National Conference on
"Role of Engineers in Nation Building" organized by VIVA Institute of Technology, Mumbai
(6th and 7th March 2020)
International Journal of Engineering Research & Science (IJOER)
ISBN:[978-93-5391-287-1] ISSN: [2395-6992] [Vol-6, Issue-3, March-2020]

Edge Computing: Vision and Challenges

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***Abstract*—**Edge computing enables data generated by internet of things (IoT) devices to be processed nearer to where it is generatedrather than sending it across long routes to data centers or clouds. Doing this computing nearer to the edge of the network it provides organizations analyze necessary data in near time Period – a requirement for organizations across several industries, together with manufacturing, health care, telecommunications, and finance. Edge Computing, being a possible analysis dimension within the realm of 5G networks, targets to boost the network capability by harnessing the effectiveness of each cloud computing and mobile devices within the user's proximity. Keeping in view the far-ranging impact of Edge Computing in future mobile generations, a comprehensive review of the current Edge Computing frameworks and approaches are given with an in-depth comparison of its classification. Considering the data accumulated, procedures analyzed and theories mentioned, the paper provides a comprehensive summary on progressive and future analysis.

Keywords*—Cloud computing, Cloudlets, Edge cloud, Fog computing, Internet of things*

I. INTRODUCTION

Cloud computing has dominated IT discussions for the last 20 years, notably, Since Amazon popularized the term in 2006 with the release of its Elastic Compute Cloud In its simplest type, cloud computing is that the centralization of computing services to take advantage of a shared data center infrastructure and also the economy of scale to scale back prices. [4]However, latency, influenced by the amount of router hops, packet delays introduced by virtualization, or server placement within a data center, has continuously been a key issue of cloud migration. This is where edge computing comes in. Edge computing is basically the method of decentralizing computer services and moving them nearer to the source of data. [14]this will have a major impact on latency, because it will drastically scale back the amount of information affected and also the distance it travels. The term "edge computing" covers a large area of technologies, together with peer-to-peer, grid/mesh computing, fog computing, blockchain, and content delivery network. It has been well-liked among the mobile sector and is currently branching off into nearly each business.

With the explosive growth in numerous access devices and end-user demands, IoT is driving digital transformation altogether aspects of the present fashionable life it's predicted by Cisco that the amount of devices connected to IoT can become fifty billion by 2020. The rising IoT introduces new challenges, like tight latency, capability constraints, resource-constrained devices, uninterrupted services with intermittent connectivity, and increased security, that can not be adequately self-addressed by the centralized cloud computing design. Aprogressive cloud computing paradigm that breaks through the centralized design and alleviates the capability and latency constraints is desperately needed to deal with these challenges.

IoT applications generate enormous amounts of data by IoT sensors. Big data are afterwards analyzed to work out reactions to events or to extract analytics or statistics. [7]However, sending all the information to the cloud would require prohibitively high network bandwidth. Recent analysis efforts are investigating on a way to effectively exploit capabilities at the edge of networks to support the IoT and its needs In edge computing, the large information generated by differing kinds of IoT devices may be processed at the network edge rather than sending them to the centralized cloud infrastructure attributable to bandwidth and energy consumption issues. Edge computing will offer services with quicker response and larger quality, compared with cloud computing. Edge computing is more appropriate to be integrated with IoT to produce economical and secure services for an oversized range of end-users, and edge computing-based design will be thought-about for the longrun of IoT infrastructure.

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II. PREVIOUS GENERATION TECHNOLOGIES

2.1 CLOUD COMPUTING

Most enterprises are aware of cloud computing since it's currently an actual standard in several industries.[3]Fog and edge computing are extensions of cloud networks that are a group of servers comprising a distributed network.Such a network will permit a corporation to greatly exceed the resources that may rather be accessible to it, releasing organizations from the necessity to stay infrastructure on-site the first advantage of cloud-based systems is that they permit information to be collected from multiple sites and devices that is accessible anyplace within the world. Embedded hardware obtains information from on-the-spot IIoT devices and passes it to the fog layer pertinent information is then passed to the cloud layer that is often in a very completely different geographical location. The cloud layer is therefore able to have the benefit of IIoT devices by receiving their information through the other layers.Organizations typically reach superior results by integration a cloud platform with on-the-spot fog networks or edge devices. Most enterprises are currently migrating towards a fog or edge infrastructure to extend the use of their end-user and IIoT devices.

