Cloud-Fog-Edge-IoT Continuum

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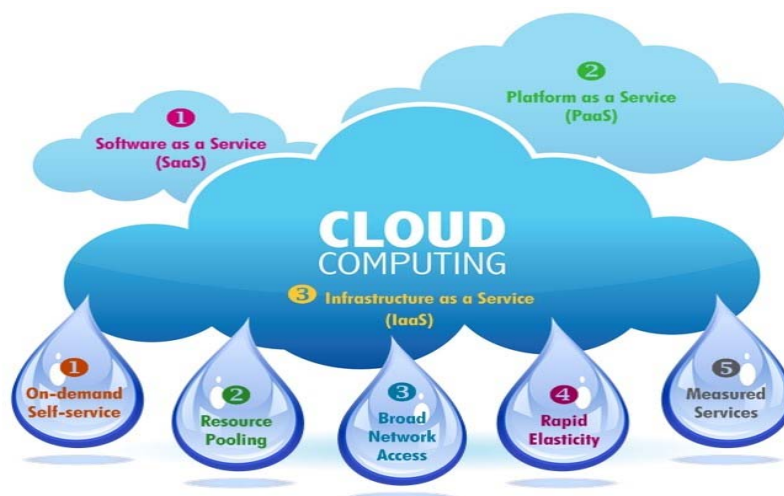
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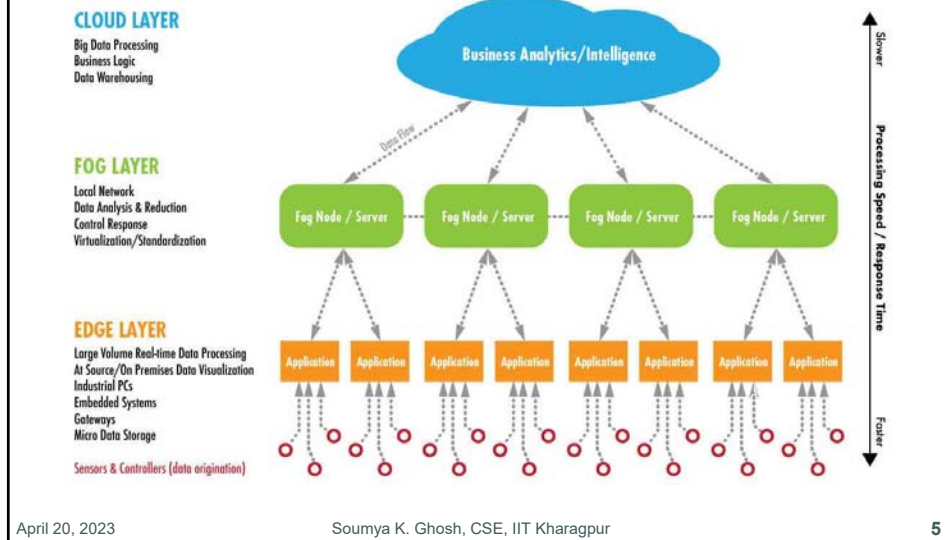## Cloud Computing: "Anything"-as-a-Service

Fog Computing

- Fog computing a model in which data, processing and applications are concentrated in devices at the network edge rather than existing almost entirely in the cloud.
- The term "Fog Computing" was introduced by the Cisco Systems as new model to ease wireless data transfer to distributed devices in the Internet of Things (IoT) network paradigm
- Vision of fog computing is to enable applications on billions of connected devices to run directly at the network edge.

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Edge Computing

- Origins of edge computing are in the early 1990s with the creation of the first content delivery network (CDN), which put data collecting nodes closer to end users.
- 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
- Edge computing is a topology- and location-sensitive form of distributed computing, while IoT is a use case instantiation of edge computing.
- "Edge Computing" refers to an architecture rather than a specific technology.

