User Mode vs Supervisor Mode (Kernel Mode)

1 What is it?

Modern processors support at least two operating modes to protect system resources and ensure safe multitasking:

- **User Mode:** Limited access mode — used for applications such as browsers, games, etc.
- **Supervisor Mode (Kernel Mode):** Full access mode — used for operating system tasks like memory management, I/O control, and system calls.

2 Key Differences

Feature	User Mode	Supervisor Mode (Kernel)
Access to hardware	No direct access	Full access
CPU instruction set	Limited	Full (including privileged instructions)
Memory access	Restricted	Full memory access
Who operates here?	User applications	Operating System kernel
Safety	Very safe (cannot crash OS)	Risky if misused

Table 1: Comparison of User Mode and Supervisor Mode

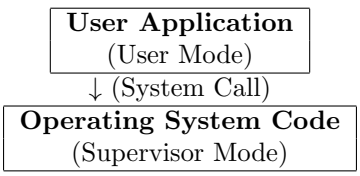
3 Why is it Important?

- Prevents accidental or malicious code from damaging the system.
- Supports multitasking and security isolation.
- Enables system calls — e.g., when a user app requests access to a file, it switches to Supervisor Mode.

4 Mode Switching

When an application needs services from the operating system, it uses a **system call**.

Diagram of Mode Switching



Example in C

Listing 1: System call from user mode

```
open("data.txt", O_RDONLY); // Triggers a syscall
```

5 Real-world Analogy

- **User Mode:** Like a hotel guest — can use services but cannot access staff-only areas.
- **Supervisor Mode:** Like a hotel manager — has master keys and full control over the entire facility.