Reminders

- Start project 2!
  - It’s long
  - Read the assignment carefully
  - Read it again
- Project 2 will be done in groups of 3
  - E-mail groups to me
- Part 1 due in 2 weeks (10/27)
- Part 2 due in 3.5 weeks (11/7)

Project 2

- You have to:
  - Implement a user thread library
  - Implement synchronization primitives
  - Solve a synchronization problem
  - Add Preemption
  - Implement a multithreaded web server
  - Get some results and write a (small) report

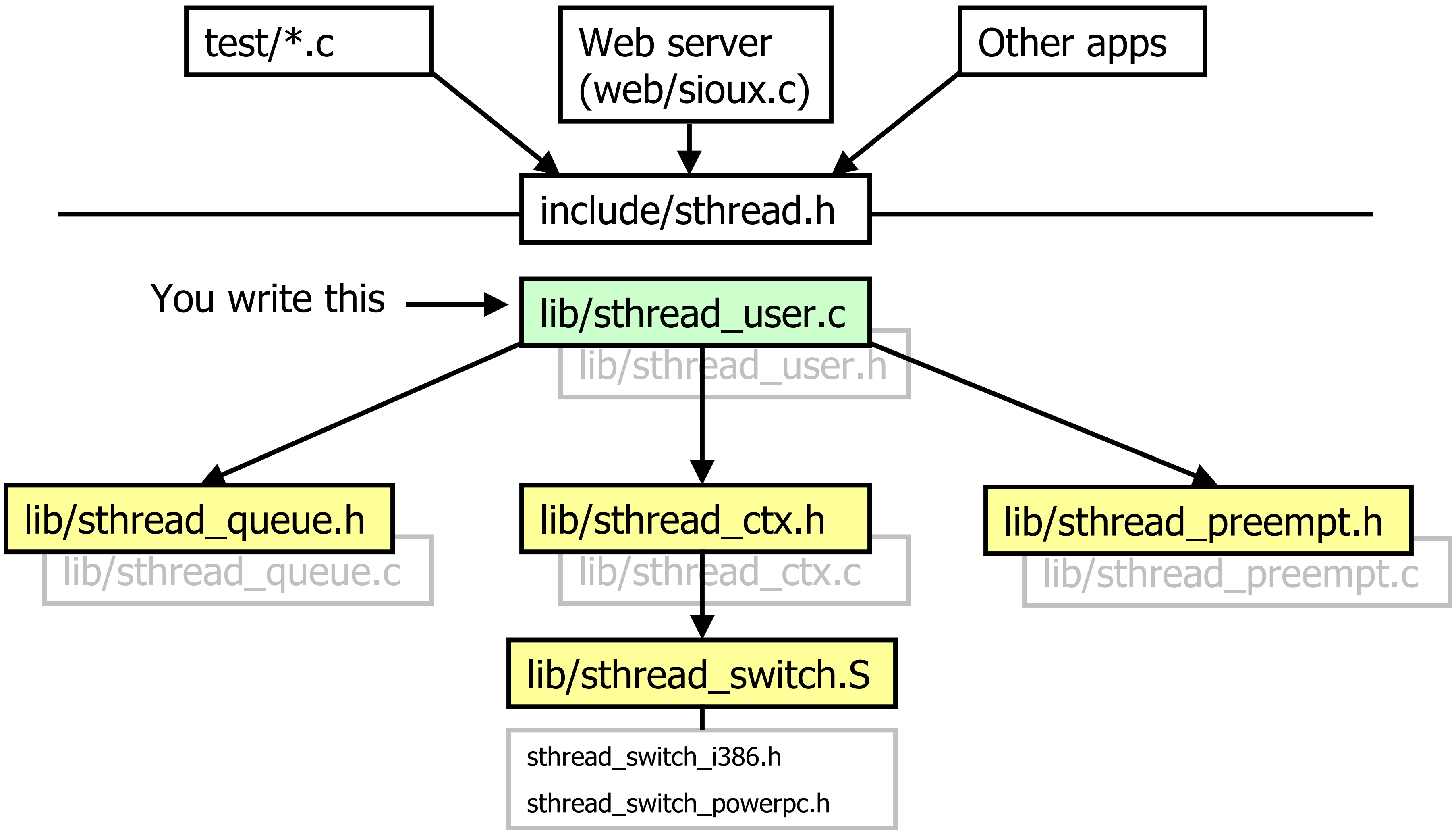
Part 1

Part 2

Simplethreads

- We give you:
  - Skeleton functions for thread interface
  - Machine-specific code
    - Support for creating new stacks
    - Support for saving regs/switching stacks
  - A generic queue
    - When do you need one?
  - Very simple test programs
    - You should write more
  - Singlethreaded web server

