
Efficient Edge-to-Cloud Workload Management
Project Overview

ENACT Project at Glance

ENACT -> Adaptive Scheduling and Deployments of Data Intensive Workloads on Energy Efficient Edge to Cloud Continuum

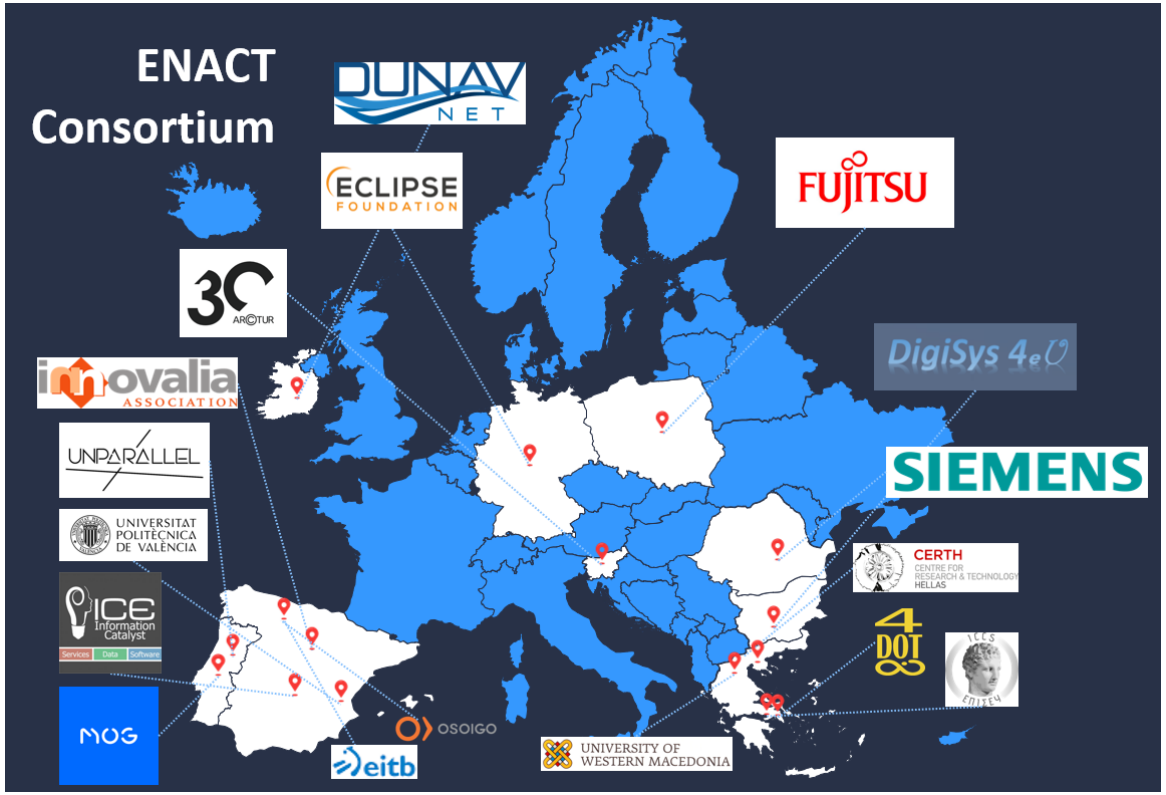
HORIZON-CL4-2023-DATA-01-04
GA number: 101135423
Type of action: RIA

