Performance Results

Chapel Team, Cray Inc.

Chapel version 1.18

September 20, 2018

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Summary

- **Generally speaking, performance has improved with 1.18**

- **Previous slides have shown performance improvements:**

  …due to communication reductions
  …due to compiler and library optimizations
  …due to runtime optimizations

- **These slides contain additional 1.18 performance results**
  - not tied to any specific effort, just comparisons across releases

Outline

- Single-Locale Performance Trends
- Multi-Locale Performance Trends
- Scalability Trends
- Priorities and Next Steps

Single-Locale Performance Trends

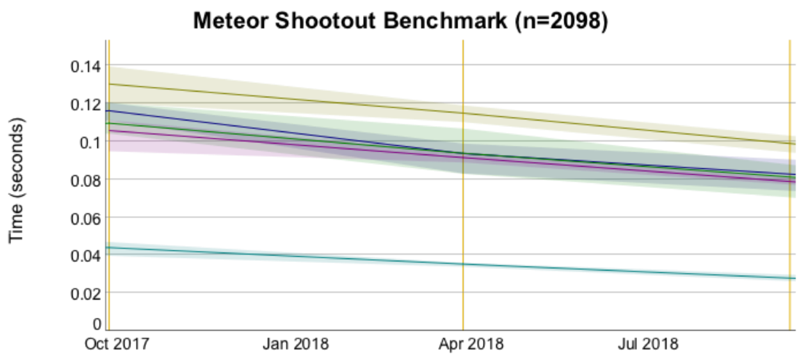
Single-Locale Performance Configuration

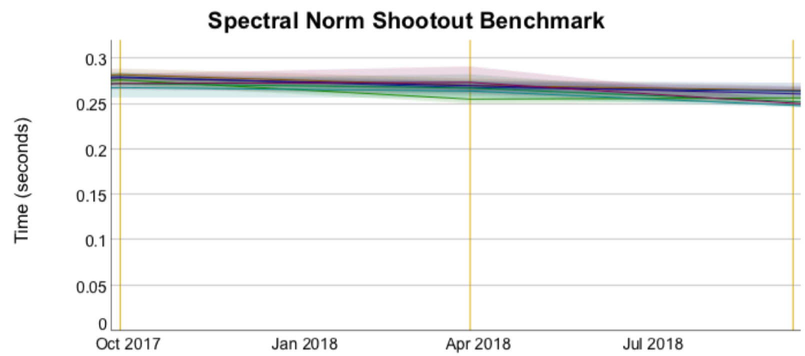
- **Hardware:**
  - 24-core, 128GB RAM
    - (2) 12-core "Haswell" 2.6 GHz processors

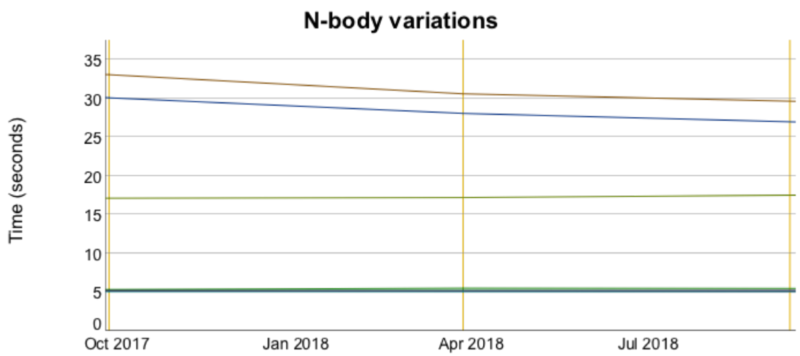
- **Software:**
  - SLES 12
  - GCC 6.3
  - Chapel 1.16.0, 1.17.1, 1.18.0

