Operating System(315319)

Unit 1 : Operating System services and components

Hours: 10 Marks: 14

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Learning Outcomes

The learners will be able to:

- Operating System(OS) Concept and functions
- Different Types of Operating Systems
  - Batch OS
  - Multi Programmed OS
  - Time Shared OS
  - Multiprocessor Systems
  - Distributed Systems
  - Real Time Systems
  - Mobile OS
- Command Line & GUI Based OS.
- Different Services of Operating System, System Calls: Concept, types of system calls
- Operating System Components: Process Management, Main Memory Management, File Management, IO Management, Secondary Storage Management

What is an Operating System?

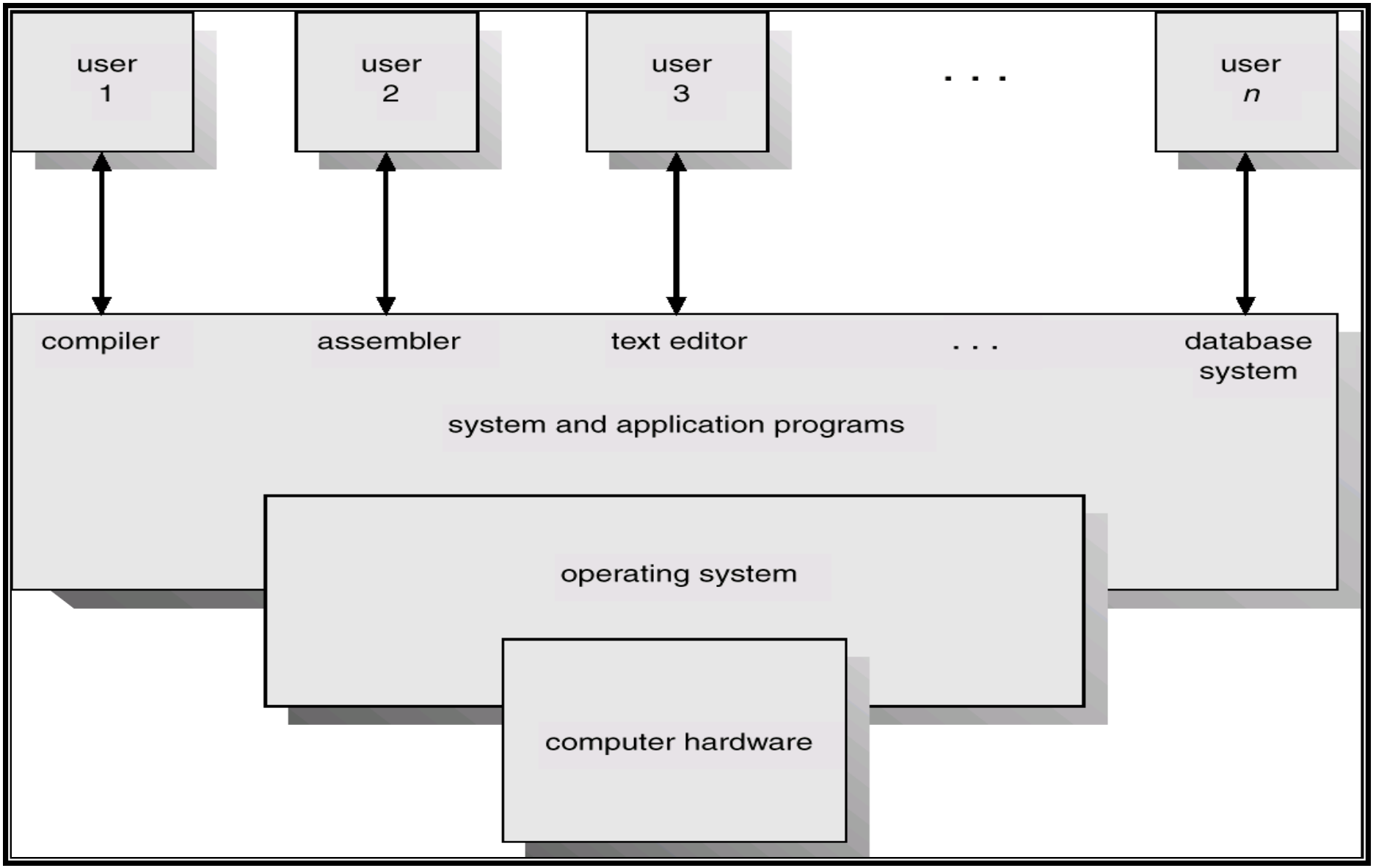
- A program that acts as an intermediary between a user of a computer and the computer hardware.
- Eg :-Windows 10, Windows 8, Apple's mac OS & Linux

- 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.

