



Performance Results

Chapel Team, Cray Inc.
Chapel version 1.17
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Summary

- **Generally speaking, performance has improved with 1.17**
- **Previous slide decks have shown performance changes:**
 - ...due to task-spawning improvements
 - ...due to compiler and library optimizations
 - ...due to runtime optimizations
- **These slides contain additional 1.17 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



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Single-Locale Performance Configuration

- **Hardware:**

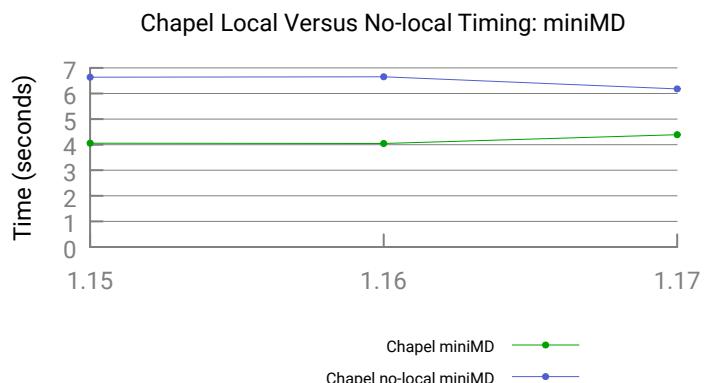
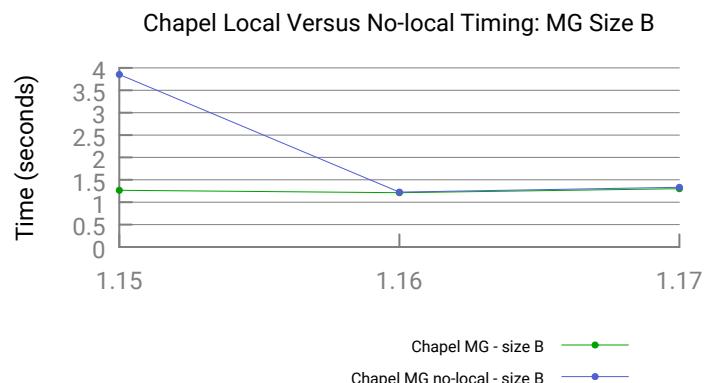
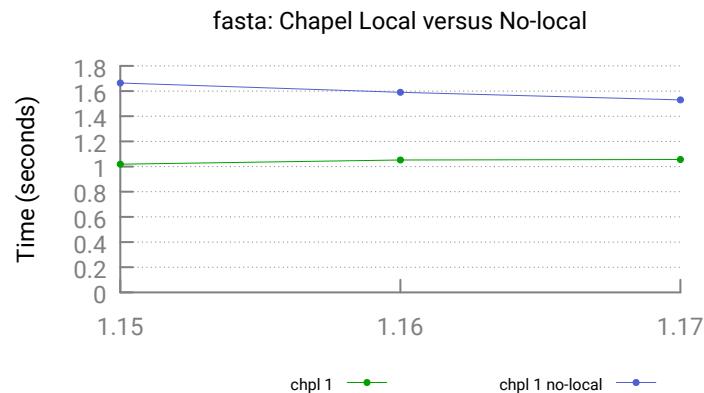
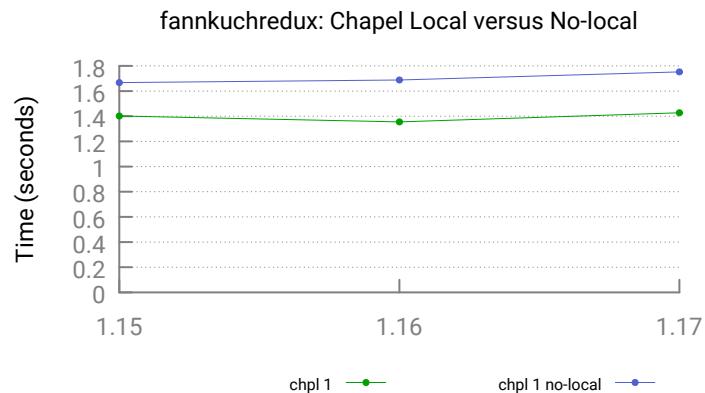
- 24-core, 128GB RAM
 - (2) 12-core "Haswell" 2.6 GHz processors

