

Operating Systems

Process versus thread

Process	Thread
independent executing program	lightweight execution unit within a process
separate address space	shares process memory/resources
context switch usually heavier	context switch usually lighter
communication needs IPC	threads communicate through shared memory

CPU scheduling

Algorithm	Idea	Main issue
FCFS	first come, first served	convoy effect
SJF	shortest burst first	requires burst estimate; long jobs may starve
SRTF	preemptive SJF	more context switches
Round Robin	fixed time quantum	very small quantum means overhead; huge quantum resembles FCFS
Priority	highest priority first	starvation; aging reduces it

- Turnaround time = completion time – arrival time.
- Waiting time = turnaround time – CPU burst time.
- Response time = first CPU start time – arrival time.

Synchronisation

A critical section accesses shared data. Problems include race conditions and lost updates.

- Mutex: mutual exclusion lock, normally one owner.
- Semaphore: integer synchronisation primitive; binary semaphore can act like a lock, counting semaphore tracks several resources.
- Deadlock: processes wait forever for resources.

Four necessary deadlock conditions:

1. mutual exclusion;
2. hold and wait;

3. no preemption;
4. circular wait.

Breaking one condition can prevent deadlock.

Memory management

Term	Meaning
Paging	fixed-size pages and frames
Segmentation	variable-size logical sections such as code/data/stack
Virtual memory	uses disk to extend apparent memory
Page fault	requested page is not currently in main memory
TLB	cache for recent page-table translations
Internal fragmentation	unused space within allocated block
External fragmentation	free space split into small scattered blocks

Demand paging loads a page when needed. A page fault is normal in demand paging; it is not "a corrupted page."

File systems and I/O

- File descriptor: integer handle used by a process to access a file/stream.
- Buffering reduces expensive I/O operations.
- Spooling queues jobs for a device, such as a printer.
- DMA lets an I/O device transfer data to memory with minimal CPU involvement.

Operating-system quick comparisons

- Kernel mode can execute privileged instructions; user mode cannot.
- An interrupt is usually hardware/external event; a system call is a controlled request from user program to OS.
- A context switch saves one execution state and loads another.

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