EUCloudEdgeIoT.eu

Building the EUROPEAN CLOUD, EDGE AND IOT CONTINUUM for Business and Research

The Research Community Booklet

Index

The European Cloud, Edge and IoT Continuum

The European Cloud, Edge & IoT Continuum (EUCloudEdgeIoT.eu) aims to realise a pathway for the understanding and development of the CEI Continuum by promoting cooperation between a wide range of research projects, developers and suppliers, business users and potential adopters of this new technological paradigm.

The European Cloud, Edge & IoT Continuum acts as an enabling force, to reach key outcomes:

- Support the definition of the large-scale pilots envisaged by the European Commission in line with the EU Data Strategy
- Baseline common open architecture for computing continuum research projects
- Reinforce the collaboration between European public and private initiatives from cloud to edge to IoT
- Increase the awareness of the importance of Open Source and standards for EU digital autonomy

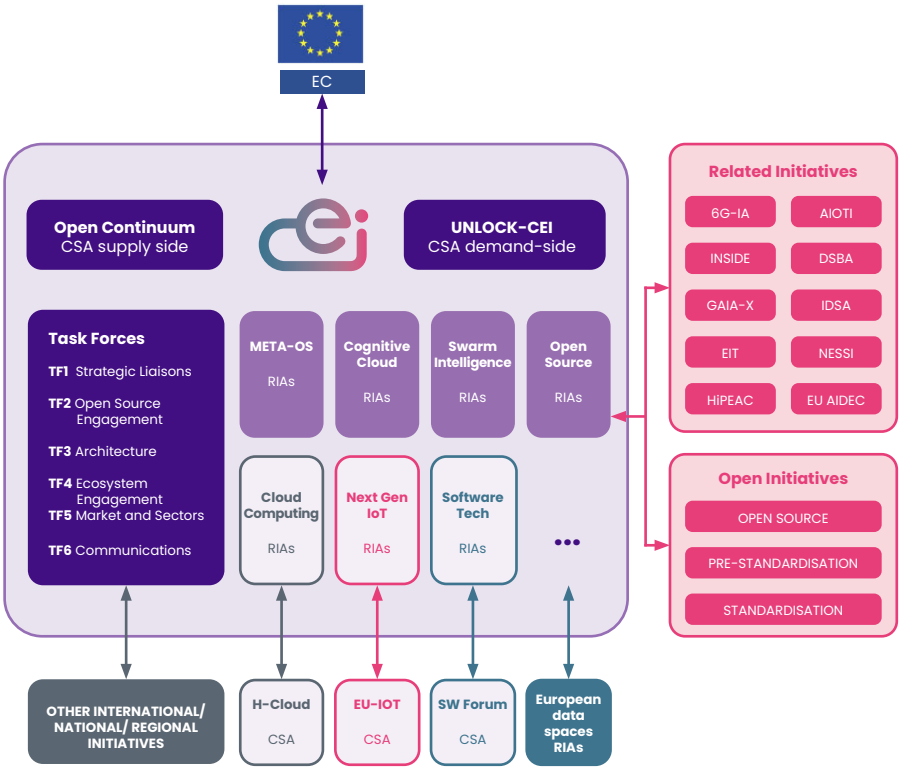
The Research and Innovation Actions

The EUCloudEdgeIoT.eu contributes to the coordination of a portfolio of research projects in the CEI Computing Continuum funded under:

- **Cloud Computing:** towards a smart cloud computing continuum (ICT-40-2020)
- **Software Technologies** (ICT-50-2020)
- **Next Generation Internet of Things** (ICT-56-2020)

- **Future European platforms for the Edge: Meta Operating Systems** (HORIZON-CL4-2021-DATA-01-05)
- **Cognitive Cloud:** AI-enabled computing continuum from Cloud to Edge (HORIZON-CL4-2022-DATA-01-02)
- **Programming tools for decentralised intelligence and swarms** (HORIZON-CL4-2022- DATA-01-03)
- **Open source for cloud-based services** (HORIZON-CL4-2022-DIGITAL-EMERGING-01-26)

These will also benefit from the synergies and legacy of other existing EU projects in the domains of Cloud, Edge, IoT, AI, and connectivity, including, among others, NGIoT, SW Forum and H-Cloud, as well as companies and startups such as Axelera AI.



The European Cloud-Edge-IoT Continuum Landscape

Cloud Computing: Towards a smart cloud computing continuum

(ICT-40-2020)

AI-Sprint

Artificial Intelligence in Secure PRIvacy-preserving computing coNTinuum (101016577)

Abstract

AI, to become fully pervasive, needs resources at the edge of the network. The cloud can provide the processing power needed for big data, but edge computing is close to where data are produced and therefore crucial to their timely, flexible, and secure management. AI-SPRINT will define a framework for developing AI applications in computing continua, enabling a finely-tuned tradeoff between performance (e.g., in terms of end-to-end latency and throughput) and AI model accuracy, while providing security and privacy guarantees. AI-SPRINT outcomes are: i) simplified programming models to reduce the steep learning curves in the development of AI software in computing continua; ii) highly specialized building blocks for distributed training, privacy preservation and advanced machine learning models, to shorten time-to-market for AI applications; iii) automated deployment and dynamic reconfiguration to decrease the cost of operating AI software. Beneficiaries include end-users of AI systems, software developers, system integrators, and cloud providers. A sustainability path is pursued through the creation of an Alliance and Adopter Acceleration club as a marketplace for AI businesses.

Project Information

Start Date: 1 January 2021

End Date: 31 December 2023

ID: 101016577

Programme: Horizon 2020

Keywords: Cloud computing, Artificial intelligence, intelligent systems, Cloud trust & security, Software Design & Development, Cloud Infrastructures, Privacy, Edge/fog computing; new management strategies; cloud performance; data protection.

Channels

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Main project (expected) KERs:

- AI-SPRINT Design & PyCOMPSs: Allow to specify partitionable models, performance, device and security constraints. Automatically parallelize code.
- AI-SPRINT Monitoring Subsystem: Monitor and enforce QoS constraints, with live reconfiguration of complex deployments, including operating in air-gap mode.
- Infrastructure Manager & TOSCARIZER: Open-source TOSCA-compliant tools for users to self-provision customized virtual infrastructures on multiple Clouds.
- OSCAR & SCAR: Deploy containerised event-driven serverless applications that execute along the computing continuum.
- OSCAR-P: Open-source tool to automatically profile AI data-processing through OSCAR and SCAR in the computing continuum.
- Krake: Schedule and re-schedule virtualized and containerized workloads on geographically separated cloud platforms based on energy related metrics.
- SPACE4AI-D & SPACE4AI-R: Design-time resource selection and component placement of AI applications in computing continua and their runtime adaptation.
- POPNAS: Automatic generation of optimized neural network models, given a user-defined classification task.
- SCONE: Framework to transform native applications into confidential ones such that they can facilitate trusted execution environments such as Intel SGX.
- GPU Scheduler: Optimal resource allocation and scheduling of Deep Learning training jobs on GPU-accelerated private and public cloud clusters.

Use Cases:

- Maintenance & Inspection: Exploit AI models for identifying windmill blade damage based on vision and thermal images collected by drones.
- Personalized Healthcare: Apply AI models to data from wearable devices to identify patterns associated with stroke. Enhance prevention and patient management.
- Farming 4.0: Exploit AI models to process data collected in the field. Data are used to yield forecast and reduction of phytosanitary products.

Charity

Cloud for Holography and Cross Reality

Abstract

There is a global trend to adopt virtual solutions to support day-to-day business operations, social events, and general lifestyle. A subset of these innovative media applications includes Virtual Reality, Augmented Reality, and Holography, but they do not come without challenges and requirements. For a satisfactory user experience, the requirements for the computing platform and its underlying network are extreme and far from what is attainable today. CHARITY designs a complete framework that attempts to overcome the challenges and meet the requirements of such applications. CHARITY leverages an innovative cloud architecture that exploits edge solutions, a computing and network continuum autonomous orchestration, application-driven interfacing, mechanisms for smart, adaptive and efficient resource management, strong community involvement, and overreaching compatibility with all infrastructure vendors. This integrated framework will be put into test in a broad diversity of use cases targeted at advanced media applications, such as holographic events, virtual reality training, and mixed reality entertainment.

Project Information

Start Date: 1 January 2021

End Date: 30 June 2024

ID: 101016509

Programme: Horizon 2020

Keywords: Cloud computing, Cloud Services, Cloud Infrastructures, Network technologies / Internetworking

Channels

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Main Contact Person (Coordinator): Uwe Herzog, herzog@eurescom.eu, EURESCOM

Main project (expected) KERs:

- A system for the autonomous orchestration and life cycle management of a wide range of compute and network resources, and infrastructures
- A collection of tools, mechanisms and algorithms enabling the efficient, contextualized and network-aware exploitation of edge resources and application reconfiguration.
- A set of VNFs and VNF repository that supports highly interactive applications leveraging on tools, technologies and platforms
- Tools for the application providers to simplify the deployment and management of application components, targeting mainly the needs of SMEs.

Use Cases:

- Holographic Concerts
- Holographic Meetings
- Holographic Assistants
- VR Medical Training
- VR Tour Creator
- Collaborative Gaming
- Manned-unmanned operations trainer

SERRANO

Transparent Application Deployment in a Secure, Accelerated and Cognitive Cloud Continuum

Abstract

SERRANO defines an intent-based paradigm of federated infrastructures consisting of edge, cloud and HPC resources, which will be realized through the SERRANO platform. At the top, SERRANO will create an abstraction layer that automates the process of application deploying functionality across the various computing technologies. The SERRANO platform will automatically determine the most appropriate (computing, storage, networking) resources of the cloud continuum to be used by an application, and then transparently deploy workloads and coordinate data movement. A sense, discern, infer, decide, and act, continuous control loop will run over an infinite to adjust resources and migrate tasks. SERRANO platform will also develop hardware and software-based mechanisms that provide security, privacy and multi-tenancy by design. SERRANO will capitalize on the benefits offered by hardware accelerators used to execute prototype tasks that arise often in applications, coupled with novel transprecision computing mechanisms to exploit the accuracy versus resource usage trade-off, further improving the overall performance and energy efficiency of the infrastructures.

Project Information

Start Date: 1 January 2021

End Date: 31 December 2023

ID: 101017168

Programme: Horizon 2020

Keywords: edge-cloud-HPC continuum, intent, hardware acceleration, secure storage, workload isolation, trust, cognitive orchestration, transparent deployment

Channels

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Main project (expected) KERs:

- The ARDIA framework comprises the application, service and resource models aiming at providing a rich semantic representation of the continuum.
- The AI-enhanced Service Orchestrator maps the high-level requirements of the applications and services into infrastructure-aware objectives.
- The Event and Anomaly Detection Engine (EDE) is an event and anomaly detection engine designed to detect complex and contextual anomalies from large scale distributed systems.
- A set of services that expands SkyFlok storage in the edge with the goal of making it more enterprise friendly.
- End-to-end cognitive orchestration over distributed and heterogeneous edge/cloud/HPC infrastructures.
- The REMAP framework that performs design-space exploration in order to determine the optimal configuration of approximate kernels (FPGA/GPU).
- A software package for HPC signal processing applications for large data volumes.
- Hardware accelerated solutions, using NVIDIA's DPUs, for NVMEoTCP traffic and TLS encryption/decryption.
- vAccel software components that enable workloads to enjoy hardware acceleration while running on environments without direct (physical) access to acceleration devices.

Use Cases:

- Use Case 1 – Secure Storage: Secure and high-performance storage at the edge of the network.
- Use Case 2 – High-performance Fintech Analysis: Advanced computing capabilities for the management of investment personalized portfolios.
- Use Case 3 – Machine Anomaly Detection in Manufacturing Environments: Online detection of machine anomalies, while the hardware equipment keeps running.

DATACLOUD

DataCloud: Enabling the big data pipeline lifecycle on the computing continuum

DataCloud

Abstract

DataCloud provides a novel paradigm covering the complete lifecycle of managing Big Data pipelines through discovery, design, simulation, provisioning, deployment, and adaptation across the Computing Continuum. Big Data pipelines in DataCloud interconnect the end-to-end industrial operations of collecting pre-processing and filtering data, transforming and delivering insights, training simulation models, and applying them in the cloud to achieve a business goal. DataCloud delivers a toolbox of new languages, methods, infrastructures, and prototypes for discovering, simulating, deploying, and adapting Big Data pipelines on heterogeneous and untrusted resources. DataCloud separates the design from the run-time aspects of Big Data pipeline deployment, empowering domain experts to take an active part in their definitions.

The main exploitation targets the operation and monetization of the toolbox in European markets, and in the Spanish-speaking countries of Latin America. Its aim is to lower the technological entry barriers for the incorporation of Big Data pipelines in organizations' business processes and make them accessible to a wider set of stakeholders regardless of the hardware infrastructure. DataCloud validates its plan through a strong selection of complementary business cases offered by SMEs and a large company targeting higher mobile business revenues in smart marketing campaigns, reduced production costs of sport events, trustworthy eHealth patient data management, and reduced time to production and better analytics in Industry 4.0 manufacturing.

The balanced consortium consists of 11 partners from eight countries. It has three strong university partners specialised in Big Data, distributed computing, and high-productivity languages, led by a research institute. DataCloud gathers six SMEs and one large company (as technology providers and stakeholders/users/early adopters) that prioritise the business focus of the project in achieving high business impacts.

Main project (expected) KERs:

- DIS-PIPE: Tool for extraction of Big Data pipelines event logs considering distributed data over a variety of sources, incomplete data, data outliers, and different event granularity levels.
- DEF-PIPE: Visual tool and domain specific language capturing distributed

Project Information
Start Date: 01 January 2021
End Date: 31 December 2023
ID: 101016835
Programme: Horizon 2020
Keywords: Big Data Pipelines, Cloud Computing, Edge Computing, Dark Data, Resources Marketplace, Pipelines Simulation, Pipelines Definition, Pipeline Deployment, Pipeline Discovery

Channels
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data pipeline syntax and semantics on the Computing Continuum infrastructure along with a format for data serialization and deserialization.

- SIM-PIPE: Data pipeline simulation system, including a sandbox for evaluating and simulating individual steps performance.
- R-MARKET: Decentralized marketplace for software appliances with preinstalled Big Data frameworks for publishing and monetizing proprietary, original cryptographically signed software.
- ADA-PIPE: Scheduling and monitoring tool with data-aware prediction algorithm for smart management of resources and services across the Computing Continuum with adaptation to infrastructure drifts.
- DEP-PIPE: An orchestration tool capable of providing elastic, scalable and resilient deployment of Big Data pipelines over the Computing Continuum.

