

PRINCIPLES OF OPERATING SYSTEMS



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Operating System

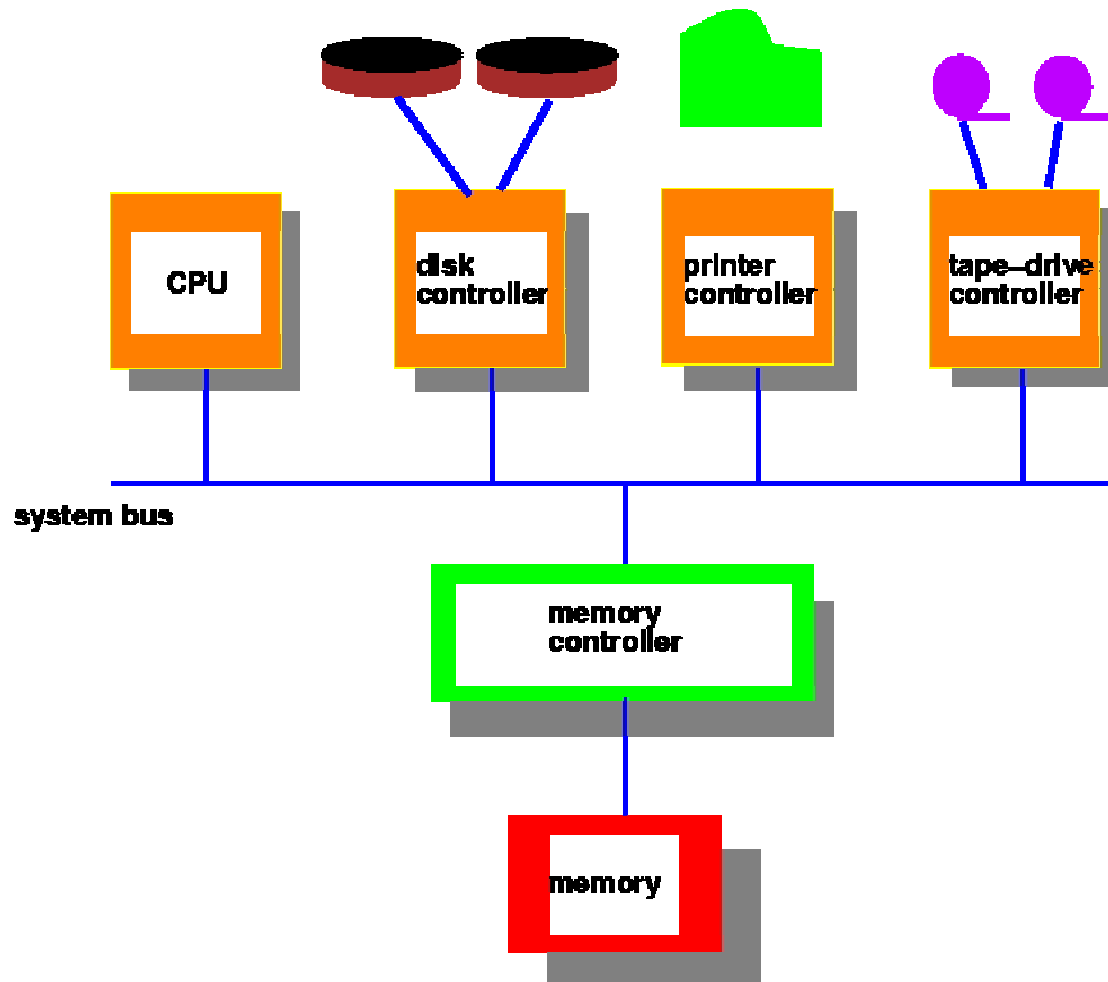
LECTURE-2

***OPERATING SYSTEM FUNCTIONS &
MULTITASKING & MULTIPROCESSING OS***

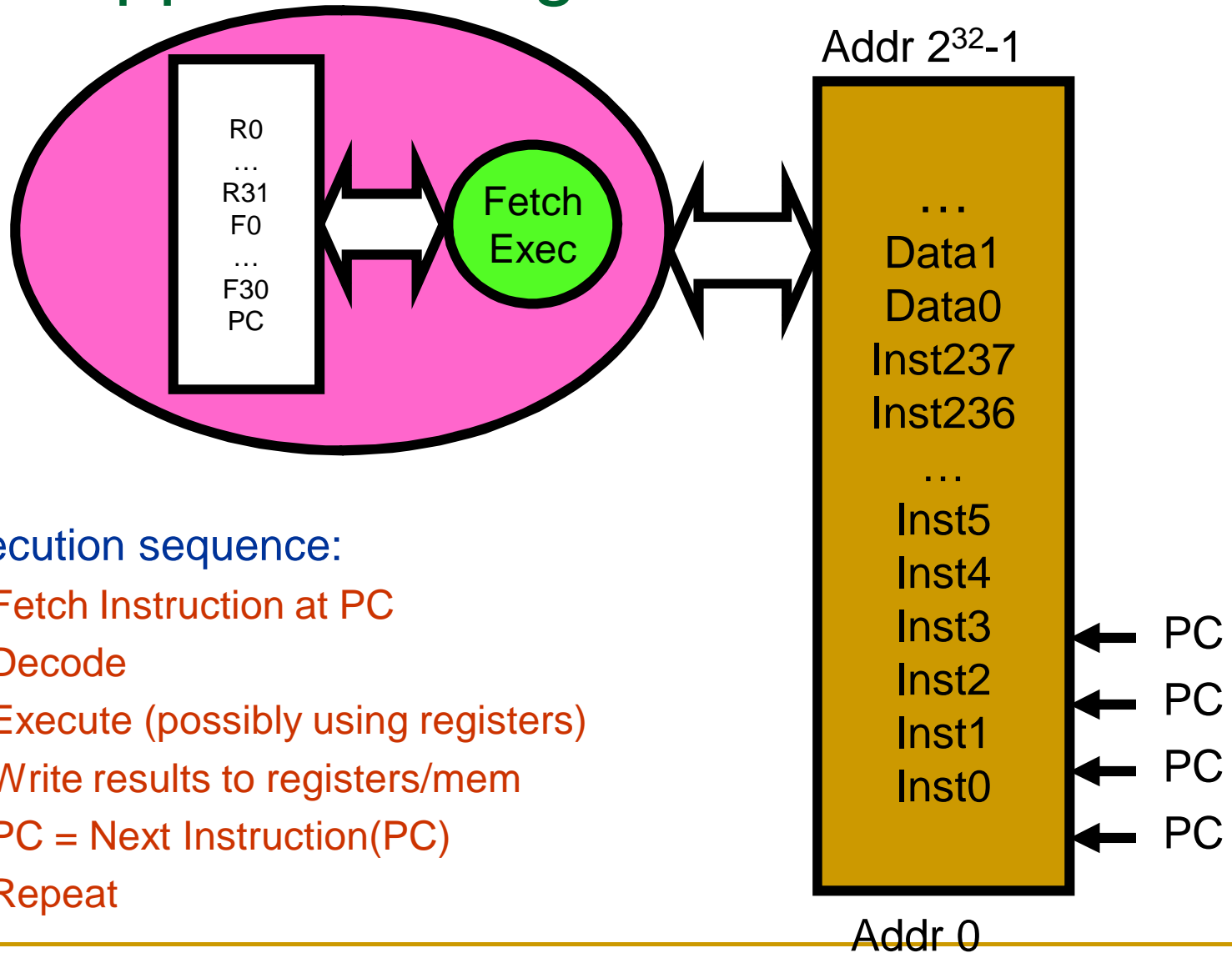
Computer System & OS Structures

- Computer System Operation
 - I/O Structure
 - Storage Structure, Storage Hierarchy
 - Hardware Protection
 - Operating System Services, System calls, System Programs
 - Structuring OS
 - Virtual Machine Structure and Organization
 - OS Design and Implementation
 - Process Management, Memory Management, Secondary Storage Management, I/O System Management, File Management, Protection System, Networking, Command-Interpreter.
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Computer System Architecture



What happens during execution?



Execution sequence:

- ❑ Fetch Instruction at PC
- ❑ Decode
- ❑ Execute (possibly using registers)
- ❑ Write results to registers/mem
- ❑ PC = Next Instruction(PC)
- ❑ Repeat

