Tools

Chapel Team, Cray Inc.

Chapel version 1.14

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Outline

- chplvis Improvements
- chpldoc Improvements

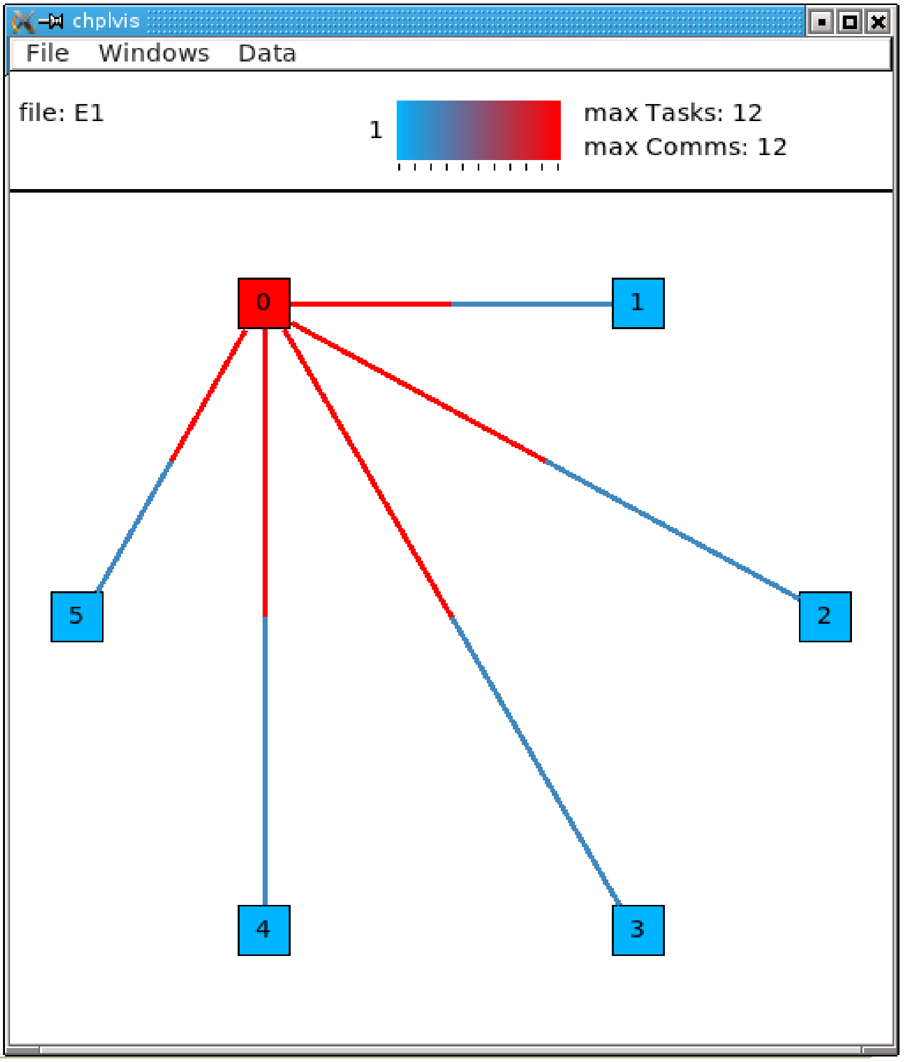
chplvis Improvements

chplvis: Background

- **chplvis first available with Chapel 1.12.0**
- **chplvis is a tool to visualize tasks and inter-locale communication in a graphical user interface**
- **Instrumentation done by programmer by adding calls to procedures in the VisualDebug module.**
  - At runtime, each locale writes a data file with events
  - Task events are: task creation, task begin and end execution
  - Communication events: gets, puts, "on calls"
- **chplvis reads data files written at run time and provides a post run view of the Chapel program run**
  - Shows CPU time, clock time, number of tasks and concurrency, and size or volume of communication events

chplvis: Original Example Display

- **Simple coforall and on-clause display, 6 locales**
  - Boxes are locales
  - Lines are communication
  - Color shows data value
    - Segment adjacent to box indicates number of communications *into* locale
- **Interactive display**
  - Click on boxes
  - Click on lines
  - Data menu changes display