Use Cases:

- SMARK Digital Marketing: Develop a new product–Smart Mobile Marketing Campaigns for massive data-driven management of marketing campaigns.
- MOGSPORT Live Media Streaming: Develop a new product–Automatic Live Sports Content Annotation to lower the production costs and enhance audience. engagement and experience in decentralised crowdsourced live sport broadcasting.
- TLUHEALTH Electronic Healthcare: Develop a new product–Digital Health System for provisioning of a scalable digital health system to support and help home patients, especially elderly stay during treatment and care with ensured data privacy and trust.
- P-DICE Manufacturing adaptation: Develop a new product–Predicting Deformations in Ceramics providing a platform that enables smart adaptation of manufacturing sanitary systems.
- AMANS Industry 4.0: Develop a new product–Analytics of Manufacturing Assets to enhance factory automation through cost-effective provisioning of monitoring and diagnostics applications.

PHYSICS

Optimized hybrid space-time service continuum in FAAS

PHYSICS

Abstract

The EU-funded PHYSICS project is empowering European cloud service providers to leverage cutting-edge, scalable and cost-effective cloud models, such as function-as-a-service (FaaS) ones, operated across multiple hardware types, locations, edge computing nodes and multi-cloud resources. The project applies a vertical solution consisting of a cloud design environment enabling the design of visual workflows and an optimised platform-level FaaS. It applies a unified continuum approach, including functional and operational management across sites and service stacks, performance through the relativity of space (location of execution) and time (of execution), enhanced by semantics of application components and services. PHYSICS has produced an Artefacts Marketplace (RAMP), in which internal and external entities are able to contribute fine-grained reusable artefacts (functions, flows, controllers etc). PHYSICS contributes to open-source tools and initiatives/policies (Gaia-X, Green Deal, EOSC, Eur. Strategy for Data), while validating the outcomes in 3 real-world applications (eHealth, Agriculture and Manufacturing), making a business, societal and environmental impact on EU citizen life.

Project Information

Start Date: 1 January 2021

End Date: 31 December 2023

ID: 101017047

Programme: Horizon 2020

Keywords: Cloud Computing models, Cloud Services, Semantic web technologies, Cloud Infrastructures, System Software, Scalability

Channels

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Main project (expected) KERs:

- Reusable Artefacts Marketplace Platform (RAMP)
- It incorporates reusable solutions across the various fields of PHYSICS, such as cloud patterns implementations, controller/optimizer algorithms, management schedulers, and more.
- CSP Cloud Design Environment
- It mainly defines the incorporation process and application graph of the implementation of permitting cloud design patterns to be exploited by the application components.
- Optimized Platform Level FaaS Services Toolkit
- Enable the CSPs to undertake new platform roles as well as revealing the means to implement these roles.
- CSP Backend Optimization Toolkit
- Improves the backend management by enabling new performance monitoring and adaptation techniques, providing a superior adaptation to user demands.

Use Cases:

- Smart Agriculture for near real-time greenhouse management.
- eHealth for Personalized Monitoring and Collective Analysis.
- Smart Manufacturing for increased resilience and interplay.

Software Technologies

(ICT-50-2020)

Piacere

Programming trustworthy Infrastructure As Code in a sEcuRE framework

Abstract

The Horizon 2020 PIACERE project aims to provide means (tools, methods and techniques) to enable most organizations to fully embrace the Infrastructure-asCode approach, through the DevSecOps philosophy, by making the creation of such infrastructural code more accessible to designers, developers and operators (DevSecOps teams), increasing the quality, security, trustworthiness and evolvability of infrastructural code while ensuring its business continuity by providing self-healing mechanisms, anticipation of failures and violations, allowing the system to self-learn from the conditions that triggered such re-adaptations.

Project Information

Start Date: 1 December 2020

End Date: 30 November 2023

ID: 101000162

Programme: Horizon 2020

Keywords: DevOps, Infrastructure as Code, DevOps Modelling Language, Code Generator, IaC, self-learning and self-healing mechanisms, optimization algorithms, machine learning techniques, security analysis

Channels

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Main project (expected) KERs:

- KER1: PIACERE DevSecOps Modelling Language. Improve the ability of (non-) expert DevSecOps teams to model provisioning, deployment and configuration through the abstraction of execution environments
- KER2: PIACERE Design Time Security. Regain trust in IaC through the DOML verification and the automation of IaC code quality checking for errors and vulnerable dependencies, and thus improving IaC integrity and applicability
- KER3: PIACERE IaC Execution Manager. Avoid vendor lock-in and time consuming manual processes in infrastructure management, while increasing resilience and supporting self-healing
- KER4: PIACERE IaC Optimized Platform. Perform the most appropriate deployment configurations that best meet your defined constraints out of DevSecOps catalogue of services, resources and infrastructural elements by means of optimization algorithms.
- KER5: PIACERE Canary Sandbox. Allow unit testing of the behaviour of the infrastructural code on an isolated environment, which would enable the simulation of conditions for the production environment and identify some of the most common anti-patterns.
- KER6: PIACERE Runtime Security. Ensure that the conditions of the QoS are met at all times and that a failure or non-compliance of NFRs is not likely to occur, with verified security violations at runtime.

Use Cases:

- (SI-MPA) The Slovenian Ministry of Public Administration for hosting information systems on a centralized infrastructure
- Prodevelop Critical Maritime Infrastructures for fulfilling the management needs of port authorities
- ERICSSON Public Safety on IoT in 5G of both human and IoT devices

Cosmos

DevOps for Complex Cyber-physical Systems

Abstract

Much of the increasing complexity of ICT systems is being driven by the distributed and heterogeneous nature of these systems, with Cyber-Physical Systems (CPS) accounting for an increasing portion of Software Ecosystems. COSMOS focuses on blending best practices DevOps solutions with development processes used in the CPS context to enable the CPS world to deliver software more rapidly and result in more secure and trustworthy systems. COSMOS brings together a balanced consortium of big industry, SMEs and academics that are developing enhanced DevOps pipelines which target CPS software development. These pipelines integrate more sophisticated validation and verification, which is comprised of a mix of static code analysis correlated with issues/bug reports, automated test case generation, runtime verification, Hardware in the Loop (HiL) testing, and feedback from field devices. Approaches based on Machine Learning, model-based testing and search based test generation are being employed. Techniques to prioritise and schedule testing to maximise efficacy of the testing process and to minimise security threats are being developed.

Project Information

Start Date: 1 January 2021

End Date: 31 December 2023

ID: 957254

Programme: Horizon 2020

Keywords: Cyber-physical Systems, DevOps, Agile Software Development, Software Testing, Software Quality

Channels

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Main project (expected) KERs:

- CI/CD bad practice detector and Pipeline Reconfiguration tools
- Build Outcome Predictor and Allocation Tools
- Test Execution Automator and Physical Testing Optimizer
- Runtime Verification and Monitoring Framework
- Security Vulnerability Testing Framework including Metamorphic Security Testing Tool and Metamorphic Testing Optimiser
- Refactoring Toolset including Anti-patterns Detector, Refactoring Recommender and Build Scheduler
- Test Case Decomposition Framework including Test Case Generator and Test Oracle Generator
- User-Oriented Maintenance and Testing Framework including Scenarios Generator, Scenarios Optimizer and User Interaction and Feedback Analyser
- Change Analysis and AI-based support for DevOps Cycles including tools for Continuous Quality Assessment, Detection, and CPS Degradation Remedies
- AI-based support for self-adaptability of CPS

Use Cases:

- DevOps tools and technologies for design, development, testing and evolution of Medical systems
- DevOps tools and technologies for design, development, testing and evolution of Railways control systems
- DevOps tools and technologies design, development, testing and evolution of Avionics systems
- DevOps tools and technologies for design, development, testing and evolution of Automotive systems
- DevOps tools and technologies for design, development, testing and evolution of Smart Cities Utilities systems

XANDAR

X-by-Construction Design framework for Engineering Autonomous & Distributed Real-time Embedded Software Systems

Abstract

The next generation of networked embedded systems (ES) requires fast prototyping and high performance in addition to its key properties of reliability and safety. However, the dependence of the current autonomous systems trend on machine learning and artificial intelligence applications in combination with fail-operational requirements makes the verification and validation of ES a challenging endeavour. The EU-funded XANDAR project will address the goals defined within the ICT-50-2020 Software Technologies call, delivering a mature software toolchain that fulfils the industrial requirements for rapid prototyping of interoperable and autonomous ES. A model-based system architecture to support novel automatic model synthesis and software parallelisation techniques will be used to achieve the objectives of a new real-time, safety- and security-by-construction paradigm.

Project Information

Start Date: 1 January 2021

End Date: 31 December 2023

ID: 957210

Programme: Horizon 2020

Keywords: X-by-Construction, embedded systems, safety, security, real-time behaviour, machine learning, multicore platforms

Channels

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Main project (expected) KERs:

- End-to-end toolchain from logical modelling to the deployment on multicore platforms
- X-by-Construction library of trusted building blocks for safety and security
- Safety-aware integration of machine learning algorithms (e.g. from ONNX format)
- Behaviour specification approach based on the Logical Execution Time concept
- Hypervisor-based security and health monitoring components
- Verification/validation strategy to complement the X-by-Construction paradigm
- Target-aware approaches for the automatic parallelisation of software
- Continuous testing, integration, and deployment of toolchain components

Use Cases:

- Resilient Avionic Architecture for Urban Air Mobility (DLR)
- Autonomous Systems with integrated machine learning applications (BMW)

VeriDevOps

Automated Protection and Prevention to Meet Security Requirements in DevOps Environments

Abstract

VeriDevOps is about fast, flexible system engineering that efficiently integrates development, delivery, and operations, thus aiming at quality deliveries with short cycle time to address ever evolving challenges. Current system development practices are increasingly based on using both off-the-shelf and legacy components which make such systems prone to security vulnerabilities. Since DevOps is promoting frequent software deliveries, verification methods artifacts should be updated in a timely fashion to cope with the pace of the process. VeriDevOps aims at providing faster feedback loop for verifying the security requirements i.e. confidentiality, integrity, availability, authentication, authorization and other quality attributes of large scale cyber-physical systems. VeriDevOps is focusing on optimizing the security verification activities, by automatically creating verifiable models directly from security requirements, and using these models to check security properties on design models and generate artefacts (such as tests or monitors) that can be used (later on) in the DevOps process. More concretely, we will develop methods and tools for: 1) creating security models from textual specifications using natural language processing, 2) automatic security test creation from security models using model-based testing and model-based mutation testing techniques and 3) generating (intelligent/adaptive, ML-based) security monitors for the operational phases. This brings together early security verification through formal modelling as well as test generation, selection, execution and analysis capabilities to enable companies to deliver quality systems with confidence in a fast-paced DevOps environment. Overall, VeriDevOps is using the results of formal verification of security requirements and design models created during the analysis and design phase for test and monitor generation to be used to enhance the feedback mechanisms during the development and operation phases.

Main project (expected) KERs:

- Demonstrable impact of automation of security requirements formalization. Automation of security requirements formalization is one of the main enablers for the effectiveness of the approach. The formalization

is a tedious, error-prone and effort consuming process. Automated tools should bring significant time reduction to the whole lifecycle.

- Demonstrable impact of leveraging formal specifications in operations for protection and at development time for prevention of security flaws. Further benefits for adopters depend on efficiency to exploit formal specifications for generation of verification artifacts such as monitors and tests.
- Demonstrable improvement of security issues detection and resolution time for industrial adopters, The risk for economic losses grows significantly each minute a security breach is present. Demonstrating the decrease in time to detect and resolve security issues is the major criteria for success of the VeriDevOps technology. 4. Convincing demonstration and rewards of industry benefits. The success, further exploitation and sustainability of the project results depend on perceived economic benefits for the end-users. The tight collaboration in the case studies will help to validate the rewards for the end-users.

Project Information	**Channels**
Start Date: 1 October 2020	**Website:** www.veridevops.eu
End Date: 31 January 2024	**Twitter:** @VeriDevOps
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Programme: Horizon 2020	**YouTube:** @veridevopsproject8369
Keywords: Model Driven Software Development, Software Design & Development, Systems Engineering and Design Management	**Main Contact Person (Coordinator):** Gunnar Widforss, Mälardalens University, gunnar.widforss@mdu.se

Use Cases:

- Fagor: manufacturing machinery - automotive mechanical and hydraulic presses : Within this project, FAG aims to respond to the needs the companies of its sector, needs and goods, with a clear Digital Transformation strategy. These needs have raised in terms of cybersecurity as FAG needs to enter a market safely where cybersecurity is already considered an obligation.
- ABB: Automation Industry and Operation of Cranes : VeriDevOps will offer a fast track to efficient, safe and secure crane operations for both remote and cabin-based crane operation in an authentic environment - as close to real crane operation and realistic conditions as it is possible.

ELEGANT

Secure and Seamless Edge-to-Cloud Analytics

Abstract

The EU-funded ELEGANT project aims to develop a novel software solution that addresses key challenges facing IoT and Big Data: interoperability, reliability, safety, and security. Some of the key innovations of the proposed framework are lightweight virtualisation, automatic code extraction compatible with IoT and Big Data frameworks, intelligent orchestration, dynamic code motion and advanced code verification and cybersecurity mechanisms. These should enable the seamless operation of end-to-end IoT/Big Data systems. To achieve its goal, the project will gather a consortium of experts on low-level system software, IoT, Big Data, AI-assisted scheduling, and DevOps.

Project Information

Start Date: 1 January 2020

End Date: 31 December 2023

ID: 957286

Programme: Horizon Europe

Keywords: IoT, Big Data, Software Programming paradigm, Performance, Energy Efficiency, Security, Reliability, Dependability, JVM

Channels

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Main Contact Person (Coordinator): Sotiris Diamantopoulos, s.diamantopoulos@exus.ai, EXUS

Main project (expected) KERs:

- Unified API for Cloud/Edge deployment
- ELEGANT Elastic Runtime
- ELEGANT Intelligent Orchestrator
- ELEGANT Acceleration Service
- ELEGANT Code Verification Service
- Networking Cybersecurity Layer
- ELEGANT DevOps Tools

Use Cases:

- Secure Smart Riding
- Large-Scale Secure Smart Metering
- Video Surveillance
- Medical Wearables

FOCETA

Foundations for Continuous Engineering of Trustworthy Autonomy

Abstract

Applications are increasingly being developed based on complex autonomous systems driven by artificial intelligence. As smart robots are starting to replace humans in complicated or dangerous tasks on the road, in industry, or in hospitals, their safety, autonomy, and trustworthiness are the subject of concern. This is due to the increasing complexity of deployments, especially those of learned-enabled systems (LES), which cannot easily be traced by continuous engineering (DevOps). The EU-funded FOCETA project will develop the foundation for continuously engineering trustworthy learning-enabled autonomous systems (LEAS) integrating data-driven and model-based engineering. A new system, grounded on open source tools with open data-exchange standards, will be demonstrated with the most demanding applications, such as urban driving automation and intelligent medical devices, to prove viability, scalability, and safety.