Structure


test/*.c
Web server (web/sioux.c)
Other apps
include/sthread.h
You write this
lib/sthread_user.c
lib/sthread_user.h
lib/sthread_queue.h
lib/sthread_queue.c
lib/sthread_ctx.h
lib/sthread_ctx.c
lib/sthread_preempt.h
lib/sthread_preempt.c
lib/sthread_switch.S
sthread_switch_i386.h
sthread_switch_powerpc.h

Thread operations

- `void sthread_init()`
  - Initialize the whole system
- `sthread_t sthread_create`
  `(func start_func, void *arg)`
  - Create a new thread and make it runnable
- `void sthread_yield()`
  - Give up the CPU
- `void sthread_exit(void *ret)`
  - Exit current thread
- What about the **TCB**?

```
struct _thread {
     sthread_ctx_t *saved_ctx;
     .....
}
```

- Others?

Sample threaded program

```
int main(int argc, char **argv) {
   int i;

   sthread_init();
   if (sthread_create(thread_start, (void*)i) == NULL) {
     printf("sthread_create failed\n");
     exit(1);
   }

   sthread_yield();  //yield main thread to our new thread
   printf("back in main\n");
   return 0;
}

void *thread_start(void *arg) {
  printf("In thread_start, arg = %d\n", (int)arg);
  return 0;
}
```

Managing contexts

- Thread context = thread stack + stack pointer
- `sthread_new_ctx(func_to_run)`
  - gives a new thread context that can be switched to
- `sthread_free_ctx(some_old_ctx)`
  - Deletes the supplied context
- `sthread_switch(oldctx, newctx)`
  - Puts current context into oldctx
  - Takes newctx and makes it current

Things to think about

- Who will call sthread_switch?
- Where does sthread_switch return?
- How do we delete a thread?
  - Can a thread free its stack itself?
- Starting up a thread
  - sthread_new_ctx() takes a function foo
  - sthread_new_ctx doesn’t pass parameters to foo
  - But in sthread_create, you give a function *and* an arg!
  - **Bottom line:** how do you pass arguments to a function with no arguments?

Programming in groups

- How to work on same files?
- One way:
  - Keep every version of code, all with different names:
    - Project2good
    - Project2_10_13_04
    - Project2working
  - Send emails back and forth with new changes
  - Merge different versions by hand

CVS

- The CVS way:
  - One version, saved in the CVS repository
  - Multiple people can work on the same file concurrently
  - CVS merges the edited versions automatically as you put them back in the repository
  - Maintains all old versions of files, so you can go back

Setting up CVS

- Set up CVS root environment var
  - Tells CVS where to find your repository
    - `setenv CVSROOT /cse451/groupleader/cvs`
    - (bash) `export CVSROOT=/cse451/groupleader/cvs`
- Initialize a repository (only one person per group)
  - Create a dir in your group's dir to hold repository (master copy of code)
    - `cd /cse451/groupleader`
    - `mkdir cvs`
  - Initialize repository
    - `cvs init`
  - You now have an empty repository

Setting up CVS (2)

- Add/Import the simplethreads distribution to your repository
  - `tar xvfz simplethreads-1.20.tar.gz`
  - `cd simplethreads-1.20`
  - `cvs import –m “initial code” simplethreads SIMPLETHREADS SIMPLETHREADS_1_20`
  - `cd ..`
  - `rm –fr simplethreads-1.20`

CVS commands

- Check out a project (sandbox, or local copy) to your home directory to work on:
  - CVS creates a dir simplethreads/ and puts copy of all source files in repository into that dir
  - Also adds CVS dir where it stores data about what you check out
    - `cd <wherever>`
    - `cvs checkout simplethreads`
    - `cd simplethreads`
  - Do this once

- Merge in new changes from repository (update):
  - `cvs update [files…]`

CVS commands (2)

- Save your edited files into the repository so others can use them:
  - `cvs commit -m “fixed annoying bugs” [files…]`
- Add a new file (source files .c or .h) to the repository
  - `cvs add [files…]`
- Check status of a file
  - `cvs status file.c`
- Check differences between your file and one in the repository:
  - `cvs diff file.c`
  - `cvs diff -r 1.1 file.c` (specifies version)
- View log of changes for a file
  - `cvs log file.c`

- More info
  - http://www.cvshome.org or `man cvs`

CVS Miscellany

- Use emacs for cvs commit log editing (default is vi):
  - `setenv VISUAL emacs`

- Access CVS from another machine besides forkbomb?:
  - `setenv CVSROOT forkbomb.cs.washington.edu:/cse451/groupleader/cvs`
  - `setenv CVS_RSH ssh`

  (for CVS to know how to access repository – use ssh)