

# Intelligent Service Provisioning in Fog Computing

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# Why Intelligent Service Orchestration?

Modern telecommunication systems:

- Flexible
- Scalable
- Distributed
- Energy-efficient
- Low-latency



Machine Learning Enabled Service Orchestration



Fog Computing

# Why Fog Computing?

Modern telecommunication systems:

- Flexible
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Machine Learning Enabled Service  
Orchestration



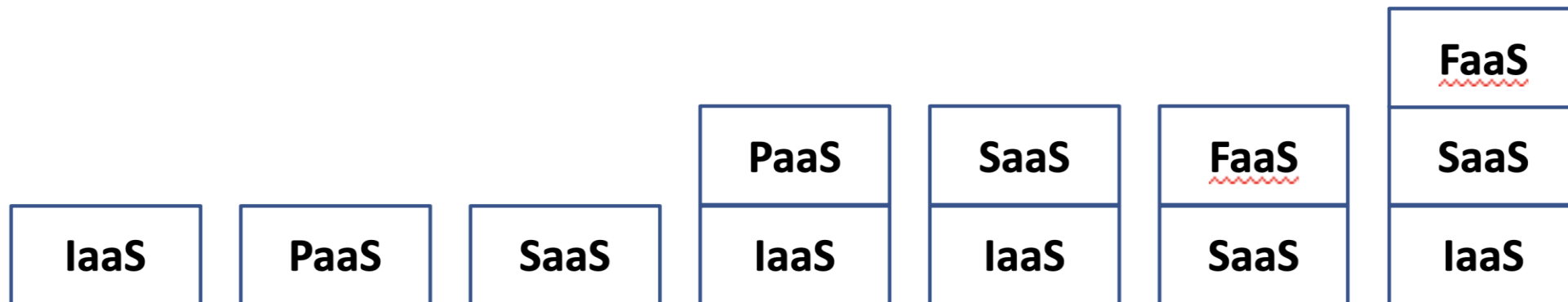
**Fog Computing**

# “Service” is key

## The **Everything-as-a-Service** model:

- Infrastructure-as-a-Service

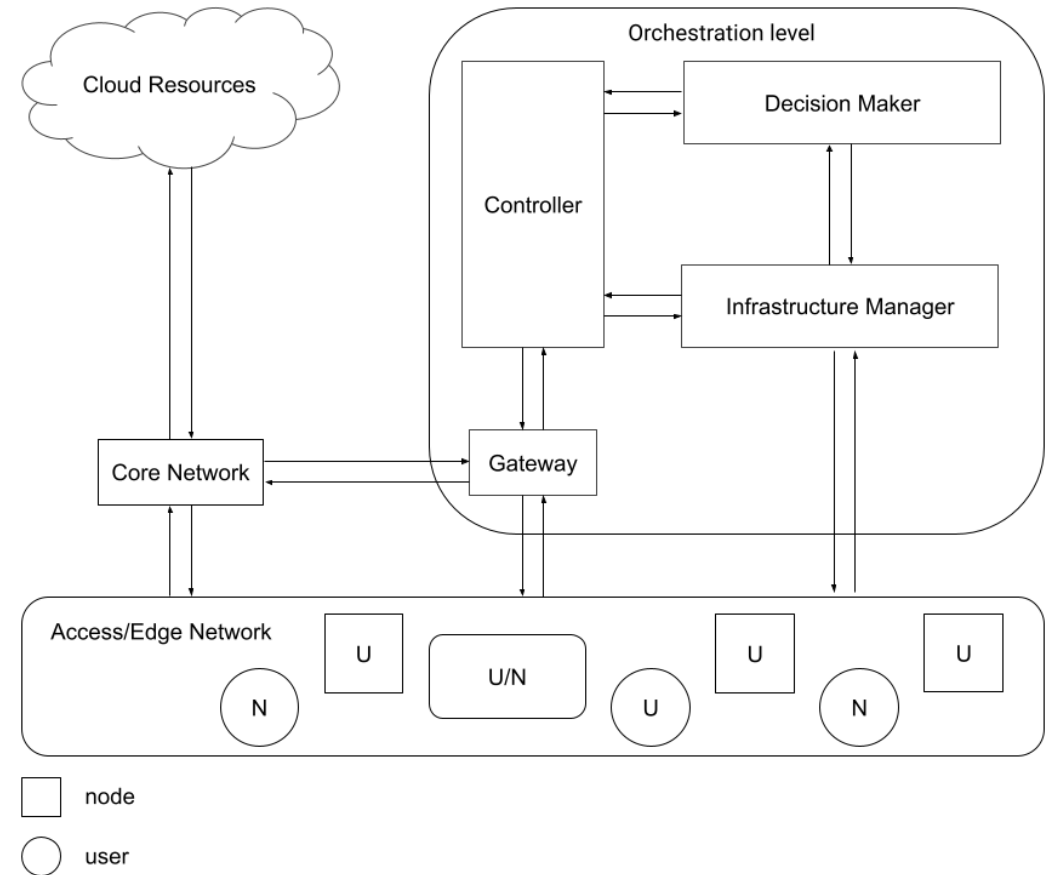
- Platform-as-a-Service
- Software-as-a-Service
- Function-as-a-Service
- ...



