



جامعة المستقبل  
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## Lecture 03: (Operating systems)

وصف المحاضرة: نظام التشغيل

**Subject: Computer Organization and Logic Design**

**First Stage: Semester II**

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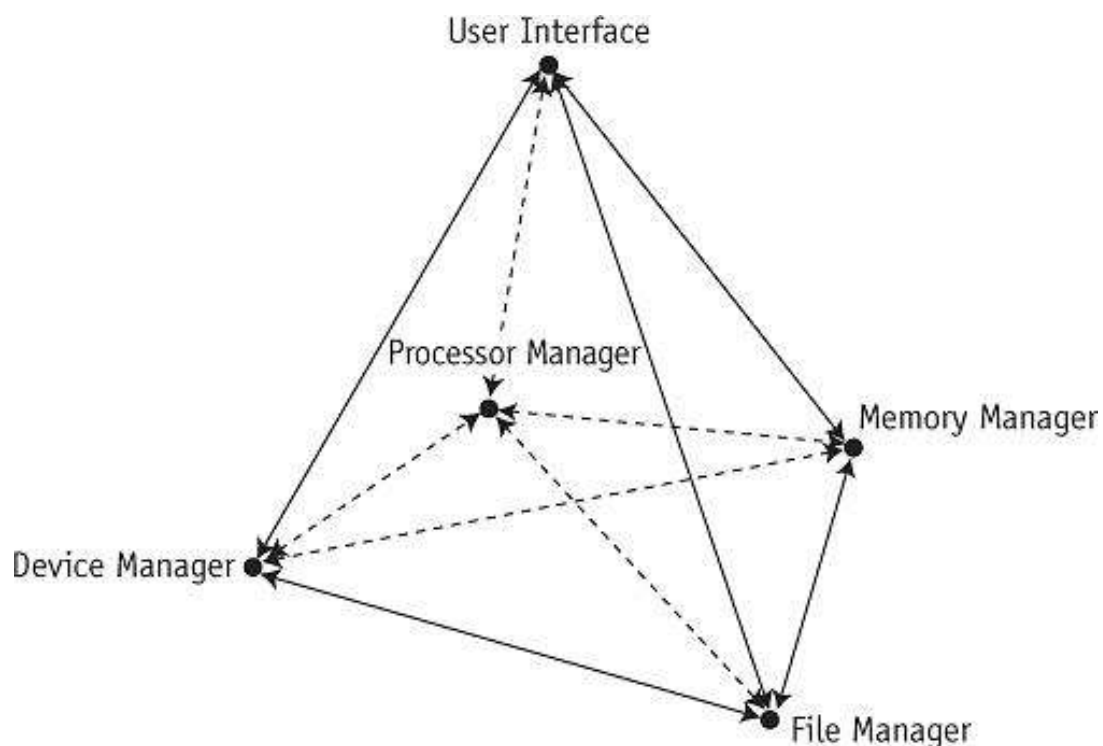
## **OPERATING SYSTEMS**

### **Introduction:**

- Manage computer system hardware and software
  - This text explores:
    - What they are
    - How they work
    - What they do
    - Why they do it
  
- **What is an Operating System?**
  - Computer system
    - **Software** (programs)
    - **Hardware** (tangible machine/electronic components)
  - Operating system
    - Chief software component
    - Manages all hardware and all software and controls:
      - ✓ Every file, device, section of main memory, and moment of processing time
      - ✓ Who can use the system and how system is used.



- Includes four essential subsystem managers
  - Memory Manager
  - Processor Manager
  - Device Manager
  - File Manager
- Each manager:
  - Works closely with other managers
  - Performs a unique role



**Figure 1.1:** This pyramid represents an operating system on a stand-alone computer unconnected to a network. It shows the four subsystem managers and the User Interface.



