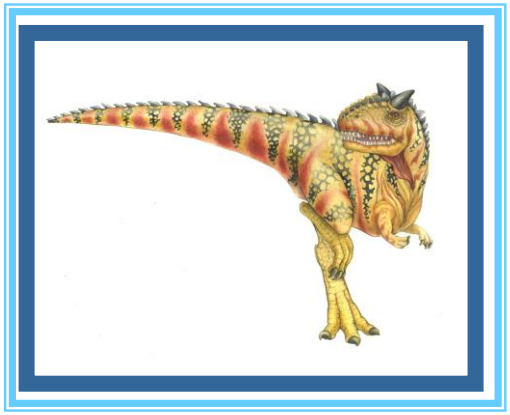
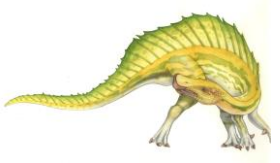
Introduction to Operating System
Day1: Sep 2021

Kiran Waghmare



Agenda

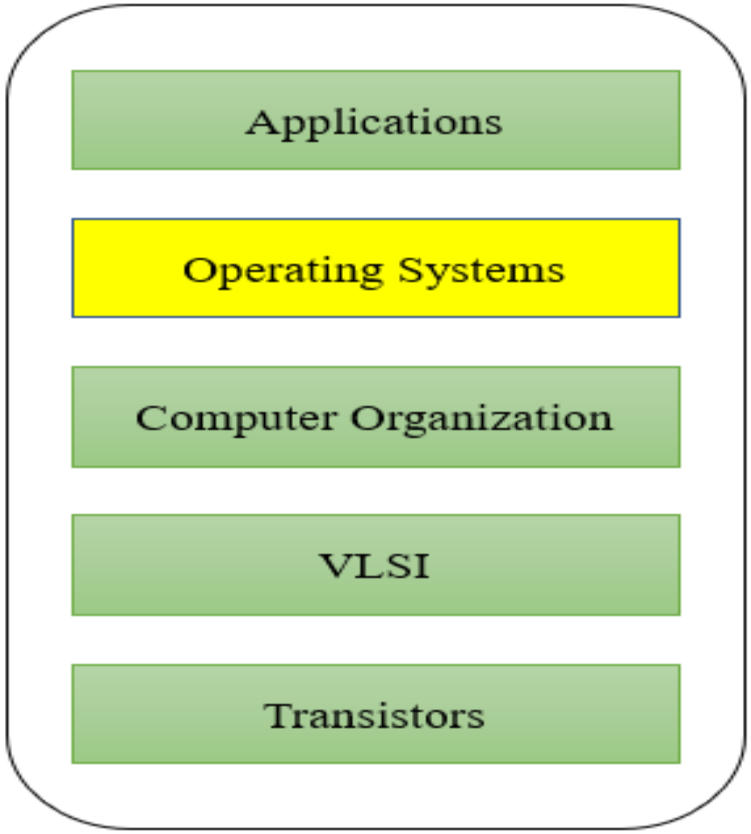
- **Introduction to OS**
  - OS
  - Application Software
  - Hardware dependent
  - Componenets of OS
  - Difference between :
    - Mobile OS,Embedded system OS,
    - Real Time OS,
    - desktop OS server machine os
  - Functions of OS
  - User and Kernel space & model
  - Interrupts & system calls

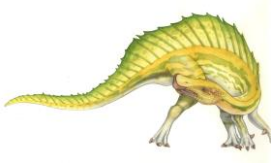


What is an Operating System?

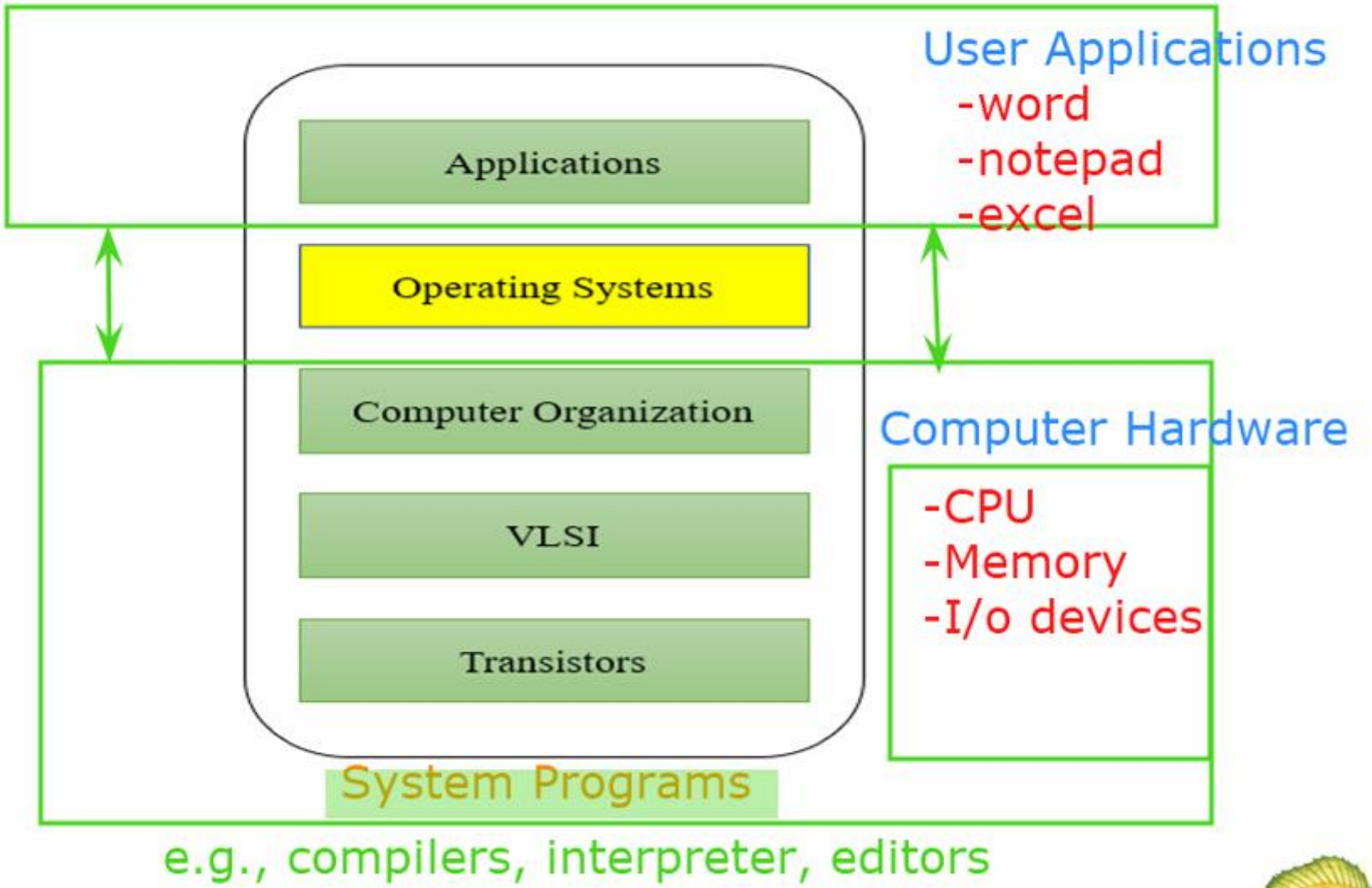
- A program that acts as an **intermediary between a user of a computer and the computer hardware**
- **Operating system goals:**
  - Execute user programs and **make solving user problems easier**
  - Make the **computer system convenient** to use
  - Use the computer hardware in an efficient manner

