LOCA
Enabling HW/SW Co-Design for IoT to HPC

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HPC today

• Europe has led the way in defining a common open HPC software ecosystem
• Linux is the de facto standard OS despite proprietary alternatives
• Software landscape from Cloud to IoT already enjoys the benefit of open source
• Open source provides:
  • A common platform, specification and interface
  • Accelerates building new functionality by leveraging existing components
  • lowers the entry barrier for others to contribute new components
  • Crowd-sources solutions for small and larger problems
• What about Hardware and in particular, the CPU?
• Inhibits opportunities in holistic co-design
  • Facing barrier to innovation
  • Being able to have a conversation or not
Why Europe needs its own processor

Processors now control almost every aspect of our lives

Security (back doors, etc.)

Possible future restrictions on exports to EU due to increasing protectionism

A competitive EU supply chain for HPC technologies will create jobs and growth in Europe
Mont-Blanc HPC Stack for ARM

Industrial applications

- Pharmacelera
- MUREX
- Tecma Fluids
- Cenaero

Applications

- GENCI
- CINECA
- HLRIL
- University of Bristol

System software

- ARM
- ETH Zürich
- Inria

Hardware

- ARM
- BSC
- Bull
- UC3A
More and more global IT actors are adopting RISC-V architectures to be vendor independent.

And of course the entire IoT ecosystem for lower performance, lower energy applications.
HPC tomorrow

- Europe can lead the way to a completely open SW/HW stack for the world
- RISC-V provides the open source hardware alternative to dominating proprietary non-EU solutions
- Europe can achieve complete technology independence with these foundational building blocks
- Currently at the same early stage in HW as we were with SW when Linux was adopted many years ago
- RISC-V can unify, focus, and build a new microelectronics industry in Europe.
Today's technology trends

Massive penetration of Open Source Software
- IoT (Arduino),
- Mobile (Android),
- Enterprise (Linux),
- HPC (Linux, OpenMP, etc.)

New Open Source Hardware
Momentum from IoT and the Edge to HPC
- RISC-V
- OpenPOWER
- MIPS

Moore's Law + Power = Specialization (HW/SW Co-Design)
- More cost effective
- More performant
- Less Power
LOCA @ BSC?
BSC full stack

Software/Hardware Co-Design

HPC Applications

Specialization using HW/SW Co-Design

HPC Hardware
LOCA Goals

• Mechanism to extend open source ecosystem to include H/W
  • Add H/W expertise to BSC and European partners, leverage existing S/W expertise
  • Open European IP repository → rapid implementation
  • Provide usable Open Source H/W
  • Intersection of academia and industry
  • Catalyst to reinvigorate European ICT industry Global collaboration and training center
  • Incubator for European IP
Participation from Academia across Europe
- Student training
- Affiliate Labs at other institutions
- Research collaboration
- Repository for research work

Participation from European industry and open to global vendors
- Engagement with European Research and Development
- Access to European talent
- European visibility and branding
- Innovation incubator
European Collaboration & Education

- Traditional chip design is done in a Master/Apprentice environment
- LOCA recreates this environment by bringing in Masters from industry to collaborate with a variety of people, pushing beyond RTL
- Professors, students, and industry veterans all together
- Ideal sandbox for creative and innovative work
- Research and Design to chip fabrication

Casteller
(human tower)
Focus, Freedom, and Forward

- BSC is embracing Open Source Hardware to complement OSS
  - RISC-V has the momentum to succeed as the Open Source ISA, much like Linux

- BSC is building the infrastructure to support the future of computing
  - Combining applications, system software, hardware design and hardware

- BSC can organize and coordinate full stack efforts
  - More resources = faster time to success
  - More partners (Academia/Industry)
  - Research/Resource multiplier

- Europe and the world can unite around the BSC Vision to move forward faster, together
LOCA → broader?

European Open Hardware, Architecture Initiative?
Thank you

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