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# CODECO: AI-Driven Orchestration for Multi-Cluster Edge Deployment

## A Horizon Europe Project

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Funded by the European Union

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Cognitive Decentralised Edge Cloud Orchestration

# Horizon Europe research projects

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# What is Horizon Europe (HE)?

- Instrument to drive innovation.
- Strengthen the EU's position as a world leader in science, innovation, and technology.
- Help Europe become more attractive for research and innovation investment.
- Facilitate the collaboration of the public and private sectors in finding solutions to major challenges in Europe.

# Red Hat Horizon Europe projects

| Project | Call | Start | Duration / Months |
|---|---|---|---|
| **AC3** | HORIZON-CL4-2022-DATA-01-02 Cognitive Cloud: AI-enabled computing continuum from Cloud to Edge | Jan 2023 | 36 |
| **CODECO** | **HORIZON-CL4-2022-DATA-01-02 Cognitive Cloud: AI-enabled computing continuum from Cloud to Edge** | **Jan 2023** | **36** |
| **Green.Dat.AI** | HORIZON-CL4-2021-DATA-01-03 Technologies for data management (AI, Data and Robotics Partnership) (IA) | Jan 2023 | 36 |
| **P2CODE** | HORIZON-CL4-2022-DATA-01-03 Programming tools for decentralised intelligence and swarms (RIA) | Sep 2022 | 36 |
| **CHESS** | HORIZON-WIDERA-2022-ACCESS-04-01 Excellence Hubs | Jan 2023 | 48 |
| **AERO** | HORIZON-CL4-2022-DIGITAL-EMERGING-01-26 Open source for cloud-based services (RIA) | Jan 2023 | 36 |
| **CONNECT** | HORIZON-CL5-2021-D6-01-04 Cyber Secure and Resilient CCAM | Sep 2022 | 36 |

# How does this benefit Red Hat?

**Open Source Contributions**

CODECO strictly uses Open Source software, allowing us to contribute to various different upstream Red Hat products

**Product Exposure**

We are incharge of what technologies we propose, meaning we can always push to get the Consortium of 15+ companies using Red Hat's upstreams

**EU Funding**

This research is funded entirely by the EU, meaning cost is kept low for Red Hat

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# CODECO Overview

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# Cognitive Decentralised Edge-Cloud Orchestration

## 1 of 7 EU Research Projects

CODECO is a “unique, smart, and **cross-layer orchestration** between the **decentralised** data flow, computation, and networking services, to address **Edge-Cloud challenges** derived from the rising Internet and IoT service decentralisation using only **open-source** technologies.”

OR...

A Kubernetes plug-in which handles **scheduling** on the edge through **AI recommendations**, aswell a having focus on **energy efficiency and multi cluster management**

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# 5 components, 16+ partners

fortiss

INOVA+

Atos

INTRACOM TELECOM

ATHENA Research & Innovation Information Technologies

GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN

SIEMENS

netcompany intrasoft

ECLIPSE FOUNDATION

IBM

i2cat

UNIVERSITY OF PIRAEUS RESEARCH CENTER

Telefónica

POLITÉCNICA UNIVERSIDAD POLITÉCNICA DE MADRID

Red Hat

almende ORGANIZING NETWORKS

AFFILIATED ENTITIES:

GÖTTINGEN STADT, DIE WISSEN SCHAFFT

Atos EVIDEN an atos business

uc3m Universidad Carlos III de Madrid

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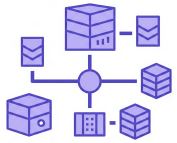
# Red Hat’s Role within CODECO



## Multi Cluster Management

Using Open Cluster Management (OCM)

## Smart Application Deployment

Using AI Generated Placements

## Multi Cluster Monitoring

Prometheus & Thanos

## Documentation

Deliverables & Proposals

## Component Installation

5 core components, 4 sub-components

## Component Integration

Ensuring all components can connect as needed

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# What are we trying to achieve?

