

CISC 7310X
C04b: Thread Libraries

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Acknowledgement

- This slides are a revision of the slides by the authors of the textbook

Outline

- Thread Libraries
 - Pthread
 - Windows thread
 - Java thread and Java Executor Framework
- Implicit Threading
- Threading Issues
- Operating System Examples

Thread Libraries

- **Thread library** provides programmer with API for creating and managing threads
- Two primary ways of implementing
 - Library entirely in user space
 - Kernel-level library supported by the OS

Pthreads

- May be provided either as user-level or kernel-level
- A POSIX standard (IEEE 1003.1c) API for thread creation and synchronization
- ***Specification, not implementation***
- API specifies behavior of the thread library, implementation is up to development of the library
- Common in UNIX operating systems (Linux & Mac OS X)

Pthreads Example

Windows Threads

Windows Threads Example

Java Threads

Java Threads Example

Java Executor Framework

- Rather than explicitly creating threads, Java also allows thread creation around the Executor interface:

```
public interface Executor
{
    void execute(Runnable command);
}
```

The Executor is used as follows:

```
Executor service = new Executor;
service.execute(new Task());
```

Java Executor Framework: Example

Questions?

- Thread libraries
 - Pthreads
 - Windows threads
 - Java threads and Java Executor Framework