Computer System Components

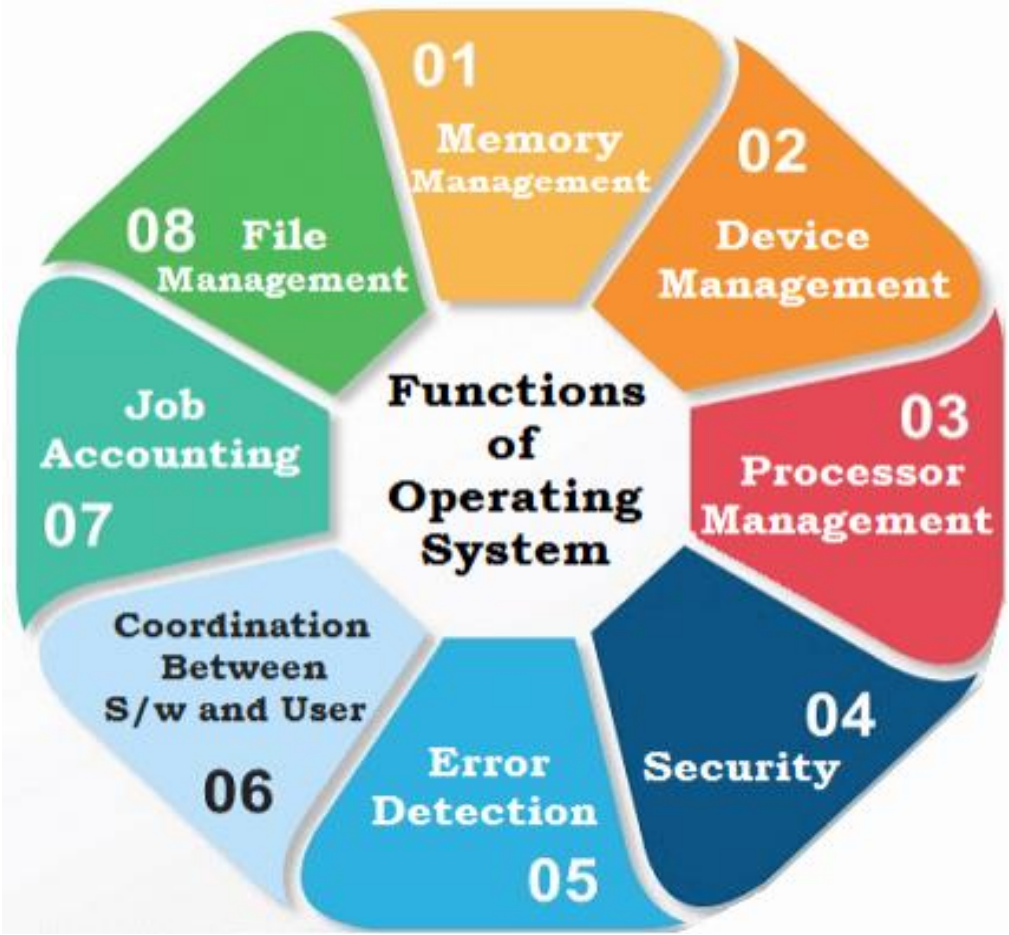
1. Hardware – provides basic computing resources (CPU, memory, I/O devices).
2. Operating system – controls and coordinates the use of the hardware among the various application programs for the various users.
3. Applications programs – define the ways in which the system resources are used to solve the computing problems of the users (compilers, database systems, video games, business programs).
4. Users (people, machines, other computers).

Abstract View of System Components



Operations /Functions/Services of OS

- Memory Management
- Device Management
- Processor Management
- Security
- Error detecting aids
- Coordination between other
- software and users
- Job accounting
- File Management



Cont……

Memory Management

- Keeps tracks of primary memory, i.e., what part of it are in use by whom, what part are not in use.
- Allocates the memory when a process requests it to do so.
- De-allocates the memory when a process no longer needs it or has been terminated.

Processor Management

- Keeps tracks of processor and status of process. The program responsible for this task is known as traffic controller
- Allocates the processor (CPU) to a process.
- De-allocates processor when a process is no longer required.

Cont……

Device Management

- Keeps tracks of all devices. The program responsible for this task is known as the I/O controller.
- Decides which process gets the device when and for how much time.
- Allocates the device in the most efficient way.
- De-allocates devices.

File Management

- Keeps track of information, location, uses, status etc. The collective facilities are often known as file system.
- Decides who gets the resources.
- Allocates the resources.
- De-allocates the resources.

Cont……

Security :- By means of password and similar other techniques, it prevents unauthorized access to programs and data.

Job accounting :- Keeping track of time and resources used by various jobs and users.

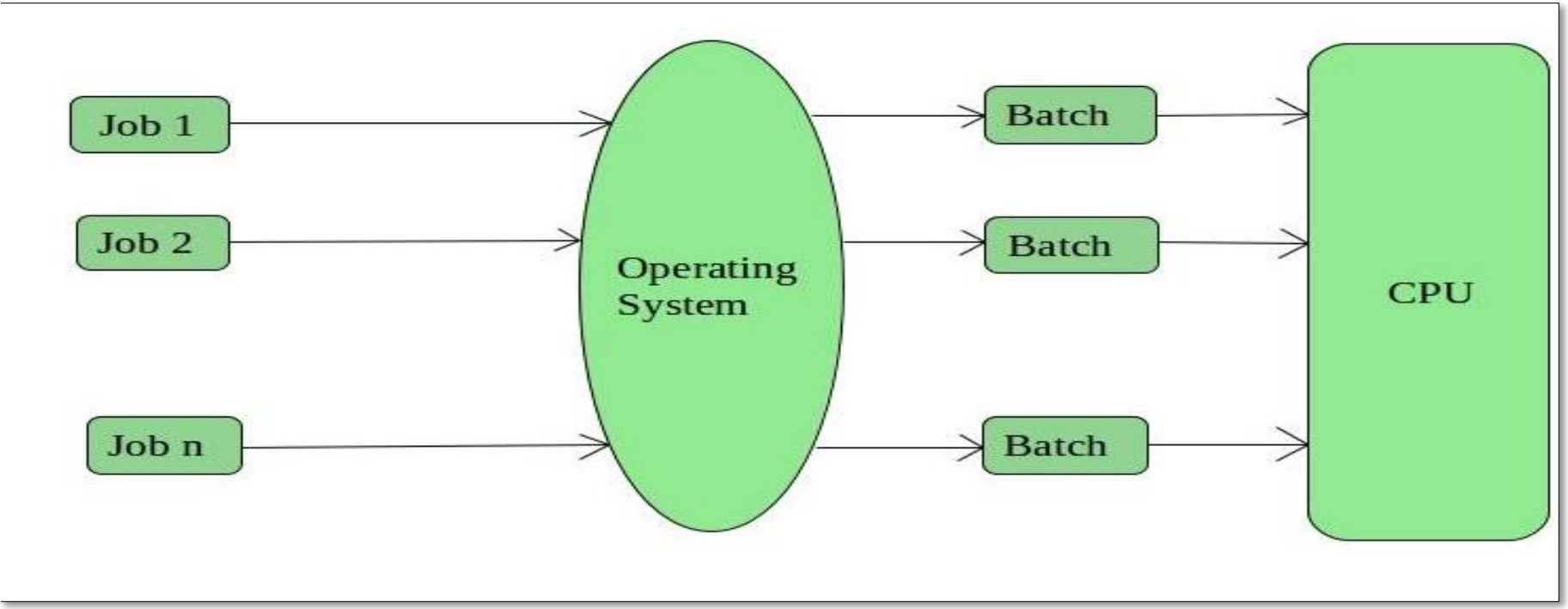
Error detecting aids :- Production of dumps, traces, error messages, and other debugging and error detecting aids.