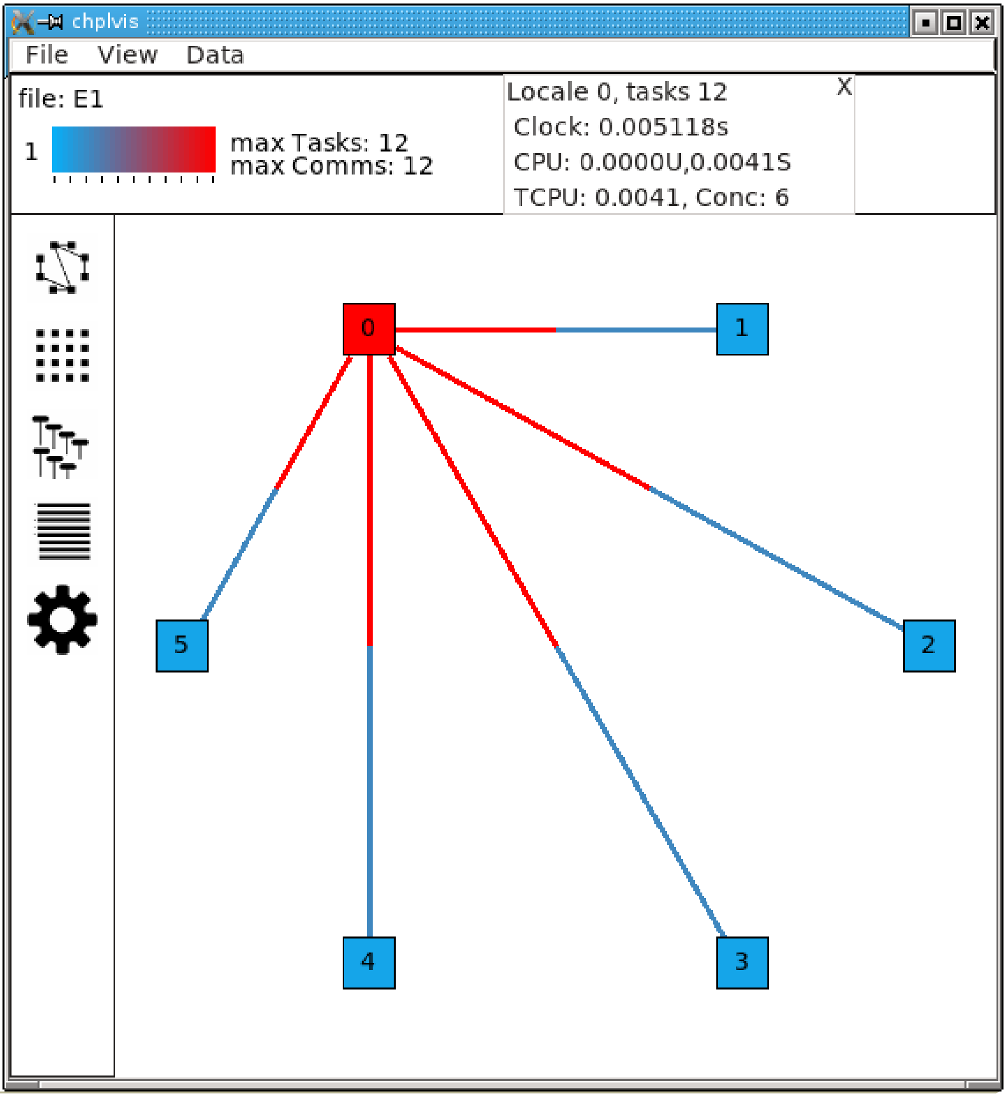


chplvis: VisualDebug Module / Runtime

- **Original version: VisualDebug module always “on”**
  - User added calls to VisualDebug module in their code
  - VisualDebug always ran unless commented out by user
- **Added VisualDebugOn**
  - Config const: VisualDebugOn – allows user to disable data collection
- **Completed callback mechanisms in runtime**
  - Task Events: Creation, Start execution, End execution
  - Communication Events: gets, puts, on Clause calls
- **Internal function names, filenames**
  - Source file name table
  - Internal function name table
  - Used by VisualDebug module for source view

chplvis: New Default Display

- **Original view now called graph view**
- **One window design**
  - Locale clicks bring up information box instead of a window
  - Communication clicks bring up comm (gets, puts, on calls) box
- **View zooms and scrolls**
- **View selection on left bar**

