**Edge and Cloud Computing: A Comprehensive Survey of Architectures, Challenges, and Opportunities**

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**Abstract**

The popularity of Internet of Things (IoT) devices these days demands low-latency applications have exposed the limitations of traditional Cloud Computing. Edge Computing has emerged with a different approach, by bringing computation and data storage closer to the sources of data. This paper provides a comprehensive survey on Edge-Cloud computing by focusing on its architecture models, challenges faced in adopting the said models and future opportunities. Finally, we explore the promising future of this system as well as its implementation in the synergy with AI/ML and impact on 5G/6G networks. This survey serves as a valuable lesson for understanding the current state and future evolution of Edge and Cloud Computing.

**Keywords:**

1. **Introduction**

The formal definition of cloud computing is a technology that allows users to store, manage, and process data on data (remote) centers instead of on their local computers. Multiple companies provide this service such as Amazon (AWS), Google (GCP), or Microsoft (Azure) to name a few. In the past decade, Cloud Computing has established itself as a cornerstone of modern digital infrastructure, offering unprecedented scalability, on-demand resources, and centralized data processing power. But nowadays Internet Of Things (IoT) is being used in every sector of our live such as vehicles to Augmented Reality (AR), due to this specific needs such as ultra-low latency, real-time decision-making, and efficient use of network bandwidth have become necessary and which were not fulfilled due to physical distance of remote cloud data centers.

To address these limitations, Edge Computing has emerged in recent years. What edge computing does is that it brings data processing closer to the source of data - like IoT devices, sensors, or smartphones - rather than relying on distant cloud servers which in turn reduces the latency and are important for mission - critical services. However the true strength is not in replacing cloud computing with edge but creating a symbiotic cloud - edge system that leverages the strength of both such as the responsiveness and context-awareness of the edge with the robust computational and storage capabilities of the cloud. Cloud - Edge system sounds revolutionary in planning but its possibility for implementation still remains a mystery.

This paper presents a comprehensive survey of the Edge-Cloud computing paradigm. We provide 3 major contributions. First, we provide a systematic taxonomy of Edge-Cloud architectures, classifying existing models to bring more clarity for pros and cons for each model. Second, we conduct a critical analysis of the key challenges that impede the global implementation of these systems. Finally, we will discuss future possible implementation of this system in technologies like 5G/6G networks and Artificial Intelligence (AI). This survey aims to serve as a foundation and the future roadmap for this everchanging field.

1. **Methodology**
2. **Results and Discussion**
3. **Conclusions**

**References**