The extended distribution of information processing and storage created attainable by these systems reduces network traffic, so rising operational efficiency.The cloud additionally performs high-order computations like estimate analysis and business management, that involves these computations are then passed backtrack the computation stack in order that it may be utilized by human operators and to facilitate machine-to-machine (M2M) communications and machine learning.

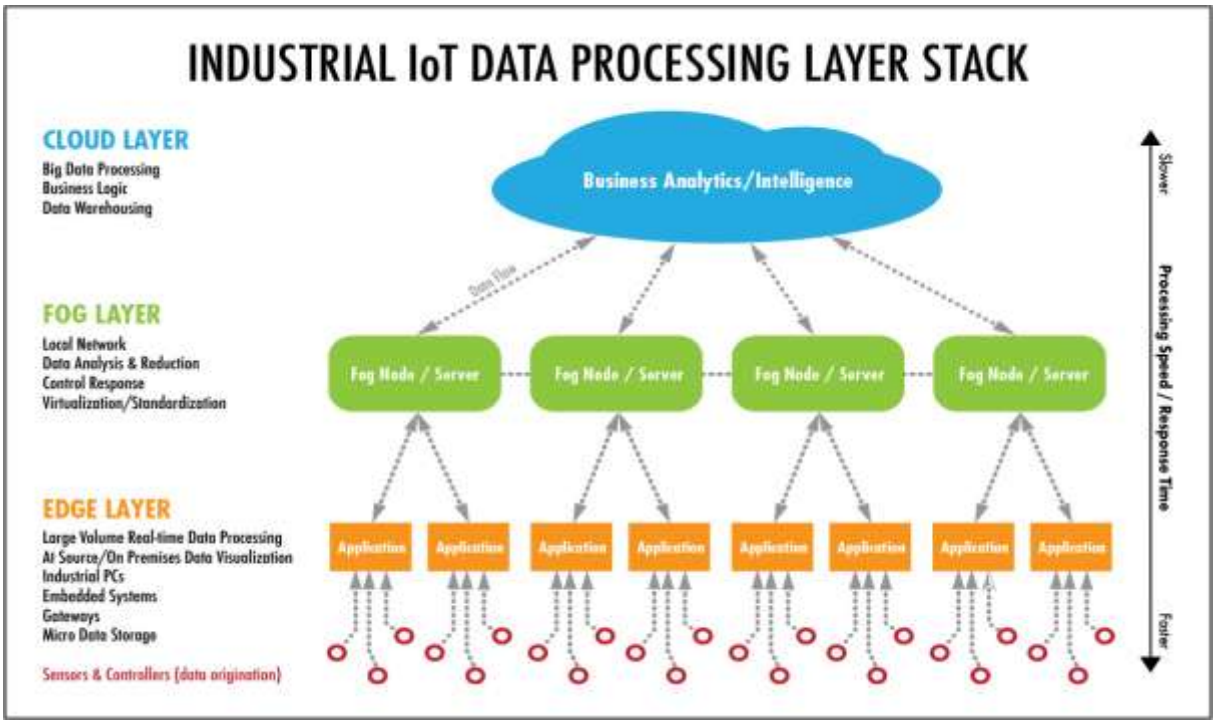

FIGURE 1. Cloud, Fog and Edge Computing

[5]Edgecomputing and cloud computing both are different things. One doesn't replace the opposite. However several articles confuse IT professionals by suggesting that edge computing can displace cloud computing. It's no truer than saying PCs would replace the datacenter.

Edge and cloud computing will and work well along, however edge computing is for purposeful systems with special needs. Cloud computing could maybe a general platform that can also work with purposeful systems in this recent client/server model.

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2.2 FOG COMPUTING

Fog computing and edge computing seems similar since they involve bringing intelligence and processing power nearer to the creation of information. However, the key difference between the fog and edge lies in wherever the location of intelligence and computing power is placed. A fog atmosphereplaces intelligence at the local area network (LAN). This design transmits data from endpoints to a gateway, wherever it'sthen transmitted to sources for processing and return transmission.

Edge computing places intelligence and processing power in devices like embedded automation controllers.The goal of this can beto bring basic analytic services to the network edge, increasing performance by positioning computing resources nearer to where they are required, thereby reducing the gap that data needs to be transported on the network, increasing overall network efficiency and performance. Fog computing may also be deployed for security reasons, because it has the power to segment bandwidth traffic, and introduce extra firewalls to a network for higher security.

