

CSMC 412

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Set 2

Computer-System Structures

- Operating System Services
- User Operating System Interface
- System Calls
- Types of System Calls
- System Programs
- Operating System Design and Implementation
- Operating System Structure
- Virtual Machines
- Operating System Generation
- System Boot

Objectives

- To describe the services an operating system provides to users, processes, and other systems
- To discuss the various ways of structuring an operating system
- To explain how operating systems are installed and customized and how they boot

Operating System Services

- One set of operating-system services provides functions that are helpful to the user:
 - User interface - Almost all operating systems have a user interface (UI)
 - Varies between Command-Line (CLI), Graphics User Interface (GUI), Batch
 - Program execution - The system must be able to load a program into memory and to run that program, end execution, either normally or abnormally (indicating error)
 - I/O operations - A running program may require I/O, which may involve a file or an I/O device.
 - File-system manipulation - The file system is of particular interest. Obviously, programs need to read and write files and directories, create and delete them, search them, list file information, permission management
 - Communications – Processes may exchange information, on the same computer or between computers over a network
 - Communications may be via shared memory or through message passing (packets moved by the OS)
 - Error detection – OS needs to be constantly aware of possible errors
 - May occur in the CPU and memory hardware, in I/O devices, in user program
 - For each type of error, OS should take the appropriate action to ensure correct and consistent computing
 - Debugging facilities can greatly enhance the user's and programmer's abilities to efficiently use the system

Operating System Services (Cont.)

- Another set of OS functions exists for ensuring the efficient operation of the system itself via resource sharing
 - **Resource allocation** - When multiple users or multiple jobs running concurrently, resources must be allocated to each of them
 - ▶ Many types of resources - Some (such as CPU cycles, main memory, and file storage) may have special allocation code, others (such as I/O devices) may have general request and release code.
 - **Accounting** - To keep track of which users use how much and what kinds of computer resources
 - **Protection and security** - The owners of information stored in a multiuser or networked computer system may want to control use of that information, concurrent processes should not interfere with each other
 - ▶ **Protection** involves ensuring that all access to system resources is controlled
 - ▶ **Security** of the system from outsiders requires user authentication, extends to defending external I/O devices from invalid access attempts
 - ▶ If a system is to be protected and secure, precautions must be instituted throughout it. A chain is only as strong as its weakest link.

User Operating System Interface - CLI

- Two principle forms:
 - CLI allows direct command entry
 - ▶ Sometimes implemented in kernel, sometimes by systems program
 - ▶ Sometimes multiple flavors implemented – **shells**
 - ▶ Primarily fetches a command from user and executes it
 - Sometimes commands built-in, sometimes just names of programs
 - ✦ If the latter, adding new features doesn't require shell modification