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FACULTY OF ENGINEERING & TECHNOLOGY

BCS-501 Operating System

Lecturer-10

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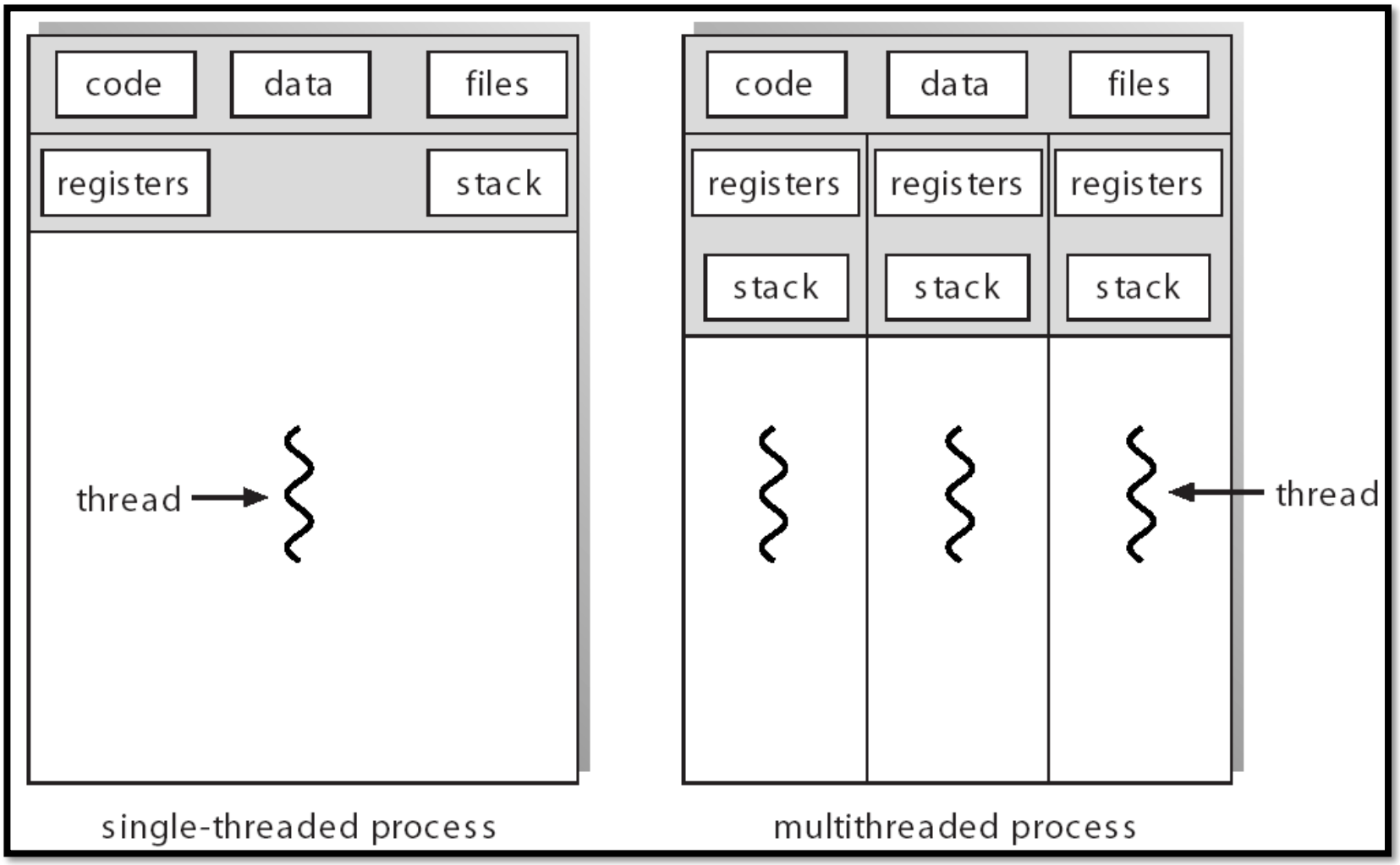
Threads