The Layers in Systems

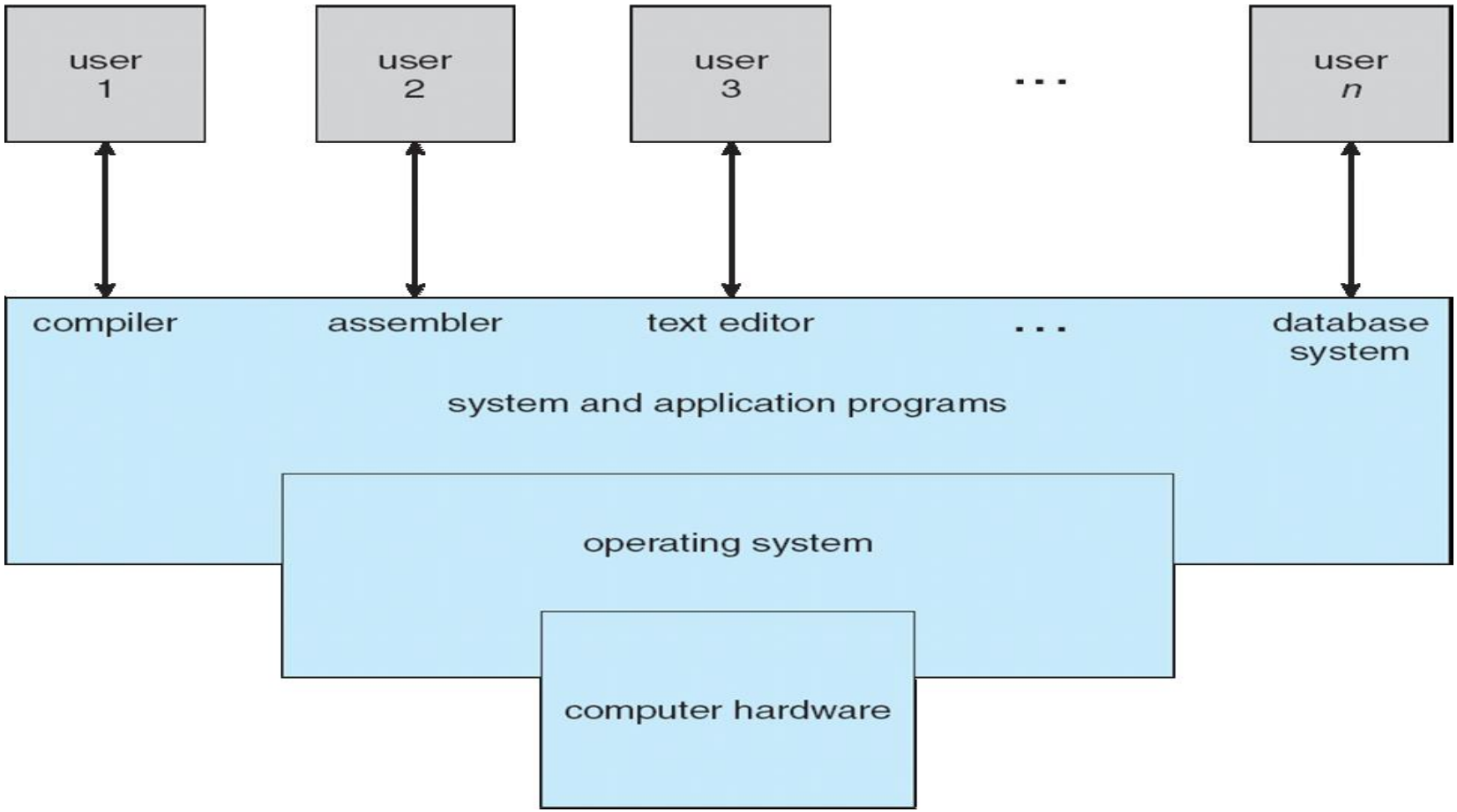




The Layers in Systems



Four Components of a Computer System



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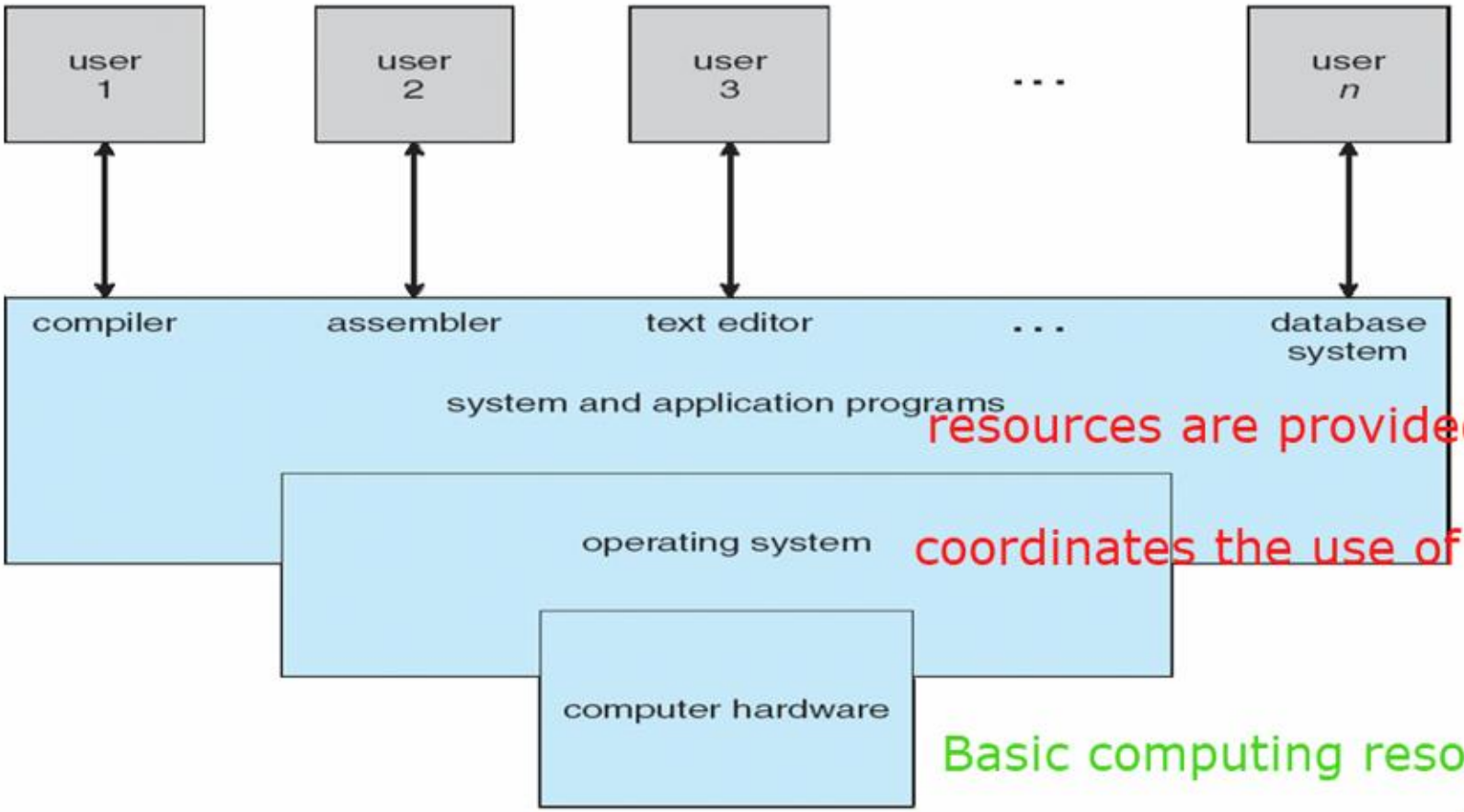