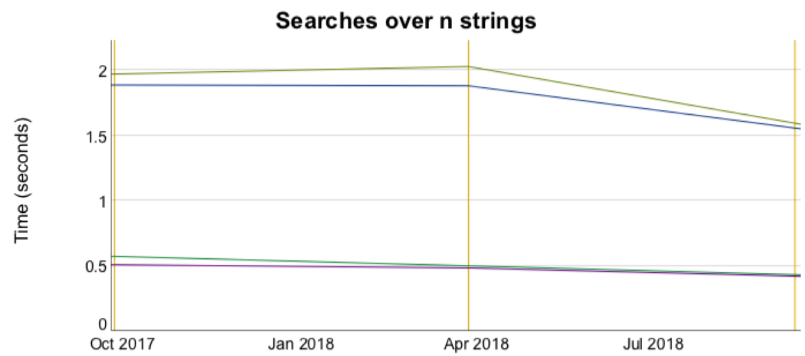
Single-Locale Performance

- **No major single-locale performance changes**
  - Minor improvements for a handful of benchmarks



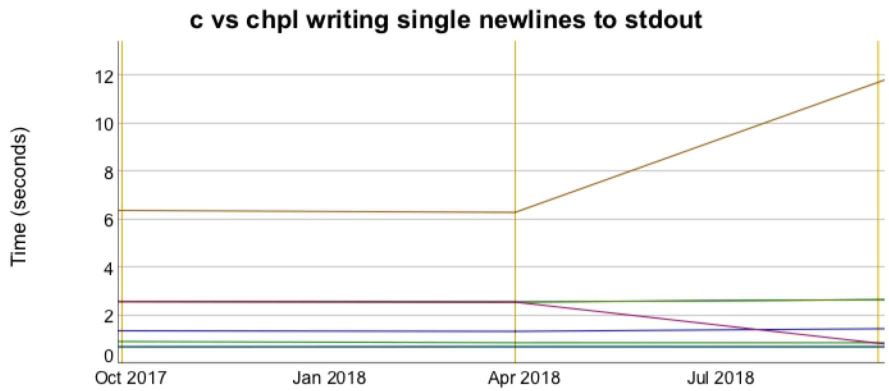






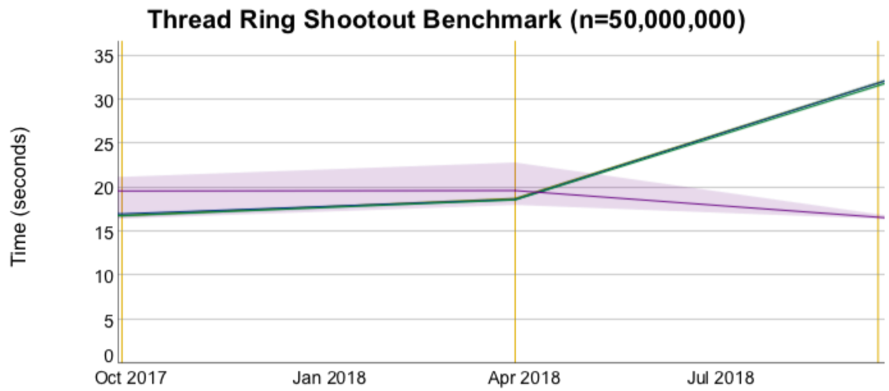
Single-Locale Performance

- **Some known/expected single-locale regressions**
  - Serial I/O sacrificed for better Parallel I/O
    - plan to address in later release with a hybrid lock for I/O
    - users can opt into unlocked I/O if needed



Single-Locale Performance

- **Some known/expected single-locale regressions**
  - Producer/consumer style sync variable performance hurt
    - but significantly improved performance for sync-based locks/barriers
    - working with qthreads team for a better solution



