Documentation Improvements

Chapel Team, Cray Inc.
Chapel version 1.13
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Outline

- **chpldoc Improvements**
- **Online Documentation Improvements**
- **Key Web Updates**
- **Chapel Users Guide**
- **Other Documentation Improvements**
chpldoc Improvements
Background:
- Previously, chpldoc generated documentation for all ‘use’d modules
  - Arguably unintuitive as an end-user interface
  - Required all dependent modules to be available to generate docs
  - Led to errors when generating docs without a full Chapel installation

This Effort:
- changed chpldoc to only document files listed on its command line
  - Improves documentation time for a single file slightly
    - (chpldoc is quite fast in either case)
  - New flag reverts to previous behavior: --process-used-modules
Background: chpldoc generated 1 page per source file

- So, sub-modules appeared on the same page as their parent module
- Made documentation dense and difficult to read
- rst-related bug mis-associated symbols following a sub-module with it
chpldoc: Handling Submodules

This Effort:
- Switched to creating 1 page per module
- Sidebar menu now reflects sub-module hierarchy
- Parent modules link to sub-modules at the top of their page
- Avoids incorrect sub-module association bug
chpldoc: Building Online Docs

**Background:** chpldoc built html by default

- Building online docs required repetitive steps
- Difficult to integrate non-chpldoc documentation with chpldoc output
  - e.g., HTML files created from .rst documentation files in the release

**This Effort:** New chpldoc flag: --[no-]html

- Only builds intermediate (reStructureText) files
- Enables integrating chpldoc and non-chpldoc documentation

**Impact:**

- Online documentation builds ~2x faster
- Users can integrate their chpldoc docs with external files
chpldoc: Next Steps

- Output ‘usage’ information for each module
  - (didn’t make it into 1.13, but on master now)

- Change testing of chpldoc to validate .rst output
  - currently uses distinct text-oriented mode which could then be retired

- Add class/record view, including inheritance
  - Plus, class and record index

- Support testing Chapel code used in chpldoc comments
  - Similar to Python doctests

- Link module documentation to source code

- Misc bug fixes
  - Fix accidental output of code within nested block statements
  - Clean up HTML appearance of type and param methods
Online Documentation Improvements
Online Documentation: Background

- **v1.12 documentation improved significantly over v1.11**
  
  - Some pages included undocumented items
  - Organization seemed poor at times
  - Some docs remained on chapel.cray.com rather than in docs/
Online Documentation: This Effort

- **New content:**
  - `chpl` & `chpldoc` man pages
  - Moved documents from website to chapel.cray.com/docs hierarchy:
    - Quick Reference, Language Specification, and Language Evolution
  - Improved documentation coverage
  - Started a Chapel Users Guide

- **Improved organization**
  - Standard modules broken into more logical containers
    - Standard and Package modules
    - Standard Layouts and Distributions
  - Numerous other minor changes

- **Improved look-and-feel**
  - Upgraded Sphinx & Read the Docs versions
  - Added broken link detection for documentation via ‘make check’
    - Using this, fixed all broken links (over 100)
Chapel Documentation

Compiling and Running Chapel

- Quickstart Instructions
- Using Chapel
- Platform-Specific Notes
- Technical Notes
- Tools

Writing Chapel Programs

- Quick Reference
- Language Specification
- Built-in Types and Functions
- Standard Modules
- Package Modules
- Standard Layouts and Distributions
- Chapel Users Guide (WIP)

Language History

- Chapel Evolution

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- Chapel Online Documentation Index
Standard Modules: 1.12

Contents:
- Module: AdvancedIters
- Module: Assert
- Module: Barrier
- Module: BitOps
- Module: Buffers
- Module: CommDiagnostics
- Module: Curl
- Module: Error
- Module: FFTW
- Module: FFTW_MT
- Module: FileSystem
- Module: GMP
- Module: HDFS
- Module: HDFSIterator
- Module: Help
- Module: IO
- Module: LAPACK
- Module: List
- Module: Math
- Module: Memory
- Module: Norm
- Module: Path
- Module: Random
- Module: RecordParser
- Module: Regexp
- Module: Search
- Module: Sort
- Module: Spawn
- Module: Sys
- Module: SysBasic
- Module: Time
- Module: Types
- Module: UtilReplicatedVar
Standard Modules: 1.13

Standard Modules

Standard modules are those which describe features that are considered part of the Chapel Standard Library.

All Chapel programs automatically use the modules `Assert`, `Math`, and `Types` by default.

