

Extreme Scale Demonstrators Workshop

ARM as a Foundation For European HPC

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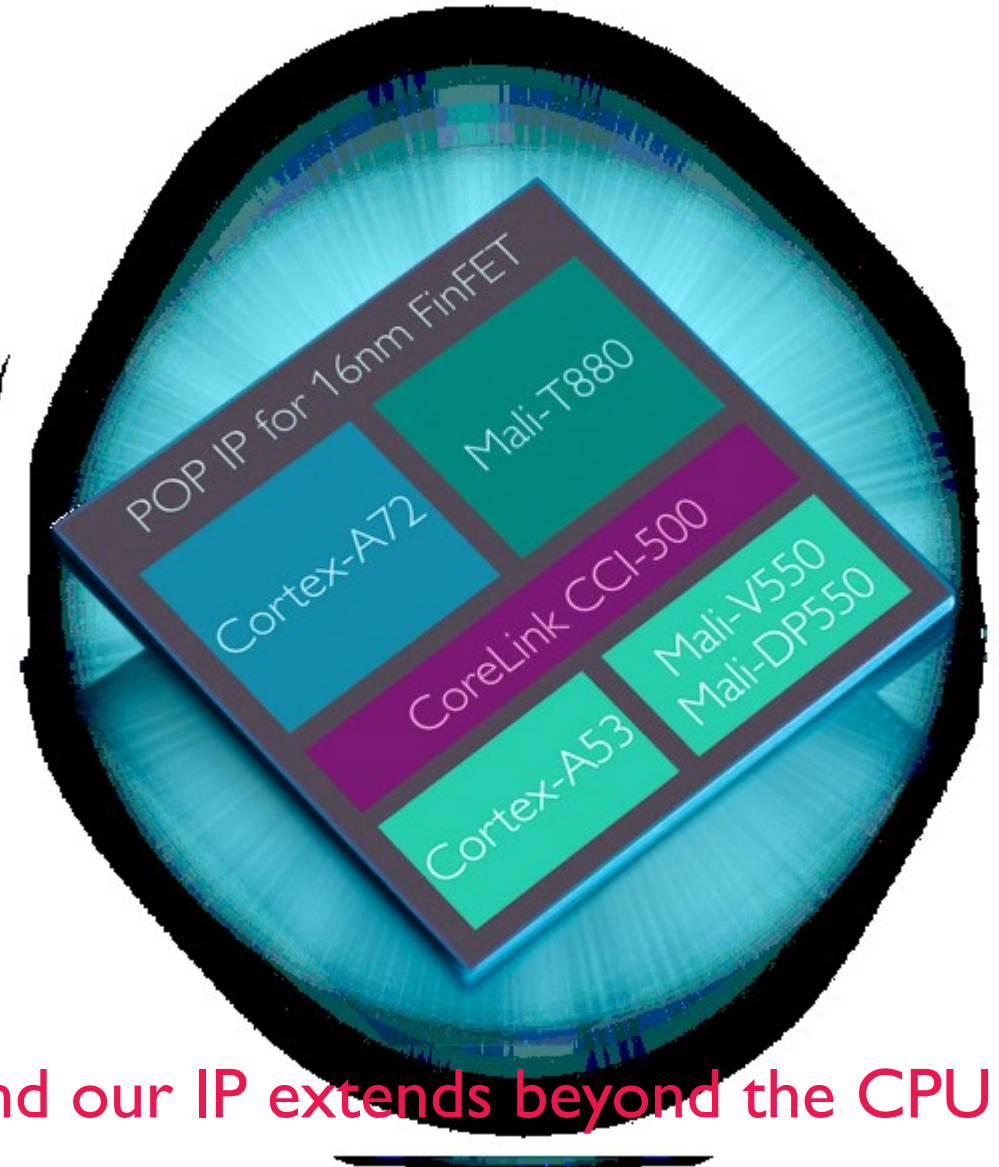
An introduction to ARM

ARM is the world's leading semiconductor intellectual property supplier.

We license to over 450 partners, are present in 95% of smart phones, 80% of digital cameras, 35% of all electronic devices, and a total of 70 billion ARM cores have been shipped since 1990. (15B during 2015)

Our CPU business model:

- License technology to partners, who use it to create their own system-on-chip (SoC) products.
- We may license an ISA (e.g. “ARMv8-A”) or a specific microarchitectural **implementation** (e.g. “Cortex-A72”)
- We do not produce silicon, nodes, or systems.



...and our IP extends beyond the CPU

Goal – Create a Diverse and Vibrant Ecosystem



ARM's HPC Strategy

2014-2015

2016-2017

2018

Enablement of Base Hardware
Availability of Open Source /
Commercial Software Tools & Libs

Enablement of Advanced
Hardware
Engagement with key partners
for application porting
Software Tools & Libs increase in
performance and offerings

ARM Supercomputers on
multiple continents
Expansion of tools and
applications to support broader
Scientific Workloads
See workshops titled "Why is US
HPC running on EU technology?"

Innovation, Collaboration and Community

ARM Interests in Future HPC Technologies

- Application driven co-design based on science codes, not artificial benchmarks
- Focus on homogenous general-purpose architecture
 - One size doesn't fit all, but a properly designed architecture can
 - General purpose approach essential to leveraging economies of scale and targeting other domains (big-data, cloud)
 - Despite heroic effort, accelerators are still difficult to program and reconfigurable technologies push hardware design complexities and problems to the software developer
- System on chip integration
 - Essential for energy efficiency
 - Tightly couple network interfaces, high bandwidth memory, and NV technology
- Centralized processing -> Distributed computation
 - Data reorganization and data conditioning
 - Compute near memory, compute near network, compute near storage
 - Reduce data movement and making any data movement more efficient

ARM Interests in the EsD Call ...

- We want to enable anyone proposing the use of ARM technology
 - ARM IP available to all with same terms and conditions as to our existing partners
- We are available to partner in proposals
 - We are a small company with limited resource so focus is on commercially viable approaches
 - Direct involvement on industrial oriented projects with a direct path to productization.
- Well placed to assist with system architectural, application optimization and performance evaluation ...
 - ARM IP knowledge
 - HPC focused compilers, runtimes, and tools
 - Modeling experience, operating systems, reliability, energy optimization, etc.
- Contact:
 - **Emre Ozer** (emre.ozar@arm.com) or **Ian Phillips** (ian.phillips@arm.com)
 - Both based in ARM HQ, Cambridge, UK.

(Note: ARM does not Design or Manufacture chips)

Comments on EsD Rollout

- Demonstrators should favor funding prototypes with a direct path to product
 - Complexity of HPC design favors industrial solutions versus academic ones.
- EU must consolidate funding, even if it means fewer projects, in order to produce competitive solutions
 - Designing an HPC SoC competitive with US and Asia produced chips will cost between €100M-200M
 - Just SoC, does not include system and interconnect
 - A strong, diverse, and comprehensive EU supply chain is critical to Europe's future

Region	NRE Investment	Projects
US	\$320M/year	5
China	\$200M/year	5
Japan	\$200M/year	1

* Data from April 2016 ITIF Report

Thanks

And a brief advertisement:

ARM is hosting a Research conference this fall (15-16 September in Cambridge, UK)

HPC will be one of the focus areas:

More details: <http://arm.com/research/>