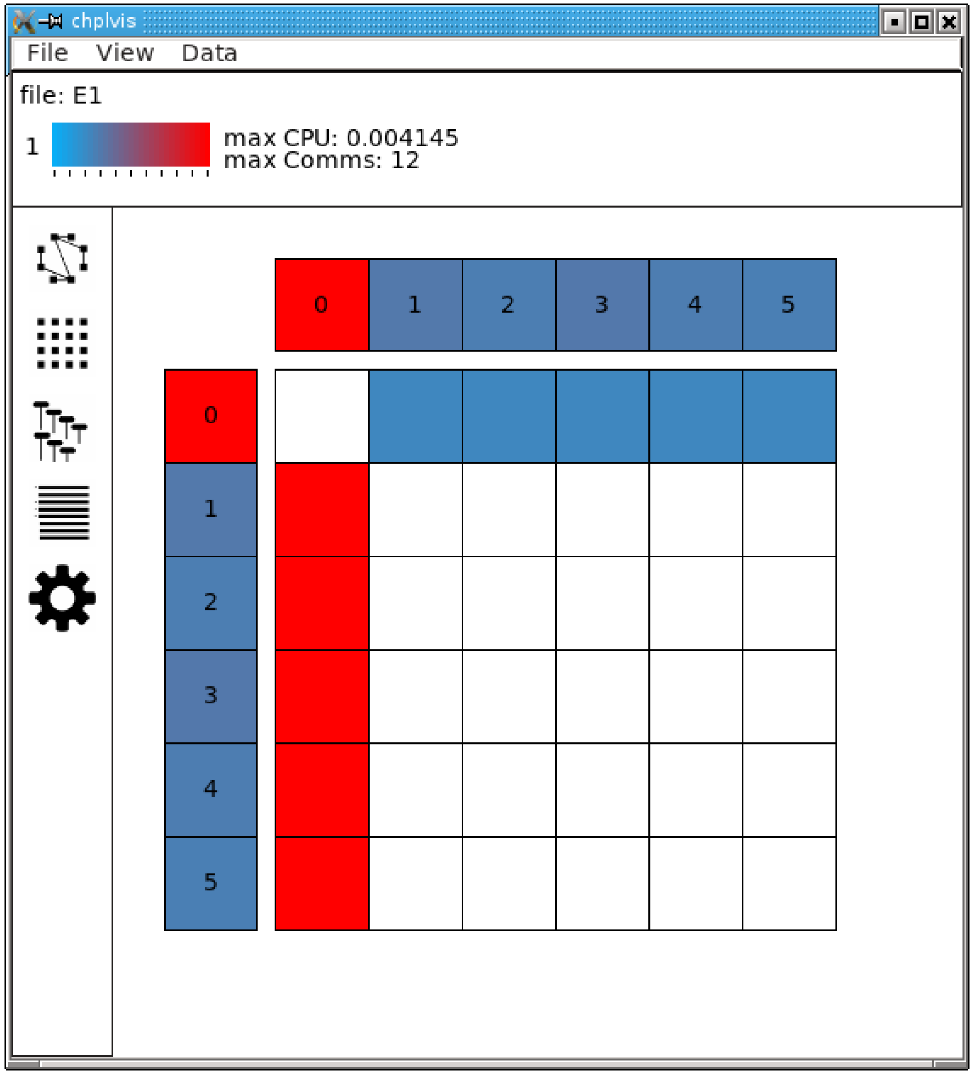


file: E1
max Tasks: 12
max Comms: 12

Locale 0, tasks 12
Clock: 0.005118s
CPU: 0.0000U,0.0041S
TCPU: 0.0041, Conc: 6

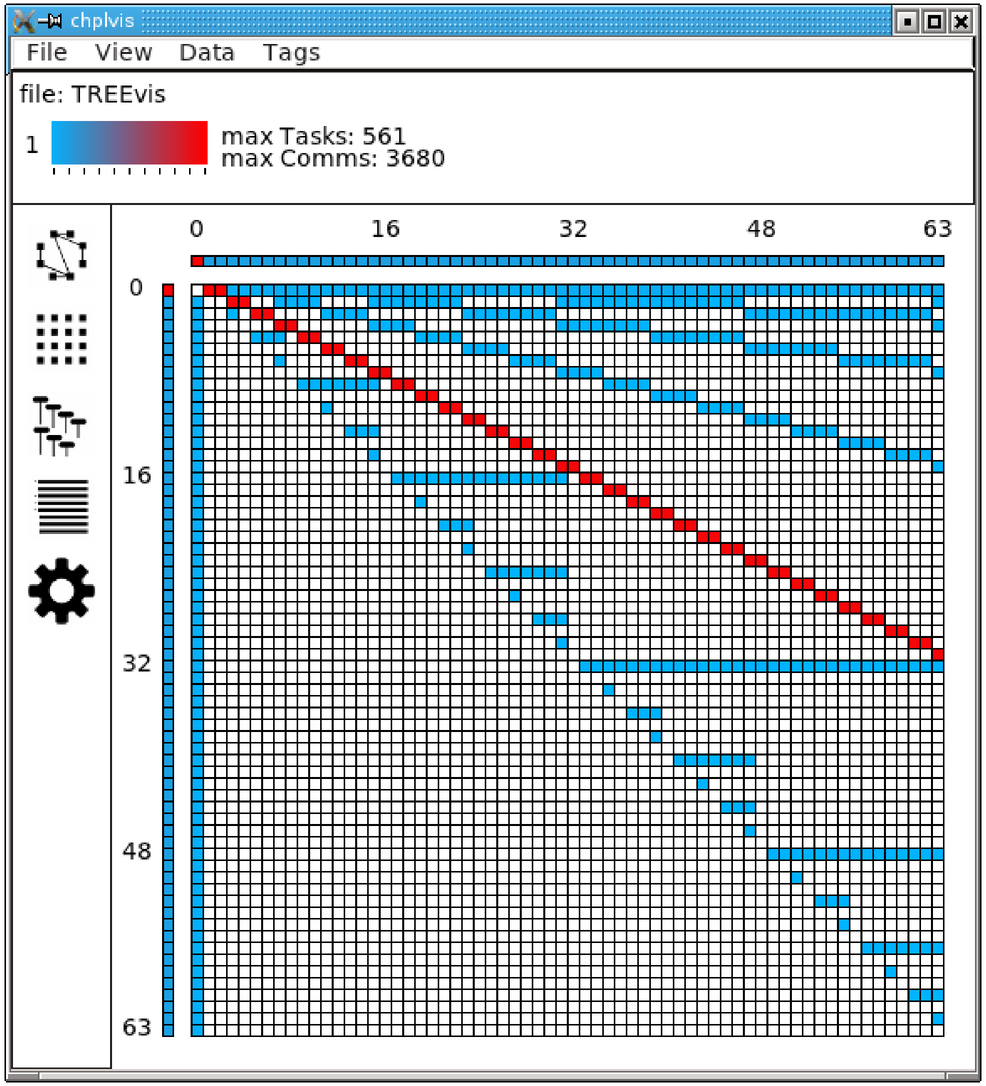
chplvis: Grid View

- Alternate view of same data
- Locales left and top
- Comm from left locale to top locale
