Operating System

Sunbeam Infotech

Multiprogramming

- Single user cannot keep CPU and I/O devices busy at all times
- Multiprogramming organizes jobs (code and data) so CPU always has one to execute
- A subset of total jobs in system is kept in memory
- One job selected and run via job scheduling
- When any job has to wait (for I/O for example), OS switches to another job
- Multiprogramming needed to use the system in efficient way.

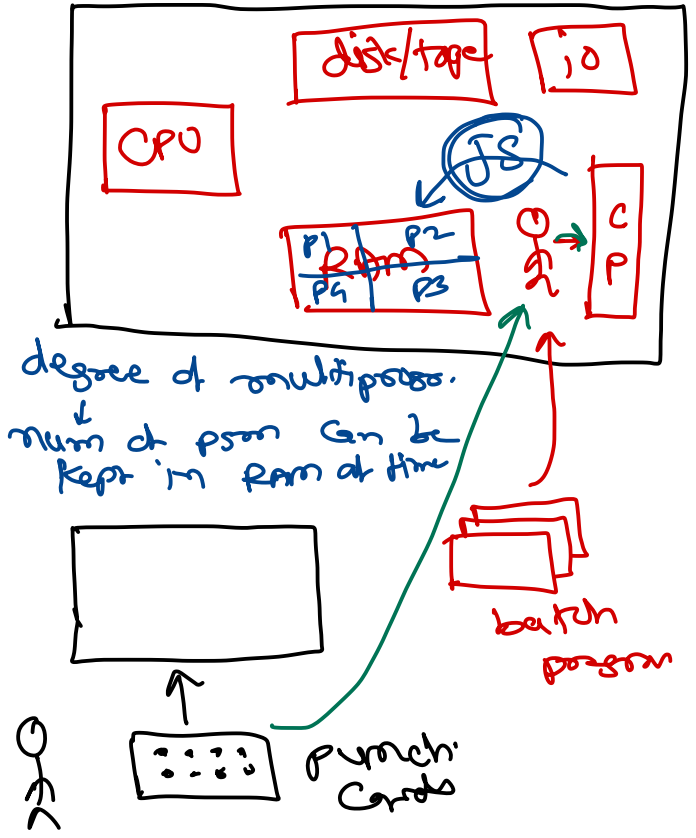
Multitasking

- Multitasking (Time sharing) is logical extension in which CPU switches jobs so frequently that users can interact with each job while it is running
- Response time should be < 1 second
- If several jobs ready to run at the same time CPU scheduling is necessary to schedule them all.
- Multitasking can be achieved in one of the ways:
  - multi-processing
  - multi-threading
- Virtual memory allows execution of processes not completely in memory. If processes don't fit in memory, they are swapped in and out to run.

Types of operating systems

- Few operating systems are designed to be efficient while other are designed to be convenient.
- Depending on design goals and hardware constraints different types of operating systems exists.
  - Mainframe Systems
  - Desktop Systems
  - Multiprocessor Systems
  - Distributed Systems
  - Real -Time Systems
  - Handheld Systems

