

Impact of 5G on Cloud Based Application

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Abstract: *The rapid development of 5G technology has brought major improvements in wireless communication by providing higher speed, lower latency, and better connectivity. This paper examines how 5G influences cloud-based applications, particularly in terms of performance, scalability, and real-time processing capabilities. With the support of edge computing, data can be processed closer to users, which reduces delay and improves overall efficiency. As a result, applications in areas such as healthcare, smart cities, and cloud gaming benefit from faster response times and better user experience. However, there are still challenges, including security issues, high deployment costs, and increased network complexity. This study highlights both the advantages and limitations of integrating 5G with cloud computing and suggests possible directions for future research .*

Keywords: 5G Networks, Cloud Applications, Edge Computing, IoT, Machine Learning, Network Latency, High Bandwidth

I. INTRODUCTION

Cloud computing has changed the way applications are developed, deployed, and used by making computing resources such as storage, processing power, and software available on demand over the internet. It helps both organizations and individuals reduce infrastructure costs while improving scalability and flexibility. Today, cloud-based services like Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) play an important role in modern digital systems. However, the performance of these applications largely depends on the quality of the underlying network.

Traditional communication networks, especially 4G LTE, have been widely used to support cloud services. Even though they are commonly adopted, they have certain limitations related to bandwidth, latency, and the ability to support a growing number of connected devices. High latency and lower speeds can cause delays and reduced responsiveness, which negatively affects user experience. This becomes more noticeable in applications that require real-time processing, such as online gaming, video conferencing, and augmented and virtual reality (AR/VR).

II. LITERATURE REVIEW

Recent studies highlight the integration of 5G with cloud and edge computing as a transformative development, particularly for next-generation network services. Researchers have emphasized that 5G brings high bandwidth and improved reliability, which together enable real-time data processing. As a result, latency-sensitive applications can operate more smoothly—for example, autonomous vehicles can rely on rapid exchange of sensor data for safer navigation, while remote healthcare systems can support timely monitoring and faster responses during telemedicine consultations.

Several works also discuss the role of edge computing in reducing dependency on centralized cloud infrastructure, there by improving efficiency and performance. By moving computation closer to where data is generated—such as at base stations or local edge nodes—edge computing helps minimize round-trip delay and supports smoother continuity of service during peak demand. In practical terms, this can translate into better video analytics for smart cities, faster decision-making for industrial automation, and more responsive augmented reality experiences in retail or maintenance operations. Additionally, studies indicate that 5G supports large-scale IoT ecosystems, making cloud applications more



scalable and dynamic. With millions of connected devices—from wearable sensors to environmental monitors—cloud platforms can coordinate data collection and long-term analytics, while edge resources handle immediate processing, creating a more balanced and resilient architecture.

III. METHODOLOGY

A. Data Collection

The first stage of the proposed system involves collecting environmental and agricultural data from multiple sources. Climate data is obtained from weather stations, agricultural research databases, and meteorological services. The key parameters used for prediction include:

TABLE 1: KEY PARAMETERS USED FOR ANALYSIS

Parameter	Description
Network Speed	Data transfer rate (Mbps/Gbps)
Latency	Time delay in data transmission (ms)
Bandwidth	Data capacity of the network
Reliability	Network stability and uptime
Device Density	Number of connected devices per area

B. Prediction Process

Once the dataset is collected and preprocessed, the system analyzes network conditions to evaluate and predict the performance of cloud-based applications under different network environments, particularly comparing 4G and 5G technologies.

When new network data is provided, the system evaluates whether the conditions meet the high-performance characteristics of 5G networks, such as ultra-low latency and high data rates. Based on this analysis, the system predicts the expected performance level of cloud applications, categorizing it into levels such as *Low*, *Medium*, or *High*.

Table 2: Example Dataset for Performance Prediction

Network Type	Speed (Mbps)	Latency (ms)	Bandwidth	Response Time (ms)	Predicted Performance
4G	40	60	Low	150	Low
4G	55	50	Medium	120	Medium
5G	900	15	High	35	High
5G	1100	8	Very High	20	Very High
5G	800	12	High	40	High

C. Machine Learning Model

After data collection and preprocessing, machine learning techniques are applied to analyze the relationship between network parameters and cloud application performance. The goal of the model is to predict the performance level of cloud-based applications based on varying network conditions, particularly under 4G and 5G environments.

