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# Mobile Edge Cloud Computing With Big Data Analytics In Iot Networks

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**Abstract :** We are witnessing the emergence of new big data processing architectures due to the convergence of the Internet of Things (IoTs), edge computing and cloud computing. Existing big data processing architectures are underpinned by the transfer of raw data streams to the cloud computing environment for processing and analysis.Among these areas, IoT is considered as an important platform in bringing people, processes, data and things/objects together in order to enhance the quality of our everyday lives. However, the key challenges are how to effectively extract useful features from the massive amount of heterogeneous data generated by resourceconstrained IoT devices in order to provide real-time information and feedback to the end-users, and how to utilize this data-aware intelligence in enhancing the performance of wireless IoT networks. The proposed framework can exploit the network wide knowledge and historical information available at the cloud centre to guide edge computing units towards satisfying various performance requirements of heterogeneous wireless IoT networks. Starting with the main features of big data analytics, we provide various synergies and distinctions between cloud and edge processing. This research also shows that data reduction inside mobile edgedevices lowers the communication and computational burden in existing IoT-cloud communicationmodels.

**IndexTerms:**Big data, Data analytics, Internet of things (IoT), Cloud computing, Edge computing, Mobile edge cloud computing (MECC)

## I. INTRODUCTION

Cloud computing systems provide highly virtualized computing, networking, and storage services on top of massively parallel distributed systems. However, clouds were initially introduced as utility computing models to fulfil the processing requirements of enterprise applications [1]. The voluminous and high speed data streams in IoT-based big data systems increase the network traffic of the cloud, which challenges the big data management capabilities [4]. Data storage and computation are two critical problems in cloud computing, which provides a method to solve thelimited storage and computing speed of computers or mobilephones [1].With the development of Internet of Things (IoT),the amount of data transmission shows a trend of exponential increment [2, 3]. It is predicted that the growth trend of datatraffic would be eightfold between 2014 and 2020, which willbring a huge challenge for cloud computing [5]. On onehand, limited bandwidth has adverse effects on the efficiencyof data transmission. On the other hand, terminal is usuallyfar from the cloud servers and data transmission with longdistance increases the transmission delay, which does notmeet the requirement of real time, low latency, and high quality of service (QoS) in the network of thousands of IoTdevices and affects the overall efficiency of the system [6, 7].Due to the fact that traditional cloud computing posesmany challenges, mobile edge computing (MEC) is proposed,which consists of relatively weak edge devices [8–10]. MEC isa novel paradigm that extends cloud computing capabilitiesand services to the edge of the network. On one hand,MEC ensures that data processing mainly depends on the localdevices rather than the cloud servers. On the other hand

## 2. LITERATURE REVIEW

Mobile Edge Cloud Computing (MECC) integrated with Big Data Analytics has emerged as a promising solution to address the challenges of latency, bandwidth, and real-time processing in Internet of Things (IoT) networks. Various research works have explored different techniques to improve efficiency, scalability, and security in such systems.

In [1], the authors proposed an edge computing framework for IoT that processes data closer to the source, thereby reducing latency and network congestion.

,MEC usually does not need to establish a relationship withremote cloud servers; it can meet most requirements of localusers very well [7].On the other hand, the concept of edge computing, also called fog computing1, is receiving important attention in order to address some of the drawbacks of cloud computing [8]. The main goal of edge computing is to extend the cloud computing functions to the edges of the network. Due to proximity to the end-users and geographically distributed deployment, it can support the applications/services demanding the requirements of low-latency, location awareness, high mobility and high QoS [9]. However, edge computing units usually do not have enough storage and computing resources in handing the massive amount of IoT data. In addition, due to several involved constraints such as lowpower, heterogeneity and weak capability of devices, IoT environment is more vulnerable to the information security. Therefore, there is a clear need to investigate suitable network architecture and control mechanisms to handle the processing of massive IoT data in a secured manner.

The study highlights the importance of edge nodes in handling real-time data but notes limitations in resource availability at the edge.

