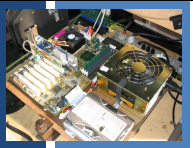
TCSS 422: OPERATING SYSTEMS



Condition Variables, Concurrency Problems

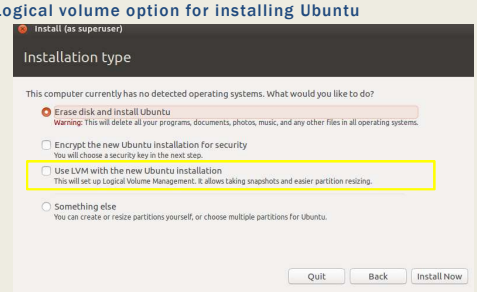
Wes J. Lloyd
Institute of Technology
University of Washington - Tacoma

OBJECTIVES

- Midterm Review
- Tutorial 1 Questions
- Homework 1 Questions
- Homework 2
- Ch. 30
  - Condition Variables
- Ch. 32
  - Concurrency Problems

UBUNTU INSTALLATION

- Logical volume option for installing Ubuntu



HELLO KERNEL MODULE

- Can be downloaded here:
- http://faculty.washington.edu/wlloyd/courses/tcss422/examples/assignments/a2/hello_module.tar.gz
- Package installation if not already installed:
- `apt-get install build-essential linux-headers-`uname -r``
- Trace system log file: /var/logs/syslog
- `tail –fn 100 /var/log/syslog`

CHAPTER 30 – CONDITION VARIABLES

CONDITION VARIABLES

- There are many cases where a thread wants to wait for another thread before proceeding with execution
- Consider when a precondition must be fulfilled before it is meaningful to proceed …

CONDITION VARIABLES - 2

- Support a signaling mechanism to alert threads when preconditions have been satisfied
- Eliminate busy waiting
- Alert one or more threads to "consume" a result, or respond to state changes in the application
- Threads are placed on an **explicit queue** (FIFO) to wait for signals
- **Signal**: wakes one thread
  broadcast wakes all (ordering by the OS)

CONDITION VARIABLES - 3

- Condition variable

```
pthread_cond_t c;
```

  - Requires initialization
- Condition API calls

```
pthread_cond_wait(pthread_cond_t *c, pthread_mutex_t *m);    // wait()
pthread_cond_signal(pthread_cond_t *c);                      // signal()
```

- wait() accepts a mutex parameter
  - Releases lock, puts thread to sleep
- signal()
  - Wakes up thread, awakening thread acquires lock

CONDITION VARIABLES - QUESTIONS

- **Why would we want to put waiting threads on a queue… why not use a stack?**
  - Queue (FIFO), Stack (LIFO)
  - Using condition variables eliminates busy waiting by putting threads to "sleep" and yielding the CPU.
- **Why do we want to not busily wait for the lock to become available?**
- A program has 10-threads, where 9 threads are waiting. The working thread finishes and broadcasts that the lock is available. **What happens next?**

MATRIX GENERATOR

Matrix generation example

Chapter 30
signal.c

QUESTIONS