Documentation Improvements

Chapel Team, Cray Inc.

Chapel version 1.11

April 2nd, 2015

Safe Harbor Statement

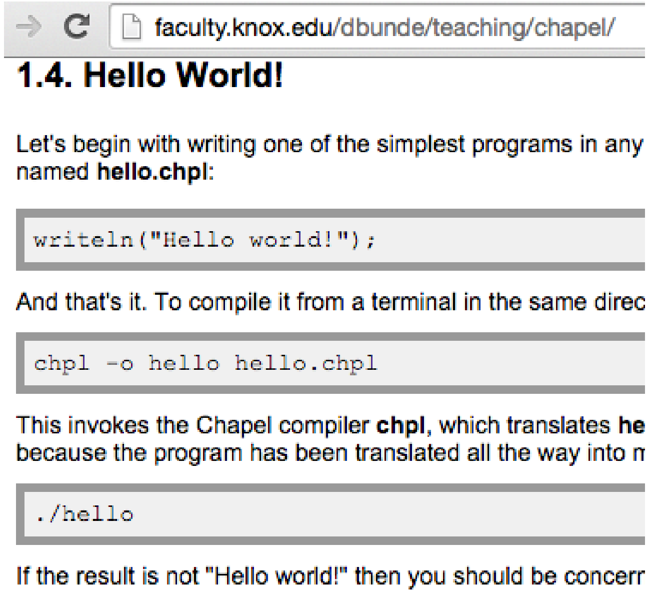
This presentation may contain forward-looking statements that are based on our current expectations. Forward looking statements may include statements about our financial guidance and expected operating results, our opportunities and future potential, our product development and new product introduction plans, our ability to expand and penetrate our addressable markets and other statements that are not historical facts. These statements are only predictions and actual results may materially vary from those projected. Please refer to Cray's documents filed with the SEC from time to time concerning factors that could affect the Company and these forward-looking statements.

Outline

- Background
- Standard Module Documentation
- Website Updates
- Other Documentation Improvements
- Documentation Priorities and Next Steps

Chapel Docs: Background

- **Existing Chapel documentation:**
  - Chapel Spec
  - Quick Reference Guide
  - READMEs in doc/ directory
  - Online tutorials
  - Primers



faculty.knox.edu/dbunde/teaching/chapel/

1.4. Hello World!

Let's begin with writing one of the simplest programs in any
named **hello.chpl**:

```
writeln("Hello world!");
```

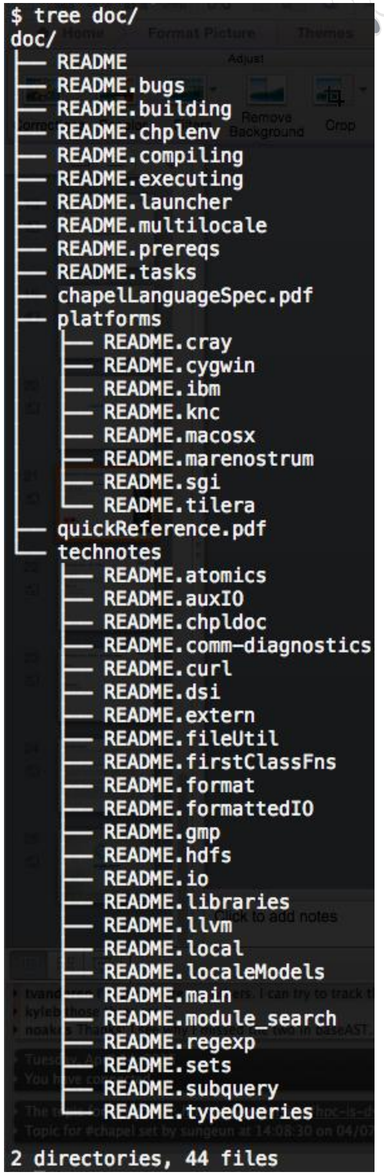
And that's it. To compile it from a terminal in the same direc

```
chpl -o hello hello.chpl
```

This invokes the Chapel compiler **chpl**, which translates **he**
because the program has been translated all the way into m

```
./hello
```

If the result is not "Hello world!" then you should be concerr



```
$ tree doc/
doc/
├── README
├── README.bugs
├── README.building
├── README.chplenv
├── README.compiling
├── README.executing
├── README.launcher
├── README.multilocale
├── README.prereqs
├── README.tasks
├── chapelLanguageSpec.pdf
├── platforms
│   ├── README.cray
│   ├── README.cygwin
│   ├── README.ibm
│   ├── README.knc
│   ├── README.macosx
│   ├── README.marenostrum
│   ├── README.sgi
│   └── README.tilera
├── quickReference.pdf
└── technotes
    ├── README.atomics
    ├── README.auxIO
    ├── README.chpldoc
    ├── README.comm-diagnostics
    ├── README.curl
    ├── README.dsi
    ├── README.extern
    ├── README.fileUtil
    ├── README.firstClassFns
    ├── README.format
    ├── README.formattedIO
    ├── README.gmp
    ├── README.hdfs
    ├── README.io
    ├── README.libraries
    ├── README.llvm
    ├── README.local
    ├── README.localeModels
    ├── README.main
    ├── README.module_search
    ├── README.regexp
    ├── README.sets
    ├── README.subquery
    └── README.typeQueries

2 directories, 44 files
```

Chapel Docs: More Background

- Module documentation spread out
- Not easily searchable
- As a result, not updated often

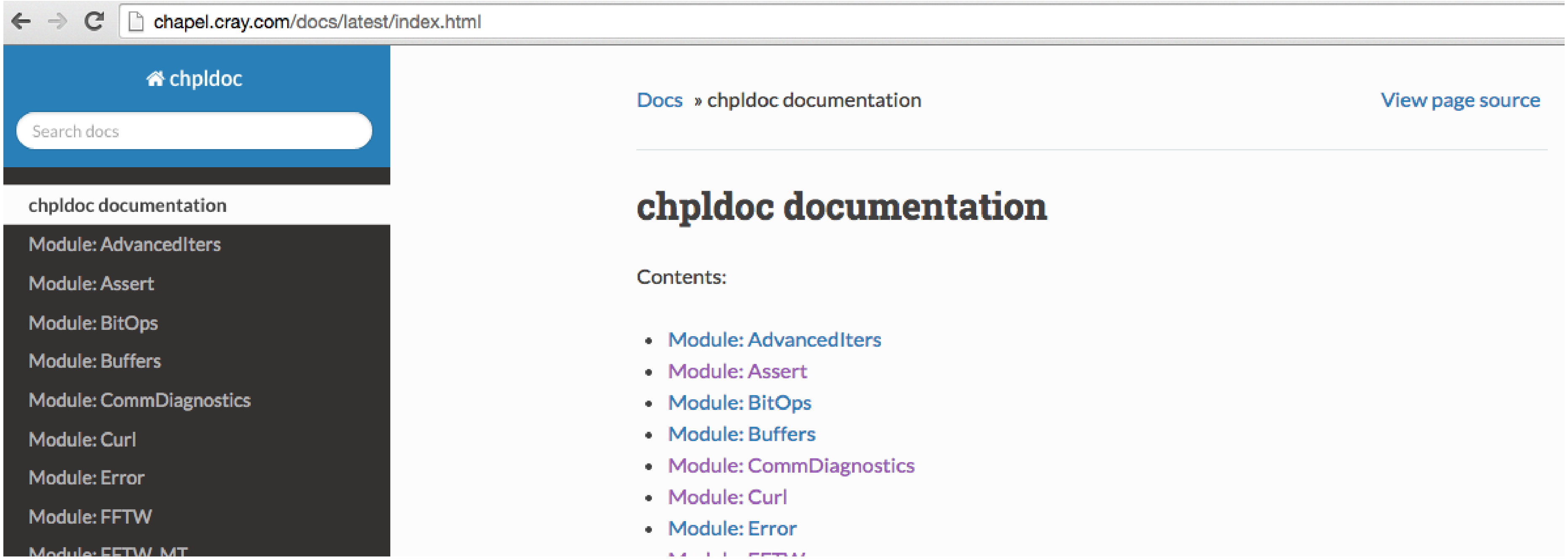
Chapel Docs: This Effort

- **Module documentation on the web**
- **Improved introduction to Chapel on website**
  - “Hello, World!” examples on website
  - Code sample front-and-center on main page