Multi-Locale Performance Trends

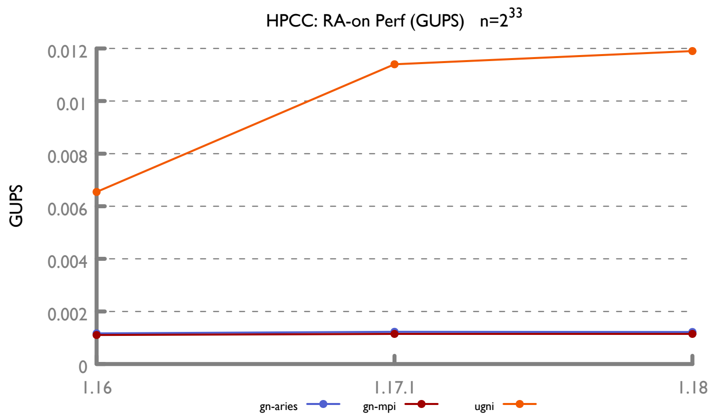
Multi-Locale Performance Configuration

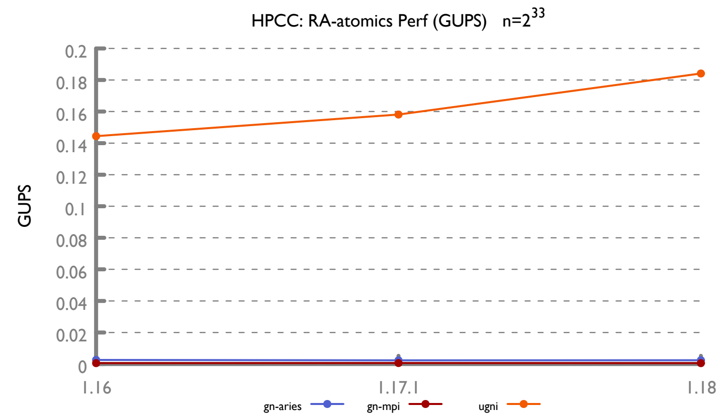
- **Hardware: 16 nodes of a Cray XC**
  - 28-core, 128GB RAM
    - (2) 14-core "Broadwell" 2.6 GHz processors

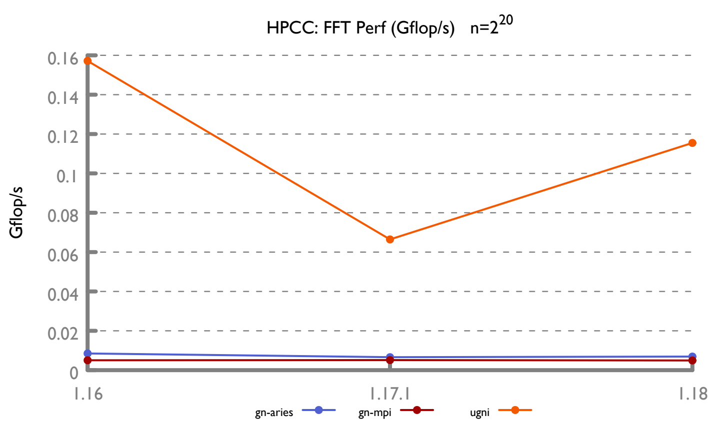
- **Software:**
  - CLE6
  - GCC 6.3
  - Chapel 1.16.0, 1.17.1, 1.18.0

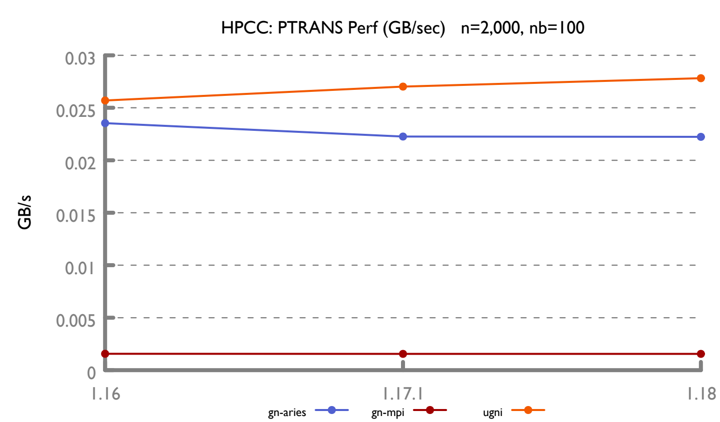
Multi-Locale Performance

- **Modest multi-locale performance improvements**
  - Performance graphs (up is better)