Coordination between other software and users :- Coordination and assignment of compilers, interpreters, assemblers and other software to the various users of the computer systems.

Operating System – Types

- Batch Operating System
- Multiprogramming operating system
- Time-sharing Operating Systems
- Distributed Operating System
- Real-Time Operating System

Batch Operating System

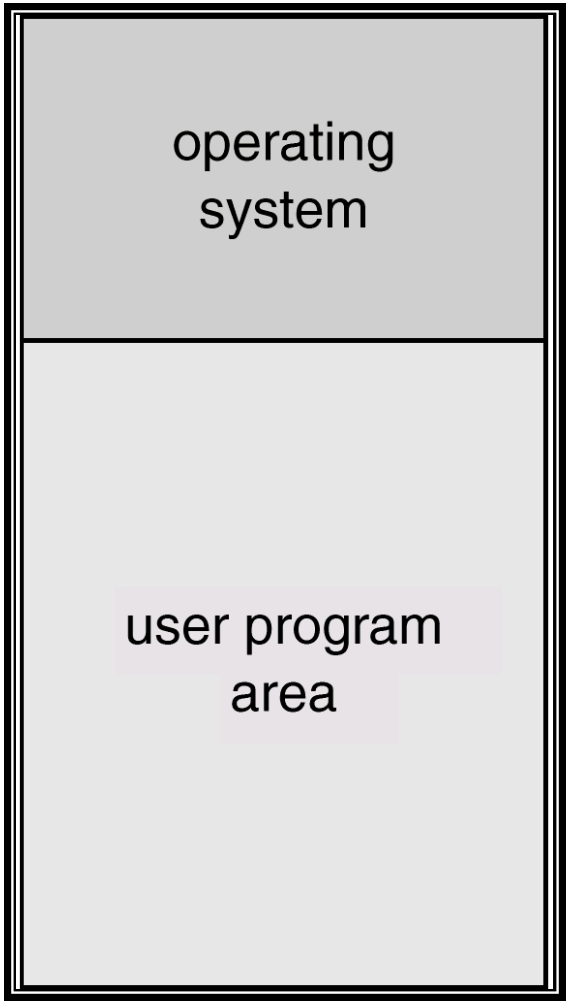


- This type of operating system does not interact with the computer directly. There is an operator which takes similar jobs having same requirement and group them into batches. It is the responsibility of operator to sort the jobs with similar needs.

Batch OS

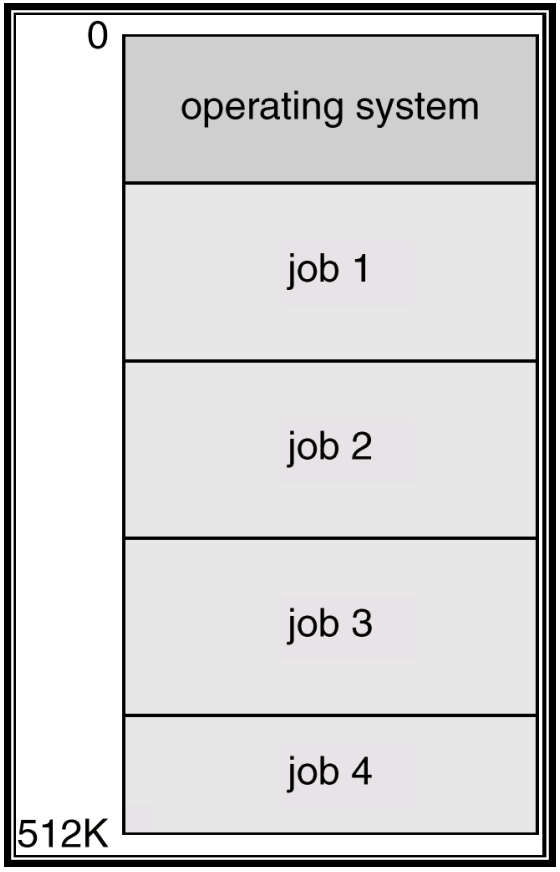
- In a punch card system, human intervention was required for each punch card, which was an overhead.
- Thus in Batch Systems, a collection of cards known as batch used to submit reducing human intervention.
- 2 Types of Cards were used :
  - 1. Data Cards : used to contain actual information
  - 2. Control Cards : Used to control the flow of execution.

Memory Layout for a Simple Batch System



Multiprogrammed Systems

Several jobs are kept in main memory at the same time, and the CPU is multiplexed among them.



OS Features Needed for Multiprogramming

- I/O routine supplied by the system.
- Memory management – the system must allocate the memory to several jobs.
- CPU scheduling – the system must choose among several jobs ready to run.
- Allocation of devices.