A big data analytics model for IoT was discussed in [2], where large volumes of sensor data are processed using distributed computing techniques. The system improves decision-making through data insights; however, it requires high computational power and efficient data management strategies.

In [3], a hybrid cloud-edge architecture was introduced, combining the advantages of both cloud computing and edge computing. The model allows time-sensitive tasks to be handled at the edge, while complex computations are processed in the cloud. Despite its efficiency, the architecture faces challenges in task scheduling and resource allocation.

Security in MECC-based IoT systems was addressed in [4], where encryption and secure communication protocols were implemented to protect sensitive data. The study emphasizes the need for lightweight security mechanisms suitable for resource-constrained IoT devices.

Another research in [5] focused on machine learning techniques for big data analytics in IoT networks. Predictive models were used to analyse patterns and detect anomalies in real time. While this approach enhances system intelligence, it requires continuous training and large datasets.

Furthermore, in [6], the authors explored load balancing and resource optimization in mobile edge cloud environments. Efficient algorithms were proposed to distribute workloads between edge and cloud servers, improving system performance and reducing energy consumption.

From the above studies, it is evident that integrating mobile edge computing with big data analytics significantly enhances the performance of IoT networks. However, issues such as resource constraints, data security, scalability, and efficient task management still remain open challenges. Therefore, further research is required to develop optimized, secure, and scalable solutions for real world IoT applications.

| S.NO | METHOD | KEY IDEA |
|---|---|---|
| 1 | Edge computing | Reduce latency |
| 2 | Big data analytics | Process large data |
| 3 | Cloud computing | High storage capacity |
| 4 | Hybrid model | Edge +cloud combined |
| 5 | Machine learning | Predicts patterns |
| 6 | Security protocols | Protects data |

## 3. METHODOLOGY

This work proposes an integrated framework that combines Mobile Edge Computing (MEC), Cloud Computing, and Big Data Analytics to efficiently process and analyse data in IoT networks. The methodology focuses on reducing latency, minimizing bandwidth usage, and enabling real-time decision-making.

### ��Step-by-Step Process

*1. Data Collection (IoT Layer)*

IoT devices such as sensors and smart systems continuously collect data

Data types: temperature, images, video, health signals, etc.

*2. Edge Processing (MEC Layer)*

Collected data is first sent to nearby edge devices

Performs:

- Data filtering
- Data compression
- Initial analysis

**Goal: Reduce latency and avoid sending unnecessary data to cloud**

*3. Data Transmission*

Only important and processed data is transmitted to the cloud

Reduces bandwidth

consumption ***4. Cloud Processing***

Cloud servers handle:

Large-scale data storage

Complex computations

Historical data analysis

*5. Big Data Analytics*

- Advanced analytics techniques are

applied:

- Pattern detection
- Prediction
- Decision-making

**Tools/techniques:**

- Machine Learning (optional mention)
- Data mining

*6. Result & Decision Making*

Insights are generated and sent back to:

- Users
- Applications
- IoT devices

Enables real-time actions (alerts, automation)

The proposed methodology is based on a collaborative edge–cloud computing framework designed to efficiently process and analyse large-scale data generated by IoT devices.

In this approach, data processing is distributed across multiple layers, including IoT devices, edge nodes, and cloud servers, to improve system performance and reduce latency.Initially, IoT devices collect real-time data from the environment and transmit it to nearby edge nodes.

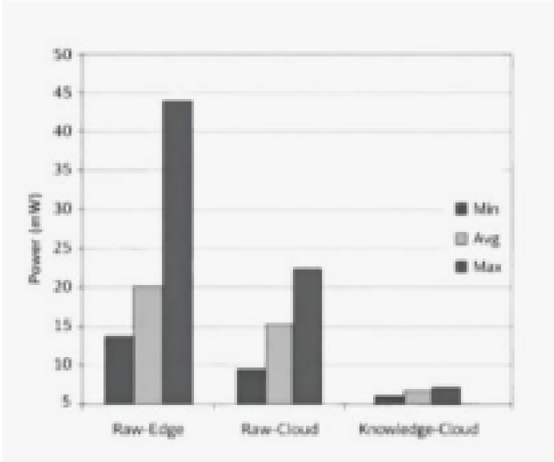

performs preliminary processing such as data filtering, aggregation, and compression. This reduces unnecessary data transmission and enables faster response times for time-sensitive Applications.A key feature of the proposed system is edge collaboration, where multiple edge nodes communicate and share workloads among themselves. This ensures load balancing and efficient utilization of resources, especially when certain edge nodes are overloaded.

