OPERATING SYSTEM

Synchronization Examples

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Outline

- Solaris Synchronization

- Windows Synchronization

- Linux Synchronization

- Pthread Synchronization

- Implements a variety of locks to support multitasking, multithreading (including real-time threads), and multiprocessing

- Uses **adaptive mutexes** for efficiency when protecting data from short code segments
  - Starts as a standard semaphore spin-lock
  - If lock held, and by a thread running on another CPU, spins
  - If lock held by non-run-state thread, block and sleep waiting for signal of lock being released

- Uses **condition variables**

- Uses **readers-writers** locks when longer sections of code need access to data

- Uses **turnstiles** to order the list of threads waiting to acquire either an adaptive mutex or reader-writer lock
  - Turnstiles are per-lock-holding-thread, not per-object

- Priority-inheritance per-turnstile gives the running thread the highest of the priorities of the threads in its turnstile

- Uses interrupt masks to protect access to global resources on uniprocessor systems

- Uses **spinlocks** on multiprocessor systems
  - Spinlocking-thread will never be preempted

- Also provides **dispatcher objects** user-land which may act mutexes, semaphores, events, and timers
  - **Events**
    - An event acts much like a condition variable
  - Timers notify one or more thread when time expired
  - Dispatcher objects either **signaled-state** (object available) or **non-signaled state** (thread will block)

- Linux:
  - Prior to kernel Version 2.6, disables interrupts to implement short critical sections
  - Version 2.6 and later, fully preemptive

- Linux provides:
  - Semaphores
  - atomic integers
  - spinlocks
  - reader-writer versions of both

- On single-cpu system, spinlocks replaced by enabling and disabling kernel preemption

- Pthreads API is OS-independent

- It provides:
  - mutex locks
  - condition variable

- Non-portable extensions include:
  - read-write locks
  - spinlocks

THANK YOU

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