Standard Module Documentation

Chapel Docs: Module Docs on the Web

URL: http://chapel.cray.com/docs/latest/



chapel.cray.com/docs/latest/index.html

chpldoc

Search docs

- chpldoc documentation
- Module: AdvancedIters
- Module: Assert
- Module: BitOps
- Module: Buffers
- Module: CommDiagnostics
- Module: Curl
- Module: Error
- Module: FFTW
- Module: FFTW_MT

Docs » chpldoc documentation

View page source

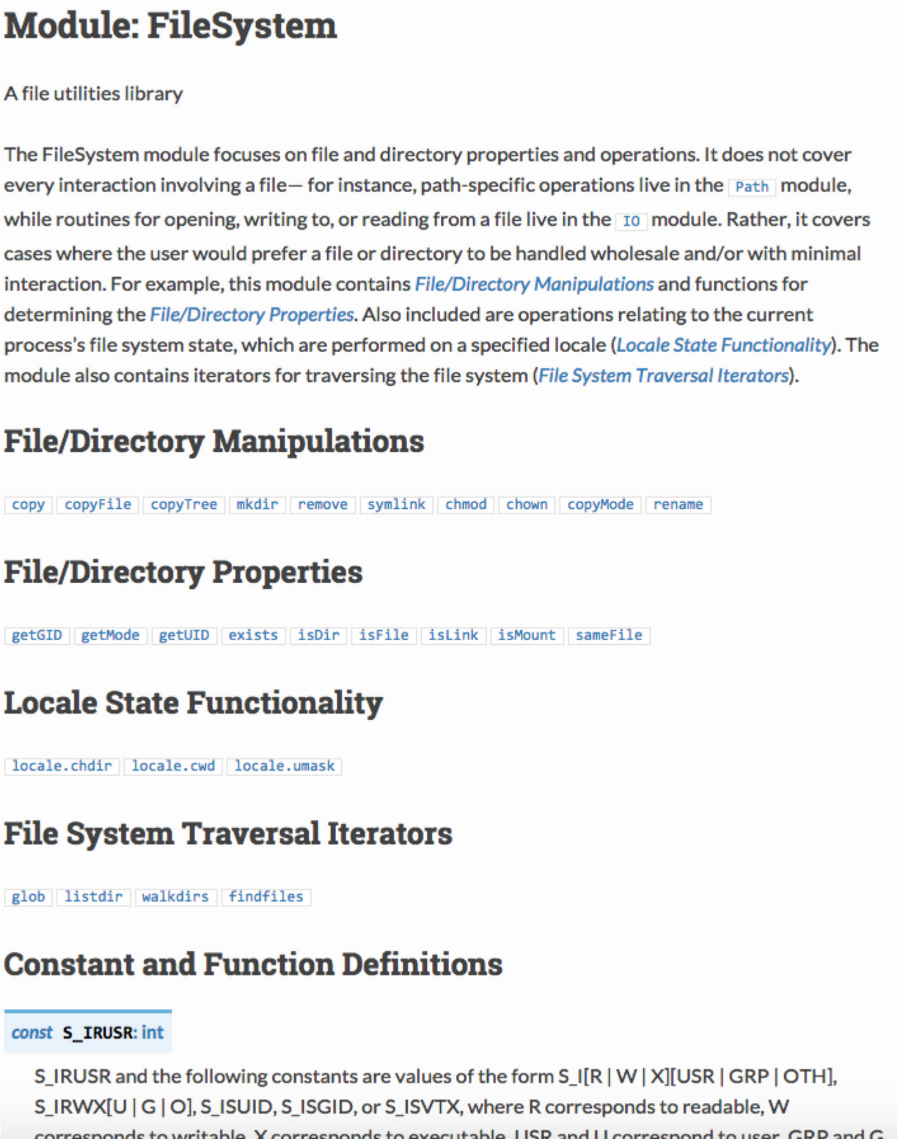
chpldoc documentation

Contents:

- Module: AdvancedIters
- Module: Assert
- Module: BitOps
- Module: Buffers
- Module: CommDiagnostics
- Module: Curl
- Module: Error
- Module: FFTW

Chapel Docs: Module Documentation

- **One page per module**
- **Module description at top**
- **Based on code comments**
  - Updated chpldoc tool
- **Supports rich formatting:**
  - Emphasis
  - Bold
  - Links
  - Section titles
  - etc



Module: FileSystem

A file utilities library

The FileSystem module focuses on file and directory properties and operations. It does not cover every interaction involving a file— for instance, path-specific operations live in the `Path` module, while routines for opening, writing to, or reading from a file live in the `IO` module. Rather, it covers cases where the user would prefer a file or directory to be handled wholesale and/or with minimal interaction. For example, this module contains *File/Directory Manipulations* and functions for determining the *File/Directory Properties*. Also included are operations relating to the current process's file system state, which are performed on a specified locale (*Locale State Functionality*). The module also contains iterators for traversing the file system (*File System Traversal Iterators*).

File/Directory Manipulations

`copy` `copyFile` `copyTree` `mkdir` `remove` `symlink` `chmod` `chown` `copyMode` `rename`

File/Directory Properties

`getGID` `getMode` `getUID` `exists` `isDir` `isFile` `isLink` `isMount` `sameFile`

Locale State Functionality

`locale.chdir` `locale.cwd` `locale.umask`

File System Traversal Iterators

`glob` `listdir` `walkdirs` `findfiles`

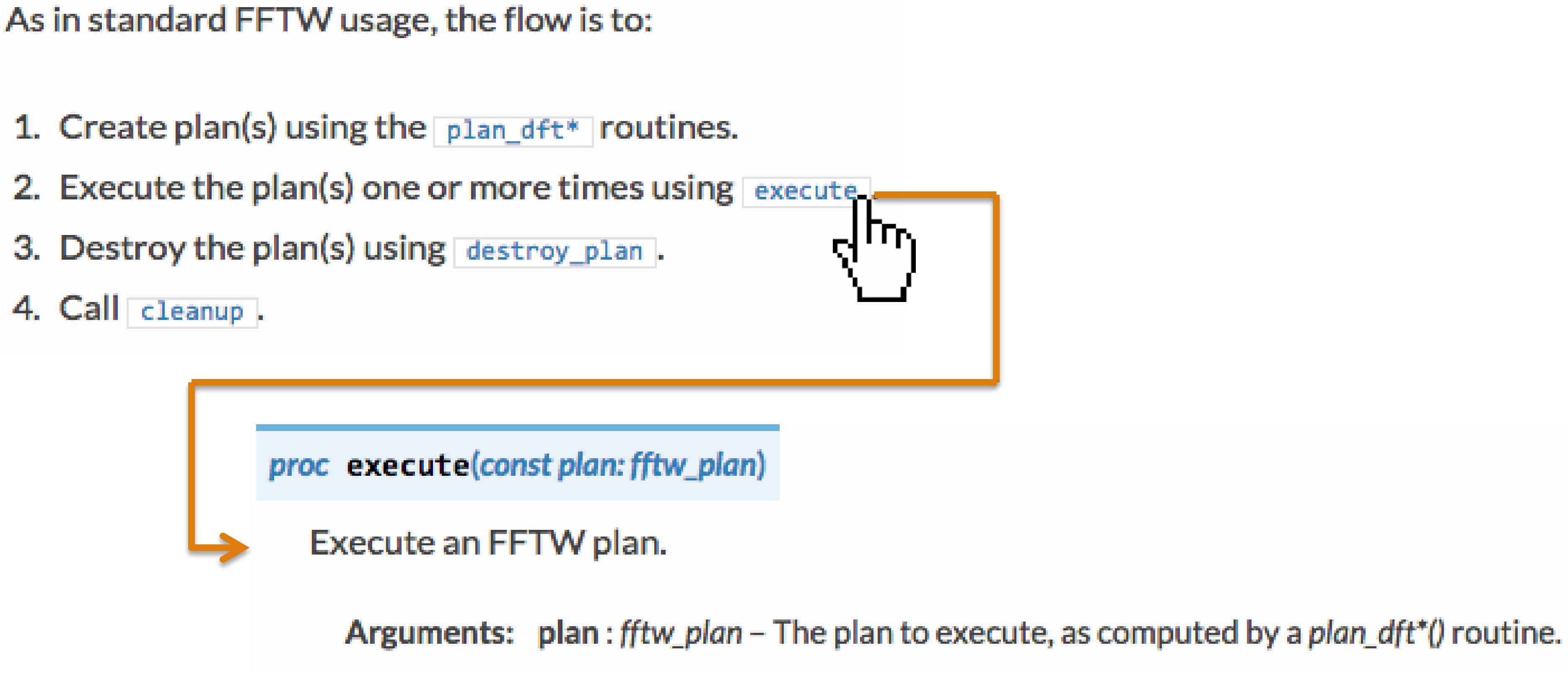
Constant and Function Definitions

const **S_IRUSR**: int

S_IRUSR and the following constants are values of the form S_I[R | W | X][USR | GRP | OTH], S_IRWX[U | G | O], S_ISUID, S_ISGID, or S_ISVTX, where R corresponds to readable, W corresponds to writable, X corresponds to executable, USR and U correspond to user, GRP and G

Chapel Docs: Cross References (links)

- Supports inter-documentation links
- Reader can quickly find types, procedures, etc.