- `Assert`
- `Barrier`
- `BitOps`
- `Buffers`
- `CommDiagnostics`
- `DynamicInets`
- `Error`
- `FileSystem`
- `GMP`
- `Help`
- `IO`
- `List`
- `Math`
- `Memory`
- `Path`
- `Random`
- `Reflection`
- `Regexp`
- `Spawn`
- `Sys`
- `SysBasic`
- `SysCTypes`
- `Time`
- `Types`
- `UtilReplicatedVar`

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- Chapel Online Documentation Index
Distributions

Contents:

- Module: BlockCycDist
- Module: BlockDist
- Module: CyclicDist
- Module: DimensionalDist2D
- Module: PrivateDist
- Module: ReplicatedDist
- Module: BlockCycDim
- Module: BlockDim
- Module: ReplicatedDim
Standard Layouts and Distributions

Standard Layouts

Standard layouts are domain maps that target a single locale and describe the local storage of domains and arrays.

- LayoutCSR

Standard Distributions

Standard distributions are domain maps that target multiple locales and describe how domains and arrays are stored across them.

- BlockCycDist
- BlockDist
- CyclicDist
- DimensionalDist2D
- PrivateDist
- ReplicatedDist
- BlockCycDim
- BlockDim
- ReplicatedDim

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- Chapel Online Documentation Index
Module: Math

This module provides wrappers for `<cmath>` (math.h) numerical constants and routines. Its symbols are provided by default; an explicit 'use' statement is not necessary.

The C Math library is part of the C Language Standard (ISO/IEC 9899), as described in Section 7.12. Please consult that standard for an authoritative description of the expected properties of those constants and routines.

In general, where the C math library provides a `double` and a `float` version of a function, the float version has a suffix 'f'. In the Chapel interface, the suffix is dropped, and the type of the operand determines which version is called — according to the usual function overloading and resolution rules. Normally, the result has the same precision as the argument(s). Please consult the C standard for specifics.

Rounding – The rounding mode for floating-point addition (subtraction) is implementation-defined.

Error Handling – At present, Chapel does not provide control over error handling in the Math module. The default behavior is as if the macro `math_errhandling` is set to 0: Given erroneous input at run-time, all math functions will return an implementation-defined value; no exception will be generated.

```chapel
proc abs(i: int??w))
    Returns the absolute value of the integer argument.
    Return type: The type of i.

proc abs(i: uint??w))
    Returns the absolute value of the unsigned integer argument.
    Return type: The type of i.
```
Math

Usage

```
use Math;
```

This module provides mathematical constants and functions.

Note

All Chapel programs automatically `use` this module by default. An explicit `use` statement is not necessary.

It includes wrappers for many of the constants in functions in the C Math library, which is part of the C Language Standard (ISO/IEC 9899) as described in Section 7.12. Please consult that standard for an authoritative description of the expected properties of those constants and routines.

In general, where the C math library provides a `double` and a `float` version of a function, the float version has a suffix ‘f’. In the Chapel interface, the suffix is dropped, and the type of the operand determines which version is called -- according to the usual function overloading and resolution rules. Normally, the result has the same precision as the argument(s). Please consult the C standard for specifics.

Rounding -- The rounding mode for floating-point addition (subtraction) is implementation-defined.

