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LIST OF ABBREVIATIONS

IoT – Internet of Things

QoS – Quality of Service

EC – Edge Computing

AR – Augmented Reality

CDN – Content Delivery Networks

MEC – Multi-Access Edge Computing

AI – Artificial Intelligence

EI – Edge Intelligence

RAN – Radio Access Networks

VR – Virtual Reality

V2V – Vehicle-to-Vehicle

IIoT – Industrial IoT

ABSTRACT

Edge Computing (EC) has emerged as a critical solution to address increasing Quality of Service (QoS) constraints, such as latency, bandwidth, and jitter, exacerbated by the growing number of IoT devices and the resulting congestion in core networks. By processing and caching data closer to the source, EC reduces the strain on central servers, improving both network efficiency and response times. This evolution of EC can be traced back to foundational concepts such as Content Delivery Networks (CDNs), progressing through intermediary technologies like Cloudlets and Fog Computing, and eventually leading to modern Multi-Access Edge Computing (MEC).

Exploring the evolution of Edge Computing from its foundational elements to its current role as an enabler of distributed, low-latency processing. Key components will be discussed, including resource management strategies that optimize computing and storage at the network’s edge, and computation offloading mechanisms that shift intensive tasks from resource-constrained devices to nearby edge servers. Data management techniques, critical for handling and storing the increasing volumes of data generated by edge nodes, will also be examined.

Enabling technologies such as Edge Intelligence, which integrates AI and machine learning at the edge for real-time decision-making, will be highlighted alongside 5G, whose high-speed, low-latency network infrastructure is pivotal in supporting EC's wide-scale deployment. The role of containerization in managing and scaling distributed edge workloads efficiently will also be explored.

Various real-world applications of EC, from the development of smart cities that rely on edge nodes to manage traffic and utilities, to e-Health solutions enabling remote patient monitoring and real-time data processing, will illustrate its impact. Military applications, where rapid decision-making and secure communications are essential, further emphasize the technology’s transformative potential.

Finally, discussing future considerations for EC, particularly around the adoption of green energy to ensure sustainability in powering edge infrastructures and the importance of standardization in promoting interoperability across diverse edge computing platforms. These factors will shape the trajectory of EC, ensuring it remains a viable and scalable solution to meet the ever-growing demands of modern digital ecosystems.