# CSC369 Week 1 Notes

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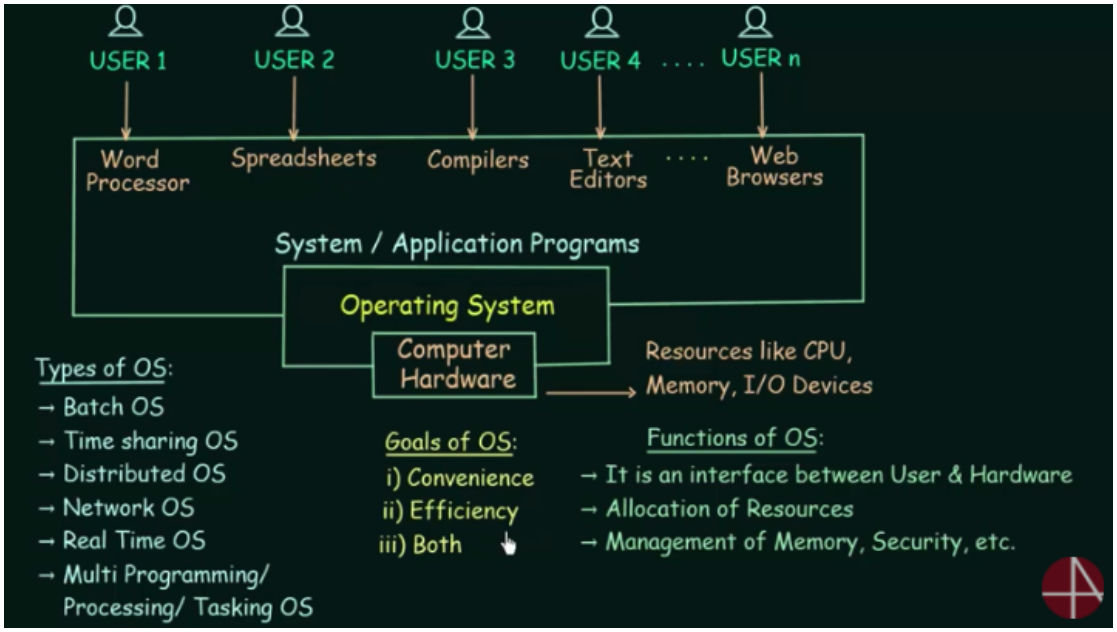
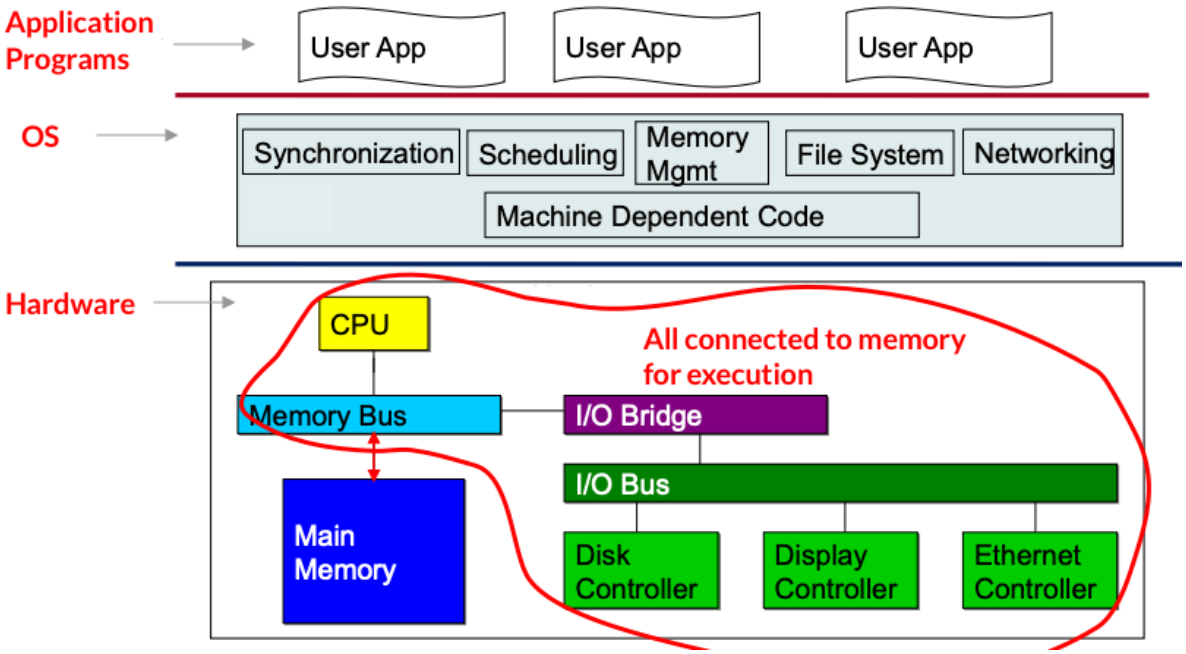
May 18, 2020

## 1 Intro to OS

- What is Operating System
  - is the program that manages the computer hardware
  - is the software layer between user applications and hardware
  - is used for
    - Allication of resources
    - Management of memory, security, etc.

