Hardware and Software for AI Gateway Edge Computing

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Edge Devices

- An edge device is a device that provides an entry point into enterprise or service provider core networks.
- Examples include routers, routing switches, integrated access devices (IADs), multiplexers, and a variety of metropolitan area network (MAN) and wide area network (WAN) access devices.
- Edge devices also provide connections into carrier and service provider networks. An edge device that connects a local area network to a high speed switch or backbone (such as an ATM switch) may be called an edge concentrator.

Functions

- In general, edge devices are normally routers that provide authenticated access (most commonly PPPoA and PPPoE) to faster, more efficient backbone and core networks.
- The trend is to make the edge device smart and the core device(s) "dumb and fast", so edge routers often include quality of service (QoS) and multi-service functions to manage different types of traffic.

Functions

- Consequently, core networks are often designed with switches that use routing protocols such as Open Shortest Path First (OSPF) or Multiprotocol Label Switching (MPLS) for reliability and scalability, allowing edge routers to have redundant links to the core network.
- Links between core networks are different—for example, Border Gateway Protocol (BGP) routers are often used for peering exchanges.

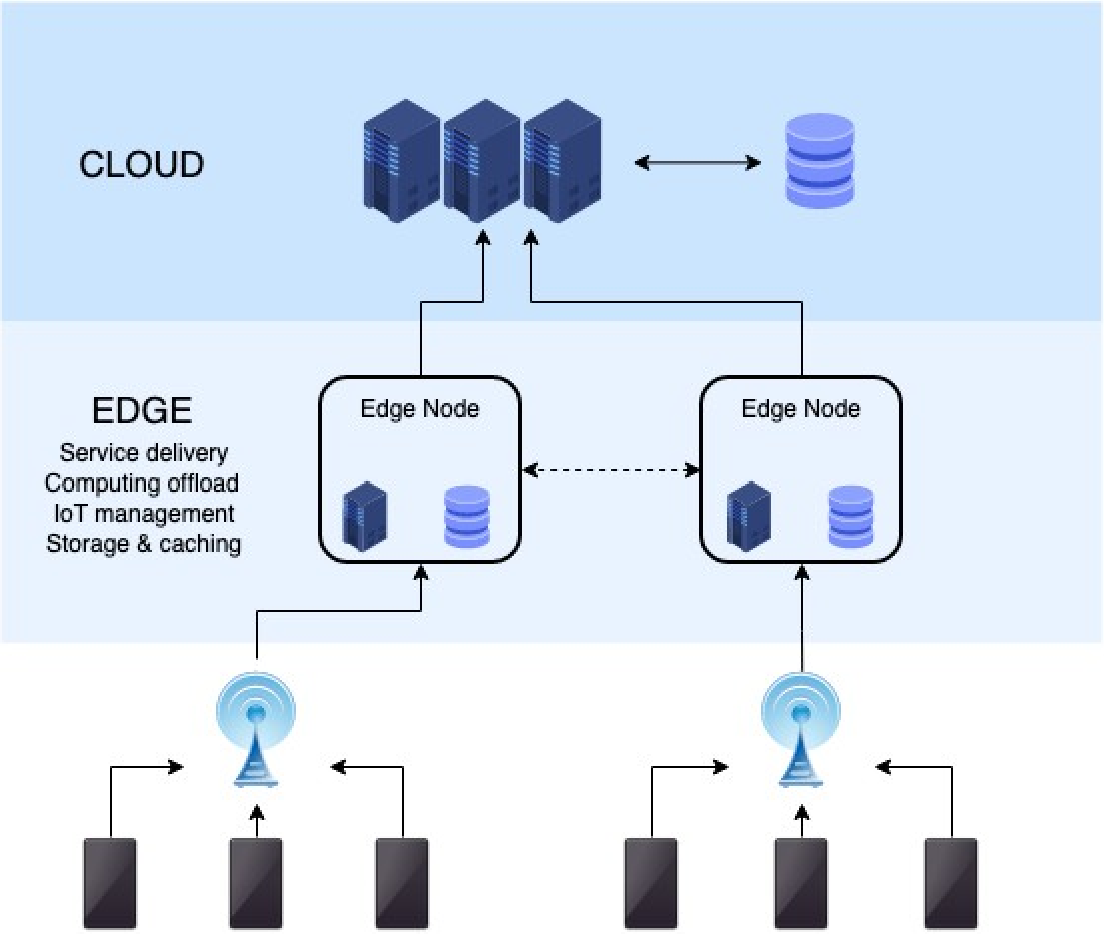
Edge Computing

- Edge computing is a distributed computing paradigm that brings computation and data storage closer to the sources of data.
- This is expected to improve response times and save bandwidth.
- "A common misconception is that edge and IoT are synonymous. Edge computing is a topology- and location-sensitive form of distributed computing, while IoT is a use case instantiation of edge computing."
- The term refers to an architecture rather than a specific technology.

Edge Computing

- The origins of edge computing lie in content distributed networks that were created in the late 1990s to serve web and video content from edge servers that were deployed close to users.
- In the early 2000s, these networks evolved to host applications and application components at the edge servers, resulting in the first commercial edge computing services that hosted applications such as dealer locators, shopping carts, real-time data aggregators, and ad insertion engines

Edge Computing



Edge Computing

- The world's data is expected to grow 61% to 175 zettabytes by 2025.
- According to research firm, Gartner, around 10% of enterprise-generated data is created and processed outside a traditional centralized data center or cloud. By 2025, the firm predicts that this figure will reach 75%.
- The increase of IoT devices at the edge of the network is producing a massive amount of data - storing and using all that data in cloud data centers pushes network bandwidth requirements to the limit.