- Create an open source framework which plugs into **kubernetes**
- Manage workloads on the **edge cloud** using advanced scheduling based on **AI**
  - Leveraging Open Cluster Management capabilities
- Focus on **energy efficient** application delivery
  - Exploring Kubernetes Efficient Power Level Exporter (Kepler)
- Explore Key Areas:
  - Hybrid Cloud
  - Edge
  - IoT
  - AI

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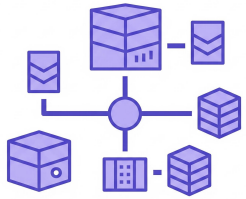
# CODECO Components



## Advanced Cluster Management (ACM)

Component Installation point

## Meta Data Manager (MDM)

Controls & discovers metadata

## Scheduling & Workload migration (SWM)

Multi objective scheduling

## PDLC

AI based workload placement

## NetMA

Network exposure & data exchange

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# Use Cases

## Smart Cities

P1: Smart Monitoring of the Public Infrastructure

## Vehicular Safety

P2: Vehicular Digital Twin for Safe Urban Mobility

## Media Streaming

P3: Media Delivery Streaming (MDS) across Decentralised Edge-Cloud

## Energy

P4: Demand-side Management in Decentralized Grids

## Manufacturing

P5: Wireless AGV Control via CODECO for Flexible Factories

## Smart Buildings

P6: Automated Crownstone Application Deployment for Buildings

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# Smart Framework Deployment

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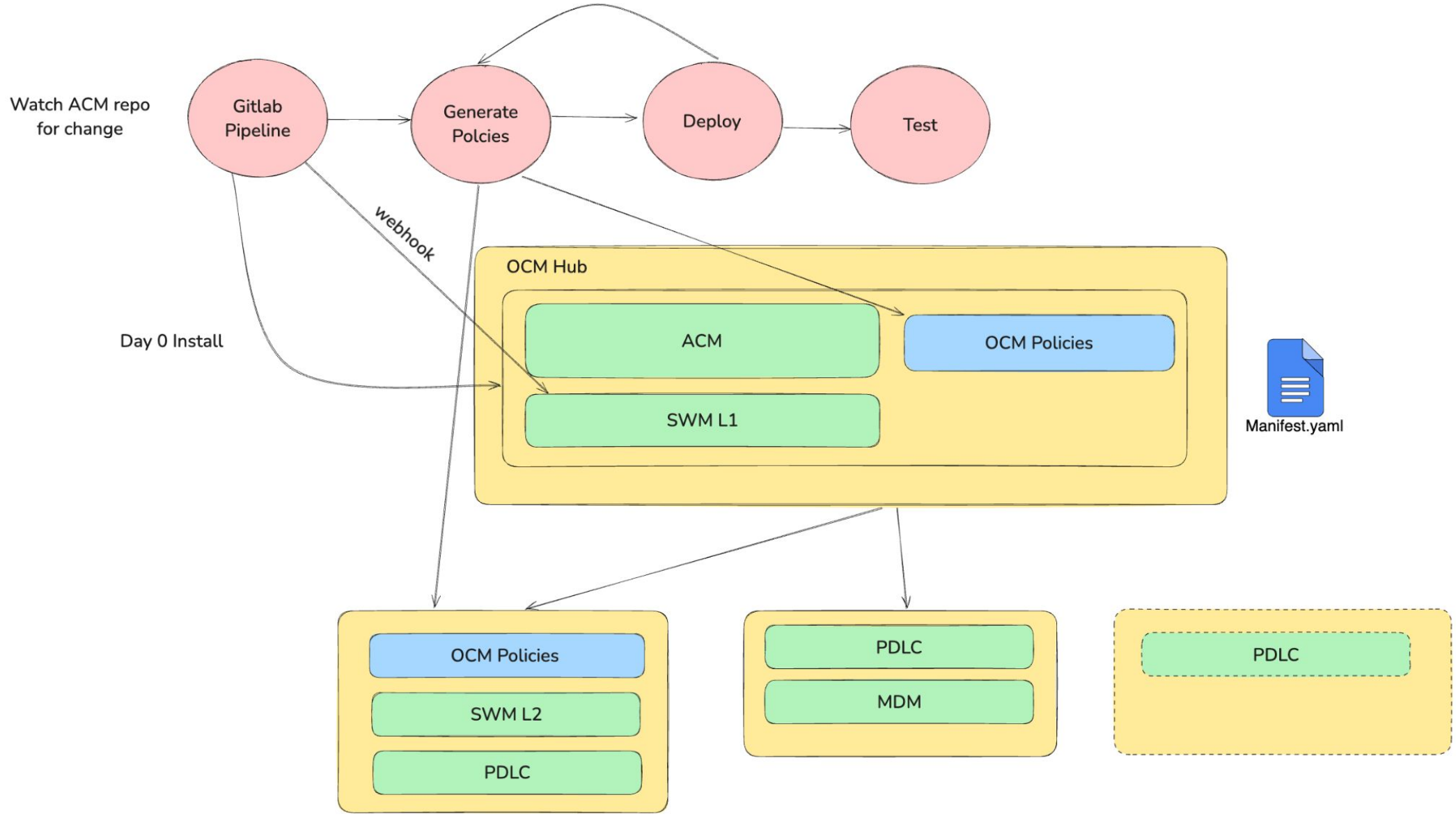