# Envisioned Architecture

## Functional Entities:

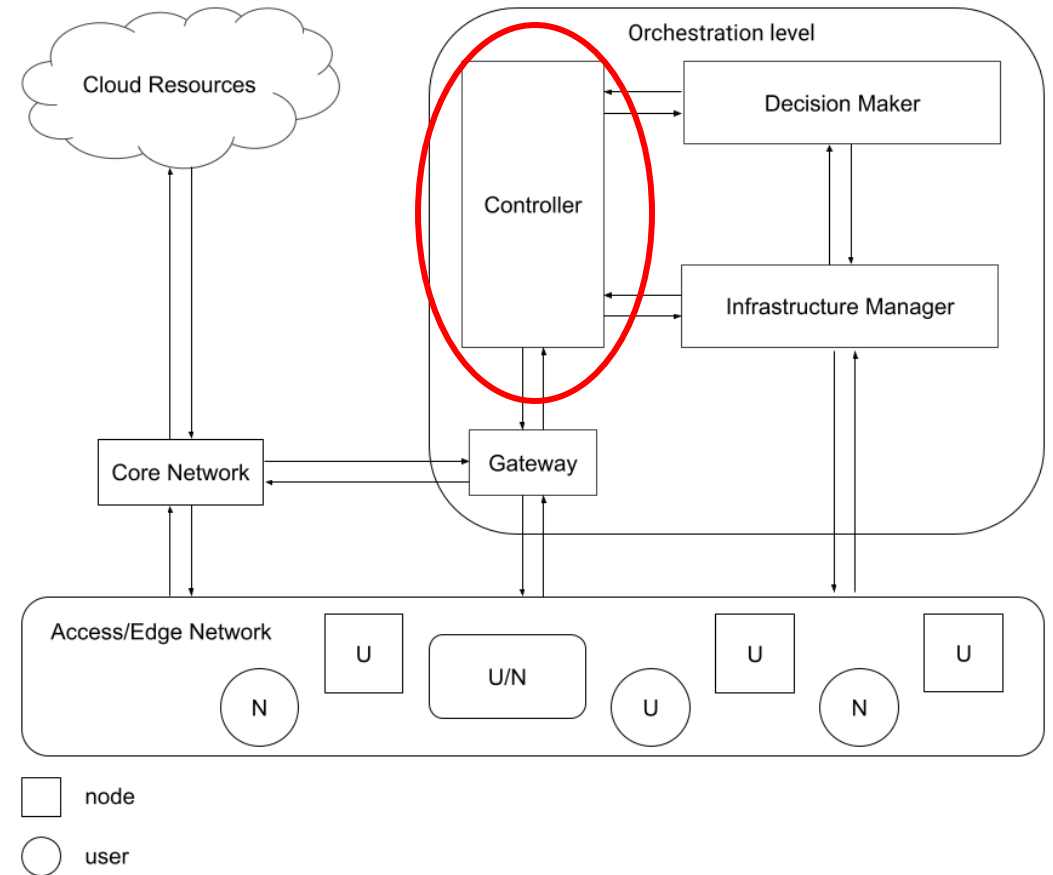
- Controller
- Infrastructure Manager
- Gateway
- Decision Maker