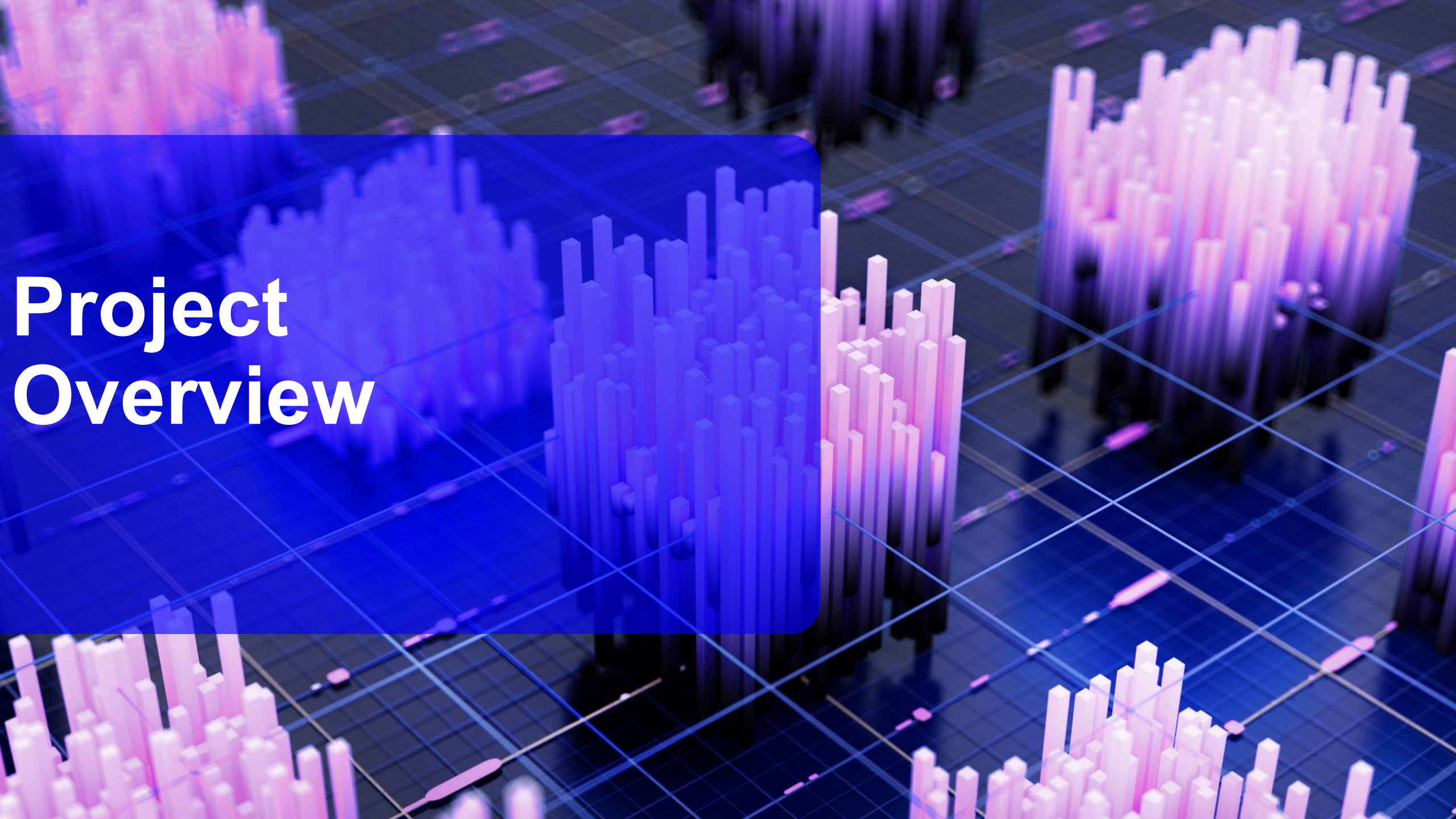
Duration: 36 months
Starting date: 1 January 2024
Ending date: 31 December 2026