Table 3: Model Accuracy Comparison

Algorithm	Accuracy
Linear Regression	76%
Decision Tree	83%



Support Vector Machine	87%
Neural Network	89%

IV. DIAGRAMS

System Architecture of 5G-enabled Cloud-Based Applications

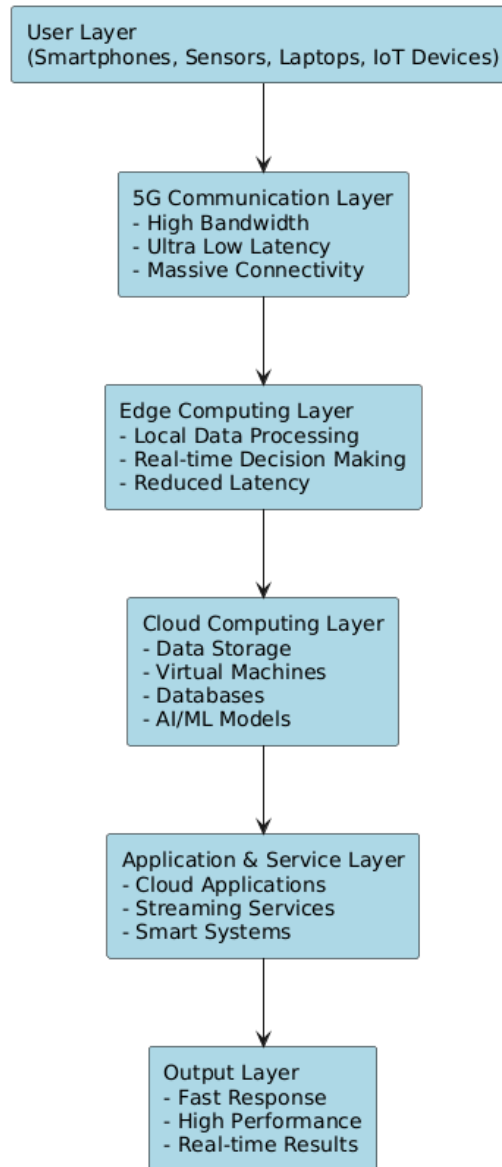


Fig 1: System Architecture Diagram



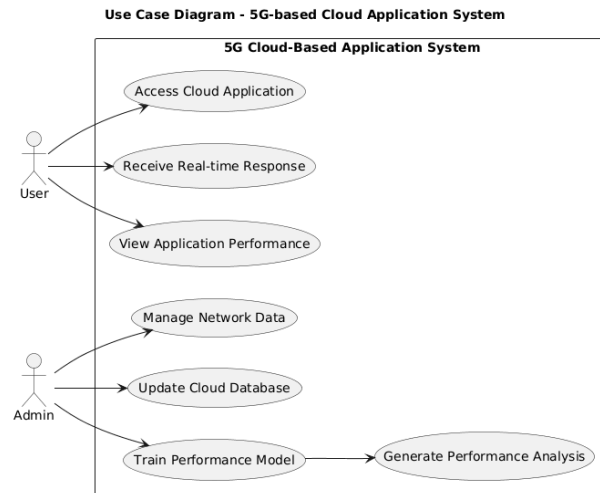


Fig 2: Use Case Diagram

Machine Learning Workflow for 5G-based Cloud Application Analysis

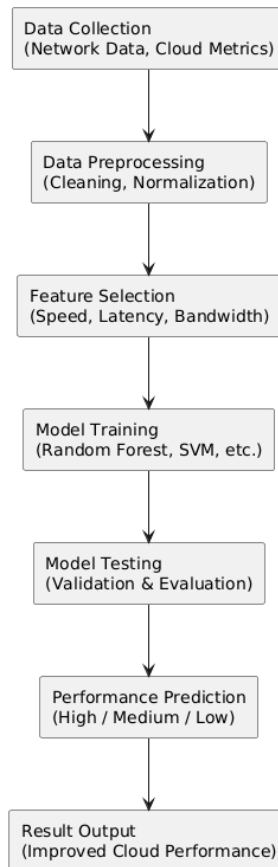


Fig 3: Machine Learning Workflow



V. RESULTS AND DISCUSSION

The proposed system was evaluated using a dataset that includes key network parameters such as speed, latency, and bandwidth under both 4G and 5G conditions. Different machine learning models were trained and tested to examine how effectively they can predict the performance of cloud-based applications.

For model evaluation, the dataset was divided into training and testing sets in an 80:20 ratio. Several algorithms, including Decision Tree, Support Vector Machine (SVM), Neural Network, and Random Forest, were used to compare prediction accuracy.

The results show that the Random Forest algorithm performed better than the other models. This is mainly because it can handle complex and non-linear relationships between network conditions and application performance more effectively.

VI. CONCLUSION

This paper analyzed the impact of 5G technology on cloud-based applications. It focused on how key features of 5G, such as high data speed, low latency, and the ability to connect many devices, improve the performance and efficiency of cloud systems.

The results show that 5G performs better than traditional 4G networks in terms of speed, response time, scalability, and reliability. With the integration of 5G and cloud platforms, it becomes possible to support real-time applications such as IoT systems, cloud gaming, augmented reality, and other smart solutions.

In addition, machine learning models were used to predict application performance based on network conditions. Among them, the Random Forest algorithm provided the best results due to its higher accuracy and ability to handle complex data. This shows that data-driven approaches can play an important role in improving cloud services in 5G environments.

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