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EDGE COMPUTING: NOT JUST A BUNCH OF CLOUDS

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Abstract - *The rapid increase in the deployment of IoT with the success of the cloud along with the 5G network pushed the computing paradigm to the next level which brings computing close to your source data. This reduces the need for long-distance communication between client and server, which reduces the latency and bandwidth requirement thereby handling the concerns regarding response time requirement, battery life constraint, as well as data safety and privacy. In this paper, we will learn about the basics of Edge computing and also its influence in the world we live in with highly fast and secure devices that can make smart homes and smart cities. We also address the issues faced by edge computing and future scope in this sphere to motivate more research and product developments.*

Key Words: **cloud computing, bandwidth cost, edge network, automation, intelligent device, reduced latency**

1. INTRODUCTION

In the earlier days, the entire computational tasks were solely done by the server itself and the client used to deal with input and output. This led to a high load on the server side so to cope up with this problem the client-server model was introduced, later on with the advancement of technology and the introduction of internet of things turned the end devices to smart devices, which in turn increased the load on the server-side exponentially. The cloud computing has immensely changed the way we access our data, now the entire data is transferred to the cloud and the user can care freely access them. The introduction of IoT has made it very much a reality, the Internet of things is the concept of "making a computer sense information without the aid of human intervention and these devices generate a large amount of data. Transferring such a large amount of data to the cloud may cause high latency and even lead to various cybersecurity attacks. This problem could be solved by performing the calculation at the edge of the network which highly reduce the latency and the amount of data to be sent. This gave rise to the concept of edge computing that is implementing the processing capacity at the edge of the network.

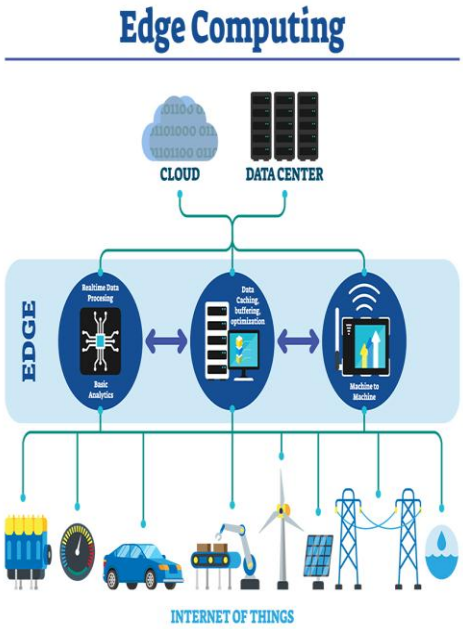

Fig -1: Model of Edge Computing

2. EDGE COMPUTING: Why it is important?

From a pure infrastructure point of view edge computing is essentially cloud principles applied at the network edge close to the user. It includes virtualization, on-demand services, API driven approach, automated LCM and commodity hardware. In other words, this is a technology that focuses on the idea of pushing intelligence to the edge of the network. In edge computing, the computational task is done at the edge of the network devices and only the important output is sent back to the server.

Edge considerably reduces the load on the network as well as the server. It may even offer new functionalities which were traditionally not expected. Let us consider a surveillance camera that usually monitors the motions around it and send it to the server, Usually, a traditional camera would simply record the potage 24x7 and send it to the server but in case of edge computing the edge devices like surveillance camera are made more intelligent by allowing it to sense the video and send only those images to the server that shows some severe movements in it

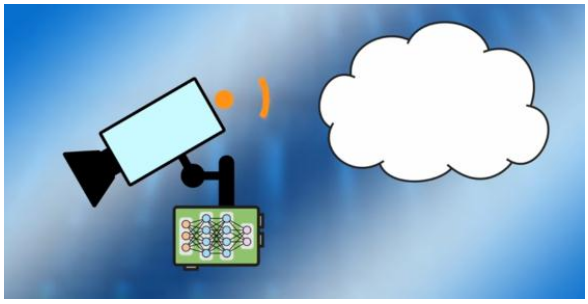

Fig -2: Only important data send to cloud from the Edge device (Surveillance camera)

3. USECASE OF EDGE COMPUTING

At a higher level, the use case of Edge computing falls under two big buckets

3.1. Third-Party Edge Applications

- Real-Time Application: These are applications that require very low latency and low jitter. Augmented reality, Virtual reality, connected cars and smart cities all fall under this bucket.
- Immersive Application: These are the one which requires extremely high network throughput for example 360 degree video, 4K video etc.
- Cost Reduction Application: These are the applications which are trying to save upstream bandwidth and reduce processing in the central cloud. A good example is a video surveillance camera and IoT gateways etc.

3.2. Operator Applications

- Analytics: It is all about collecting a large amount of data analysis and even running analysis at the edge itself and send small data to the server.
- Security: It is all about moving security parameter very close to the source and in this way we can block security threat at the edge itself and secure the core

4. KEY BENEFITS OF EDGE COMPUTING

- Ultra-low latency: typical latency is in milliseconds which is significantly lower compared to the centralized data centre.
- High network throughput: Since the content is locally generated or cached here, the network throughput can be orders of magnitude greater than the core data centre.
- Context-awareness: Awareness can be increased as the edge has access to Radio networks. The information provided by the radio access network can be used by edge apps.
- Data filtering and reduction: Data analysis apps at the edge, can substantially reduce the amount of data being sent in an upstream channel.
- Compliance: Edge applications can help the user with more privacy and data location laws, as the computations are taking place at a closer level to the user.
- Security: CSPs can protect their network against attacks from user equipment (UE) or customer premier equipment (CPE) using edge applications.