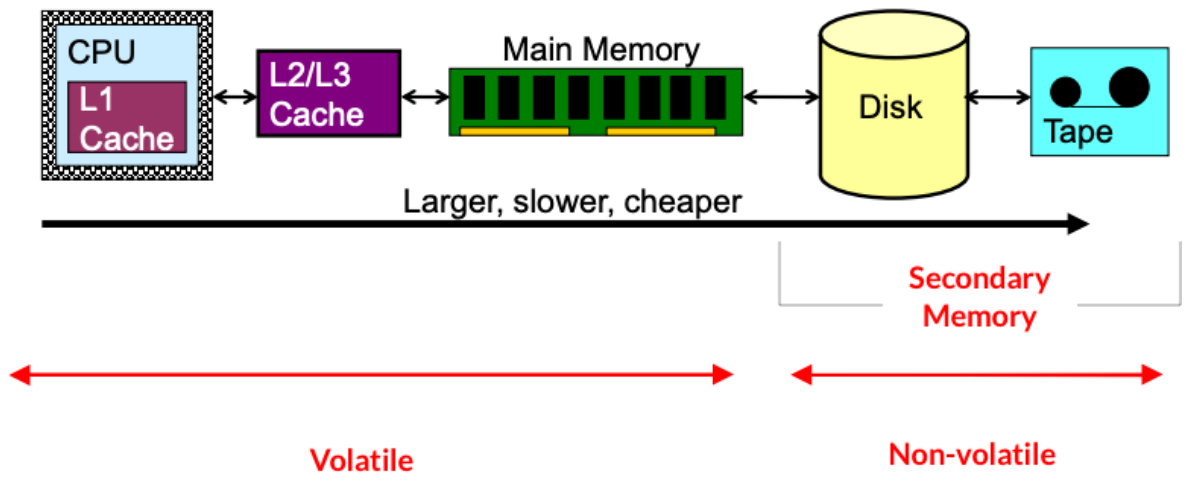



- Overview of Computer System




  - All hardware devices are connected through common **bus** and are loaded to memory for execution.
  - **Synchronization:** to ensure orderly acces to the shared memory

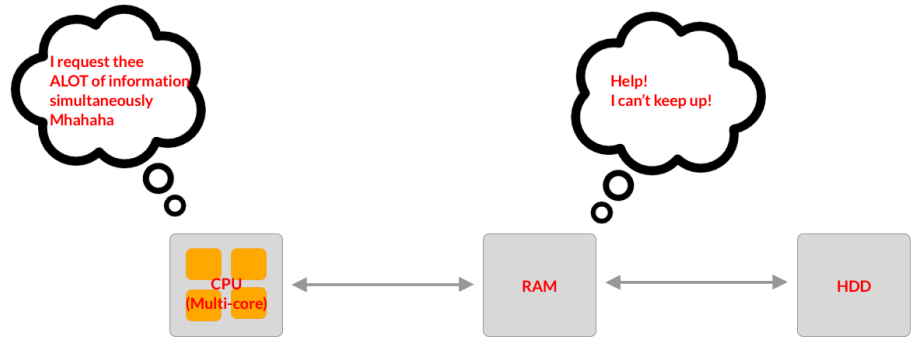
- Storge Hierarchy / Storage Structure

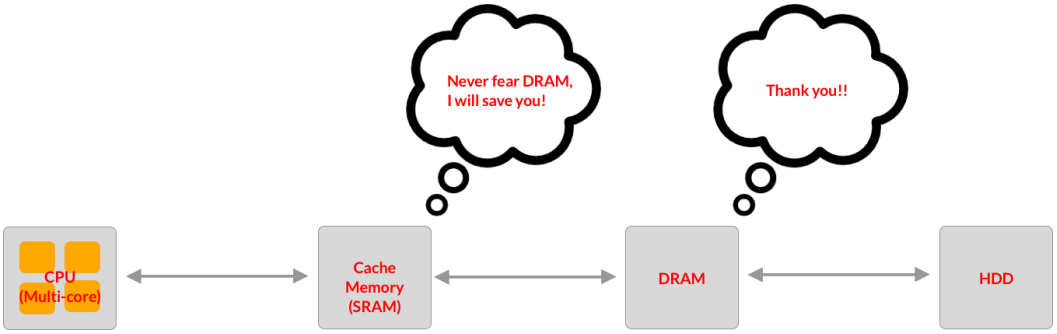



  - **Volatile** → Loses contents when power is removed
  - **Non-volatile** → Retains contents even when power is removed

