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# EMCO: Edge Relocation using Temporal workflows

Grzegorz Panek, Piotr Matysiak: [Orange](#)

Sundar Nadathur, Srinivasa Addepalli: [Intel](#)



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# Agenda

- Introduction to EMCO and Temporal
- Demo Setup
- Demo: *Relocate an application from cluster A to cluster B*
- Current and future work

# Edge Multi Cluster Orchestrator

## Major Trends:

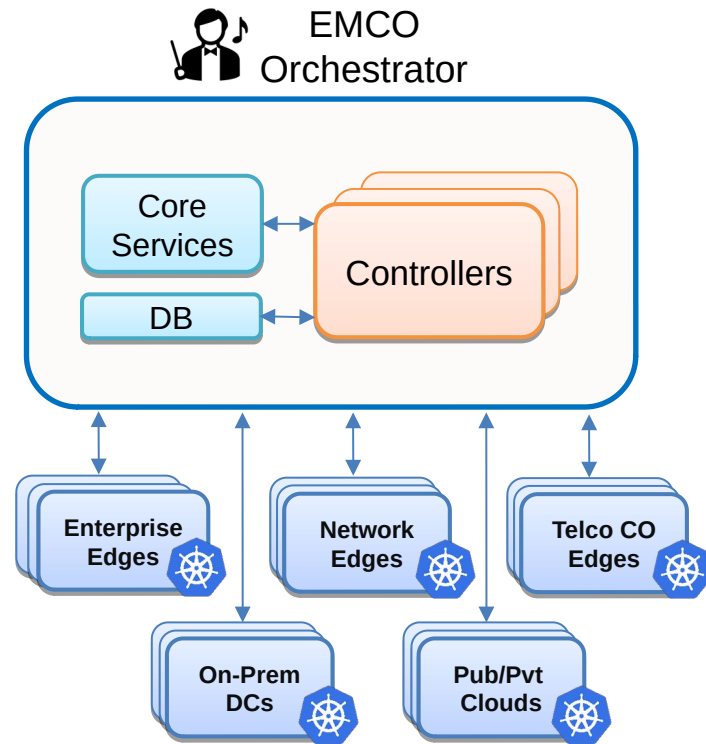
- Multi-access Edge Computing + Cloud
  - Geo-distributed apps, Clusters at scale
- Kubernetes everywhere for Cloud-Native Apps

## EMCO

- Linux Foundation's [project-emco.io](https://project-emco.io)
- Intent-based Lifecycle management of apps and network functions
- Various edge locations, cloud/on-prem DCs
- Highly extensible with in-tree or 3<sup>rd</sup> party controllers

## New!

- Workflows: complex sequences of tasks in Go, Java, etc.
- A new way to extend EMCO for complex use cases
- Collaboration of Intel and Orange
- Available in EMCO 22.03



# Temporal Workflow Engine

**Temporal** is an open-source workflow engine offering resilience and scale;

**Temporal Cluster** + **Worker Processes** = **Temporal Platform**

We can use **Temporal SDK** to develop **Temporal Clients**, **Workflow Definitions** and **Worker Programs**.