5. APPLICATIONS OF EDGE COMPUTING

- Autonomous Vehicle: Edge computing provides a better decision to stop immediately then relying on a remote server. It can also be used for interaction among the vehicles more efficiently because rather than first sending data to a remote server they communicate among themselves.
- Healthcare Devices: Health monitoring devices can provide a faster response if the decision is made locally. Edge computing can also be helpful if the devices used in surgery can make decisions among themselves rather than on a remote server as it provides faster response.
- Security Solutions: Security Surveillance systems can work in real-time if edge computing is used for better security protection.
- Retail Advertising: The advertisements that retail organizations receive are based on some parameters like the location. In this case, edge computing can provide better privacy to the server by encrypting the data and not sending the location to the remote server.
- IoT Devices: IoT devices can work faster even with weak internet and also provides required adaptability.
- Video conferencing: The quality of video or voice during video conferencing can be improved by deploying the server-side closer to the user.

6. IFRASTRUCTURAL REQUIREMENTS OF EDGE COMPUTING

1. Ultra-low latency: Edge applications demand ultra-low latency (<10ms) from the infrastructure.
2. High network bandwidth: having network bandwidth is very much critical for immersive edge applications.

3. Constrained resources: This includes space constraint, power constraint and cooling constraint. In many cases, there is a need for ruggedized racks.

4. Need for flexible infrastructure: The edge application must be capable to iterate and evolve to new requirements.

5. High performance: Extremely high performance to support good user experience is also very important. The performance criteria include CPU, memory, storage, EPA, DP acceleration etc.

6. Distributed Architecture: Edge systems include a large number of geographically dispersed remote Edge clouds.

7. Automation: Edge computing must support automation such as zero-touch provisioning, zero-touch LCM, zero-touch operations, logging, monitoring and altering etc.

8. Compatibility: Edge Infrastructure needs to be compatible with MANO and MEC application orchestras.

7. MIGRATION TO EDGE COMPUTING

Centralized management
All edge devices present at each corner of the network have their configuration. Managing these configurations is quite a big deal so it becomes necessary to have centralized management from was an admin can manage all the devices.

Interoperability of equipment
With edge computing, the standards of the system are not that solid. You might have certain issues while communicating with another edge device.

API's/extensibility
For the edge devices to act as a superior device it becomes necessary to flourish them with required software and other intelligent functionalities like biometric reading, face recognition system, licence plating etc.

Support & Updates
These edge device randomly sit on the network and are vulnerable to cyber-attacks so it is quite necessary to support regular updates.

8. ISSUES IN EDGE COMPUTING

- Bad configurations are a lot easier. If even one of the configuration of any of the edge device is screwed up it backfires and the system may be a total failure.

- With edge, the "Hacking" vector may be increased because now not only someone can compromise your PC, your server but even your intermediate source devices which now performs the computations.

- Licensing Cost is quite high now you need to pay extra cost for the computational functionality at each edge device. So it might be possible that you double the cost in-licensing of these devices.

9. FUTURE SCOPE OF EDGE COMPUTING

Edge computing can provide its application in a variety of industries by fulfilling the demands of computation, networking and storage. So, it is expected that the market of Edge computing will grow at least 60% in a couple of years.

The companies will benefit from edge computing as they need not purchase multiple vendor solutions. Single vendor edge computation solutions will fulfil all their needs as it also provides flexibility.

According to research, it is predicted that by 2030 the number of devices using edge computing will be 50 Billion.

10. CONCLUSION

Edge computing is a really good technology, but we still warn you before adding edge computing to your infrastructure as it might be quite complex. Edge computing is all about the quality of services, where people believe adding edge will fix all their issues to the slow network. By reducing the load on the network there are still chances that every edge device might send output on an exceptionally large quantity and overload the servers. But in overall with growing IT sector and mankind dependency on the digital world it is quite crucial to move forward and adapt to edge computing.

REFERENCES:

[1] H. Sundmaeker, P. Guillemin, P. Friess, and S. Woelfflé, "Vision and challenges for realizing the Internet of things," vol. 20, no. 10, 2010.
[2] Challenges and Opportunities in Edge Computing Blesson Varghese, Nan Wang, Sakil Barbhuiya, Peter Kilpatrick and Dimitrios S. Nikolopoulos School of Electronics, Electrical Engineering, and Computer Science Queen's University Belfast, UK.
[3] AI Benchmark: Running Deep Neural Networks on Android Smartphones Andrey Ignatov Qualcomm, Inc. andrey@vision.ee.ethz.ch
[4] Calheiros R.N., Ranjan R., Beloglazov A., De Rose C.A.F. & Buyya R. CloudSim: A toolkit for modeling and simulation of cloud computing environments and evaluation of resource provisioning algorithms. Softw. - Pract. Exp. 41, 23–50
[5] El-Sayed H., Sankar S., Prasad M., Puthal D., Gupta A., Mohanty M. and Lin C.T. Edge of Things: The Big

Picture on the Integration of Edge, IoT and the Cloud in a Distributed Computing Environment. IEEE Access 6, 1706–1717 (2017).

[6] Zeng F., Ren Y., Deng X. & Li W. Costeffective edge server placement in wireless metropolitan area networks. Sensors (Switzerland) 19, (2019).

[7] Shi W., Cao J., Zhang Q., Li Y. & Xu L. Edge Computing: Vision and Challenges. IEEE Internet Things J. 3, 637–646 (2016).