Budget: 5.055.074,00 €
EU funding: 5.055.074,00 €

17 partners

9 countries



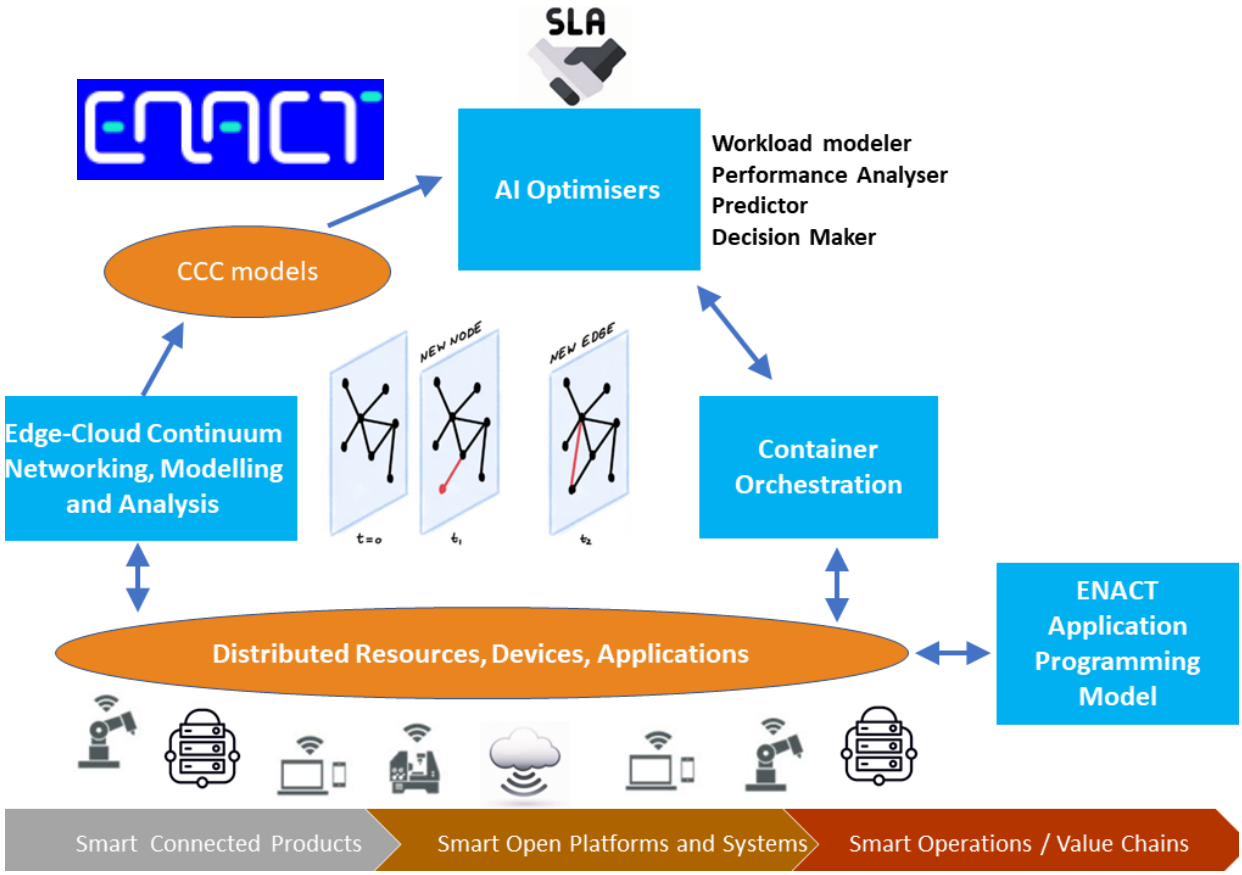

Project
Overview

ENACT Approach

Tools to connect and discover distributed resources, devices and services across the compute continuum, characterize and model them to support complex application deployment needs

AI-powered orchestrator capable of deploying and managing applications across distributed (edge – cloud) nodes in an optimal way to support the energy efficiency and adaptations in applications

Application development toolkit for developing or adapting complex applications, making them distributed, responsive, robust and adaptive to changing environments



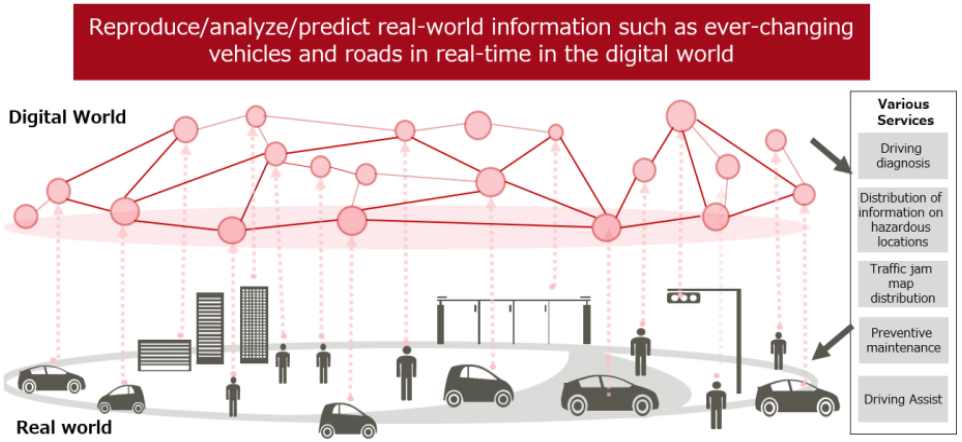
ENACT Impact

- Development of common standards and infrastructure for Computing Continuum and Data Spaces technologies as a key element to create a more open and interoperable data ecosystem for Europe
- ENACT will allow a wider and more effective use of data processed with in the continuum computing. It will enable real-time decision-making in applications such as manufacturing, media, telecommunication, transportation and many other sectors.

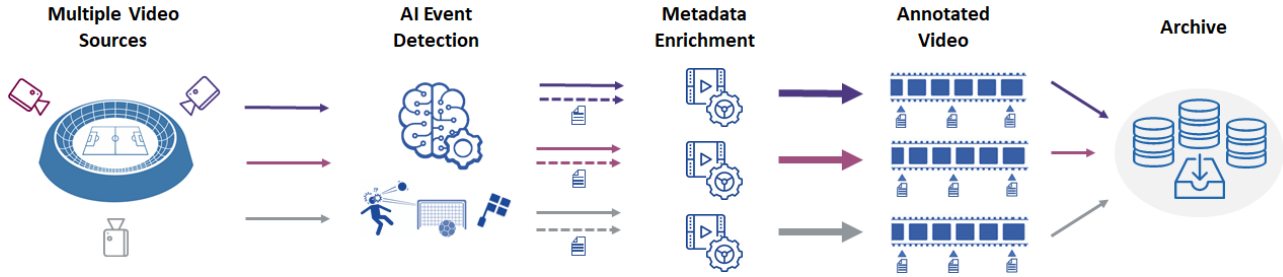
- ENACT will design energy aware data infrastructures that will avoid the explosion of ICT footprint and provide deeper understanding of the potential of decentralized intelligence to support green digital solutions by exploiting ML capabilities to process data from smart connected objects
- ENACT outcomes aim at enabling a market shift from the widespread use of cloud-edge continuum market models that are currently dominated by non-EU entities, to a future strategy for European SMEs