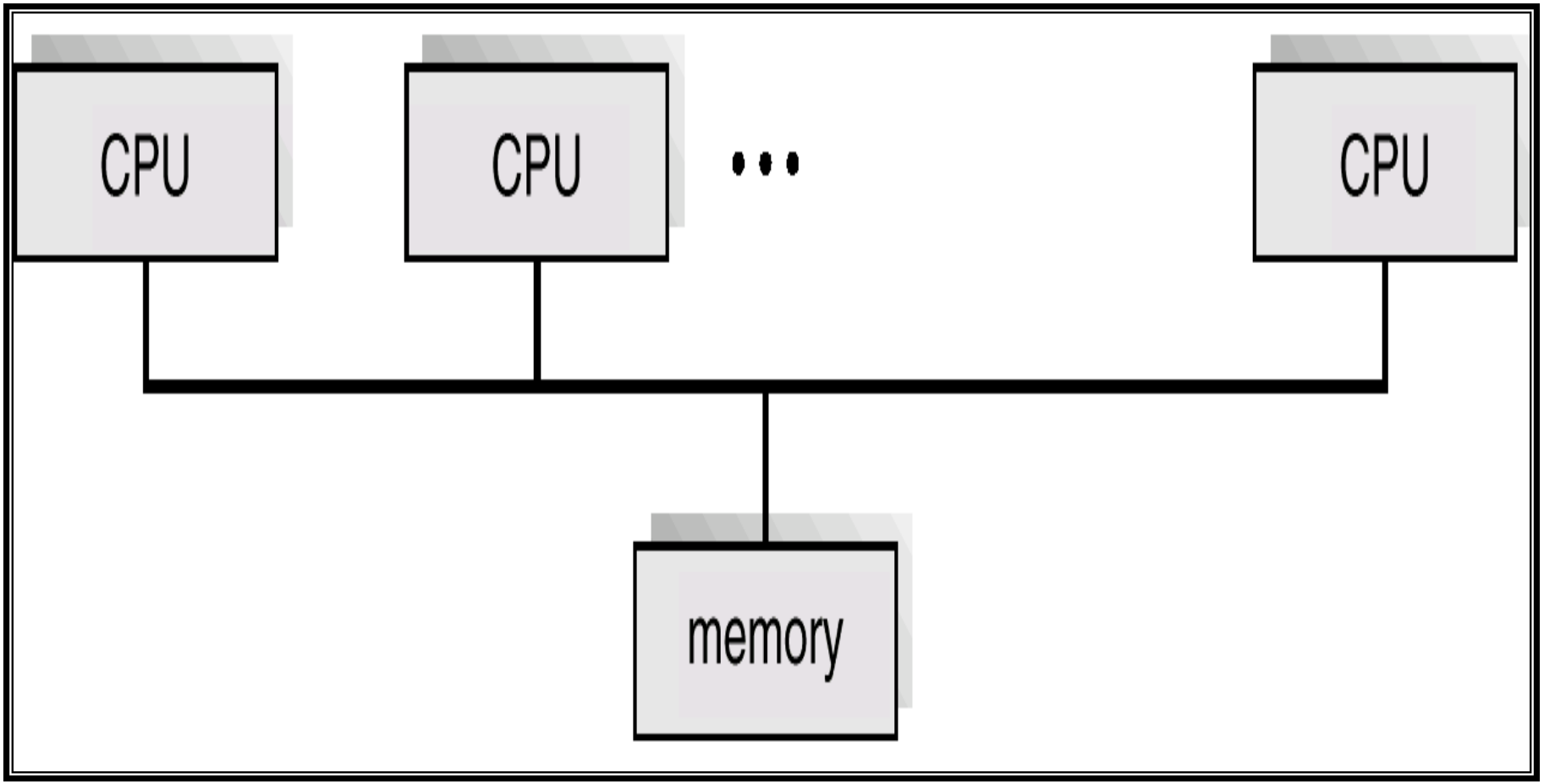
Multiprocessor Systems(Parallel Systems)

- Multiprocessor systems with more than on CPU in close communication.
- *Tightly coupled system* – processors share memory and a clock; communication usually takes place through the shared memory.
- Advantages of parallel system:
  - Increased *throughput*
  - Economical
  - Increased reliability
    - graceful degradation
    - fail-soft systems

Parallel Systems (Cont.)

- *Symmetric multiprocessing (SMP)*
  - Each processor runs and identical copy of the operating system.
  - Many processes can run at once without performance deterioration.
  - 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

