

MS3D: Riding the Cambrian Explosion in Hardware for Scientific Computing



Barcelona Supercomputing Center Centro Nacional de Supercomputación

RISC-V@BSC: Paving the way for overcoming HPC workloads' challenges

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The "Cambrian Explosion": sudden appearance of most of the world's known animal phyla, all within a very brief period of geological time. The sudden appearance of so many of the major innovations to the basic structures of known animal forms has always been somewhat problematic for Darwin's theory of gradual innovation.









Icons from www.flaticon.es



Sustainability	Circular economy – Modernise industry to green transition
Autonomy	Avoid one-sided dependencies
Competitiveness	Scale up start-ups in innovation-friendly ecosystems
Sovereignity	Modernize education, training and reskilling in all areas



2 B€

✓ RISC-V ISA plays a central role on EU's technology strategy

RISC-V[®] International

Next-Gen HPC: The RISC-V Ecosystem



What is RISC-V?

- An open Instruction Set Architecture (ISA)
 - Standardisation activities driven by expert members
 - Numerous areas of focus ranging from HPC & ML to the data centre to embedded computing
 - Additional extensions, tools and resources
- Phenomenal growth



- Why is this interesting for HPC?
 - Freely develop new technologies based upon RISC-V
 - As the standards are **community driven** then we can shape this to suite our needs
 - Modular design of ISA = pick and mix the parts that you need (ranging from low power embedded devices to HPC and Al accelerators)



RISC-V Ecosystem

- From the RISC-V Ecosystem
 Landscape
- <u>https://landscape.riscv.org/</u>
- Market Cap ~\$6T
- Funding ~\$10B

RISC-V®

- But this is more nuanced than a simple diagram
- And changing all the time!



Special Interest Group – High Performance Computing

• Get involved in **SIG-HPC**

You need to be a RISC-V member
 (either individual or as part of your organization)
 <u>https://lists.riscv.org/g/sig-hpc</u>

- Subscribe:
 - Send email to: <u>sig-hpc+subscribe@lists.riscv.org</u>
- <u>Monthly meetings</u>
 - <u>3rd Thursday of the month</u>
 - Next meeting: June 20th @ 16:00 CET



Join & get involved



RISC-V Summit Europe in Munich, June 24-28

https://riscv-europe.org/





LOCA@BSC: Laboratory for Open Computer Architectures







Earth Sciences

> Astro, High Energy & Plasma Physics

Engineering

Materials, Chemistry & Nanoscience

Life Sciences & Medicine

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HPC: An enabler 4 ALL scientific fields & Society concerns

BSC

RISC-V°



BSC full stack: codesign cycle

SW

HW

BSC









EPI: EPAC (European Processor Accelerator)



BSC involved in the desing of the VPU (Vector Processing Unit)



EPAC v1.0 (SGA1)

- Chip fabrication Q2 2021
- GF22FDX
- Total area: 5.9 x 4.6 mm²



EPAC v1.5 (SGA2)

- Successful tapeout Q4 2022
- GF22FDX
- Total area: 5.9 x 4.6 mm²
- Successful bring-up: Nov 2023





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EUPIL

• Design, build, and validate the first EU-based pre-exascale accelerator system for HPC and ML/AI









RISC-V@BSC: Combining top/down & bottom/up approach





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Thank you!!

Q&A

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LOCA