

GLT: Edge Gateway ELT for Data-driven Intelligence Placement

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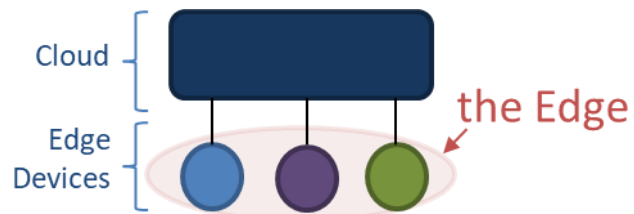
Outline

- Edge Computing
- Elastic Edge Intelligence
- GLT Architecture
- IoT Prototype
- Discussion

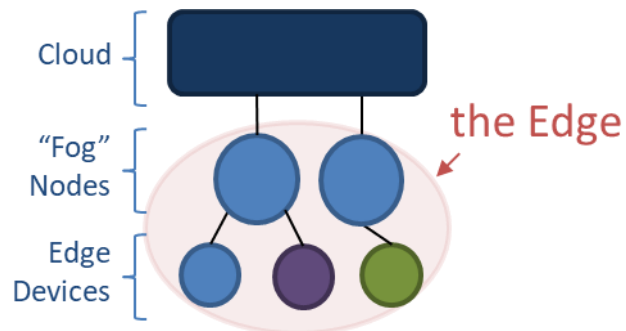
What is the “Edge”?

❖ Ans: Who is asking?

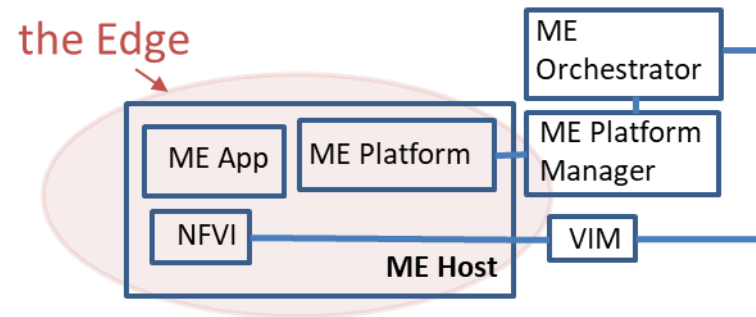
- *Narrow Edge Computing* view



- *Fog Computing* view [1]



- *Mobile Edge (ME) Orchestration*



From *ETSI MEC (Multi-access Edge Computing)* [2]

- A growing ecosystem...

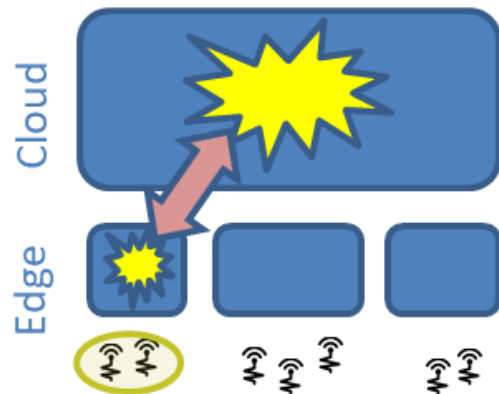
LF Edge, Open Edge Computing, K8s IoT & Edge WG, Automotive EC Consortium, Kinetic Edge Alliance...

[1] OpenFog Consortium: “will not replace the CC, but cooperation cloud/fog is envisaged”