Symmetric Multiprocessing Architecture



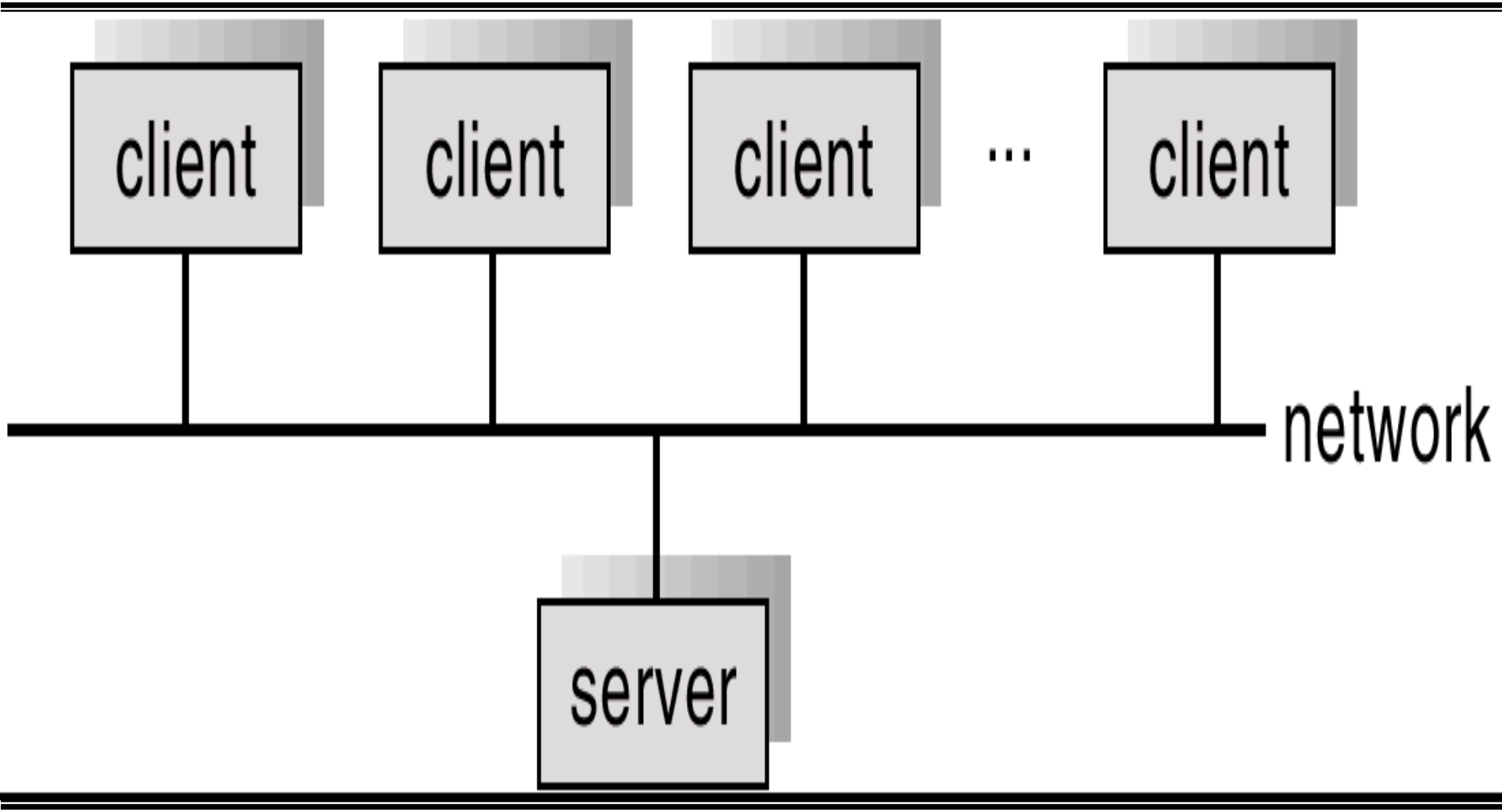
Distributed Systems

- Distribute the computation among several physical processors.
- *Loosely coupled system* – 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
  - Computation speed up – load sharing
  - Reliability
  - Communications

Distributed Systems (cont)

- Requires networking infrastructure.
- Local area networks (LAN) or Wide area networks (WAN)
- May be either client-server or peer-to-peer systems.

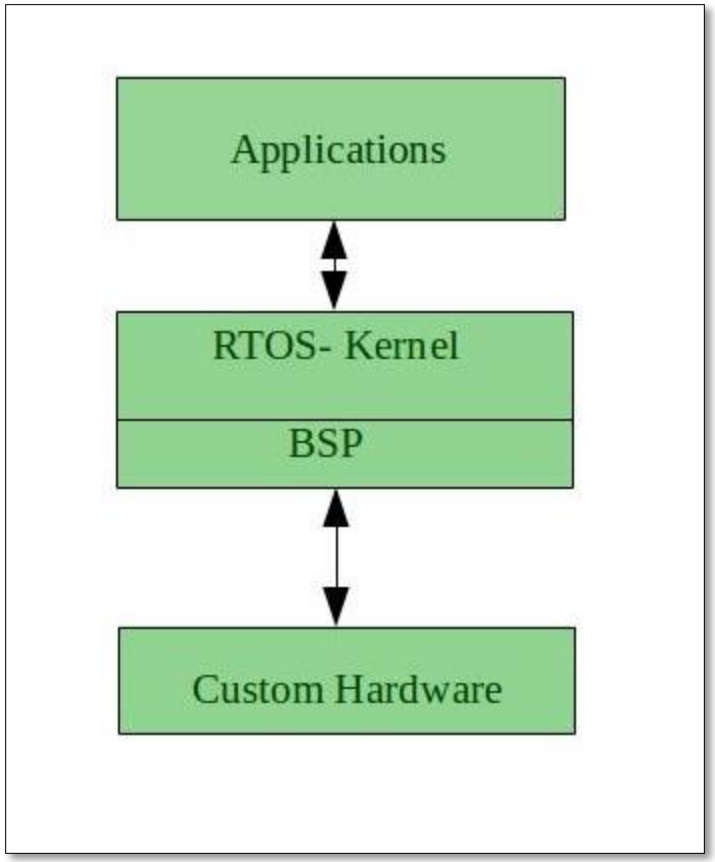
General Structure of Client-Server



Real-Time Systems

- 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.
- Real-Time systems may be either *hard* or *soft* real-time.

Real-Time Systems



Real-Time Systems (Cont.)

- Hard real-time:
  - Secondary storage limited or absent, data stored in short term memory, or read-only memory (ROM)
  - Conflicts with time-sharing systems, not supported by general-purpose operating systems.
- Soft real-time
  - Limited utility in industrial control of robotics
  - Useful in applications (multimedia, virtual reality) requiring advanced operating-system features.

Mobile OS

- A mobile OS is a software that allows smartphones, tablet PCs and other hand held devices to run applications and programs.