ENACT Deployment and Validations (Use Cases)

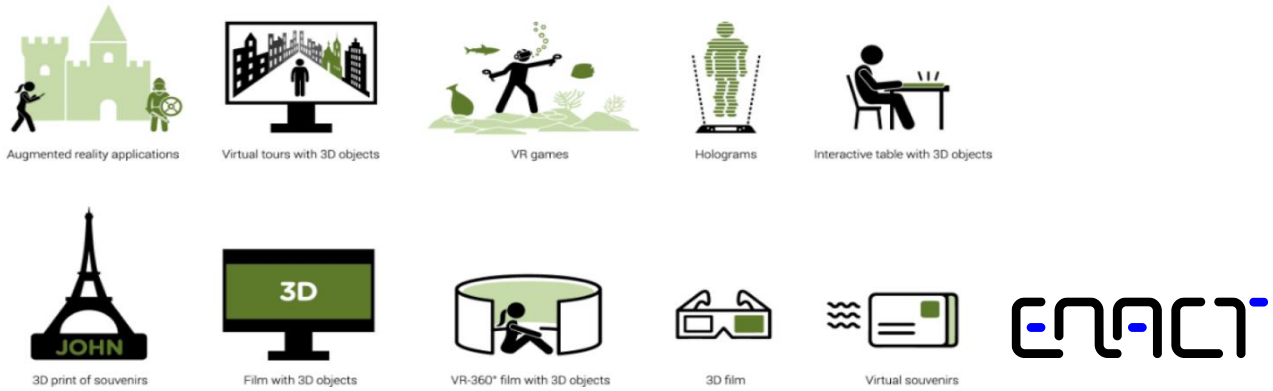
Pilot 1: Distributed Data Processing for Fujitsu's Mobility Digital Twin Initiative



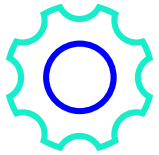
Pilot 2: Distributed Media and Entertainment Content Management



Pilot 3: Production and Distribution of Media Content for Cultural Heritage and Tourism Sectors



ENACT Objectives



O1: Provide mechanisms to optimize the execution of distributed applications and proactively balance, and optimize the compute swarm according to needs and opportunities in the CCC

O2: Provide mechanisms for smartly deploy and execute distributed applications proactively based on their context, available resources, supporting the autonomous reconfiguration of resources, availability, and devices churn adjustment

O3: Support decentralized and proactive coordination of hyper-distributed applications strengthening transparency, openness, autonomy and resource optimization in novel business collaborative interactions

O4: Provide a toolbox to facilitate to developers the development and integration of new and existing hyper-distributed intelligent applications capable of learning from other nodes of the compute continuum

O7: Establish proven knowledge exchange and community building scenarios for fostering a competitive European software industry

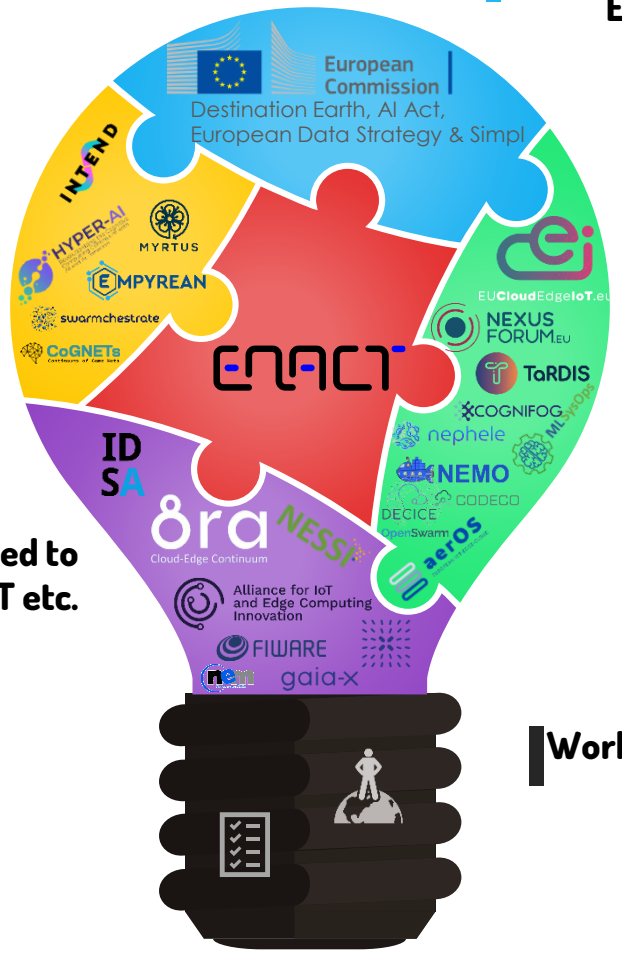
O5: Setup the core mechanisms to enable and boost future ENACT continuum's adoption by multidomain and different size companies

O6: Validation of ENACT tools and mechanisms in real-world scenarios that require seamless management of distributed resource, as well as efficient processing of data in hyper distributed applications

ENACT in Current Landscape

EC strategy for Data, AI, Environment etc.

