



# ECOSCALE

Reconfigurable Computing and Runtime System  
for Future Exascale Systems

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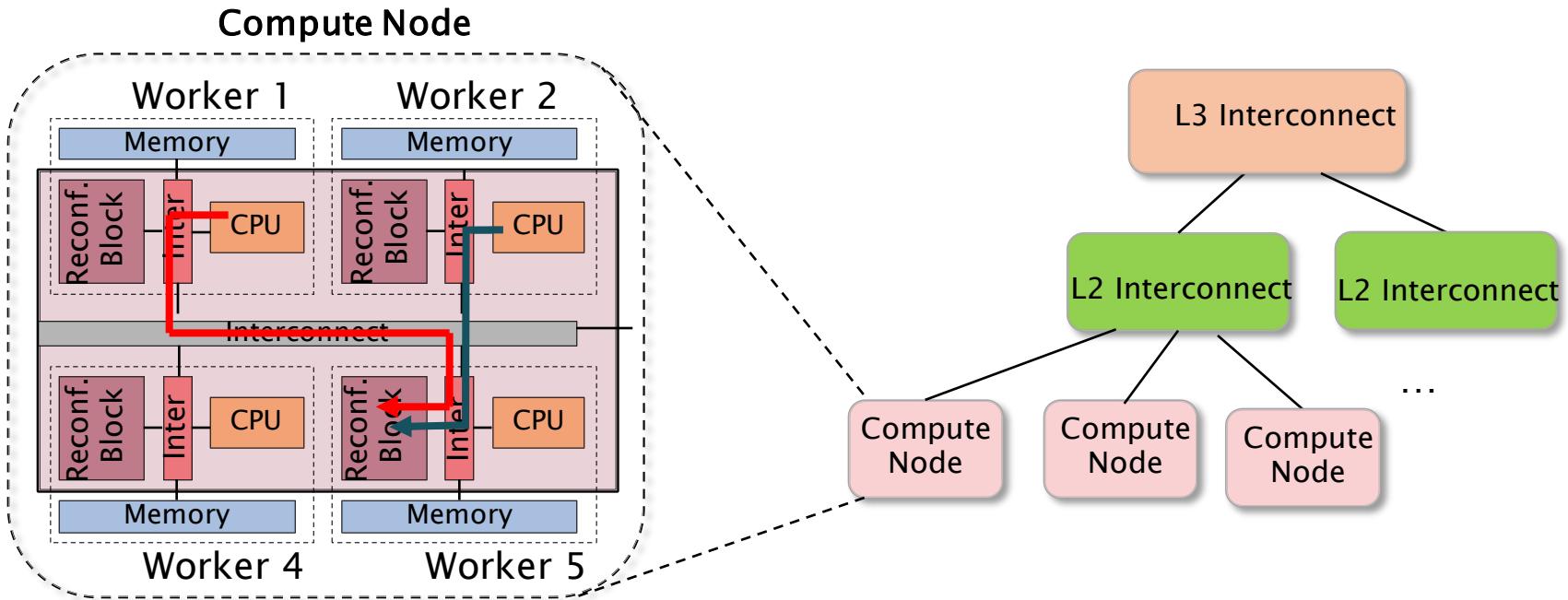
# Outline

- ▶ 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 ☺) ?