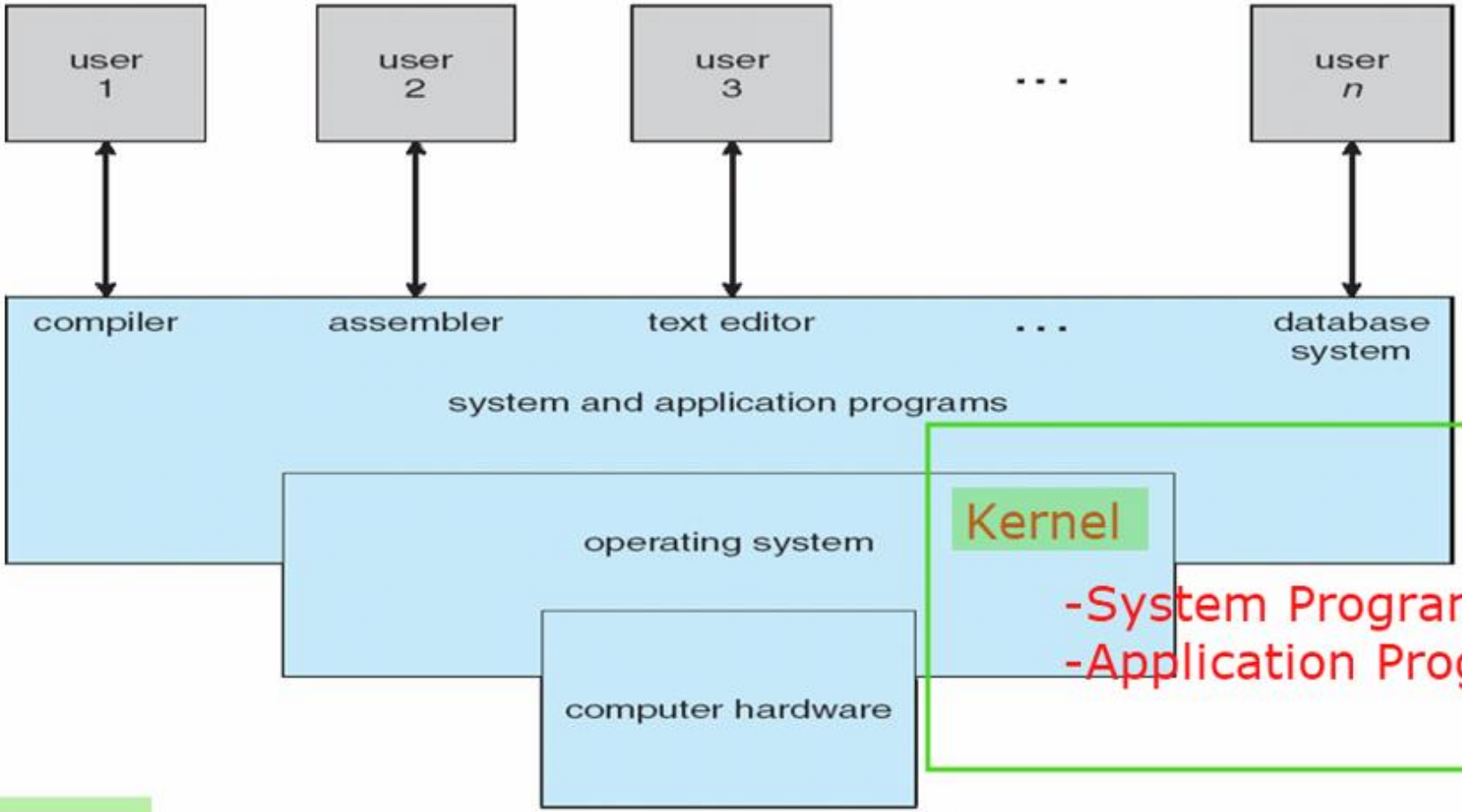
resources are provided by OS

coordinates the use of h/w

Basic computing resources

CDAC Mumbai: Kiran Waghmare
Silberschatz, Galvin and Gagne ©2009

Four Components of a Computer System



Kernel: one program which runs all the time in computer

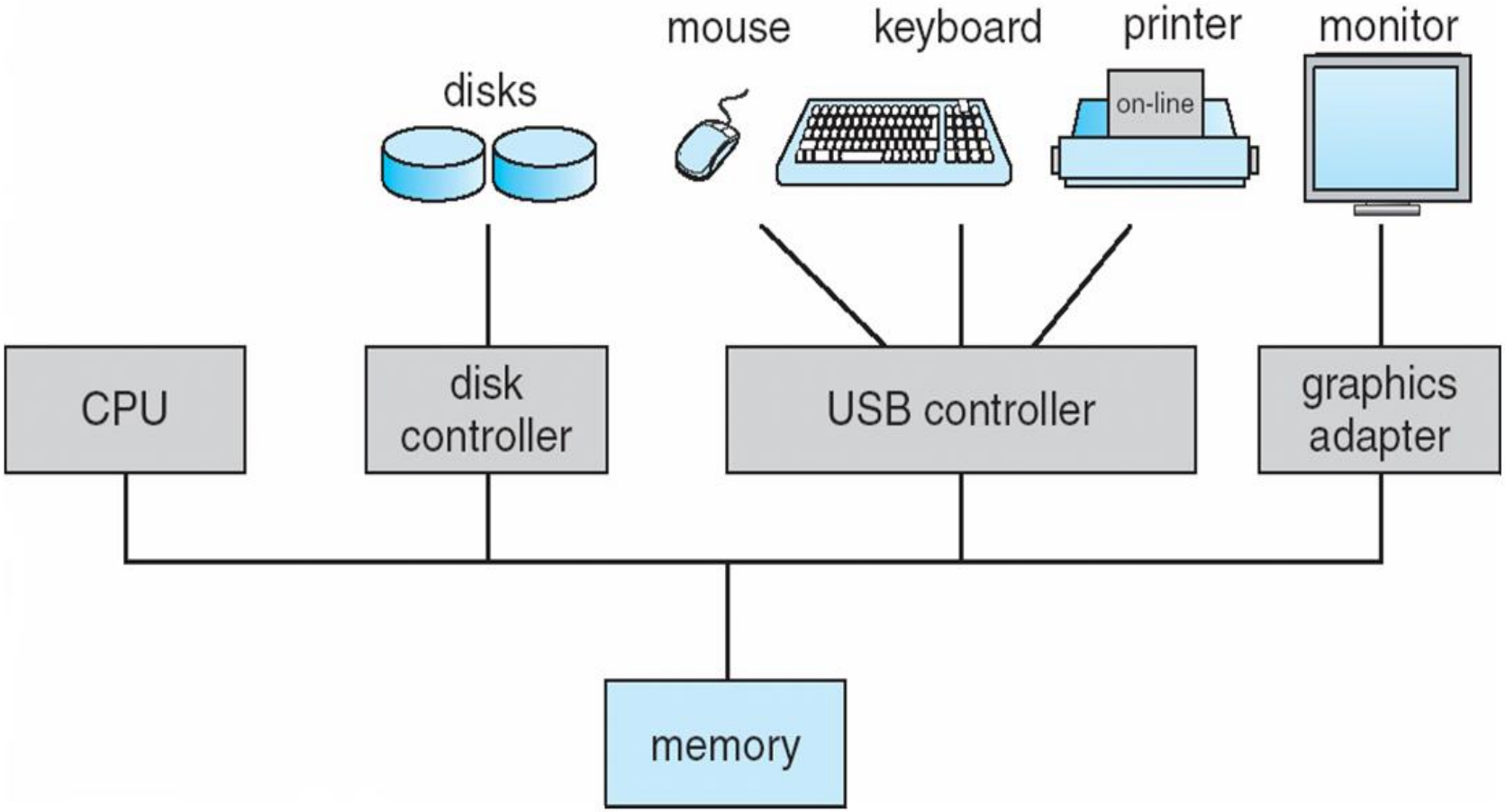
Operating System Definition

- OS is a **resource allocator**
  - Manages all resources
  - Decides between conflicting requests for efficient and fair resource use
- OS is a **control program**
  - Controls execution of programs to prevent errors and improper use of the computer

Computer Startup

- **bootstrap program** is loaded at power-up or reboot
  - Typically stored in ROM or EPROM, generally known as **firmware**
  - Initializes all aspects of system
  - Loads operating system kernel and starts execution

Computer System Organization



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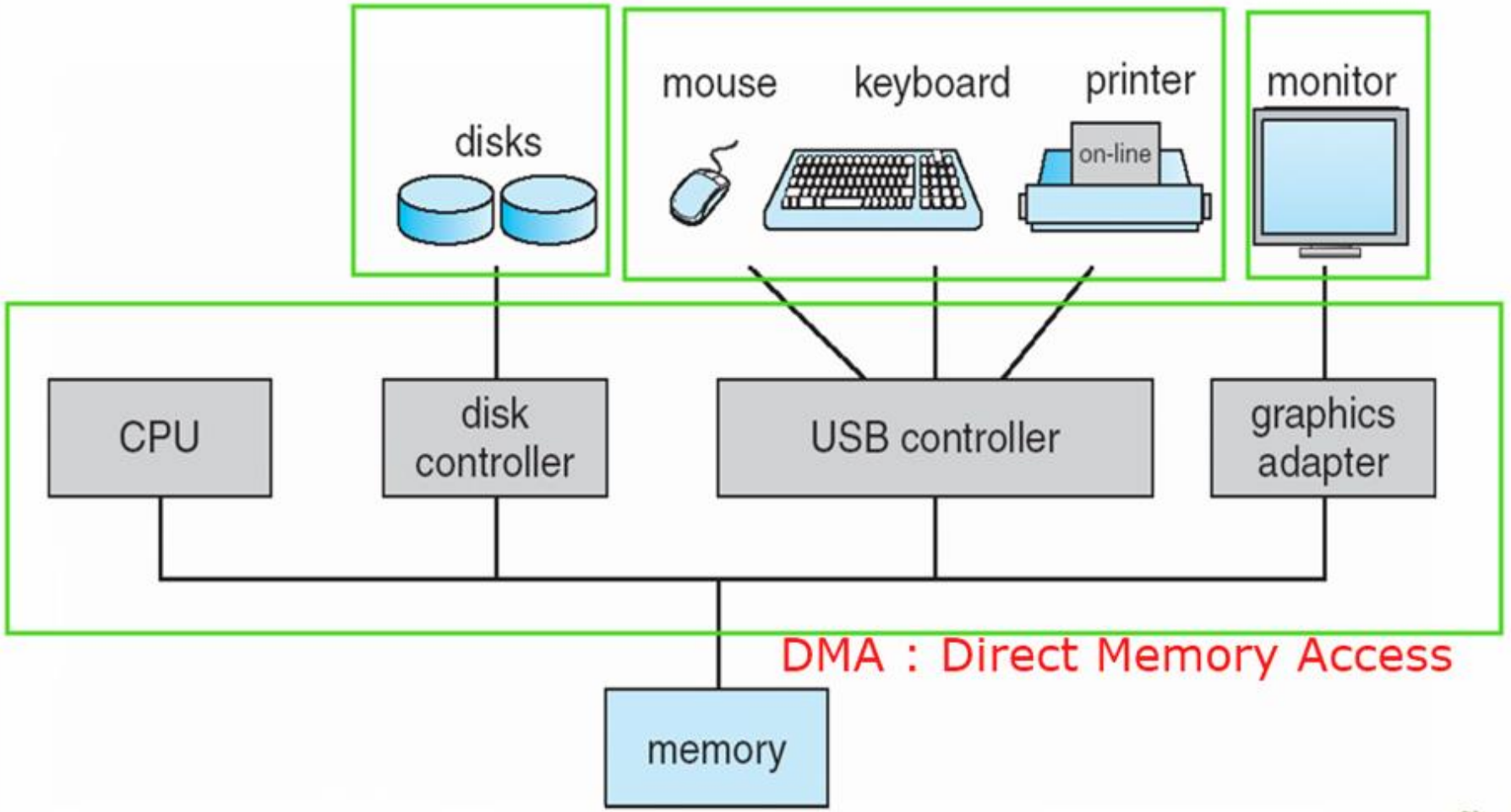


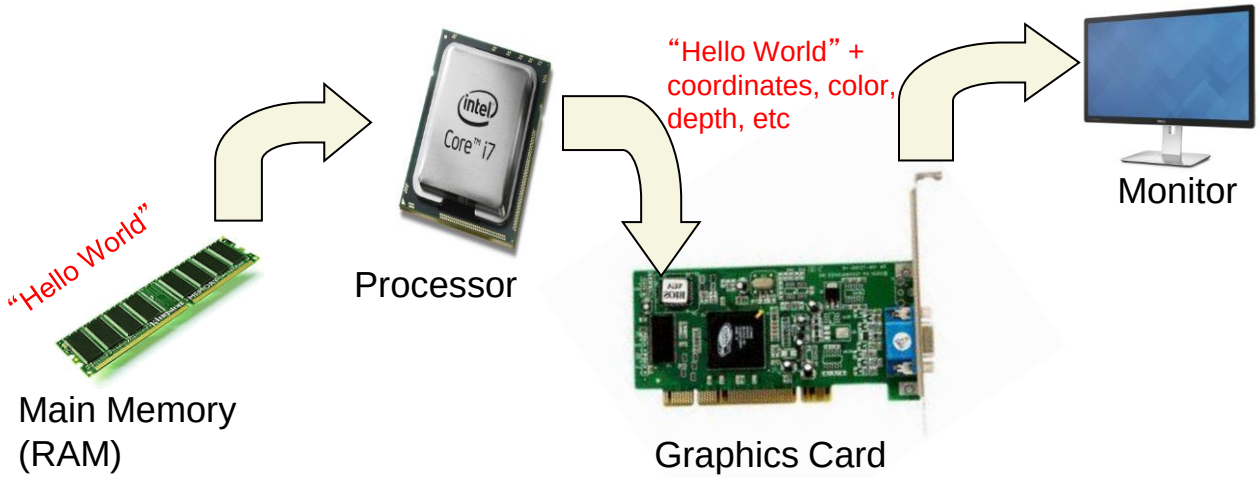
A Simple Program

What is the output of the following program?

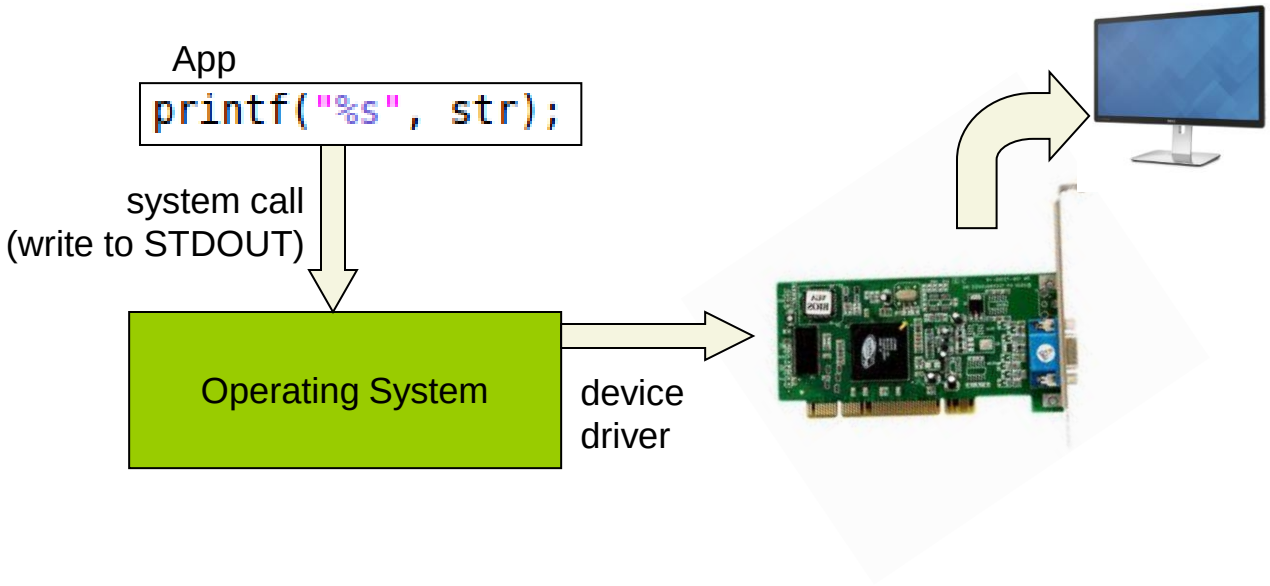
```
#include <stdio.h>

int main(){
   char str[] = "Hello World\n";
   printf("%s", str);
}
```

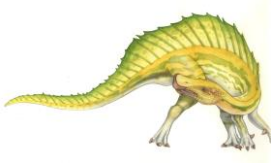
How is the string displayed on the screen?