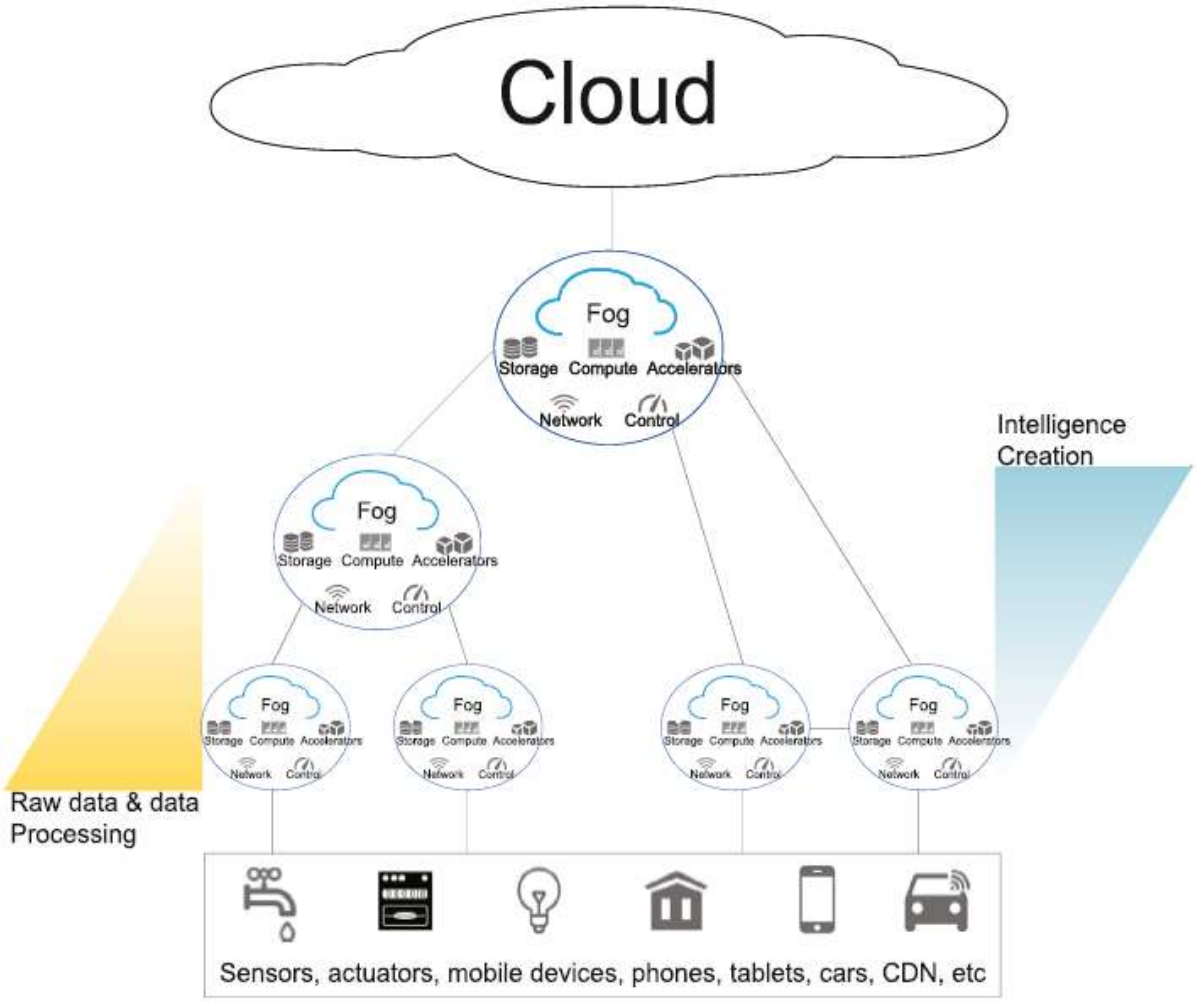

FIGURE 2. A typical hierarchical architecture based on fog computing

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III. NEW TECHNOLOGY DETAILS

Edge computing are often traced back to the Nineties when Akamai launched its content delivery network (CDN), which introduced nodes at locations geographically nearer to the end-user. These nodes store cached static content like pictures and videos. Edge computing takes this idea further by allowing nodes to perform basic computational tasks. In 1997, scientist Brian Noble signifies how mobile technology might use edge computing for speech recognition. 2 years later, this technique was additionally used to extend the battery lifetime of mobile phones. At the time, this method was termed "cyber foraging," that is largely how each Apple's Siri and Google's speech recognition services work.

