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Cloud v/s Edge Computing

Shubham Sharma[1], Shivam Yadav[2], Abhinav Kumar Mittal[3],Ms. Shruti Vyas[4]
Department of Artificial Intelligence & Data Science, Department of Artificial Intelligence & Data Science Jaipur Engineering College & Research Centre, Jaipur Engineering College & Research Centre
[1]shubhamsharma.ai24@jecrc.ac.in , [2]shrutiarya.ai@jecrc.ac.in

Abstract

- In recent years, the Edge computing paradigm has gained considerable popularity in academic and industrial circles. It serves as a key enabler for many future technologies like 5G, Internet of Things (IoT), augmented reality and vehicle-to-vehicle communications by connecting cloud computing facilities and services to the end users. The Edge computing paradigm provides low latency, mobility, and location awareness support to delay-sensitive applications. This article is meant to serve as a comprehensive survey of recent advancements in Edge computing highlighting the core applications. It also discusses the importance of Edge computing in real life scenarios where response time constitutes the fundamental requirement for many applications. The article concludes with identifying the requirements and discuss open research challenges in Edge computing.

Keywords: Cloud, IaaS, PaaS, SaaS, Fog, Edge Computing, Cloud Server, Network Traffic, bandwidth cost.

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1. Introduction

Edge computing constitutes a new concept in the computing landscape. It brings the service and utilities of cloud computing closer to the end user and is characterized by fast processing and quick application response time. The currently developed the internet-enabled applications such as surveillance, virtual reality, and real-time traffic monitoring require fast processing and quick response time. End users normally run these applications on their resource- constrained mobile devices while the core service and processing are performed on cloud servers. Leveraging services of cloud by mobile devices result in high latency and mobility-related issues. Edge computing fulfills the above-mentioned application requirements by bringing the processing to the edge of the network. The cloud computing issues can be resolved through the three Edge computing models Cloudlets, Fog and Mobile Edge computing.

The European Telecommunications Standards Institute (ETSI) has introduced the concept of Mobile Edge computing where mobile users can utilize the computing services from the base station. The Fog computing concept has been introduced by Cisco [10], which enables the applications to run directly at the network edge through billions of smart connected devices.

Presently due to the usage of computers in almost all Edge computing directs computational data, applications, and services away from Cloud servers to the edge of a network. The content providers and application developers can use the Edge computing systems by offering the users services closer to them. Edge computing is characterized in terms of high bandwidth, ultra-low latency, and real-time access to the network information that can be used by several applications. These are the popular medium widely existing as a recent medium of currency in the e-cash scenario. The mode of usage and the security provided by these currency mediums are as follows.

A. Cloud Computing: Cloud computing has high jitter whereas Edge computing has very low jitter. Unlike the Cloud computing, Edge computing is location- aware and high support mobility. Edge computing uses a distributed model for server distribution as compared to Cloud computing that uses a centralized model. The probability of data en-route attacks is higher in Cloud computing than Edge computing caused by the longer path to the server. The targeted users for Cloud computing are general Internet users whereas the targeted service subscribers for Edge computing are the Edge users. Unlike the global scope of Cloud computing, the scope of Edge computing is limited. Lastly, Edge hardware possesses limited capabilities that make it less scalable than the Cloud. The targeted users for Cloud computing are general Internet in Cloud computing. The services in Edge computing are located in the Edge network whereas the services in the Cloud are located within the Internet. telephone and electronic authorization using the Internet, known as a cloud computi

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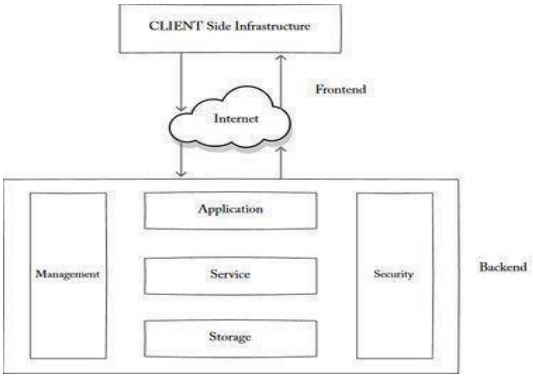

Fig 1. Cloud Computing

B. Smart City: In the future cities will have sensors that will collect various data, for example, in transportation, medical health, and urban security. Moreover, urbanization is rapidly increasing. According to the UN, it is estimated that, by 2050, over 6 billion people will be living in the cities [57]. In the future, to have sustainable development in the town, a smart city is an excellent solution. This might help to solve the problems that may arise in food supply, medical care, transportation, culture and

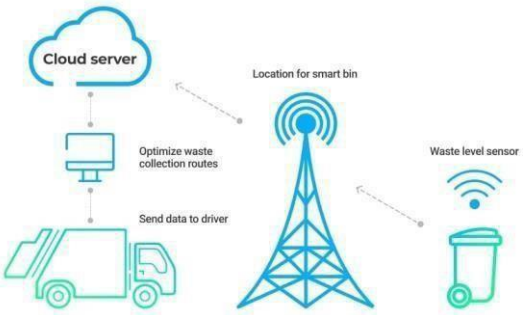

Fig 2. Smart City

III. METHODOLOGY

A. MEDICAL APPLICATIONS: HPC at the Edge for medical imaging merges HPC/AI and medical sensing technology in order to provide precision

This granular, yet massive amount of patient data can be analyzed at the Edge, transformed, and then only pertinent data is sent to the cloud such as alerts or data stripped of information that could able to provide better care at reduced costs

B. INDUSTRIAL/MANUFACTORINGAPPLICATIONS: Industry 4.0 combines Edge HPC with AI in industrial automation environments. It aims towards waste reduction, work reduction, and worry reduction in the work space. It is used for connecting machines-to-machines and machines-to-people in a way where on-demand production environments, equipment, and workers can quickly and intelligently react to dynamically changing factory floor/environmental conditions. Certain industrial applications may need to react quickly to real-time changing environmental conditions which may be uncovered in data too voluminous to be sent to the cloud, such as image recognition data that guides a robotic arm to interact with an object on a moving assembly line or creates alerts if dangerous conditions arise.

