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Insights on IoT Architecture Application and Research for End-Net-Cloud Edge Computing

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Introduction

The advancement of IoT technology allows everything to be connected. Cloud computing, with its powerful data processing and storage capabilities, simplifies the process of IoT data collection, processing, and storage. It provides elastic and scalable infrastructure services for business applications such as computing, storage, and networking. This traditional cloud computing platform is built on a centralised architecture for non-real-time, long-cycle data and business decision scenarios that require high reliability and on-demand distribution. However, with the widespread adoption and deployment of 5th-Generation (5G) mobile technology, the volume of IoT edge devices and data has skyrocketed. The number of IoT edge devices is expected to reach 55 billion in 2022 and 150 billion by 2025, with endpoint data volumes reaching 300 ZB, according to International Business Machines Corporation (IBM). In the 5G era, cloud computing technologies have emerged as limitations in terms of centralised data processing models and technology development in meeting the new specific requirements of a broader range of IoT scenarios.

Edge computing is a robust research solution that promises to solve the above problems by extending capabilities such as computation, control, storage, and services from the network core to the network edge. Edge computing avoids bandwidth and latency bottlenecks by transforming traditional IoT architectures' centralised cloud computing model into a center-region-edge distributed computing model, resulting in an IoT edge computing (EC-IoT) architecture with collaborative computing between edge and cloud computing. In comparison to traditional IoT architectures, this architecture will enable faster and more comprehensive data analysis, deeper insights, shorter response times, and improved customer experience.

Description

The first prototype of edge computing can be found in 1998, when Akamai launched the Content Delivery Network (CDN), which was only responsible for storage and data marginalisation at the time. Following that, it saw the emergence and evolution of cloudlet, mobile edge computing, fog computing, cloud-sea computing, and other related concepts until 2013, when the term edge computing was first proposed. Edge computing has been defined by international standards organisations, enterprises, industry, academia, and others. While current definitions of edge computing differ, the consensus remains that cloud computing capabilities are sunk to edge nodes via edge networks [1-3].

Edge computing combines edge node computing power, storage, and application resources with distributed cloud computing technology, reducing response time and bandwidth requirements. Edge computing supports edge applications such as telematics, intelligent manufacturing, and ultra-high-definition video broadcasting with efficient capability support. Edge computing is primarily concerned with business scenarios such as real-time, short-term data collection and local decision-making. It is better suited for integration into IoT architectures in order to provide efficient and secure services to a large number of end users.

The central cloud services are gradually extended along the network nodes in the EC-IoT reference architecture to build multiple small and medium-sized edge cloud servers that can provide the computing and resources required to host edge applications at the end edge, network edge, and cloud edge. Each edge cloud is primarily comprised of three core cloud centre service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) (SaaS). IaaS: Provides hardware, data centres, network components, and storage. PaaS: Platform as a service, which allows users to deploy and run new applications. SaaS: Software or applications that perform and store user work online [4,5].

Conclusion

The controller receives, processes, and forwards data based on control commands from the end-edge cloud server and can support initial analysis and filtering of edge data. The edge gateway can collect data from sensor devices using wired networks (such as fieldbus, industrial ethernet, industrial optical fibre, and so on) or wireless networks (such as Wi-Fi, Bluetooth, RFID, NB-IoT, LoRa, 5G, and so on) and act as an edge cloud server to provide heterogeneous computing. Edge gateways can combine data from multiple devices to make more decisions than sensor devices and controllers. Edge gateways are also capable of device management.

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