- Red column is comm into locale 0
- Blue row is comm from locale 0 to others



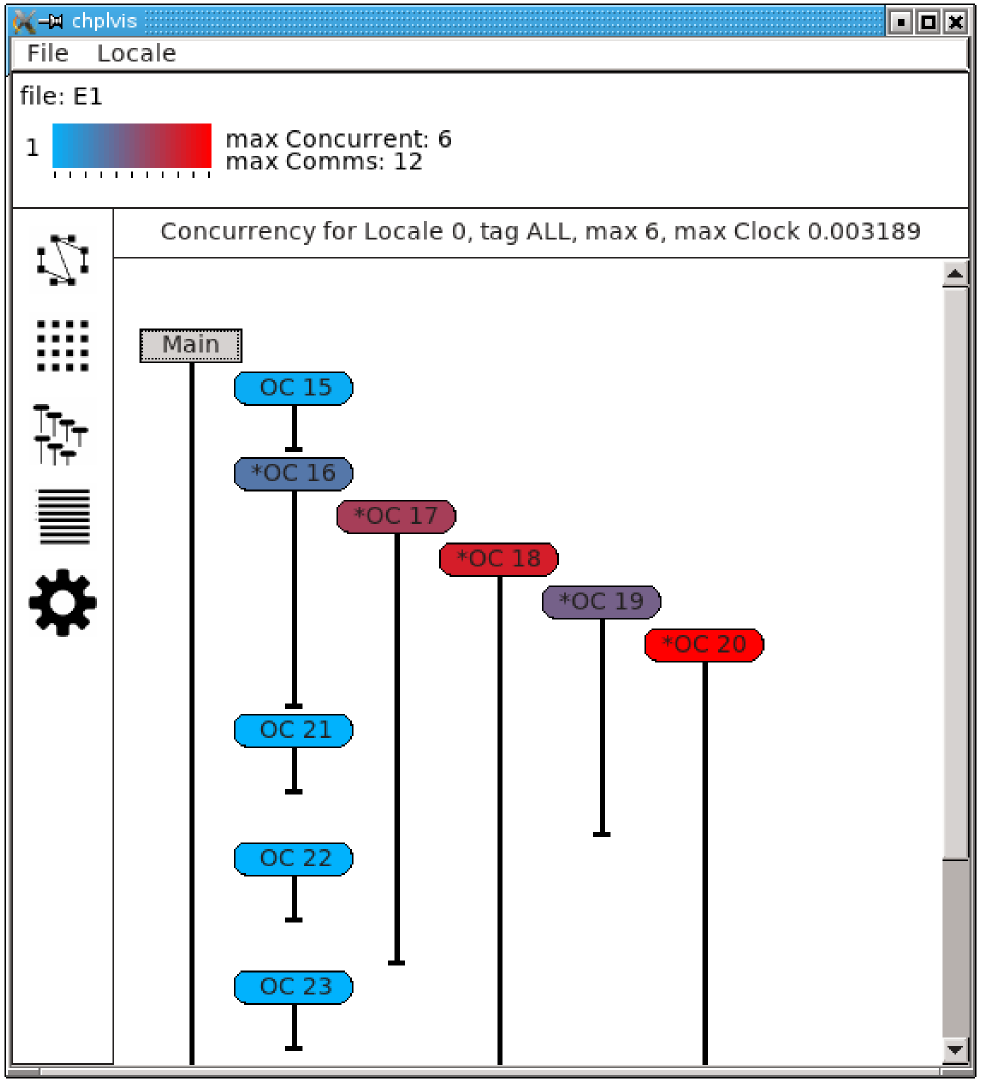
chplvis: More Than 32 Locales

- Grid view easily shows >32 locales
- Box size varies based on number of locales, window size
- View zooms and scrolls