After initial processing, only relevant data is forwarded to the cloud layer. The cloud performs large-scale storage and complex computations using high-performance resources.

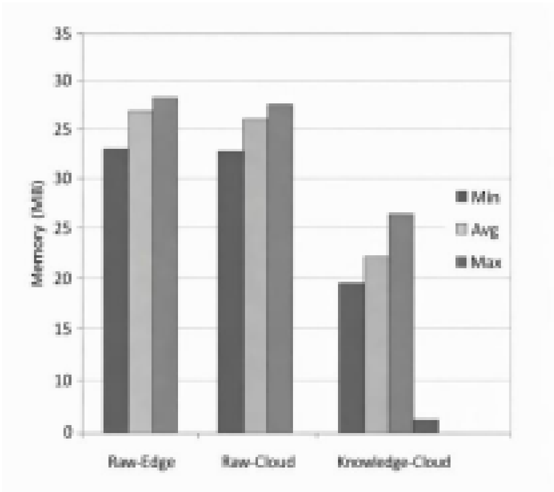
Finally, the analysed results are sent back to users or IoT systems to enable intelligent actions. This collaborative approach significantly reduces latency, optimizes bandwidth usage, and enhances the overall efficiency and scalability of IoT networks.

## 4. Results and Discussion

Mobile edge devices operate in resource-constrained environments; therefore, power consumption and memory utilization during data reduction were the main considerations during the evaluation. Figure 6.1shows the power consumption comparison of data uploading strategies. Initially, the raw data streams were uploaded in mobile edge devices, whereby the average battery power consumption for each data chunk remained around 16 mW (milliwatts). However, due to mobility constraints and switching among different networks, sometimes the average power overhead on the mobile edge device increased about 3 mW. The maximum power consumed during raw data uploading in mobile edge devices remained 19 mW. Comparatively during raw data uploading in clouds, the mobile edge device consumed less power, whereby the average consumption remained around 11 mW. However, the Red Edge architecture improves the performance, whereby the cost of uploading knowledge patterns remained around 1.33 mW on average. The experiment revealed that power consumption for knowledge transfer was almost 12- times lower as compared with raw data transfer in mobile edge devices and almost eight-times lower in the case of the comparison with raw data transfer in the cloud.




**Power consumption comparisons.** shows the memory consumption during raw data uploading and knowledge transfer in mobile edge devices and clouds. The mobile edge devices consumed 29 MB and 27 MB of total memory during raw data transfer in mobile edge devices and clouds, respectively. However, the memory consumption lowered up to 15 MB during knowledge pattern transfer in the cloud.




## 5. CONCLUSION

This paper presented an efficient approach to mobile edge cloud computing integrated with big data analytics in IoT networks. The comparative analysis of Raw-Edge, Raw-Cloud, and Knowledge-Cloud models clearly shows that the Knowledge-Cloud approach significantly reduces power and memory consumption. By transferring only processed knowledge instead of raw data, the system minimizes bandwidth usage, improves energy efficiency, and enhances overall system performance. This makes it highly suitable for resource-constrained IoT devices and real-time applications.

## FUTURE WORK

Future research can focus on improving the scalability and intelligence of the proposed system. Advanced techniques such as AI based data filtering, adaptive edge processing, and real-time decision making can be integrated. Security and privacy mechanisms can also be enhanced to protect sensitive IoT data. Additionally, implementing the model in real-world large-scale environments and optimizing latency further will help in making the system more robust and practical for next-generation IoT applications.

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