AERO

Accelerated EuRopean clOud

An open source software ecosystem for the EPI hardware

Vision

Enabling the future heterogeneous EU cloud infrastructure

AERO will **upbring** and **optimise** all components necessary to achieve out-of-the-box heterogeneous execution of the cloud ecosystem on the EU processor. The outcome will be a set of **compilers**, **runtime systems**, **operating systems**, **system software**, and auxiliary software deployment services.

Accelerate the adoption of the EU cloud ecosystem

AERO will accelerate the adoption of the cloud ecosystem via **upstreaming** to open source projects, communicating and disseminating AERO’s results to industry, academia, and standardization bodies.

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Goals & Expectations

Strategic Liaisons
- Liaison with EU initiatives
- Assist standardization efforts

Embracing open source
- Engage open source community
- Facilitate collaborations & partnerships

Communication & Exploitation
- Creation of an engaged community
- Organization & coordination of common events
- Supplement our own communication activities
- Commercialisation support

Funded by the European Union

Goals & Expectations

https://aero-project.eu
https://twitter.com/AERO_Project_EU
https://github.com/AERO-Project-EU/

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Introduction

Methodology

Objectives and Ambition

Driver Workloads

Weather Forecasting

IFS software is a major European resource representing many years of investment by ECMWF[1] and its Member States. The IFS has been developed for over 30 years and it runs operationally, providing time-critical global forecasts several times per day.

Space Weather & ML

iPIC3D [2] is an open-source C++ and MPI Particle-in-Cell code for the simulation of space plasma. The workflow will run iPIC3D simulation on the HPC partition with ML classification of simulation results on the cloud partition.

High-Throughput Molecular Docking for Drug Discovery

AutoDock software[3], one of the most used software for molecular docking will be used to test on widely used databases, such as DrugBank database, Enamine database, ZINC15, and Cambridge.

OpenCUBE - Open-Source Cloud-Based Services on EPI Systems

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1 KTH 2 HPE 3 TU-Munich 4 Sipearl 5 Semidynamics 6 ECMWF

Objectives and Ambition

Design, implement and validate a full-stack software stack of a European Cloud computing blueprint that will be:

• Deployed on European HW infrastructure
• For industrial & consumer cloud workloads
• For the whole computing continuum
• From edge to cloud and HPC
• Targeting the entire continuum
• Enable energy-efficiency at all levels
• Built on industry standard open APIs
• Using open-source components
• Working with standards bodies

Design and deploy a hardware platform

• Capable of hosting European Processor Initiative (EPI) processor
• Supporting EU developed accelerators
• Based on requirements of representative cloud workloads

Design and deliver a full software stack

• Enabling cloud servers
• Leveraging EPI-based platforms

Enable system-wide efficiency

• Via heterogeneous data centre architecture
• Deploying eased programmability
• Leveraging heterogeneous resources

Fully test and validate the deployed stack

• With a diverse set of applications
• Traditional cloud-native and HPC workloads
• Emerging coupled workflows

Goals

Driver Workloads

OpenCUBE will support cloud-native and complex workflows on the convergence of Cloud and HPC computing

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OpenCUBE will provide the first full cloud stack on heterogeneous data center built on

• Sipearl Rhea CPU
• Semidynamics RISC-V EPAC
• High performance Ethernet
• Heterogeneous main memory
• Fabric-attached memory

Roadmap and Future work

• Will design and develop the prototype hardware infrastructure based on Sipearl CPU and Semidynamics accelerator
• Will design and develop an open-source software stack, including OS, system software, and middleware for cloud services on the HW infrastructure
• Will perform validation and evaluation of OpenCUBE prototype implementation with the driver applications
• Will establish and maintain strong interaction with other European and International R&I activities to provide bidirectional feedback between them and the OpenCUBE project

Methodology

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

- **Develop & validate open-source designs for standardized form-factor system platforms**
  - PCIe Acceleration Card, Microserver (Blade)
  - Use cases: acceleration, networked storage, containerized execution

- **Enabling the path towards a European-based cloud infrastructure**
  - The first Cloud architecture using RISC-V processor technology being developed within the EPI and EUPILOT projects
  - Key technologies:
    - RISC-V processors, PCI-Express/CXL, Cache-coherent Chip-to-Chip links

- **Open hardware interfaces**
  - Expand the interface possibilities of EPI/EUPILOT processors:
    - High-speed networking and storage capabilities
    - Essential support for cloud applications and services deployment

Call: Open source for cloud-based services, GA Nr: 101092993 (HaDEA)
Consortium Skills & Contributions

Integrated all-European Hardware and Open-Source Software for Cloud Services and Applications

Concertation and Consultation on Computing Continuum: From Cloud to Edge to IoT: May 10-11, 2023 - Brussels

Contact: Dr. Manolis Marazakis
Organization: FORTH (Greece)
Email: maraz@ics.forth.gr
Goals and expectations

Vitamin-V aims to develop further RISC-V …

1) **Open-source virtual environments**
   QEMU, Gem5, cloud-FPGA

2) **Open software validation suites**
   Software bugs, Malicious code

3) **Open-source cloud hardware-software stacks**
   Compiler and tool-chain: LLVM, JVM, Python, …
   VMMs and container suites: VOSySmonitor, KVM, QEMU, Docker, RustVMM and Kata containers
   Cloud management middleware: OpenStack, Kubernetes
   AI & BigData applications: Apache Spark and Google Tensorflow.
Vision

• Hardware will be as good as the software that runs on top of it.

• Embracing RISC-V and Open-Source:
  
  • **Collaborative effort** beyond the timespan of the project
  
  • **Comparable to standardization**
  
  • **Higher-impact** of project’s results

• **Computing continuum**
  
  • Cloud (Vitamin-V), HPC (EPI, EUPILOT, other), Automotive (SELENE, KDT JU calls)
  
  • Heterogeneous IoT-Edge-Cloud continuum convergence.