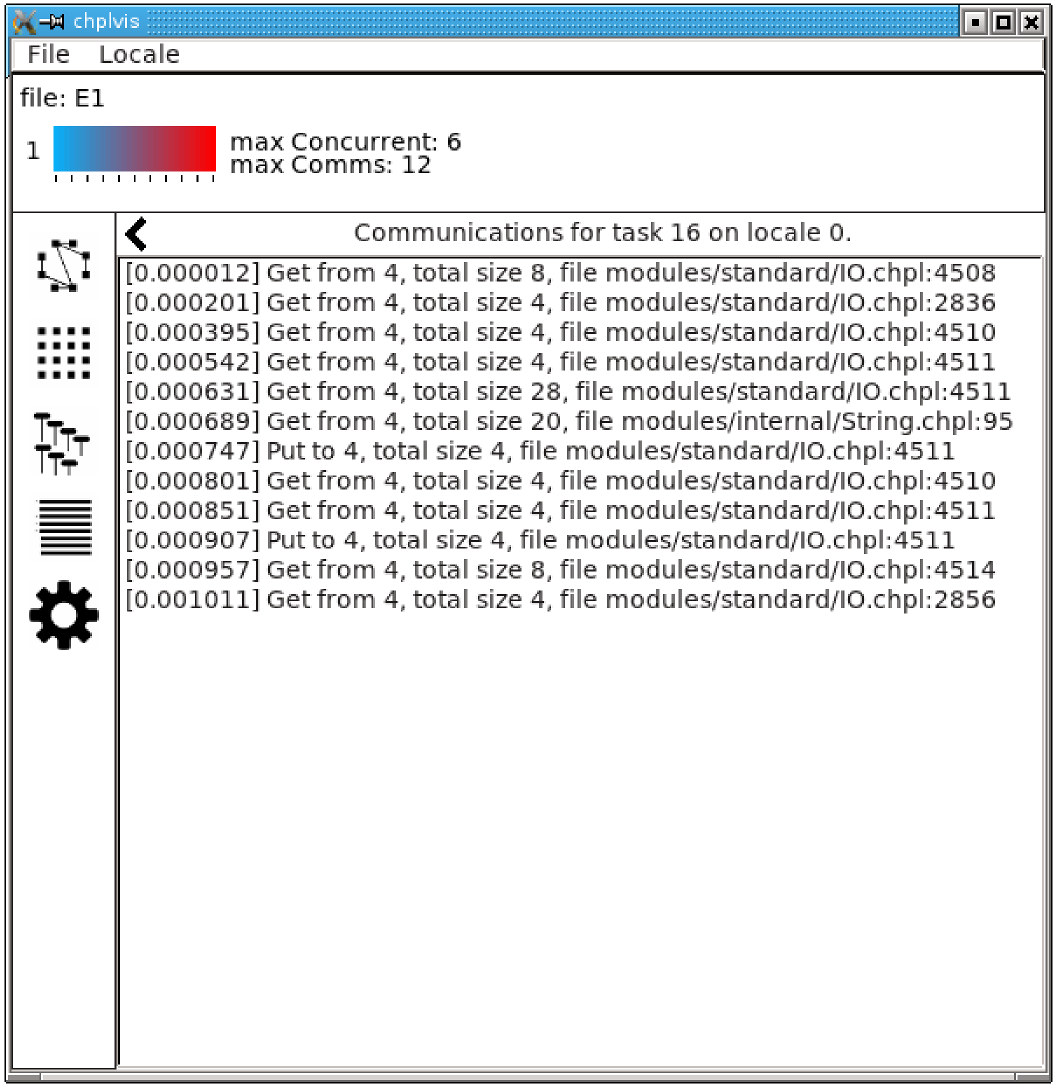
chplvis: Concurrency View

- View instead of a window
- tasks with communication now identified with '*' (*OC 16, *OC 17, …)
- Menus allow selection of locales and tags
- Click on task brings up task communication view



