

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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Lecture-7 By Vivek Dubey

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COMPUTER SCIENCE AND ENGINEERING

CS403PC

COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

CS403PC

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

Scheme of Operating System

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S. No.	Course Code	Course Title	L	T	P	Credits
3	CS403PC	Operating Systems	3	0	0	3
6	CS406PC	Operating Systems Lab	0	0	3	1.5

UNIT-1: *Operating System - Introduction*



- **Structures –**
 - Simple Batch, Multi-programmed, Time-shared,
- **Systems –**
 - Personal Computer, Parallel, Distributed Systems, Real-Time Systems
- **System components**
- **Operating System Services**
- **System Calls**

System components

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

Process Management

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- 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

Main Memory Management

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- **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 de-allocate memory space as needed.

File Management

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- 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.

I/O System

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- The I/O system consists of:
 - A buffer-caching system
 - A general device-driver interface
 - Drivers for specific hardware devices

Secondary-Storage Management

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- 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

Operating System Services

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- **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.

Contd.. *Operating System Services*

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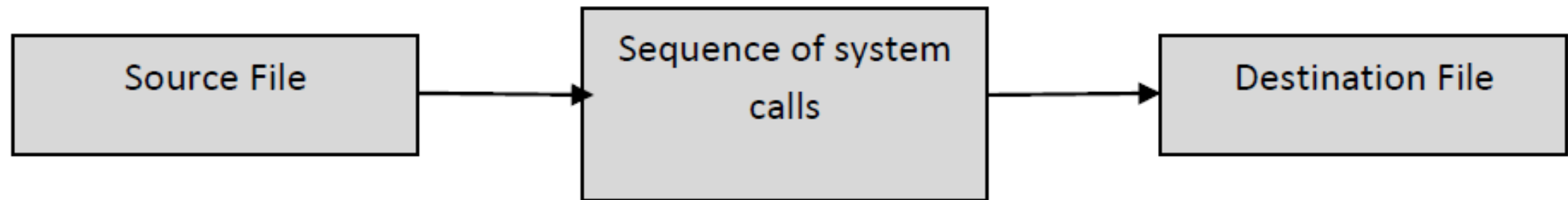
- Additional functions exist not for helping the user, but rather for ensuring efficient system operations.
 - **Resource allocation** – allocating resources to multiple users or multiple jobs running at the same time.
 - **Accounting** – keep track and record which users use how much and what kinds of computer resources for account billing or for accumulating usage statistics.
 - **Protection** – ensuring that all access to system resources is controlled.

System Calls

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- System calls **provide the interface** between a running program and the operating system.
 - Generally available as **assembly-language instructions**.
 - **C , C++ Languages** defined to replace assembly language for systems programming allow system calls to be made directly.
- Example: A routine to read data from one file and copy them to another file.



