



ECOSCALE

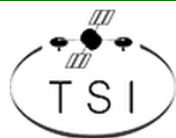
Reconfigurable Computing and Runtime System for Future Exascale Systems

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Outline

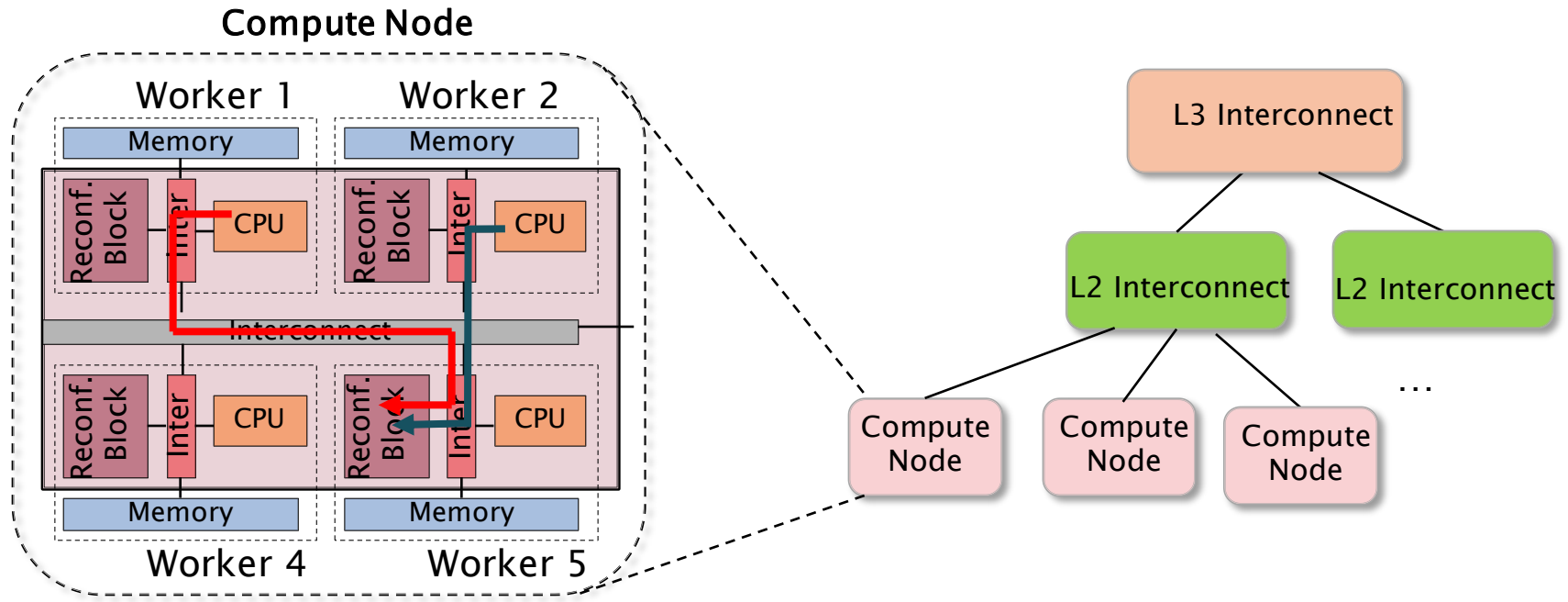
- ▶ **ECOSCALE Highlights**
- ▶ **What we can offer to an EsD Project**
- ▶ **Conclusions for ECOSCALE**
- ▶ **Suggestions for preparatory actions for EsD projects**

Objectives

▶ Use OpenCL to utilize reconfigurable computing

- 👉 Get orders of magnitude more performance with conventional software development process
- 👉 Get an order of magnitude higher energy efficiency by having dedicated hardware modules for power hungry tasks
- 👉 Get orders of magnitude higher reliability in terms of MTTF since FPGAs can easily be reconfigured after deployment

How We Will do it ?



- ▶ Create a computing node incorporating FPGAs and high-end ARM cores tightly together
- ▶ Provide hooks to allow for the interconnection with vast storage efficiently (Through the ExaNest project)
- ▶ More complex Processing units will be seamlessly integrated (Through the ExaNode project)

Nice Hardware ... what about Software

- ▶ The whole system will be programmed by “conventional” OpenCL
 - The programmer will not be aware of the FPGA’s intricacies
 - Even the reconfiguration of the system will be done in a “zero latency” manner
- ▶ Most OpenCL kernels would be automatically translated into efficient hardware accelerators
- ▶ Certain optimized OpenCL kernels will be initially developed while a complete such repository is envisioned (through an EsD project?)

ECOSCALE and EsD projects

- ▶ ECOSCALE can offer to an EsD project:
 - The novel reconfigurable hardware and software platform with all its validated features
- ▶ ECOSCALE can be extended in an ESD:
 - Integrate it with other homogeneous and/or heterogeneous large scale HPC system(s)
 - Add low-level software (e.g. intercommunication middleware, adapted OSs, tools for monitoring, debugging, performance analysis, security, QoS etc)
 - Create an ECOSCALE optimized library for HPC applications
- ▶ Any other suggestions ??

Conclusions

- ▶ ECOSCALE provides an ecosystem comprising of a High Level programming environment coupled with a novel runtime system running on top of a pioneering hardware infrastructure
- ▶ ECOSCALE utilizes
 - Distributed Reconfigurable Logic
 - OpenCL programmability
 - Hidden runtime reconfiguration
- 👉 So you get performance, power efficiency and resilience for free in terms of development time (almost 😊)
- ▶ ECOSCALE can (and should ?) be a part of an EsD project so as to be commercially exploited and allow highly demanding HPC applications to take advantage of its unique features

What we need to best prepare?

- ▶ What if CoEs and Technology FET–HPC projects investigate together which applications from the CoEs can be efficiently executed in each developed system ?
 - Using funding for exchanges from HiPEAC and/or ETP4HPC?
- ▶ What if we set up clusters and publicly lead some of the next EsD proposals ?
- ▶ What if those clusters organize workshops where any potential project/company/institution can specify its contributions (yes small EsD round tables per cluster 😊 ?