Project Information

Start Date: 1 October 2020

End Date: 30 September 2023

ID: 956123

Programme: Horizon 2020

Keywords: Trustworthy learning-enabled autonomous systems, ependable Machine Learning, Model-Driven and Data-Driven Software Development, Rigorous System Design continuously engineering , Runtime monitoring of ML Models, Formal Verification and Testing of ML Models, Runtime enforcement and Shielding, Specification Mining

Channels

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Main project (expected) KERs:

- Methodology for designing and addressing the correctness and safety of LEAS through bridging the gap between the currently applied development, verification, and validation techniques for LES and their operation in the real world.
- Design Flow for Trustable AI/ML models: i) trustworthy perception and sensing, ii) safe Data-Driven control
- The design flow for LEAS consists of two parts: the design part (design time) for the design, implementation, and verification of LEAS, and the (run time) operations part, focusing on the deployment of the LEAS and their operation in the real world.
- Co-simulation framework (Data-Driven and Model-based), testing and monitoring at Design Time
- Continuous development and operations of learning-enabled autonomous systems

Use Cases:

- Automated Valet Parking: The demonstrated use case is automated valet parking (AVP) with mixed traffic, i.e., with pedestrians as well as vehicles controlled by humans.
- Anaesthetic drug Target Control Infusion: Develop a test-bench platform for an autonomous infusion pump controller for Depth of Anaesthesia (DoA).

Next Generation Internet of Things

(ICT-56-2020)

IntellIoT

Intelligent, distributed, human-centered and trustworthy IoT environments

Abstract

IntellIoT is a Pan-European Research Project supported by the European Commission with €8 million EU funding. IntellIoT comprises a consortium of 13 partners spread across 9 countries which bring together key expertise and technologies for the next generation IoT and build the basis for an ecosystem on top of the IntellIoT framework beyond the project. Enabling technologies such as 5G, cybersecurity, distributed ledger technology, Augmented Reality, and tactile internet, the project champions end-user trust, adequate security, and privacy by design.

Project Information

Start Date: 1 October 2020

End Date: 30 September 2023

ID: 957218

Programme: Horizon 2020

Keywords: IoT, Trustworthy, Collaborative, Human-Centric, semi-autonomous, human-in-the-loop

Channels

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Main Contact Person (Coordinator): Vivek Kulkarni, Siemens, vivekkulkarni@siemens.com

Main project (expected) KERs:

- Patient personalized AI models: Ensuring local training of the personalized AI models enhances privacy and security, while providing personalized suggestions related to physical activities and chronical diseases.
- Security Assurance Platform: A solution supporting modern security auditing methods, while integrating incident response capabilities with codeless workflow specification.
- Mobile Computing Platform for Agriculture: A platform able to incorporate the human-in-the-loop in the intelligent IoT environment of a semi-autonomous agricultural vehicle, while improving safety, reliability and security measures.
- Infrastructure for Web-based MAS: Supporting Multi-agent System (HyperMAS) that manages available artifacts and agents along with available procedural knowledge
- 5G OAI testbed for VR: Infrastructure for easy development, deployment and evaluation of novel approaches for VR solutions by providing basic OAI RAN, CN and VR traffic functionality.
- Computational Resource Manager: Web-based edge orchestrator to optimize the allocation of applications using ILP, particle swarm and DRL methods to ensure reliability, min. response time and optimal energy consumption.
- 5G OpenAir Interface: Open-Source SW components to utilize, test and evaluate network features from the 5G standard in future emerging applications.

Use Cases:

- Agriculture: Semi-Autonomous Operations for Agricultural Vehicle Fleets
- Healthcare: Collaborative IoT-Enabled Support for Remote Patient Monitoring in Healthcare
- Manufacturing: Human-Machine Cooperation in Shared Manufacturing
- Smart City, Construction and Energy: IntellIoTs architectural framework is also applied in the Smart City, Construction and Energy sector via its Open Call partners.

Terminet

nexT gEneRation sMart INterconnectEd ioT

Abstract

The vision of TERMINET is to provide a novel next generation reference architecture based on cutting-edge technologies such as Software Defined Networking (SDN), multiple-access edge computing, and virtualisation for NG-IoT, while introducing new, intelligent IoT devices for low-latency, market-oriented use cases. TERMINET targets at (a) applying distributed AI at the edge by using accelerated hardware and federated learning, (b) reducing the complexity of heterogeneous devices through a flexible SDN-enabled middleware layer, (c) designing, novel, intelligent IoT devices such as smart glasses, haptic devices, and autonomous drones, (d) fostering AR/VR contextual computing, (e) implementing a decentralised and distributed blockchain framework within manufacturing, for supporting maintenance and supply chain optimisation, (f) applying a vertical security by design methodology, (g) providing novel disruptive business models, while fostering standardisation activities for the IoT ecosystem, and (h) validating and demonstrating six proof-of concept, realistic use cases in compelling IoT domains such as the energy, smart buildings, smart farming, healthcare, and manufacturing.

Project Information

Start Date: 1 November 2020

End Date: 31 October 2023

ID: 957406

Programme: Horizon 2020

Keywords: Software Defined Networking (SDN), Multiple-Access Edge Computing, Federated Learning, Smart Farming, Smart Healthcare, Blockchain, Smart Energy, Smart Manufacturing, Smart Glasses, AR/VR

Channels

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YouTube: @terminetproject3921

Main Contact Person (Coordinator): Panagiotis, Sarigiannidis, psarigiannidis@uowm.gr, University of Western Macedonia

Main project (expected) KERs:

- TERMINET AGROMIND Dashboard:
  - An advanced data visualization dashboard to aid the producer monitor field operations towards achieving their production goals.
- Centralised Federated Learning System:
  - A complete platform able to train and evaluate Federated Learning

models using decentralized data and deploy prediction modules to the Edge.
- Vertical Application Orchestrator:
  - It builds a top popular container and Infrastructure as a Service cloud platforms to provide automated service deployment, localization, scaling, and lifecycle management.
- FINT's Edge Accelerating Infrastructure:
  - This entity with utilise FPGA hardware devices to significantly accelerate computational procedure connected to the TERMINET Architecture.
- Platform Data Management Ledger (PDML):
  - This framework deploys a decentralized Blockchain network, using smart contract to share and authenticate information and their sources.
- Smart glasses:
  - The main human centric intelligent IoT device for the TERMINET use cases. Used as wearable tech hardware platform to run applications and connect to other IoT devices.
- New Generation RTU device:
  - It embeds secure IoT interfaces for sharing operational and maintenance-related data in real-time for SCADA and Substation Automation Systems.
- Bootstrapping Trust and Integrity Measurement Tool (BIM):
  - This tool addresses the diverse vulnerabilities and threats of the Edge by leveraging sophisticated crypto primitives.
- Attestation Gateway (AG):
  - It provides a unifying process to remotely attest devices and services by acting as a middleware between the involved entities, namely, the attesters, the provers, and the verifiers.
- IoT Digital Twin Environment and Prediction Models:
  - An experimental environment for quality-aware Digital Twin technology in I4.0 environments.

Use Cases:
- UC #1: User-Centric Devices in Smart Farming
  - Heterogeneous data coming from crops, livestock, and mixed farming systems are coupled with AI capabilities to enhance agriculture systems' sustainability.
- UC #2: Pathway of Personalized Healthcare
  - A higher level of medical education will be provided to health practitioners, diagnosis will be leveraged and patient satisfaction and safety will be improved.
- UC #3: Smart, Sustainable and Efficient Buildings
- Optimize energy consumption and harvesting of smart buildings.
- UC #4: Prediction and Forecasting System for Optimizing the Supply Chain in Dairy Products
- Provide efficient supply chain forecasting, based on different types of production and sales data.
- UC #5: Group Training Surgery Using VR enabled IoT Technologies
- Enhance the understanding of treatment by efficiently providing a virtual training environment for medical personnel.
- UC #6: Mixed Reality and ML Supported Maintenance and Fault Prediction of IoT based Critical Infrastructure
- Reduce the operational costs of the end user and the burden of maintenance engineers.

VEDLIoT

Very Efficient Deep Learning in IoT

Abstract

As the Internet of Things (IoT) continues to take shape, promising widespread automation and data exchange, one of the biggest challenges is to act on the data generated. The amount of data collected is huge, the computational power required for processing is high, and the algorithms are complex. The EU-funded VEDLIoT project develops an IoT platform that uses deep learning algorithms distributed throughout the IoT continuum. The proposed new platform with innovative IoT architecture is expected to bring significant benefits to a large number of applications, including industrial robots, self-driving cars, and smart homes. The project offers an Open Call at project midterm, incorporating additional VEDLIoT-related industrial use-cases in the project, increasing the market readiness of the VEDLIoT solutions.

Project Information

Start Date: 1 November 2020

End Date: 31 October 2023

ID: 957197

Programme: Horizon 2020

Keywords: Internet of things, Home automation, Deep learning, Cognitive IoT hardware platform, Heterogenous computing, Reconfigurable system architecture, Co-Design for flexible hardware accelerators, Resource-efficiency, Security, privacy and trust by design, Robustness and Safety

Channels

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Main Contact Person (Technical Coordinator): Jens Hagemeyer, jhagemey@cit-ec.uni-bielefeld.de, Universität Bielefeld

Main project (expected) KERs:

- Embedl optimization engine: python library to optimise deep learning models for inference. Well suited for optimising vision systems in embedded systems.
- Cognitive IoT platform: a heterogeneous microserver platform for IoT and edge computing > significant advantage compared to actual computing platforms.

- Secure IoT Gateway: eases the management of secure IoT network environments, supporting the wireless communication technologies WiFi and LoRa.
- Reconfigurable RISC-V soft processor core: Configurable at design-time and reconfigurable at runtime.
- Modular, reconfigurable template-based ML-Accelerator for FPGAs: The generator will support variable precisions including floating-point support for training.
- Twine - An Embedded Trusted Runtime for WebAssembly: Embeds WebAssembly-compiled applications within Intel SGX enclaves and provides access to TEE facilities
- SIRE - Trusted Verifier Service: A replicated infrastructure supporting remote attestation, application membership management, auditable integrity-protected storage and coordination primitives.
- HW-SW Co-Design ML-Accelerator: Modular, co-design ML accelerator for FPGAs. It will explore model characteristics and the co-design will give feedback to model optimizations
- ADAS (Advanced Driver Assistance system): Enhanced automotive safety. With increased and distributed AI processing capability an improved collective perception of the traffic scenario is possible.
- ShieLD: Secure Communication Channel for TrustZone-M: It provides a secure communication channel for TrustZone worlds to communicate and share data with confidentiality and integrity preserved.

Use Cases:

- Industrial IoT – Employs DL-based solutions for motor condition monitoring and for arc detection, involving different challenges concerning the usage of DL models.
- Automotive - Focuses on increasing the processing efficiency DL tasks over the resources that are present in the traffic environment.
- Smart home – A Smart Mirror as demonstrator for the class of smart home applications. It serves as interface between residents and the smart environment.
- Open Call use cases:
- Honey.AI - The Evolved and optimized AI-related IoT solution for the honey industry
- MushR - A Smart, Automated and Scalable Indoor Harvesting System for Gourmet Mushrooms
- Power Edge RL - Control of electric power systems via edge computing-based reinforcement learning
- DUNE RCO - Deep learning for multi-technology fusion in industrial indoor asset localization and tracking
- BEAM_IDL - Multiple laser BEAM-shaping monitoring and IDentification boosted by deep-Learning algorithms
- AI_RIDE - Artificial Intelligence - driven RIding Distributed Eye
- FLEDGED - Feasibility of Low-energy Embedded Deep-Learning-Models Geared for Edge Devices
- AccBD - Accelerated Biomarker Candidate Discovery
- Edge4iwelli - Edge computing to support the iwelli ecosystem of services for smart home care and independent living
- FLAIR - Federated Learning Extension for Very Efficient Deep Learning in IoT

Assist – IoT

Architecture for Scalable, Self-*, human-centric, Intelligent, Secure, and Tactile next generation IoT

Abstract

ASSIST-IoT aims at creating a novel NG-IoT architecture addressing scalability and flexibility of data processing and analytics, by implementing a decentralized and secure solution, supported by smart components (i.e., devices, edge nodes, networks, applications, and services), allowing execution of context-aware applications with new interaction interfaces (e.g., AR/VR/MR). The blueprint architecture covers the needs of next generation IoT deployments, establishing the basic technology for such solutions, and instructing on how to incorporate new "modules" (enablers) to achieve diverse NGIoT innovations. The solution integrates AI-based functions transferring intelligence closer to the edge (data sources), including devices. The reference architecture is being validated in three realistic pilots: (i) port automation; (ii) smart safety of workers, and (iii) cohesive vehicle monitoring and diagnostics. ASSIST-IoT is human-centric, keeping them as core part of the IoT deployments regarding usability, data protection, rights and freedom preservation, and the computing itself. To achieve this, ASSIST-IoT incorporates a suite of enablers like DLT, trust, AI and cybersecurity.

Project Information

Start Date: 1 November 2020

End Date: 31 October 2023

ID: 957258

Programme: Horizon 2020

Keywords: reference architecture, enablers, smart orchestrator, DevSecOps, Kubernetes, edge computing, decentralization, network, federated learning, DLT

Channels

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Main Contact Person (Coordinator): Prof. Carlos E. Palau Salvador, cpalau@dcom.upv.es, UPV

Main project (expected) KERs:

- ASSIST-IoT Reference Architecture
- Enabler encapsulation design and guidelines
- GWEN (IoT Gateway enabler)
- Smart Orchestrator
- ASSIST-IoT Horizontal Autoscaling
- In-service emission diagnostic
- Multiwirless ROS
- UWB Geofencing
- DevSecOps

Use Cases:

- Port automation: Automated alignment of CHE, Yard fleet asset location, Augmented Reality and Tactile Internet HMIs for fleet yard drivers and Remote control of CHE
- Smart safety of workers: optimization of safety plans with AR support, smart actuation of IoT devices adjusted to individual needs and identification of hazards.
- Cohesive vehicle fleet management: Advanced powertrain monitoring and diagnostics, vehicle condition monitoring through scanners equipped with AI.

INGENIOUS

Next-GENeration IoT sOlutions for the Universal Supply chain

Abstract

iNGENIOUS aims to design and evaluate the Next-Generation IoT (NG-IoT) solution, with emphasis on 5G and the development of Edge and Cloud computing extensions for IoT, as well as providing smart networking and data management solutions with Artificial Intelligence and Machine Learning. For this purpose, the project has exploited some of the most innovative and emerging technologies in line with the standardised trend, contributing to the NG-IoT and proposing technical and business enablers to build a complete platform towards the future fully digitized supply chain management. Project outcomes has been validated into 4 large-scale Proof of Concept demonstration, covering 1 factory, 2 ports, and 1 ship, encompassing 6 uses cases.

The consortium is formed by 21 partners from eight countries, including telecom vendors and manufacturers, network operators, logistics partners, universities, research institutes and seven high-tech SMEs.

iNGENIOUS embraces the 5G Infrastructure Association (5G IA) and Alliance for Internet of Things Innovation (AIOTI) vision for empowering smart manufacturing and smart mobility verticals.