chplvis: Task Communication

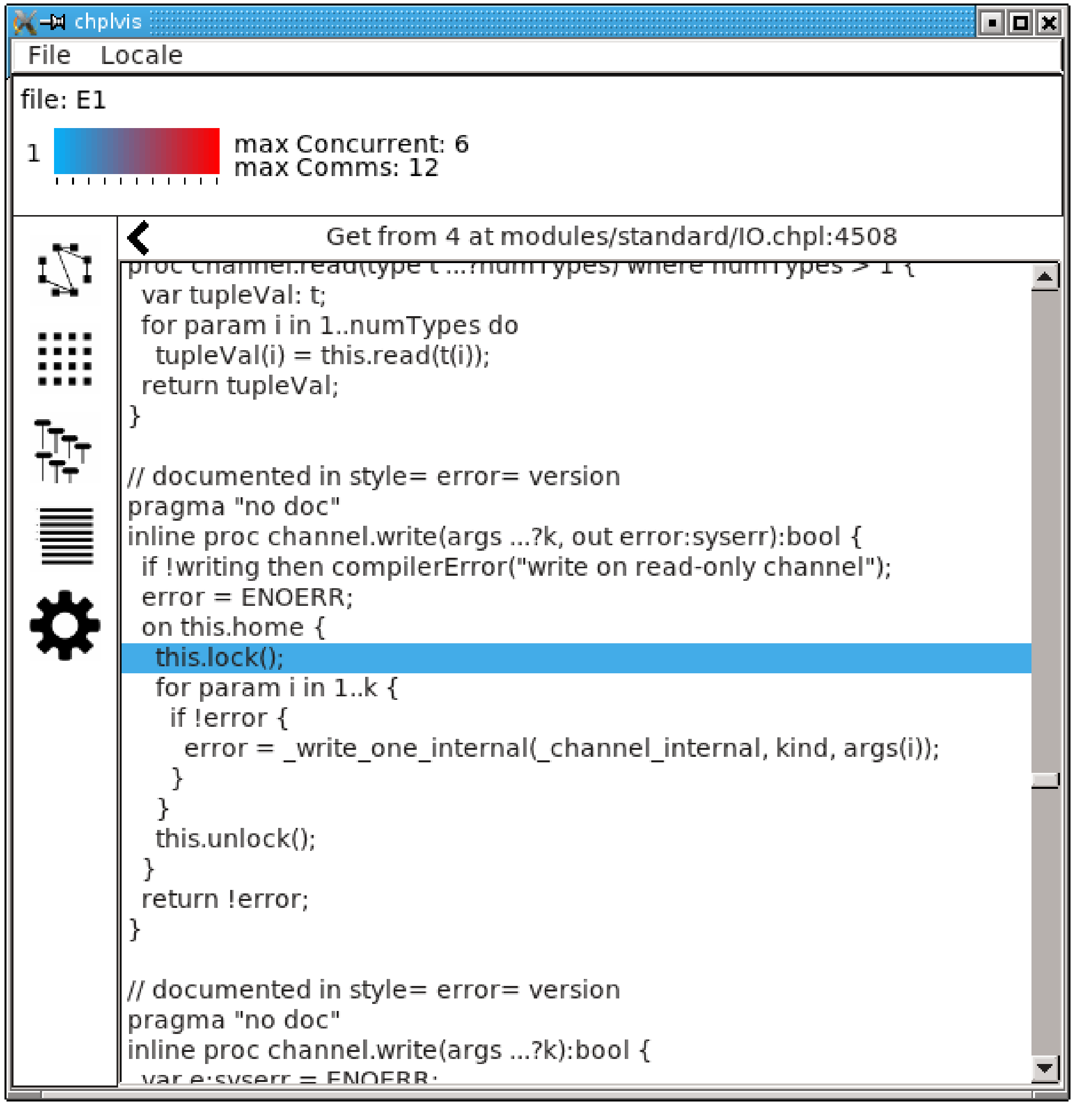
- Lists comm events for single task
- Click on comm brings up file at line number listed



```
[0.000012] Get from 4, total size 8, file modules/standard/IO.chpl:4508
[0.000201] Get from 4, total size 4, file modules/standard/IO.chpl:2836
[0.000395] Get from 4, total size 4, file modules/standard/IO.chpl:4510
[0.000542] Get from 4, total size 4, file modules/standard/IO.chpl:4511
[0.000631] Get from 4, total size 28, file modules/standard/IO.chpl:4511
[0.000689] Get from 4, total size 20, file modules/internal/String.chpl:95
[0.000747] Put to 4, total size 4, file modules/standard/IO.chpl:4511
[0.000801] Get from 4, total size 4, file modules/standard/IO.chpl:4510
[0.000851] Get from 4, total size 4, file modules/standard/IO.chpl:4511
[0.000907] Put to 4, total size 4, file modules/standard/IO.chpl:4511
[0.000957] Get from 4, total size 8, file modules/standard/IO.chpl:4514
[0.001011] Get from 4, total size 4, file modules/standard/IO.chpl:2856
```

chplvis: File View

- **Line highlighted for comm location or task definition**
- **Back arrow to get to view that led to file view**