- Overview
- Multithreading Models
- Threading Issues
- Pthreads

Overview


code
data
files
registers
stack
thread
single-threaded process
code
data
files
registers
registers
registers
stack
stack
stack
thread
multithreaded process

User Threads

- Thread management done by user-level threads library
- Three primary thread libraries:
  - POSIX Pthreads
  - Java threads
  - Win32 threads

Kernel Threads

Supported by the Kernel

Examples

- Windows XP/2000
- Solaris
- Linux
- Tru64 UNIX
- Mac OS X

Multithreading Models

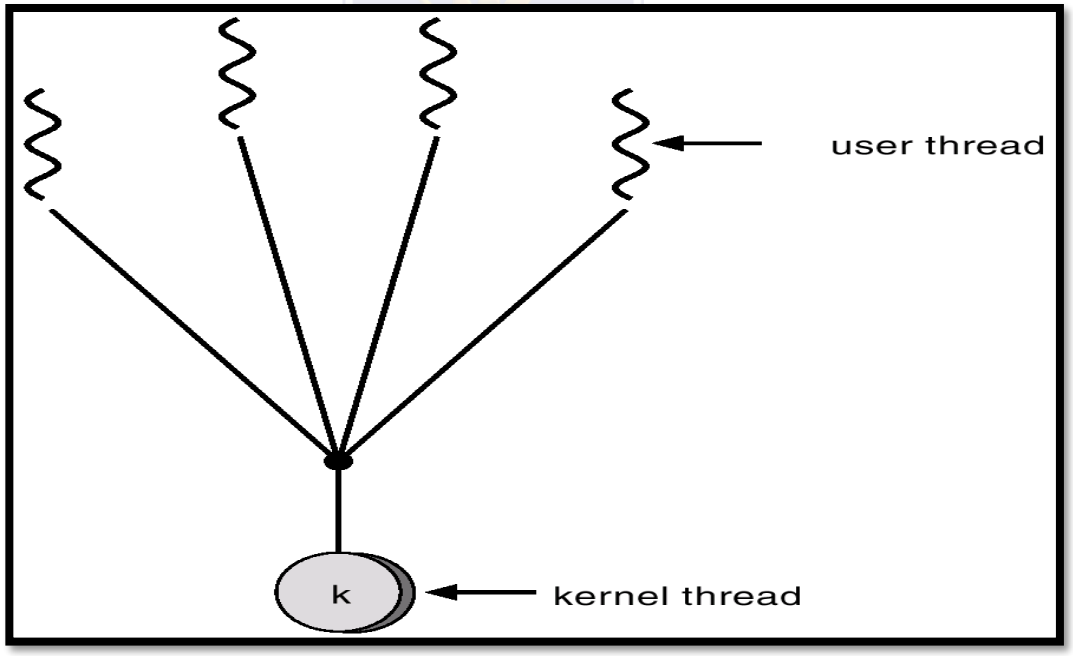
- Many-to-One
- One-to-One
- Many-to-Many