[2] ETSI MEC: <https://www.etsi.org/technologies/multi-access-edge-computing>

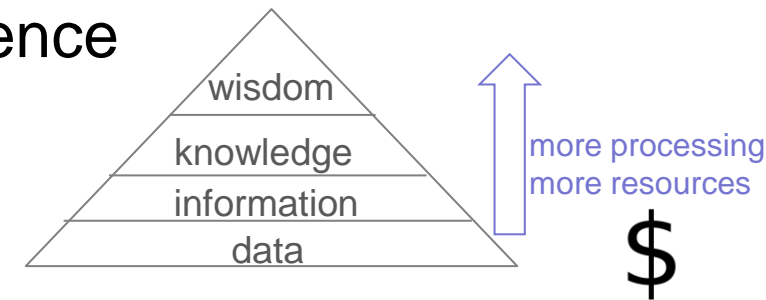
Elastic Edge Intelligence

- Rapid **informed decisions** on device-related events
 - Edge GW: **CDN** Edge Server, **IoT** GW, industrial plant local server, in-vehicle computer...
- Push **intelligence** to Edge only when worth the cost
 - Consider available/unutilized resources
 - Assess value (mainly **non-functional**) in deploying edge analytics tasks
 - Bandwidth savings, avoid end-to-end delay
 - Adaptive application **QoE**
 - Compute **resources efficiency**



Elastic Edge Intelligence

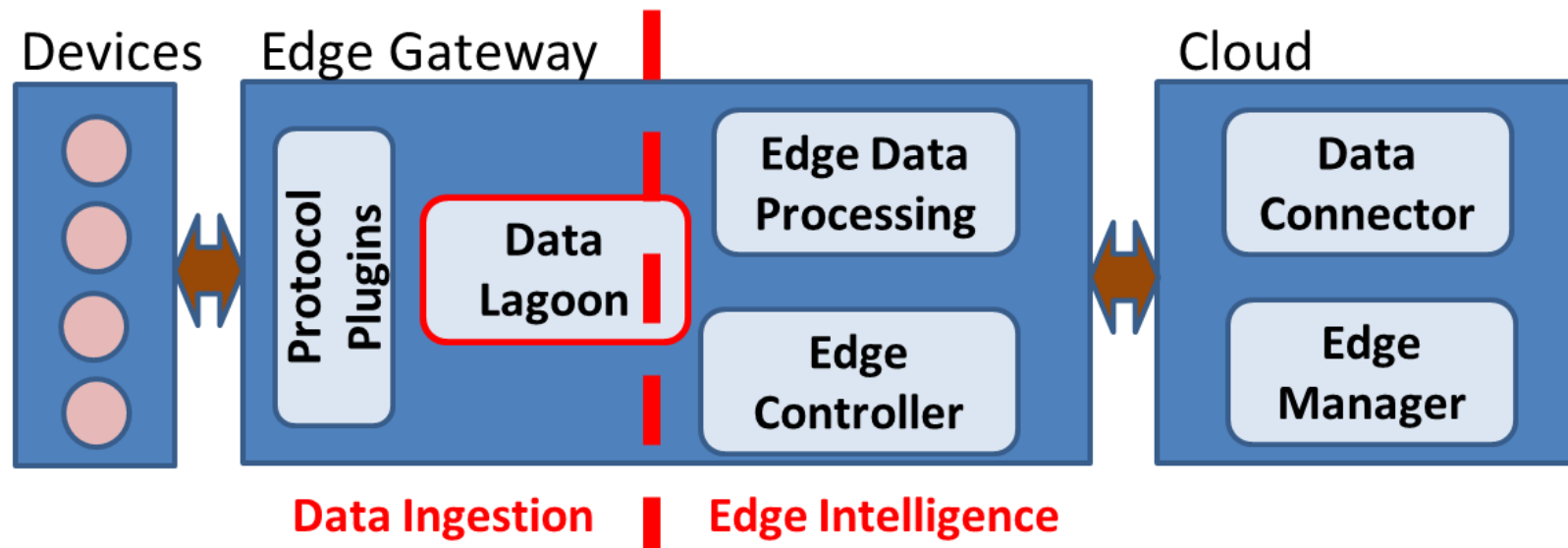
- **Elastic:** ability to dynamically adjust the **intensity** of edge processing
 - Tasks from Cloud to Edge and vice versa
- Make data-driven decisions of when to move intelligence
 - Use **test & monitoring data** to backup control actions
 - **Runtime experiments** to assess (local) optimality