- Caching / Cache Memory

  - Is also called **Static Random Access Memory (SRAM)**
  - Is more costly
  - Hides performance differences when large access-time gap exsists between two levels
    * Quad-quare requesting RAM for information




  - More can be found here

- Concurrency
  - Is execution of several instruction sequences at same time
    * i.e, CPU and device controllers
  - **Interrupt:** are signals sent to the CPU by external devices, (usually I/O devices)
    * It's like telling 'Hey CPU, please stop this process, and do $y$ instead, since this is more important'
    * i.e. Network Packet has arrived, Disk I/O comeplete occured
  - **System Call:** are interrupt signals sent by software
    * Is a programmatic way of a program requesting for service to kernel of operating system
    * i.e. Accessing a hard-disk drive
  - IMPORTANT: An operating system is an event-driven program.

# 2 Process Threads

- Part 1: The Process Concept
  - **Process:** is a program in execution
  - **Threads:** is the unit of execution within a process.

$$\text{Thread} = \frac{\text{Job}}{\text{Unit of Work}} \tag{1}$$

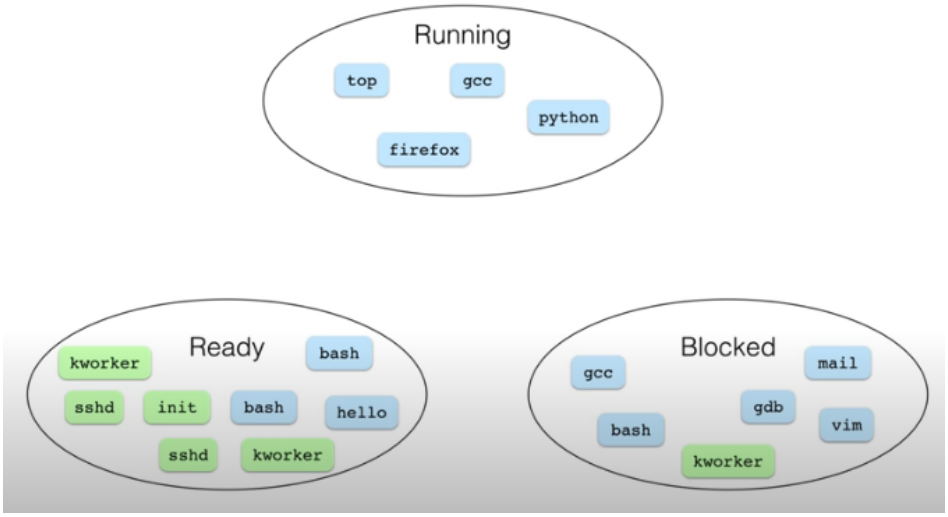
    - A process can have anywhere from one thread to many threads

- Process Data Structure (PCB)
  - Is called Process Control Block
  - Is OS data structur representing each process
  - Generally includes
    1. Process State
       - (Ready, running, blocked)
    2. Program Counter
       - Is an address that indicates the line of code that has to be executed next
       - i.e. the next line of code i need to execute is line 2 :)

```
print("Hello World");
print("Hi World!") //<- Line 2
```

    3. CPU Register ***Need to come back*
    4. CPU Scheduling Information
       - Priority of process
       - Higher the priority → executed first
    5. Memory Management ***Need to come back*
    6. I/O Status Information
       - Is list of input output devices assigned to this process
       - Is used during execution
       - i.e. Sound, Mouse, Keyboard