C. SMART GRID AND PUBLIC SAFETY: Electricity is one of the primary sources for humans to conduct most of the activities in daily life. In recent years, special emphasis has been placed on how electricity is produced and distributed to facilitate better economic, technical, and environmental reports. In particular, 8 how it is generated, distributed, and controlled, and monitored through digital instruments. The smart grid is a term that refers to how the whole electricity production and distribution are controlled by the smart digital instruments (for example, sensors) and embedded systems. Figure 16 shows an example of Edge Computing in the smart grid. Over the past years, surveillance security has been playing an important role in our daily life, for example, ATM Centre. Most of the surveillance security is based on the visual feed, where this feed needs to be analyzed quickly using AI/ML/DL better security reasons without taking much time with accuracy. lead to the patient's privacy being compromised. Medical Imaging at the Edge using HPC/AI removes the latency and dependence on AI used in medical imaging provides tools that augment the clinician's intelligence in a way where they are

IV. CLOUD SERVICES

Following are three foremost service models of cloud computing —

Infrastructure as a Service (IaaS) Platform as a Provision (PaaS) Program as a Provision

There are pure changes among the three and

what they can suggestion an occupational in rapports of storing and basis combining, then they can to cooperate through individually additional method of wide-ranging prototypical of cloud computing.

A. IaaS (Infrastructure as Service)

This is the most communal service methods of cloud adding as it offers the fundamental infrastructure of virtual servers, network, systems and data storage drives. It consents flexibility, reliability and the scalability that many businesses pursue with the cloud.

This makes it model for minor and a average sized structuring observing for charge and virtual IT explanation to provision occulated development. IaaS is an entirely subcontract recompense-for-custom facility.

B. PaaS (Platform as a Provision) Platform as a service (PaaS) where a third- party provider delivers hardware and software tools to users over the internet. Usually,these tools are neededfor application development. A PaaS provider hosts the hardware and software on its own infrastructure. As a result, PaaS frees developers from having to install in-house hardware and software to develop or run a new application.

C. SaaS (Software as a Service)

This cloud calculating explanation includes the disposition of software over internet to several productions who pay via contribution or a pay-per-use model. It is a valued tool for CRM and for requests that need a lot of web or mobile charge — such as a mobile sales organization software. SaaS is accomplished from a dominant position so trades don't have to concern about sustaining it themselves, and is model for short-term schemes

V. Public Cloud

This cloud distribution model is a modified infrastructure maintained by a single business. It offers a precise environment in which contact to IT resources is additionally centralized within the business. The present exemplary perhaps visibly introducedeitherobtainable handled internal. Even though secluded cloud introducing obtainable valuable, as largest productions it could be action a developed equal of safety and extra self-sufficiency to modify the storing,interacting and calculate mechanisms toward ensemble their IT necessities.

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VII. Compensations of Cloud Computing

1) Back-up and bring back information Once the data is deposited in the cloud, it is calmer to get back-up and return that data using the cloud.

2) Improved collaboration Cloud applications expand association by allowing groups people to rapidly and simply share information in the cloud via shared storage.

3) Outstanding convenience Cloud permits swiftly and simply access supply anywhere, anytime in the entire world, with an internet assembly. An internet cloud substructure growths group output and competence safeguarding that our information is constantly nearby.

4) Low preservation charge Cloud calculating reduce both hardware a software conservation organization.

5) Mobility Cloud adding allows us to simply entree all cloud information via mobile.

VIII. Drawback of Cloud Calculating

1) Internet Connectivity In cloud computing, each facts (picture, audial, audio-visual, etc.) is stowed on the cloud, and we admittance these data concluded the cloud by means of the internet linking

2) Vendor lock-in Vendor lock-in is the main difficulty of cloud computing. Firm may face difficulties when relocating their facilities from one seller to a further As dissimilar vendors provide various stages, that can reason trouble affecting from one cloud to additional

3) Imperfect Controller Cloud organization is entirely owned, accomplished, and checked by the provision source, so the cloud manipulators have fewer control concluded the purpose and implementation of facilities inside a cloud framework.

4) Security though cloud facility workers expedient the greatest safety values to stock significant info.

IX. CONCLUSION AND FUTURE WORK

This technical report gives an overview of the Edge Computing paradigm and its applications, provides a comparison between Edge and Cloud Computing, and also points out the importance of this novel computing model to sustain the digital developments ongoing within our society. The key characteristics of Edge Computing architectures are discussed, including a brief survey of the orchestration middleware available together with the tools enabling the management, the effective deployment and the integration of data analytics capabilities within this novel distributed computing infrastructure. The latest trends at the heart of hardware developments for Edge Computing platforms are analyzed, with concrete examples on the way Artificial Intelligence techniques and associated algorithms are tackled in this context. This technical report further explains why Edge Computing still depends on cloud technology or HPC supercomputers

and lists a few critical challenges still opened in Edge Computing implementation. Finally, four categories of real-world applications affecting our daily life are proposed. They only illustrate the concrete benefit and potential impact this novel paradigm can bring to improve our digital society for the coming decades

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