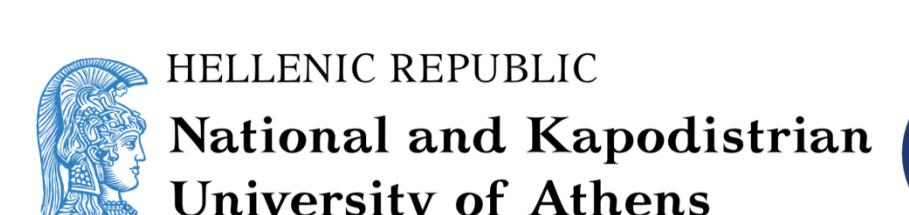




Vitamin-V: Expanding Open-Source RISC-V Cloud Environments



Horizon Europe - 2023-2025

Abstract

Vitamin-V aims to develop further RISC-V environment/tools for:

- 1. open-source virtual environments
- 2. software development and validation suites
- 3. cloud hardware-software stacks

Support for EPI-based RISC-V chips for both the main CPUs and relevant accelerators such as the memory compression.

RISC-V open-source virtual environments

Develop a powerful virtual environment for software development, validation, verification and test, that considers the relevant RISC-V ISA extensions for Cloud deployment.

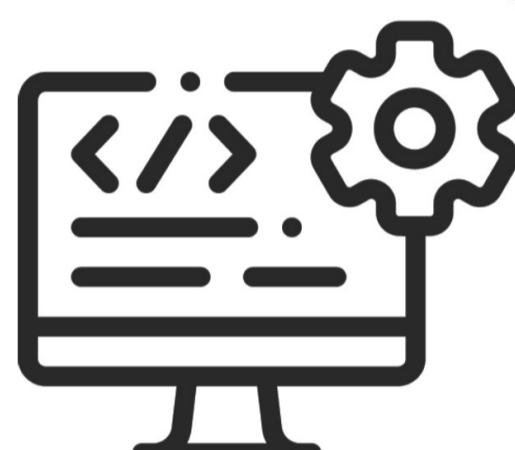
- **Three virtual environments:** QEMU, gem5 and Cloud-FPGA prototype.
- **Extensions:** virtualization, bit manipulation, crypto and vectorization.

Classic, modern and serverless cloud stacks



Concept and technologies

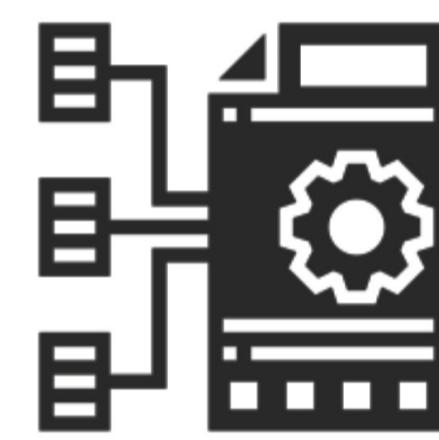
AI and BigData frameworks ported to RISC-V



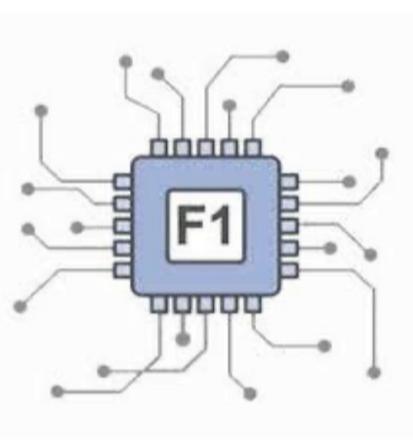
VMM and cloud management stack port to RISC-V



RISC-V compiler and toolchain with cloud-relevant ISA support

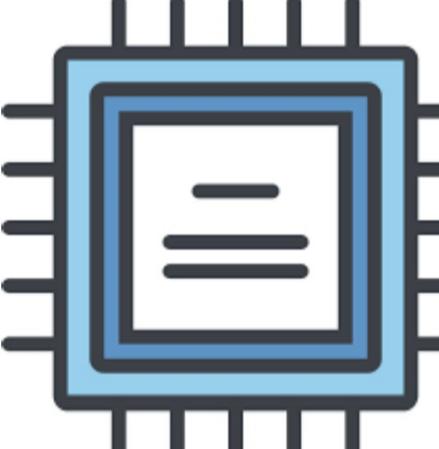


V-RISCV — Virtual execution environment with cloud-relevant RISC-V ISA



EPI RISC-V core extended with cloud-relevant ISA

EPI memory compression and interconnect OS support

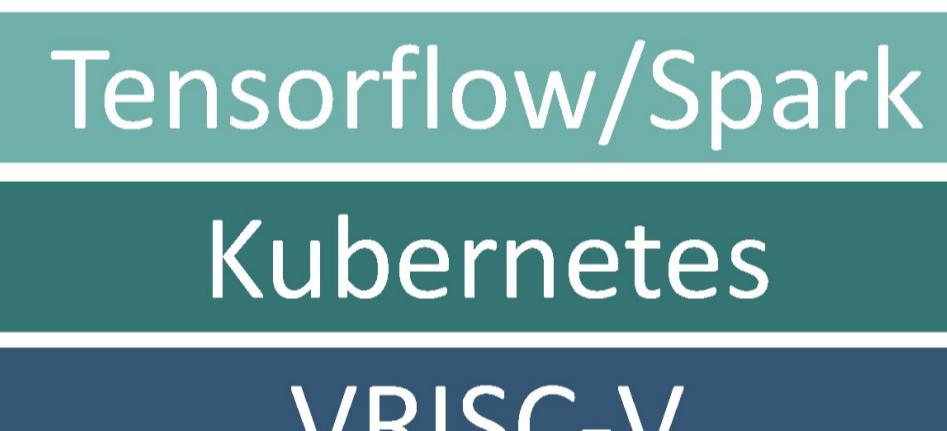


Cloud stacks demonstrated

Classical cloud



Modern cloud



Serverless cloud



Software validation suites

Vitamin-V will fully support rapid software development providing:

- A mature compiler toolchain based on LLVM including its extensions.
- A validation, verification, and testing (VVT) toolset for developers to identify software bugs and illegal or malicious code.

Benchmarking

- Relevant AI workloads such as Google Net, ResNet and VGG19
- BigData workloads (TPC-DS)
- Serverless applications such as FunctionBench and ServerlessBench

Summary

Vitamin-V will **deploy a complete RISC-V hardware-software stack for cloud services** based on cutting-edge cloud open-source technologies for RISC-V cores with a special focus for EPI cores.

Vitamin-V incorporates an **innovative RISC-V virtual execution environment providing hardware emulation, simulation, and FPGA prototyping** to enable **software development, verification, and validation** before actual hardware is released.

Vitamin-V also contributes to the **porting of the complete cross-compiling toolchain, software stack, and essential application libraries** for the forthcoming release of the RISC-V EPI processors.

