Recitation 8

Scheduling, sched-demo, and skeletons

Agenda

- Ucontext Review
- Sched-demo.c
- Scheduling
- Kernel Stuff

Ucontext Review

- User level threads
- Each has its own separate stack and execution context
- Very primitive and easy to segfault
- Man page https://man7.org/linux/man-pages/man3/getcontext.3.html

Sched-demo.c

- Schedules 4 threads total, one running “cat” and 3 which just increment a value
- Uses a timer and a signal handler to switch between different contexts
- Need to use VALGRIND_STACK_REGISTER to avoid valgrind errors when switching between stacks
- Ctrl-D to exit from the program
- Can compile with just **clang sched-demo.c**

Sched-demo.c and helloContext.c

- Live Demo

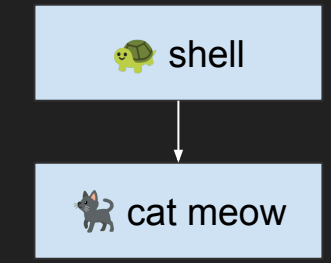
Scheduling

- Every clock tick, switch to scheduler
- Processes have priority 1, 0, -1, with -1 scheduled the most
- -1 is scheduled 1.5x 0
- 0 is scheduled 1.5x 1
- Processes are 0 by default, but shell is -1
- Still schedule a process even if

For Milestone 1

- Should be able to schedule multiple processes
- Already have what a process is
- Be able to switch between processes
- There should be priority enforcement

Kernel stuff 🌽
+ skeleton code 💀



User Programs

```
void shell() {
  p_spawn(cat, {"meow"}, ...);
  p_waitpid(pid, ...);
}

// shell built-in
void cat() {
  char buf[];
  p_read(buf);
  p_write(buf);
}
```

User Level Functions

```
void p_spawn() {
  k_process_create();
}

void p_read() {
  if (stdin) {
    read();
  } else {
    f_read();
  }
}
```

Kernel Level Functions

```
void k_process_create() {
  makecontext();
  // modify PCB
}

void f_read() {
  // read relevant file
  // from PennFAT
  // binary file
}
```

extern + header guards

- Global state across files
- #include is preprocessor that literally includes content into source code
- Header guards → prevent including code multiple times in same file

global_state.h

```c
#ifndef GLOBAL_STATE_H
#define GLOBAL_STATE_H

typedef struct GlobalState {
  int id;
} GlobalState;

extern GlobalState gs;

#endif // GLOBAL_STATE_H
```

main.c

```c
#include "global_state.h"
#include "helper.h"

GlobalState gs;

int main() {
  gs.id = 0;
  ...
}
```

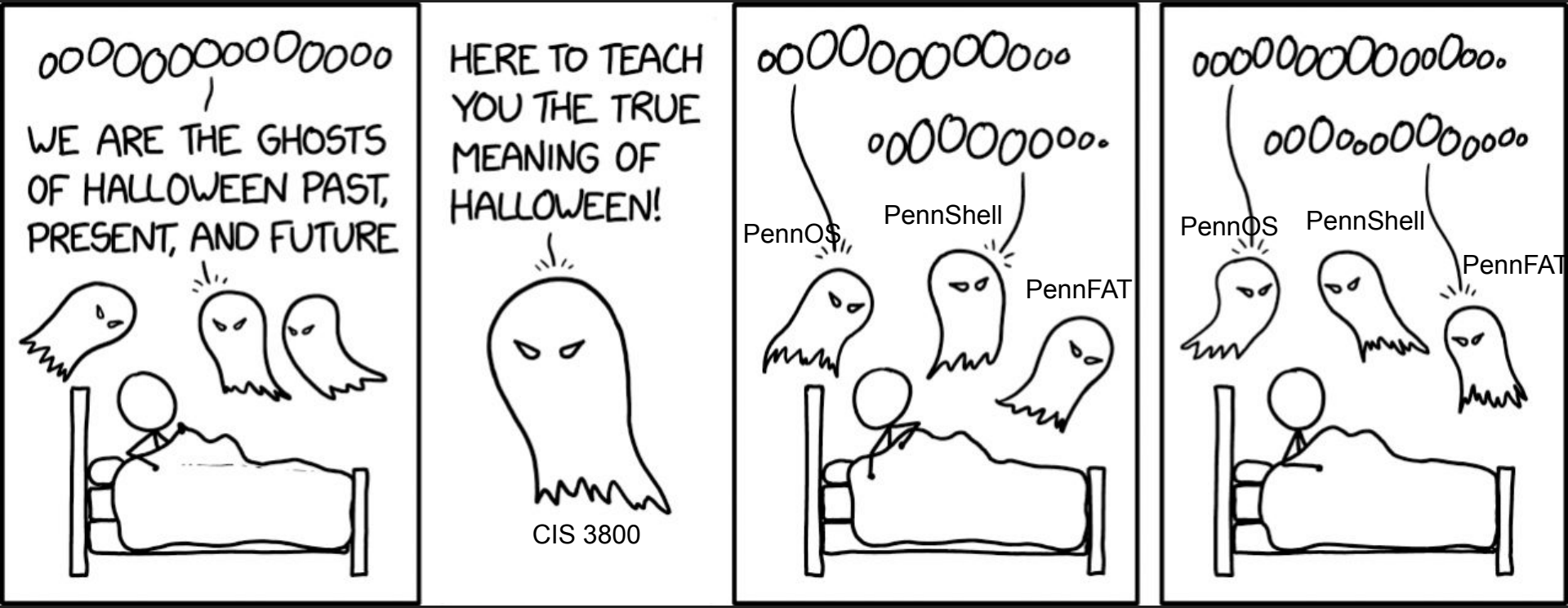
helper.c

```c
#include "global_state.h"

void helper_func() {
  gs.id++;
  printf("%d\n", gs.id);
}
```

<stdarg.h>

```c
#include <stdio.h>
#include <stdarg.h>

void foo(char *fmt, ...) {
  va_list ap;
  va_start(ap, fmt);
  while (*fmt) {
    switch (*fmt++) {
      case 's':   // string
        printf("%s ", va_arg(ap, char*));
        break;
      case 'd':   // int
        printf("%d ", va_arg(ap, int));
        break;
      case 'c':   // char
        // need a cast bc va_arg only takes fully promoted types
        printf("%c ", (char) va_arg(ap, int));
        break;
    }
  }
  va_end(ap);
}
```

```c
foo("dsc", 4871, "memory leaks", '!');
// Prints “4871 memory leaks !”
```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HERE TO TEACH YOU THE TRUE MEANING OF HALLOWEEN!
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