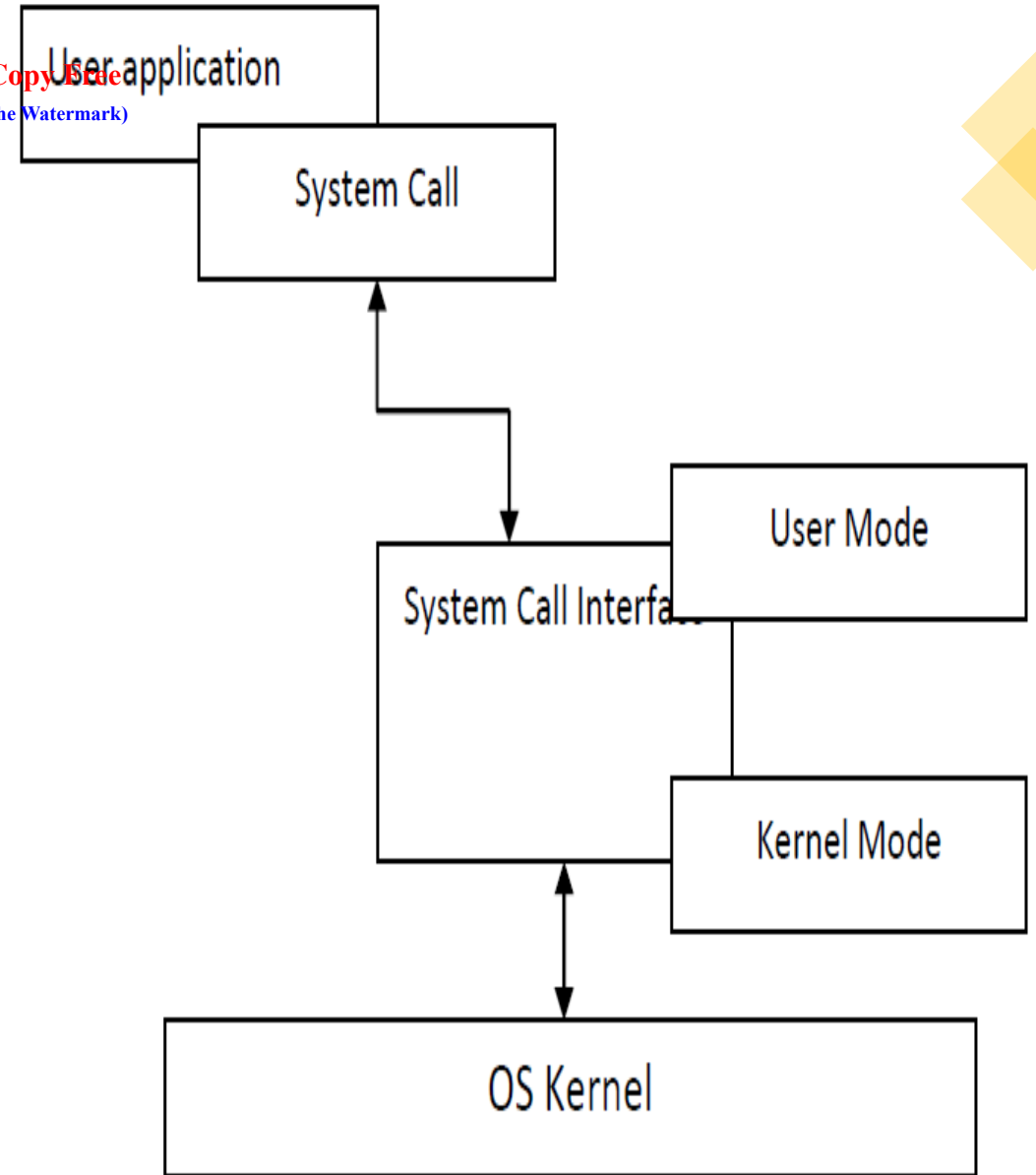
Application Program Interface



- Application developers design programs according to an Application Programming Interface (API) that specifies a set of functions with required parameters that are passed to each function for performing the task.
- **Common APIs are:**
 - Windows API for Windows systems
 - POSIX API for POSIX-based systems
 - Java API for Java Virtual Machine
- An API is assessed through the library of code (.lib) **provided by the operating system.** For example, Windows function `CreateProcess()` invokes the `NTCreateProcess()` system call in the Windows kernel.

System call interface

- In most of the programming languages, run-time support system provides a system call interface that serves as the link to system calls made available by the operating system.
 - The **system-call interface** intercepts function calls in the API and invokes the necessary system calls within the operating system.
 - **Each system call has a unique number associated to it, and the system-call interface maintains a table indexed according to these numbers**
- The **system call interface** then **invokes the intended system call in the operating-system kernel** and **returns the status of the system call.**