Displaying on the Screen



Operating Systems provide Abstraction

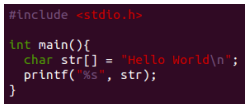


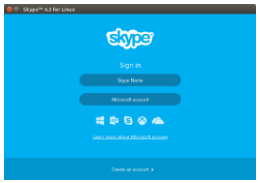


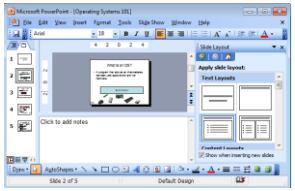
OS as a Resource Manager

- Multiple apps but limited hardware

Apps



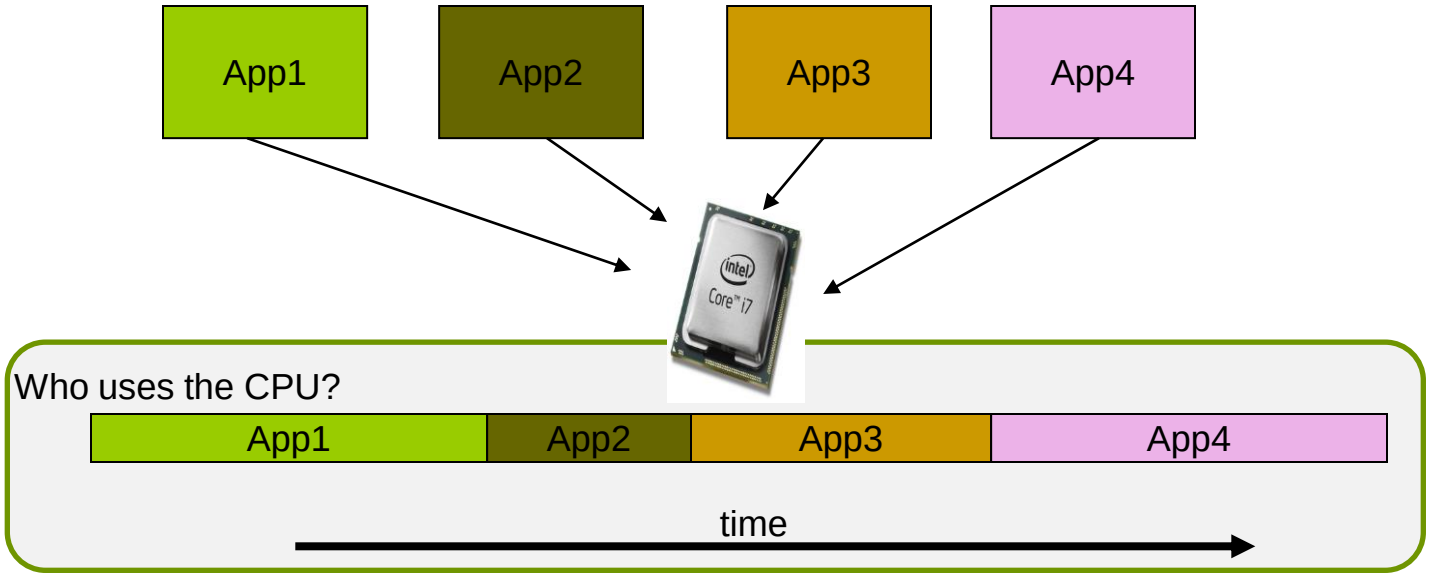




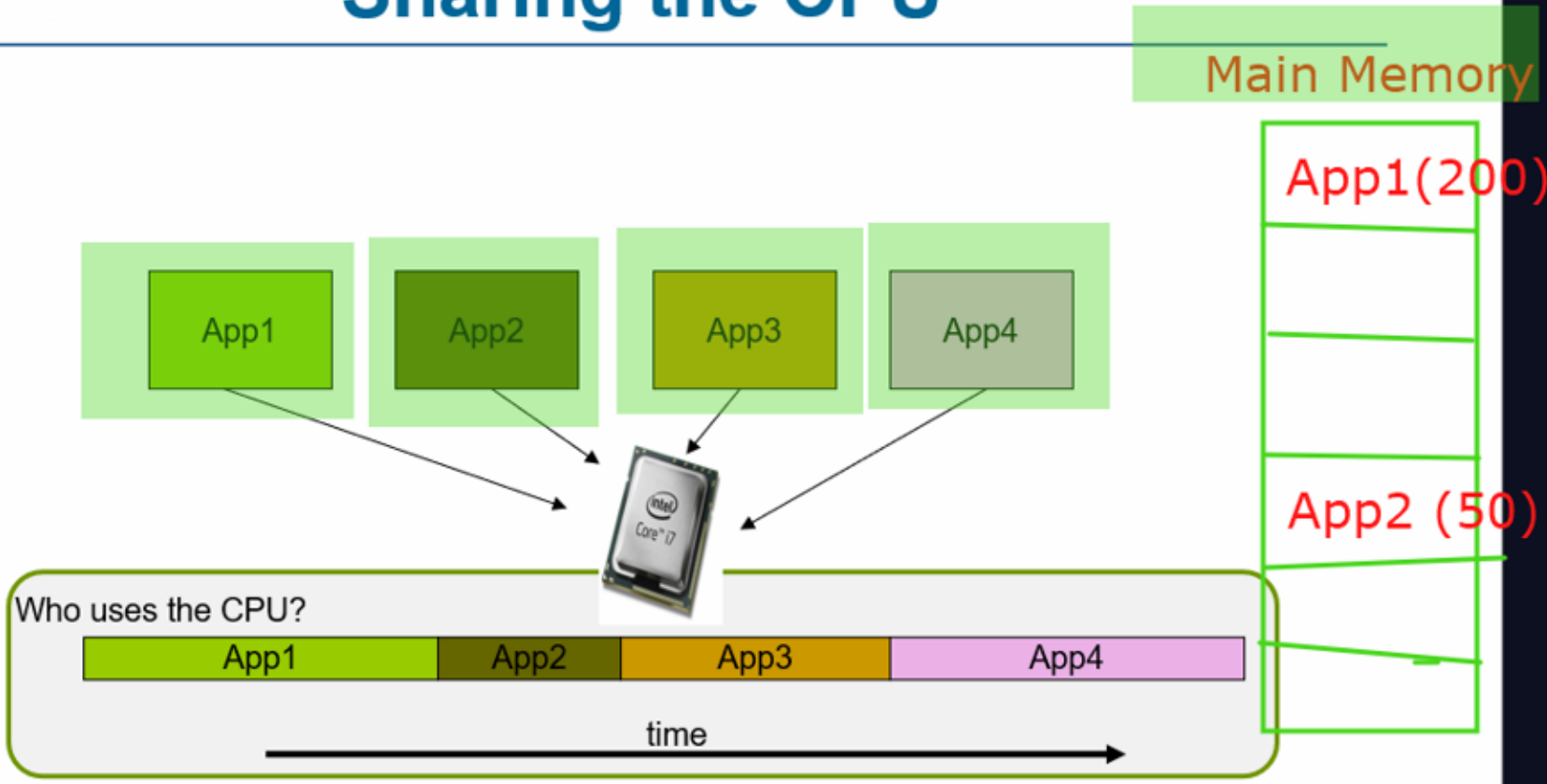
Operating Systems

Allows sharing of hardware!!

Sharing the CPU



Sharing the CPU

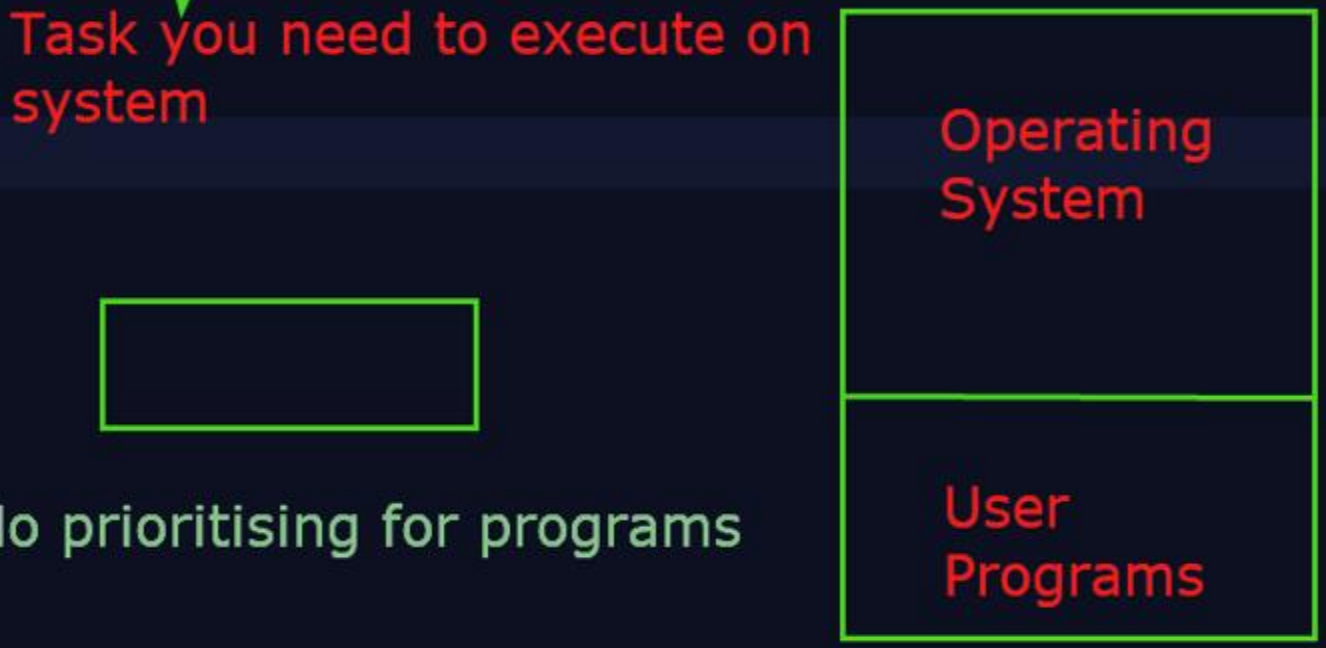


Types of OS:

Simple Batch system:

-no direct communication

-submit a job, submit batch of jobs---->Results of progra



Types of OS:

Simple Batch system:

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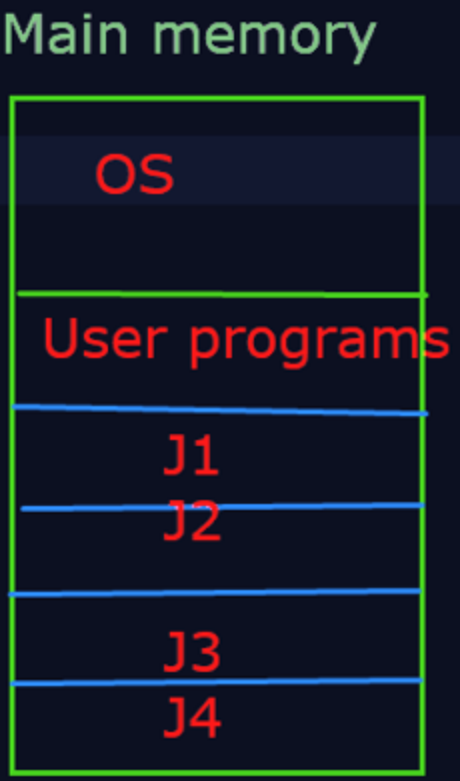
Multiprogramming Batch System:

Cpu processing:J1,J2,j2,j1,j4

IO Processing:-J2,J3,J1,



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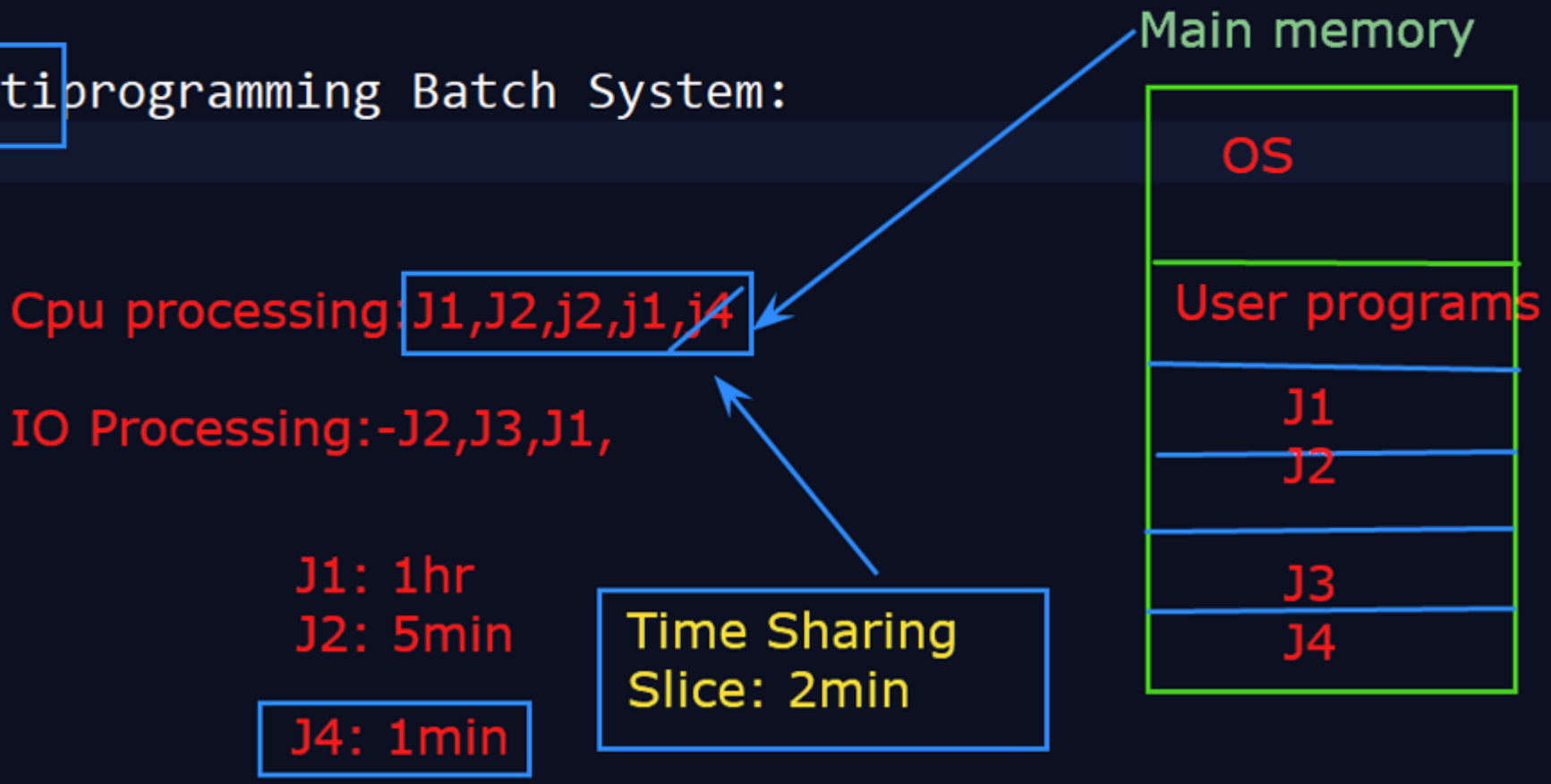
Multiprogramming Batch System:



Types of Operating Systems

- Following are some of the most widely used types of Operating system.
  - Simple Batch System
  - Multiprogramming Batch System
  - Multiprocessor System
  - Desktop System
  - Distributed Operating System
  - Clustered System
  - Realtime Operating System
  - Handheld System

Types of OS:

Simple Batch system:

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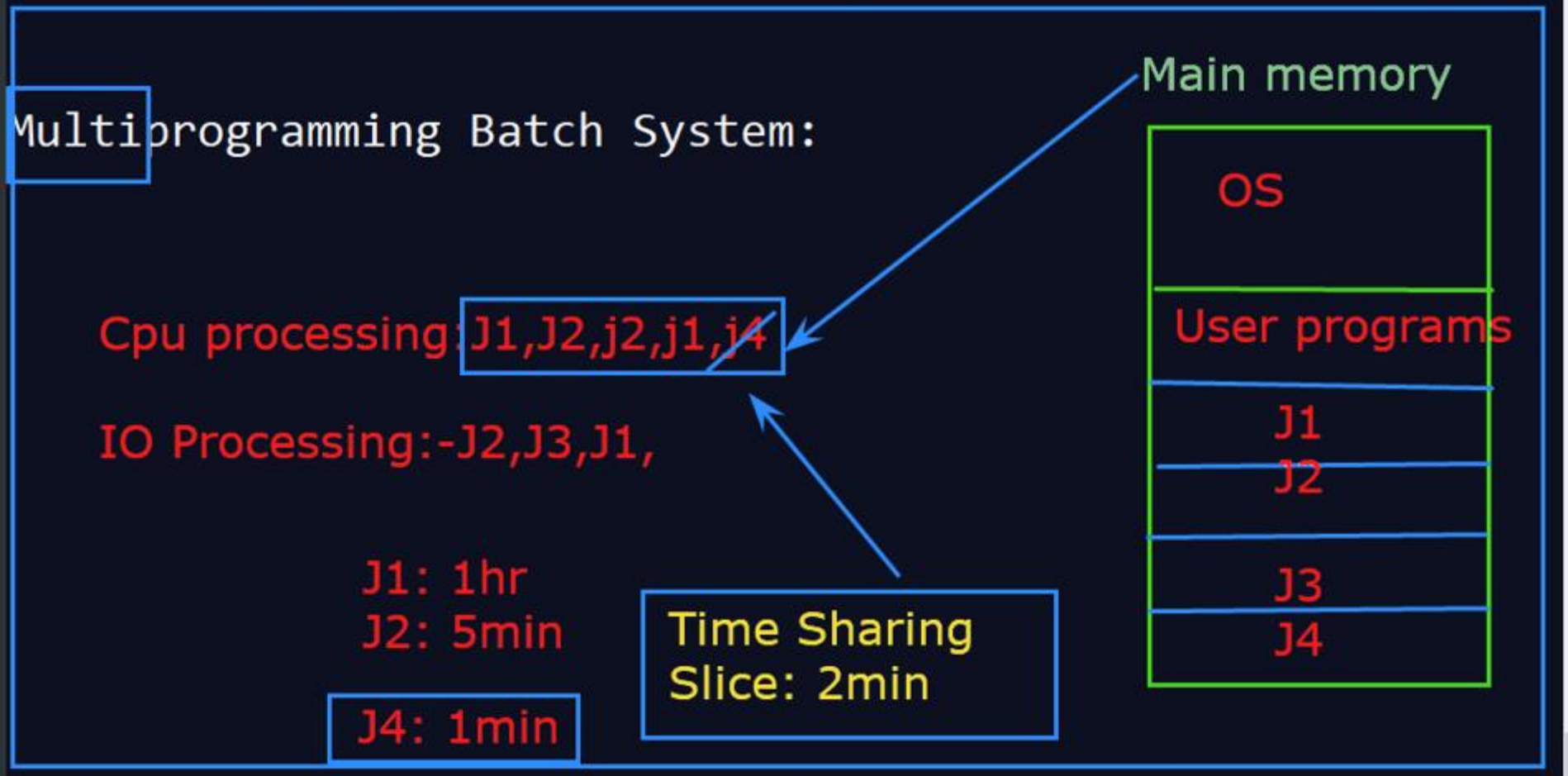
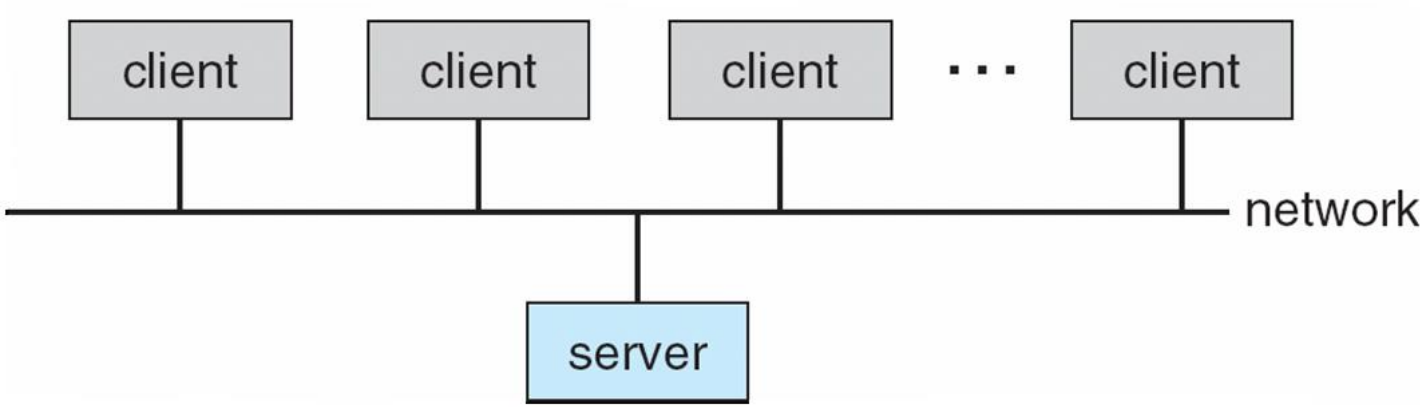


Multiprocessor System:more of processor

Computing Environments (Cont)