Project Information

Start Date: 1 October 2020

End Date: 31 March 2023

ID: 957216

Programme: Horizon 2020

Keywords: IoT, 5G, cloud, edge, Machine Learning, Supply Chain, Industry 4.0, Smart Ports, Smart Logistics, Automated Guided Vehicles

Channels

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Main Contact Person (Coordinator): David Gómez Barquero, dagobar@iteam.upv.es, Universitat Politècnica de València (UPV)

Main project (expected) KERs:

- Cloud-based analytics services for maritime traffic prediction
- Low-power ML-enabled sensors for transportation health monitoring
- Smart IoT Gateway integrating multiple IoT radio technologies, communication protocols, and data conversion
- 5G Rel-15 modem component to make IoT devices 5G capable
- 5G-Core Network, Slice Management module, NWDAF, 5GLAN and TSN network functions
- Cross-DLT solution integrating different DLTs as trust mechanisms for information exchange in the supply chain
- Data virtualization layer for machine-to-machine (M2M) platforms and other information systems to allow applications access to all data sources
- Proposed features for cellular IoT 4G and 5G chipsets and modules to make them more attractive to industrial supply chain applications (e.g., transportation use cases).

Use Cases:

- Automated Robots with Heterogeneous Networks: Enablement of 5G+ networks for industrial environments, especially for centralized control of industrial robots
- Transportation Platform Health Monitoring: Monitoring of cargo train carriages for defects and secure automatic reporting via IoT sensors
- Situational Understanding and Predictive Models in Smart Logistics: Enhance situational understanding of events in maritime ports and terminals
- Improve Driver's Safety with MR and Haptic Solutions: Improve driver safety by allowing automated guided vehicles (AGVs) to operate in more scenarios, with humans assisting them via remote control in few difficult situations
- Inter-Modal Asset Tracking Via IoT and Satellite: End-to-end tracking of assets in shipping containers
- Supply Chain Ecosystem Integration: Provide interoperability layer over separate IoT solutions for unified data access and new cross-sector applications

IOT-NGIN

Towards an innovative IoT infrastructure to sustain European industry and values

Abstract

IoT-NGIN is an EU funded, collaborative project aiming at acting as the "IoT Engine" which will unleash the power of Next Generation IoT as an essential dimension of the Next Generation Internet (NGI). The major challenge in the evolving IoT world is the fragmentation of vertically oriented, closed systems where interoperability is still only a dream. The IoT-NGIN strategy is to achieve interoperability through technology-agnostic, secure, open federation. The IoT-NGIN federation approach is:

- on-the-fly adaptation and interpretation of heterogenous data and control messages
- privacy preserving federated ML training – Distributed AI
- keeping the data in their original locations
- Inter-DLT technologies for secure and trusted data sharing
- Zero knowledge techniques for ML models verification

Project Information

Start Date: 1 October 2020

End Date: 30 September 2023

ID: 957246

Programme: Horizon 2020

Keywords: IoT, ML, DLT, Meta-Architecture, 5G, Augmented Reality

Channels

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YouTube: @iot-ngin6208

Main Contact Person (Coordinator): Ghasan, Bhatti, ghasan.bhatti@capgemini.com , Capgemini

Main project (expected) KERs:

- Industrial 5G Core with network slice manager.
- Enhanced IoT/5G Federated D2D API.
- ML as a Service platform.
- ML Online Learning framework.
- Semantic twins.
- IoT Device Discovery.
- Moving Target Defence (MTD) network of Honeypots.
- IoT Vulnerabilities Crawler.
- Privacy-preserving self-sovereign identity solutions.
- Decentralised Interledger Bridge.

Use Cases:

- Traffic Flow Prediction & Parking prediction (Jätkäsaari harbour, Helsinki)
- Crowd Management (Jätkäsaari harbour, Helsinki)
- Co-commuting solutions based on social networks (Jätkäsaari harbour, Helsinki)
- Crop diseases prediction, smart irrigation and precision aerial spraying
- Sensor aided crop harvesting
- Human-centred safety in a self-aware indoor factory environment
- Human-centred Augmented Reality assisted build-to-order assembly
- Digital powertrain and condition monitoring
- Move from reacting to acting in smart grid monitoring and control
- Driver-friendly dispatchable EV charging

MetaOS

(HORIZON-CL4-2021-DATA-01-05)

aerOS

aerOS - Autonomous, scalablE, tRustworthy, intelligent European meta Operating System for the IoT edge-cloud continuum

Abstract

aerOS goal is to design and build a virtualized, platform-agnostic meta operating system for the IoT edge-cloud continuum. As a solution, to be executed on any Infrastructure Element within the continuum aerOS will: (i) deliver common virtualized services to enable orchestration, virtual communication, and efficient support for frugal, explainable AI and creation of data-driven applications; (ii) expose a flexible, everywhere-available API and (iii) include a set of infrastructural services and features addressing cybersecurity, trustworthiness and manageability.

aerOS answers the urgent need for a trustworthy, decentralized, autonomous, orchestrated solution, enabling bottom-up formation of compute continuum ecosystems, where hyper-distributed services are efficiently executed, within any selected "fragment" of heterogeneous physical infrastructure.

In addition, aerOS, will be validated in five relevant real scenarios, covering disparate verticals such as (i) Industry 4.0, (ii) containerized data centers near renewable energies, (iii) high performance agriculture and construction mobile machinery, (iv) digitalized maritime ports and (v) smart and efficient buildings.

Project Information	Channels
Start Date: 1 September 2022	**Website:** https://aeros-project.eu
End Date: 31 December 2025	**Twitter:** @AerosProject
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Programme: Horizon Europe	**YouTube:** @aerOS Project
Keywords: federated orchestration, data fabric, DevPrivSecOps, explainable AI, frugal AI, smart networking, virtualization, data autonomy, lightweight, edge	**Main Contact Person (Coordinator):** Prof. Carlos E. Palau Salvador, cpalau@dcom.upv.es, UPV

Main project (expected) KERs:

- aerOS installable and deployable meta Operating System
- aerOS architecture
- aerOS Federated Orchestation Module
- aerOS Frugal AI
- aerOS Explainable AI methods
- aerOS Smart Data Models (several)
- aerOS Technological Supporting Features (in the form of software components)
- DevPrivSecOps
- aerOS Infrastructure Element design
- aerOS Trust, Authentication and Authorization framework

Use Cases:

- Data-Driven Cognitive Production Lines: Manufacturing Autonomy Level 4 (MAL4) in 4 public-private Pilot Lines.
- Edge Computing near Renewable Energy Sources: EDGE Data Centers connected to smart infrastructure providing Cloud continuity.

FluiDOS

Flexible, scaLable, secUre, and decentralIseD Operating System

Abstract

FLUIDOS will create a fluid, dynamic, scalable, and trustable computing continuum that spans across devices, unifies edge and cloud in an energy-aware fashion, and possibly extends beyond administrative boundaries. FLUIDOS will build upon consolidated Operating Systems and orchestration solutions like Kubernetes, on top of which it will provide a new, enriched layer enacting resource sharing through advertisement/agreement procedures, and hierarchical aggregation of nodes, inspired by Inter-domain routing in the Internet. Intent-based orchestration will leverage advanced AI Algorithms to optimize costs and energy usage in the continuum, promoting efficient usage of edge resources. A Zero-Trust paradigm will allow FLUIDOS to securely control and access geographically diverse resources, while Trusted Computing will provide strong isolation and guarantee a safe deployment of applications and services. FLUIDOS will pursue the above goals through the creation of an open, collaborative ecosystem, focused on the development of a multistakeholder market of edge services and applications, promoting European digital autonomy.

Project Information

Start Date: 01 Sep 2022

End Date: 31 Aug 2025

ID: 101070473

Programme: Horizon Europe

Keywords: Computing continuum, Edge cloud, Resource sharing, Service sharing, Zero trust, Green computing, Kubernetes, Liqo.

Channels

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Main Contact Person (Coordinator): Albert Seubers, albert.seubers@martel-innovate.com, Martel Innovate B.V.

Main project (expected) KERs:

- Extensible, modular node with resource-agnostic abstraction capabilities (PoC software and algorithms).
- Borderless continuum through intent-based, scalable, fluid and decentralised OS (PoC software and algorithms).
- Seamless, Zero-trust Security and Privacy-aware computing continuum (PoC software and algorithms).
- Methodology, algorithms and PoC software to build energy-aware ICT Infrastructures.

Use Cases:

- Intelligent and Resilient Power Grid – Energy: leverage the FLUIDOS continuum to increase the robustness of the ICT network controlling the energy distribution.
- Smart Viticulture – Agriculture: leverage the FLUIDOS continuum to facilitate the deployment of edge-to-cloud services including in rural areas.
- Robotic logistics – Smart factories: leverage the FLUIDOS continuum to optimize computing resources among robots in a factory, while reducing energy consumption.

ICOS

Towards a functional continuum operating system

Abstract

The unstoppable proliferation of novel computing and sensing device technologies, and the ever-growing demand for data-intensive applications in the edge and cloud, are driving a paradigm shift in computing around dynamic, intelligent and yet seamless interconnection of IoT, edge and cloud resources, in one single computing system to form a continuum.

The ICOS project aims at covering the set of challenges coming up when addressing the continuum paradigm, proposing an approach embedding a well-defined set of functionalities, ending up in the definition of an IoT-2Cloud Operating System (ICOS). Indeed, the main objective of the project is to design, develop and validate a meta operating system for a continuum, in a data-driven system built upon the principles of openness, adaptability, data sharing and a future edge market scenario for services and data.

It will address several challenges: device volatility and heterogeneity; continuum infrastructure virtualisation and diverse network connectivity; optimised and scalable service execution and performance; and resource consumption. ICOS will also tackle security, privacy and trust.

Project Information

Start Date: 1 September 2022

End Date: 31 August 2025

ID: 101070177

Programme: Horizon Europe

Keywords: continuum, IoT, edge, cloud, security, cost reduction, openness, adaptability, data sharing, heterogeneity

Channels

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Main Contact Person (Coordinator): Francesco D'Andria (ATOS), francesco.dandria@atos.net

Main project (expected) KERs:

- ICOS platform: Complete set of features and functionalities easing the IoT-edge-cloud continuum management.
- Data Management: Single data platform to facilitate the management of data distributed across the continuum.
- Security and Trustworthy Layer.
- Meta-Kernel: Adaptation engine for monitoring, scheduling and orchestrating workloads across the continuum.
- Intelligent Continuum: Set of techniques for optimising and pruning ML models to be adapted to the characteristics of edge devices without losing accuracy.
- ICOS AI Marketplace: Marketplace connected to other existing model repositories.

Use Cases:

- In-car Advanced Infotainment and Multimedia Management System focusing on optimising the distribution of multimedia content even in low-connectivity situations.
- Agriculture Operational Robotic Platform optimising farming with agro robots for precision agriculture.
- Railway Structural Alert Monitoring System improving the railway monitoring process minimising maintenance costs.
- Energy Management and Decision Support System focusing on the energy consumption in smart homes.

NebulOuS

A Meta Operating System for Brokering Hyper-Distributed Applications on Cloud Computing Continuums

nebulous

Abstract

NebulOuS will develop a novel Meta Operating System and platform for enabling transient fog brokerage ecosystems that seamlessly exploit edge and fog nodes, in conjunction with multi-cloud resources, to cope with the requirements posed by low latency applications. NebulOuS will accomplish substantial research contributions in the realms of cloud and fog computing brokerage by introducing advanced methods and tools for enabling secure and optimal application provisioning and reconfiguration over the cloud computing continuum.

Project Information

Start Date: 01 September 2022

End Date: 31 August 2025

ID: 101070516

Programme: Horizon Europe

Keywords: cloud and fog computing brokerage, cloud computing continuum, Meta Operating System

Channels

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YouTube: @nebulouscloud

Main Contact Person (Coordinator): Maria Navarro Abellán, maria.navarro@eurecat.org, Eurecat

Main project (expected) KERs:

- NebulOuS Meta-OS platform;
- Semantic models for fog brokerage;
- Multi-Criteria Decision Making (MCDM) based cloud & fog service brokerage;
- Optimized application life cycle Management;
- Autonomous and secure reconfiguration support;
- Distributed Event Management System (EMS) with automatic anomaly detection.

Use Cases:

- Windmill Maintenance: validate the NebulOuS framework in deploying wind turbine inspection software in an optimal way, making appropriate use of cloud and fog resources.
- Computer Vision for City Maintenance: The NebulOuS goal is to give connectivity, edge analytics, and interoperability to these cities, giving them the capacity to evolve.
- Supply of fresh food to a city: Digital Twin approach under the meta-OS of NebulOuS, which will enable efficient and decentralized management.
- Precision Agriculture: The goal of NebulOuS is enhancing all the data processing jobs to their fullest potential.
- Crisis Management: NebulOuS' purpose is to enable widespread communication and computing even in crisis scenarios by delivering a flexible fog computing platform that can adapt to the situation at hand.

NEMO

Next Generation Meta Operating System

Abstract

Massive IoT deployment and data generation are pushing for more effective operations on data and human-machine interactions management and analytics. This introduces the concept of Artificial Intelligence of Things (AIoT), a fusion of AI and IoT, supported by edge and cloud capabilities. Based on this, NEMO aims to establish itself as a game changer of AIoT-edge-cloud continuum proposing the next generation of open, modular and cybersecure meta-operating system. By exploiting existing open-source technologies and standards, while introducing new models, methods and tools, NEMO will bring intelligence closer to the data and make AI-as-a-Service an integral part of micro-services' lifecycle management. NEMO will introduce innovations at different layers of the protocol stack, enabling on-device Cybersecure Federated ML/DRL, deliver time-triggered (TSN) multipath ad-hoc/hybrid self-organized and zero-delay failback/self-healing multi-cloud clusters, multi-technology Secure Execution Environment and on-Service Level Objectives meta-Orchestrator, Plugin and Apps Lifecycle Management and Intent Based tools. Moreover, NEMO will be validated in 5 industrial sectors in 5 +1 Living Labs.

Project Information	Channels
Start Date: 1 September 2022	**Website:** https://meta-os.eu/ and https://nemo-iot.eu/
End Date: 31 August 2025	**Twitter:** @HE_NEMO_Project
ID: 101070118	**LinkedIn:** https://www.linkedin.com/in/HE-NEMO/
Programme: Horizon Europe	**YouTube:** @henemoproject
Keywords: Internet of Things, Continuum, Edge, Cloud, AI	**Main Contact Person (Coordinator):** Enric Pages, enric.pages@atos.net, ATOS

Main project (expected) KERs:

- CMDT: is a component that abstracts the concept of digital twins which allows the service orchestrator to deploy applications both at the edge and in the central cloud.
- CF-DRL: CyberSecure Federated Deep Reinforcement Learning framework introducing a Cybersecure Federated MLOps layer.
- mNCC: is focused on the creation, life-cycle management, and assurance of the end-to-end connectivity in the edge-cloud-networking continuum.