As in standard FFTW usage, the flow is to:

1. Create plan(s) using the `plan_dft*` routines.
2. Execute the plan(s) one or more times using `execute`.
3. Destroy the plan(s) using `destroy_plan`.
4. Call `cleanup`.

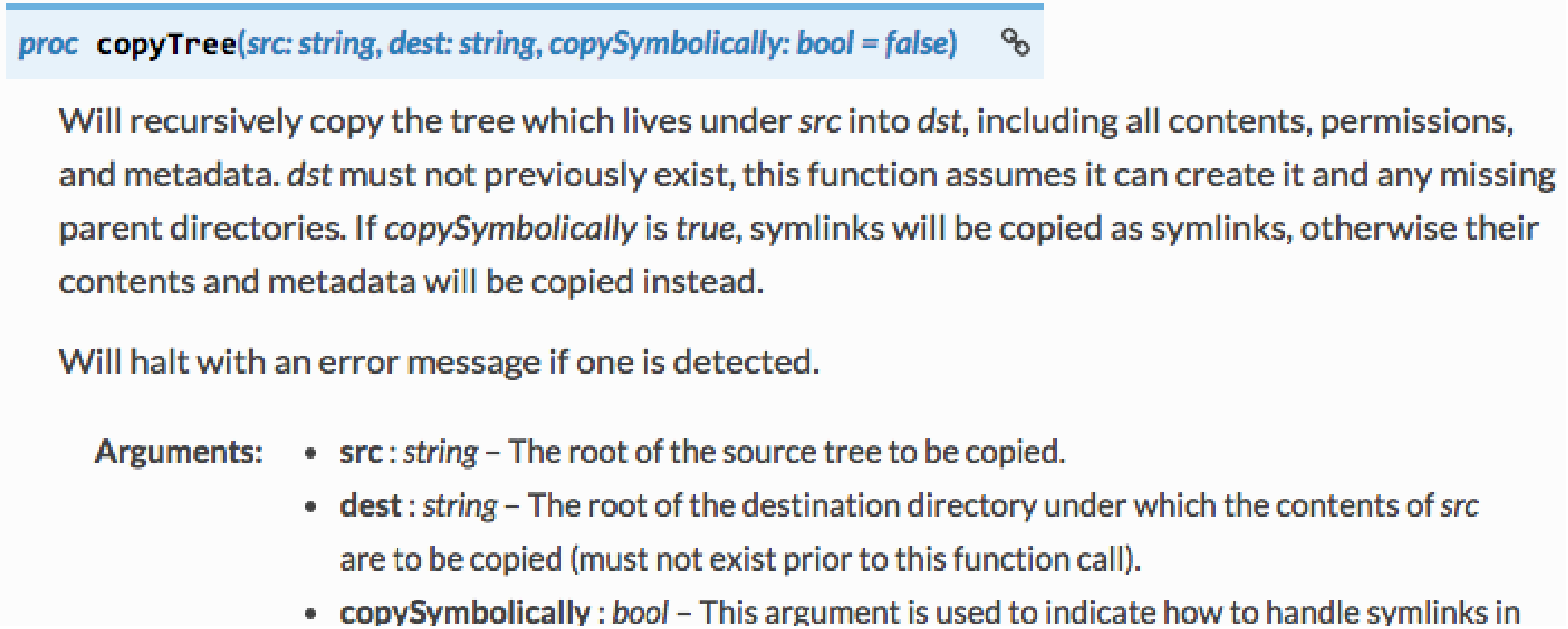
proc **execute**(*const plan: fftw_plan*)

Execute an FFTW plan.

Arguments: **plan** : *fftw_plan* – The plan to execute, as computed by a *plan_dft*()* routine.

Chapel Docs: Procedures and Iterators

- **Procedure docs include:**
  - Signature and procedure documentation
  - Arguments, return type and description
- **Supports rich formatting**



proc `copyTree`(*src: string, dest: string, copySymbolically: bool = false*)

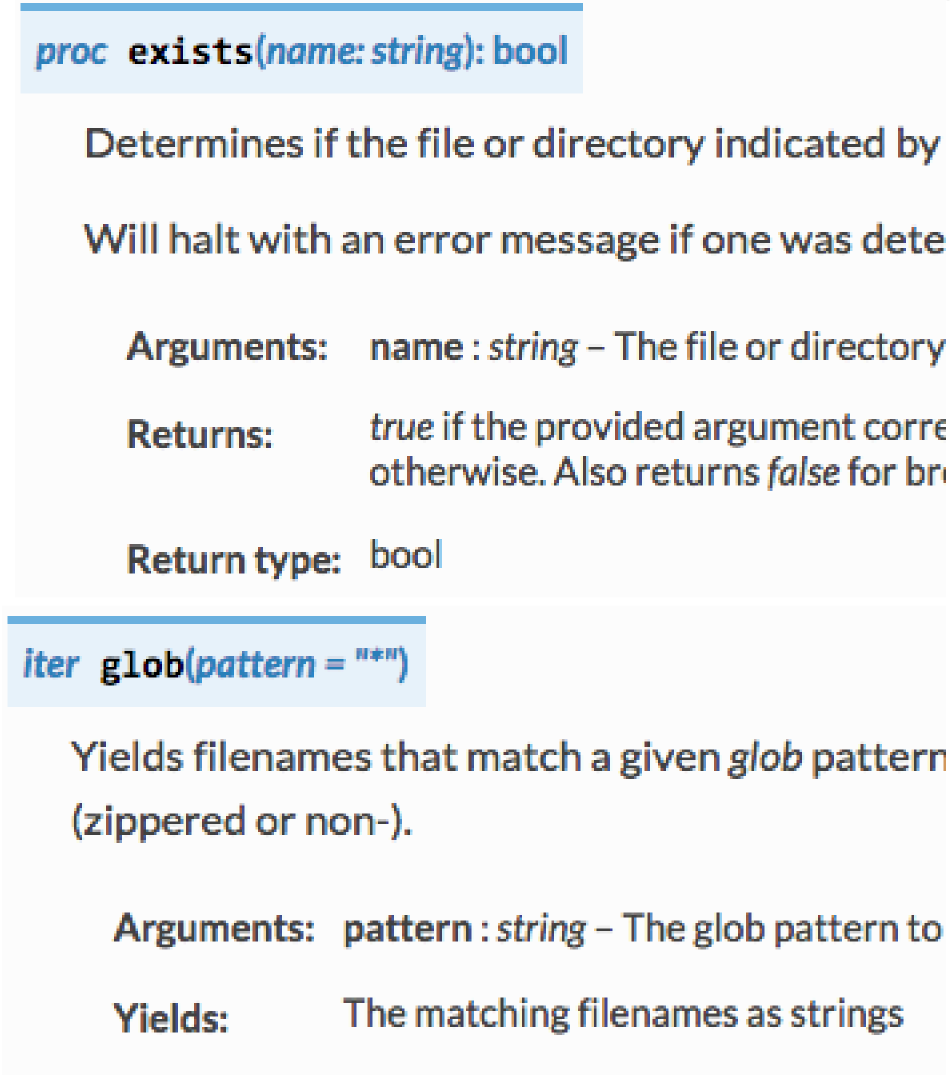
Will recursively copy the tree which lives under *src* into *dst*, including all contents, permissions, and metadata. *dst* must not previously exist, this function assumes it can create it and any missing parent directories. If *copySymbolically* is *true*, symlinks will be copied as symlinks, otherwise their contents and metadata will be copied instead.

