Tools Updates

Chapel Team, Cray Inc.
Chapel version 1.12
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Outline

- chplvis: a Tool for Performance Visualization
- ‘chpldoc’ Improvements
chplvis: a Tool for Performance Visualization
chplvis: Background

- **Performance debugging tool support for Chapel is limited**
  - No support for tools like Tau, ParaView, and VisIt
  - Basic support for tools like valgrind and gdb
  - Parallel performance debugging is not easy

- **Chapel runtime uses tasks and locales**
  - Direct support for these features is important
  - Other tools do not support this exact paradigm
    - e.g., provide thread-based information rather than task-based
      \[\Rightarrow\] Challenging to integrate support for Chapel in other tools
chplvis: A Communication and Task Viewer

- **A new visualization tool for…**
  - Inter-locale communication
  - Task concurrency within a locale
  - CPU and clock time

- **Support provided via a standard module: `VisualDebug’**
  - User calls module functions to indicate program segments to visualize
  - Runtime collects data about runtime events, creates data files
  - Chplvis program displays data from files visually
**chplvis: VisualDebug.chpl module**

**startVdebug(“dataDirName”)**
- Starts collecting runtime events
- Creates named directory for data collection
- Each locale writes a separate data file

**stopVdebug()**
- Stops all data collection, closes all data files

**tagVdebug(“tagName”)**
- Inserts tag in the data, allows partial run visualizations
- Chplvis tool uses tag name to control displayed data

**pauseVdebug()**
- Temporarily suspend collection of runtime events
Simple `coforall` and `on` clause:

```chpl
use VisualDebug;

startVdebug("E1");

coforall loc in Locales do
  on loc do
    writeln("Hello from locale " + here.id + ".");

stopVdebug();
```
chplvis: Simple 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
Jacobi computation loop:

```c
while (delta > epsilon) {
    tagVdebug("computation");  // Tag the computation part of this loop
    for t in 1..compLoop {
        forall (i,j) in R do A[i,j] = Temp[i,j];
        forall (i,j) in R do
    }
    tagVdebug("max");  // tag the reduction part of this loop.
    forall (i,j) in R do
        Diff[i,j] = abs(Temp[i,j] - A[i,j]);
    delta = max reduce Diff;
    pauseVdebug();
    iteration += compLoop;
}
```
chplvis: Jacobi Example Display

- **8 locale run with tags**
  - ‘All’ ⇒ program start to first tag
  - Tag names taken from calls
  - Gray segments indicate no communication into that locale
chplvis: Intra-locale task example

- **Task concurrency display**
  - Ovals are tasks
  - Colors show task clock time
  - Lines show (logical) lifetime
  - Tags may be shown in task timeline

- **Display interaction**
  - Click task for list of the task’s communications
  - Hover over task for summary display of times and communication counts
chplvis: Status and Next Steps

Status:
- No known bugs
- Works well up to 32 locales
- All planned features working

Next Steps:
- Get user feedback
- Improve visualization for more than 32 locales
- Longer-term: introduce more data-centric views of computation
‘chpldoc’ Improvements
Chpldoc Improvements: Background

- **chpldoc was much improved in 1.11**
  - Including distinct flags from chpl binary

- **Still some bugs to iron out**
  - Initialization expressions of certain types were handled poorly
  - Numeric enum values were dropped on the floor
  - Needed pragma to hide symbols from output

```chapel
/* An enum of three constants */
enum Vals {foo = 1, bar, baz};
```

```chapel
Chapel 1.11:

```
chpldoc -h
Usage: chpldoc [flags] [source files]

Documentation Options:
-o, --output-dir <dirname>
   --save-sphinx <directory>
   --comment-style <indicator>
   --text-only
-h, --help
```

An enum of three constants
Chpldoc Improvements: This Effort

- chpldoc now shows an enum’s numeric values
- fixed enum, real, imag, complex initialization expressions

```chapel
/* An instance of the enum, set to the second constant initially */
var inst1 = Vals.bar;

/* An instance of a real */
var inst2 = 13.0;
```

Chapel 1.11:

- `var inst1 = (Vals, "bar")`
  - An instance of the enum, set to the second constant initially
- `var inst2 =`
  - An instance of a real

Chapel 1.12:

- `var inst1 = Vals.bar`
  - An instance of the enum, set to the second constant initially
- `var inst2 = 13.0`
  - An instance of a real
Chpldoc Improvements: This Effort

● Previously: only ignored symbols with pragma “no doc”

    \texttt{pragma \texttt{"no doc"}}

    \texttt{var foo: int;}

● Pragmas aren’t currently intended for end-users
● Already wanted privacy control in namespaces
  ● This was a quick fix, not a long-term solution

● Now: private symbols are also ignored by chpldoc

● Still supporting “no doc” pragma
  ● Not all symbols support ‘private’ yet
  ● Even then, may not want everything ‘public’ to be documented
Chpldoc Improvements: This Effort

● **More flags**
  ● New: --author for setting author output
  ● Other flags shared with chpl binary
    ● License, copyright, etc.
    ● Better developer debugging

**Chapel 1.11:**

```
chpldoc -h
Usage: chpldoc [flags] [source files]
```

Documentation Options:

- `--output-dir <dirname>`
- `--save-sphinx <directory>`
- `--author <author>`
- `--comment-style <indicator>`
- `--text-only`
- `--[no-]print-commands`

Information Options:

- `--help`
- `--help-env`
- `--help-settings`
- `--version`
- `--copyright`
- `--license`

Developer Flags:

- `--[no-]devel`
- `--gdb`
- `--lldb`
- `--print-chpl-home`

**Chapel 1.12:**

```
chpldoc -h
Usage: chpldoc [flags] [source files]
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Chpldoc Improvements: Next Steps

● More bug fixes

● **Support testing example codes within chpldoc comments**
  ● Similar to python doctests

● **Compatibility with newly converted .rst files**

● **Support class/record view, including inheritance info**
  ● And add class and record index

● **Link to source code from docs**
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