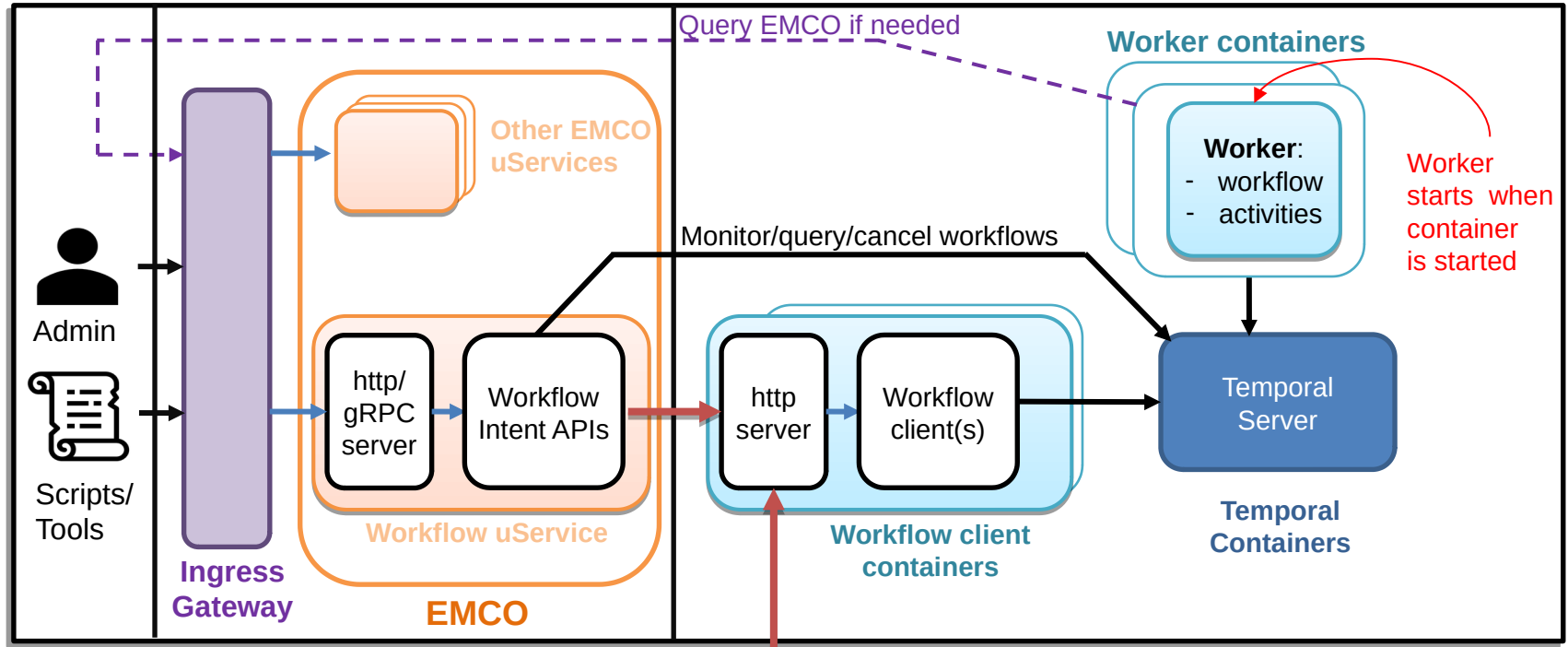
Then we can deploy all components and use **Temporal Clients** to communicate with **Temporal Platform** to **Start a Workflows**, **Get result of a Workflow**, etc.

At the end **Workflow Workers** would serve invoked **Workflows** and serve until they are done.

*Temporal does not preclude EMCO integration with other workflow engines in the future.*

*„Less plumbing, more coding.”*

# EMCO + Temporal



```
curl -X POST http://container-ip:9090/invoke/my-workflowclient
```

## Example Scenarios for Workflows

- ❑ **Relocate an application from edge cluster A to edge cluster B, because:**
  - UE has roamed and cluster B is now closer to the UE.
  - Cluster A needs to be brought down for maintenance.
  - Cluster A is approaching its capacity limit.
  
- ❑ Update the network policies (firewall rules, load balancer policies, etc.) in an external device.
  
- ❑ Spin up a new Kubernetes cluster (infrastructure orchestration).



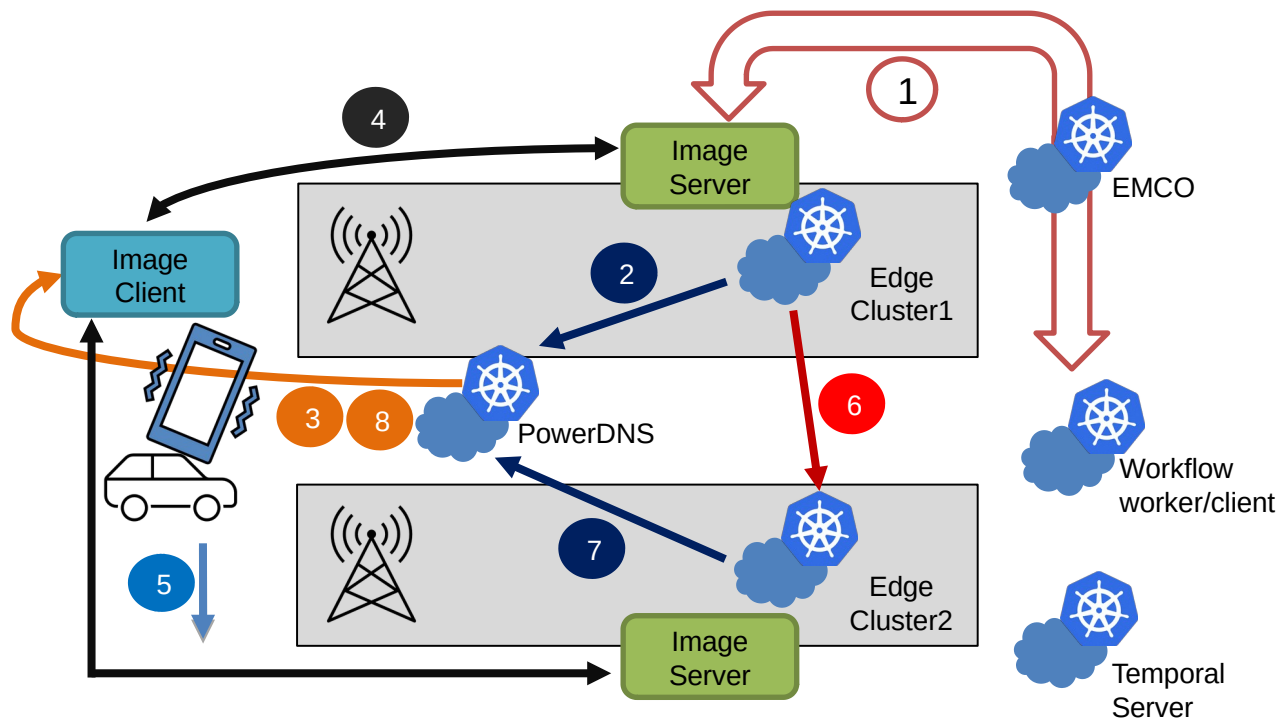
## Problem statement according to ETSI standards