Will halt with an error message if one is detected.

Arguments:
- **src** : *string* – The root of the source tree to be copied.
- **dest** : *string* – The root of the destination directory under which the contents of *src* are to be copied (must not exist prior to this function call).
- **copySymbolically** : *bool* – This argument is used to indicate how to handle symlinks in

Chapel Docs: Procedures and Iterators

- Arguments, return/yield have separate section
- Types can link to class or record docs



proc `exists`(*name: string*): bool

Determines if the file or directory indicated by

Will halt with an error message if one was dete

Arguments: **name** : *string* – The file or directory

Returns: *true* if the provided argument corre otherwise. Also returns *false* for br

Return type: bool

iter `glob`(*pattern = "*"*)

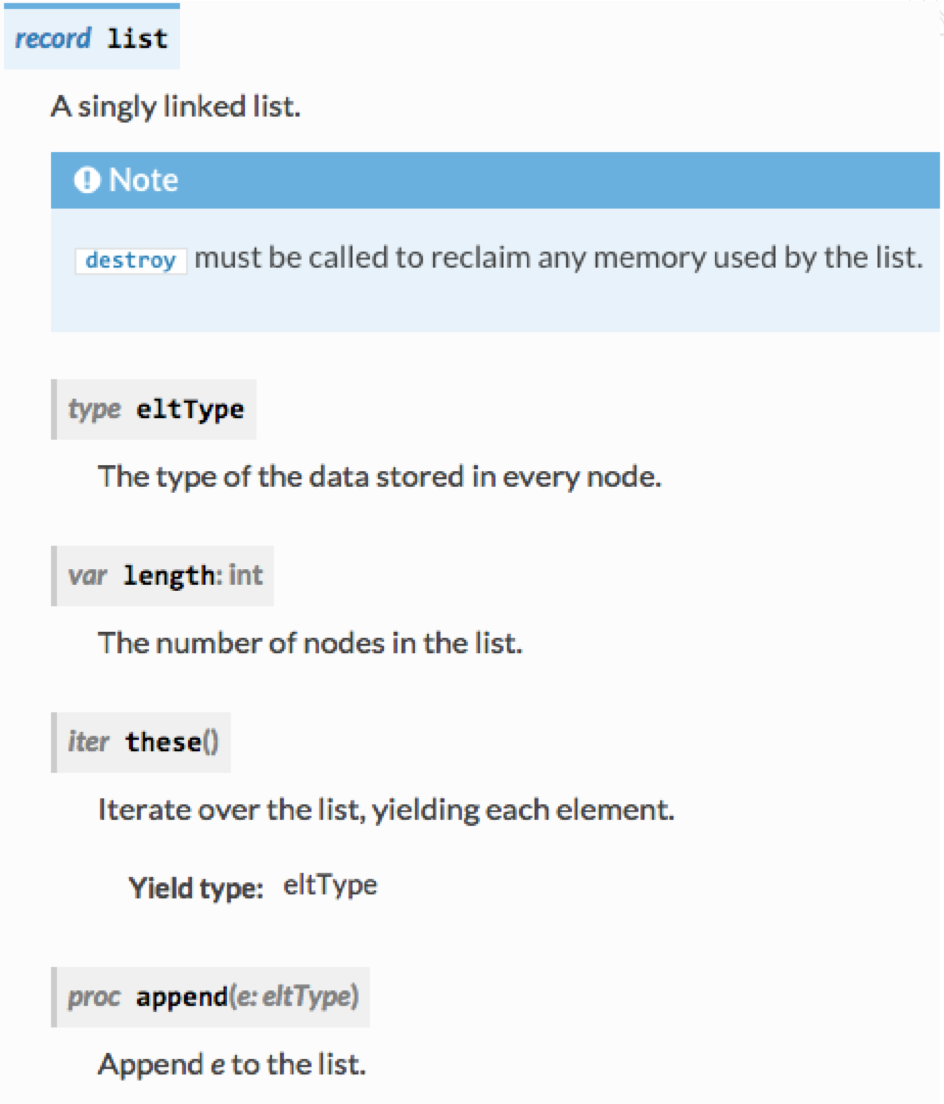
Yields filenames that match a given *glob* pattern (zippered or non-).

Arguments: **pattern** : *string* – The glob pattern to

Yields: The matching filenames as strings

Chapel Docs: Classes and Records

- Class/record description
- Member docs
- Method and iterators
- Cross-reference all items



record `list`

A singly linked list.

Note

`destroy` must be called to reclaim any memory used by the list.

type `eltType`

The type of the data stored in every node.

var `length`: int

The number of nodes in the list.

iter `these`()

Iterate over the list, yielding each element.

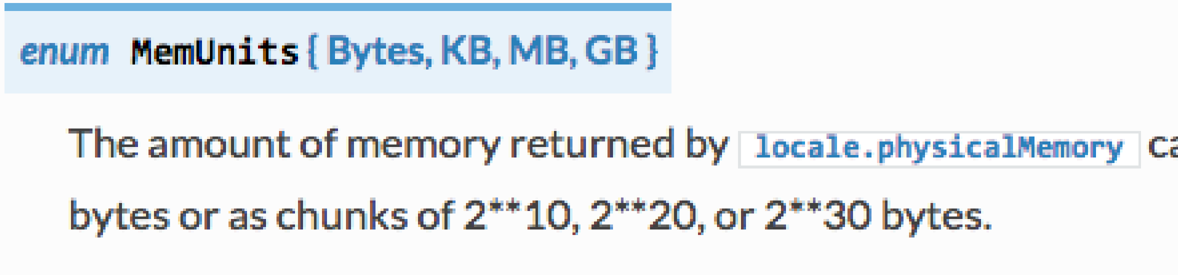
Yield type: eltType

proc `append`(*e: eltType*)

Append *e* to the list.

Chapel Docs: Enums, Types, Configs

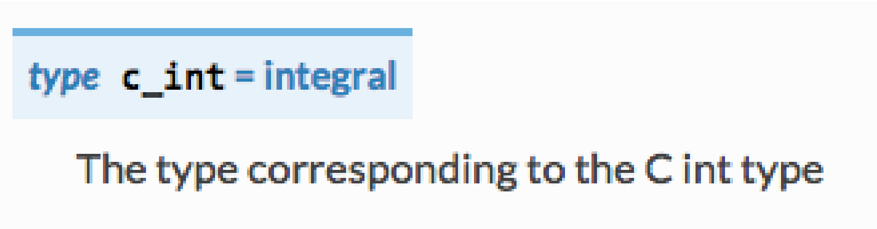
- **Enums**



`enum MemUnits { Bytes, KB, MB, GB }`

The amount of memory returned by `locale.physicalMemory` ca
bytes or as chunks of 2**10, 2**20, or 2**30 bytes.