[8]Typically, IoT information is collected and transmitted to a cloud or data center, wherever it is processed and analyzed. This approach is reliable but long. As a result, edge computing is changing into an progressively well-liked and quicker approach In edge computing, sensors, controllers, and different connected devices collect and analyze IoT information themselves, or transmit it to a close-by electronic computer, like a server or laptop computer, for analysis. [13]once this processing and analysis occur at the edge of a network, as opposition a data center or cloud, the data are often instantly analyzed—and place into action Edge computing is sometimes erroneously referred to as fog computing, however both are completely different. In fog computing, one centralized electronic computer processes data from multiple endpoints in a network. In edge computing, every device in a network plays its own role in processing information. Edge computing works at the individual device, fleet, or plant level.

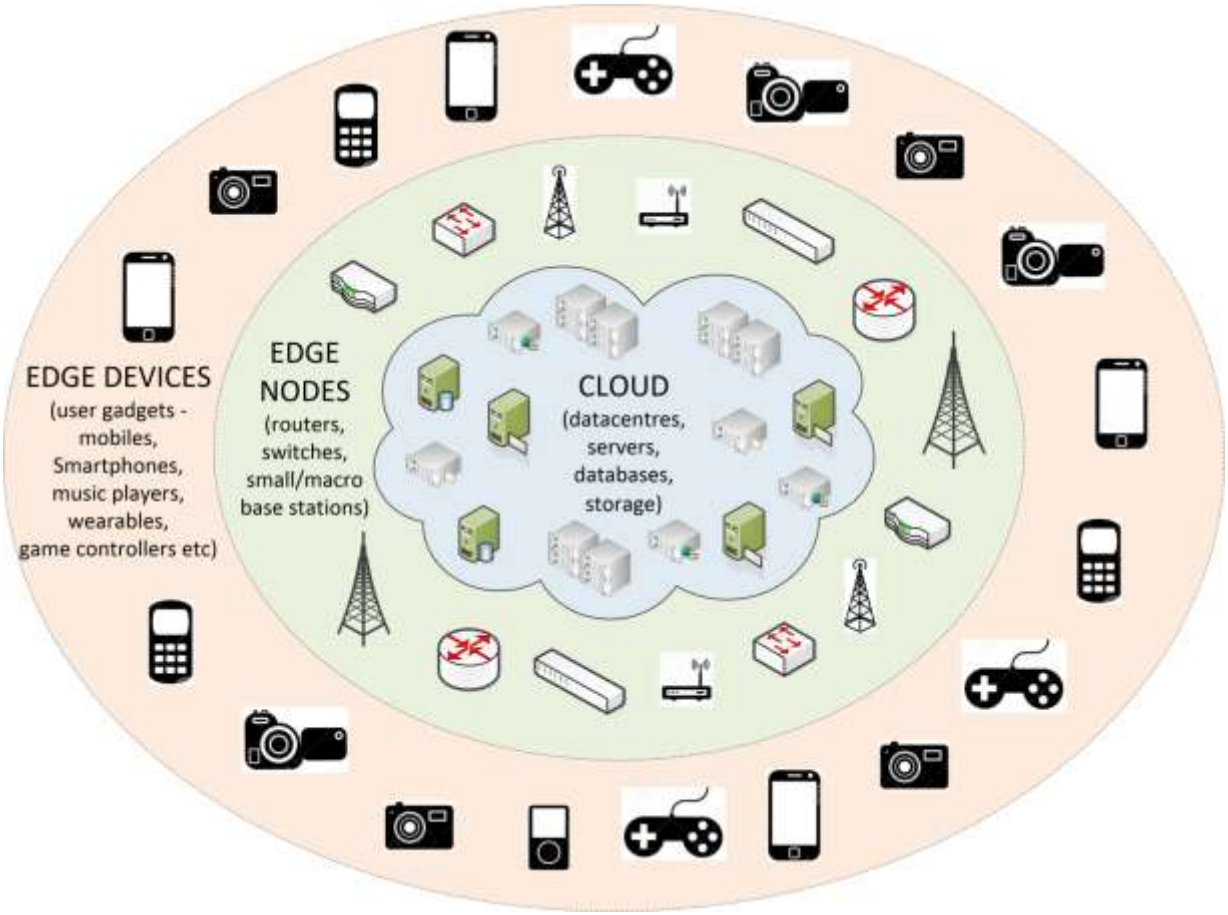

FIGURE 3. Edge devices and edge nodes with relation to the cloud

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3.1 ADVANTAGES

3.1.1 HIGHER LATENCY

If applications depend upon immediate feedback (e.g. to create"real-time" decisions), sending information to the cloud, calculating and sending the information back to the device might take too long. However, if the trail is reduced to the (much closer) Edge Node and back, several use cases will be completed.