# Envisioned Architecture

## Functional Entities:

- Controller
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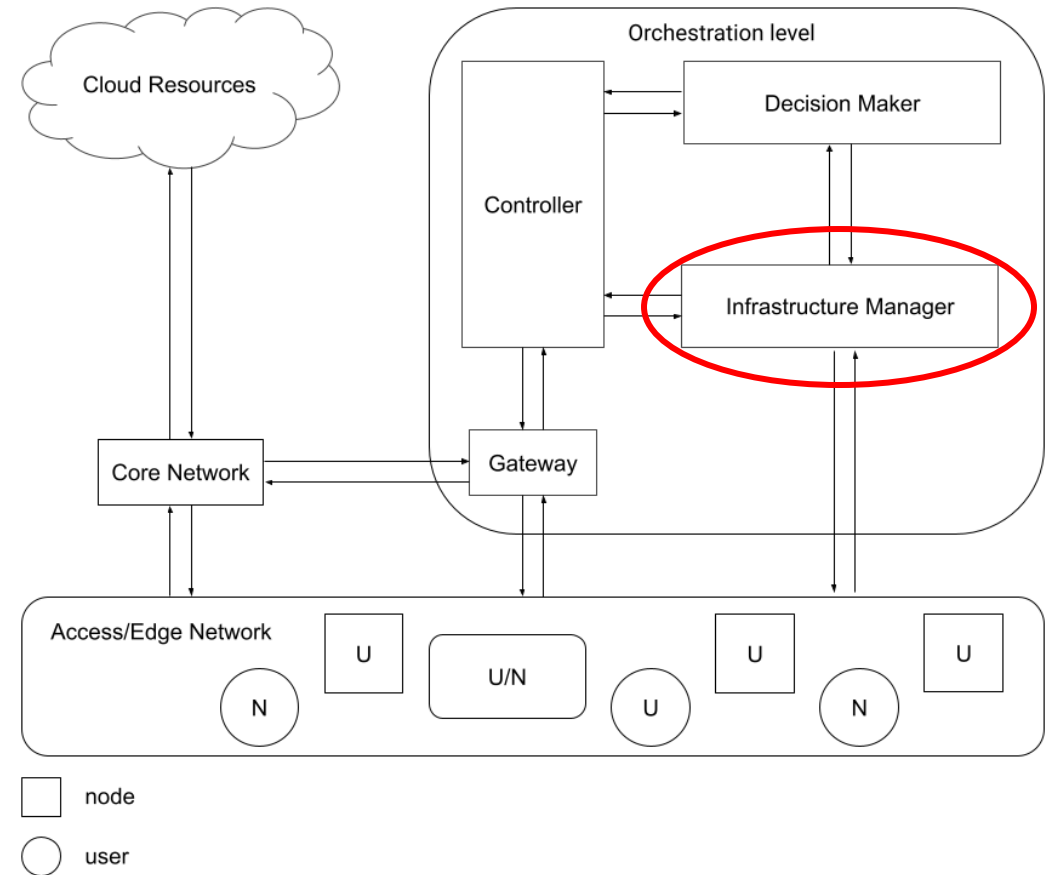
# Controller (C)

- It is the entity that oversees and **coordinates** the work of all other functional elements;
- Exchanges information with the Cloud and pulls data from it if necessary;
- It is in charge of **handling failures** that may occur in the system, taking control and trying to find a solution for them before **interrupting** the request being served.

# Envisioned Architecture

## Functional Entities:

- Controller
- **Infrastructure Manager**
- Gateway
- Decision Maker





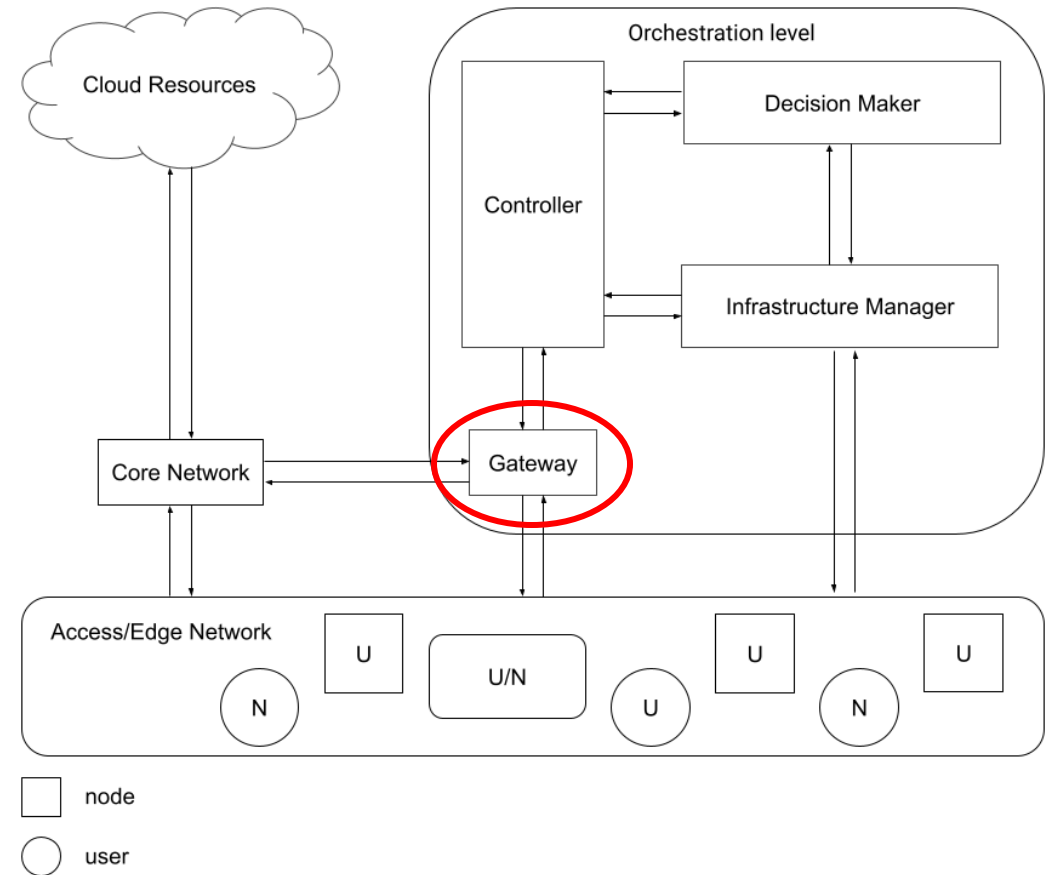
# Infrastructure Manager (IM)