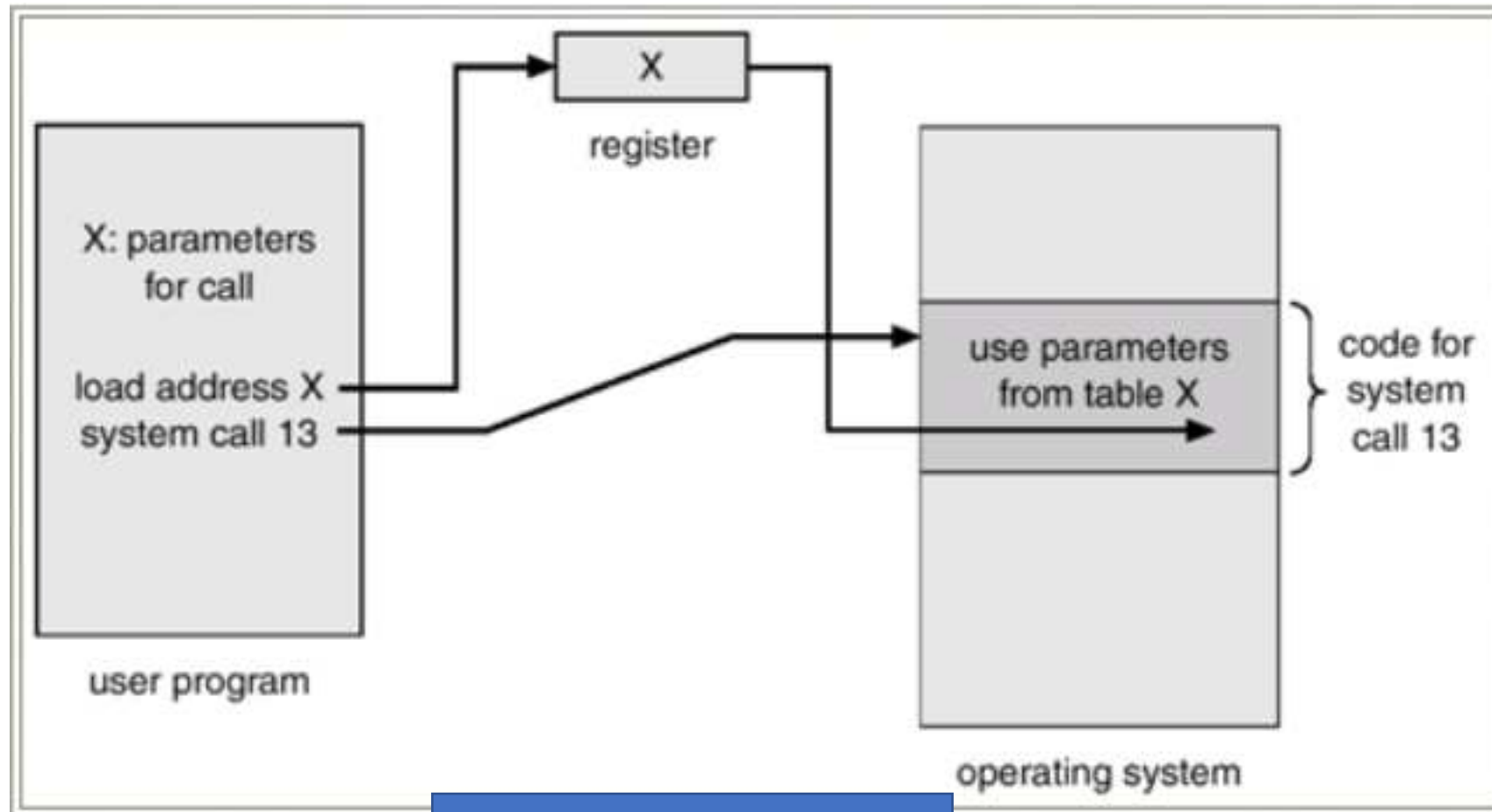
Passing Parameters Methods



- Three general methods *are used to pass parameters between a running program and the operating system.*
 - **Pass parameters** in registers.
 - **Store the parameters** *in a table in memory, and the table address is passed as a parameter in a register.*
 - **Push (store) the parameters** onto the stack by the program, and pop off the stack by operating system.