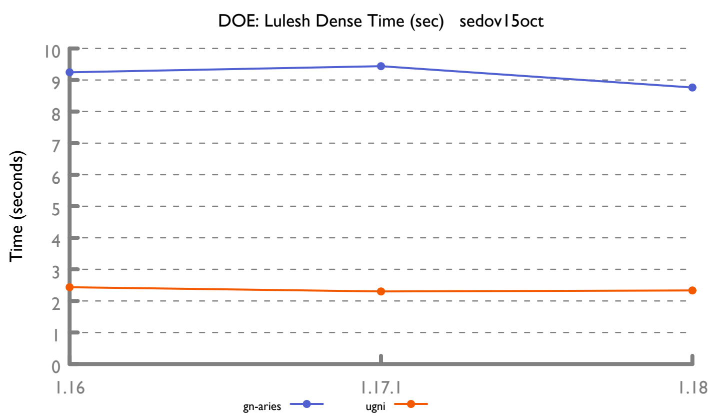


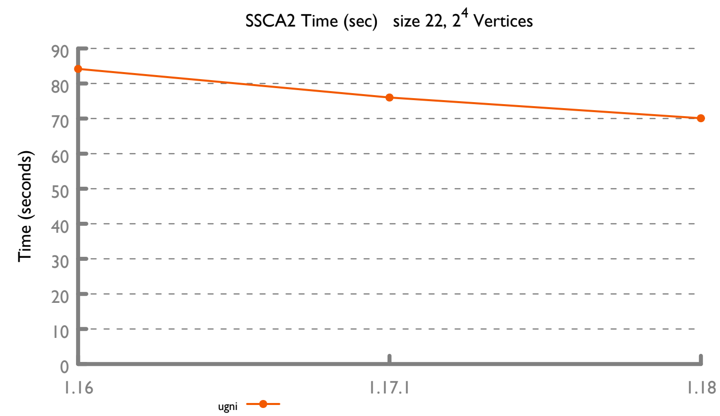


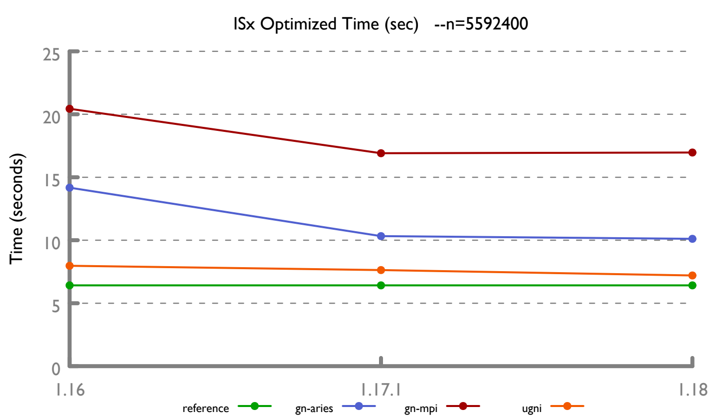


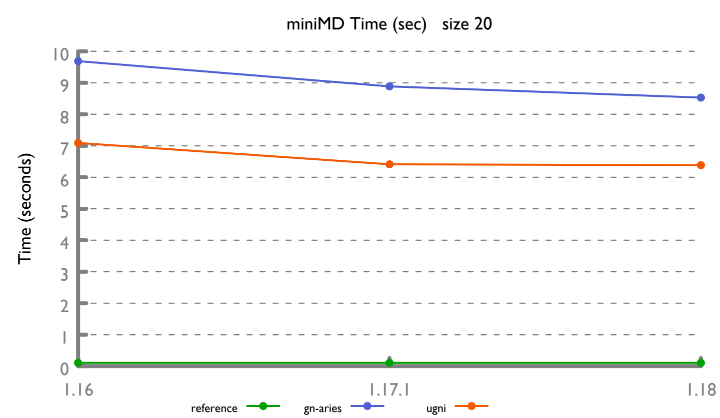
Multi-Locale Performance

- **Modest multi-locale performance improvements**
  - Time graphs (down is better)









