: If a customer wants to make a machine as he wants, they can use fog computing applications to build. These applications are built by using the right set of tools by developers. Once after development of their machine they can deploy it anywhere they want.

Bandwidth: Data generated by sensors or other devices are analysed locally instead of sending whole data into cloud and process there. Since selected data is extracted locally, it's easier to send data to the cloud, because of this bandwidth required for a device to push data to the cloud is very low.

Latency: Cloud is very close to the earth, there are high capability resources to process sensor data. This can be useful where data wants to be reached to the cloud quickly. Even at the time of pulling back to the local analysis system it takes too less time to pull.

DISADVANTAGES

Complexity: Due to the complexity of the fog computing concept it's hard to understand it easily. There are more fog nodes located geographically and will be analysing data so it leads to complexity in data analysis.

Maintenance: Since more devices and storages are distributed geographically it's required to provide more maintenance to all devices.

Power consumption: Number of fog nodes available in the environment directly consumes power. This means power required to these devices is high in order to perform functions.

IV. CONCLUSION

This research gives a summary of vision and defined important key characteristics of fog computing. The most effective platform to serve a rich portfolio of recent services and applications at the sting of the network. We envision the Fog to be a unifying platform, well enough to provide this new breed of emerging services and enable the event of recent applications.

V. REFERENCES

[1] Mohammed Al-khafajiy, Hilal Abbood Al-Libawy, Thar Baker, Carl Chalmers Fog Computing Framework for Internet of Things Applications.

[2] Muhammad Rizwan Anawar ,1 Shangguang Wang ,1 Muhammad Azam Zia,2 Ahmer Khan Jadoon,1 Umair Akram,3 and Salman Raza1 Fog Computing: An Overview of Big IoT Data Analytics.

[3] Flavio Bonomi, Rodolfo Milito, Jiang Zhu, Sateesh Addepalli Fog Computing and its Role in the Internet of Things.

[4] A. George, H. Dhanasekaran, J. P. Chittiappa, L. A. Challagundla, S. S. Nikkam and O. Abuzaghleh Internet of Things in health care using fog computing

[5] Shreya Waghmare, 2 Shruti Ahire, 3 Himali Fegade, 4 Pratiksha Darekar Securing Cloud using Fog Computing with Hadoop Framework

[6] Jared Lynskey, and Choong Seon Hong* Real-time FOG computing healthcare monitoring

[7] J. Li, T. Zhang, J. Jin, Y. Yang, D. Yuan and L. Gao, Latency estimation for fog-based internet of things

[8] S. K. Sharma and X. Wang, "Live Data Analytics with Collaborative Edge and Cloud Processing in Wireless IoT Networks," IEEE Access, vol. 5, pp. 4621–4635, 2017.

[9] M. Ahmad, M. B. Amin, S. Hussain, B. H. Kang, T. Cheong, and S. Lee, "Health Fog: a novel framework for health and wellness applications," The Journal of Supercomputing, vol. 72, no. 10, pp. 3677–3695, 2016.

[10] X. Zhu, D. S. Chan, H. Hu, M. S. Prabhu, E. Ganesan, and F. Bonomi, "Improving video performance with edge servers in the fog computing architecture," Intel Technology Journal, vol. 19, 2015.

[11] A Research Perspective on Fog Computing David Bermbach Information Systems Engineering Research Group Atos Spain SA

[12] Antoine Bagula An IoT-Based Fog Computing Model ISAT Laboratory, Department of Computer Science, University of the Western Cape, Bellville 7535, South Africa;

[13] Fog Computing Architectures, Privacy and Security Solutions July 2019 DOI:10.22385/jutes. v24i0.292

[14] S. Yi, C. Li, and Q. Li, "A survey of fog computing: concepts, applications and issues," in Proceedings of the 2015 workshop on mobile big data, 2015, pp. 37– 42.

[15] S. Reif, L. Gerhardt, K. Bender, and T. Hönig, "Towards Low-Jitter and Energy-Efficient Data Processing in Cyber-Physical Information Systems," p. 8.

[16] J. Valenzuela, J. Wang, and N. Bissinger, "Real-time intrusion detection in power system operations," IEEE Transactions on Power Systems, vol. 28, no. 2, pp. 1052–1062, May 2013.

[17] Gollaprolu Harish, S.Nagaraju, Basavoju Harish, Mazeeda Shaik A Review on Fog Computing and its Applications International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8, Issue-6C2, April 2019

[18] Muhammad Ijaz 1,2, Gang Li Integration and Applications of Fog Computing and Cloud Computing Based on the Internet of Things for Provision of Healthcare Services at Home CISTER Research Centre and ISEP/IPP, 4249-015 Porto, Portuga

[19] Alexandru, A.; Coardos, D.; Tudora, E. IoT-Based Healthcare Remote Monitoring Platform for Elderly with Fog and Cloud Computing. In Proceedings of the 2019 22nd International Conference on Control Systems and Computer Science (CSCS), Bucharest, Romania, 28–30 May 2019; pp. 154–161.

[20] Hariharan, U.; Rajkumar, K. The Importance of Fog Computing for Healthcare 4.0-Based IoT Solutions. In Studies in Big Data; Metzler, J.B., Ed.; Springer: Berlin/Heidelberg, Germany, 2020; pp. 471–494.