*The user (UE) is consuming a service, while moving out of the coverage area of Source MEC Host (Cluster A). Later he/she enters the coverage area of Target MEC Host (cluster B) and expects to resume the same service. This requires a relocation of a service instance from cluster A to cluster B.*

## Requirements for application relocation (identified by ER WG):

- Service continuity must be assured to the UE;
- The new instance of the application must be declared to be 'ready' before we can steer the traffic to the new app instance;
- If there are several candidates for the target MEC cluster, the final choice should be made by MEC Orchestrator

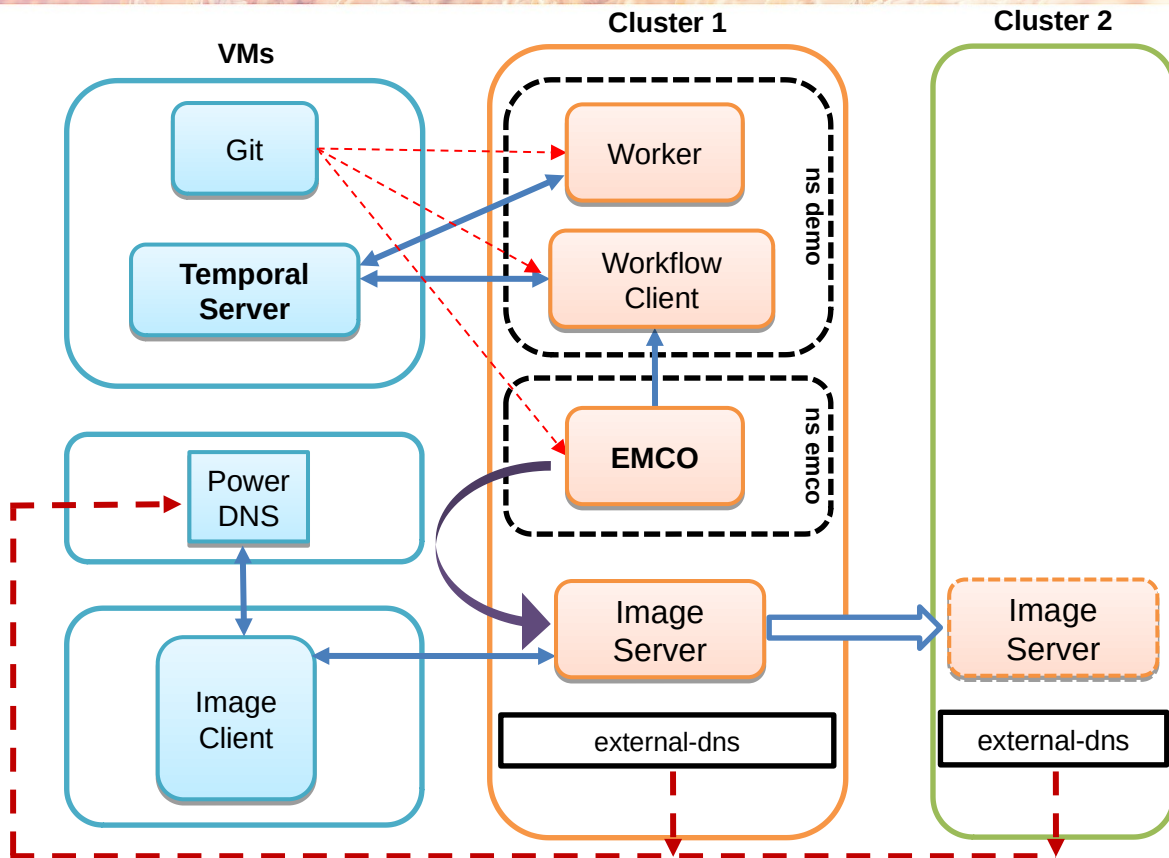
# Demo Scenario



- 1 EMCO deploys app
  - 2 App published in DNS
  - 3 Client queries DNS
  - 4 Client traffic to server
  - 5 Client roams to tower 2
  - 6 EMCO starts workflow to migrate app
  - 7 App updated in DNS
  - 8 Client queries DNS
- Client traffic to server  
In cluster 2!

Automate in future

# Demo Layout and Steps



## DEMO STEPS

1. Define app in EMCO with intents
2. Deploy app from EMCO
3. Define workflow intent in EMCO
4. Bring up worker and workflow client
5. Start workflow: app migrates

