Contribution ID: **3** Type: **Demonstrations & Tutorials**

Autopoietic Cognitive Edge-cloud Services

Currently, data processing and analysis predominantly occur within data centers and centralized computing environments, with 80% of this activity centralized and only 20% happening through intelligent, connected devices. Additionally, merely one out of four European companies leverages cloud technologies, and non-EU entities control 75% of Europe's cloud market.

To leverage the shift towards edge computing, which aligns with Europe's strategies on data, the environment, and industry, it's crucial for Europe to consolidate significant investments. The emphasis should be on the creation and implementation of advanced computing components, systems, and platforms. These technologies are essential for facilitating the move to a computing continuum that boasts potent edge and far-edge capabilities, all while being energy-efficient and reliable.

The development of the edge to cloud continuum faces a number of technological and conceptual challenges. First, seamless, transparent and trustworthy integration of diverse computing and data environments spanning from core cloud to edge, in an AI-enabled computing continuum. Secondly, automatic adaptation to the growing complexity of requirements and the exponential increase of data driven by IoT deployment across sectors, users and contexts while achieving optimal use of resources, holistic security and data privacy and credibility. Finally, interoperability challenges among computing and data platform providers and cloud federation approaches based on open standards, interoperability models and open platforms.

To cope with those challenges, ACES will provide an edge-services cloud with hierarchical intelligence, specifically autopoiesis and cognitive behaviors to manage and automate the platform.

These solutions include:

- Autopoiesis-based edge-services cloud
- Awareness tools, AI/ML agents for workload placement, service and resource management, data and policy management, telemetry and monitoring
- Autopoiesis agents to safeguard stability in situations of extreme load and complexity
- Swarm technology-based methodology and implementation for orchestration of resources
- Edge-wide workload placement and optimization
- App store for classification, storage, sharing and rating of AI models used in ACES.

Such new solutions are tested through three use cases:

- The energy marketplace case study in Greece demonstrates how distributed edge services can autonomously match energy supply and demand across regions, promoting renewable energy use and optimizing resource distribution.
- Distributed energy grid process management: utilizing an edge mesh for the Greek energy grid decentralizes management, enhancing the use of local energy resources and adapting to consumption needs, shifting from centralized to a resilient, adaptive infrastructure with a user interface that aids operators in decision-making and intervention.
- An IoT based asset monitoring and management: the innovation aims to show that integrating Advanced Metering Infrastructure data, grid-edge sensors, and GIS systems can enhance outage detection, improve prediction accuracy, and support reliable investment planning, including deferral, by analyzing diverse IoT and operational data for asset life assessment.

Extended list of the consortium members includes:

- RTOs and Universities: INESC-ID Lisboa, Technical University of Darmstadt, Polytechnic University of Madrid, University of Ljubljana, The University of Applied Sciences and Arts of Southern Switzerland, Lakeside Labs
- Small and Medium Enterprises: Hiro Microdatacenters, Datapower Consulting, Martel Innovate, SixSq
- Public Agency: Hellenic Independent Power Transmission Operator

Topic

Environmental informatics: Green Computing

Primary author: Dr BUINING, Fred (HIRO Microdatacenters)

Co-author: Mr REMOTTI, Luca (DataPower Consulting)

Presenters: MUREDDU, Francesco (The Lisbon Council); Mr REMOTTI, Luca (DataPower Consulting)

Session Classification: Demonstrations & Posters