- PRESS: Safety and Policy enforcement framework for providing multi-faced, policies able to cope with the different aspects of the applications life cycle.
- SEE: The framework will be developed to enable migration of micro-services, unikernels and binaries to the IoT devices, the edge, or the cloud.
- MOCA: will enable flexible business models and accelerate pre-commercial exploitation of multi-tenant AIoT-Edge-Cloud continuum via DLT-based smart contracts.
- meta-Orchestrator: A SLO-sensitive meta-orchestrator which facilitate the distribution of computing workflow from IoT up to edge-cloud while respecting policies and KPIs, including significant reduction of the energy consumption and the CO2 footprint
- Plugin Manager: NEMO Plugin & Applications Life-Cycle Manager is flexible mechanism for unified, just-in-time plugins and applications life cycle management.
- MaaS: Migration as a Service (MaaS) will offer "Intent-based Migration as a Service" and process automations towards ZeroOps deployment.
- Digital Identity Attestation: Tools and extensions that are needed to ensure end-to-end secure, trusted, and traceable micro-services execution, along with encryption and identity verification.

Use Cases:

- Aerial Precision Bio-Spraying: Protect the olive trees from olive fruit fly through aerial spraying. Optimize the use of bio-spraying, without compromising organic certification.
- Terrestrial Precision Bio-Spraying: by using semi-autonomous robots equipped with cameras to locate weeds and enable optimal precision spraying with organic insecticide.
- Smart Grid Flexibility: Monitoring and analysing the MV/LV electricity voltage quality to identify potential local energy grid discrepancies and unstable operational boundaries.
- Smart Mobility/City: will realise driver-friendly scenarios for smart city mobility and dispatchable charging of EVs based on RES demand-response along with human-centred smart micro-contracts and micro-payments.
- Fully automated indoor logistics/supply chain: We aim to fully automate controlled material picking from Auto Store and autonomous transfer to the production line.
- Human-centred indoor factory environment safety: will provide a high precision AGV localization layer merging real time localizations info obtained from cognitive sensors.
- Round of Athens Race: Enhance the live sport event spectating experience by enriching the content through AI driven data and content analysis and XR capabilities.
- XR Time Machine: We aim to optimise multi-sensorial stimuli via effects such as wind, heat, vibration, in addition to audiovisual (AV) and tactile.

NEPHELE

A lightweight software stack and synergetic meta-orchestration framework for the next generation compute continuum

nephele

Abstract

The vision of NEPHELE is to enable the efficient, reliable and secure end-to-end orchestration of hyper-distributed applications over programmable infrastructure that spans across the compute continuum, removing existing openness and interoperability barriers and introducing automation and decentralized intelligence mechanisms powered by 5G and distributed AI technologies. The NEPHELE project introduces two core innovations, namely: (i) an IoT and edge computing software stack for leveraging virtualization of IoT devices at the edge part of the infrastructure and supporting openness and interoperability aspects in a device-independent way; and (ii) a synergetic meta-orchestration framework for managing the coordination between cloud and edge computing orchestration platforms, through high-level scheduling supervision and definition, based on the adoption of a "system of systems" approach. The NEPHELE outcomes are going to be demonstrated in various vertical industries, including areas such as disaster management, logistic operations in ports, energy management in smart buildings and remote healthcare services.

Project Information

Start Date: 1 September 2022

End Date: 31 August 2025

ID: 101070487

Programme: Horizon Europe

Keywords: IoT software stack, virtual object, digital twin, synergetic orchestration, computing continuum

Channels

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YouTube: @nepheleproject6432

Main Contact Person (Coordinator): Prof. Symeon Papavassiliou, papavass@mail.ntua.gr, National Technical University of Athens

Main project (expected) KERs:

- Virtual Object Stack (VOStack) as an IoT and edge computing software stack for leveraging virtualization of IoT devices at the edge part of the infrastructure.
- Synergetic meta-orchestration framework for managing the synergy between cloud and edge computing orchestration platforms.
- Development of a set of Virtual Objects (VOs) for specific types of IoT Devices.
- Development of a set of IoT enablers and a set of virtualized IoT-specific functions.
- Implementation of successful demonstrators in a set of vertical industries based on WP6 activities and the outcomes of the open call.

Use Cases:

- Use Case #1: Emergency/Disaster Recovery
- Use Case #2: AI-assisted Logistics Operations in the Port of Koper
- Use Case #3: Energy management in smart buildings/cities
- Use Case #4: Remote healthcare services

Cognitive Cloud

(HORIZON-CL4-2022-DATA-01-02)

CODECO

Cognitive Decentralized Edge Cloud Orchestration

Abstract

The overall aim of CODECO is to contribute to a smoother and more flexible support of services across the Edge-Cloud continuum via the creation of a novel, cognitive Edge-Cloud management framework. To achieve this aim, CODECO proposes 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.

CODECO shall develop an ecosystem consisting of open-source toolkits, large-scale experimentation, training tools and events, use-cases across 4 vertical domains (Smart Cities, Energy, Manufacturing, Smart Buildings), multiple events integrated into a unique Innovation and Research Community Engagement Programme.

The CODECO consortium comprises a total of 16 partners across Europe and its associated states Israel and Switzerland. The consortium partners represent several types of organizations, ranging from SMEs with a focus on open-source software and innovation management (Inova Mais, Eclipse Foundation, Almende); renowned universities (University of Göttingen, Universidad Politecnica de Madrid, University of Pireus research Center) and research institutes (fortiss, I2CAT, ATHENA); large companies (ATOS, Telefonica, Siemens, Intracom-Telecom, RedHat, Netsoft-Intrasoft, IBM).

Project Information

Start Date: 01 January 2023

End Date: 31 December 2025

ID: 101092696

Programme: Horizon Europe

Keywords: Edge, Cloud, Kubernetes, orchestration, IoT, federated Learning, data, network, computation

Channels

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YouTube: @fortissTV/playlists

Main Contact Person (Coordinator): Rute, C. Sofia, sofia@fortiss.org, fortiss GmbH

Main project (expected) KERs:

- Open, cognitive toolkits ans smart App
- Edge-Could Use-cases
- Open-source Eclipse repository
- R&I Engagement Programme
- Training Database
- Open Experimental Framework

Use Cases:

- **P1:** Smart Monitoring of the Public Infrastructure (Smart Cities)
- **P2:** Vehicular Digital Twin for Safe Urban Mobility (Mobility)
- **P3:** Media Delivery Streaming across Decentralized Edge Use-case (Smart Cities)
- **P4:** Collective Demand Side Management in Decentralized Grids (Energy)
- **P5:** Decentralized, Wireless AGV Control for Flexible Factories (Manufacturing)
- **P6:** Smart Buildings (Energy)

ACES

Autopoietic Edge-Cloud Services

Abstract

ACES researches and develops an open common AI and ML-enabled architecture to respond to the increasing need of cloud-type services at the edge, independent of any platform. It provides end-to-end transaction resilience; reliability and stability of automation in infrastructure utilization and services management and secure flows of sensitive data and applications. ACES delivers optimises computing and network management, storage, and analytics, using AI and M/L techniques. Our project uses autopoiesis, a combination of reductionist and emergent AI/ML to manage resources and workloads in respect to edge-relevant requirements such as latency, energy efficiency, security, and throughput. The objective is to create a platform that enables autonomous behaviour in the smallest building blocks of edge embedded datacenters and ensures optimised data management, storage, replication, and data movement. The ACES platform data collection and intelligence will support research regarding edge infrastructures and improve the experience of operators, software and application developers as well as end-users. The value creation of the ACES platform for edge supporting infrastructure will be demonstrated in the Greek energy sector, the intelligent grid. ACES allows the creation of a resilient edge infrastructure that processes locally big data and AI, supporting the future management, autonomy and interoperability between microgrids.

Project Information

Start Date: 01 January 2023

End Date: 31 December 2026

ID: 101093126

Programme: Horizon Europe

Keywords: Edge Services Architectures; cognitive edge-cloud, energy efficient infrastructure, autopoiesis, resilient autonomous edge

Channels

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YouTube: @aces-horizon

Main Contact Person (Coordinator): Fernando Ramos, fvramos@tecnico.ulisboa.pt, INESC ID

Main project (expected) KERs:

- Autopoiesis cognitive edge-services cloud: Intelligent highly automated full edge-services stack
- Cognitive framework: Platform with awareness tools, AI/ML agents for workload placement, service, resource, and policy management, telemetry and monitoring
- Autopoiesis framework: Platform bio-mimic agents for workload placement, service and resource management, data and policy management, telemetry and monitoring
- Swarm orchestration: technology-based methodology and implementation for orchestration of resources in the edge.
- Workload placement and optimization: edge-wide workload placement and optimization service and implementation of scalable ML to facilitate this.
- Application store: "App store" for storage of AI models, incl. search, compare, rate, share and auto-deployment functions.

Use Cases:

- (uc1) Marketplace management and asset distribution for energy supply and demand from microgrids, across a wide region and islands in Greece.
- (uc2) Distributed process management to decentralise the energy power flows in the Greek grid.
- (uc3) IoT based asset monitoring and management deploying an Advanced Metering Infrastructure system using data from grid-edge sensors and GIS systems.
- Manned-unmanned operations trainer

SovereignEdge. COGNIT

A Cognitive Serverless Framework for the Cloud-Edge Continuum

Abstract

An effective platform for the cognitive cloud-edge continuum must address a number of unsolved challenges, many of them derived from constrained resource devices, infrastructure heterogeneity, and the need to meet criteria such as performance, resilience, security, data sovereignty, and energy efficiency. A disaggregated architecture is required, making use of Artificial Intelligence, automation, and portability to manage and adapt resources and workloads, and to respond in real time to any incidents and security threats. This innovative approach requires computation-intensive data processing functions to be easily executed outside edge devices, sensors, and actuators. The COGNIT Project will implement a new distributed Function-as-a-Service (FaaS) paradigm for edge application management and smart orchestration, which will change how applications and services are deployed and executed along the increasingly heterogeneous cloud-edge continuum. Our AI-enabled adaptive serverless framework will provide applications access to a continuous data processing environment that abstracts the large-scale, geo-distributed, and low-latency capabilities provided by the cloud-edge continuum.

Project Information

Start Date: 1 January 2023

End Date: 31 December 2025

ID: 101092711

Programme: Horizon Europe

Keywords: System Software, Cloud Computing models, Cloud Architectures, Open Source Software, Cloud Infrastructures

Channels

Website: https://cognit.sovereignedge.eu

Twitter: @SovereignEdgeEU / #COGNITproject

LinkedIn: https://www.linkedin.com/company/Sovereign-Edge-EU

YouTube: https://vimeo.com/sovereignedge

Main Contact Person (Coordinator): Dr Alberto P. Martí, amarti@opennebula.io, OpenNebula Systems

Main project (expected) KERs:

- Open source software for new distributed FaaS model with new features to enablenew user interfaces and programming models.
- Open source vendor-neutral abstraction layer for serverless workloads to enable portability, mobility, and self-adaptation across the cloud-edge infrastructure.
- Open source software for automatic and intelligent adaptation of the cloud-edge continuum to enable intelligent adaptation and energy efficiency in the cloud-edge.
- Open source distribution for AI-enabled Cloud-Edge Serverless Framework for value-added infrastructure services.
- Open source distribution for AI-enabled Cloud-Edge Serverless Framework for business partnerships with HW vendors using a European open source edge stack.
- Demonstrators in key application domains which require more power at the edge for gaining competitive advantage and bringing a more complete solution.

Use Cases:

- Smart Cities: An intelligent transport system, featuring city-wide distributed decision-making capabilities at the edge based on dense networks of infrastructure resources.
- Wildfire Detection: Early wildfire detection in remote rural areas, featuring energy management and unpredictable rare events with sudden peaks of data processing requests.
- Energy: Resource-constrained, smart energy meters managing EV charging and heating looking at optimising local green energy usage and energy costs in a microgrid context.
- Cybersecurity: Anomaly detection and remediation in a smart mobility-context, featuring live migration between 5G locations and management of security policies at the edge.

Decice

Device-Edge-Cloud Intelligent Collaboration framEwork

Abstract

The cloud computing industry has grown massively over the last decade and with that new areas of application have arisen. User requirements such as ultra-low latency, security and location awareness (e.g., Smart Cities) are becoming more common. Modern cloud applications have also become more complex and need to be placed in locations close to the user. Unifying diverse systems into centrally controlled compute clusters and providing sophisticated scheduling decisions across them are two major challenges in this fi eld. DECICE aims to develop an open and portable cloud management framework for automatic and adaptive optimization of applications by mapping jobs to the most suitable resources in a heterogeneous system landscape, including computing from the very large (e.g., HPC) systems to the very small (e.g., IoT sensors connected on the edge). By utilizing holistic monitoring, the project constructs a Digital Twin of the system that reflects on the original system. An AI-Scheduler makes decisions on placement of job and data as well as conducting job rescheduling to adjust to system changes. A virtual training environment is provided that generates test data for training of ML-models and the exploration of what-if scenarios. The portable framework is integrated into the Kubernetes ecosystem and validated using relevant use-cases (smart traffic control, digital healthcare, and intelligent emergency response) on realworld heterogeneous systems.

Project Information

Start Date: 1 November 2022

End Date: 31 October 2025

ID: 101092582

Programme: Horizon Europe

Keywords: AI-scheduling, digital twin, system monitoring, machine learning, heterogeneous systems, data centers, edge computing, Kubernetes

Channels

Website: https://www.decice.eu/

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Main Contact Person (Coordinator): Prof. Dr. Julian Kunkel, office@decice.eu (UGOE)

Main project (expected) KERs:

- Result 1.1: The DECICE framework
- Result 2.1: Improved Kubernetes job scheduler
- Result 2.2: Automated deployment mechanism for applications on the available resources
- Result 2.3: Energy-efficiency demonstration results showing a reduction of energy consumption
- Results 3.1: DECICE API supporting control of network, computing and data resources.
- Result 4.1: Code of the Dynamic Digital Twin implementation
- Result 4.2: Prediction of various system metrics with an accuracy of 90%.
- Result 5.1: Use case implementations and obtained performance results.
- Result 6.1: Evaluation of how the DECICE framework allows cloud service providers to reach a high level of trustworthiness and comply with information security frameworks like Cloud Computing Compliance Controls Catalogue (C5).

Use Cases:

- Intelligent Intersection with VRU Detection (MARUN)
  - Enhancing Autonomous Driving with Device-Edge-Cloud Intelligent Collaboration Framework.
- MRI Scans (GWDG)
  - Providing fast image analysis and preventing data storage on unregistered devices.
- In-the-Field Intelligence Supporting Emergency Response (UNIBO)
  - Aims at developing an open digital platform to support emergency response operators exploiting data from drones and satellites.