Passing of Parameters as a Table

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Type of System Call

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

Process Control

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- end, abort,
- load, execute
- create process, terminate process
- get process attributes, set process attributes
- wait for time
- wait event, signal event
- allocate and free memory

File management

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- create file,
- delete file, open, Close
- read, write,
- Reposition get file attributes,
- set file attributes

Device management

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- request device, release device
- read, write, reposition
- get device attributes, set device attributes
- logically attach or detach devices

Information maintenance

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- Communications may be via shared memory or through message passing (using mailbox)
- 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

Communication

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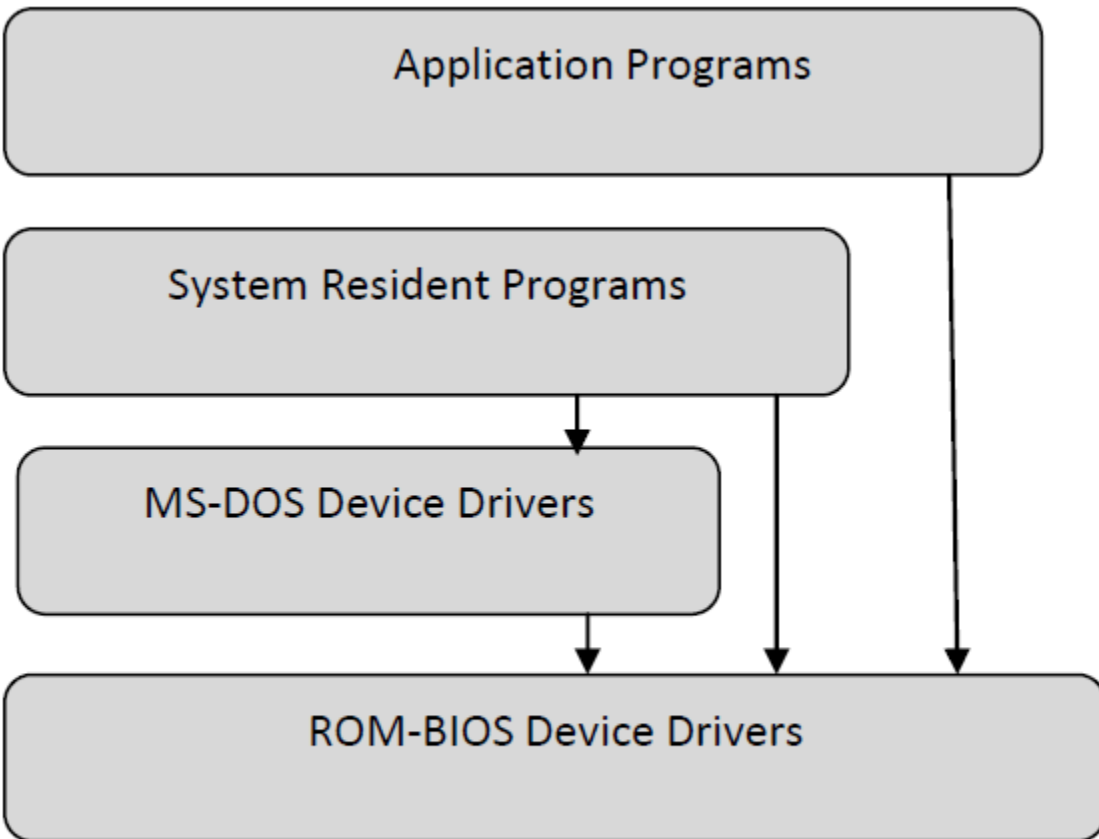


- Create, delete communication connection
- Send, receive messages
- Transfer status information
- Attach or detach remote devices