'Sister' projects under HORIZON-CL4-2023-DATA-01-04 topic



CSAs and projects in topics of Cognitive Cloud, Swarm Computing, MetaOS etc.

Initiatives and associations related to Cloud-Edge Continuum, Data, IoT etc.

World leaders in cloud-edge technologies, AI, IoT & Standardization entities

ENACT Key Achievements (M1-M9)

Design of ENACT CCC

Definition of ENACT Architecture, Specifications, Requirements and Use Case Scenarios

Initial Implementations of ENACT CCC Components

Telemetry Data Collector, Dynamic Graph Modeler, GNN+DRL Agent, ZTP Service etc.

Comprehensive SotA regarding CCC

Research and Commercial landscape has been identified

Dissemination Activities & Clustering

9 events participation/presentation
1 scientific publication
Cluster setup for CCC call

Project Setup

GA, CA, KOM, Templates, Procedures, Website etc.

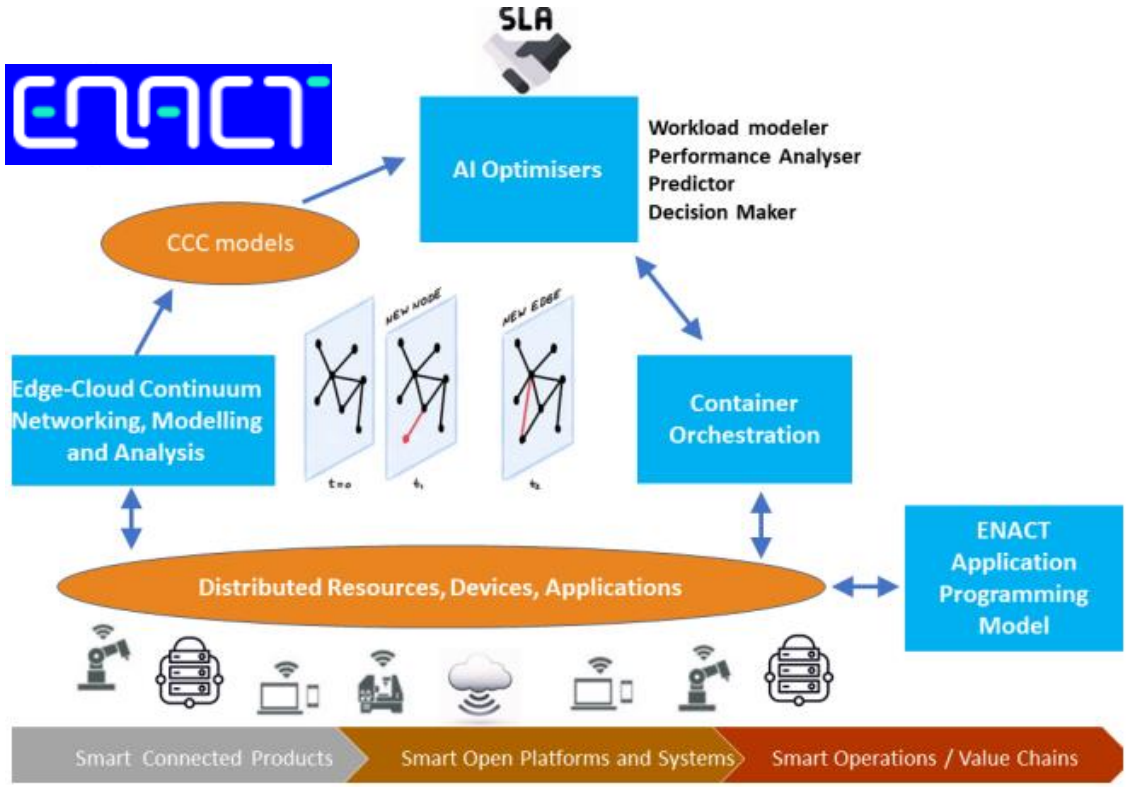
ENACT as ECLIPSE Open-source Project

Over 160 issues reported
Source code of initial implementations available


Technical Overview

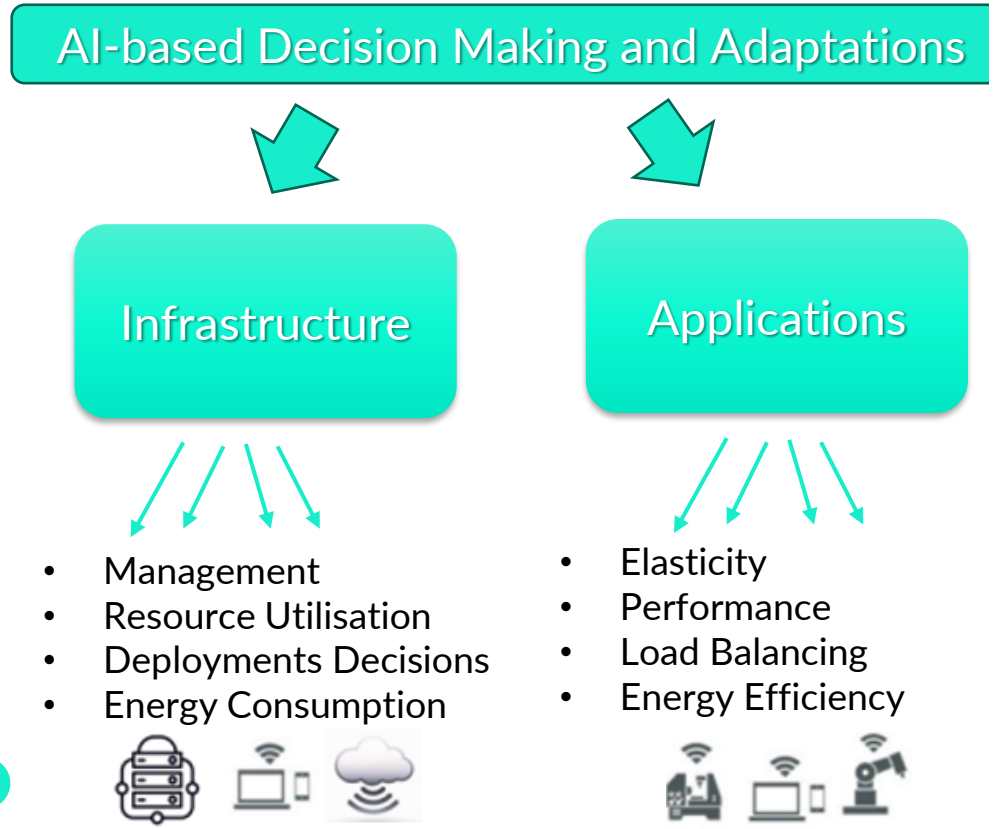
Technical Overview

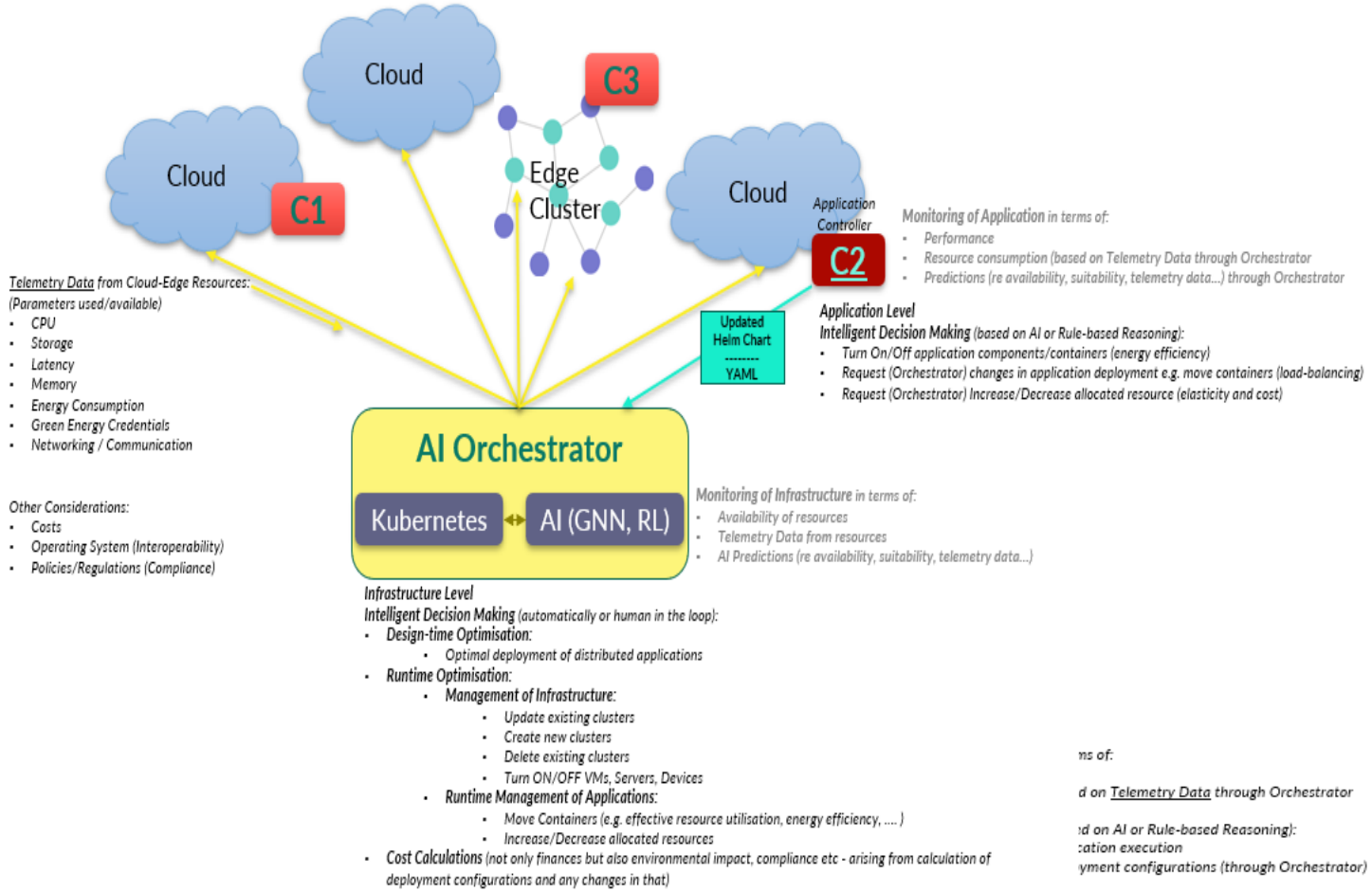
- Enabling Cognitive Cloud Continuum by:
  - Automatically interlinking and/or configuring distributed edge-cloud devices
  - Bringing visibility to interconnected devices and changes in their characteristics
  - Deploying and orchestrating applications based on AI-based multi-criteria optimisation techniques
  - Enhancing applications with techniques for intelligent decision making and self-adaptation



