

REBECCA

Reconfigurable Heterogeneous Highly Parallel Processing Platform for safe and secure AI

Challenges and objectives

The REBECCA project develops a **RISC-V-based ASIC with integrated AI and security accelerators**, for advanced edge-AI systems. Targeted at critical applications like automotive, healthcare, and smart cities, our **ASIC connects to an external FPGA with application-specific AI accelerators** and I/O, enhancing flexibility for complex, scalable AI tasks. Our solution provides **high-levels of security, low-latency and high energy-efficiency** while supporting Europe's goals for technological sovereignty.

Technical goals

- **RISC-V-based ASIC:** Develop a modular, scalable ASIC with integrated AI and security accelerators.
- **External FPGA Integration:** Connect the ASIC to an FPGA for additional accelerators and I/O flexibility.
- **Near-Memory Processing:** Implement NMC for efficient, close-to-storage data processing.
- **Security Features:** Use hardened RISC-V cores to enhance security and privacy.
- **Complete Software Stack:** Develop a low-power, secure software stack supporting virtualization.
- **Diverse Use Cases:** Validate the platform across multiple real-world applications, including smart appliances, energy, and infrastructure inspection.

These goals aim to build a versatile, high-performance edge-AI platform.

Expected impact

Targeted at edge-AI applications in sectors like smart appliances, energy, and infrastructure inspection, it offers high performance, energy efficiency, security and safety. Our **modular, adaptable platform** provides industry and academia with a **versatile open edge-AI solution** for diverse applications. The value creation from this project extends to multiple dimensions:

- **Economic Growth:** REBECCA fosters Europe's tech autonomy by developing a scalable edge-AI platform, enhancing market opportunities for EU industries.
- **Employment and Expertise:** Supports job creation and skill development in edge-AI hardware and software, increasing demand for skilled professionals.
- **Academic Impact:** Plans for 20+ peer-reviewed publications and 45+ conference presentations, contributing to edge-AI research.
- **Sustainability and Community Engagement:** Establishing a Sustainability Body to create an ecosystem for long-term adoption and community innovation.



REBECCA

Contact details:

Project Coordinator
Iakovos Mavroidis
Technical University of Crete
iakovosmavro@gmail.com

REBECCA Hardware Platform

REBECCA Chip



REBECCA Chip





Clock Generator

HyperRAM

RISC-V (EXA)

HyperRAM Controller

Interconnect (EXA)

Accelerators

- IDS (TSI)
- NMP (LU)
- Neuromorphic (IMEC)
- IBEX (IMEC)

C2C (FRAUN)

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