

WELCOME TO THE CHARM++ BOF

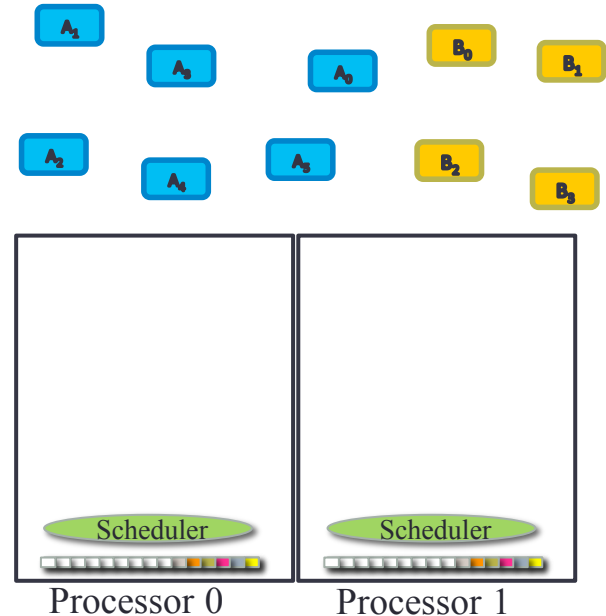
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Charm++ Programming Model and Capabilities

- Object-based processor virtualization:
 - Computation is expressed as a large number of objects
 - Interacting via asynchronous method invocations
 - Number of objects is independent of processors
 - Communication: using global names, not procs
- Migratability: The RTS assigns Objects to processors, and may reassign them
- Asynchrony: A message Driven Scheduler



- Dynamic load balancing via object migration
- Resilience support
- Compositionality: interleaves execution of modules
- Power management

Charm++ features and improvements

- Releases
 - Version 6.8.0 (8/16/2017)
 - Version 6.8.1 (10/6/2017)
 - Version 6.8.2 (10/26/2017)
- Highlights:
 - OpenMP integration
 - GreedyRefineLB
 - Fine-grain performance optimized
 - [aggregate] attribute and TRAM
 - ❖ for message agglomeration
 - Large messages:
 - ❖ [nocopy], one-sided API
- Interoperation:
 - Charm++ programs can now define their own main() function
 - MPI interoperability enhanced
- Support for malleable jobs
- Enhanced support for reductions
- Platform support:
 - Power8/PAMI, OFI
- AMPI: much enhanced

Charm++ / AMPI Roadmap: some highlights

- 6.9 will require C++11 support
- Python version: CharmPy
- Improved sections and collectives
- Refactored load balancing framework with several new classes of strategies
- More automation of load balancing
- Generally, improved out-of-box performance via better defaults
- Enhancements of shrink/expand and other features for cloud deployment
- GPGPU support: next slide

Using GPUs in Charm++

- Interfaces

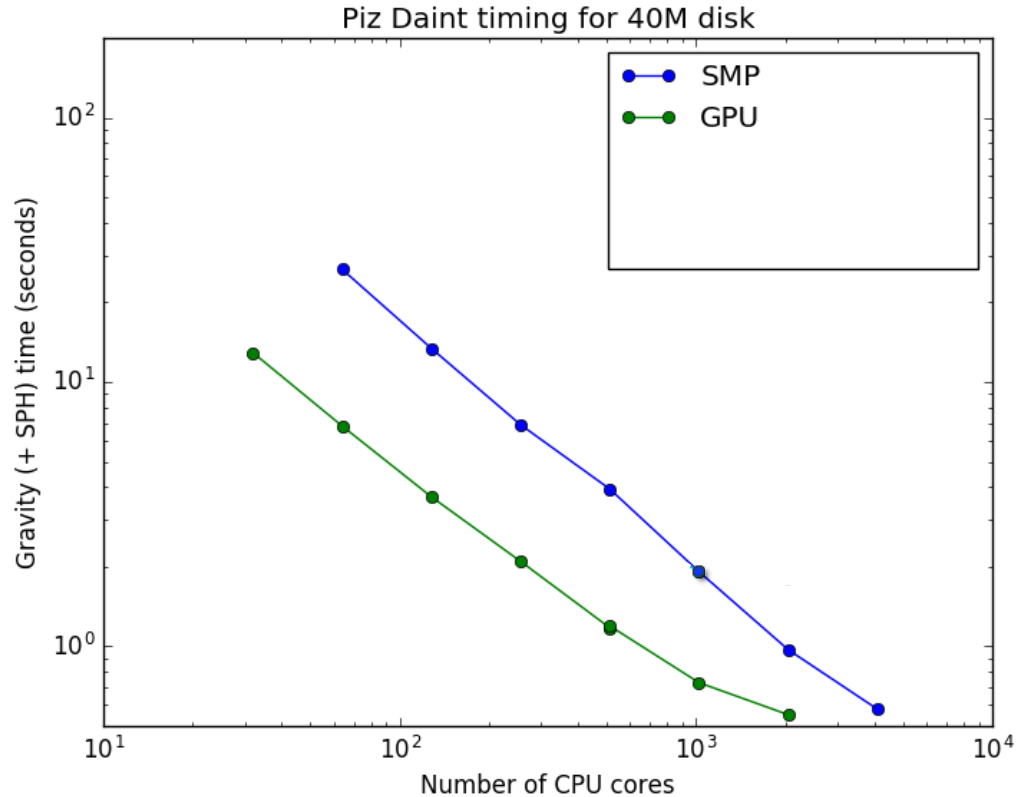
- HAPI - Hybrid API
 - GPU Manager
 - Accel Framework
- Less
↑
Abstraction
↓
More

- Road Map

- Heterogeneous load balance
- New execution modes (sched, PEs)

- Applications

- ChaNGa – full GPU manager support
- OpenAtom – experimental support
- NAMD – migration to profiling



Applications

- Our applications saw a lot of successes
 - You will hear about some of them
- A few highlights
 - 2017 NERSC Award for Innovative Use of HPC
 - ❖ Bhatele et al, CCGrid 2016 paper on simulation of infectious diseases
 - On NSF's Blue Waters system, past and current PRAC awards:
 - ❖ ChaNGa, NAMD, EpiSimdemics, Cello/Enzo-P, OpenAtom, ..
 - New scaling results from several of them
 - ❖ Cello, ChaNGa, NAMD, OpenAtom (GW), ..

- Charm++ is now a supported commercial product
 - Exclusively licensed to Charmworks, Inc. and supported by it
- Univ. of Illinois continues to distribute Charm++ with its license
 - *Freely available in source code form, non-commercial use*
 - For-profit use should license Charm++ from Charmworks, Inc.
 - Evaluation use by commercial entities is allowed
- Funding from DoE SBIRs:
 - Phase 2 for Charm++, Phase 1 for AMPI
- Charmworks has made several improvements over the last year
 - Most checked back into the University version
- Hopefully, you have had a chance to stop by Charmworks booth #2233

16th Annual Workshop on Charm++ and Applications

- Dates are almost final: April 11-12 2018,
 - at the University of Illinois in Urbana Champaign
- There will be tutorials
 - Preceding and/or succeeding days
 - Please register your preference for topics by email