- **Software:**

- SLES 12
- GCC 6.3
- Chapel 1.15.0, 1.16.0, 1.17.0

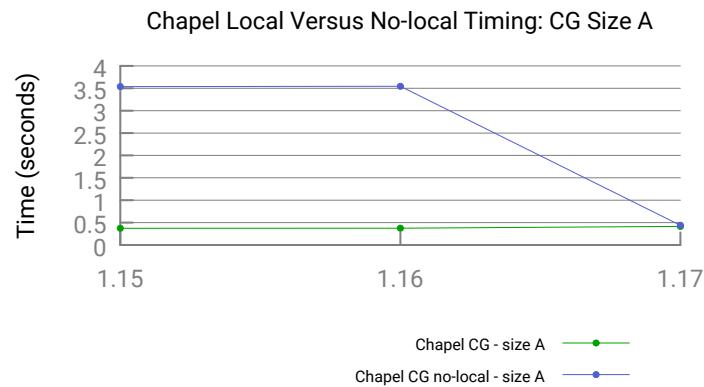
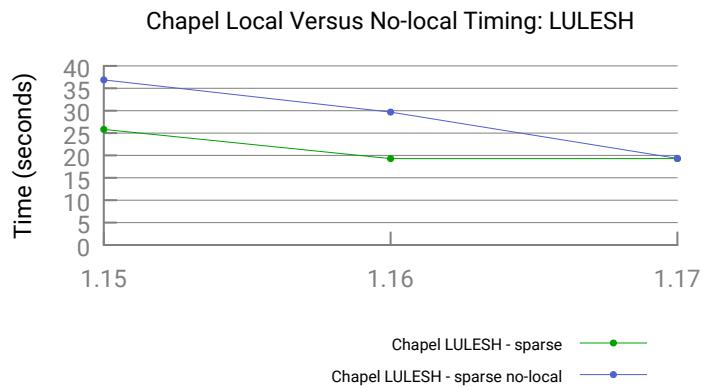
Single-Locale Performance