EDGELESS

Cognitive edge-cloud with serverless computing

Abstract

EDGELESS is set to efficiently operate serverless computing in diverse computing environments, from resource-constrained edge devices to highly-virtualised cloud platforms. By taking advantage of AI/ML solutions, it will enable automatic deployment and reconfiguration to fully exploit compute resources available on clusters of edge nodes. EDGELESS will define novel orchestration systems that provide a flexible horizontally scalable compute solution able to fully use heterogeneous edge resources, while preserving vertical integration with the cloud and the benefits of serverless. This challenge will be met via distributed computing solutions to partition the edge environment in clusters that cooperate to compose complex applications on-demand. In each cluster, orchestration and scheduling of jobs will run smoothly thanks to real-time monitoring and anticipatory AI-powered algorithms to manage lightweight virtualised lambda executors, e.g., unikernels. EDGELESS innovations will be validated through testbeds, integrated through a federated edge-cloud infrastructure, and three pilots: Autonomous Smart City Surveillance, Internet of Robotic Things, and HealthCare Assistants.

Project Information

Start Date: 1 January 2023

End Date: 31 December 2025

ID: 101092950

Programme: Horizon Europe

Keywords: cloud architecture, AI/ML, orchestration, real-time data analytics, edge systems, distributed computing, smart city, internet of robotic things, healthcare assistant

Channels

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YouTube: @edgelessproject

Main Contact Person (Coordinator): Antonio Paradell, antonio.paradell@worldline.com, Worldline Iberia

Main project (expected) KERs:

- R#1 - State management framework at the edge. Distributed data management and persistence in a local cluster to enable the execution of stateful FaaS functions.
- R#2 - Small device hypervisor. Framework for the execution of serverless functions on small devices, starting from lightweight virtualisation tools, such as unikernels.
- R#3 - Specialised HW serverless executor. Transparent and efficient execution of functions on devices with specialised hardware for computationally-intensive tasks.
- R#4 - Trusted Execution Environment. Deployment of FaaS executors in a secure and efficient manner, with little overhead, on edge nodes with matching capabilities.
- R#5 - Physically-isolated secure elements. Firmware to run lambda executors signed directly in microcontrollers and IoT devices in a secure and isolated environment.
- R#6 -controller. Dynamic provisioning of ancillary functions, with consensus and distributed ML algorithms to select best candidate for serverless functions execution.
- R#7 - orchestrator. Cognitive orchestrator including hypervisor, virtualisation and AI processes for automatic adaptation of lambda functions to available cluster nodes.
- R#8 - SLA in serverless edge/cloud context. Serverless SLA manager for complex edge topologies with AI-based anomaly detection to prevent SLA violations.

Use Cases:

- UC#1 - Autonomous Smart City Surveillance. Increase citizens safety by monitoring strategic geographical places through a city-wide distribution of CCTV cameras.
- UC#2 - Internet of Robotic Things. AI-supported reconfiguration of manufacturing systems to handle large-scale factory automation and flexible manufacturing.
- UC#3 - HealthCare Assistant. ML-enabled personalised assistant for seniors and patients living at home capable of detecting behaviour anomalies and take decisions.

MLSysOps

Machine Learning for Autonomic System Operation in the Heterogeneous Edge-Cloud Continuum

Abstract

MLSysOps will enable autonomic end-to-end system management across the cloud-edge continuum. A hierarchical, agent-based AI architecture will interface with the underlying resource management/provisioning and application deployment/orchestration mechanisms. Adaptivity will be achieved through MAPE loops controlled by explainable ML models. ML models will incorporate changes to the execution environment through continual learning orchestrated in par with application execution. Support for plugin ML models will enhance the openness and extensibility of the system. An innovative, portable, container-based technology will enable flexible application execution on heterogeneous infrastructures. The key concerns to be addressed by MLSysOps using ML are energy efficiency, performance, low latency, transparent tier-less storage, cross-layer orchestration including resource-constrained devices, resilience to imperfections/attacks of physical networks, and trust. The framework will be evaluated using research testbeds and two real-world application testbeds in the domain of smart cities and smart agriculture. Realistic system simulators will be used to conduct scale-out experiments.

Project Information

Start Date: 01 January 2023

End Date: 31 December 2025

ID: 101092912

Programme: Horizon Europe

Keywords: cloud/edge computing; IoT; system software; machine-learning, continual & explainable learning; application deployment & orchestration; multi-agent systems; heterogeneous platforms; energy-efficiency & green operation.

Channels

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LinkedIn: https://www.linkedin.com/company/mlsysops/

Main Contact Person (Coordinator): Spyros Lalis, lalis@uth.gr, University of Thessaly

Main project (expected) KERs:

- Framework for end-to-end system management and configuration across the cloud-edge-IoT continuum based on a hierarchical ML agent architecture.
- Methods for flexible and adaptive application deployment and orchestration in the continuum.
- Methods for transparent computation acceleration on top of heterogeneous platforms.
- Methods for transparent storage in the continuum.
- Methods for the management of last mile wireless network resources.
- Methods for the management of data break-out and UPFs in 5G networks.
- Methods for the management of trust for edge nodes.
- Methods for energy efficient and green system operation at the edge and in the cloud.

Use Cases:

- Smart Agriculture: Improved detection of weeds on crop fields using cameras and embedded computing systems on a tractor and a drone.
- Smart City: Improved management of pedestrian and car traffic on public streets using cameras and embedded computing systems on smart lampposts.

AC3

Agile and Cognitive Cloud edge Continuum management

Abstract

The ever-growing resource needs of modern-day applications regarding guaranteed low latency and the massive data transfer rate are constantly pushing the boundaries of technologies and requiring a paradigm shift. To cater for these escalating resource needs, modern IT computing platforms have evolved beyond the more traditional central cloud/DC with bleeding-edge processing powers and high-capacity networking infrastructure to extend their coverage all the way to the network edge, which may also include the far-edge nowadays. This creates a new paradigm called cloud edge computing continuum (CECC), whereby the services span from core cloud to edge and far edge. To efficiently manage and continuously optimize resources through this new model using the CECC approach, we propose an Agile and Cognitive Cloud-edge Continuum (AC3) management framework. This framework will play a critical role in providing scalability, agility, effectiveness, and dynamicity in service delivery over the CECC infrastructure. AC3 will offer a common and secure federated platform that manages data sources, CECC resources, and application behaviour in a unified and harmonized manner to ensure the desired SLA and save energy consumption. Moreover, the AC3 platform can adapt to a different context and events happening in the network, such as lack of resources, data deluge, or mobility of data source, by managing (i.e., deploying or migrating) micro-services across CECC infrastructures. AC3 will leverage AI, ML, and semantic and context awareness algorithms to provide an efficient life cycle management system of services, data sources, and CECC resources for ensuring low response time and high data rate while saving energy consumption.

Project Information

Start Date: 1 January 2023

End Date: 31 December 2025

ID: 101093129

Programme: Horizon 2020

Keywords: Cloud Infrastructures, Cloud trust & security, Computer architecture, pervasive computing, ubiquitous computing, Internet of Things

Channels

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Main Contact Person (Coordinator): Prof. Christos Verikoukis, cveri@isi.gr, ATH/ISI

Main project (expected) KERs:

- An intelligent CECCM component that handle micro-service-based application LCM and efficiently manages the CECC federated infrastructure.
- A band new data management scheme provided as PaaS integrated with the CECCM and available via a GUI to application developers.
- Semantic-aware language allowing the application developers to specify intents and policies regarding computing, network and data.
- A new trust and security-oriented mechanisms that accelerate federation and resource sharing as well the first common API for resource federation in CECC.
- Innovative explainable AI algorithms for green-oriented resource management of the CECC infrastructure
- AI/ML aided application profile definition and creation to reduce by 80% application SLA violation.
- Definition of new SLA model for micro-service-based application in CECC
- New mechanisms for seamless migration of micro-service (including stateful micro-services) on the CECC infrastructure including far edge.
- 3 UCs that will demonstrate the advantage of CECC to the scientific community and the private sector.

Use Cases:

- Use-case 1: IoT and Data (LEAD: IQU/SPA): The CECCM's capabilities will be demonstrated to deploy and run microservices at the edges of the monitored infrastructure allowing us to build applications that take advantage of edge infrastructures, provide lower latency in the computation process, as close as possible to the point of data generation, with increased data security and privacy. It also allows developers to accelerate the development and distribution of their application in all the levels of the cloud-edge continuum.
- Use case 2: Smart Monitoring System using UAV (LEAD: FIN/EUR): A smart monitoring system is proposed that will harness the current proliferation of video surveillance devices using enabling technologies and techniques, such as UAVs, far edge, AI, and ML. The objective of this use case is to demonstrate the flexibility that offers CECM to the application for changing its behaviour in an easy and seamless. Moreover, we will demonstrate the CECM's capabilities to deploy and run micro-services on top of the far edge (e.g., UAV) and anticipate drone unavailability by migrating the micro-service from one drone to another or the infrastructure edge.
- Use-case 3: Deciphering the universe: processing hundreds of TBs of astronomy data (LEAD: UCM/RHT): The CECCM's capabilities will be demonstrated to deploy and run astronomical software to potentially process hundreds of TBs of data cubes. This will allow us to integrate scientific applications that will take advantage of hybrid cloud native infrastructures, to optimize the computation process based on smart AI algorithms. The implementation of this UC also enables the whole astronomy community, scientific and research teams to accelerate the analysis of the novel data gathered from newer and additional instruments and data sources, such as JWST.

COGNIFOG

AI-empowered Edge Cloud Continuum for self-aware cognitive computing environments

Abstract

Next generation enablers, such as IoT, AI and cloud computing come with significant data management challenges.

COGNIFOG proposes to build a Cognitive Fog Framework to: (i) reduce energy consumption and latency in next generation IT systems by reducing the network traffic, by analysing data at the edge closer to where they are generated, rather than routing them through the communication networks to a data center; (ii) reduce OPEX and faster service provisioning by providing a cognitive, self-adaptive framework with minimum or no human intervention, with dynamic provisioning of computing, storage and networking resources along the far-edge-to-edge-to-cloud path; (iii) ensure European leadership by providing an open interoperable framework with open APIs for application developers to rapidly create and deploy applications benefiting the edge-cloud continuum on top of heterogenous IoT/IT systems.

COGNIFOG will validate project results in three representative application domains: critical collaboration missions, smart health and smart industry. With a consortium of 12 European partners, leaders in their domains, COGNIFOG will be a cornerstone in the cognitive fog computing domain.

Project Information

Start Date: 1 January 2023

End Date: 31 December 2025

ID: 101092968

Programme: Horizon Europe

Keywords: Edge to cloud continuum, Artificial Intelligence, IoT, Security, Orchestration

Channels

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Main Contact Person (Coordinator): Selma Azaiez, selma.azaiez@cea.fr, CEA

Main project (expected) KERs:

- A comprehensive set of advanced technological solutions provided by the COGNIFOG project, will be exploited commercially by industrial consortium partners after the end of the project.
- A number of advanced technological and methodological elements of COGNIFOG, will be offered as a free open-source version immediately after the end of the project.
- Innovative joint business models (co-developed with the stakeholders possibly through a joint venture) that will support the decision making in the selection of internet connectivity options and edge technology solutions tailored to the needs of vertical industries
- Enrich scientific knowledge through scientific publications in journals and datasets, broadening existing knowledge and capacity of relevant research domain and fields and incorporating COGNIFOG's scientific innovations in partner's MSc and/or PhD curricula.

Use Cases:

- UC1 (Thales, Paris-Saclay) - Collaborative Missions in urban areas : it will validate the integration of COGNIFOG building blocks to support coordinated crisis management, with a focus on demonstrating the dependability and time-predictability of cloud-native services.
- UC2 (TMA, Piraeus Greece) - E-health services in the Edge-Cloud Continuum: it will showcase the use of edge computing in e-health services, with further cloud processing and storage using an AI framework.
- UC3 (LMS, Patras Greece) - Automated Edge-Cloud Continuum for smart manufacturing: it twill improve shopfloor efficiency by introducing flexible mobile dual-arm robots controlled by a flexible IT infrastructure.

CLOUDSKIN

Name description

Abstract

As of today, 80% of the data processing and analysis occurs in cloud data centers, and only 20% of processing occurs at the edge. CloudSkin pursues to build a cognitive cloud continuum platform with three main innovations: 1. The CloudSkin platform will leverage AI/ML to optimize workloads, resources, energy, and network traffic for a rapid adaptation to changes in application behavior and data variability, re-configuraing the "sweet spot" between the cloud and the edge in the face of the rapid varying conditions; 2. The CloudSkin platform will also help users to achieve "stack identicality" across the Cloud-edge continuum, whereby the same (legacy) software stacks (e.g., MPI programs) running in data centers can seamlessly run at remote edges. The development of a new lightweight, portable virtualizaion abstraction will be paired with the development of new confidential abstractions to protect data while it is in use; and 3. CloudSkin will also contribute to prepare the needed infrastructure to integrate the new virtualized execution abstractions into the virtual resource continuum, particularly, for those Cloud-edge applications composed of small tasks with fast data access and sharing requirements.

Project Information

Start Date: 1 January 2023

End Date: 31 December 2025

ID: 101092646

Programme: Horizon Europe

Keywords: Cloud Computing models, System Software, Trustworthy ICT

Channels

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Main Contact Person (Coordinator): Marc Sanchez, marc.sanchez@urv.cat, Universitat Rovira I Virgili (URV)

Main project (expected) KERs:

- World-wide impact in the OMICS community. Massive adoption of EMBL's METASPACE, tens of entities joining the system.
- High impact in Surgery video analytics community. Dresden (NCT) create the first international data space on surgery based on open source project technologies. A number of German and Spanish hospitals show interest in the technology.
- Highly cited publication in bioinformatics & OMICS technology (e.g., Nature).
- CLOUDSKIN's novel technologies, namely AI-enabled orchestration; virtualization; and fast storage adopted by several Cloud and edge providers around the world like IBM, but also European ones like KIO or OVHCloud. Adoption of AI-enabled orchestration in 5G telco operators.
- AI/ML models developed in CLOUDSKIN will enhance the orchestration capabilities and place the NearbyOne platform by NRB in an advantageous position in the market.
- Highly cited scientific publication (e.g., NSDI, FAST) in in data-driven analytics over Object Storage.