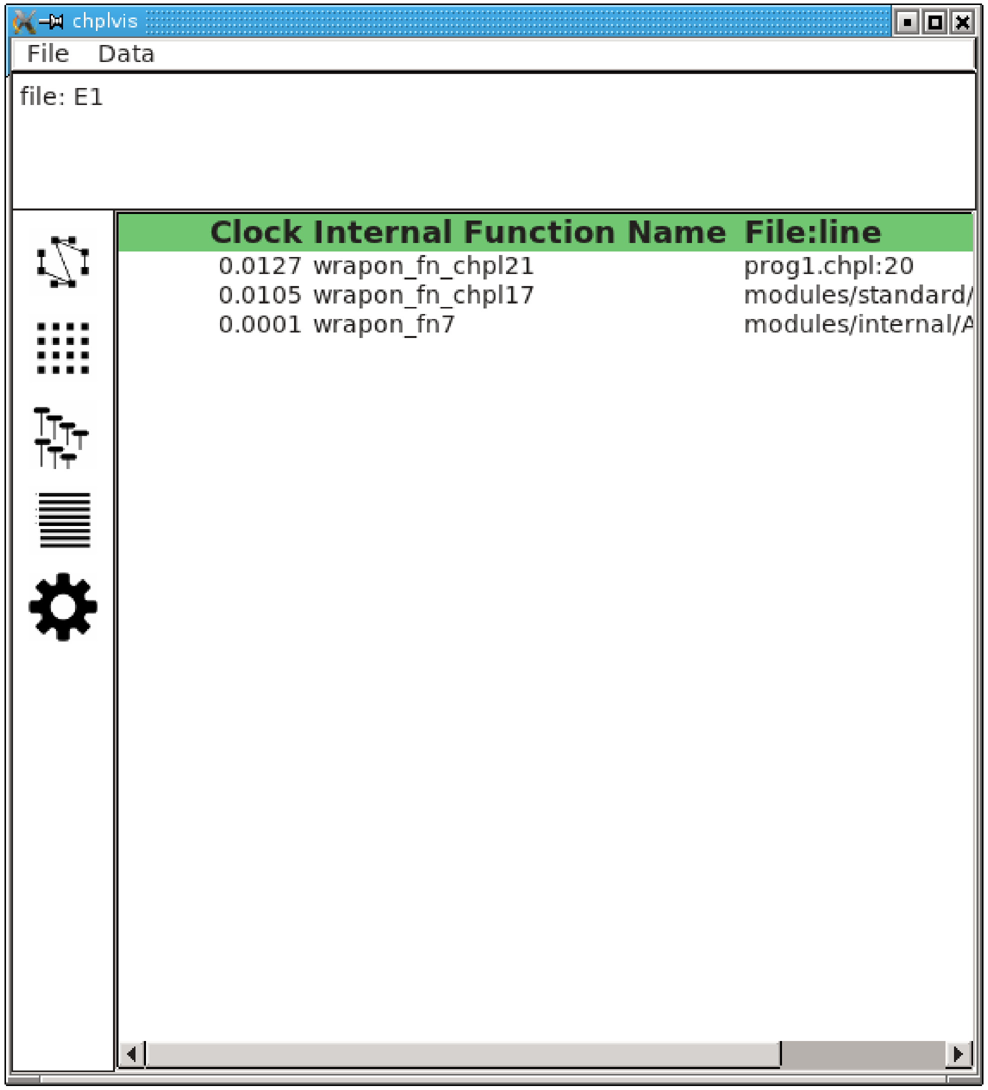
```
proc channel.read(type t ...?numTypes) where numTypes > 1 {
  var tupleVal: t;
  for param i in 1..numTypes do
    tupleVal(i) = this.read(t(i));
  return tupleVal;
}

// documented in style= error= version
pragma "no doc"
inline proc channel.write(args ...?k, out error:syserr):bool {
  if !writing then compilerError("write on read-only channel");
  error = ENOERR;
  on this.home {
    this.lock();
    for param i in 1..k {
      if !error {
        error = _write_one_internal(_channel_internal, kind, args(i));
      }
    }
    this.unlock();
  }
  return !error;
}

// documented in style= error= version
pragma "no doc"
inline proc channel.write(args ...?k):bool {
  var e:syserr = ENOERR;
```

chplvis: Profile View

- Profile view of internal functions
- Clicking on line brings up file view
- Profile data: clock, tasks, communication, on calls, gets, puts
- Selection via menu