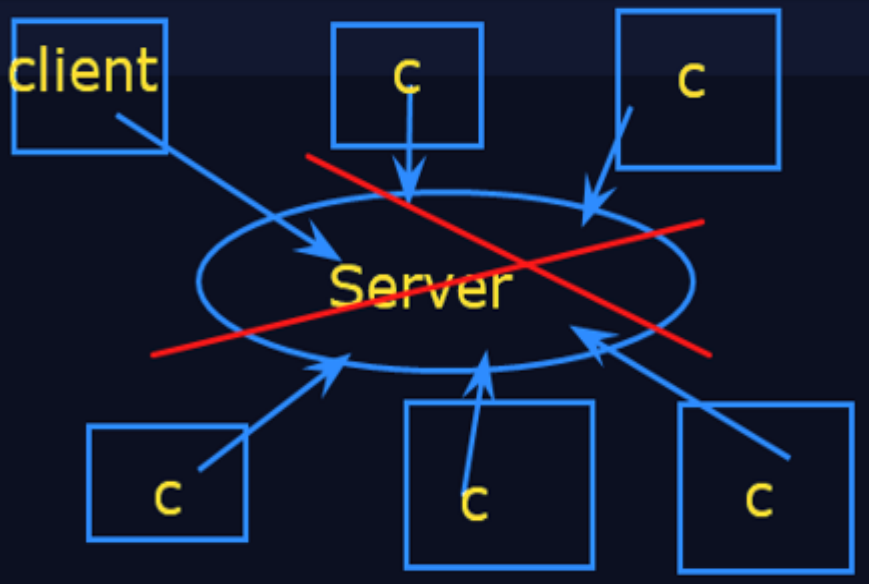
- **Client-Server Computing**
  - Dumb terminals supplanted by smart PCs
  - Many systems now **servers**, responding to requests generated by **clients**
    - **Compute-server** provides an interface to client to request services (i.e. database)
    - **File-server** provides interface for clients to store and retrieve files



Multiprocessor System:more of processor

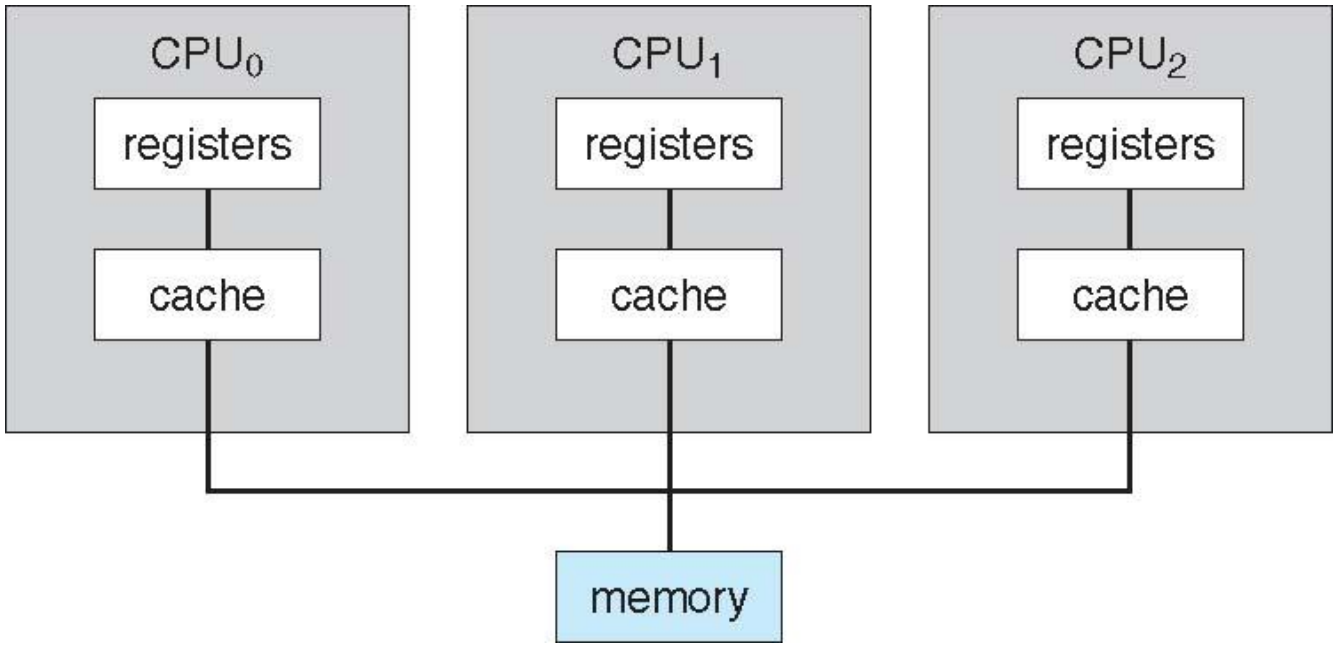
Distributed Os:

1. Client server Arch
2. Peer to Peer Arch

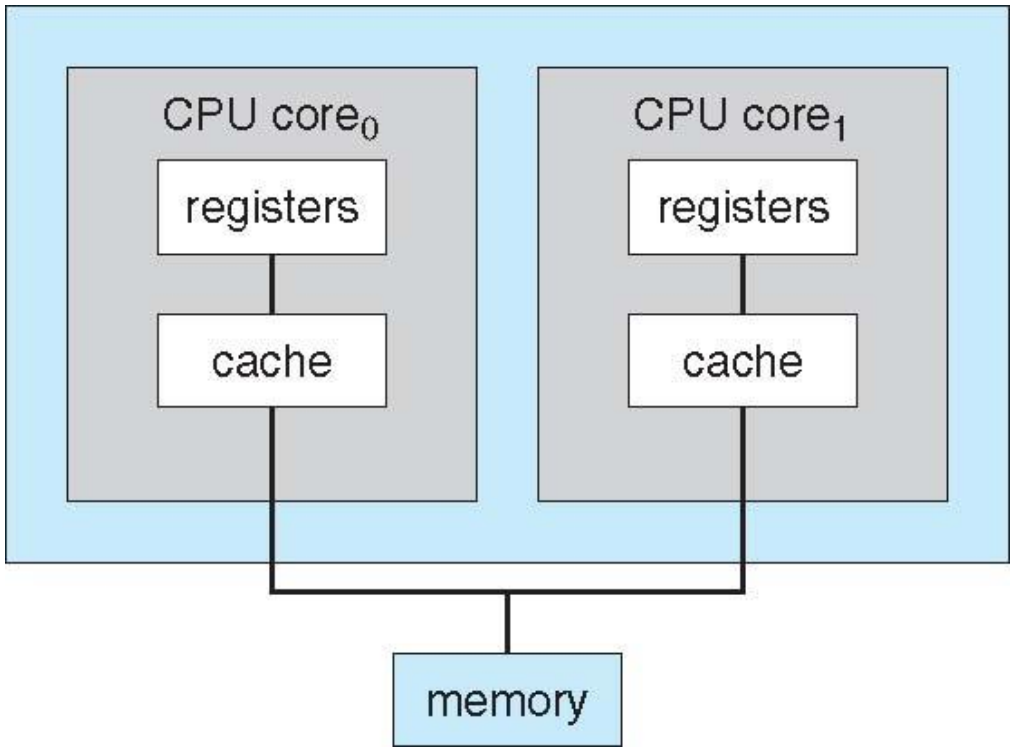


Failure

Symmetric Multiprocessing Architecture



A Dual-Core Design



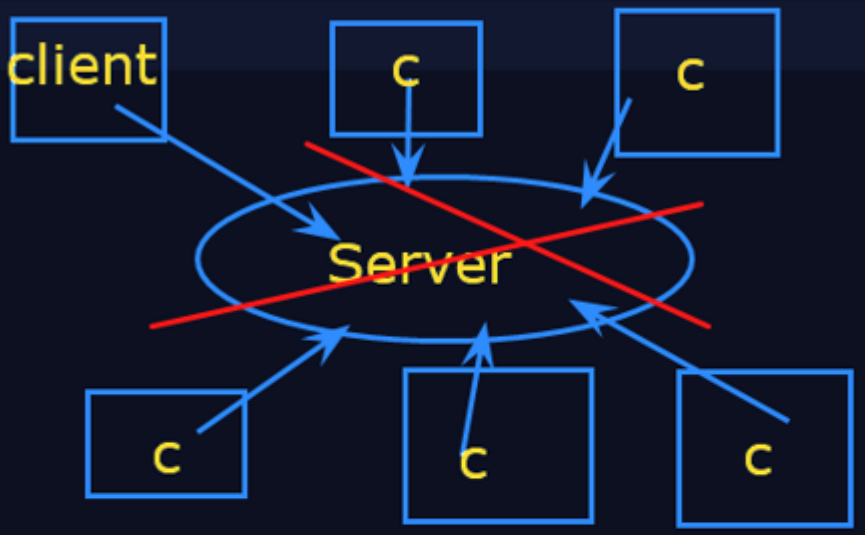
Peer-to-Peer Computing

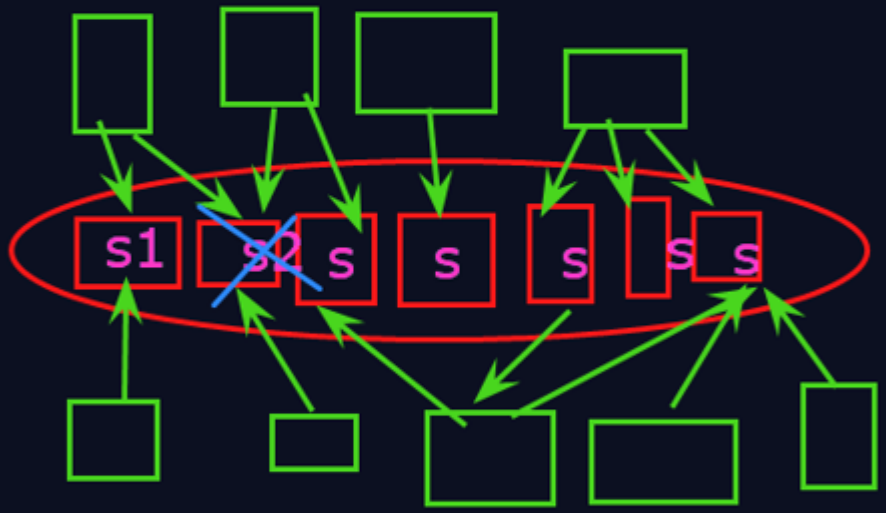
- Another model of distributed system
- P2P does not distinguish clients and servers
  - Instead all nodes are considered peers
  - May each act as client, server or both
  - Node must join P2P network
    - Registers its service with central lookup service on network, or
    - Broadcast request for service and respond to requests for service via **discovery protocol**
  - Examples include *Napster* and *Gnutella*

Multiprocessor System:more of processor

Distributed Os:

1. Client server Arch
2. Peer to Peer Arch



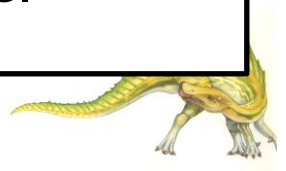


Clusters

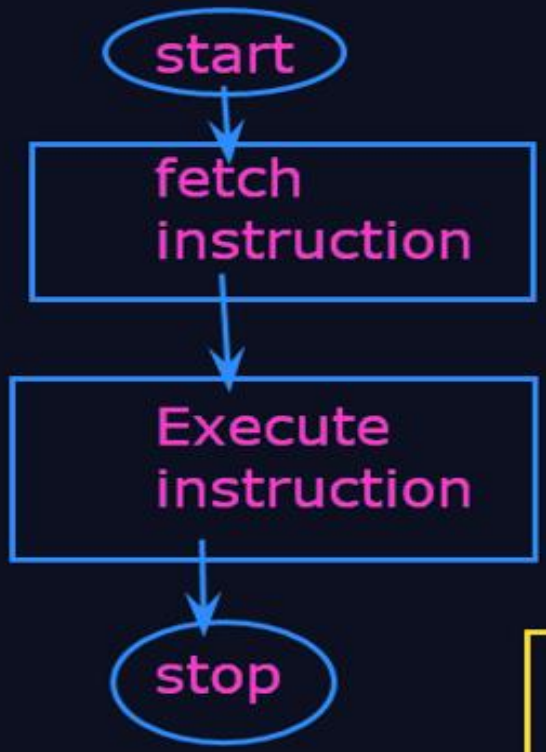
Failure

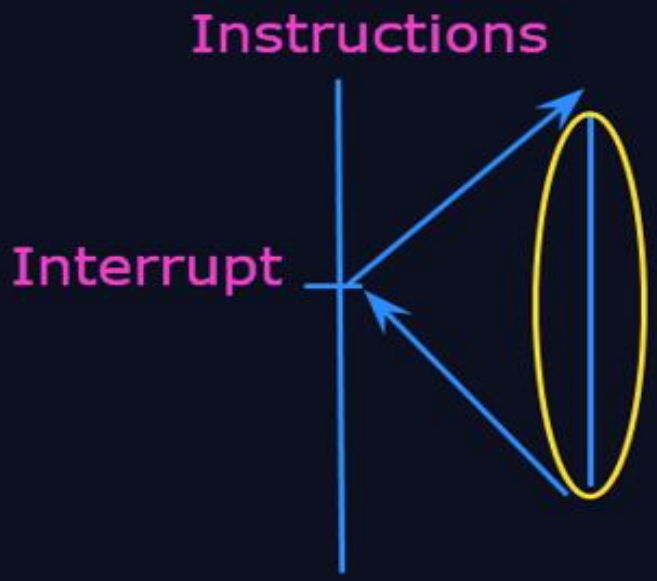
Real Time Operating System

- It is defined as an operating system **known to give maximum time for each of the critical operations** that it performs, like OS calls and interrupt handling.
- The Real-Time Operating system which guarantees the maximum time for critical operations and complete them on time are referred to as Hard Real-Time Operating Systems.
- While the real-time operating systems that can only guarantee a maximum of the time, i.e. the critical task will get priority over other tasks, but no assurity of completing it in a defined time. These systems are referred to as Soft Real-Time Operating Systems.



Interrupts:
-defined as an event that alters the sequence of instructions executed by a processor.





Interrupt Handling

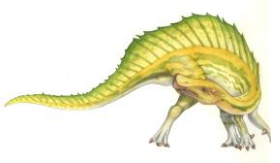
-Polling
-Vectored interrupt system

Bourne Shell Command Interpreter

Terminal

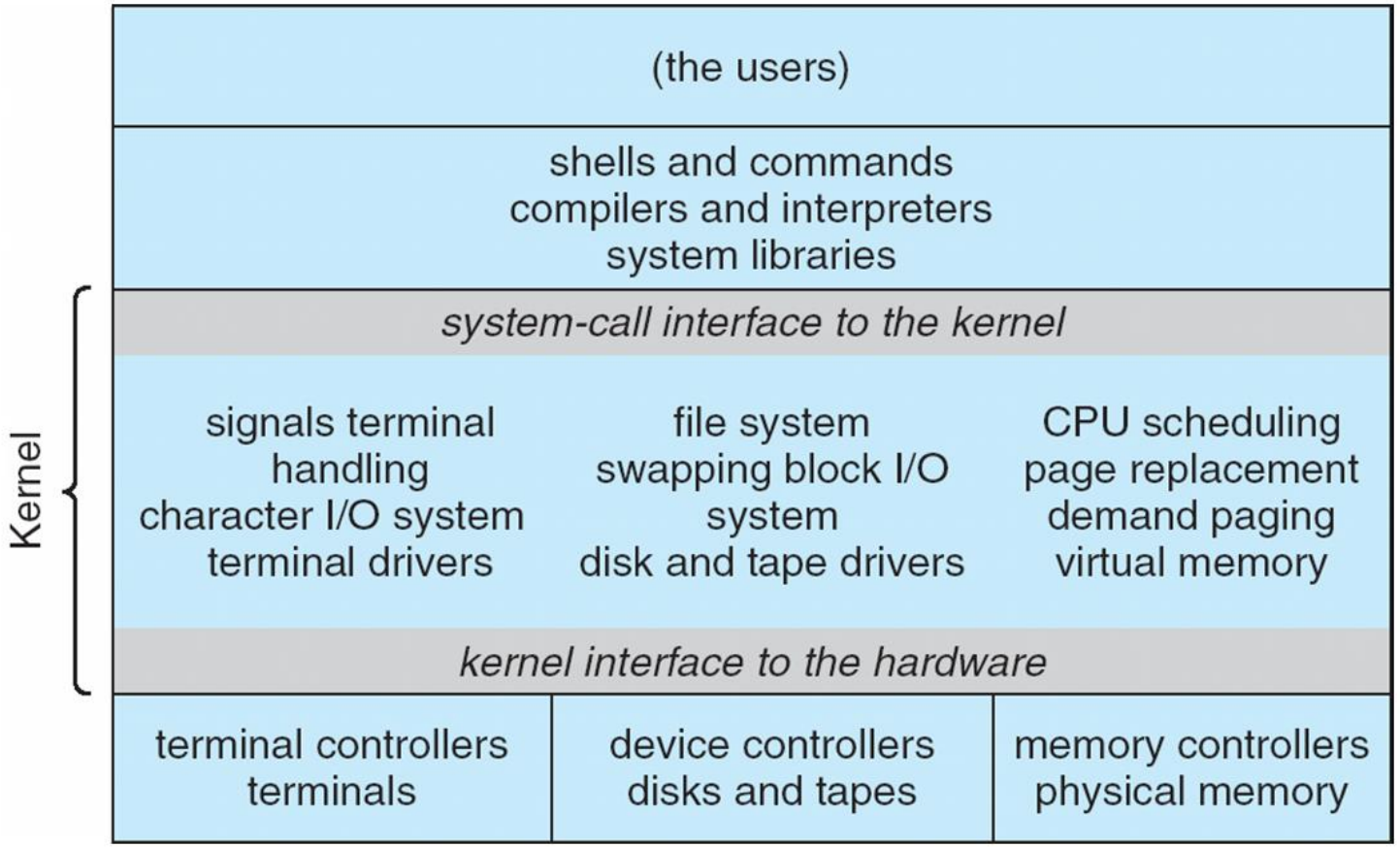
File Edit View Terminal Tabs Help

```
fd0       0.0     0.0     0.0     0.0  0.0  0.0     0.0    0   0
sd0       0.0     0.2     0.0     0.2  0.0  0.0     0.4    0   0
sd1       0.0     0.0     0.0     0.0  0.0  0.0     0.0    0   0
                  extended device statistics
device    r/s     w/s    kr/s    kw/s wait actv  svc_t  %w  %b
fd0       0.0     0.0     0.0     0.0  0.0  0.0     0.0    0   0
sd0       0.6     0.0    38.4     0.0  0.0  0.0     8.2    0   0
sd1       0.0     0.0     0.0     0.0  0.0  0.0     0.0    0   0
(root@pbg-nv64-vm)-(11/pts)-(00:53 15-Jun-2007)-(global)
-(/var/tmp/system-contents/scripts)# swap -sh
total: 1.1G allocated + 190M reserved = 1.3G used, 1.6G available
(root@pbg-nv64-vm)-(12/pts)-(00:53 15-Jun-2007)-(global)
-(/var/tmp/system-contents/scripts)# uptime
 12:53am  up 9 min(s),  3 users,  load average: 33.29, 67.68, 36.81
(root@pbg-nv64-vm)-(13/pts)-(00:53 15-Jun-2007)-(global)
-(/var/tmp/system-contents/scripts)# w
  4:07pm  up 17 day(s), 15:24,  3 users,  load average: 0.09, 0.11, 8.66
User     tty           login@  idle   JCPU   PCPU  what
root     console      15Jun0718days      1         /usr/bin/ssh-agent -- /usr/bi
n/d
root     pts/3        15Jun07           18      4  w
root     pts/4        15Jun0718days                w
(root@pbg-nv64-vm)-(14/pts)-(16:07 02-Jul-2007)-(global)
-(/var/tmp/system-contents/scripts)#
```

