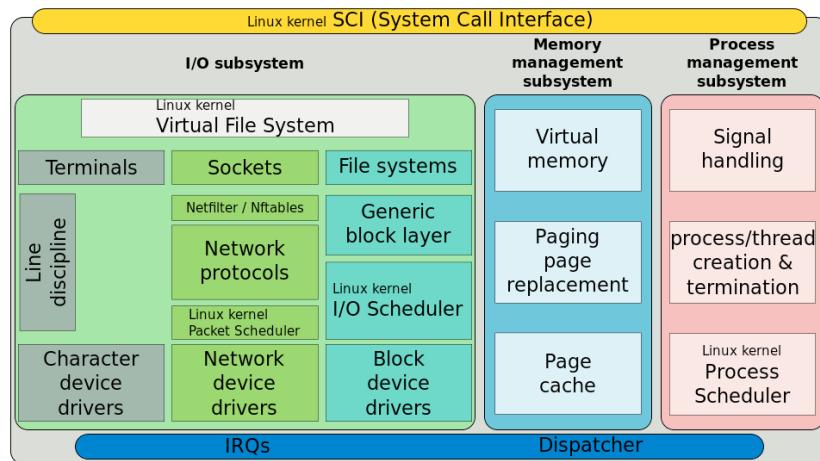


Operating systems

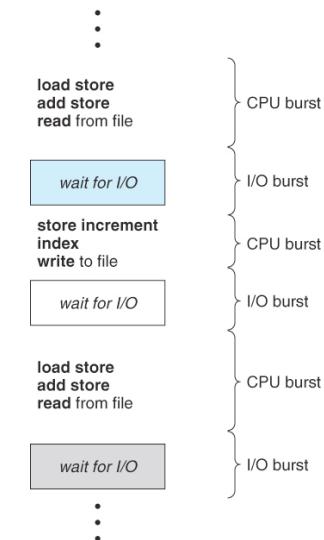
Scheduling

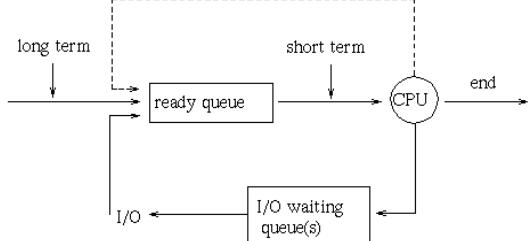
How many different types of events can cause a running program to pass control over to the OS?

- A. 1
- B. 2
- C. 3
- D. 4
- E. 5



Lifecycle
of a process





long-term vs short-term scheduler



3 simple algorithms

- FIFO/FCFS
- shortest job first
- round-robin

Steam View Friends Games Help

← → STORE LIBRARY COMMUNITY NEW GORDON FROHMAN

\$35.04 | stevethepocket's Account

CURRENT NETWORK USAGE
165.1 KB/S DOWNLOAD RATE
223.5 KB/S PEAK DOWNLOAD RATE
54.7 MB TOTAL DOWNLOADED

PAUSE ALL

Team Fortress 2
PLAY UPDATED 12.2 MB / 38.4 MB TIME INITIATED 11:40 PM TIME REMAINING Suspended

85.5 KB/S - CURRENT RATE

VIEW DETAILS VIEW NEWS

Left 4 Dead 2 (Beta)
PLAY UPDATED 23.1 MB / 7.6 GB TIME INITIATED 11:51 PM TIME REMAINING 1 hour 1 minute Downloading

165.1 KB/S - CURRENT RATE

VIEW DETAILS VIEW NEWS

Half-Life 2: Deathmatch
PLAY UPDATED 19.3 MB / 19.3 MB TIME INITIATED 11:37 PM Ready to Play

VIEW DETAILS VIEW NEWS

+ ADD A GAME... 1 ITEM DOWNLOADING 1 ITEM PAUSED

VIEW FRIENDS LIST 18 Online

BitTorent 7.6.1

File Options Help

Featured Content

Name	Size	Status	Health	Down Speed	Up Speed
1652-352-Wii-U_48_main.mtd	261 MB	Downloaded	51.3%	1.5 MB/s	0.0
Team Fortress 2	1.0 GB	Suspended	0.0%	0.0	0.0
Left 4 Dead 2 (Beta)	1.0 GB	Downloading	0.0%	0.0	0.0
Half-Life 2: Deathmatch	1.0 GB	Ready to Play	0.0%	0.0	0.0