- No major --local performance changes
 - Minor improvements and regressions



Single-Locale Performance

- Some significant --no-local performance improvements
 - For sparse codes



Multi-Locale Performance Trends



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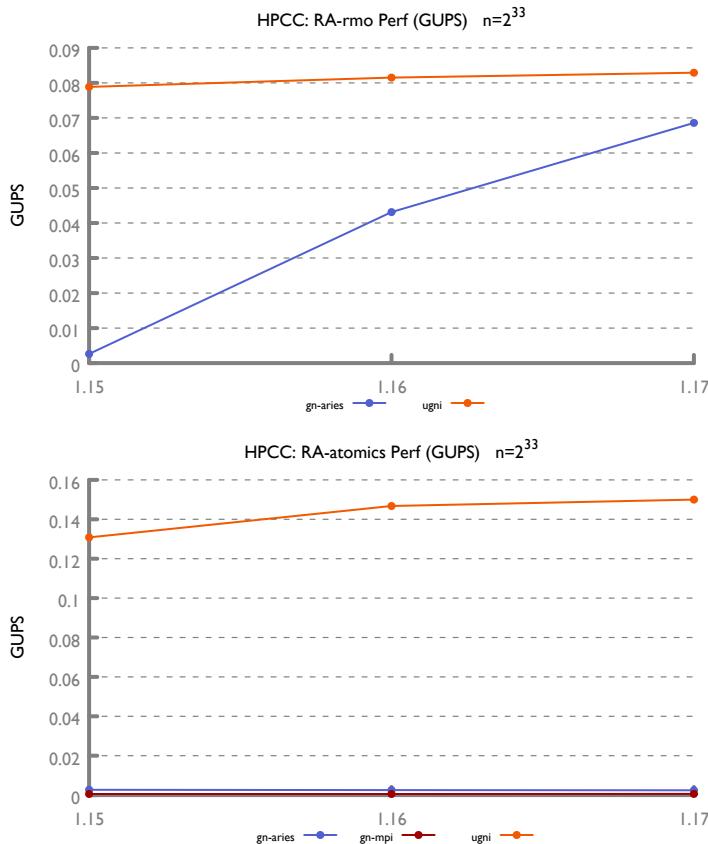
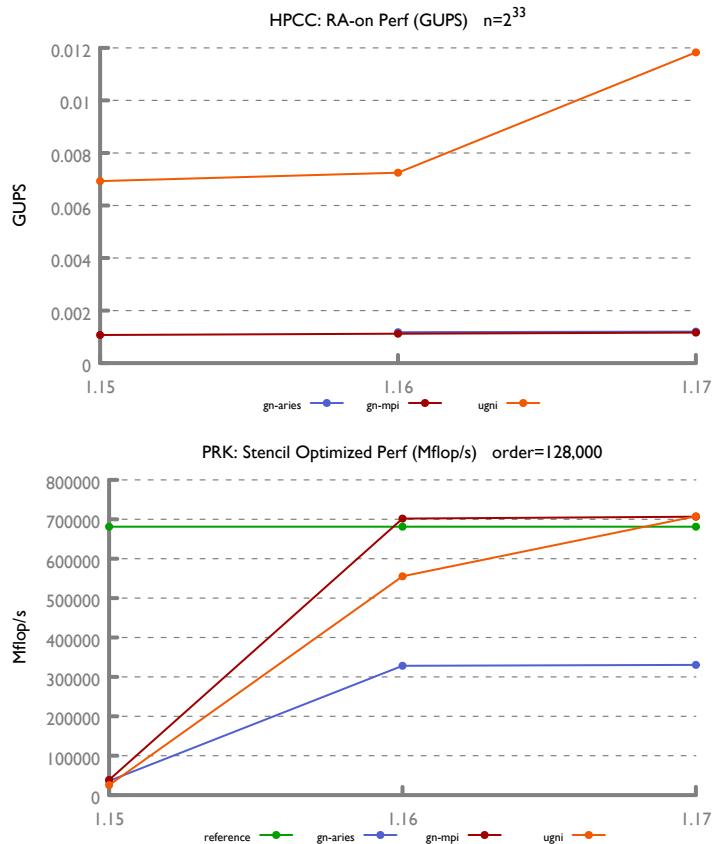
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Multi-Locale Performance Configuration