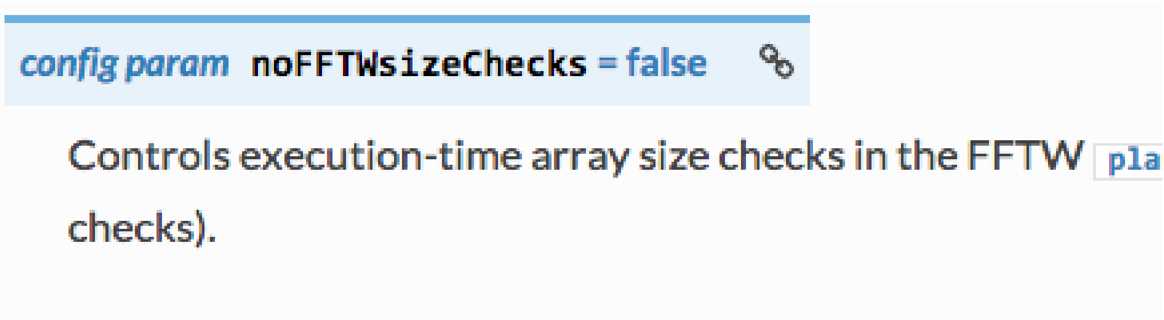
- **Types**
  - Supports extern types
  - And standalone types



`type c_int = integral`

The type corresponding to the C int type

- **Configs**
  - Supports var/const too
  - Globals also supported

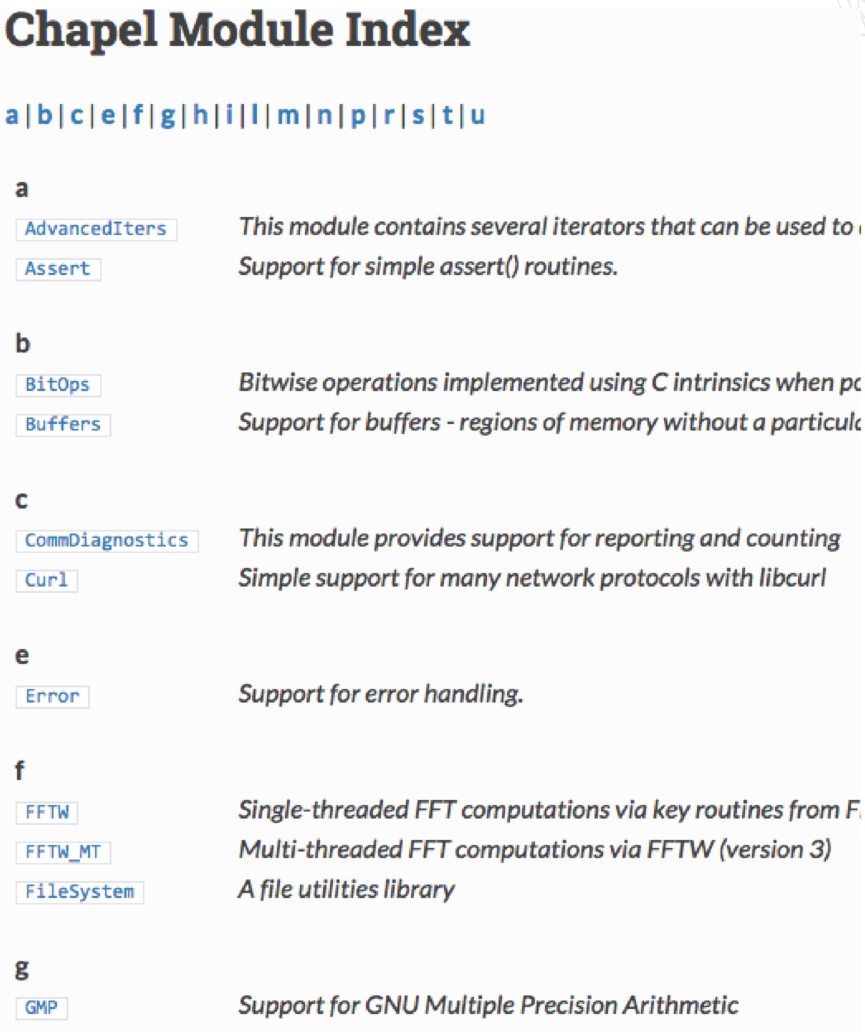


`config param noFFTWsizeChecks = false`

Controls execution-time array size checks in the FFTW `pla`
checks).

Chapel Docs: Chapel Module Index

- Module Index lists all mods
- Brief description of each mod
- Links directly to modules



Chapel Module Index

a | b | c | e | f | g | h | i | l | m | n | p | r | s | t | u

a

AdvancedIters	*This module contains several iterators that can be used to*
Assert	*Support for simple assert() routines.*

b

BitOps	*Bitwise operations implemented using C intrinsics when po*
Buffers	*Support for buffers - regions of memory without a particula*

c

CommDiagnostics	*This module provides support for reporting and counting*
Curl	*Simple support for many network protocols with libcurl*

e

Error	*Support for error handling.*

f

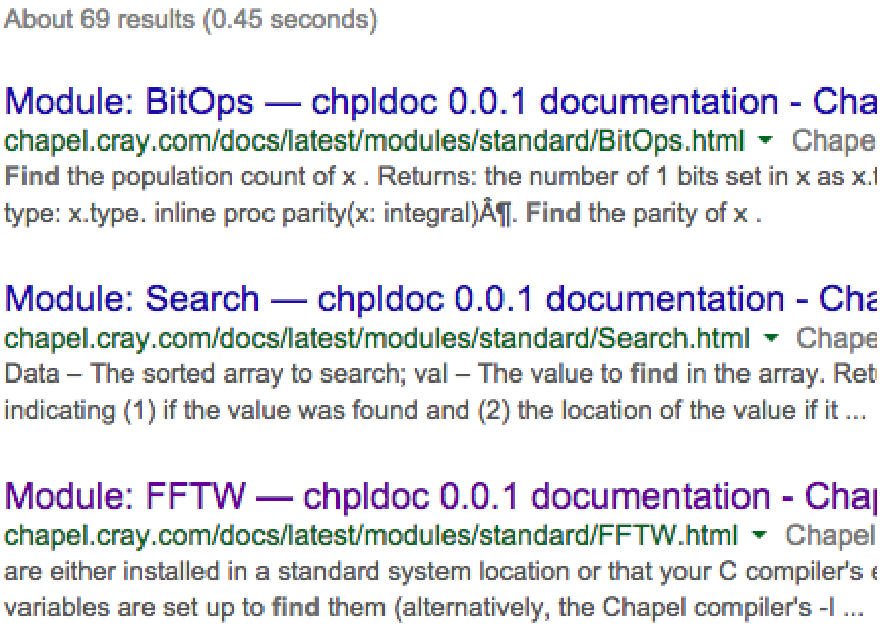
FFTW	*Single-threaded FFT computations via key routines from F*
FFTW_MT	*Multi-threaded FFT computations via FFTW (version 3)*
FileSystem	*A file utilities library*

g

GMP	*Support for GNU Multiple Precision Arithmetic*

Chapel Docs: Search

- Built-in search function
- Google, et al. also work

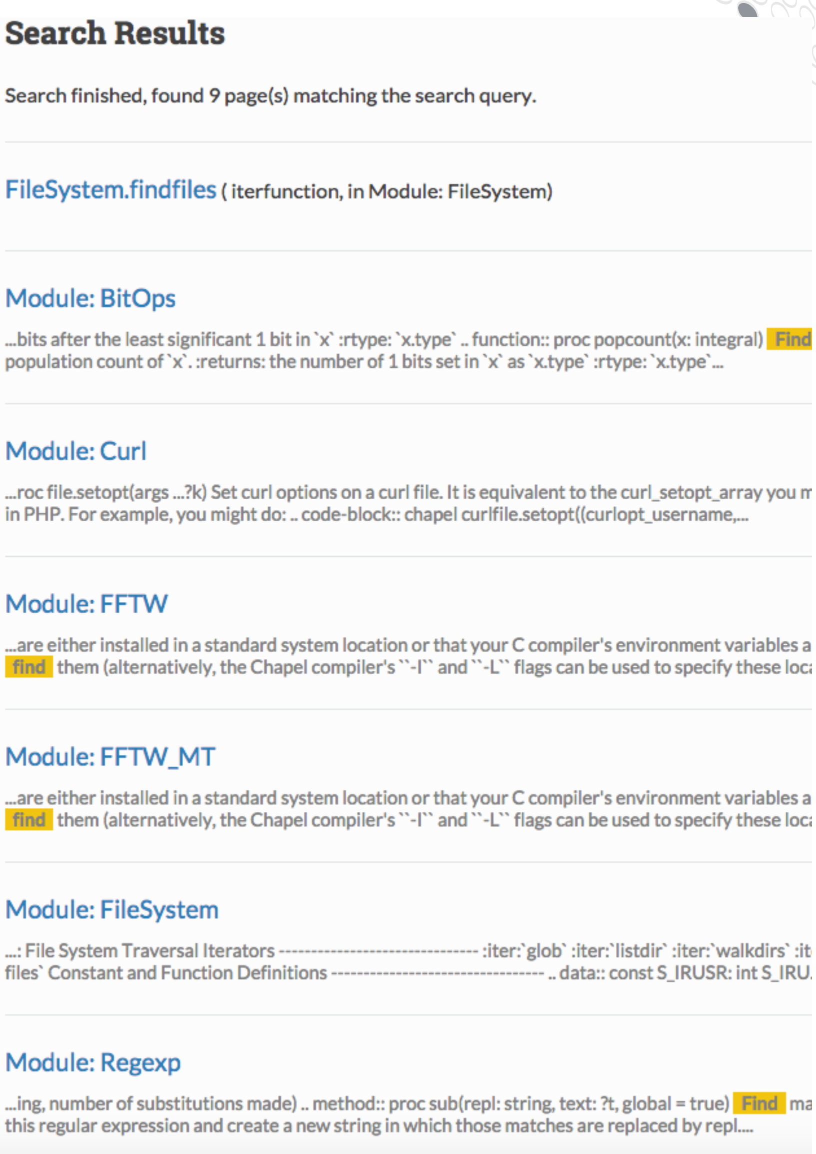


About 69 results (0.45 seconds)

Module: BitOps — chpldoc 0.0.1 documentation - Cha
chapel.cray.com/docs/latest/modules/standard/BitOps.html ▾ Chape
Find the population count of x . Returns: the number of 1 bits set in x as x.t
type: x.type. inline proc parity(x: integral)Â¶. **Find** the parity of x .