Many-to-One

Many user-level threads mapped to single kernel thread

Examples

- Solaris Green Threads
- GNU Portable Threads



Many-to-Many Model

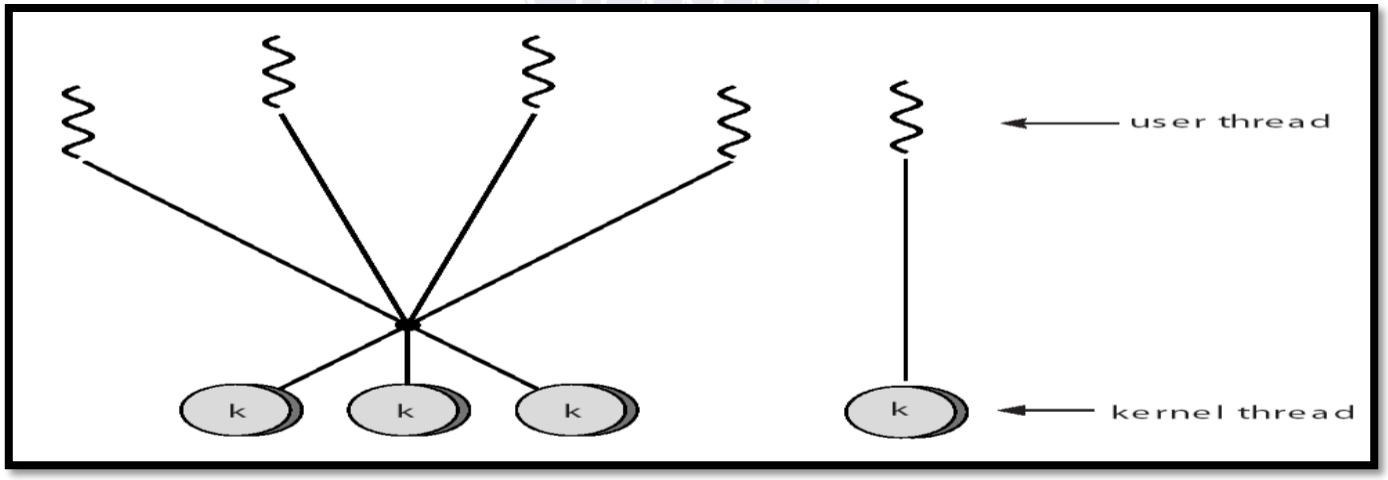
Allows many user level threads to be mapped to many kernel threads
Allows the operating system to create a sufficient number of kernel threads
Solaris prior to version 9
Windows NT/2000 with the *ThreadFiber* package

Two-level Model

Similar to M:M, except that it allows a user thread to be **bound** to kernel thread

Examples

- IRIX
- HP-UX
- Tru64 UNIX
- Solaris 8 and earlier



Threading Issues

Semantics of **fork()** and **exec()** system calls

- Thread cancellation
- Signal handling
- Thread pools
- Thread specific data
- Scheduler activations

Semantics of fork() and exec():---------
Does **fork()** duplicate only the calling thread or all threads?
Semantics of fork() and exec():----------
Does **fork()** duplicate only the calling thread or all threads?

Thread Cancellation

Terminating a thread before it has finished
Two general approaches:

Asynchronous cancellation terminates the target thread immediately
Deferred cancellation allows the target thread to periodically check if it should be cancelled

•Signal Handling:----------

- Signals are used in UNIX systems to notify a process that a particular event has occurred
- A **signal handler** is used to process signals
  1. Signal is generated by particular event
  2. Signal is delivered to a process
  3. Signal is handled

Options:

- Deliver the signal to the thread to which the signal applies
- Deliver the signal to every thread in the process
- Deliver the signal to certain threads in the process
- Assign a specific threa to receive all signals for the process

Scheduler Activations

•Both M:M and Two-level models require communication to maintain the appropriate number of kernel threads allocated to the application.

•Scheduler activations provide **upcalls** - a communication mechanism from the kernel to the thread library

•This communication allows an application to maintain the correct number kernel threads