- **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 1.15.0, 1.16.0, 1.17.0

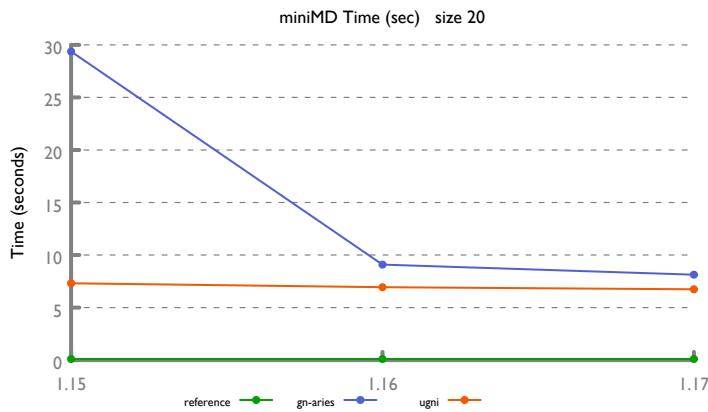
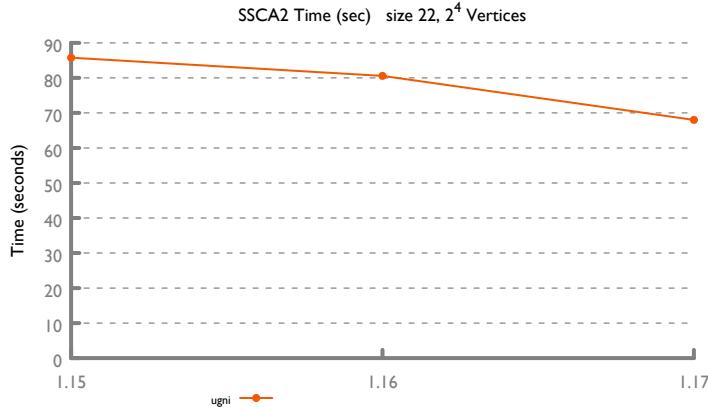
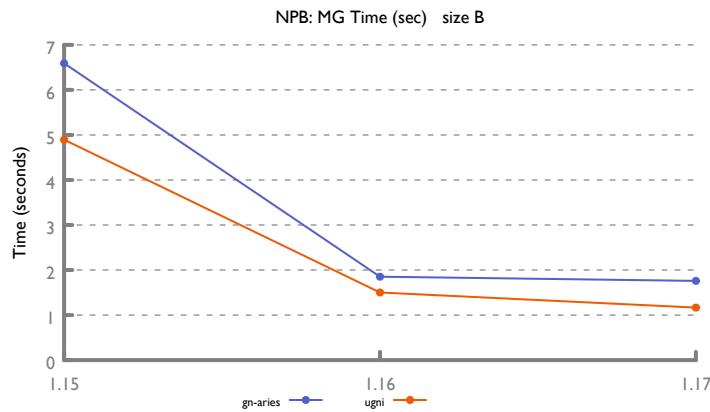
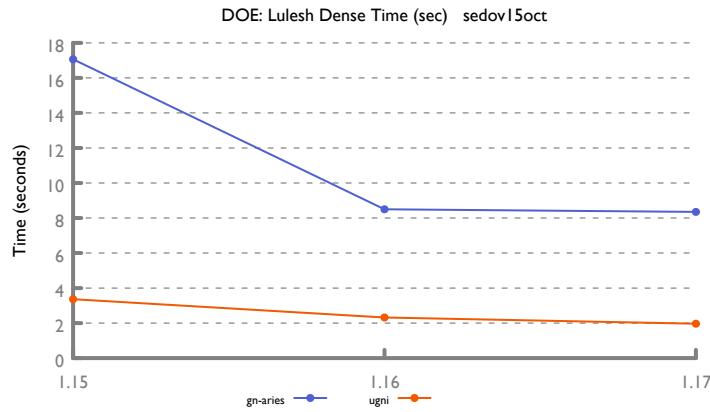
Multi-Locale Performance

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



Multi-Locale Performance

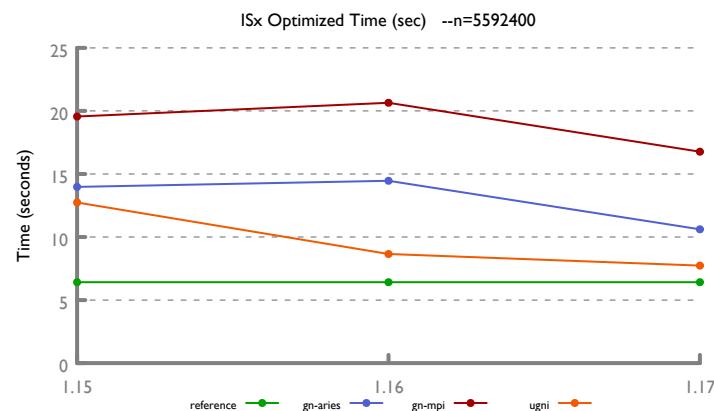
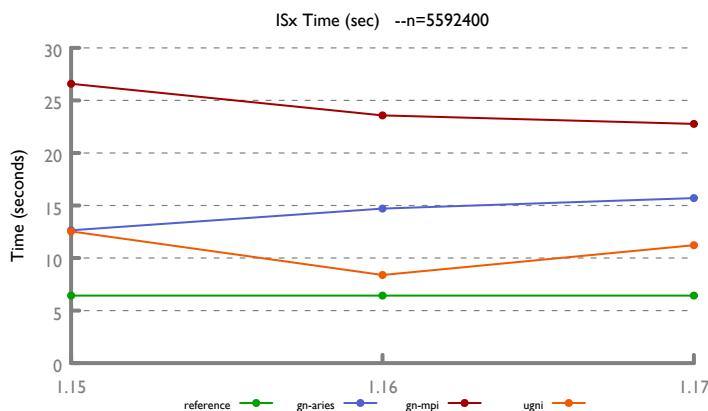
- Significant multi-locale performance improvements
 - Time graphs (down is better)