- It is in charge of **actuating the service deployment** decisions taken by the other elements;
- Provides **monitoring** over the underlying resources;
- Interact directly with hardware/software resources provided they have the necessary interfaces;
- May have multiple instances, each **specialized** in the interaction with a different underlying **infrastructure**.

# Envisioned Architecture

## Functional Entities:

- Controller
- Infrastructure Manager
- Gateway
- Decision Maker



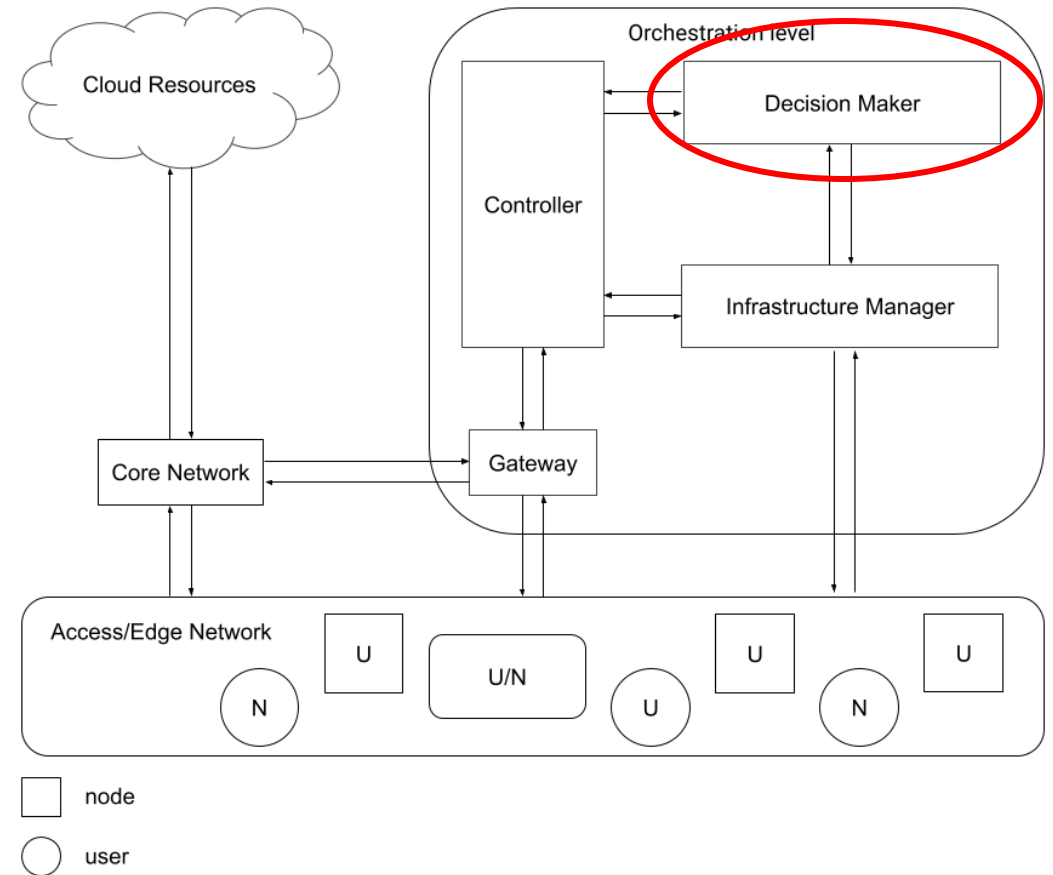
# Gateway (GW)

- It is the **contact point** between nodes and orchestrator;
- Through the GW the nodes can interact with the orchestrator requesting services;
- Information on nodes can be gathered through the GW by the system.