Mainframe Computer → PDP-7 & PDP-11 → IBM



① Resident Monitor

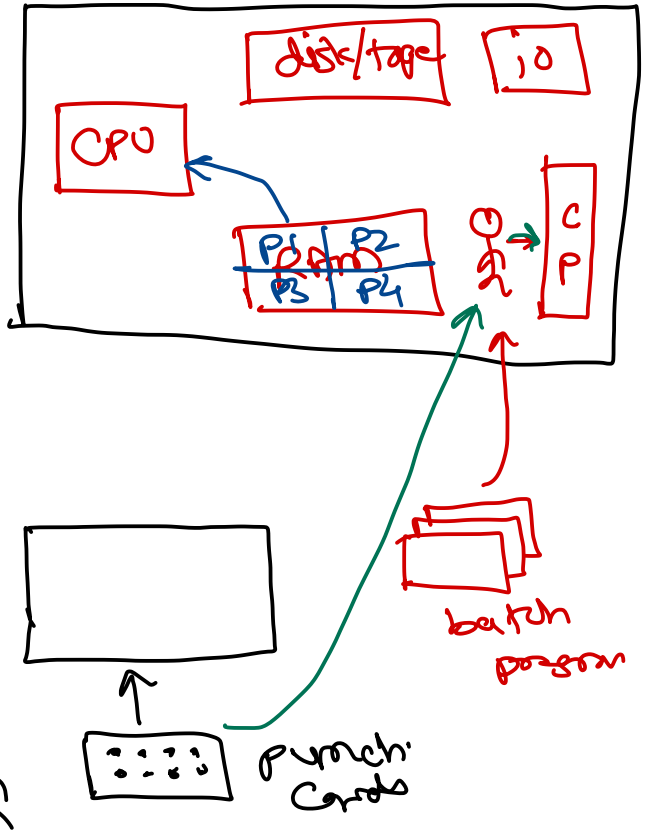
② Batch System

③ multiprogramming
- ↳ loading multiple pgms in RAM
- ↳ better cpu utilization
- ↳ job scheduler
  - ↳ loads a mix of cpu bound and io bound programs.

time = cpu burst + io burst

→ gf a&b"
→ C=a+b
→ pf C =

Mainframe Computer → PDP-7 & PDP-11 → IBM



① Resident Monitor

② Batch System

③ multi programming

④ Multi-Tasking

↳ time sharing.

time = cpu burst + io burst

→ If a&b

→ c = a+b

→ pf c

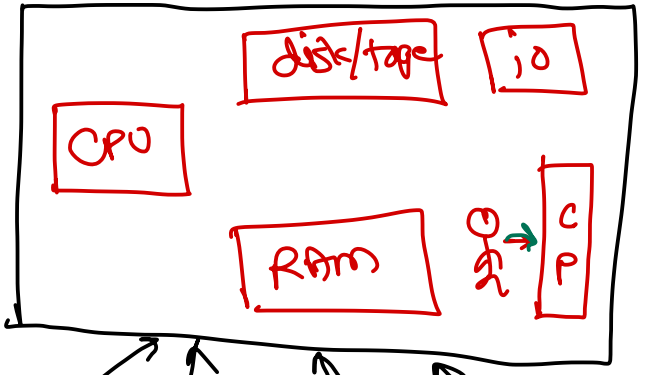
sharing cpu time among multiple tasks present in main memory & ready for execution.