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# Smart Application Deployment

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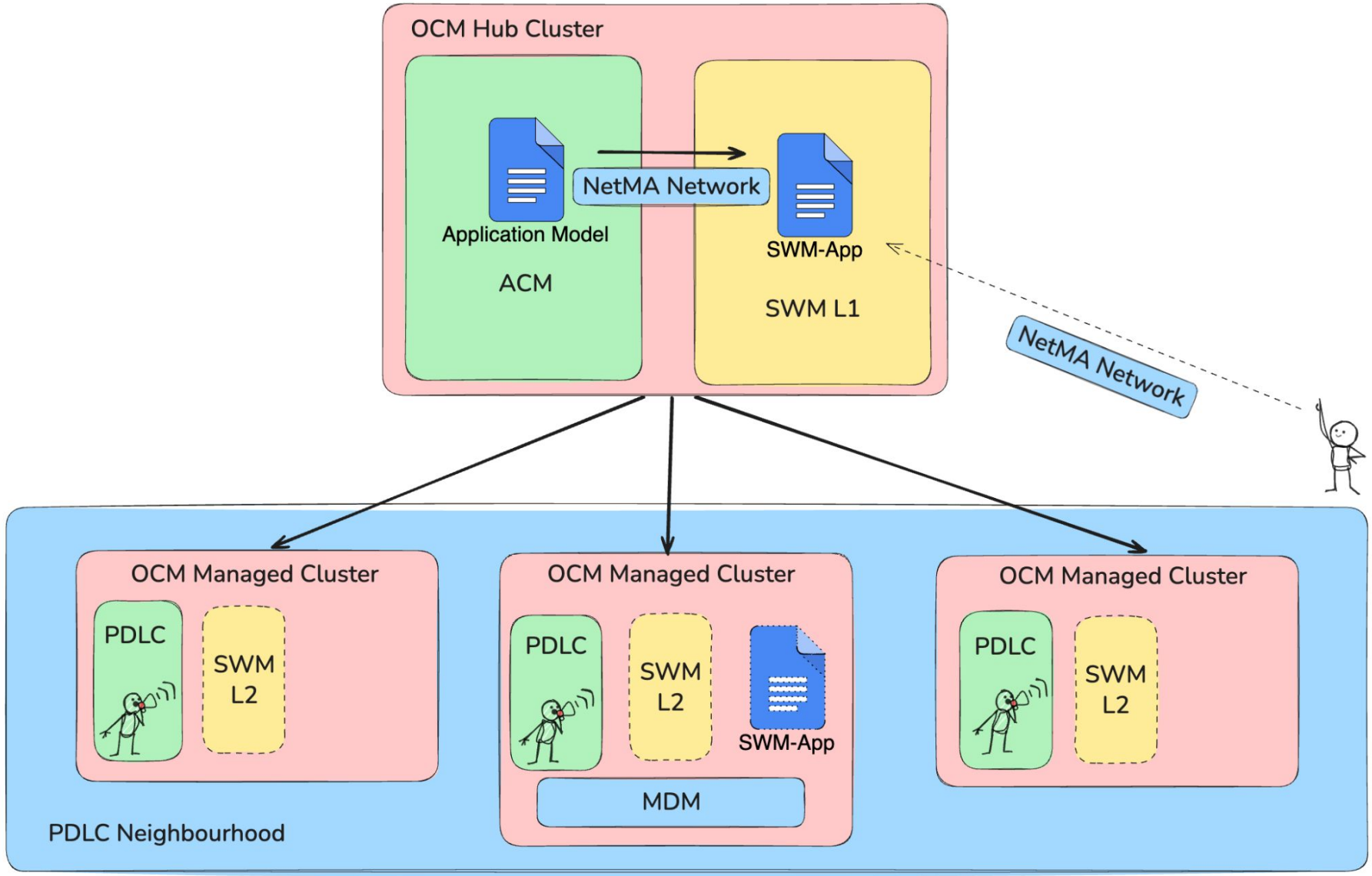


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# Thank You!

All contributions encouraged and welcome

Still in early multi cluster stage - suggestions?

If anyone is interested in contributing ping me @ dekelly@redhat.com

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