# Envisioned Architecture

## Functional Entities:

- Controller
- Infrastructure Manager
- Gateway
- **Decision Maker**



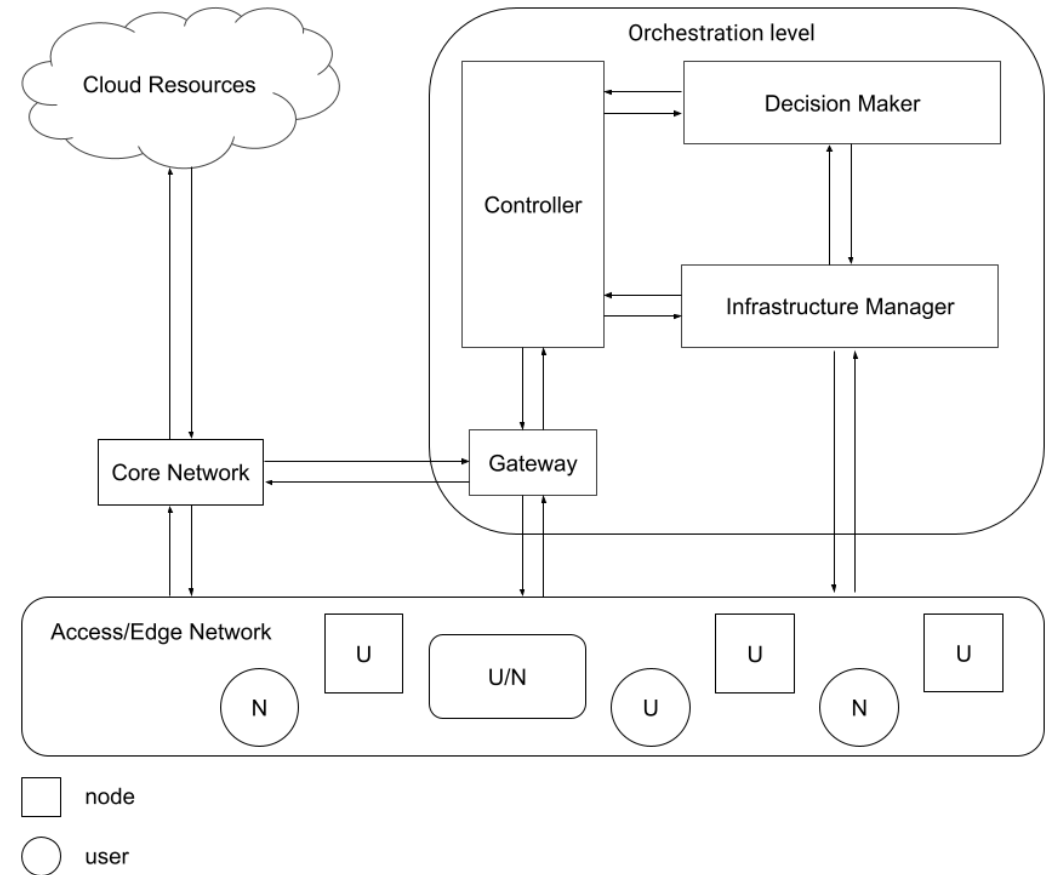
# Decision Maker (DM)

- Possesses the **intelligence** of the system;
- Runs the machine learning algorithms to enable the best fitting choices regarding **where to deploy** (latency, energy consumption, bandwidth, etc.) services and **how to manage** the users/nodes;
- Talks with the Infrastructure Manager to inform about how and where to allocate the services.

# Envisioned Architecture

## Functional Entities:

- Controller
- Infrastructure Manager
- Gateway
- Decision Maker



# Ongoing Activities

- Pittalà, Gaetano Francesco, et al. "Function-as-a-Service Orchestration in Fog Computing Environments." *2022 18th International Conference on Network and Service Management (CNSM)*. IEEE, 2022.
- Di Cicco, N., Pittalà, G. F., et al. "DRL-FORCH: A Scalable Deep Reinforcement Learning-based Fog Computing Orchestrator." *2023 9th IEEE International Conference on Network Softwarization (NetSoft)*. IEEE, 2023.
  - **TS5 - SDN, Performance & Orchestration - Thursday morning**



Programmable Networks

# Thanks for your attention!

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