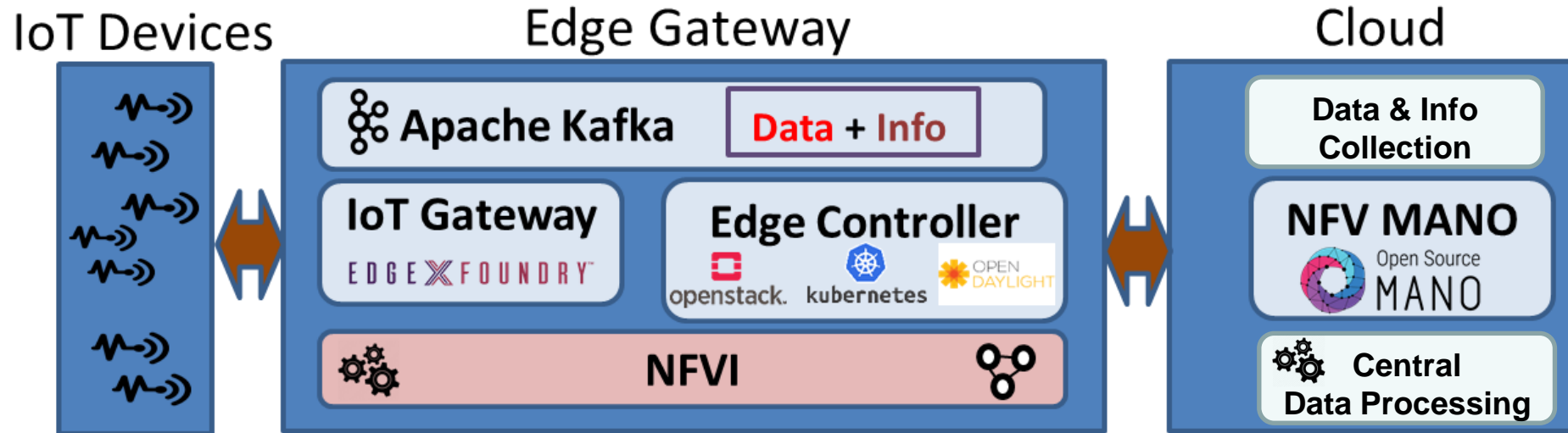
- Need an **architecture** to support **rapid reconfigurations**
 - **Anti-pattern:** reconfigure data pipelines from devices all the way to cloud
 - Changing application requirements → different pipelines ❌
 - Changing devices → different pipelines ❌
 - Coverage between analytics tasks → inefficient resource reuse ❌

The GLT Approach

- **Separation** of Data Ingestion stage from Edge Intelligence
 - Independent device management & setup from analytics tasks placement
 - **Data Lagoon**: The lightweight “Data Lake” of the Edge
 - (Raw Data \ Information) according to app(s) lifecycle changing requirements
- **Decoupling** from data ingestion + Infrastructure **automation** → **Data-driven task relocation**



IoT Prototype



- **Cloud Native** technologies
 - Containerized micro-services for analytics tasks
 - Dynamically launch tasks/jobs in seconds
 - Easily decommission when job is done
- **NFV MANO** for *zero-touch* automation
 - Virtualized infrastructures (networking, compute, storage)
 - Orchestration & Management Operations using (standardized) **models**
 - Less human → Less error-prone
 - Out-of-the-box Management features
 - Auto-scaling, monitoring, resilience

Open Research Topics

- **Semantic Layer of Data Lagoons**
 - Facilitate **interplay** between Data Lagoons & centralized **Big Data** technologies (e.g., Data Lakes)
 - “Swim” the Data Lagoon, don’t drown in Data Swamps
 - Auto-discovery of lagoon data services
 - Ontological querying (SPARQL)
- **Edge Actuation**
 - Isolate data lagoon service consumers so they can fully control devices (e.g., time-multiplexing)
 - Act upon analytics results
 - Marketing actions, QoE improvements

Summary

- Ongoing work: **Elastic Edge Intelligence**
 - **Approach:** Separate data ingestion from data processing/analysis
 - Architectural pattern: **Data Lagoon**
- Scale intelligence at runtime in resource-limited environments
 - Use observed/measured KPIs to guide deployment decisions
- Cloud-native + NFV MANO for edge **deployment agility & automation**

**thank
you**

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