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```
param e = 2.71828
```
chpl

SYNOPSIS

chpl [-O] [-no-checks] [-fast]
       [-g] [-savec directory]
       [-M directory...][-main-module mod]
       [-o outfile] [options] source-files...

DESCRIPTION

The chpl command invokes the Chapel compiler. chpl converts one or more Chapel source files into an executable. It does this by compiling Chapel code to C99 code and then invoking the target platform's C compiler to create the executable. However, most users will not need to be aware of the use of C as an intermediate format during compilation.

SOURCE FILES

Chapel recognizes four source file types: .chpl, .c, .h, and .o.

foo.chpl

Chapel sources are compiled by the Chapel compiler into C intermediate code, which is then passed to the target compiler to be compiled into object code.

foo.c

C source files are passed directly to the target C compiler.

foo.h

C header files are included in the generated C code.

foo.o

Object files are passed directly to the target linker.

OPTIONS

Module Processing Options
Online Documentation: Next Steps

- **Further improvements to look-and-feel / user interface**
  - Fork ‘read-the-docs’ and fine-tune sphinx template to our needs
    - e.g. drop-down menu for versions

- **Add developer section and/or version**
  - Move developer documentation from repository to online docs
  - Document internal methods not intended for users

- **Increase content coverage**
  - Continue adding online documentation for “built-in” features
  - Improve quality of documentation for existing modules
Key Web Updates
Web Updates: User / Developer Resources

Background:
- These pages have existed for awhile, but were wordy and stale

This Effort:
- Refresh content and make it more concise and approachable

Chapel User Resources

IRC: #chapel
The #chapel channel on Freenode is open and active. It is typically staffed by Cray developers and users.

Mailing Lists
The following mailing lists are open and active:
- chapel-announce
- chapel-developers
- chapel-commits
- chapel-test-results-regressions
- chapel-users

Note that the chapel-developers list is intended for implementation-related discussion, and is typically staffed by working members of the core development team.

Online Documentation
Most Chapel documentation is available online. For full documentation, search online.

Chapel Developer Resources

IRC: #chapel-developers (chat.freenode.net)
The #chapel-developers channel is intended for implementation-related discussion. It is typically staffed by working members of the core development team.

Mailing Lists
The following mailing lists may be of interest:
- chapel-announce: gets ~12 Chapel announcements per year.
- chapel-developers: for implementation-related discussions.
- chapel-commits: receives mail for each commit to master.
- chapel-test-results-regressions: notable testing result summaries.
- chapel-users: for user community discussions.

Note that chapel-developers and chapel-users require subscriptions to post.

Performance Tracking
Chapel's nightly performance testing generates a number of graphs which can be used to track performance changes.

Contributing

http://chapel.cray.com/community.html
http://chapel.cray.com/developers.html
Web Updates: How Can I Learn Chapel?

Background:
- This has been increasingly FAQ’d, esp. with blog posts, GSoC, etc.

This Effort:
- Gathered list of good resources, sorted by learning style
  - e.g., “I like to read” vs. “I’d like to watch talks” vs. “I like to read code”

Learning Chapel

Here are various ways to learn about Chapel, depending on your style of learning:

"I like to read."

"I'd like to read a short characterization of Chapel for a reasonably general audience."
See the Cray blog article, Chapel: Productive Parallel Programming.

"I'd like to read something short that would give me a taste of Chapel's features."
See the Cray blog series, Six Ways to say "Hello" in Chapel (part 1, 2, 3).

"I'd like to read a more in-depth overview of Chapel's background, features, and plans."
Read the Chapel chapter in Programming Models for Parallel Computing from MIT Press.
Or read A Brief Overview of Chapel, an early pre-print draft of the chapter.

"I'd like to read an example-oriented introduction to Chapel."
Try Chapel by Example: Image Processing by Greg Kreider (PMVS).

"I'd like to read a more complete description of Chapel."
See the Language Definition page.
Also see the online docs about built-ins, the standard library, and packages.

"I like to watch talks or browse their slides." [Link to resources]
Chapel Users Guide
Users Guide: Background and This Effort

Background:

● Have intended to write a users guide for some time now…
  ● goal: more readable, less formal intro to Chapel than the language spec
  …yet, it’s such a major undertaking that it’s been hard to get started

This Effort:

● Motivated by user comments at CHIUW 2015
  ● enthusiasm for first round of online documentation in v1.11
  ● desire for similar online documentation covering Chapel language itself
● Last year’s chpldoc / Sphinx effort made it easier to get started
  ● Sphinx trivially supports...
    ● ease of writing via .rst files
    ● online deployment, searching
    ● ability to trivially include testable code examples
  ● Also supports writing “a page per topic” rather than “a whole new book”
  ● To that end, started writing the users guide this release cycle
Users Guide: Status

Status:

- Taking a breadth-first approach
  - goal: cover key features earlier, yet without ignoring the base language
- Wrote 8 entries so far, available in online docs
  - response to existing docs has been positive

The final built-in locale variable that we'll cover in this section is here. For any given task, this variable resolves to the locale value on which the task is running.

As an example, the following program demonstrates that Chapel programs begin their execution on locale 0:

```chapel
writeln("Chapel programs start as a single task running on locale ", here.id);
```

Running it on any number of locales generates:

```
Chapel programs start as a single task running on locale 0
```
Next Steps:

- Continue writing, strive to write a few entries per week

The Chapel Users Guide is divided into four main sections:

**Base Language**

This is the core of Chapel and what remains when all features in support of parallelism and locality are removed.

- Simple Console Output: Hello world
- Variable Declarations

(more to come...)

**Task Parallelism**

These are Chapel's lower-level features for creating parallel explicitly and synchronizing between them.

- Task Parallelism Overview
- The begin statement

(more to come...)

http://chapel.cray.com/docs/1.13/users-guide/index.html
Other Documentation Improvements
Other Documentation Improvements

● Split “quick start” information out of top-level README
  ● README.rst
  ● QUICKSTART.rst

● Converted more README-style files to markdown:
  ● ACKNOWLEDGEMENTS.md
  ● CHANGES.md
  ● CONTRIBUTORS.md
  ● PERFORMANCE.md

● Example test updates
  ● Added ISx and LCALS, improved MiniMD (see benchmarks slides)
  ● Fixed typos and improved explanations in primer examples
  ● Extended the linkedList example to support additional methods
    (contributed by Akash Thorat)
  ● Updated example tests to reflect language and library changes
  ● Retired README.features
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