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Operating-Systems-Notes

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Operating-Systems-Notes / 1-Overview.md

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Preview Code Blame Raw

Operating Systems Overview

Operating Systems :

- Direct operational resources [CPU, memory, devices]
- Enforces working policies [Resource usage, access]
- Mitigates difficulty of complex tasks [abstract hardware details (using system calls)]

What is an Operating System?

- Intermediate between Hardware and Software applications
- Hides hardware complexity (Read/write file storage, send/receive socket network)
- Handles resource management (CPU scheduling, Memory management)
- Provide isolation and protection (allocate different parts of memory to different applications so that applications don't overwrite other memory locations)

Operating System definition:

An **Operating System** is a layer of systems software that:

- directly has privileged access to the underlying hardware;
- hides the hardware complexity;
- manages hardware on behalf of one or more application according to some predifined policies.

- In addition, it ensures that applications are isolated and protected from one another.

Operating System examples:

Desktop	Embedded devices
Microsoft Windows	Android OS
MAC OS X (BSD)	iOS
LINUX	Symbian
...	...

OS Elements

- **Abstractions** (corresponds to applications that OS executes)
  - process, thread, file, socket, memory page
- **Mechanisms** (on top of Abstractions)
  - create, schedule, open, write, allocate
- **Policies** (how mechanisms are used to manage underlying hardware)
  - Least Recently Used (LRU) , Earliest Deadline First (EDF), etc.

Example :

Memory Management:

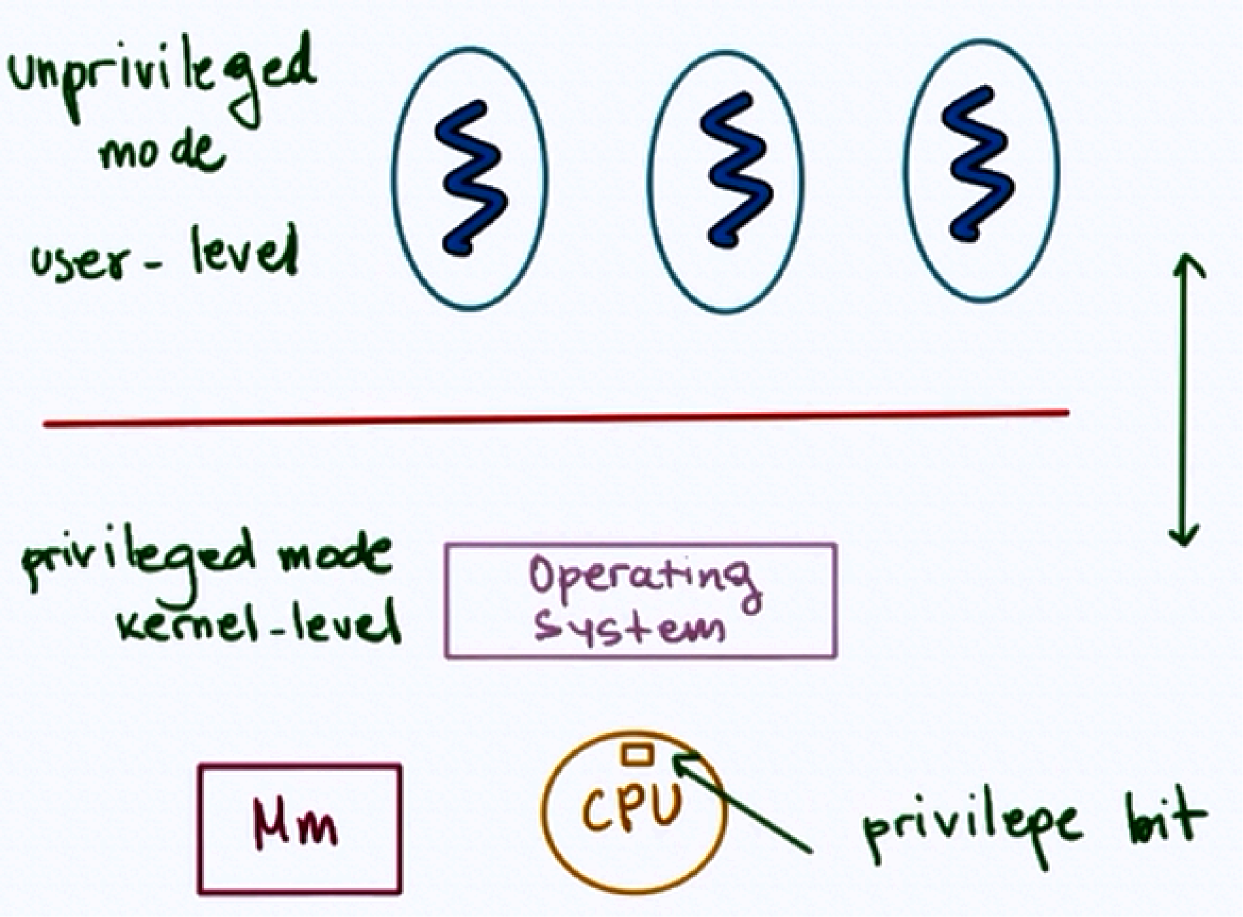
- **Abstractions**: Memory page
- **Mechanisms**: Allocate, map to a process
- **Policies**: LRU

