CSE3241: Operating System and System Programming

Class-16

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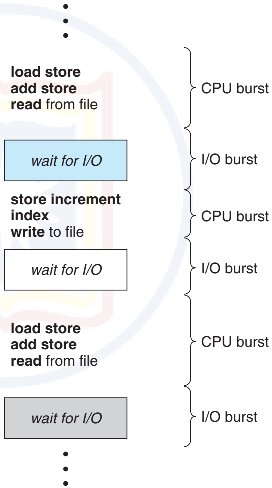
CPU Burst Vs. I/O Burst [1]

- **CPU burst** is the state when a process is being executed in the CPU.

- **I/O burst** is the state when a process is waiting for I/O for further execution.

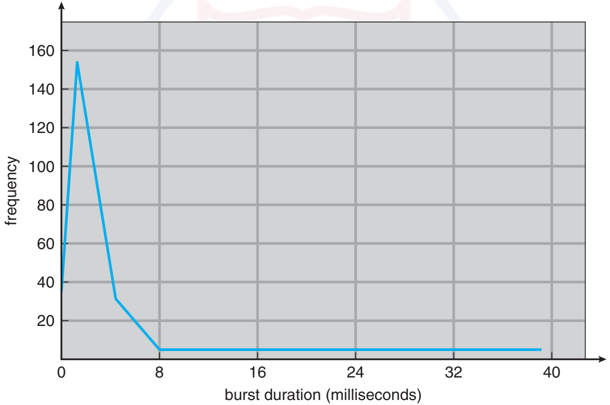
Sequences of CPU and I/O bursts



Histogram of CPU-burst durations [1]

- The durations of **CPU bursts** vary greatly from process to process and from computer to computer.

- They tend to have a frequency curve similar to the following figure.

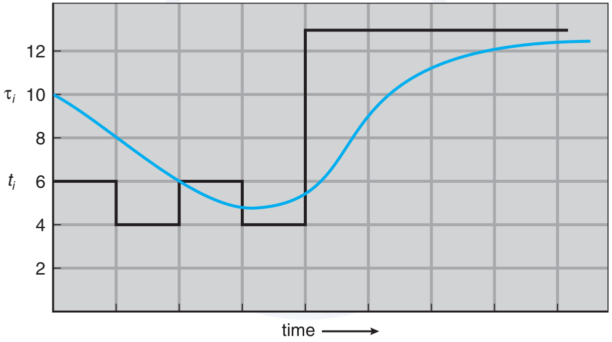


Prediction of the next CPU Burst [1]

■ The next **CPU burst** can be predicted as an exponential average of the lengths of previous CPU bursts.

$$\tau_{n+1} = \alpha t_n + (1 - \alpha)\tau_n$$

where τ_n: past history, t_n: most recent information



CPU burst (t_i)		6	4	6	4	13	13	13	…
"guess" (τ_i)	10	8	6	6	5	9	11	12	…

Exponential Average

- The exponential average can be used to predict the next CPU burst:

$$\tau_{n+1} = \alpha t_n + (1-\alpha)\alpha t_{n-1} + \ \dots\ + (1-\alpha)^j \alpha t_{n-j} + \ \dots\ + (1-\alpha)^{n+1}\tau_0$$

where

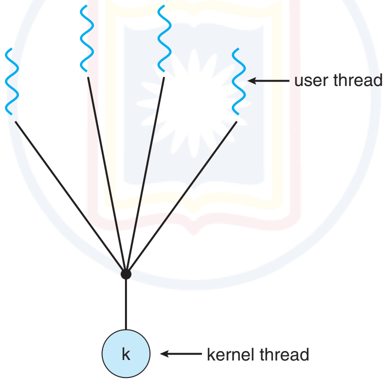
τ_0: past history,
t_n: most recent information
$0 \leq \alpha \leq 1$

Multithreading Models

- There is a relationship between user-level threads and kernel threads.
- Three common ways to establish relation between user threads and kernel threads:
  1. Many-to-One Model
  2. One-to-One Model
  3. Many-to-Many Model

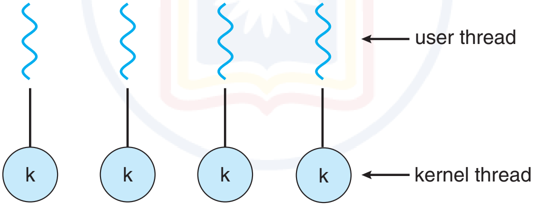
Many-to-One Model [1]

- Many user-level threads are mapped to one kernel thread.
- Only one thread can access the kernel at a time.
- The entire process will block if a thread makes a blocking system call.



One-to-One Model [1]

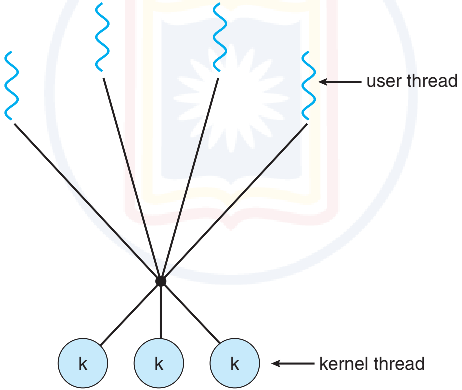
- Each user thread is mapped to a kernel thread.
- Another thread is allowed to run when a thread makes a blocking system call.
- Creating a user thread requires creating the corresponding kernel thread.



Many-to-Many Model [1]

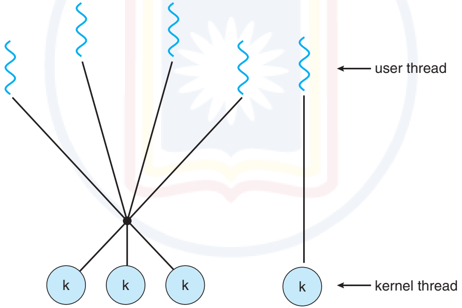
- Many user-level threads are mapped to a smaller or equal number of kernel threads.

- When a thread performs a blocking system call, the kernel can schedule another thread of execution.



Two-level Model [1]

- Many user-level threads are mapped to a smaller or equal number of kernel threads.
- A user-level is **also** allowed to be bound to a kernel thread.



References

P. B. Galvin A. Silbeschatz and G. Gagne.
Operating System Concepts.
John Wiley & Sons, 9 edition, 2012.