Module: Search — chpldoc 0.0.1 documentation - Cha
chapel.cray.com/docs/latest/modules/standard/Search.html ▾ Chape
Data – The sorted array to search; val – The value to **find** in the array. Ret
indicating (1) if the value was found and (2) the location of the value if it ...

Module: FFTW — chpldoc 0.0.1 documentation - Chap
chapel.cray.com/docs/latest/modules/standard/FFTW.html ▾ Chapel
are either installed in a standard system location or that your C compiler's e
variables are set up to **find** them (alternatively, the Chapel compiler's -I ...



Search Results

Search finished, found 9 page(s) matching the search query.

FileSystem.findfiles (iterfunction, in Module: FileSystem)

Module: BitOps

...bits after the least significant 1 bit in `x` :rtype: `x.type` .. function:: proc popcount(x: integral) Find
population count of `x`. :returns: the number of 1 bits set in `x` as `x.type` :rtype: `x.type`...

Module: Curl

...roc file.setopt(args ...?k) Set curl options on a curl file. It is equivalent to the curl_setopt_array you m
in PHP. For example, you might do: .. code-block:: chapel curlfile.setopt((curlopt_username,...

Module: FFTW

...are either installed in a standard system location or that your C compiler's environment variables a
find them (alternatively, the Chapel compiler's ``-I`` and ``-L`` flags can be used to specify these loc

Module: FFTW_MT

...are either installed in a standard system location or that your C compiler's environment variables a
find them (alternatively, the Chapel compiler's ``-I`` and ``-L`` flags can be used to specify these loc

Module: FileSystem

...: File System Traversal Iterators ------------------------------ :iter:`glob` :iter:`listdir` :iter:`walkdirs` :it
files` Constant and Function Definitions -------------------------------- .. data:: const S_IRUSR: int S_IRU

Module: Regexp

...ing, number of substitutions made) .. method:: proc sub(repl: string, text: ?t, global = true) Find ma
this regular expression and create a new string in which those matches are replaced by repl....

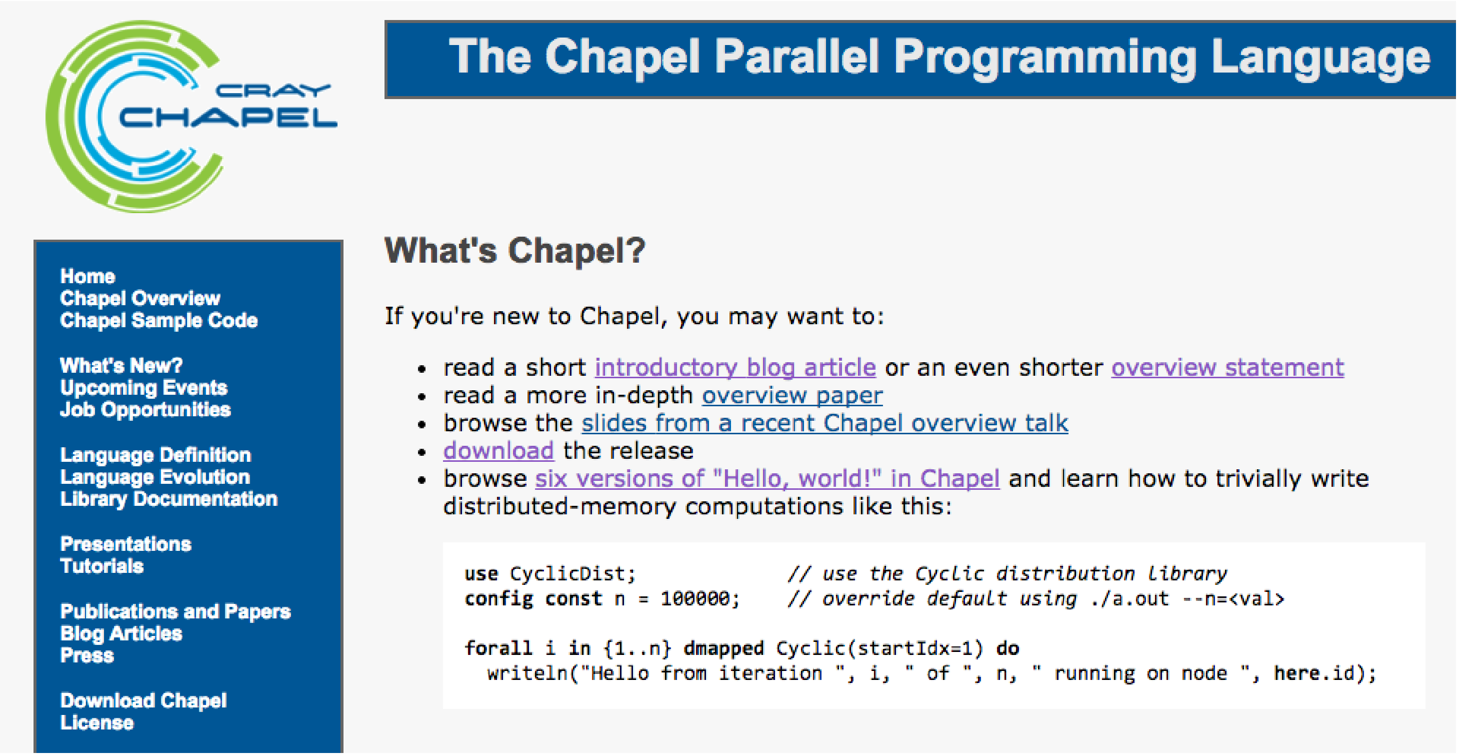
Chapel Docs: Module Documentation

- **All standard modules are documented**
- **Added and edited a lot of module documentation!**
  - ~47k words
  - ~11k lines of reStructuredText
  - Every developer on the Cray team contributed docs
  - Took ~6 weeks to complete all the documentation

Website Updates

Chapel Docs: Website Updates

- “Hello, World!” examples on website
- New code snippet on front page



The Chapel Parallel Programming Language

What's Chapel?