- Despite the improvements of network technology, data centers cannot guarantee acceptable transfer rates and response times, which, however, often is a critical requirement for many applications

Privacy and security

- The distributed nature of this paradigm introduces a shift in security schemes used in cloud computing. In edge computing, data may travel between different distributed nodes connected through the Internet and thus requires special encryption mechanisms independent of the cloud.
- Edge nodes may also be resource-constrained devices, limiting the choice in terms of security methods. Moreover, a shift from centralized top-down infrastructure to a decentralized trust model is required.
- On the other hand, by keeping and processing data at the edge, it is possible to increase privacy by minimizing the transmission of sensitive information to the cloud.

Scalability

- Scalability in a distributed network must face different issues.
- First, it must take into account the heterogeneity of the devices, having different performance and energy constraints, the highly dynamic condition, and the reliability of the connections compared to more robust infrastructure of cloud data centers.
- Moreover, security requirements may introduce further latency in the communication between nodes, which may slow down the scaling process.

Speed

- Edge computing brings analytical computational resources close to the end users and therefore can increase the responsiveness and throughput of applications.
- A well-designed edge platform would significantly outperform a traditional cloud-based system. Some applications rely on short response times, making edge computing a significantly more feasible option than cloud computing.
- Examples range from IoT to autonomous driving, anything health or human / public safety relevant, or involving human perception such as facial recognition, which typically takes a human between 370-620 ms to perform.

Efficiency

- Due to the nearness of the analytical resources to the end users, sophisticated analytical tools and Artificial Intelligence tools can run on the edge of the system.
- This placement at the edge helps to increase operational efficiency and is responsible for many advantages to the system.
- Additionally, the usage of edge computing as an intermediate stage between client devices and the wider internet results in efficiency savings that can be demonstrated in the following example: A client device requires computationally intensive processing on video files to be performed on external servers.

Applications

- cloud gaming, where some aspects of a game could run in the cloud, while the rendered video is transferred to lightweight clients running on devices such as mobile phones, VR glasses, etc. This type of streaming is also known as pixel streaming.
- Other notable applications include connected cars, autonomous cars, smart cities, Industry 4.0 (smart industry), and home automation systems

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