3.1.2 DATA THROUGHPUT

[9]Devices might generate huge amounts of information. One single autonomous automobile as an example might generate up to 4000 gigabytes of information per day. If each single automobile sent all information it generates all the way to central datacenters it might produce an enormous load on the network. By performing the required computations on edge Nodes near to the device, most of the trail is often cropped. This can be particularly necessary when considering the increasing importance of the internet of things and also the rising variety of devices connected to the internet.

3.1.3 RELIABILITY AND ROBUSTNESS

the main functionality of devices should still be accessible, though communications to the central cloud are impaired. This could be achieved by relying on local communication with an edge Node that should (in theory at least) be less vulnerable to issues. If an edge Node fails, the devices are shifted to another Edge Node.

3.1.4 PRIVACY

In several use cases grouping user information is needed or at least helpful. However, in cases where collective information is enough, the users' privacy is preserved by aggregating the information on the edge Node rather than the cloud.

3.1.5 SCALABILITY

In most cases, the computing power of devices is restricted by their little size. What is more, developing a brand new use case that needs stronger hardware would require all potential users or the network administrator to update the devices that limit the use cases' adoption rate. Edge Nodes don't suffer from these issues and might be extended both very simply and continuously. Using a appropriate Edge Computing framework, adding, exchange or upgrading Edge Nodes could be a terribly easy and extremely machine-driven method.

3.2 DISADVANTAGES

Where there are advantages, there are risks, and edge computing is not any exception. Firms should bear in mind of the subsequent risks of edge computing:

3.2.1PROCESSES SUBSET OF DATA

Edge computing processes and analyzes solely a subset of data, discarding raw information and incomplete insights. Firms should think about what level of data loss is suitable.

3.2.2SECURITY ISSUE

Edge computing will increase attack vectors. With the addition of the IoT, network-connected devices, and built-in computers, the opportunities have enhanced for attacks and malicious hackers to infiltrate the devices and access sensitive information.

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3.2.3 NEEDS ADDITIONAL NATIVE HARDWARE

as an example, IoT cameras need an inbuilt computer to send videoinformation over the internet likewise as a more subtle computing method for a lot of advanced process application, like motion-detection or facial recognition formula.

IV. CONCLUSION

This paper outlines and surveys the state-of-the-art edge computingtechnologies. With the goal of understanding further intricacies of thekey technologies, we have broadly divided the body of knowledge intocloudlet, mobile edge computing, and fog computing. Within each ofthese aspects, we have given a detailed tutorial on the principle, system architecture, standards, and applications. Nevertheless, given the relativeinfancy of the field, there are still many outstanding problems thatrequire further investigation from the perspective of key techniques andadvanced solutions. Given the extensiveness of the research areas, it isalso concluded that more rigorous investigations are required withgreater attention to be focused on transforming well-established fogcomputing into fog computing-based RANs. Furthermore, with theintroduction of the advanced big data mining and network slicing, theavailability of varied degrees of freedom along with the associated constraintsfurther beckon the design and validation of the original models inthe context of edge computing.

REFERENCES

[1] http://10.3.200.202/cache/8/03/etsi.org/6e14a9668574b8b935111768d9f6e501/etsi_wp11_mec_a_key_technology_towards_5g.pdf.
[2] https://www.winsystems.com/cloud-fog-and-edge-computing-whats-the-difference/
[3] https://opensource.com/article/17/9/what-edge-computing
[4] https://www.quora.com/Whats-the-difference-between-edge-computing-and-cloud-computing
[5] https://www.infoworld.com/article/3197555/make-sense-of-edge-computing-vs-cloud-computing.html
[6] https://www.researchgate.net/publication/318303653_Edge_cloud_computing_technologies_for_internet_of_things_A_primer
[7] https://www.infoworld.com/article/3197555/make-sense-of-edge-computing-vs-cloud-computing.html
[8] https://business.sprint.com/blog/four-advantages-edge-computing/
[9] https://www.inovex.de/blog/edge-computing-introduction/
[10] https://www.researchgate.net/publication/333857220_A_Comprehensive_Survey_on_Edge_Computing_for_the_IoT
[11] https://www.go-rbcs.com/articles/fog-computing
[12] https://www.researchgate.net/publication/321989470_Multi-access_edge_computing_open_issues_challenges
_and_future_perspectives
[13] http://www.datacentervendors.com/xn/detail/3234673:BlogPost:55842
[14]https://www.ibm.com/developerworks/community/blogs/open-idea/entry/Edge_Computing_in_a_brief?la
ng=en