Scalability Trends

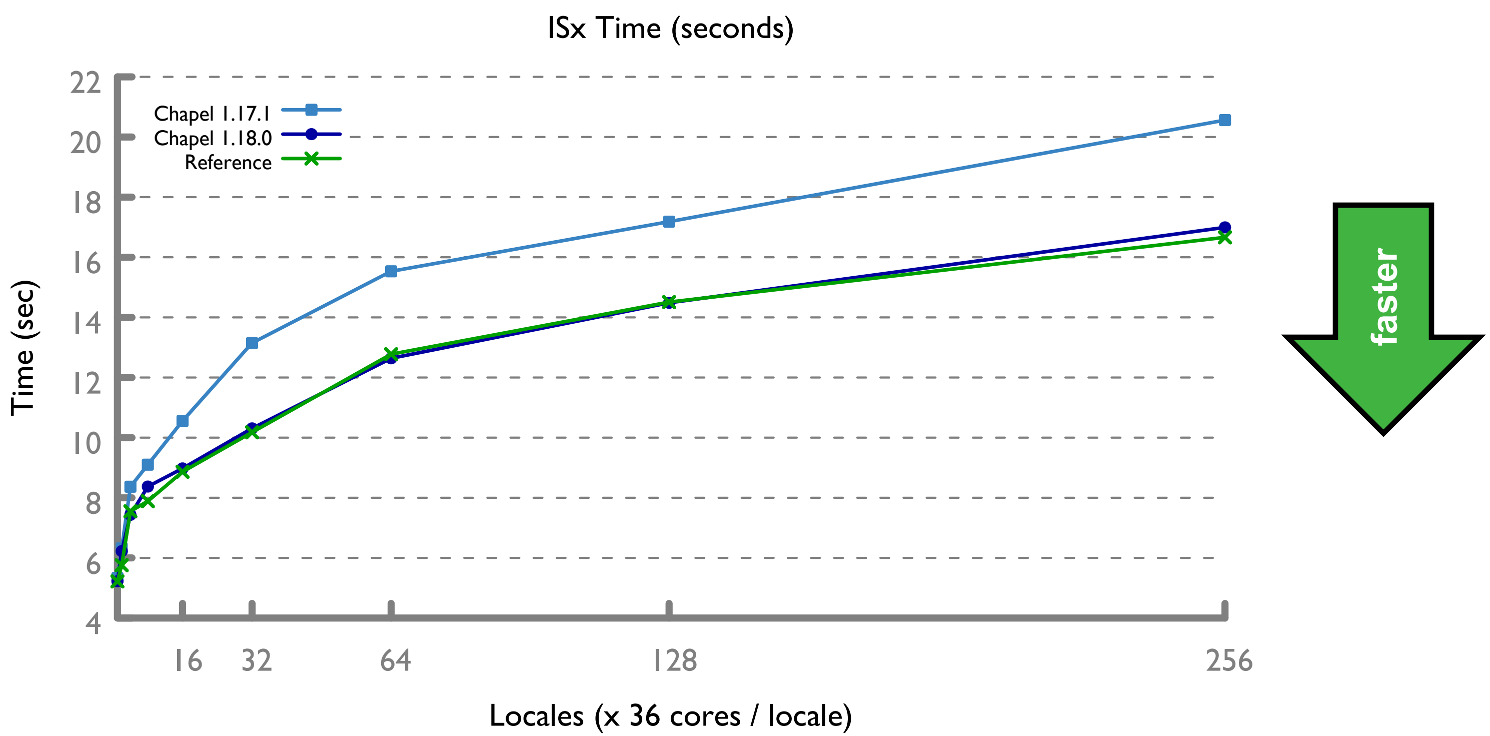
Scalability Configuration

- **Hardware: Up to 256 nodes of a Cray XC**
  - 36-core, 128 GB RAM
    - (2) 18-core "Broadwell" 2.1 GHz processors

- **Software:**
  - CLE6
  - GCC 6.3
  - Cray mpich/shmem 7.6.2
  - Chapel 1.17.1, 1.18.0

