Performance Results

Chapel Team, Cray Inc.
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Executive Summary

● Generally speaking, performance has improved with 1.15
  ● in fact, this is our strongest release ever

● Previous slide decks have shown performance changes:
  …due to array improvements
  …due to compiler and library optimizations
  …due to runtime optimizations

● These slides contain additional v1.15 performance results
  ● not tied to any specific effort, just comparisons across releases
Outline

- **Single-Locale Performance Trends**
- **Multi-Locale Performance Trends**
Single-Locale Performance Trends
Single-Locale Performance

- A few expected performance regressions
  - minor thread-ring regression caused by limiting qthreads pool size
    - change was necessary, no other benchmarks impacted
  - minor pi-digits regression caused by hybrid spin/condwait
    - change had an enormously positive impact overall
    - minor regressions for serial/low-task applications only
Single-Locale Performance

- A few surprising --no-local regressions
  - caused by array memory management improvements
  - slipped by our --no-local perf triage, will track more closely in the future
  - nbody regression has already been resolved
  - investigating fixes for other regressions
Single-Locale Performance

- Overall, single-locale performance improved dramatically
Single-Locale Performance

- Overall, single-locale performance improved dramatically
- Speedups for single-idiom micro-benchmarks

Serial 1D Array Performance

Array Vector Operations

Reductions Time (sec)

Empty Task Spawn Timings (500,000 x maxTaskPar)
Single-Locale Performance

- Overall, single-locale performance improved dramatically
- improvements for several shootout codes

**Meteor Shootout Benchmark (n=2098)**

**Chameneos Redux Shootout Benchmark (n=6,000,000)**

**N-body variations**

**Submitted Fasta Shootout Benchmark**

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**Single-Locale Performance**

- Overall, single-locale performance improved dramatically
- substantial speedups for HPCC codes

![Graphs showing performance improvements over time for HPCC PTRANS, FFT, RA, and HPL benchmarks.](image-url)
Single-Locale Performance

- Overall, single-locale performance improved dramatically
- huge improvements for core proxy apps
Multi-Locale Performance Trends
Multi-locale Performance

- Significant multi-locale performance improvements
- no known regressions
Multi-locale Performance

- Significant multi-locale performance improvements
- No known regressions (qthreads now outperforms muxed even more)
Performance Priorities and Next Steps
Performance Priorities and Next Steps

● **Improve NUMA-aware performance**
  ● strive to support NUMA by default without performance loss

● **Continue benchmark-driven improvements**
  ● single-locale:
    ● eliminate remaining performance gap for LCALS
    ● improve performance for shootouts and proxy apps
  ● multi-locale:
    ● reduce unnecessary communication code
    ● optimize scalability of core algorithms (task spawning, reductions, barriers)
    ● focus on ISx, MiniMD/CoMD, LULESH
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