

Trustworthy, Cognitive and AI-Driven Collaborative Associations of IoT Devices and Edge Resources for Data Processing



EMPYREAN envisages the creation of federations of collaborative resources, Associations, that will provide a secure execution environment by utilizing distributed, cognitive and dynamic AI-enabled decision-making to provide scalability, resiliency, energy efficiency and quality of service.



Project Title: Trustworthy, Cognitive and AI-Driven Collaborative Associations of IoT Devices and Edge Resources for Data Processing

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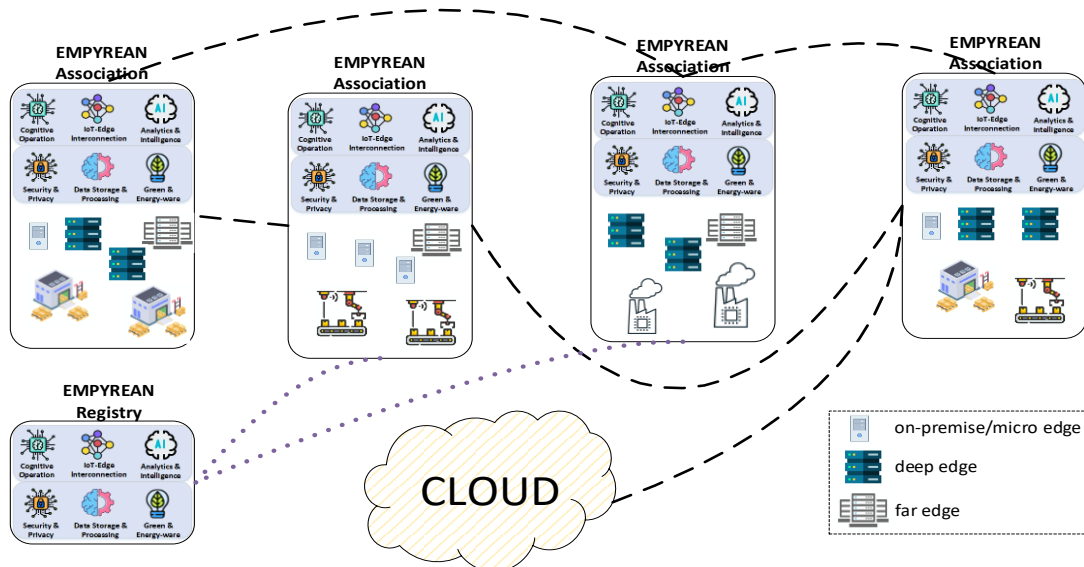


The Challenge

Internet of Things (IoT) devices equipped with various sensors and mobile or stationary units mounted with computing and storage capacity, like robots, are recognized today as key for the realization of cyber physical systems, smart cities and spaces, providing critical services and business intelligence in a variety of user contexts and sectors. The conventional way of dealing with data generated and exchanged by IoT devices is to utilize jointly edge along with federated cloud resources, thus forming an IoT-edge-cloud continuum. Yet, when this continuum is implemented as a monolithic pipeline, it cannot efficiently serve the emerging hyper-distributed applications.

Vision

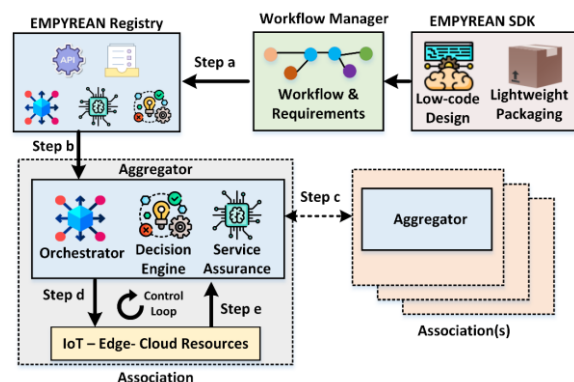
EMPYREAN aims to create a collaborative autonomous computing ecosystem over heterogeneous resources, different providers and connectivity types. It will be supported by a seamless, distributed and AI-enabled control and management plane across the IoT-edge-cloud continuum, which will enable IoT/IIoT devices and edge resources to operate in a location (e.g., factory, warehouse, agricultural field) and dynamically and autonomously cooperate through EMPYREAN's Associations. These distributed Associations will underpin the ubiquitous compute, storage and communication needs of current and future hyper-distributed, dynamic, and time-critical applications through the provision of a distributed fabric controlled by decentralised intelligence and innovative management techniques.



EMPYREAN general concept and vision

Project Objectives

An Association is a collection of IoT devices, multilayer edge resources and federated cloud platforms that dynamically and autonomously cooperate via a sophisticated coordination framework. Their operation will be empowered by a cognitive platform and will also be coupled with identity and access management mechanisms to assure controlled access and confidentiality of data. EMPYREAN will develop an S3-compatible distributed secure storage and will provide a decentralized and distributed interconnection and data distribution service. Communication mechanisms will be developed for direct message and data transfer, using an FPGA-based RDMA device driver that drastically improves small-message transfer performance. EMPYREAN also contributes to workflow-based, AI-augmented application development and seamless control and deployment on the edge-cloud continuum. EMPYREAN will demonstrate its advanced innovative capabilities through three well-defined use cases that involve device- and data-rich applications in advanced manufacturing, smart agriculture and warehouse automation. Also, a South Korea based use case in smart factories will further showcase the use of the EMPYREAN platform in international scenarios to ensure a guaranteed level of interoperability and portability.



Applications' lifecycle workflow in EMPYREAN

Expected Impact

EMPYREAN's modular-by-design approach supports the creation of a plethora of services that can be placed in the center of an innovative market ecosystem, which drives business innovation and enterprise transformation.

IMPACT 1: EMPYREAN will play a crucial role in EU's strategic autonomy, in its effort for the edge/cloud dominance.

IMPACT 2: EMPYREAN unique technological advancements, their application in diverse key sectors (manufacturing, agriculture and warehousing) through the UCs will substantially contribute toward the realization of Europe's Digital Decade targets by 2030, while benefiting EU industry roadmap.

IMPACT 3: EMPYREAN is committed to promote interoperability and portability at every stage of the innovation process, towards an EMPYREAN-based open ecosystem.

IMPACT 4: EMPYREAN partners will promote the strategic industrial cooperation in AI/ML-based data storage and processing that can benefit the EU industry roadmap.