- Common Mobile OS
  - Android
  - ios
  - Windows

Command Line & GUI Based OS

- Command Line Based OS :
  - This Permits user to interact with system using commands.
  - Example : DOS, UNIX etc.

- GUI Based OS :
  - This Permits user to interact with system using graphical controls.
  - Example : Windows, LINUX , MaC OS etc.

EXAMPLE


iOS
TIZEN
Operating Systems
Ubuntu
Mac
Windows
Android
ios
Linux
Tizen
Debian
Chrome

Services of OS

- Services for the user
  - **Program execution** – system capability to load a program into memory and to run it.
  - **I/O operations** – since user programs cannot execute I/O operations directly, the operating system must provide some means to perform I/O.
  - **File-system manipulation** – program capability to read, write, create, and delete files.
  - **Communications** – exchange of information between processes executing either on the same computer or on different systems tied together by a network. Implemented via *shared memory* or *message passing*.
  - **Error detection** – ensure correct computing by detecting errors in the CPU and memory hardware, in I/O devices, or in user programs.

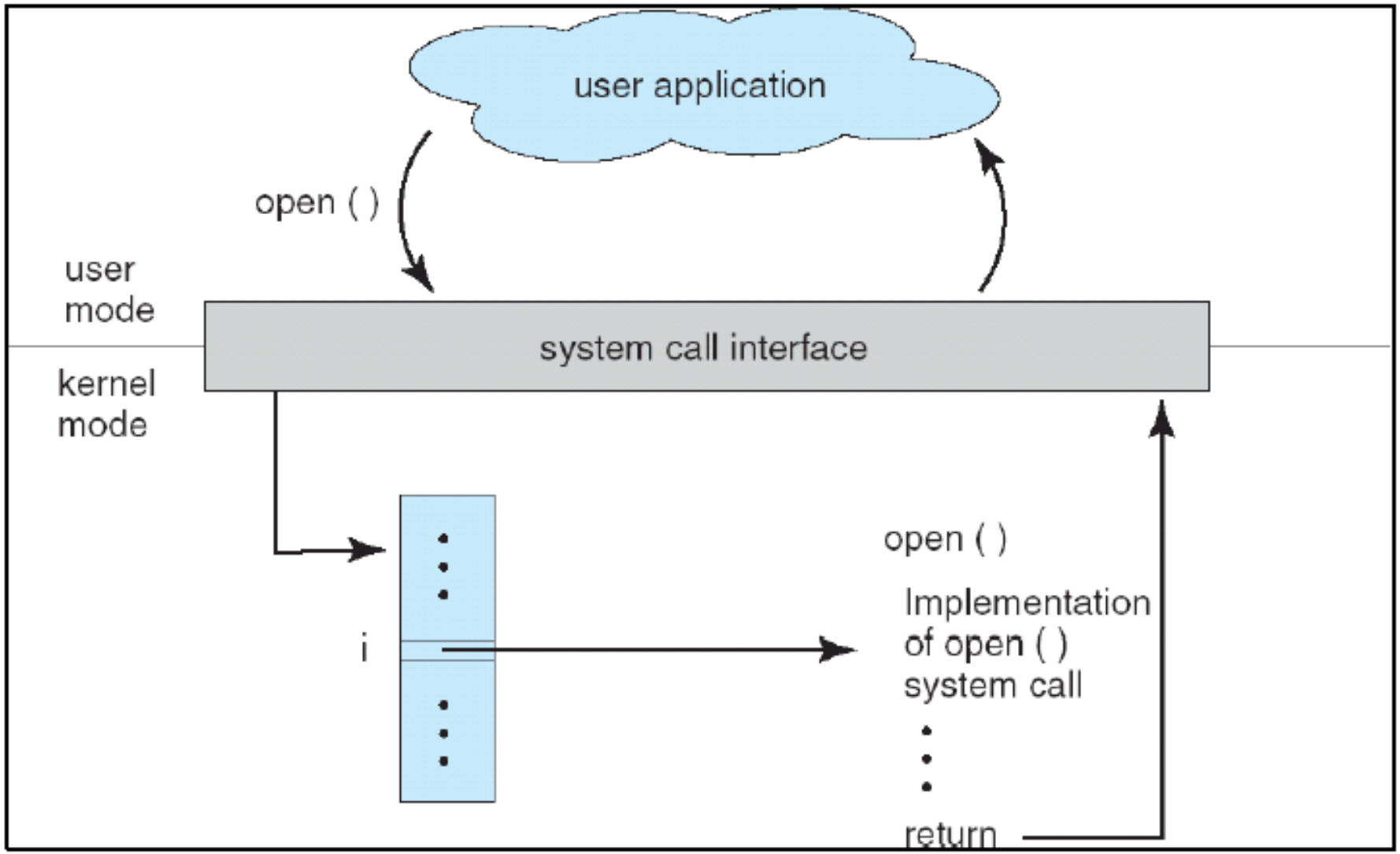
Services of OS(Cont…)

- Services for OS itself
  - **Resource allocation** – allocating resources to multiple users or multiple jobs running at the same time.
  - **Accounting** – keep track of and record which users use how much and what kinds of computer resources for account billing or for accumulating usage statistics.
  - **Protection** – ensuring that all access to system resources is controlled.

