An Insight into Edge and Fog Computing

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Overview

TRADITIONAL DATA PROCESSING STEPS

- **Data Collection:** Data collecting devices (sensors, cameras, IoT devices)
- **Data Transmission:** Data to Central Server or Cloud Data Center
- **Data Processing**
- **Response Transmission:** Processing Result to Original Device
- **Action Execution**

EDGE COMPUTING

- **Nearby Processing – at the "Edge" of the Network**
  - Local Systems
  - IoT devices themselves (sensors, cameras, gateways etc.)

EDGE COMPUTING...

- reduces time and effort.
- saves bandwidth, saves cost.
- can work with limited or no internet connectivity.
- eliminates delay and congestion.

EDGE COMPUTING

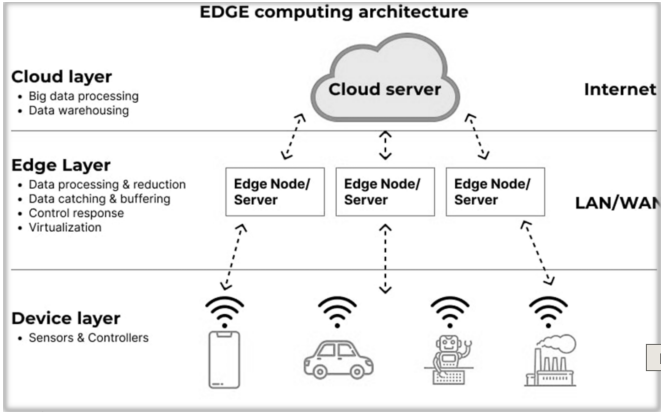

Figure: [1]

EXAMPLE - SELF DRIVING CAR

Figure: [2]

Table

Feature	Without Edge Computing	With Edge Computing
Data Processing	Distant Cloud	Local
Latency	High	Low
Bandwidth Use	High	Low
Internet Dependence	High	Low

Table: DATA PROCESSING COMPARISON

GRAPH

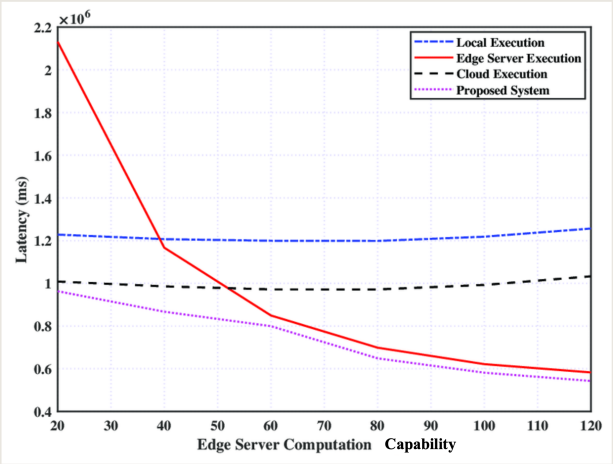

Figure: [3]

FOG COMPUTING

- **Fog Nodes - Processing in the Middle**
  - Local Systems
  - Local Devices

FOG COMPUTING...

- reduces load on edge devices.
- provides a nearby helper to edge devices.
- makes large-scale systems more efficient.
- reduces latency, bandwidth use and de-centers load.

FOG COMPUTING

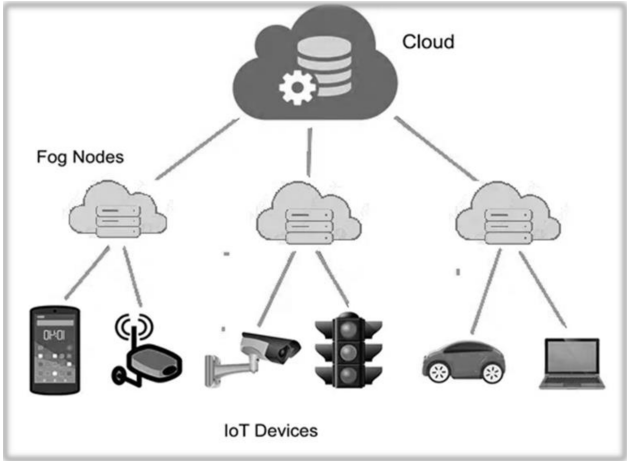

Figure: [4]

Table

Feature	Without Fog Computing	With Fog Computing
Data Processing	Distant Cloud	Distributed locally
Latency	High	Low
Bandwidth Use	High	Low
Scalability	Limited	Improved

Table: DATA PROCESSING COMPARISON

Table

Feature	Edge Computing	Fog Computing
Data Processing	At the device, or close	Local nodes near the edge
Use case example	Real-time actions	Larger-scale systems
Latency	Extremely low	Low
Power	Device Dependent	Helper nearby systems

Table: FOG AND EDGE COMPUTING COMPARISON

EDGE COMPUTING CHALLENGES

- **Limited Processing Power and Storage**
  - Problems with Data Analysis, AI algorithms, etc.
  - Example: Limited drone device analyzing real-time video footage
- **High Costs**
  - Expensive to include sufficient computing power and robustness
  - High entry barrier for small industries

EDGE COMPUTING CHALLENGES

- **Scalability issues**
  - Overwhelming to manage large-scale projects (high device quantity)
- **Data Security and Privacy**
  - Can be vulnerable to hacking/data tampering and intercepting
- **Device Management and Maintenance**
  - Updating and maintenance is challenging
- **Interoperability**
  - Compatibility issues in case of different device manufacturers

FOG COMPUTING CHALLENGES

- **Complex Architecture**
  - Designing multi-layer systems requires expertise
- **High Costs**
  - Possibly high distribution, hardware, software, maintenance costs
- **Latency and Connectivity Issues**
  - Relies on network connectivity between fog nodes and devices
- **Data Security and Privacy**
  - Data is at risk during transmission or in local storage

FOG COMPUTING CHALLENGES

- **Energy Consumption**
  - High energy costs, environmental concerns
- **Standardization Issues**
  - No universal standards
- **Latency Variability**
  - Fog nodes in different proximities can produce different latencies

COMMON CHALLENGES

- **Limited Expertise**
  - Relatively new technologies
- **Data Synchronization**
  - Decentralized processing increases difficulty
- **Hardware Reliability**
  - Failure of devices can disrupt workflow
- **Legal and Regulatory Compliance**
  - Sensitive data processing locally may differ from region to region, requiring adaptations

EDGE COMPUTING - CURRENT APPLICATION EXAMPLES

- **Self Driving Cars**
- **Smart Home Devices**
- **Healthcare**

FOG COMPUTING - CURRENT APPLICATION EXAMPLES

- **Smart Cities**
- **Telecommunications(5G)**
- **Smart Agriculture**

COLLABORATIVE FUTURE APPLICATION POSSIBILITIES

- **Autonomous Supply Chains**
- **Next-Gen Entertainment Experiences**
- **Green Energy Management for Smart Cities**

THANK YOU

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