

## What is an Operating System?

- Three views of an operating system

**Application View:** what services does it provide?

**System View:** what problems does it solve?

**Implementation View:** how is it built?

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An operating system is part cop, part facilitator.

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## Application View of an Operating System

- The OS provides an execution environment for running programs.
  - The execution environment provides a program with the processor time and memory space that it needs to run.
  - The execution environment provides interfaces through which a program can use networks, storage, I/O devices, and other system hardware components.
    - \* Interfaces provide a simplified, abstract view of hardware to application programs.
  - The execution environment isolates running programs from one another and prevents undesirable interactions among them.

## Other Views of an Operating System

**System View:** The OS manages the hardware resources of a computer system.

- Resources include processors, memory, disks and other storage devices, network interfaces, I/O devices such as keyboards, mice and monitors, and so on.
- The operating system allocates resources among running programs. It controls the sharing of resources among programs.
- The OS itself also uses resources, which it must share with application programs.

**Implementation View:** The OS is a concurrent, real-time program.

- Concurrency arises naturally in an OS when it supports concurrent applications, and because it must interact directly with the hardware.
- Hardware interactions also impose timing constraints.

## The Operating System and the Kernel

- Some terminology:

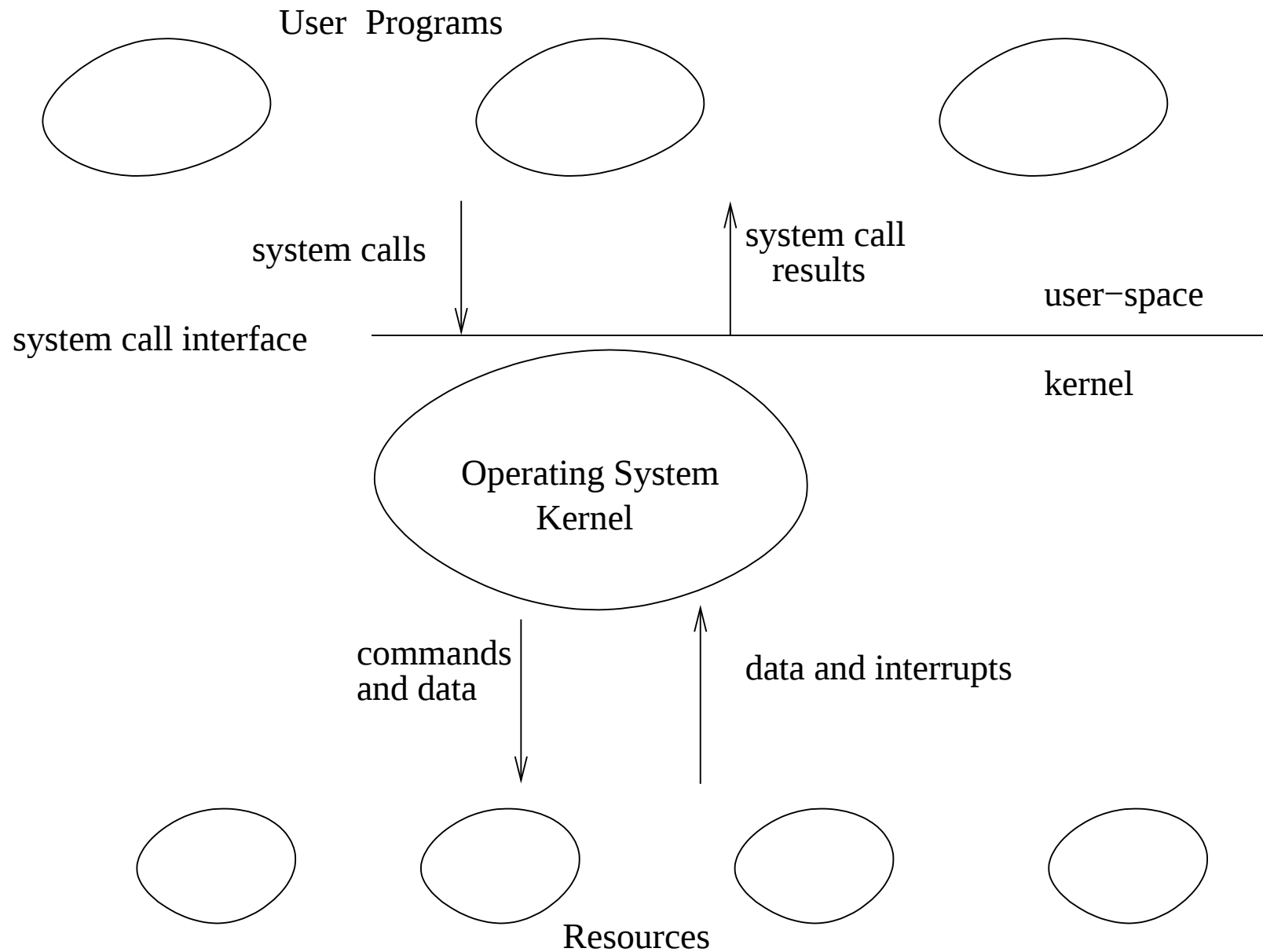
**kernel:** The operating system kernel is the part of the operating system that responds to system calls, interrupts and exceptions.

**operating system:** The operating system as a whole includes the kernel, and may include other related programs that provide services for applications.

This may include things like:

- utility programs
- command interpreters
- programming libraries

## Schematic View of an Operating System



## Operating System Abstractions

- The execution environment provided by the OS includes a variety of abstract entities that can be manipulated by a running program. Examples:

**files and file systems:** abstract view of secondary storage

**address spaces:** abstract view of primary memory

**processes, threads:** abstract view of program execution

**sockets, pipes:** abstract view of network or other message channels

- This course will cover
  - why these abstractions are designed the way they are
  - how these abstractions are manipulated by application programs
  - how these abstractions are implemented by the OS

## Course Outline

- Introduction
- Threads and Concurrency
- Synchronization
- Processes and the Kernel
- Virtual Memory
- Scheduling
- Devices and Device Management
- File Systems
- Interprocess Communication and Networking (time permitting)