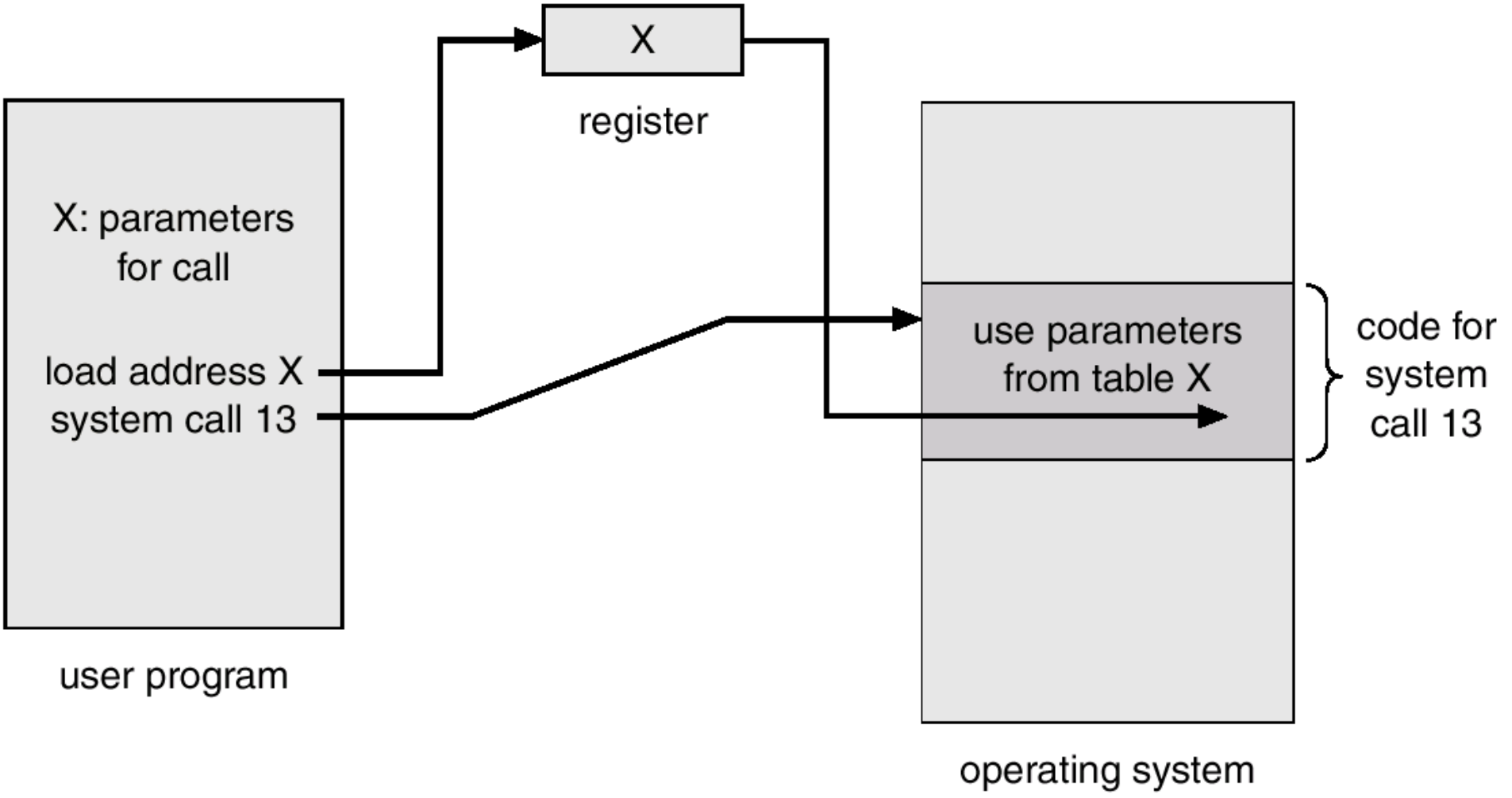
System Calls

- System calls provide the interface between a running program and the operating system.
  - ❖Generally available as assembly-language instructions.
  - ❖Languages defined to replace assembly language for systems programming allow system calls to be made directly (e.g., C, C++)
- Three general methods are used to pass parameters between a running program and the operating system.
  1) Pass parameters in *registers*.
  2) Store the parameters in a table in memory, and the table address is passed as a parameter in a register.
  3) *Push* (store) the parameters onto the *stack* by the program, and *pop* off the stack by operating system.