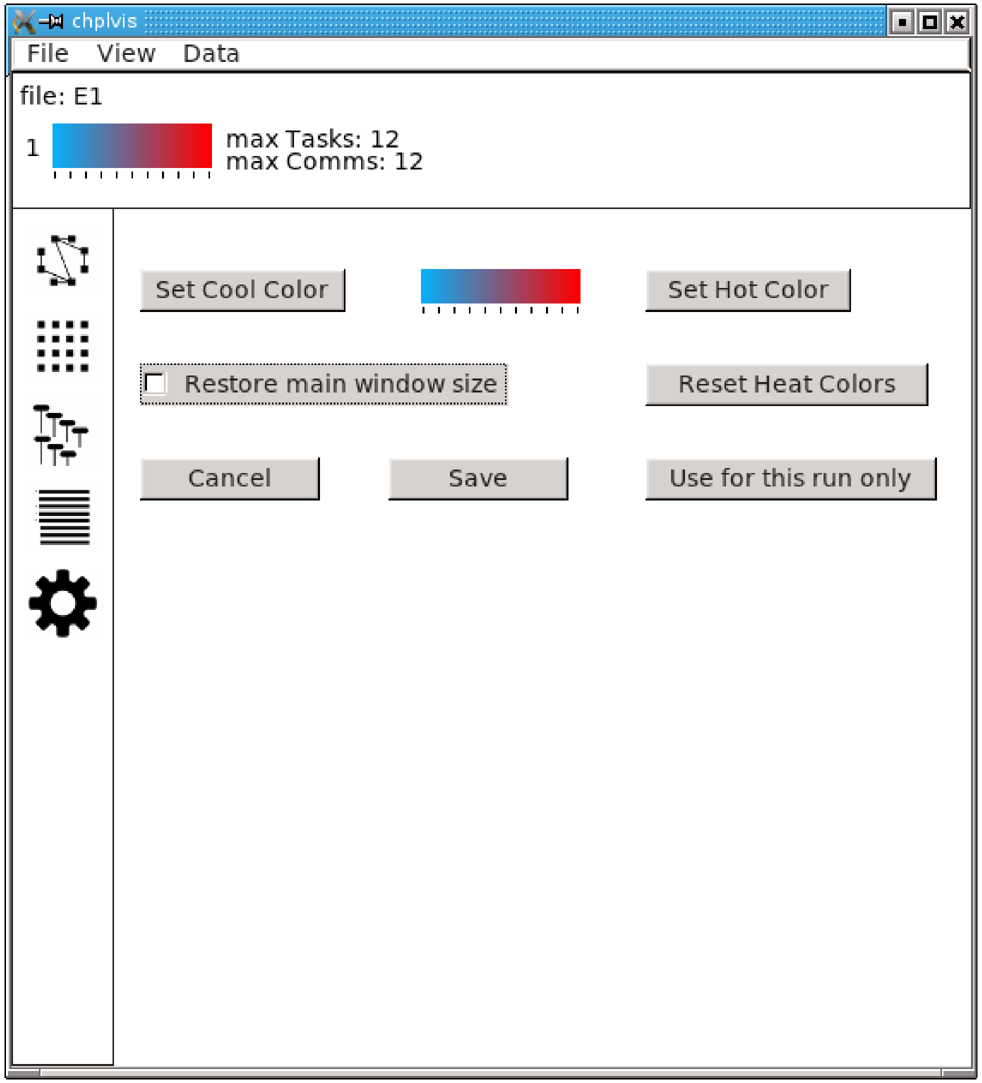


file: E1

```
Clock  Internal Function Name    File:line
0.0127 wrapon_fn_chpl21          prog1.chpl:20
0.0105 wrapon_fn_chpl17          modules/standard/
0.0001 wrapon_fn7                modules/internal/A
```

chplvis: Settings

- Heat colors selectable
- Restore window size on next run selectable



file: E1
1
max Tasks: 12
max Comms: 12

chplvis: Next Steps

- **Runtime / chplvis improvements**
  - Map more events back to user code in non-developer mode
  - Improve profile data
  - Find ways to gather and display more data
  - Look for ways to add animation to displays

- **More UI improvements**
  - Improve zooming
  - Add more settings for users, possible choices
    - background color
    - default view
    - set *CHPL_HOME* and compile directory for copied data files
  - Add a way to export a .png or .pdf of current view
  - Many more tweaks to UI possible

chpldoc Improvements

chpldoc: Background

- **Tool to generate documentation for .chpl files**
  - Originally added in Chapel 1.6.0
    - text output only
  - Improved significantly in 1.11.0 and onwards
    - HTML output revamped
    - Used to generate our online documentation for our library modules
- **Considered stable and reliable**
  - Handful of known bugs
  - Some feature requests

chpldoc: This Effort

- **Bug fixes:**
  - Stop generating documentation for symbols within:
    - Loops
    - Inner block statements

```
module M {
  var x = 10; // Should be documented
  while x > 3 {
    var inner = x / 2; // Shouldn't be documented
    … }
}
```

  - These symbols can't be accessed through a 'use' of the module
    - So they aren't part of the program's API and shouldn't be documented

chpldoc: This Effort

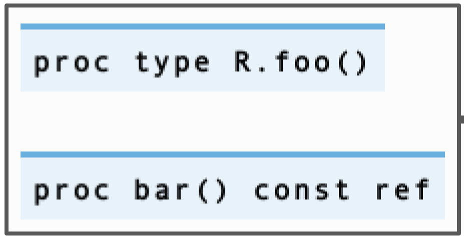
- **Bug fixes:**
  - Fix output of:
    - Dmapped variables
    - Expressions with the ‘new’ keyword

```
const rcDom = rcDomainBase dmapped new dmap(rcDomainMap);
// Turned into this instead:
const rcDom = appendExpr.Call09chpl__distributedrcDomainBase
```

chpldoc: This Effort

- **Bug fixes:**
  - HTML source highlighting for:
    - Functions with ‘const ref’ return intents
    - Type and param methods on types
  - Clean up leftover documentation of removed symbols in library docs
    - Built-ins had script to remove certain symbols, e.g. those named “chpl_*”
    - But accidentally left any documentation comments behind

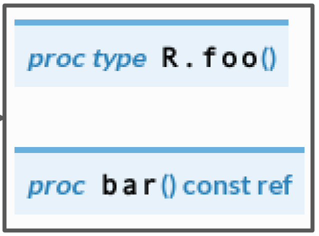
1.13 release



```
proc type R.foo()

proc bar() const ref
```

1.14 release



```
proc type R.foo()

proc bar() const ref
```

chpldoc: Next Steps

- **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**

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