Productive Programming in Chapel: A Computation-Driven Introduction

Project Status, Next Steps

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Outline

✓ Motivation
✓ Chapel Background and Themes
✓ Learning the Base Language with n-body
✓ Short Introduction to Task Par
✓ Hands-On 1: Hello World
✓ Short Introduction to Locality
✓ Data Parallelism with Jacobi
✓ Hands-On 2: Mandelbrot

➤ Project Status and Next Steps
Chapel’s 5-year push

Based on positive user response to Chapel under HPCS, Cray undertook a five-year effort to improve it
- we’re partway through our third year

Focus Areas:
1. Improving **performance** and scaling
2. **Fixing** immature aspects of the language and implementation
   - e.g., strings, memory management, error handling, …
3. **Porting** to emerging architectures
   - Intel Xeon Phi, accelerators, heterogeneous processors and memories, …
4. Improving **interoperability**
5. Growing the Chapel user and developer **community**
   - including non-scientific computing communities
6. Exploring transition of Chapel **governance** to a neutral, external body
Chapel is a Collaborative, Community Effort

(and many others as well…)

http://chapel.cray.com/collaborations.html
A Year in the Life of Chapel

- **Two major releases per year** (April / October)
  - ~a month later: detailed release notes

- **SC** (Nov)
  - annual **Lightning Talks BoF** featuring talks from the community
  - annual **CHUG (Chapel Users Group) happy hour**
  - plus tutorials, panels, BoFs, posters, educator sessions, exhibits, …

- **CHIUW: Chapel Implementers and Users Workshop** (May/June)
  - CHIUW 2014 held at IPDPS (Phoenix, AZ)
  - CHIUW 2015 held at PLDI/FCRC (Portland, OR)
  - CHIUW 2016 to be held at IPDPS (Chicago, IL)

- **Talks, tutorials, research visits, blog posts, …** (year-round)
Implementation Status -- Version 1.12.0 (Oct 2015)

Overall Status:

- **User-facing Features:** generally in good shape
  - some receiving additional attention (e.g., strings, OOP, errors)
- **Multiresolution Features:** in use today
  - their interfaces are likely to continue evolving over time
- **Error Messages:** not always as helpful as one would like
  - correct code tends to work well, incorrect code can be puzzling
- **Performance:** hit-or-miss depending on the idioms used
  - ultimately, Chapel will support competitive performance
  - effort to-date has focused primarily on correctness

This is a great time to:

- Try out the language and compiler
- Use Chapel for non-performance-critical projects
- Give us feedback to improve Chapel
- Use Chapel for parallel programming education
When teaching parallel programming, I like to cover:

- data parallelism
- task parallelism
- concurrency
- synchronization
- locality/affinity
- deadlock, livelock, and other pitfalls
- performance tuning
- …

I don’t think there’s been a good language out there…

- for teaching all of these things
- for teaching some of these things well at all
- until now: We believe Chapel can play a crucial role here

(see http://chapel.cray.com/education.html for more information and http://cs.washington.edu/education/courses/csep524/13wi/ for my use of Chapel in class)
Single-Locale Execution Time is Improving
lower is better, yellow lines indicate releases (1.6-1.11)
Suggested Reading

Overview Papers:

  ● a detailed overview of Chapel’s history, motivating themes, features

  ● a higher-level overview of the project, summarizing the HPCS period
Lighter Reading

Blog Articles:

  ● a short-and-sweet introduction to Chapel

  ● a series of articles answering common questions about why we are pursuing Chapel in spite of the inherent challenges

  ● a series of articles to illustrate the basics of Chapel

  ● a series of technical opinion pieces designed to combat standard arguments against the development of high-level parallel languages
Online Resources

Project page: http://chapel.cray.com
- overview, papers, presentations, language spec, ...

GitHub page: https://github.com/chapel-lang
- download Chapel; browse source repository; contribute code

Facebook page: https://www.facebook.com/ChapelLanguage
Community Resources

SourceForge page: [https://sourceforge.net/projects/chapel/](https://sourceforge.net/projects/chapel/)

- hosts community mailing lists
  (also serves as an alternate release download site to GitHub)

Mailing Aliases:

**write-only:**
- chapel_info@cray.com: contact the team at Cray

**read-only:**
- chapel-announce@lists.sourceforge.net: read-only announcement list

**read/write:**
- chapel-users@lists.sourceforge.net: user-oriented discussion list
- chapel-developers@lists.sourceforge.net: developer discussion
- chapel-education@lists.sourceforge.net: educator discussion
- chapel-bugs@lists.sourceforge.net: public bug forum
Surveys

Please take the time to fill out and return the surveys
(both ours and SC15’s)

Thanks!

For your interest in Chapel and your feedback
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