OS Design Principles

- Seperation of mechanism and policy
  - implement flexible mechanisms to support many policies
  - e.g. LRU, LFU, random
- Optimize for common case
  - Where will the OS be used?
  - What will the user want to execute on that machine?
  - What are the workload requirements?

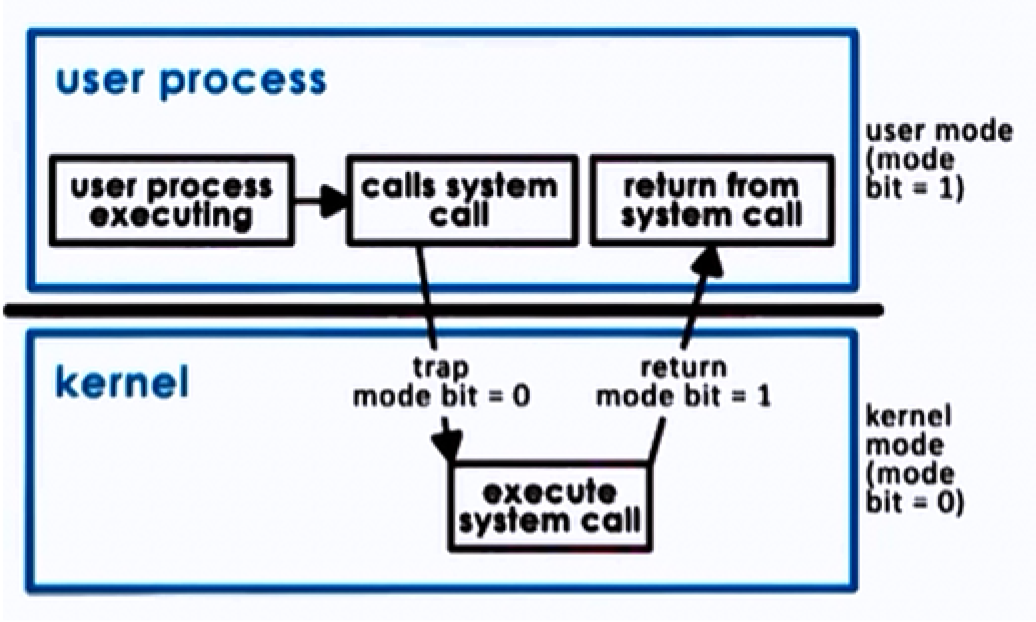
User/ Kernel Protection Boundary

- user-level => applications [underprivileged mode]
- kernel-level => OS Kernel [privileged access, hardware access]



- User-Kernel switch is supported by hardware.
  - using trap instructions
  - system calls like:
    - open (file)
    - send (socket)
    - malloc (memory)
  - signals

System call Flowcart



- To make a system call, an application must:
  - write arguments
  - save relevant data ast well defined location
  - make system calls using system call number
- In synchronous mode : wait until system call completes.