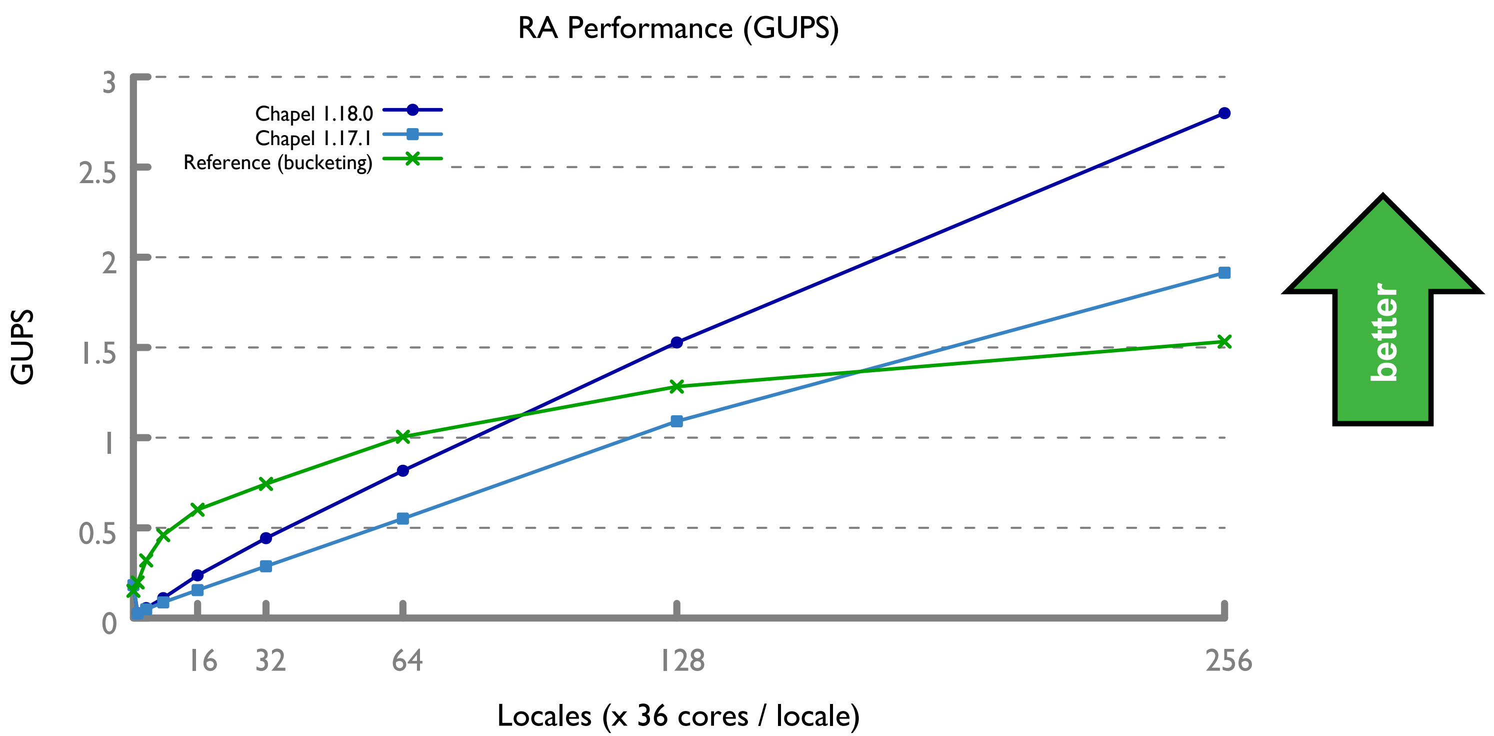
Scalability

- **Significant scalability improvements**
  - ~25% improvement for ISx, now on par with reference



