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The Qthreads Lightweight Multithreading Library

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CCMSC Programming Models Deep Dive

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Qthreads Overview

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- Programmer exposes application parallelism as massive numbers of lightweight tasks (qthreads)
  - Problem-centric rather than processor-centric decomposition enhances productivity, transparent scaling
  - Both loop-based and task-based parallelism supported
  - Full/empty bit primitives for powerful, lightweight synchronization (emulates Tera/Cray MTA/XMT behavior)
  - C API with no special compiler support required
- Dynamic run time system manages the scheduling of tasks for locality and performance
  - Heavyweight worker pthreads execute the tasks
  - Worker pthreads pinned to underlying hardware

Qthreads Capabilities

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- Locality-aware load balancing of tasks to support NUMA and complex cache hierarchies
  - Hybrid of shared queuing and work stealing methods
- Lightweight task context switching
- Interfaces for higher-level languages/libraries
  - Only scalable tasking layer for Chapel PGAS language
  - OpenMP (with the ROSE compiler as the front-end)
    - Experimental locality extensions (SC12 Best Student Paper)
    - Experimental adaptive concurrency for energy savings
  - Kokkos library for manycore (in progress)
- Ported to x86, Phi, PPC, Sparc, Tilera

Qthreads Run Time View of Locality

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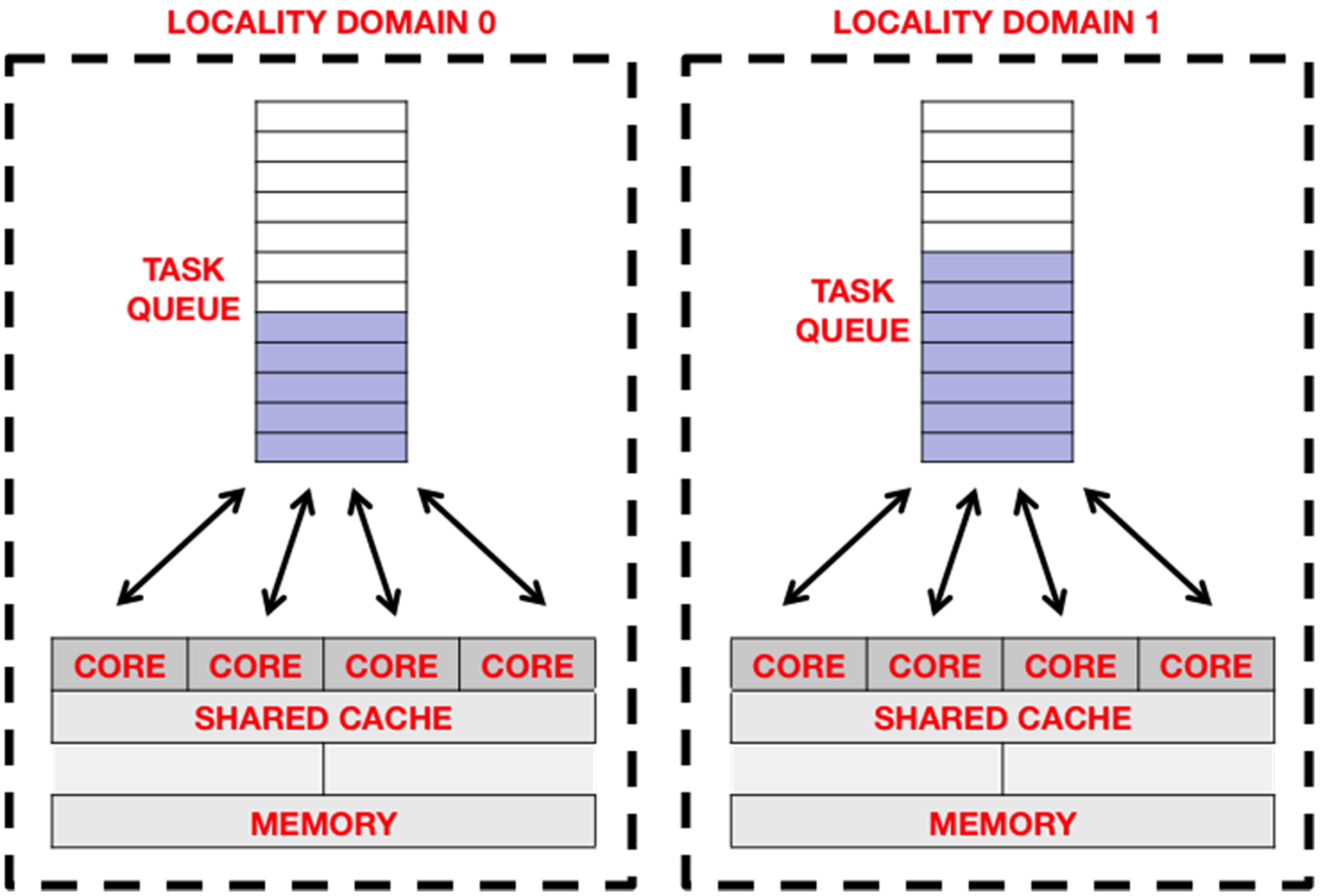

Available Online

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Qthreads

More info: http://www.cs.sandia.gov/qthreads/

Source: https://code.google.com/p/qthreads/