Computer System Organization

- I/O devices and the CPU execute concurrently.
 - Each device controller is in charge of a particular device type
 - Each device controller has a local buffer. I/O is from the device to local buffer of controller
 - CPU moves data from/to main memory to/from the local buffers
 - Device controller interrupts CPU on completion of I/O
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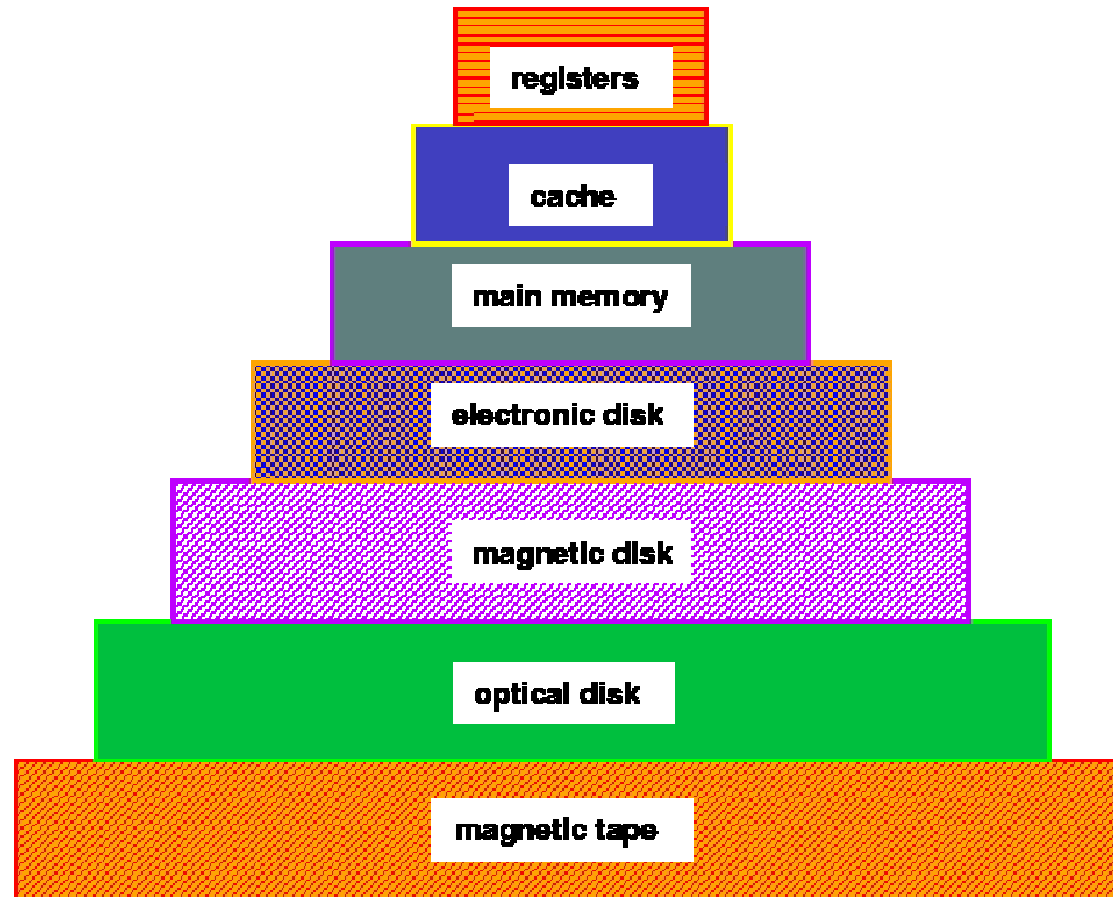
Storage Structure

- Main memory - only large storage media that the CPU can access directly.
 - Secondary storage - extension of main memory that has large nonvolatile storage capacity.
 - Magnetic disks - rigid metal or glass platters covered with magnetic recording material.
 - Disk surface is logically divided into tracks, subdivided into sectors.
 - Disk controller determines logical interaction between device and computer.
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Storage Hierarchy

- Storage systems are organized in a hierarchy based on
 - Speed
 - Cost
 - Volatility
 - Caching - process of copying information into faster storage system; main memory can be viewed as fast cache for secondary storage.
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Storage Device Hierarchy



Operating System Services

- **Services that provide user-interfaces to OS**
 - Program execution - load program into memory and run it
 - I/O Operations - since users cannot execute I/O operations directly
 - File System Manipulation - read, write, create, delete files
 - Communications - interprocess and intersystem
 - Error Detection - in hardware, I/O devices, user programs
 - **Services for providing efficient system operation**
 - Resource Allocation - for simultaneously executing jobs
 - Accounting - for account billing and usage statistics
 - Protection - ensure access to system resources is controlled
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OS Task: Process Management

- Process - fundamental concept in OS
 - Process is a program in execution.
 - Process needs resources - CPU time, memory, files/data and I/O devices.
 - OS is responsible for the following process management activities.
 - Process creation and deletion
 - Process suspension and resumption
 - Process synchronization and interprocess communication
 - Process interactions - deadlock detection, avoidance and correction
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OS Task: Memory Management

- Main Memory is an array of addressable words or bytes that is quickly accessible.
 - Main Memory is volatile.
 - OS is responsible for:
 - Allocate and deallocate memory to processes.
 - Managing multiple processes within memory - keep track of which parts of memory are used by which processes. Manage the sharing of memory between processes.
 - Determining which processes to load when memory becomes available.
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OS Task: Secondary Storage and I/O Management

- Since primary storage is expensive and volatile, secondary storage is required for backup.
 - Disk is the primary form of secondary storage.
 - OS performs storage allocation, free-space management and disk scheduling.
 - I/O system in the OS consists of
 - Buffer caching and management
 - Device driver interface that abstracts device details
 - Drivers for specific hardware devices
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OS Task: File System Management

- File is a collection of related information defined by creator - represents programs and data.
 - OS is responsible for
 - File creation and deletion
 - Directory creation and deletion
 - Supporting primitives for file/directory manipulation.
 - Mapping files to disks (secondary storage).
 - Backup files on archival media (tapes).
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OS Task: Protection and Security

- Protection mechanisms control access of programs and processes to user and system resources.
 - Protect user from himself, user from other users, system from users.
 - Protection mechanisms must:
 - Distinguish between authorized and unauthorized use.
 - Specify access controls to be imposed on use.
 - Provide mechanisms for enforcement of access control.
 - Security mechanisms provide trust in system and privacy
 - authentication, certification, encryption etc.
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OS Task: Networking

- Connecting processors in a distributed system
 - Distributed System is a collection of processors that do not share memory or a clock.
 - Processors are connected via a communication network.
 - Advantages:
 - Allows users and system to exchange information
 - provide computational speedup
 - increased reliability and availability of information
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Summary of OS Structures

- Operating System Concepts
 - Operating System Services
 - Operating System Design and Implementation
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