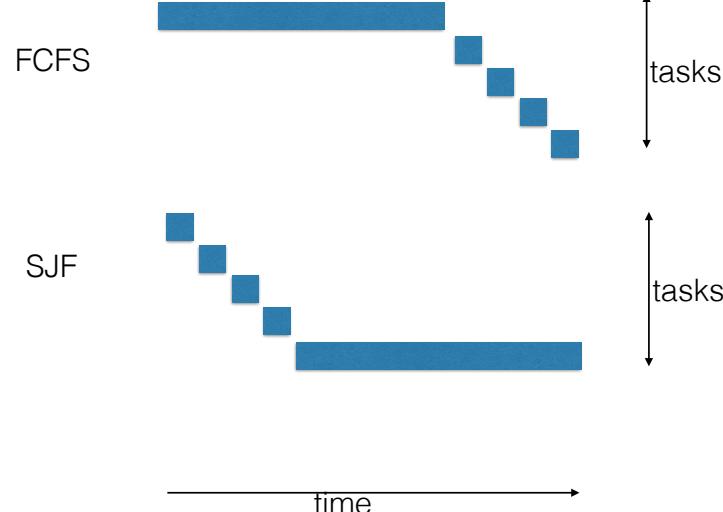
Freq Feeds Devices New App

Upgrades

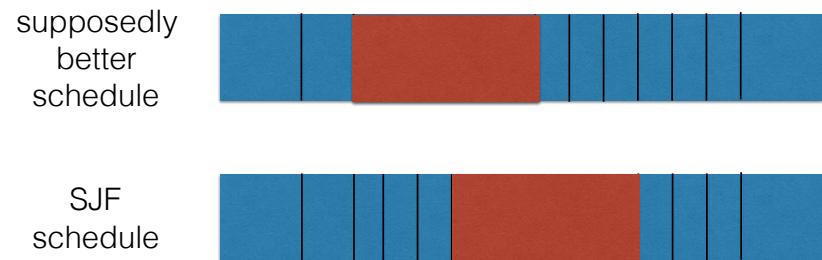
BitTorentPlus

Which scheduling algorithm do you use when downloading games or a bunch of large files?