- User Interface
  - Allows the user to issue commands to the operating system
- Manager tasks
  - Monitor the system's resources continuously
  - Enforce policies determining:
    - ✓ Who gets what, when, and howmuch?
  - Allocate a resource (when appropriate)
  - Deallocate a resource (when appropriate)

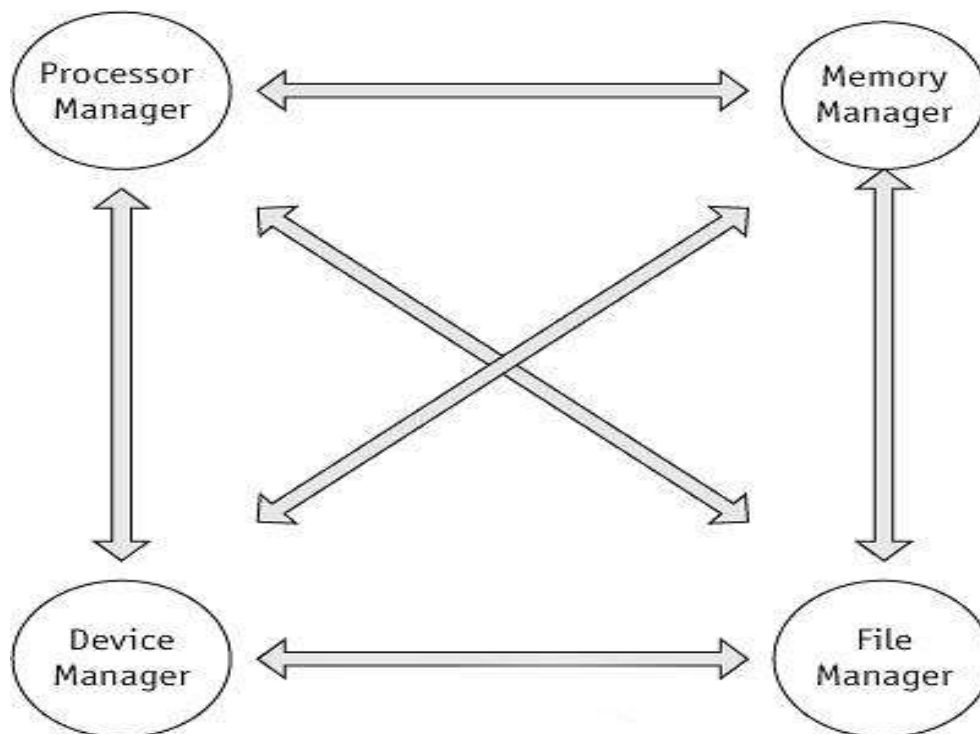


Figure 1.2: Each manager at the base of the pyramid takes responsibility for its own tasks while working harmoniously with every other manager.



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- **Network Manager**

- Coordinates the services required for multiple systems to work cohesively together
  - Shared network resources: memory space, processors, printers, databases, applications, etc.

- **Main Memory Management**

- In charge of main memory
  - Random access memory (RAM)
  - Requires constant flow of electricity to hold data

- **Responsibilities include:**

- Checking validity and legality of memory space request
- Reallocating memory to make more useable space available
- Deallocating memory to reclaim it
- Protecting space in main memory occupied by operating system



- **Read-only memory (ROM)**

- Another type of memory
- Critical when computer is powered on
- Holds firmware: programming code
  - When and how to load each piece of the operating system after the power is turned on
- Non-volatile
  - Contents retained when the power is turned off

- **Processor Management**

- Allocation of Central Processing Unit (CPU)
- Tracks process status
  - Program's "instance of execution"
- Comparable to a traffic controller
  - When a process is finished or maximum computation time expired
  - Processor Manager reclaims the CPU and allocates to next waiting process
- **Computer with multiple CPUs**
  - More complex management



### ▪ **Device Management**

- In charge of connecting with every available device
  - Printers, ports, disk drives, etc.
- Responsibilities include:
  - Choosing most efficient resource allocation method
    - ✓ Based on scheduling policy
  - Identifying each device uniquely
  - Starting device operation (when appropriate)
  - Monitoring device progress
  - Deallocating the device

### ▪ **File Management**

- In charge of tracking every file in the system
  - Data files, program files, compilers, application programs, etc.
- Responsibilities include:
  - Enforcing user/program resource access restrictions
    - ✓ Uses predetermined access policies
  - Controlling user/program modification restrictions
    - ✓ Read-only, read-write, create, delete



- Allocating space for a file on secondary storage
  - ✓ One large storage area or smaller linked pieces
- Retrieving files efficiently

### **Network Management**

- Included in operating systems with networking capability
- Authorizes users to share resources
  - Overall responsibility for every aspect of network connectivity
    - ✓ Devices, files, memory space, CPU capacity, etc.