If you're new to Chapel, you may want to:

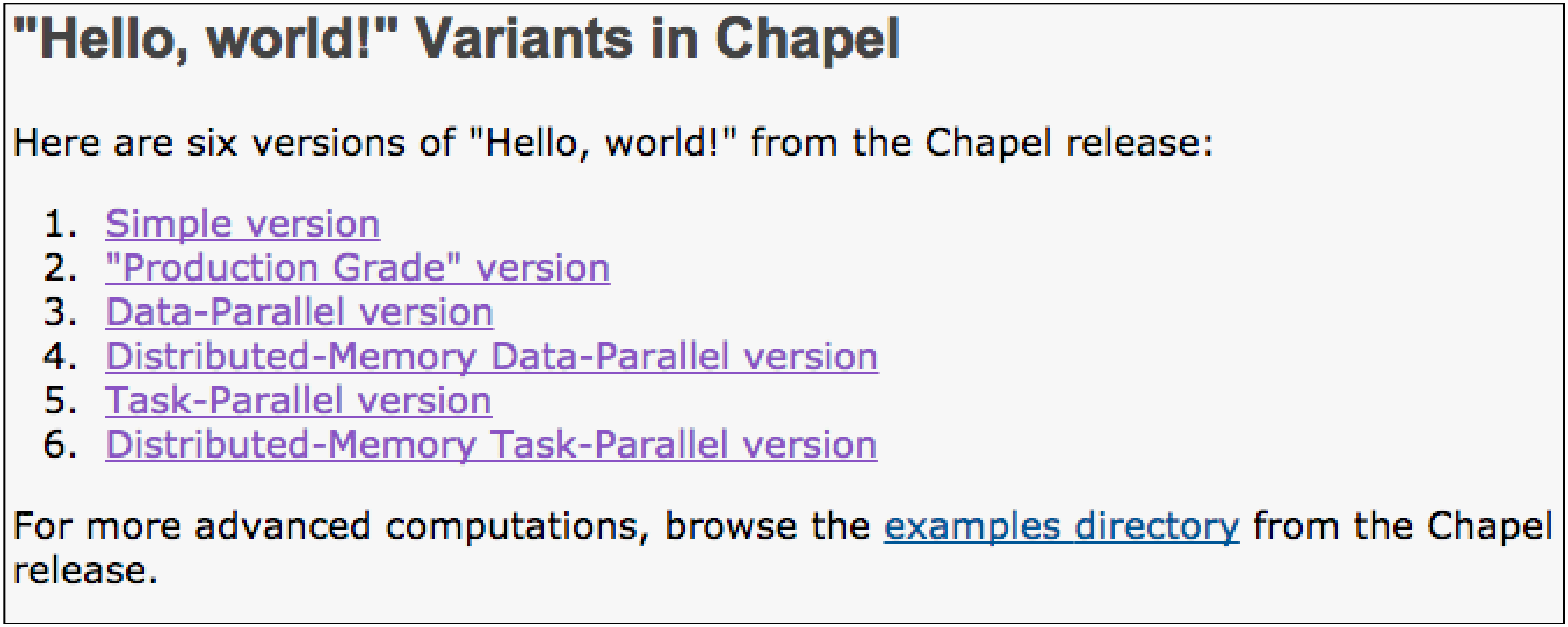
- read a short introductory blog article or an even shorter overview statement
- read a more in-depth overview paper
- browse the slides from a recent Chapel overview talk
- download the release
- browse six versions of "Hello, world!" in Chapel and learn how to trivially write distributed-memory computations like this:

```
use CyclicDist;              // use the Cyclic distribution library
config const n = 100000;     // override default using ./a.out --n=<val>

forall i in {1..n} dmapped Cyclic(startIdx=1) do
  writeln("Hello from iteration ", i, " of ", n, " running on node ", here.id);
```

Chapel Docs: Website Updates

- **Hello world examples on the website:**
  - http://chapel.cray.com/hellos.html
  - Concise, yet thorough intro to language



"Hello, world!" Variants in Chapel

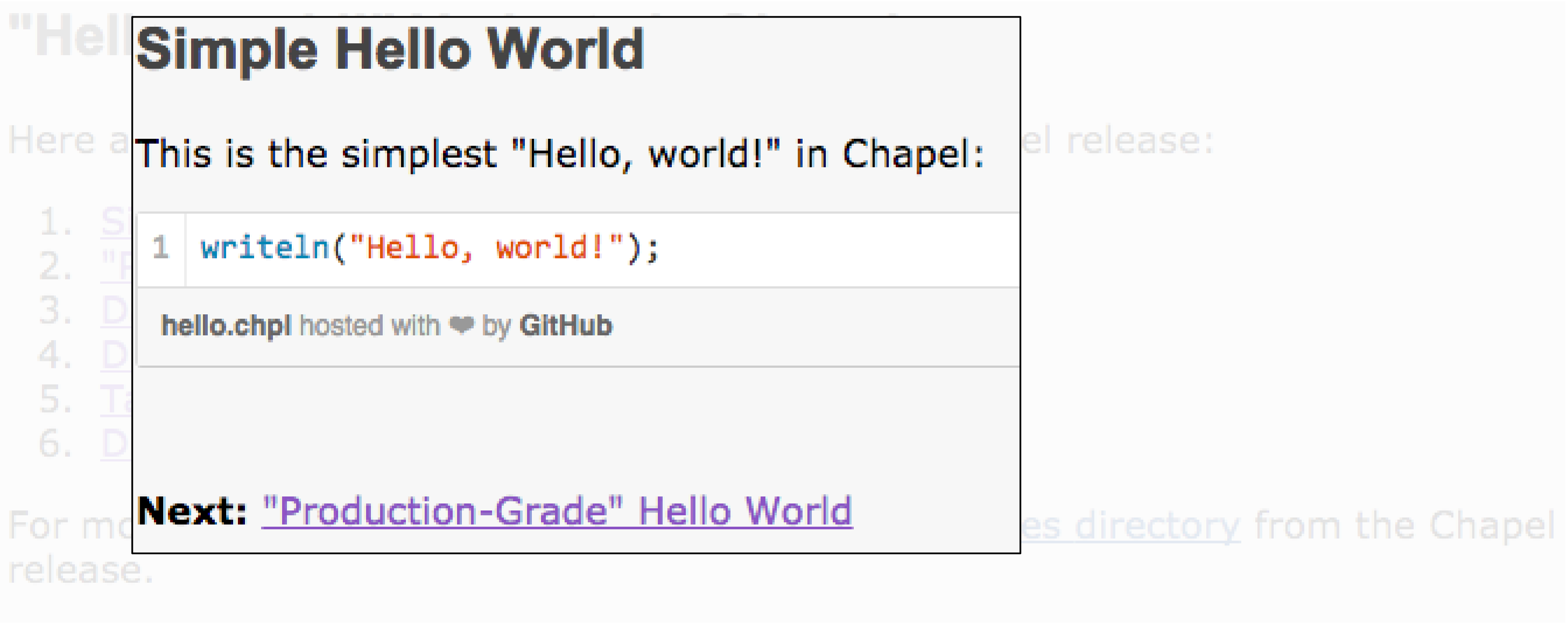
Here are six versions of "Hello, world!" from the Chapel release:

1. Simple version
2. "Production Grade" version
3. Data-Parallel version
4. Distributed-Memory Data-Parallel version
5. Task-Parallel version
6. Distributed-Memory Task-Parallel version

For more advanced computations, browse the examples directory from the Chapel release.

Chapel Docs: This Effort

- **Hello world examples on the website:**
  - http://chapel.cray.com/hellos.html
  - Concise, yet thorough intro to language



"Hel

Here a ... el release:

1. S
2. "P
3. D
4. D
5. T
6. D

For mo ... es directory from the Chapel release.

Simple Hello World

This is the simplest "Hello, world!" in Chapel:

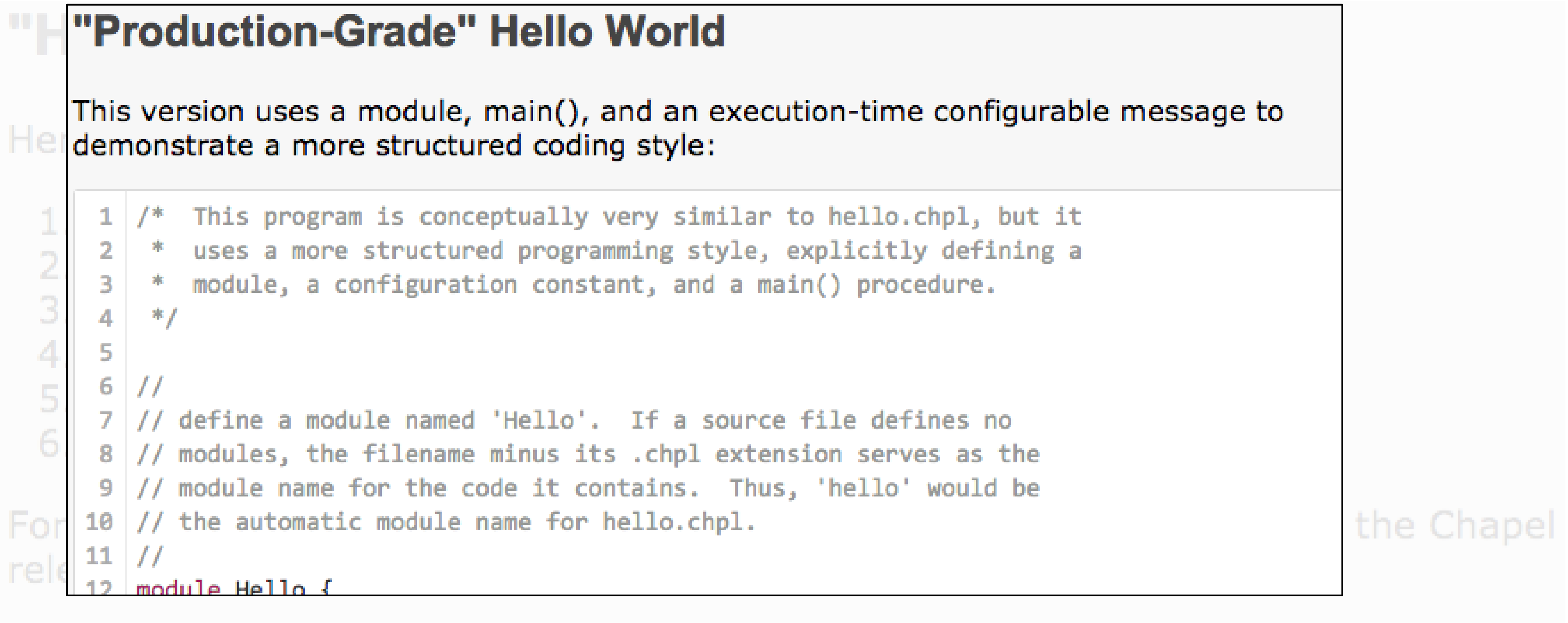
```
writeln("Hello, world!");
```

hello.chpl hosted with ❤ by GitHub

Next: "Production-Grade" Hello World

Chapel Docs: This Effort

- **Hello world examples on the website:**
  - http://chapel.cray.com/hellos.html
  - Concise, yet thorough intro to language



"Production-Grade" Hello World

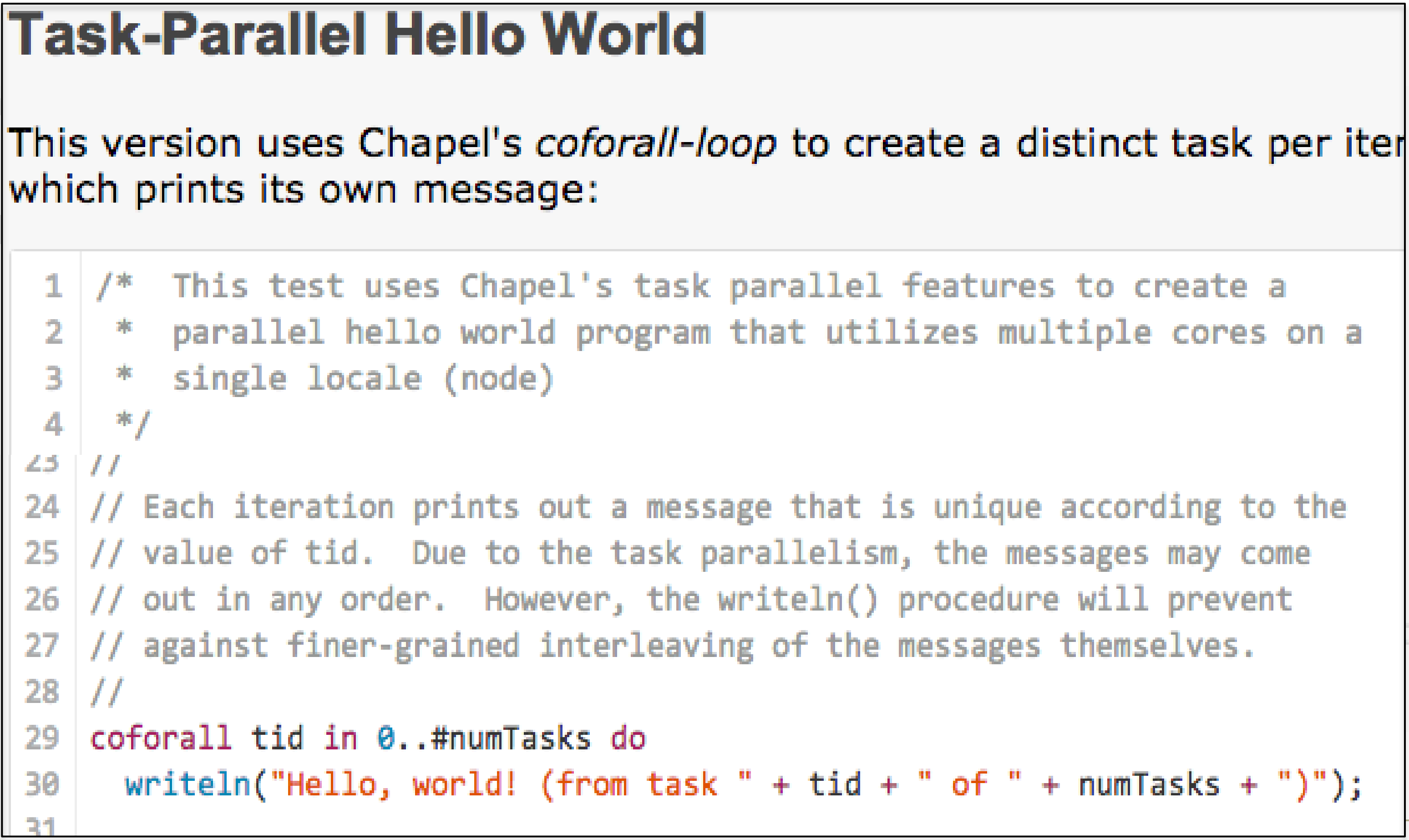
This version uses a module, main(), and an execution-time configurable message to demonstrate a more structured coding style:

```
/*  This program is conceptually very similar to hello.chpl, but it
 *  uses a more structured programming style, explicitly defining a
 *  module, a configuration constant, and a main() procedure.
 */

//
// define a module named 'Hello'.  If a source file defines no
// modules, the filename minus its .chpl extension serves as the
// module name for the code it contains.  Thus, 'hello' would be
// the automatic module name for hello.chpl.
//
module Hello {
```

Chapel Docs: This Effort

- **Hello world examples on the website:**
  - http://chapel.cray.com/hellos.html



Task-Parallel Hello World

This version uses Chapel's *coforall-loop* to create a distinct task per iter
which prints its own message:

```
/*  This test uses Chapel's task parallel features to create a
 *  parallel hello world program that utilizes multiple cores on a
 *  single locale (node)
 */
//
// Each iteration prints out a message that is unique according to the
// value of tid.  Due to the task parallelism, the messages may come
// out in any order.  However, the writeln() procedure will prevent
// against finer-grained interleaving of the messages themselves.
//
coforall tid in 0..#numTasks do
  writeln("Hello, world! (from task " + tid + " of " + numTasks + ")");
```

the Chapel

Chapel Docs: Status

- **Module documentation available online**
  - Generated from source code and comments
- **Hello world programs seen by many web users**
  - Previously requested by critics
  - hellos.html has second-highest pageviews

Other Documentation Improvements

Other Documentation Improvements

- **Minor improvements to Quick Reference document**
- **Documented class/record destructors in spec**
  - Most frequently noted undocumented feature…
- **Other spec improvements:**
  - removed an outdated [] vs. () distinction from the spec
  - clarified that integer literals may be ‘uint’s if sufficiently large
  - additional updates and improvements
- **Added a note for ‘zsh’ users to the top-level README**
- **Improved documentation for slurm* launchers**
- **Noted long-standing feature to squash reference counting**
  - (at the cost of leaking all arrays…)
  - a stopgap, see $CHPL_HOME/PERFORMANCE for details

Documentation Priorities and Next Steps

Documentation Priorities and Next Steps

- **Continue to update docs with module changes**
- **chpldoc Chapel features that have library-like interfaces**
  - e.g., arrays-as-vectors, methods on ranges and domains, etc.
- **Add primers to web as a broader Chapel tutorial**
- **Make remaining doc/ READMEs web pages**
- **Revise "Hello world" comments with web reader in mind**

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CRAY CHAPEL

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