Intelligence and Adaptation in the CCC

ENACT enables intelligence and adaptations across the CCC:





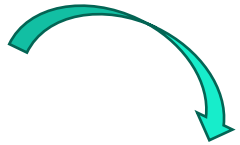
Infrastructure-level Orchestration

- ***Kubernetes***

De facto leading standards for packaging, deploying and managing applications with increased levels of agility and efficiency. Kubernetes is widely used for the orchestration of containers on clusters, offering features for automating application deployment, scaling, and management.

- ***Open Nebula***

Open-source Orchestration platform that offers provisioning and management of cloud, hybrid and edge environments. It can be used to manage and build virtualized clouds, including hybrid, public, and private clouds. It extends its native cloud management capabilities to easily incorporate edge resources



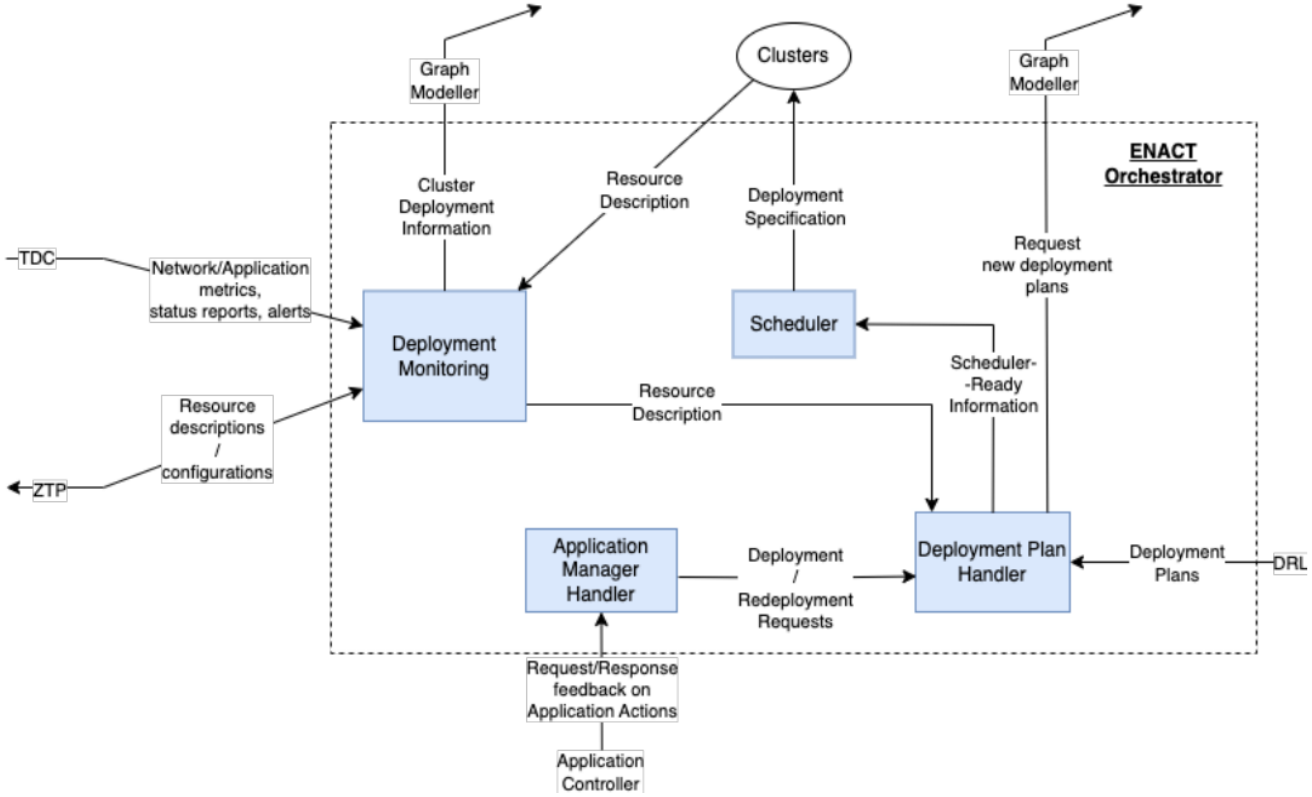
Limitations:

- Automatic monitoring and alerting
- Automatic Adaptations (resource management)
- Automatic Optimisation (feature management)
- Automatic Support for Intelligent Applications

Infrastructure-level Adaptation

ENACT Orchestrator for Edge-Cloud Continuum

will use a combination of graph neural networks (GNN) and reinforcement learning (RL) techniques to make intelligent decisions concerning scheduling, orchestration and optimal deployment of services/applications in the continuum.



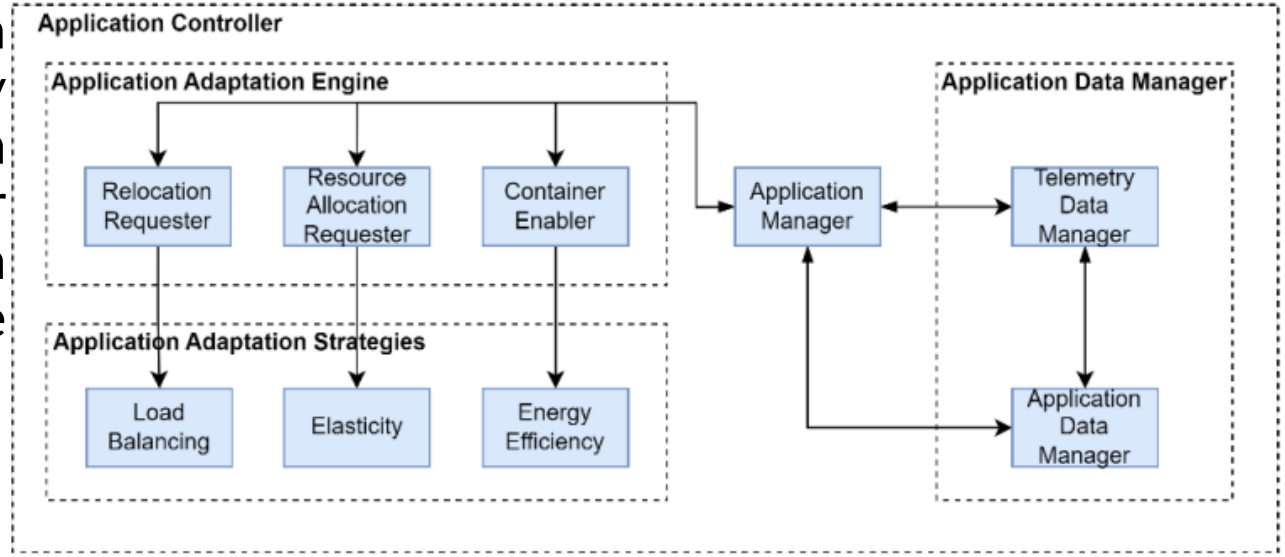
Strengths:

- Prediction on optimal deployment configuration
- Optimisations/Decisions on optimal resource allocation (design and runtime)
- Monitoring and management of infrastructure resources

Application-level Adaptation

Application Adaptation Mechanism(s)

will realise application-level adaptation mechanisms to enable applications to modify their behavior or configuration based on feedback from the environment or user preferences. Adaptation actions will focus on the following strategies to help optimize the application execution behavior.



Strengths:

- Load balancing
- Elasticity
- Energy efficiency

Partners

CERTH
CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

ICE Information Catalyst
Services Data Software

ECLIPSE FOUNDATION

MOG

FOUR DOT INFINITY

UNPARALLEL

DUNAV NET

DigiSys 4eU

ΠΑΝΕΠΙΣΤΗΜΙΟ ΔΥΤΙΚΗΣ ΜΑΚΕΔΟΝΙΑΣ

innovalia ASSOCIATION

SIEMENS

ICCS ΕΠΙΣΕΥ

ARCTUR

FUJITSU

eitb

OSOIGO

Thank you!

https://enact-horizon.eu/

https://linkedin.com/in/enact-horizon-1798122b8/

This project has received funding from the European Union's H2020 Programme Under Grant Agreement No 101135423