### **User Interface**

- Portion of the operating system
  - Direct interaction with users
- Two primary types
  - Graphical user interface (GUI)
    - ✓ Input from pointing device
    - ✓ Menu options, desktops, and formats vary
  - Command line interface
    - ✓ Keyboard-typed commands that display on a monitor





- ✓ Strict requirements for every command: typed accurately; correct syntax; combinations of commands assembled correctly

#### ▪ Cooperation Issues

- No single manager performs tasks in isolation
- Each element of an operating system
  - Performs individual tasks and
  - Harmoniously interacts with other managers
    - ✓ Incredible precision required for operating system to work smoothly
    - ✓ More complicated when networking is involved

#### ▪ Cloud Computing

- Practice of using Internet-connected resources
  - Performing processing, storage, or other operations
- Operating system maintains responsibility
  - Managing all local resources and coordinating data transfer to and from the cloud
- Role of the operating system



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- Accessing resources
  - Managing the system efficiently
  
  - **An Evolution of Computing Hardware**
    - Computer classification
      - At one time: based on memory capacity
    - Current platforms
  
  - **Types of Operating Systems (1 of 6)**
    - **Five categories**
      - Batch
      - Interactive
      - Real-time
      - Hybrid
      - Embedded



- **Two distinguishing features**
  - Response time
  - Method of data entry into the system
  
- **Batch systems:** jobs entered as a whole and in sequence
  - Input relied on punched cards or tape
  - Efficiency measured in throughput
  
- **Interactive systems:** allow multiple jobs
  - Faster turnaround than batch systems
  - Slower than real-time systems
  - Introduced to provide fast turnaround when debugging programs
  - Complex algorithms: share processing power

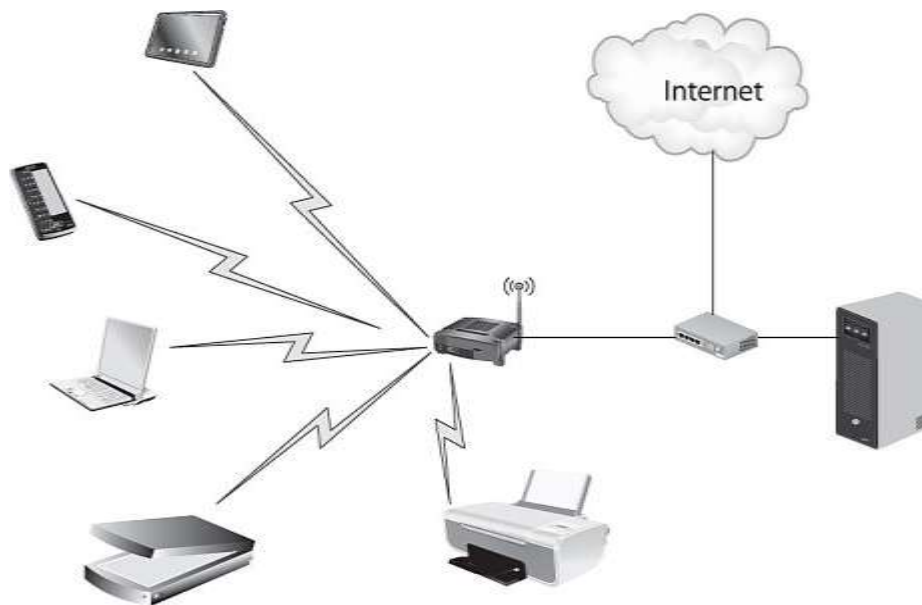


- **Hybrid systems**
  - Combination of batch and interactive
  - Light interactive load
    - Accepts and runs batch programs in the background
  
- **Real-Time Systems**
  - Reliability is critical
  - Used in time-critical environments
    - Spacecraft, airport traffic control, fly-by-wire aircraft, critical industrial processes, medical systems, etc.
  - Two types of real-time systems
    - Hard real-time systems: risk total system failure if the predicted time deadline is missed
    - Soft real-time systems: suffer performance degradation as a consequence of a missed deadline



## ▪ Network operating systems

- Special class of software
  - Users perform tasks using few, if any, local resources, e.g., cloud computing
- Wireless networking capability
  - Standard feature in many computing devices: cell phones, tablets, and other handheld Web browsers



**Figure 1.10:** Example of a simple network. The server is connected by cable to the router and other devices connect wirelessly.



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- **Embedded systems**

- Computers placed inside other products
  - Automobiles, digital music players, elevators, pacemakers, etc.
- Adds features and capabilities
- Operating system requirements
  - Perform specific set of programs
  - Non-interchangeable among systems
  - Small kernel and flexible function capabilities