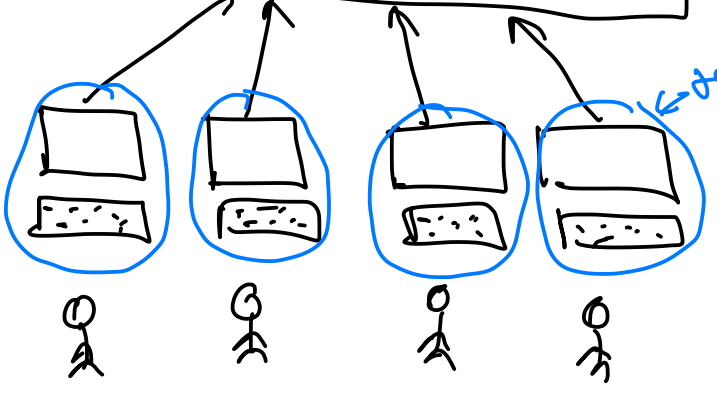
→ process based multitasking. ✓

→ thread based multi tasking ✓

↳ running multiple tasks concurrently in a prog

Mainframe Computer → PDP-7 & PDP-11 → IBM





① Resident Monitor

② Batch System

③ Multi programming

④ Multi-tasking

⑤ Multi-User

time
= CPU burst
+ IO burst

→ if a&b
→ c=a+b
→ pf c

In modern system → terminal ← input → output

↓

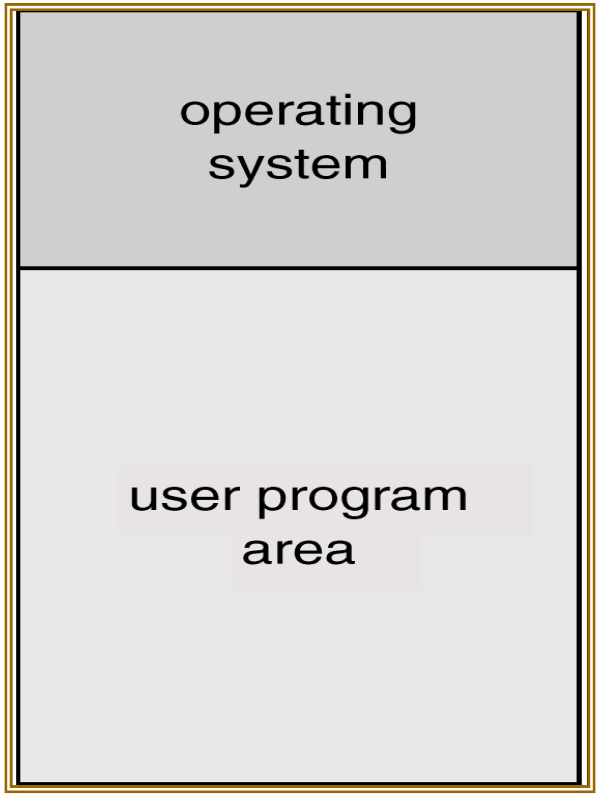
tty

Mainframe Systems

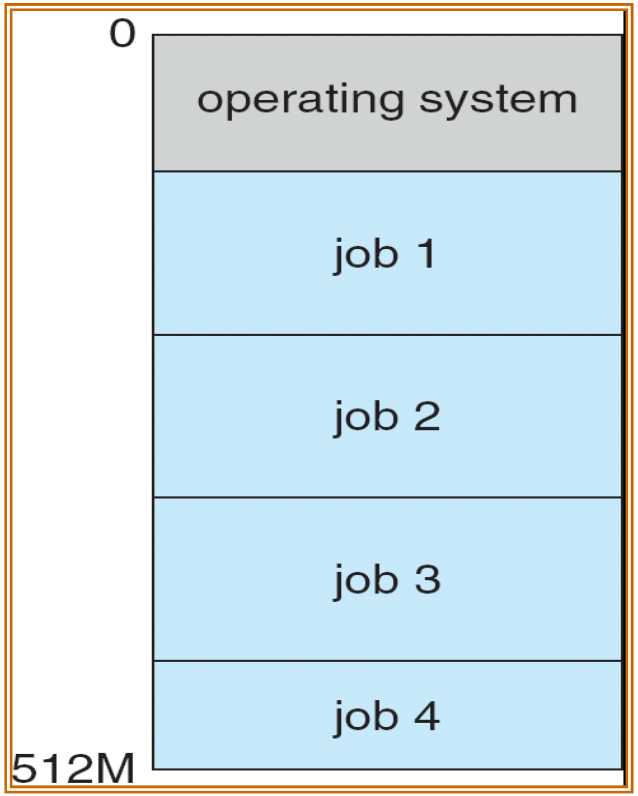
- Batch systems
  - Reduce setup time by batching similar jobs
  - Transfers control from one job to another.
- Resident monitor
  - initial control in monitor
  - control transfers to job
  - when job completes control transfers back to monitor
- Multiprogrammed systems
  - Multiple jobs in memory at a time
- Time sharing systems
  - Executes multiple jobs using time sharing concept

Mainframe Systems

e.g. UNIX, IBM360, ...