Multi-Locale Performance

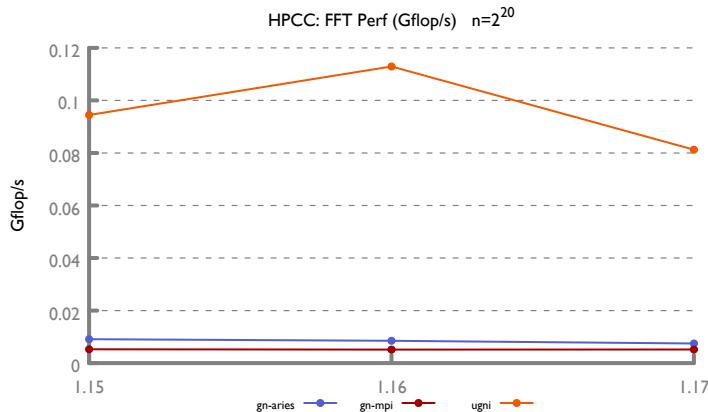
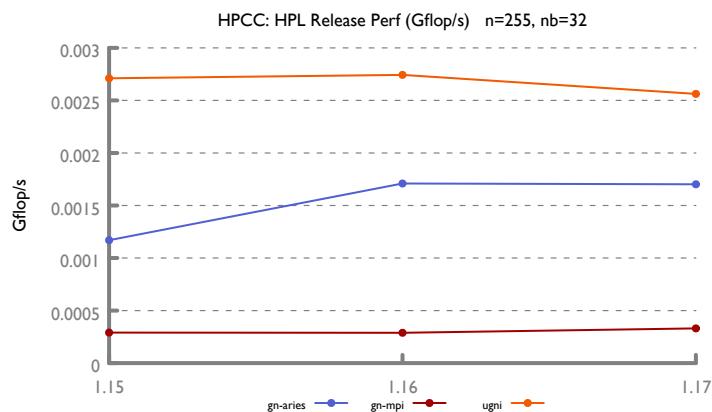
- Known regression for elegant ISx

- However, performance improved for optimized version
- (changes will be propagated to elegant version)



Multi-Locale Performance

- A few regressions from ugni dynamic registration
 - Underlying root cause not identified yet, still need to investigate



Scalability Trends



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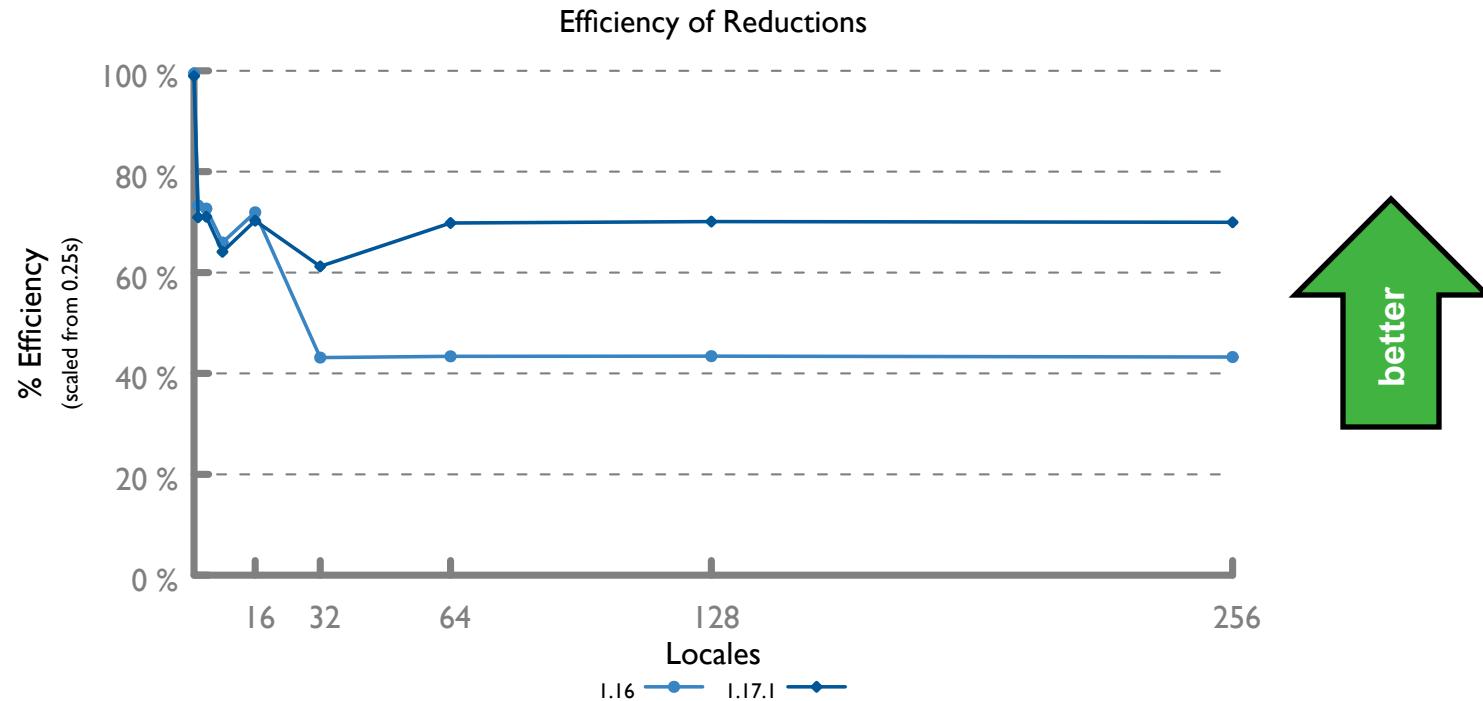
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Scalability Configuration

