

## **ACAP: Arquitectura de Computadores de Altas Prestaciones (ACAP)**

### **Description**

The world is experiencing a pivotal era marked by technological developments and breakthrough advances in Artificial Intelligence (AI). One such development is the advent of Large Language Models (LLMs), which will be a disruptive force that profoundly reshapes industries and society. Notwithstanding, the slow down in transistor miniaturization and clock frequency increases due to physical and manufacturing limits signals the end of Moore's Law, posing a significant challenge to computing technology. Thus, computer architecture plays a vital role in efficiently utilizing current hardware and preparing for future technologies. This is crucial for demanding applications, including LLM applications, genomedata analysis, digital twins, and HPC large-scale simulations.

The ACAP project seeks to advance in the open hardware design and ecosystem development towards IP technological sovereignty and to address current challenges in HPC open architectures, domain-specific accelerators, novel memory technologies, and advanced simulation methodologies and modeling. ACAP seeks to advance open RISC-V ISA by designing and implementing RISC-V cores and accelerators, particularly targeting the needs of the Spanish RISC-V ecosystem. ACAP is aligned with the RISC-V open ISA revolution, proposing designs complementary to the European Processor Initiative's HPC processors for the Zettascale era.

ACAP's goal is to design and optimize RISC-V processors with advanced micro-architectural features, develop specialized vector accelerators for diverse workloads, and explore new approaches in reliability and green computing. In the era of advanced computing, where energy efficiency is paramount, ACAP will research how to scale through methods such as approximate computing or going below the safe operating voltage to save power. To accomplish its objectives, ACAP advocates for new design methodologies to speed up hardware design cycle time, increase reliability, and enhance energy efficiency. In the competitive semiconductor sector, reducing time-to-market and costs is crucial. ACAP aims to leverage the latest AI solutions to support rapid and reliable hardware design methodologies, understanding the limitations of current architectures and developing new designs.

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