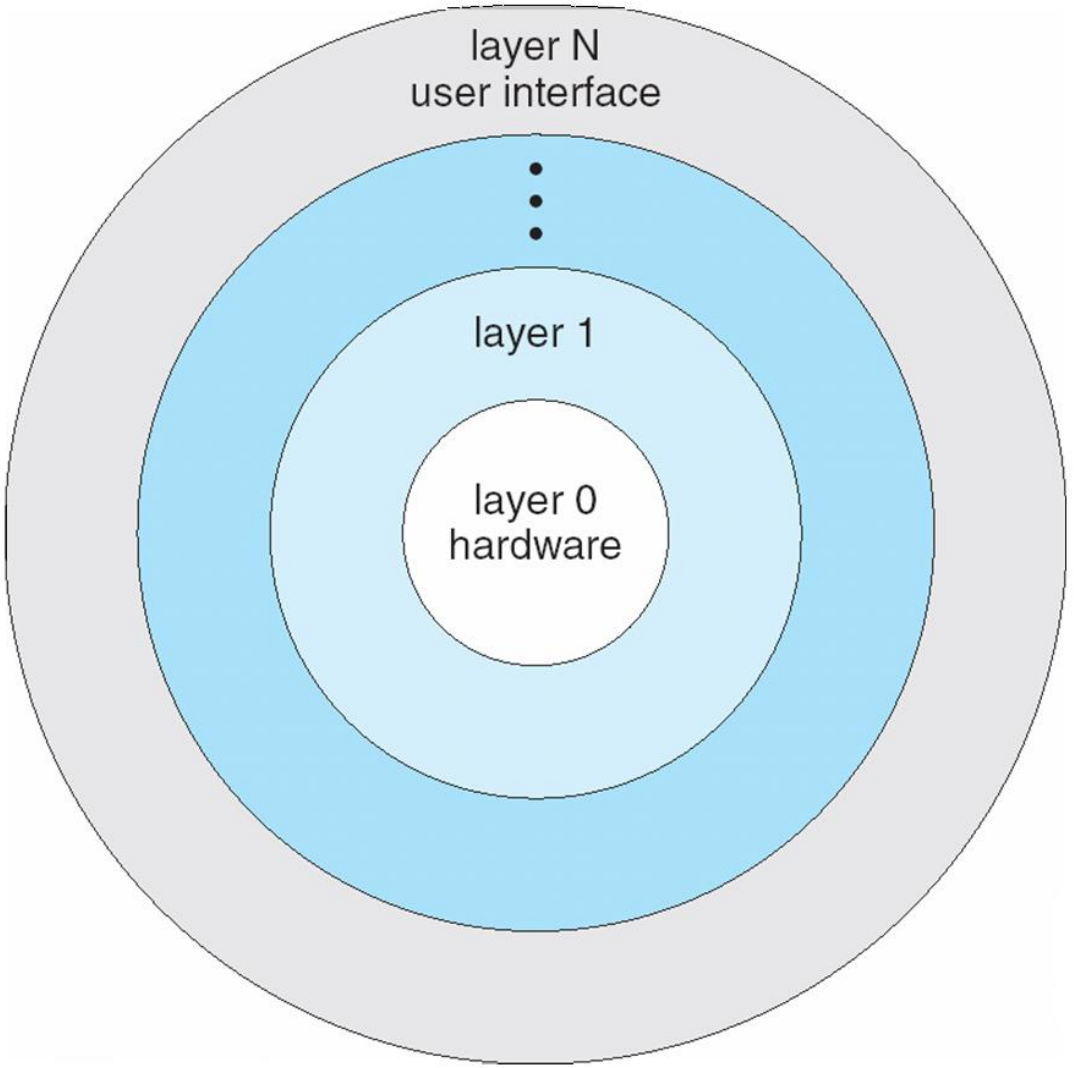


The Mac OS X GUI

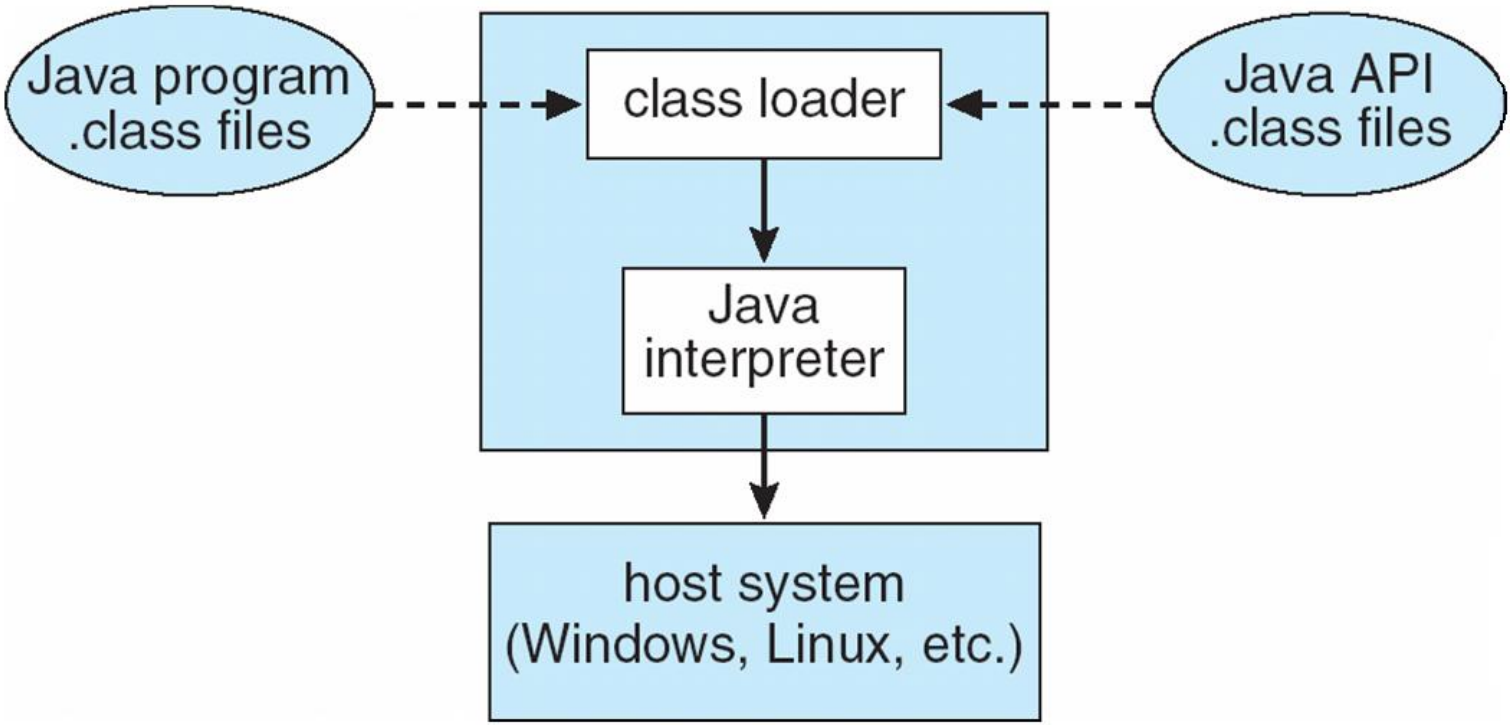
Traditional UNIX System Structure



Layered Operating System



The Java Virtual Machine



Operating System Generation

- Operating systems are designed to run on any of a class of machines; the system must be configured for each specific computer site
- **SYSGEN program** obtains information concerning the specific configuration of the hardware system
- ***Booting*** – starting a computer by loading the kernel
- ***Bootstrap program*** – code stored in ROM that is able to locate the kernel, load it into memory, and start its execution

-OS
-1969 AT&T Bell Lab
-CLI: Command Line Interpreter

Linux:
-invented by 1991, Linus Torvalds
-open source
-variant of UNIX
-Supports Multiuser, Multitasking, Multiprocessor system
-free,customizable, stability, security & portability

Kernel:
-low level core of the system that is the interface between application & hardware
-Functions
    -Memory Management
    -I/O devices
    -allocates the time between user & processor
    -interprocess communications
    -sets process priority
    etc

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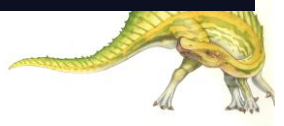
    etc

Shell:
program sits on the interface between the user and kernel.

Shell Types:
-Bourne shell(sh)
-C schell(csh)
-Korn shell(ksh)
-Bourne again shell(bash)

-Bourne again shell(bash)
    -CLI: Linux based Command Language Interpreter.
    -It is a replacement of Bourne shell (sh).
    -supports programming functionalities.
    -Extension of files: .sh
    -inventer: GNU Project :Brian Fox.

File system:
-"Root": /
-Hierarchical Structure for File organization:



-"Root": /

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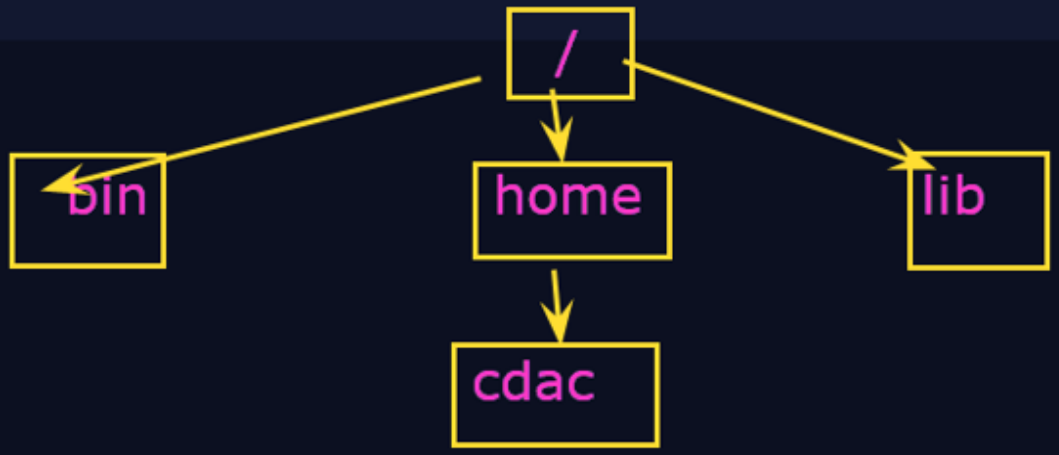
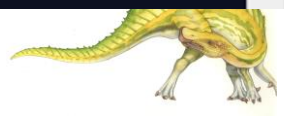
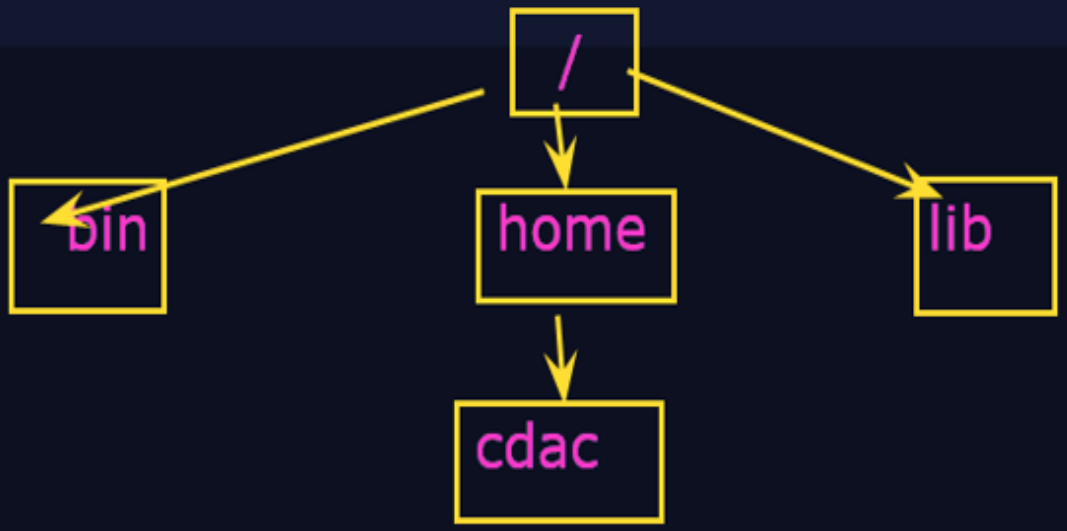




-"Root": /

-Hierarchical Structure for File organization:



.-->directory
..-->parent direntory
~-->home directory
.sh-->

/bin
/dev
/etc
/tmp