- FCFS
- SJF/SRT
- RR
- I don't mess with it
- something else

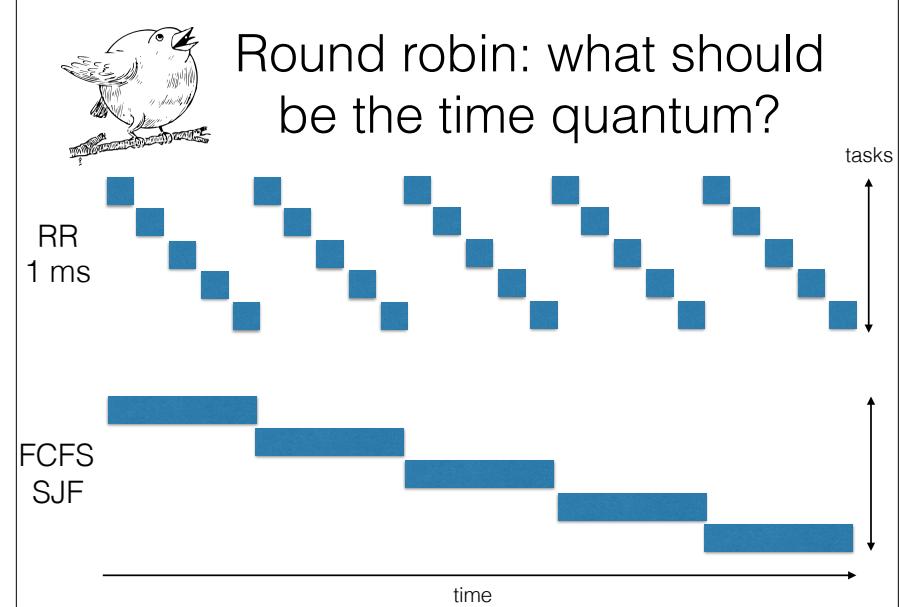


SJF minimizes average waiting time



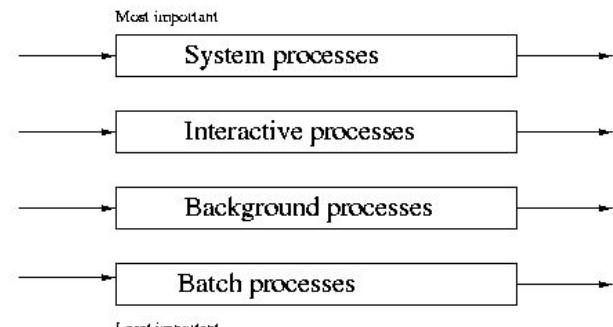
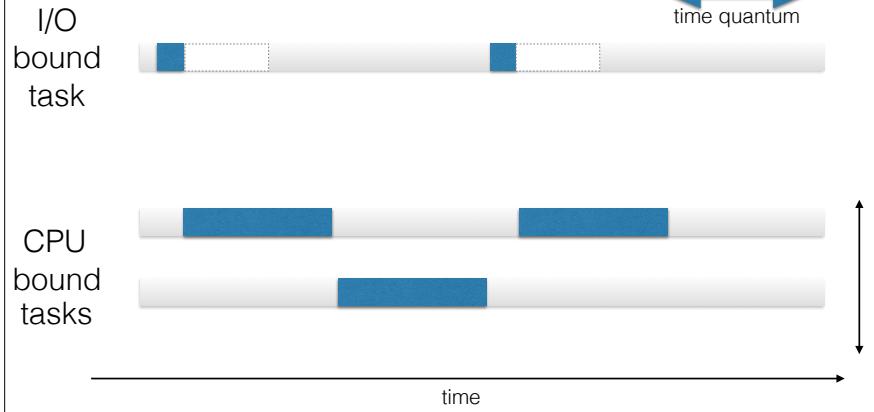
Rumor has it that when they shut down the IBM 7094 at MIT in 1973, they found a low-priority process that had been submitted in 1967 and had not yet been run.

Operating System Concepts, Silberschatz, Galvin, Gagne

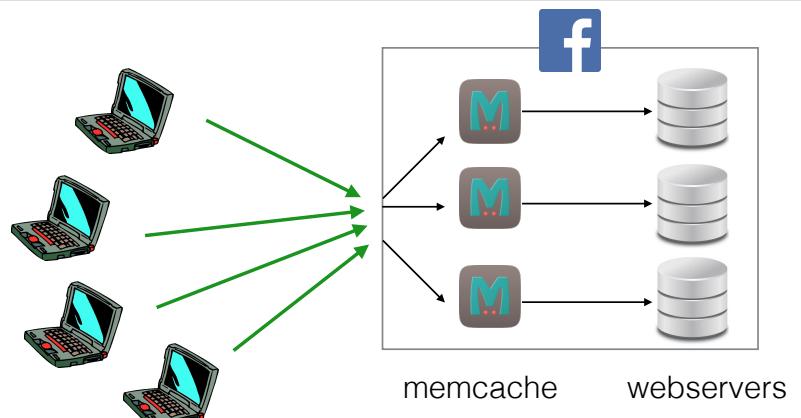




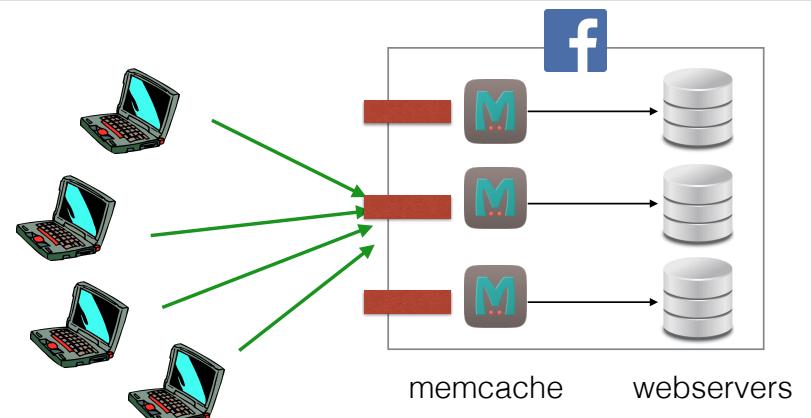
Round robin: not always the right choice



Multi-level queue



- speed up web queries
- checks if content is there (hash table lookup)
- returns content if there



which scheduling algorithm should memcache use?