Use Cases:

- 5G automotive - Edge orchestration and video analytics (BSC, NRB, TRD)
- Metabolomics - A large number of small short-lived tasks with fast data access and sharing requirements (EMBL)
- Surgery - Video stream of an endoscope live surgery must be analyzed using AI in real time (NCT, DELL)
- Agriculture IoT - Agriculture data space and water usage footprint (ALT)

Swarm Computing

(HORIZON-CL4-2022- DATA-01-03)

OASEES

Open Autonomous programmable cloud appS & smart EdgE Sensors

Abstract

OASEES aims to create an open, decentralized, intelligent, programmable edge framework for Swarm architectures and applications, leveraging the Decentralized Autonomous Organization (DAO) paradigm and integrating Human-in-the-Loop (HITL) processes for efficient decision making. The OASEES vision is to provide the open tools and secure environments for swarm programming and orchestration for numerous fields, in a completely decentralized manner. An important aspect in this process is identification and identity management, in which OASEES targets the implementation of a portable and privacy preserving ID federation system, for edge devices and services, with full compliance and compatibility to GAIA-X federation and IDSA trust directives and specifications. This situation solidifies the need for an integrated enabler framework tailored to the edge's extreme data processing demands, using different edge accelerators, i.e. GPU, NPU, SNN and Quantum.

Project Information

Start Date: 01 January 2023

End Date: 31 December 2025

ID: 101092702

Programme: Horizon Europe

Keywords: Decentralized Autonomous Organization, Human-in-the-Loop, Self Sovereign Identity , Object ID

Channels

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Main Contact Person (Coordinator): Akis Kourtis, akis.kourtis@iit.demokritos.gr, NCSR "Demokritos"

Main project (expected) KERs:

- OASEES SDK and Lifecycle Management
- OASEES Node agents
- Security and Trust Services
- Brokerage Service & Data Exchange
- OASEES UI and Notebooks
- MLOps Enablers
- OASEES Edge Node

Use Cases:

- E-Health: Smart Nodes for Analysis of Voice, Articulation and Fluency disorders in Parkinson Disease
- Mobility: EVs fleet coordinated recharging to support optimal operation of electricity grid
- Security: Drone Swarm over 5G for High Mast Inspection
- Buildings: Swarm powered intelligent Structural safety assessment for Buildings
- Industrial: Robotic Swarm powered Smart Factory for I4.0
- Renewable Energy: Smart Swarm Energy harvesting and Predictive Maintenance Wind turbines

Tardis

Trustworthy and Resilient Decentralised Intelligence for Edge Systems

Abstract

Developing and managing distributed systems is a highly complex task requiring expertise across multiple domains. This complexity increases when considering highly dynamic swarm systems that require decentralised solutions to cope with their scale and inherent heterogeneity.

TaRDIS aims to assist developers in building correct and performant systems by combining a novel programming paradigm with a toolbox of programming tools, libraries, middleware, and theories, which encapsulate the core abstractions and services to build and execute swarm applications. TaRDIS's correct-by-design approach relies on sophisticated verification techniques to automatically analyse interactions between the different components of a distributed system. While, TaRDIS distributed middleware provides essential services, including data management and decentralised machine learning components.

TaRDIS approach is guided and validated by four compelling use cases by high-impact industrial partners ranging from swarms of satellites, dynamic marketplaces in the energy sector, decentralised machine learning solutions for data privacy-preserving applications, to distributed control processes of smart factories.

Project Information

Start Date: 1 January 2023

End Date: 31 December 2025

ID: 1010930

Programme: Horizon Europe

Keywords: swarm systems, event-based programming paradigm, decentralised machine learning, correct-by-construction design, formal verification techniques, distributed data management, interoperable middleware

Channels

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YouTube: @TaRDISproject

Main Contact Person (Coordinator): Carla, Ferreira, carla.ferreira@fct.unl.pt, NOVA School of Science and Technology

Main project (expected) KERs:

- Novel low-code programming paradigm supported by analysis tools for checking communication protocols, data security and integrity.
- Techniques, algorithms, and models for decentralised learning with partially replicated data and contextual information for trustworthy swarm applications.
- Algorithms and protocols for mainstream toolchains and pipelines, with replication and coordination, for heterogeneous swarms.
- Open source interoperable and extensible toolbox, including development environment, and runtime support for heterogeneous swarms.

Use Cases:

- Multi-level smart charging towards a more sustainable and resilient energy system, with reduced CO2 emissions and increased grid stability.
- Privacy-preserving federated learning framework towards collaborative intelligence amongst devices and correct-by-design privacy-preserving solutions.
- Distributed navigation for satellite constellations towards a higher degree of autonomy by optimizing the satellite resources and lowering the computational load.
- Highly resilient factory shop floor digitalisation towards increased agility and flexibility with stringent optimization of resource usage and minimizing waste.

Incode

Programming Platform for Intelligent Collaborative Deployments over Heterogeneous Edge-IoT Environments

INCODE

Abstract

The INCODE project aims at innovating and creating a wide-open, secure, and trusted IoT-to-edge-to-cloud compute continuum that will realize the true potentials of edge intelligence.

To this aim, the INCODE project will design and develop an open platform for the deployment and dynamic management of end-user applications, over distributed, heterogeneous, and trusted IoT-Edge node infrastructures, with enhanced programmability features and tools. The platform will do so by implementing innovative design approaches and will constitute a fully-integrated infrastructure under the cloud–managed INCODE architecture.

INCODE will contribute to the wider scope of reinforcing Europe's position in the market of next generation smart systems (sensors and devices) integrated in an evolving Internet of Things and cyber-physical ecosystems with strong capacities at the edge.

Project Information

Start Date: 1 January 2023

End Date: 31 December 2025

ID: 101093069

Programme: HORIZON.2.4 & 2.4.7: Digital, Industry and Space (main), Advanced Computing and Big Data

Keywords: Swarm computing, IoT, Edge, Cloud computing continuum, smart systems, IML, cloud-native programming

Channels

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Main Contact Person (Coordinator): Stavroula-Isidora Giannakandropoulou, giannakandropoulous@unisystems.eu, UniSystems

Main project (expected) KERs:

- INCODE system platform (IML + ABPS components & interfaces)
- Drivers for programmable IoT nodes & collaborative system platforms
- Added infrastructure management functions (monitoring, resource optimisation, registration and attestation, programmability)
- Stakeholders' UIs portals & repository services
- Dashboard and monitoring services
- Use case specific applications
- Application frameworks with added services (e.g., firewalls, special security functions)
- Application design and onboarding service through graphs
- Programable modules and functions for IoT platforms, ORAN, P4, Open5G core, Kubernetes infrastructure

Use Cases:

- Logistics and transport quality value chain
- Utilities predictive maintenance and infrastructure monitoring
- Smart factories - Worker intelligent assistance
- PPDR and community services (collaborative UAV and ground robot)

Open Swarm

OpenSwarm Orchestration and Programming ENergy-aware and collaborative Swarms With AI-powered Reliable Methods

Abstract

Low-power wireless technology tends to be used today for simple monitoring applications, in which raw sensor data is reported periodically to a server for analysis. The ambition of the OpenSwarm project is to trigger the next revolution in these data-driven systems by developing true collaborative and distributed smart nodes, through groundbreaking R&I in three technological pillars: efficient networking and management of smart nodes, collaborative energy-aware Artificial Intelligence (AI), and energy-aware swarm programming.

Results are implemented in an open software package called "OpenSwarm", which is verified in our labs on two 1,000 node testbeds. OpenSwarm is then validated in five real-world proof-of-concept use cases, covering four application domains: Renewable Energy Community (Cities & Community), Supporting Human Workers in Harvesting (Environmental), Ocean Noise Pollution Monitoring (Environmental), Health and Safety in Industrial Production Sites (Industrial/Health), Moving Networks in Trains (Mobility).

Project Information

Start Date: 1 January 2023

End Date: 30 April 2026

ID: 101093046

Programme: Horizon Europe

Keywords: low-power wireless networking, embedded AI, swarm programming, testbeds, cities & community, environmental, industrial/health, mobility

Channels

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Main Contact Person (Coordinator): Thomas Watteyne, thomas.watteyne@inria.fr, Inria

Main project (expected) KERs:

- Pillar 1: Efficient networking and management of smart nodes
- TSCH scheduling to support mobility and enable latency predictability
- Zero-Wire based on RF communication
- Footprint of a secure firmware management solution for embedded devices
- Pillar 2: Collaborative energy-aware Artificial Intelligence (AI)
- partial CNN over-the-air update capabilities in constrained environments
- decentralized GNN knowledge distribution and privacy-preservation
- energy-aware scheduling methods for swarm objectives
- Pillar 3: energy-aware swarm programming
- flexible charge storage driven with energy-aware scheduling
- OpenSwarm Compiler: program a swarm by expressing its objective
- OpenSwarm VM running in a swarm node

Use Cases:

- EHS in Industrial Production Sites: smart sensors to monitor the distance between workers and potentially dangerous moving equipment
- Ocean Noise Pollution Monitoring: automated system to monitor and count boats in a protected marine area, using connected buoys equipped with hydrophones
- Moving Network in Trains: reconfigurable network of sensor nodes on Intercity Express passenger train that interacts rail infrastructure for predictive maintenance
- Supporting Human Workers in Harvesting Wild Food: using a swarm of UAVs tp map out the locations of the berries and mushrooms, making harvesting simpler
- Renewable Energy Community: achieve climate neutrality and decarbonize the energy system, using distributed swarm intelligence and low-latency communication

Open source for cloud-based services

(HORIZON-CL4-2022-DIGITAL-EMERGING-01-26)

Riser

RISC-V for cloud services

Abstract

RISER will develop the first all-European RISC-V cloud server infrastructure, significantly enhancing Europe's strategic autonomy in open-source technologies.

RISER will leverage and validate open hardware high-speed interfaces combined with a fully-featured operating system environment and runtime system, enabling the integration of low-power components, including RISC-V processor chips from the EPI and EUPILOT projects, in a novel energy-efficient cloud architecture. RISER brings together 7 partners from industry and academia to jointly develop and validate open-source designs for standardized form-factor system platforms, suitable for supporting cloud services. Specifically, RISER will build two cloud-focused platforms:

(1) An accelerator platform, which includes the Arm RHEA SoC from EPI and a PCIe acceleration board to be developed within the project which will integrate up-to four RISC-V based chips from EUPILOT.

(2) A microserver platform, interconnecting up to ten microserver boards all developed by the project, each one supporting up to four RISC-V chips coupled with high-speed storage and networking.

Project Information

Start Date: 1 January 2023

End Date: 31 December 2025

ID: 101092993

Programme: Horizon Europe

Keywords: RISC-V, open hardware interfaces, PCIe accelerator board, microserver, boot firmware, Linux operating system, open-source software stack for cloud services.

Channels

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Main Contact Person (Coordinator): Dr Manolis Marazakis, maraz@ics.forth.gr, Foundation For Research and Technology – Hellas (Forth)

Main project (expected) KERs:

- PCIe Acceleration board for acceleration of memory-intensive computation
- Microserver board (blade) for cloud workloads
- PCIe connectivity to enable host-accelerator interaction a high data rates
- Chip-to-Chip communication to enable multi-board system configurations
- NVMe storage and 100 Gbps Ethernet connectivity for the microserver platform
- RISC-V Acceleration framework supporting efficient data handling
- RISC-V Cloud software framework (incl. Kubernetes run-time services)
- System software for use cases.

Use Cases:

- Acceleration of memory-intensive computation in cloud workloads;
- Networked object and key-value storage;
- Containerized execution as part of a provider-managed IaaS environment.

Vitamin-V

Virtual Environment and Tool-boxing for Trustworthy Development of RISC-V based Cloud Services

Abstract

Vitamin-V aims to develop a complete RISC-V open-source software stack for cloud with iso-performance to the dominant x86 and a powerful virtual execution environment for software development, validation, verification, and test. Vitamin-V will add support in three virtual environments: QEMU, gem5, and cloud-FPGA platforms.

Vitamin-V builds on top of EPI's RISC-V CPU. We will extend the LLVM compiler toolchain to support for the ISA extensions (virtualization, cryptography, vectorization). Vitamin-V will port and evaluate several cutting-edge VMMs and container suites (i.e., VOSySmonitor, KVM, QEMU, Docker, RustVMM, Kata containers), cloud management software (i.e., OpenStack, and Kubernetes) together with their software and libraries dependencies (e.g. JVM, Python); and AI (i.e Tensorflow) and BigData applications (Apache Spark). These represent three cloud setups: classical (OpenStack), modern (Kubernetes), and serverless (RustVMM, Kata, Kubernetes). The cloud setups will be benchmarked against AI (i.e., Google Net, ResBet, VGG19), BigData (TPC-DS), and Serverless applications (FunctionBench, ServerlessBench).

Project Information

Start Date: 1 January 2023

End Date: 31 December 2025

ID: 101093062

Programme: Horizon Europe

Keywords: RISC-V, cloud, virtualization, containers, serverless, virtual machine, software validation, compiler, AI, BigData

Channels

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Main Contact Person (Coordinator): Ramon, Canal, ramon.canal@upc.edu, Universitat Politècnica de Catalunya

Main project (expected) KERs:

- Support for RISC-V ISA extensions in open simulation and emulation platforms (QEMU, Gem5, FPGA). Simulation throughput in par with their x86 equivalent.
- AI-based malicious code detection tools
- RISC-V ports of VMMs and container suites (i.e., VOSySmonitor, KVM, QEMU, Docker, RustVMM, Kata containers)
- RISC-V ports of cloud management software (i.e., OpenStack, and Kubernetes) together with their software and libraries dependencies (e.g. JVM, Python)
- RISC-V ports of AI (i.e Tensorflow) and BigData applications (Apache Spark)

Use Cases:

- Classical cloud setup (OpenStack)
- Modern cloud setup (Kubernetes)
- Serverless cloud setup (RustVMM, Kata, Kubernetes).
- The cloud setups will be benchmarked against AI (i.e., Google Net, ResBet, VGG19), BigData (TPC-DS), and Serverless applications (FunctionBench, ServerlessBench).

Aero

Accelerated EuROpean clOud

Abstract

The EU Processor Initiative (EPI) spearheads the development of the first EU processor towards European sovereignty in chip design and computing infrastructure. To successfully integrate the EU processor into the cloud computing ecosystem and strengthen even more EU data sovereignty, software support needs to be developed at the same pace with the hardware. The harmonic relationship of the developed software and hardware is of paramount importance in order to establish an EU cloud platform able to compete with the mainstream solutions currently delivered mainly by US companies.

AERO will upbring and optimise an open source software ecosystem that comprises a wide range of components, from OS to compilers, runtimes, system software and auxiliary software deployment services for cloud computing. The AERO software stack combines those components with novel software and hardware interfaces to seamlessly exploit the heterogeneity aspects of the EU processor with regards to high performance, energy efficiency, and security. AERO's ultimate objective is to facilitate easy migration of existing cloud customers to a cloud infrastructure that harnesses the capabilities of the EU processor.