- **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
 - Chapel 1.16.0, 1.17.1

Scalability

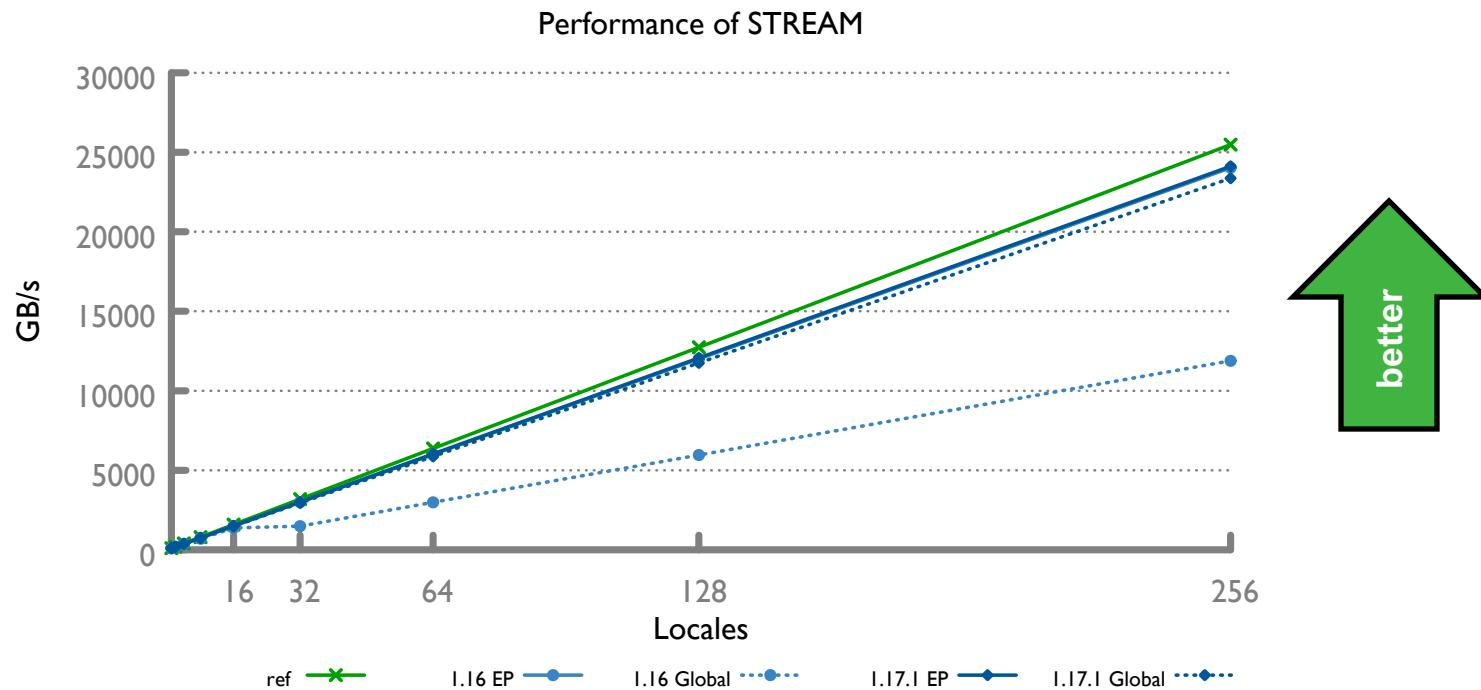
- **Significant scalability improvements**
 - Reduction efficiency significantly improved