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Cloud – Fog – Edge – IoT

CLOUD LAYER
Big Data Processing
Business Logic
Data Warehousing

Business Analytics/Intelligence

FOG LAYER
Local Network
Data Analysis & Reduction
Control Response
Virtualization/Standardization

Fog Node / Server   Fog Node / Server   Fog Node / Server   Fog Node / Server

EDGE LAYER
Large Volume Real-time Data Processing
At Source/On Premises Data Visualization
Industrial PCs
Embedded Systems
Gateways
Micro Data Storage

Sensors & Controllers (data origination)

Application   Application   Application   Application   Application   Application   Application   Application

Slower
Processing Speed / Response Time
Faster

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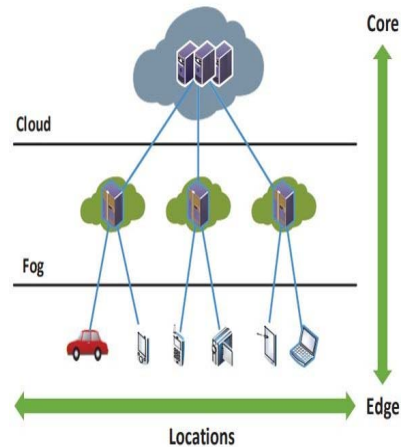

Edge Computing

- **Latency** - data processing close to the source, where it originates; avoids round-trip time to the cloud

- **Bandwidth** - optimization of communication to and from the cloud

- **Privacy/security** - sensitive data stays local

- **Connectivity** - continued processing (in some cases) despite lack of connectivity to the cloud

- **Local dependencies** - data processing close to points of interaction with end users and other system components

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Cloud-Fog-Edge Computing

- Bringing intelligence down from the cloud close to the ground/ end-user.
- Cellular base stations, Network routers, WiFi Gateways will be capable of running applications.
- End devices, like sensors, are able to perform basic data processing.
- Processing close to devices lowers response time, enabling real-time applications.
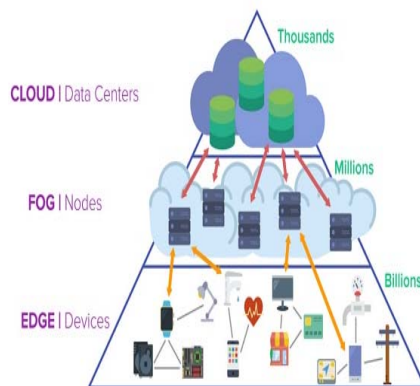
Cloud-Fog-Edge Hierarchy

Cloud Limitations
- Latency
- Large volume of data being generated.
- Bandwidth requirement

IoT Device Limitations
- Processing
- Storage
- Power requirement

Fog-Edge Computing
- Reduced **latency** supports Real-time applications
- Less n**etwork congestion**
- Reduced **cost of execution** at cloud
- Better handling of colossal data generated by sensors
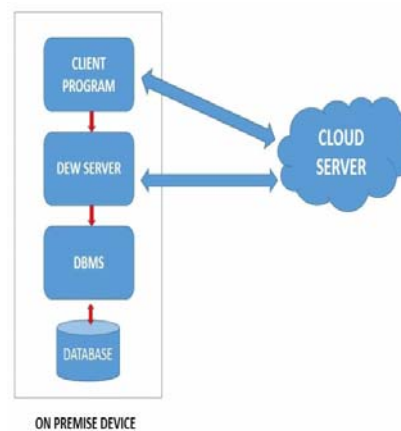- More of data location awareness

Cloud-Fog-Edge-IoHT

- To design a Fog-Edge Computing based health model to reduce latency, network usage and cost incurred at the cloud.
- To test the designed fog model using iFogSim simulator.
- To develop a customized wearable device for collection of health parameters.
- To implement the proposed model over hardware and test its efficacy.
- To study dew based computing and study its efficacy in the proposed health scenario

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Dew Computing

"Dew computing is an *on-premises* computer software-hardware organization paradigm in the cloud computing environment where the on-premises computer provides functionality that is **independent** of cloud services and is also **collaborative** with cloud services. The goal of dew computing is to fully realize the potentials of on-premises computers and cloud services".

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- W. Yu et al., "A Survey on the Edge Computing for the Internet of Things," in IEEE Access, vol. 6, pp. 6900-6919, 2018, doi: 10.1109/ACCESS.2017.2778504.

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Thank You !

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