Project Information

Start Date: 1 January 2023

End Date: 31 December 2023

ID: 101092850

Programme: Horizon Europe

Keywords: Cloud Computing, Open Source Software, System Software, Hardware Acceleration, Virtualization, EPI

Channels

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Main Contact Person (Coordinator): Dionisios, Pnevmatikatos, pnevmati@cslab.ece.ntua.gr, Institute of Communication and Computer Systems (ICCS)

Main project (expected) KERs:

- Managed Programming Languages and Application Ecosystem optimised for the EU processor (OpenJDK, Quarkus, GraalVM, TornadoVM)
- Native Programming Languages and Application Ecosystem optimised for the EU processor (SYCL, LLVM)
- Cloud software stack components optimised for the EU processor (Kubernetes, ExaFlow, Docker, rust-vmm, Firecracker)
- OS and virtualization technologies for the EU processor (KVM, firmware, drivers)
- Security extensions for the EU processor

Use Cases:

- Automotive "Digital Twins" with IoT-Cloud interoperability
- High Performance Algorithms for Space Exploration
- HPC/Cloud Database Acceleration for Scientific Computing

OpenCUBE

Open-Source Cloud-Based Services on EPI Systems

Abstract

The OpenCUBE project aims to design, implement and validate a full software stack that provides European Cloud services on an EPI-based hardware platform. OpenCUBE will be built on industry-standard open APIs, use open-source components, and develop open-source software. The project will deploy on European hardware infrastructure hosting EPI processors and EU-developed RISC-V accelerators. Power and energy efficiency are integrated at all levels to enable system-wide efficiency. The OpenCUBE software stack will also ease programmability for leveraging heterogeneous compute and memory resources to achieve high utilization and cost efficiency. OpenCUBE will provide a converged computing platform from edge to cloud and HPC, targeting the entire continuum. The outcome of the OpenCUBE project will be demonstrated in industrial and consumer cloud workloads.

Project Information

Start Date: 1 January 2023

End Date: 31 December 2025

ID: 101092984

Programme: Horizon Europe

Keywords: EPI, open-source, Sipearl, Semidynamics, RISC-V, computing continuum, cloud service

Channels

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Main Contact Person (Coordinator): Stefano, Markidis, markidis@kth.se, KTH Royal Institute of Technology

Main project (expected) KERs:

- A validated EPI-based hardware platform for providing European cloud services to industry and business users
- A full open-source software stack for enabling cloud services on hardware infrastructure hosting EPI processors and RISC-V accelerators
- Converged computing platform providing seamless services to workloads spanning the computing continuum from edge to the cloud and HPC
- Energy and power awareness integrated at all levels of the hardware infrastructure and software stack to increase competitiveness and fit for the green deal
- Enhanced programmability for developers to build applications that take full advantage of the capabilities of heterogeneous resources of compute and memory to improve efficiency and reduce cost

Use Cases:

- Provide users with Infrastructure as a Service to access virtualized computing resources, such as servers, storage, and networking.
- Provide users with the scalable computing power and storage capacity needed to process Big Data and data analytics without buying on-premises hardware.
- Provide acceleration to workloads through specialized RISC-V accelerators.
- Provide high-performance computing resources for time-sensitive workloads such as weather forecasting.
- Provide services spanning on converged computing continuum on cloud and HPC environments for cost-efficient high-throughput molecular docking for drug discovery.

SmartEdge

Semantic Low-code Programming Tools for Edge Intelligence

Abstract

The objective of the SmartEdge project is to enable the dynamic integration of decentralised edge intelligence at runtime while ensuring reliability, security, privacy and scalability. We will achieve this by enabling a semantic-based interplay of the edge devices of such systems via a cross-layer toolchain that facilitates the seamless and real-time discoverability and composability of autonomous intelligence swarm. Hence, an application can be freely built by distributing the processing, data fusion and control across heterogeneous sensors, devices and edges with ubiquitous low-latency connectivity. The goal of this project is to develop a SmartEdge solution with a low-code tool programming environment with various tools: (1) Continuous Semantic Integration (CSI); (2) Dynamic Swarm Network (DSW); and (3) Low-code Toolchain for Edge Intelligence. The SmartEdge solution will be comprehensively demonstrated over four application areas: automotive, city, factory and heath via the strong collaboration of eight industrial partners, Dell, Siemens, Bosch, IMC, Conveq, Cefiel and NVIDIA with eight research institutes.

Project Information

Start Date: 1 January 2023

End Date: 31 December 2025

ID: 101092908

Programme: Horizon Europe

Keywords: Collaborative Systems

Channels

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Main Contact Person (Coordinator): Filippo, Cugini, filippo.cugini@cnit.it, CNIT

Main project (expected) KERs:

- BOSCH: build a safe and reliable automated driving system on the road,e.g automated valet parking, driving assist, and generative braking systems
- SAG: create an open ecosystem for third party industrial apps on Mendix with SmartEdge low-code tool chain for Edge Intelligence
- DELL: roll out advanced automation solutions to other EU manufacturing facilities with SmartEdge SDKs.
- CEF: subsequent commercialization through technology transfer to customers on Continuous semantic integration and DataOps services.
- IMC: provide robust, dependable, secure and interoperable solution that we will apply in the area of monitoring of sickness & wellbeing of local residential groups.

Use Cases:

- Cooperative Perception for Driving Assist: The constructed test cases verify the ability of ADAS to make decisions certain complex situations on V2X.
- Active Option Zone Management: This option zone protection can be started well in time before the vehicles enter the option zone.
- Smart Factory with Low-Code Edge Intelligence: Smart factory provides continuous standard-based semantic integration, low-code applications, and edge intelligence in order to enable flexible production
- Smart Factories with Intelligent Mobile Robots: Smart factories can produce a broader range of products in smaller batch sizes to products to be manufactured locally where they are consumed.
- Edge/Swarm Intelligence in Health: Monitoring the swarm enables targeted medical assistance and improves the efficiency of recourse utilization in healthcare.

Others

TEADAL

Trustworthy, Energy-Aware federated DAta Lakes along the computing continuum

Abstract

TEADAL will enable the creation of trusted, verifiable, and energy-efficient data flows, both inside a data lake and across federated data lakes, based on a shared approach for defining, enforcing, and tracking data governance requirements with specific emphasis on privacy/confidentiality. The proposed stretched data lake, i.e., deployed in the continuum, will be based on an innovative control plane able to exploit all the controlled/owned resources across clouds and at the edge to improve data analysis.

The resulting capabilities of stretched data lakes also provide the essential basis for creating trustworthy mediatorless federations of data lakes to foster an effective data exchange among organizations while preserving privacy and confidentiality constraints without any imposed, and often not acceptable, third-party coordinator. Finally, applying to data governance the principles of circular economy, i.e., to reuse data, application, and computation resources belonging to the data lake federation, will enable the creation of platforms for more sustainable data analytics.

Project Information

Start Date: 1 September 2022

End Date: 31 August 2025

ID: 101070186

Programme: Horizon Europe

Keywords: stretched data lake, trust, energy-efficient, data governance

Channels

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Main Contact Person (Coordinator): Rita Santiago, rsantiago@ubiwhere.com, Ubiwhere

Main project (expected) KERs:

- Build efficient data lakes solutions with ease of data handling across the computing continuum
- Construct trustworthy data lakes and mediatorless federation of data lakes
- Reduce the environmental impact of data analytics through an energy-efficient federation of stretched data lakes
- Build privacy, organisational policies and GDPR-compliant federation of stretched data lakes
- Contribute to and influence European research and initiatives to improve data sharing

Use Cases:

- Evidence-based medicine
- Mobility federated access point
- Smart viticulture data sharing
- Industry 4.0 fast KPI calculation
- Shared financial data governance
- Regional planning for environmental sustainability
- Manned-unmanned operations trainer

Horizon-Trustee

Trust And Privacy Preserving Computing Platform For Cross-Border Federation Of Data

Abstract

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod We live in a data-driven era, where the emergence of interdisciplinary, geographically dispersed, data repositories, is inevitable. Moreover, most of the times, integrity, privacy, and security in such geographically dispersed, data repositories is either difficult, or impossible to maintain. Towards this end, TRUSTEE aims to bring a secure, trustworthy, and privacy-aware framework that will aggregate various interdisciplinary data repositories, such as Healthcare, Education, Energy, Space, Automotive, Cross-border etc., and also other EU data federation spaces and trans-national initiatives. TRUSTEE offers a secure-by-design framework, wherein stored data is private and Homomorphically Encrypted, searchable and usable in an encrypted domain, through FAIR representation, executing complex and context-aware queries through transparent trustworthy ML, AI promoting eXplainability, interoperability and accountability via a blockchain-based transaction recorder, in compliance with EU privacy and ethical frameworks. TRUSTEE's fully encrypted solution will be validated through six different use cases supporting GAIA-X, EOSC, EGI, etc. demonstrating a multi-disciplinary, Pan-European federated FAIR and private data ecosystem.

Project Information

Start Date: 1 July 2022

End Date: 31 December 2025

ID: 101070214

Programme: Horizon Europe

Keywords: Data Protection And Privacy, (User-Centric) Privacy Preservation, Digital Social Innovation, Privacy, Homomorphic Encryption, Ssi, Eidas, Edge, Ethics, Trust, Privacy, Federated Learning, Sustainable, Data Operations

Channels

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Main Contact Person (Coordinator): Emmanouil Spanakis, spanakis@ics.forth.gr, Forth

Main project (expected) KERs:

- TRUSTEE has identified the following key exploitable results to support the main outputs and the project demonstrators (Pilot cases with 6 different

datasets: energy, health, educational, automotive, space, trusted multi-disciplinary data exchange) and the overall TRUSTEE data mediator/exchange framework. All TRUSTEE data and services outputs and key results will follow TRUSTEE's IPR Strategy & Exploitation plan through licensed for stand- alone solution or for integration into Data economy applications.

- Distributed Homomorphic Capable Self-Sovereign Framework
- TRUSTEE Data Core
- Data privacy Impact assessment as a Service
- TRUSTEE SDK and Inter-communication API
- TRUSTEE Accountable Transactions Recorder
- Security-by-Design Framework
- Compliance Support Tool
- Workflow automation and Robotic Process automation
- TRUSTEE platform

Use Cases:

- Space. TRUSTEE will focus on how to support research and space missions, based on a series of detailed scenarios developed in the early phase of the project. We will identify technical and non-technical requirements, as well as structure of tests executed to check functionality and user acceptance.
- Education TRUSTEE recognizes the responsibility that educational institutions carry to generate, manage, store, secure and ensure individual privacy of students and administration. We aim to make their job easier by improving data sharing according to GDPR rules and enabling data interoperability with cross-border.
- Data TRUSTEE's goal is to establish the necessary pathway for multi-stakeholder data exchange and data sovereignty across its platform, by implementing a set of IDS interfaces with the GAIA-X federation layer to allow secure data inference across the entire platform.
- Health TRUSTEE'S platform will be used in areas such as Epidemiology & Bio statistics, Bioinformatics, Artificial Intelligence and Big Data processing to support clinical research and healthcare process improvement.
- Automotive TRUSTEE focuses on enhancing the safety indexes for autonomous driving in the presence of sensor and data sources, by assessing drivers' behaviour and HMI evolution and by using the output as informed experimental feedback for evolving the HMI.
- Energy TRUSTEE aims to help customers that have invested in energy solutions to continuously monitor PV production, energy consumption and battery storage/charging status to be able to offer Virtual Power Plant services while respecting privacy and data security.

SPADE

multi-purpoSe Physical-cyber Agri-forest Drones Ecosystem for governance and environmental observation

Abstract

SPADE is a project funded by the European Union within the Horizon Europe programme, with 21 partners from 10 European countries. The strategic objective of SPADE project is to develop an intelligent ecosystem to address the multiple purposes concept in the light of deploying unmanned aerial vehicles (UAVs alias drones) to promote sustainable digital services for the benefit of a large scope of end users in sectors of crop production, forestry, and livestock. This includes individual UAV usability, UAV type applicability (e.g., swarm, collaborative, autonomous, tethered), UAV governance models availability and UAV-generated data trustworthiness. Multi-purposes will be further determined in the sensing dataspace reusability based on trained Artificial Intelligence (AI)/Machine Learning (ML) models. These models will enable sustainability and resilience of the overall life cycle of developing, setting up, offering, providing, testing, validating, refining as well as enhancing digital transformations and "innovation building" services in agriculture. Pilot prototypes will contribute toward greater goals, such as the reduction of deforestation, precision farming and animal welfare.

Project Information

Start Date: 1 September 2022

End Date: 31 August 2026

ID: 101060778

Programme: Horizon 2020/ Horizon Europe

Keywords: Drones, Agriculture, Forestry, Geo-information and spatial data analysis, Imaging, image and data processing, Precision agriculture, digital twin

Channels

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Main Contact Person (Coordinator): Dionysis, Bochtis, d.bochtis@certh.gr, Centre for Research and Technology Hellas - CERTH

Use Cases:

- Forestry – swarm of small sized drones
- Forestry – cooperating/ two or more medium sized drones
- Forestry – Large application drone
- Crop – swarm of small sized drones
- Crop – cooperating/ two or more medium sized drones
- Crop – Large application drone
- Livestock – swarm of small sized drones
- Livestock – cooperating/ two or more medium sized drones
- Livestock – Large application drone

The Coordination and Support Actions

The European Cloud, Edge & IoT Continuum is supported by the effort of two Coordination and Support Actions (CSAs), namely **Open Continuum** and **UNLOCK-CEI**, which will cooperate focussing respectively on the supply and demand sides of the CEI Continuum. These will also benefit from the synergies and legacy of other existing EU projects in the domains of Cloud, Edge, IoT, AI, and connectivity.

OpenContinuum

OpenContinuum supports the cloud-edge-IoT domain by focusing on the supply side of the computing continuum landscape. Its goal is to foster European strategic autonomy and interoperability through an open ecosystem for the computing continuum, with open source and open standards as two key enablers to be supported and leveraged throughout the community. Such an ecosystem will contain R&I projects in the cloud-edge-IoT portfolio to be coordinated, the diverse community evolved from the current cloud and IoT ones, with the addition of actors, initiatives, and significant alliances. The supply-side nature of OpenContinuum's agenda will orient the themes and focus of project activities but will not limit the scope of community building. The project's active landscaping and engagement work will bring the cloud and IoT communities together and express all points of view with a common understanding. It will then provide guidance to European actors to contribute to and lead open-source projects and standardisation efforts.

Consortium: Martel Innovate, Atos, Eclipse Foundation, Trialog, Inside

Unlock-CEI

Unlock-CEI's ambition is to unlock the potential for accelerating the deployment of the cloud-edge-IoT (CEI) computing continuum in Europe by focusing on demand-side drivers and challenges to identify technology driven innovation and business opportunities driving demand value chains. The project represents the cloudedge-IoT demand constituency, provides insights and guidance to Horizon Europe R&I projects, and contributes to a proactive dialogue with suppliers to encourage the development of an open European cloud-edge-IoT ecosystem. It focuses on emerging value chains where investment is needed to foster the deployment of the cloud-edge-IoT continuum through forthcoming large-scale pilots, which will ultimately foster European autonomy in the digital economy.

Consortium: BluSpecs, COMMpla, EGI, IDC, Trust-IT Services, VDI|VDE|IT

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