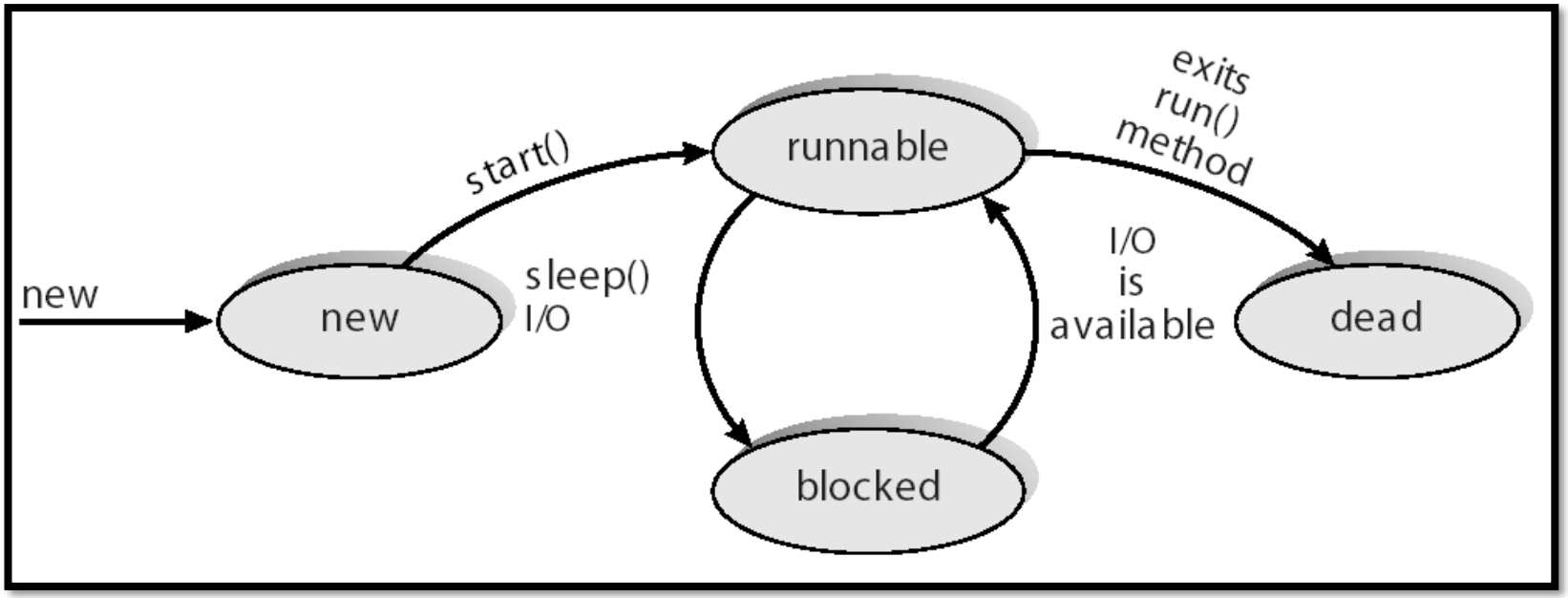
Pthreads

A POSIX standard (IEEE 1003.1c) API for thread creation and synchronization
API specifies behavior of the thread library, implementation is up to development of the library
Common in UNIX operating systems (Solaris, Linux, Mac OS X)

Extending the Thread Class:----------

```
class Worker1 extends Thread
{
   public void run() {

      System.out.println("I Am a Worker Thread");
   }
}

public class First
{
   public static void main(String args[]) {

      Worker1 runner = new Worker1();

      runner.start();


      System.out.println("I Am The Main Thread");
   }
}
```

Thread States



MCQ

Multithreading Models types……
A. Many-to-One
B. One-to-One
C. Many-to-Many
D. All of these

Which of the following is suitable for 'thread'?
A. Heavyweight process
B. Process
C. Lightweight process
D. A task

What are the components of a thread?
A. Thread Id, Program counter, Register set
B. Thread Id, Program counter, Register set, and Queue
C. Thread Id, Register set, Stack and Queue
D. Thread Id, Register set, Stack and Queue

A signal handler is used to process signals……..

A. Signal is generated by particular event
B. Signal is delivered to a process
C. Signal is handled
D. All of above

signal handler process to specify…..

A. Deliver the signal to the thread to which the signal applies
B. Deliver the signal to every thread in the process
C. Deliver the signal to certain threads in the process
D. Assign a specific threa to receive all signals for the process