Basic OS services

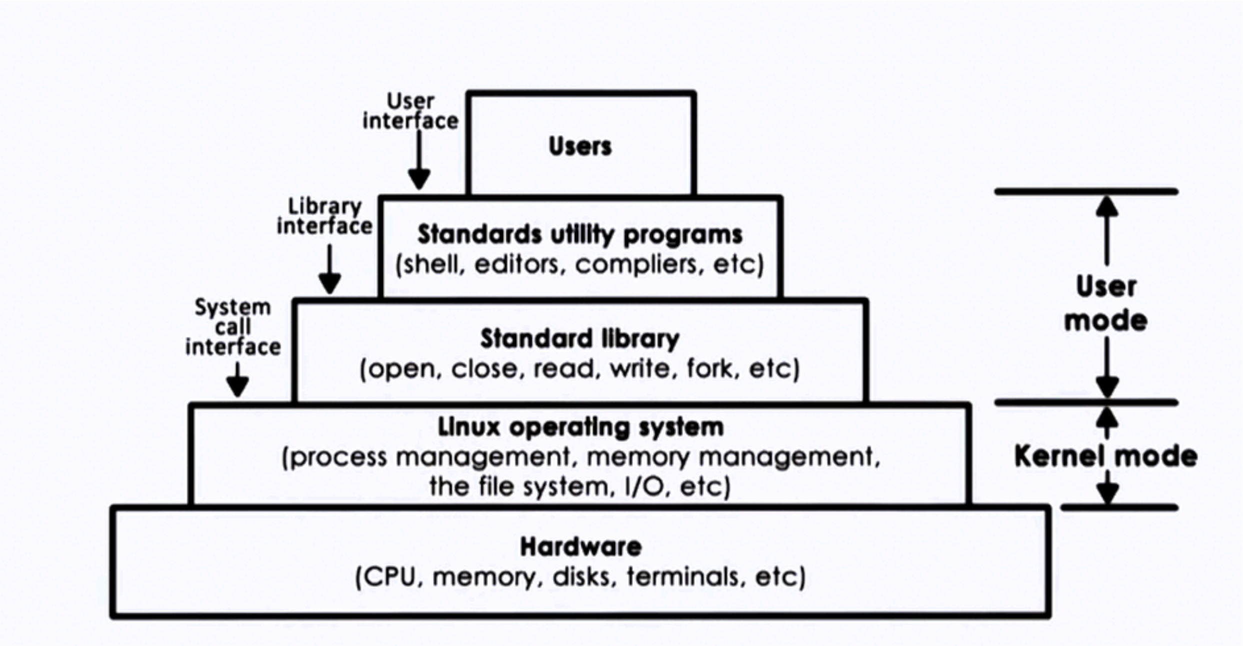
- process management
- file management
- device management
- memory management
- storage management
- security

Linux System Calls

Task	Commands
Process Control	fork (); exit(); wait();
File Manipulation	open(); read(); write();
Device Manipulation	ioctl(); read(); write();
Information Maintenance	getpid(); alarm(); sleep();

Task	Commands
Communication	pipe(); shmget(); mmap();
Protection	chmod(); umask(); chown();

Linux Architecture


User interface
Users
Library interface
Standards utility programs
(shell, editors, compliers, etc)
System call interface
Standard library
(open, close, read, write, fork, etc)
Linux operating system
(process management, memory management, the file system, I/O, etc)
Hardware
(CPU, memory, disks, terminals, etc)
User mode
Kernel mode