- Deployed from Git repo
- Data communication
- App deployed by EMCO
- App migrated by workflow
- DNS update for videosever



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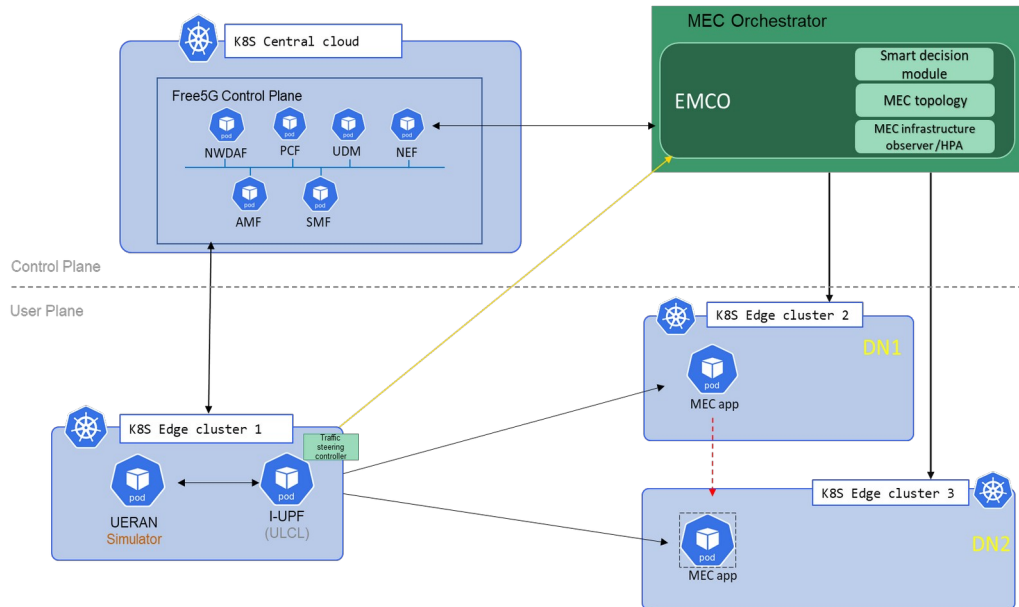
**LIVE DEMO**



# Future work

The goal is to extend existing PoC of **ER** inside Stand-alone **5G + MEC** System

- Using open-source **5G Core (Free5GC)** and **5G RAN (UERANSIM)**
- MEC architecture based on **EMCO (Management Level) + Kubernetes (Host Level)**



**This requires to design and implement:**

- Entity which will make decisions to relocate application (MEC side) or/and entity which would subscribe to **5G CN** notifications;
- Entity which will be aware of MEC topology, which would select the optimal **Edge Server (MEC Host)** to place the **MEC application**, including decision algorithm;
- **Traffic Steering** mechanism (based on ETSI standardization or *not*)
- *(optional)* Mechanism to support relocation of stateful applications

# THANK YOU FOR YOUR ATTENTION!

Project EMCO: [project-emco.io](https://project-emco.io)

Edge Relocation Working Group: [shorturl.at/vFSYZ](https://shorturl.at/vFSYZ)

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