Example of open System Calls



Passing of Parameters As A Table



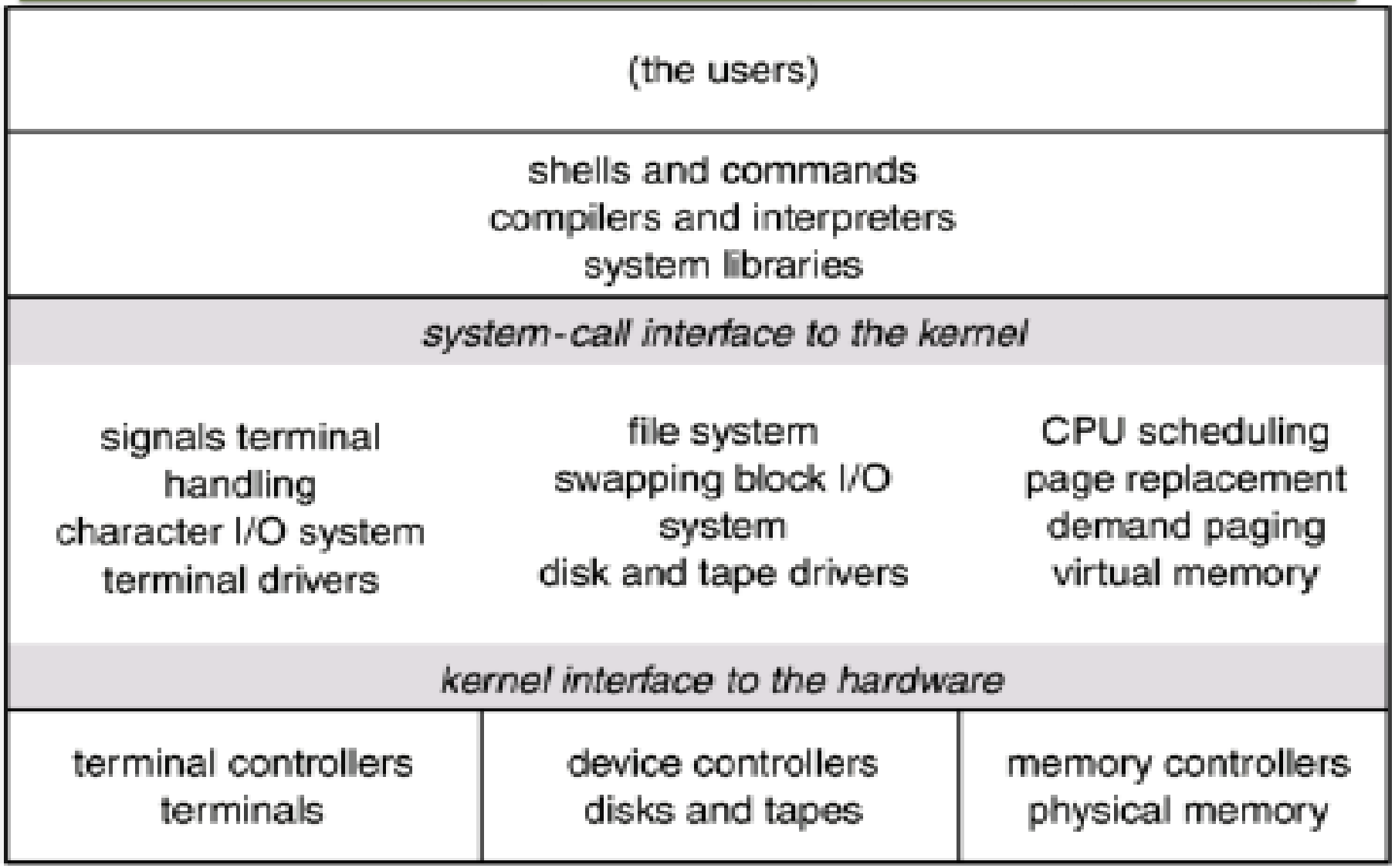
Types of System Calls

- Process control
- File management
- Device management
- Information maintenance
- Communications

OS Components

- Process Management
- Main Memory Management
- File Management
- I/O System Management
- Secondary Management

Structure of UNIX operating system



Process Management

A *process* is a program in execution. A process needs certain resources, including CPU time, memory, files, and I/O devices, to accomplish its task.

- The operating system is responsible for the following activities in connection with process management.
  - Process creation and deletion.
  - process suspension and resumption.
  - Provision of mechanisms for:
    - process synchronization
    - process communication

System Calls related to Process control are

- End, Abort
- Load, Execute
- Create process, Terminate process
- Ready process, Dispatch process
- Suspend process, Resume process
- Get process attributes, Set process attributes
- Wait for Time
- Wait event, Signal event
- Change priority of process

Main-Memory Management

- Memory is a large array of words or bytes, each with its own address. It is a repository of quickly accessible data shared by the CPU and I/O devices.
- Main memory is a volatile storage device. It loses its contents in the case of system failure.
- The operating system is responsible for the following activities in connections with memory management:
  - Keep track of which parts of memory are currently being used and by whom.
  - Decide which processes to load when memory space becomes available.
  - Allocate and deallocate memory space as needed.

File Management

- A file is a collection of related information defined by its creator. Commonly, files represent programs (both source and object forms) and data.
- The operating system is responsible for the following activities in connections with file management:
  - File creation and deletion.
  - Directory creation and deletion.
  - Support of primitives for manipulating files and directories.
  - Mapping files onto secondary storage.
  - File backup on stable (nonvolatile) storage media.

System Calls related to File Managememt are

- Create file, Delete file
- Open a file, Close a file
- Create directory
- Read, Write, Reposition
- Get file attributes, Set file attributes
- Create a link
- Change working directory

I/O System Management

The I/O system consists of:

- A buffer-caching system
- A general device-driver interface
- Drivers for specific hardware devices

Device Management

- Files can be thought of as abstract or virtual devices. Thus many of the system calls for files are also needed for devices. If there are multiple users of the system however we must first request the device to ensure that we have exclusive use of it. After we are finished with the device, we must release it. These functions are similar to the open/close system calls for files.
- Once, the device has been requested we can read, write and reposition the device just as with files. In fact the similarity between input/output devices and files is so great that many operating systems merge the two into a combined file/device structure. In this case input/output devices are identified by special file names

System Calls related to device Management

- Request device, Release device
- Read, Write, Reposition
- Get device attributes, Set device attributes

Information Maintenance

- Many system calls exist simply for the purpose of transferring information between the user program and the operating system. For example most systems have a system call to return the current time and date. Other system calls may return information about the system such as the number of current users, the version number of the operating system, the amount of free memory or disk space and so on.
- In addition the operating system keeps information about all of its jobs and processes and there are system calls to access this information. Generally, there are also calls to reset it. (get process attributes and set process attributes).

System Calls related to Information Maintenance

- Get Time or Date, Set Time or Date
- Get system Data, Set system Data
- Get process, File or Device attributes
- Set process, File or Device attributes

Secondary-Storage Management

- Since main memory (*primary storage*) is volatile and too small to accommodate all data and programs permanently, the computer system must provide *secondary storage* to back up main memory.
- Most modern computer systems use disks as the principle on-line storage medium, for both programs and data.
- The operating system is responsible for the following activities in connection with disk management:
  - Free space management
  - Storage allocation
  - Disk scheduling

Thank you……

You can mail your Queries to :

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