Scalability

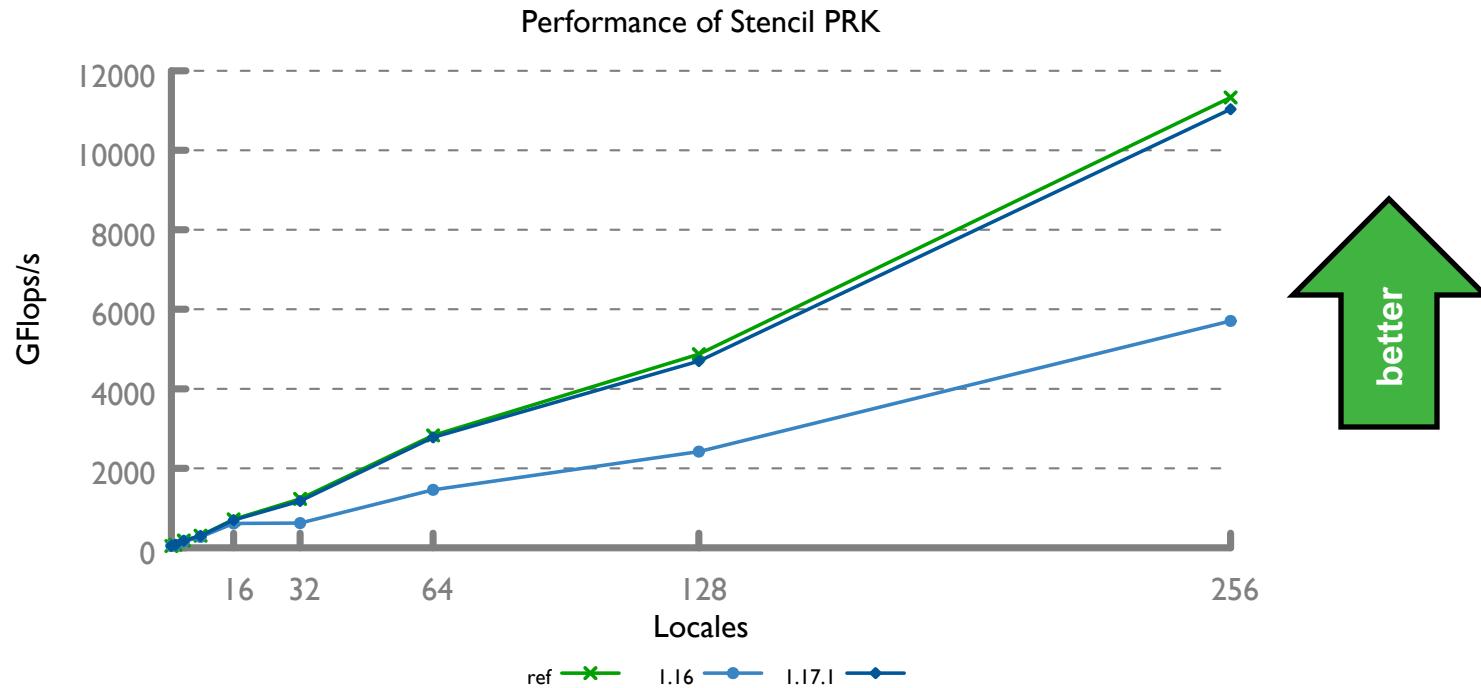
- **Significant scalability improvements**

- Stream Global scalability and performance approaching EP
 - (EP slightly behind reference because of hugepage usage)



