MassiveThreads Tasking Layer

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What is MassiveThreads?

• A user-level lightweight thread library
  ▫ Designed for High Productivity Languages

• Key characteristics:
  ▫ Efficiently support fine-grain threads
  ▫ Provide pthread-compatible API and semantics
    • Blocking I/O can trigger context switches

• We implemented Chapel tasking layer by MassiveThreads
Why MassiveThreads?

- Good performance on task-parallel application
  - Create-and-destroy: < 80ns
  - Scalable dynamic load balancing

- Support multiple locales
  - Can handle multiple I/Os concurrently

- Easy to integrate
  - Pthread-compatible API makes interaction between communication threads and tasks straightforward
Tasking Layer Implementation

- Written as a simple wrapper of MassiveThreads
- Support multiple locales without extra coding
  - Thanks to pthread-compatible API
  - Internal communication threads can be managed
Single-Locale Performance

- **fib(46)**
  - Speedup vs. # of CPU Cores
  - Speedup increases with the number of CPU cores.

- **UTS(uts-dfs,T3L)**
  - Speedup vs. # of CPU Cores
  - Speedup increases with the number of CPU cores.

- **Matrix Multiply(2048)**
  - Speedup vs. # of CPU Cores
  - Speedup increases with the number of CPU cores.

- **Quicksort**
  - Speedup vs. # of CPU Cores
  - Speedup increases with the number of CPU cores.
Summary

- Chapel tasking layer by MassiveThreads:
  - Good recursive task-parallel performance
  - Support multiple locales easily

- Future work:
  - More performance studies
  - Integrating the library into forall
  - Support multiplexing for more I/O types

- MassiveThreads source code is available!
  - License: initially LGPL, change to new BSD after review
Other Ongoing Efforts: Molecular Dynamics in Chapel

- **Programmability**
  - **Parallelization**
    - Less than 5% code modification from serial version
  - **GPGPU integration**
- **Performance implication**
- **Feedback for both users and developers**
- **Open source**
  - [http://mdoch.googlecode.com/](http://mdoch.googlecode.com/)
Other Ongoing Efforts: Molecular Dynamics in Chapel


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Thank you for your attention!