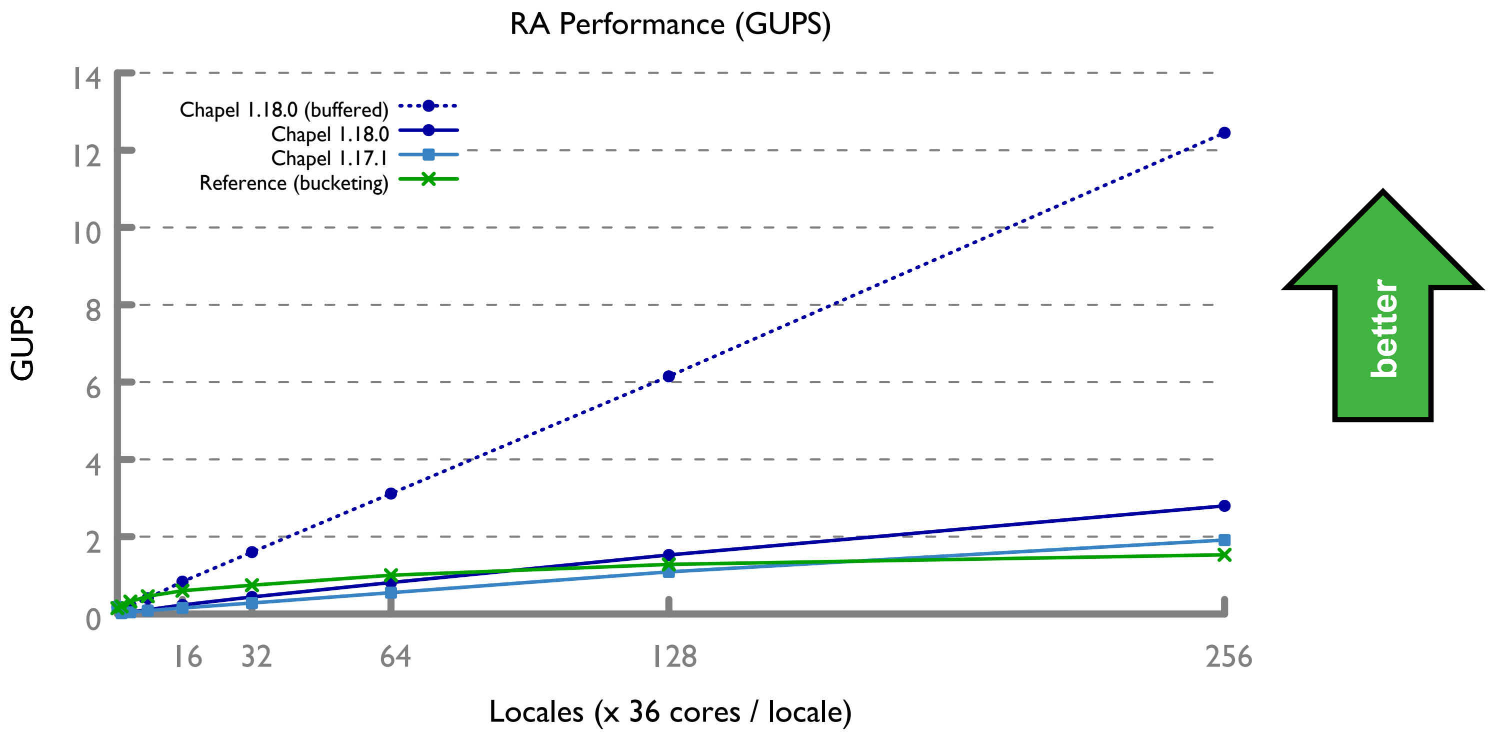
Scalability

- **Significant scalability improvements**
  - ~45% improvement for RA-atomics



Scalability

- **Significant scalability improvements**
  - 6x improvement for RA-atomics with buffered atomics



Performance Priorities and Next Steps

Performance Priorities and Next Steps

- **Continue benchmark-driven improvements**
  - Scalability:
    - add support for unordered GETs/PUTs
    - add a bulk-spawning mechanism for more scalable task-spawning
    - run scalability tests at higher scales
  - Multi-locale:
    - focus on user applications, Bale, PRKs, and DOE proxy apps
    - reduce unnecessary communication
  - Single-locale:
    - improve performance for shootouts (requires better vectorization)

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