- Simple Batch System

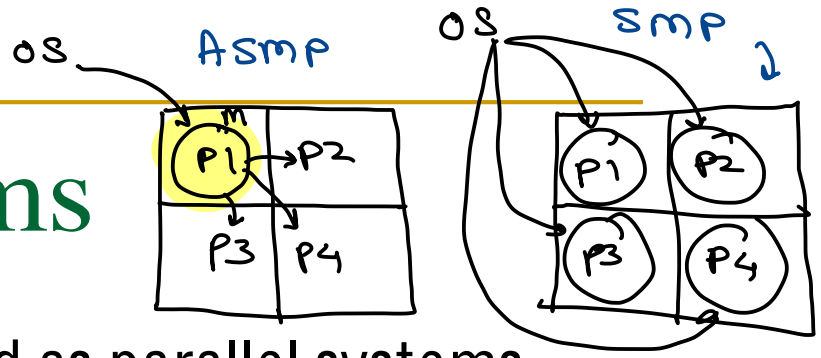


- Multiprogramming System

Desktop Systems

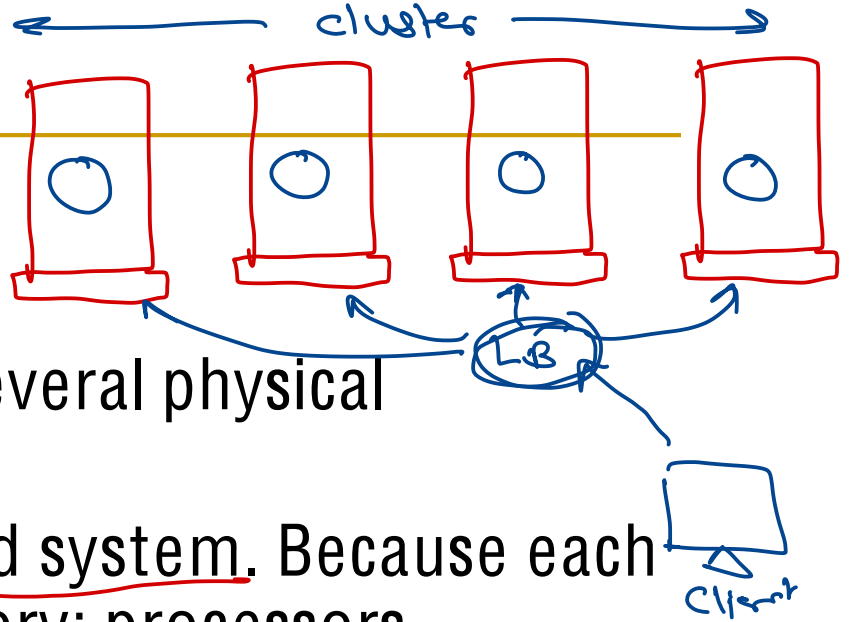
- Personal computers – computer system dedicated to a single user.
- I/O devices – keyboards, mice, display screens, small printers.
- User convenience and responsiveness.
- May run several different types of operating systems (Windows, MacOS, UNIX, Linux)

Multiprocessor Systems



- Multiprocessor systems are also called as parallel systems.
- Multiprocessor systems with more than one CPU in close communication.
- Advantages of parallel system: → increased computation ability
  - Increased throughput, Economical and Increased reliability
- Symmetric multiprocessing (SMP)
  - Each processor runs and identical copy of the operating system.
  - Most modern operating systems support SMP
- Asymmetric multiprocessing
  - Each processor is assigned a specific task; master processor schedules and allocated work to slave processors.
  - More common in extremely large systems

Distributed Systems

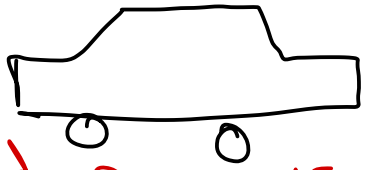


- Distribute computation among several physical processors.
- It is also called as Loosely coupled system. Because each processor has its own local memory; processors communicate with one another through various communications lines, such as high-speed buses or telephone lines.
- Advantages of distributed systems.
  - Resources Sharing, Load balancing, Reliability
- Requires networking infrastructure.
- Local area networks (LAN) or Wide area networks (WAN)
- May be either client-server or peer-to-peer systems.

1. scalability
2. availability
3. fault tolerance

accuracy = correctness + time

Real -Time Systems



minimal interrupt latency, priority based execution.

- Often used as a control device in a dedicated application such as controlling scientific experiments, medical imaging systems, industrial control systems, and some display systems.
- Well-defined fixed-time constraints.
  - missing deadline - catastrophic
- These systems may be either hard or soft real-time.
  - media player.
- Hard real-time
  - Secondary storage limited or absent, data stored in short term memory, or read-only memory (ROM)
- Soft real-time → consumer electronics
  - More flexible and hence widely used.

RTOS, pSOS, Symbian, FreeRTOS, uC/OS, VRTX, Vxworks, MiTron, WinCE,

Handheld Systems

- These systems are used for mobile hardware.
  - Personal Digital Assistants (PDAs)
  - Cellular phones
  - Portable multimedia systems
- Issues:
  - Limited memory
  - Slow processors
  - Small display screens

- Linux
- Android
- iOS
- Symbian
- window phone

Thank you!

Source: Galvin OS books/slides

Edited by: Nilesh Ghule