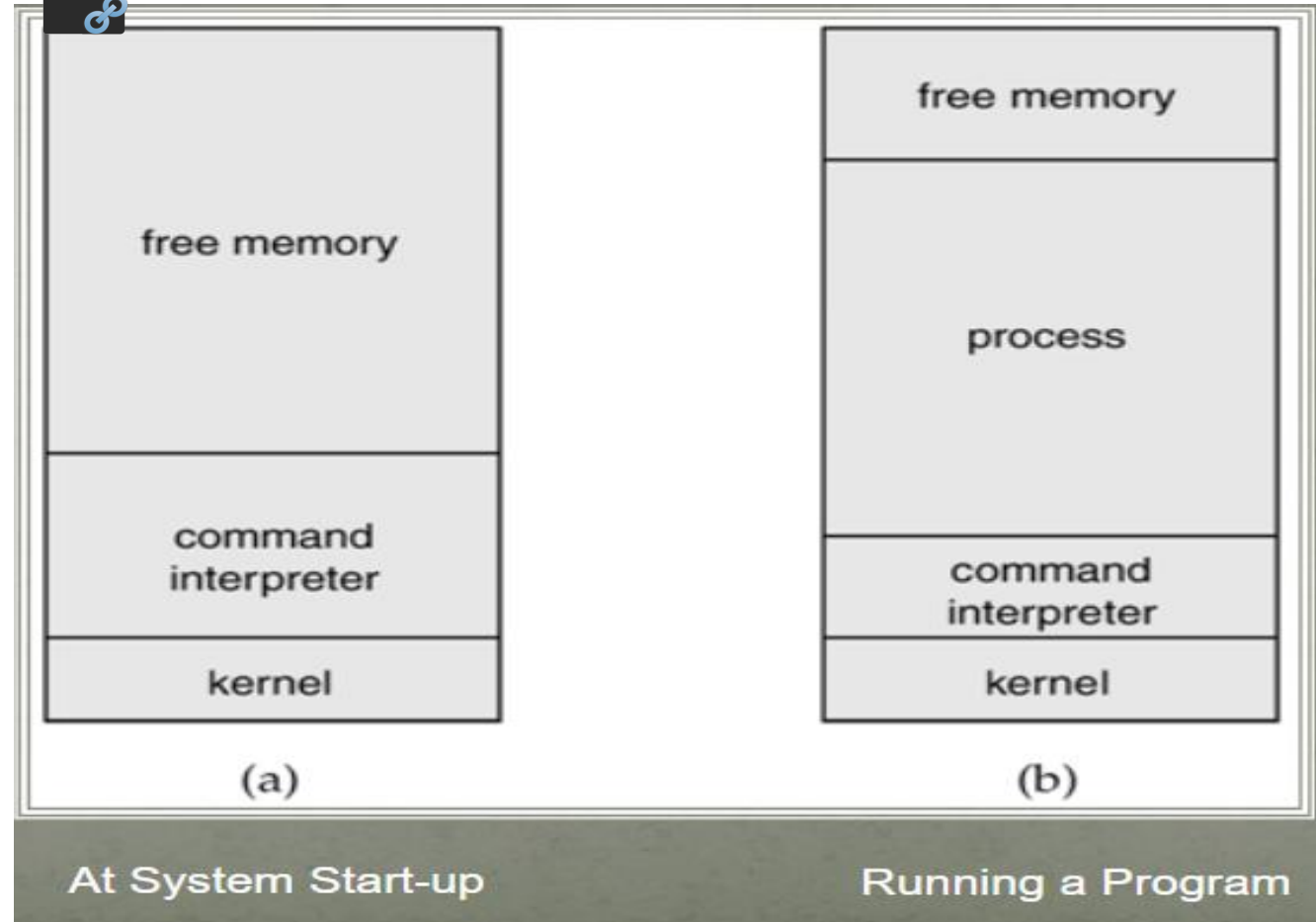
MS-DOS Execution

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MS-DOS system structure



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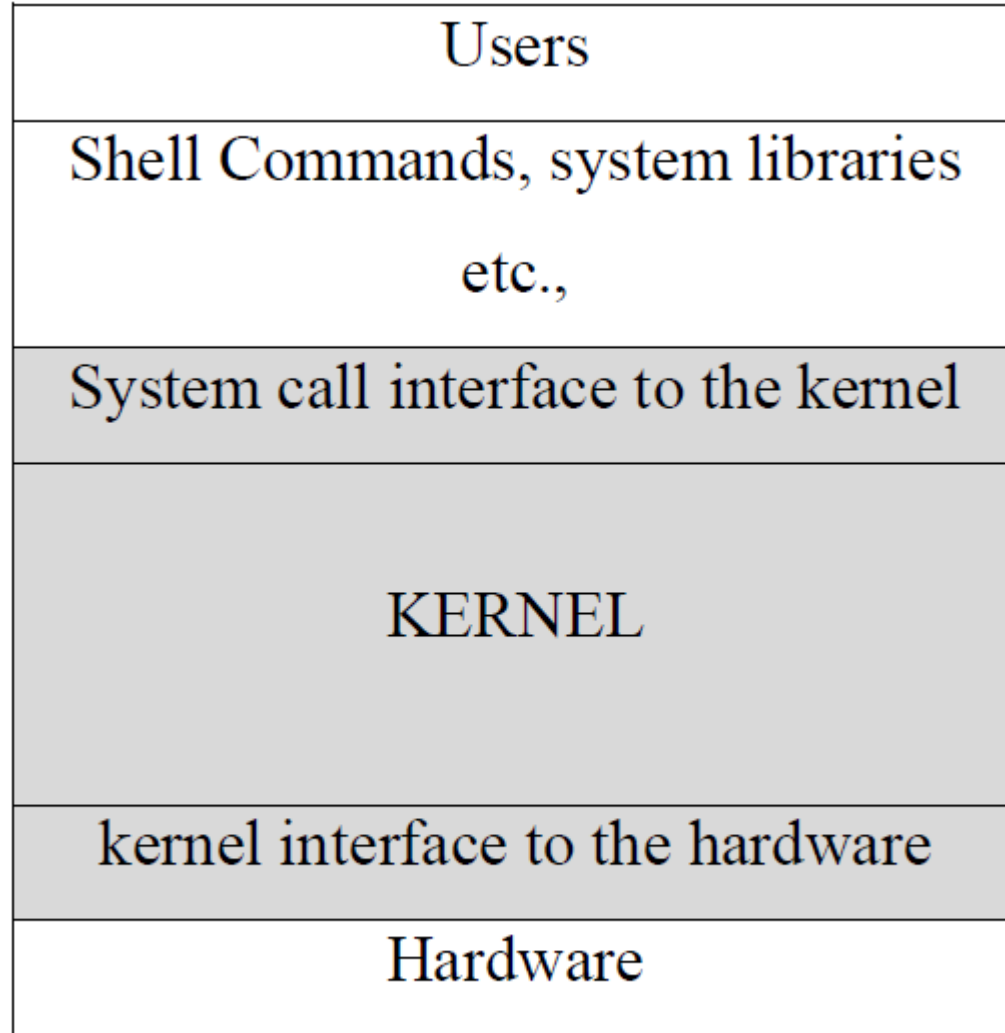
UNIX Structure



- Has two separable parts: the kernel and the system programs.
- The kernel is further separated into a series of interfaces and device drivers
- Everything below the system-call interface and above the physical hardware is the kernel.
- The kernel provides the file system, CPU scheduling, memory management, and other operating-system functions through system calls.
- It had a **distinct performance advantage**, however: there is very little overhead in the system call interface or in communication within the kernel.



Layered Structure



UNIX system structure