- Process States & State Changes



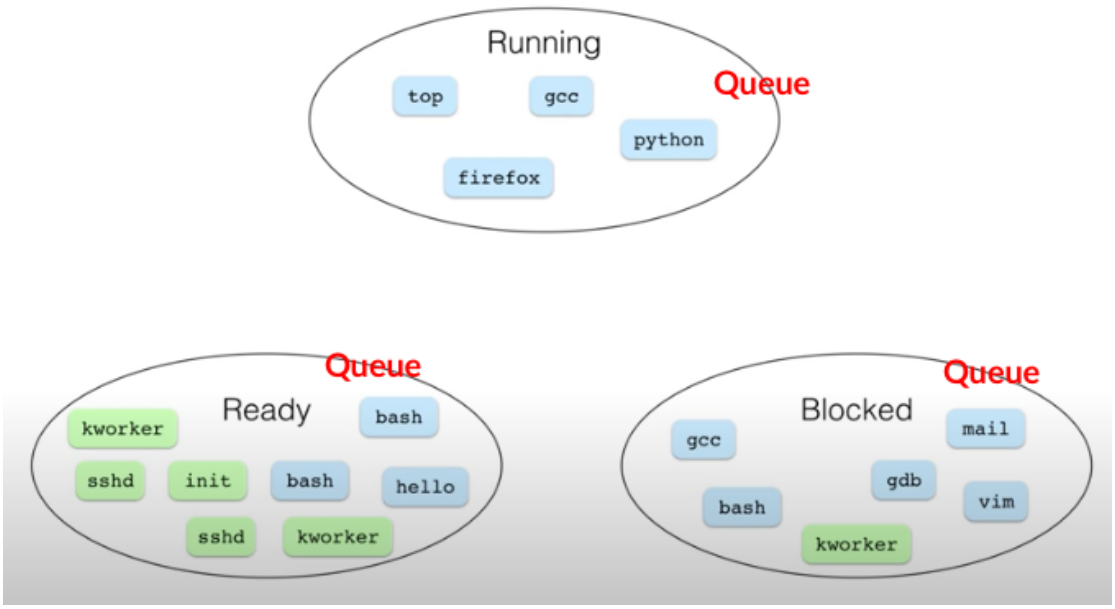

- State Queues
  - Is a part of **process scheduling**
    - keeps CPU busy at all times to deliver minimum response time for all programs

Activity Monitor (All Processes)

CPU | Memory | Energy | Disk | Network | Search

| Process Name | % CPU | CPU Time | Threads | Idle Wake Ups | % GPU | GPU Time | PID | User |
|---|---|---|---|---|---|---|---|---|
| WindowServer | 43.7 | 40:07.03 | 11 | 66 | 2.4 | 20:38.71 | 330 | _windowserver |
| Code Helper (Renderer) | 37.3 | 8:23.49 | 32 | 24 | 0.0 | 0.00 | 2584 | moegu |
| Code Helper (GPU) | 18.3 | 4:02.04 | 8 | 41 | 0.3 | 2:37.24 | 2581 | moegu |
| Adobe CEF Helper | 11.5 | 21:36.14 | 10 | 112 | 0.6 | 5:41.56 | 884 | moegu |
| kernel_task | 9.6 | 17:02.14 | 185 | 1210 | 0.0 | 0.00 | 0 | root |
| com.docker.hyperkit | 8.1 | 15:16.38 | 18 | 285 | 0.0 | 0.00 | 1389 | moegu |
| Activity Monitor | 6.8 | 9.60 | 5 | 2 | 0.0 | 0.00 | 7295 | moegu |
| Code | 4.5 | 2:06.91 | 45 | 1 | 0.0 | 0.00 | 2580 | moegu |
| Adobe CEF Helper | 3.0 | 5:43.96 | 15 | 181 | 0.0 | 0.00 | 1232 | moegu |
| Google Chrome | 2.1 | 23:40.61 | 40 | 18 | 0.0 | 0.00 | 569 | moegu |
| hidd | 1.7 | 2:15.82 | 6 | 0 | 0.0 | 0.00 | 231 | _hidd |
| launchd | 1.5 | 55.70 | 6 | 0 | 0.0 | 0.00 | 1 | root |
| sysmond | 1.4 | 2.05 | 3 | 0 | 0.0 | 0.00 | 5728 | root |
| mdworker_shared | 1.1 | 0.49 | 4 | 0 | 0.0 | 0.00 | 7266 | moegu |
| launchservicesd | 0.8 | 7.18 | 7 | 1 | 0.0 | 0.00 | 210 | root |
| Creative Cloud | 0.8 | 1:38.47 | 24 | 65 | 0.0 | 0.00 | 814 | moegu |
| Be Focused | 0.7 | 1:32.46 | 7 | 13 | 0.0 | 0.00 | 2931 | moegu |
| Google Chrome Helper (GPU) | 0.5 | 22:35.98 | 11 | 3 | 0.7 | 10:51.38 | 753 | moegu |
| mds | 0.4 | 38.98 | 9 | 4 | 0.0 | 0.00 | 197 | root |
| vpnkit-bridge | 0.4 | 32.03 | 15 | 59 | 0.0 | 0.00 | 1354 | moegu |
| tccd | 0.3 | 1.13 | 3 | 0 | 0.0 | 0.00 | 5694 | root |
| mds_stores | 0.3 | 2:46.31 | 7 | 1 | 0.0 | 0.00 | 391 | root |

    - Here, processes in queue are switched so frequently that user can interact with each program while running
  - Has one state queue for each process state
    - Job Queue, Ready Queue, Waiting Queue, Blocking Queue




- PCBs And State Queues
- Context Switch
- Operations on Processes
- Process Creation
- fork()
- Duplicating Address Processes
- Divergence
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