



SNS COLLEGE OF TECHNOLOGY



Coimbatore-35.

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COURSE NAME : 19CSB201 – OPERATING SYSTEMS

II YEAR/ IV SEMESTER

UNIT – I OVERVIEW AND PROCESS MANAGEMENT

Topic: Threads : Multi-threading Models

Mrs. M. Lavanya

Assistant Professor

Department of Computer Science and Engineering



Threading Issues

- Semantics of **fork()** and **exec()** system calls
- Signal handling
 - Synchronous and asynchronous
- Thread cancellation of target thread
 - Asynchronous or deferred
- Thread-local storage
- Scheduler Activations



Semantics of `fork()` and `exec()`

- Does **`fork()`** duplicate only the calling thread or all threads?
 - Some UNIXes have two versions of `fork`
- **`exec()`** usually works as normal – replace the running process including all threads



Signal Handling

- n **Signals** are used in UNIX systems to notify a process that a particular event has occurred.
- n 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 by one of two signal handlers:
 1. default
 2. user-defined
- n Every signal has **default handler** that kernel runs when handling signal
 - | **User-defined signal handler** can override default
 - | For single-threaded, signal delivered to process



Signal Handling (Cont.)

- n Where should a signal be delivered for multi-threaded?
 - l Deliver the signal to the thread to which the signal applies
 - l Deliver the signal to every thread in the process
 - l Deliver the signal to certain threads in the process
 - l Assign a specific thread to receive all signals for the process



Thread Cancellation

- Terminating a thread before it has finished
- Thread to be canceled is **target thread**
- Two general approaches:
 - **Asynchronous cancellation** terminates the target thread immediately
 - **Deferred cancellation** allows the target thread to periodically check if it should be cancelled
- Pthread code to create and cancel a thread:

```
pthread_t tid;

/* create the thread */
pthread_create(&tid, 0, worker, NULL);

. . .

/* cancel the thread */
pthread_cancel(tid);
```



Thread Cancellation (Cont.)

- Invoking thread cancellation requests cancellation, but actual cancellation depends on thread state

Mode	State	Type
Off	Disabled	–
Deferred	Enabled	Deferred
Asynchronous	Enabled	Asynchronous

- If thread has cancellation disabled, cancellation remains pending until thread enables it
- Default type is deferred
 - Cancellation only occurs when thread reaches **cancellation point**
 - I.e. `pthread_testcancel()`
 - Then **cleanup handler** is invoked
- On Linux systems, thread cancellation is handled through signals



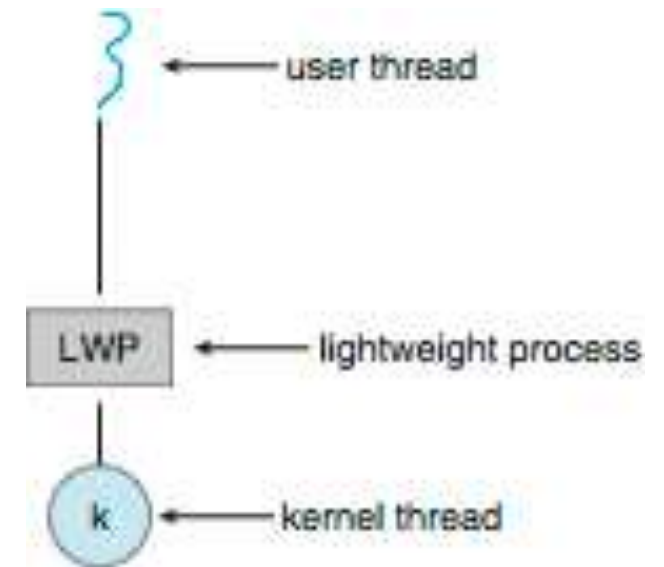
Thread-Local Storage

- **Thread-local storage (TLS)** allows each thread to have its own copy of data
- Useful when you do not have control over the thread creation process (i.e., when using a thread pool)
- Different from local variables
 - Local variables visible only during single function invocation
 - TLS visible across function invocations
- Similar to **static** data
 - TLS is unique to each thread



Scheduler Activations

- Both M:M and Two-level models require communication to maintain the appropriate number of kernel threads allocated to the application
- Typically use an intermediate data structure between user and kernel threads – **lightweight process (LWP)**
 - Appears to be a virtual processor on which process can schedule user thread to run
 - Each LWP attached to kernel thread
 - How many LWPs to create?
- Scheduler activations provide **upcalls** - a communication mechanism from the kernel to the **upcall handler** in the thread library
- This communication allows an application to maintain the correct number kernel threads





REFERENCES

TEXT BOOKS:

- T1 Silberschatz, Galvin, and Gagne, “Operating System Concepts”, Ninth Edition, Wiley India Pvt Ltd, 2009.)
- T2. Andrew S. Tanenbaum, “Modern Operating Systems”, Fourth Edition, Pearson Education, 2010

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- R1 Gary Nutt, “Operating Systems”, Third Edition, Pearson Education, 2004.
- R2 Harvey M. Deitel, “Operating Systems”, Third Edition, Pearson Education, 2004.
- R3 Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 9th Edition, John Wiley and Sons Inc., 2012.
- R4. William Stallings, “Operating Systems – Internals and Design Principles”, 7th Edition, Prentice Hall, 2011