Scalability

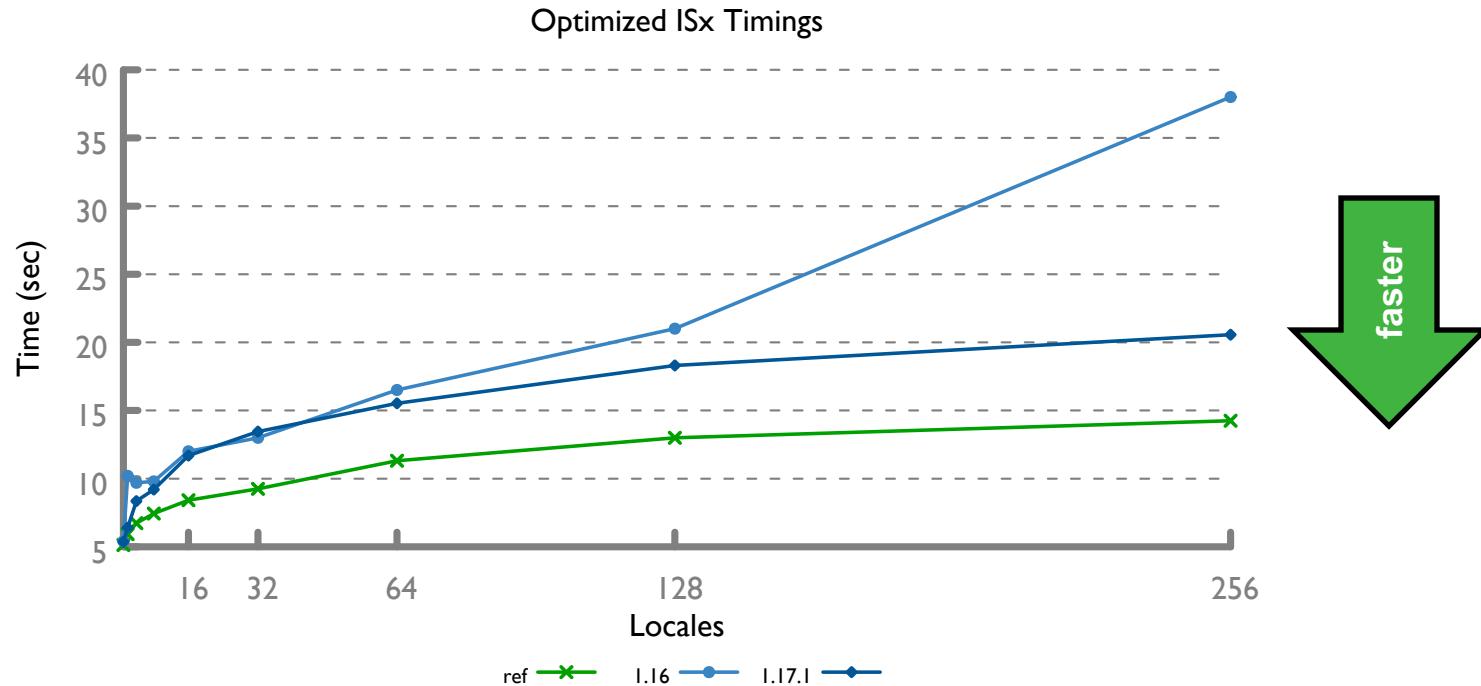
- **Significant scalability improvements**
 - PRK Stencil scalability and performance approaching reference



Scalability

- **Significant scalability improvements**

- ISx scalability on par with reference
 - (raw performance is still ~25% behind, but scaling well)



Performance Priorities and Next Steps



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Performance Priorities and Next Steps

- Continue benchmark-driven improvements

- Scalability:
 - Add a bulk-spawning mechanism for more scalable task-spawning
 - Add a cleaner user-facing scalable barrier to compliment allLocalesBarrier
 - Run scalability tests at higher scales
- Multi-locale:
 - focus on ISx, PRKs, MiniMD/CoMD, LULESH, and other DOE proxy apps
 - reduce unnecessary communication
 - improve task-affinity between consecutive forall
- Single-locale:
 - improve performance for shootouts (requires better vectorization)



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