- A. FCFS
- B. SJF
- C. RR

FCFS



- low overhead
- requests each take about the same amount of time to serve
- maximizes throughput

suffers from the convoy effect

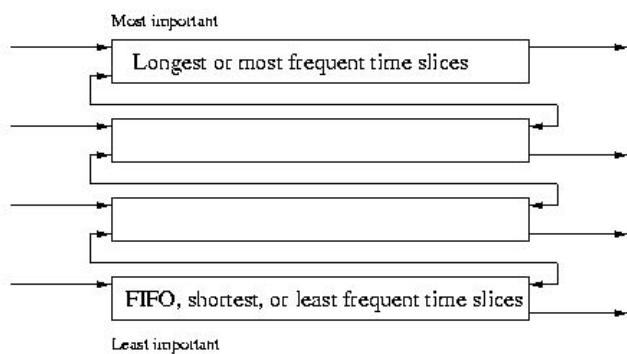


which algorithm should a bandwidth manager for a streaming server use?



- A. FCFS
- B. SJF
- C. RR

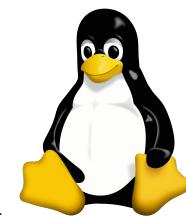
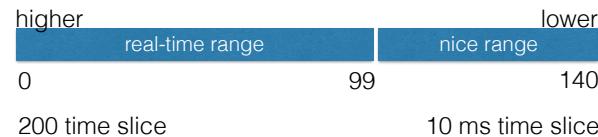
- response time much less important
- predictable, stable rate of progress more important



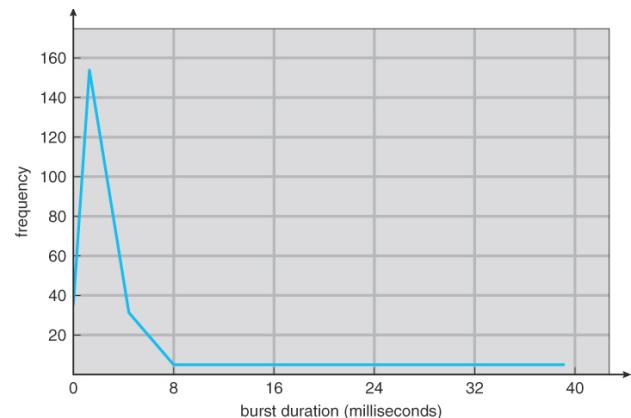
Multi-level feedback queue

Linux v2.5+

priority-based scheduler



run queue

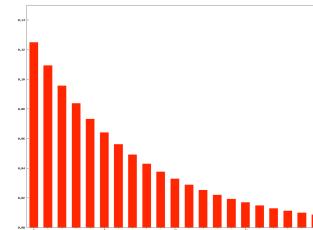


Histogram of CPU-burst durations

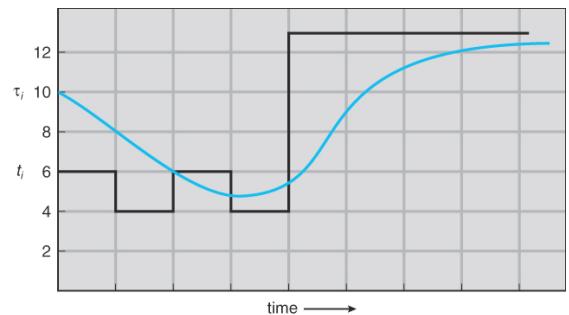
exponential average of CPU bursts

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

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



exponential average of CPU bursts



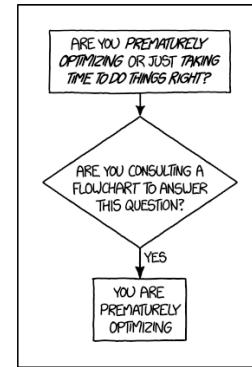
CPU burst (t_i)	6	4	6	4	13	13	13	...	
"guess" (τ_i)	10	8	6	6	5	9	11	12	...

Scheduling criteria

- waiting time
- response time (or delay)
- throughput
- predictability
- scheduling overhead
- starvation

How to evaluate a scheduling algorithm?

1. deterministic modeling
2. queueing models
3. simulations
4. implementation



<https://xkcd.com/1691/>