L4: Operating system services, user and operating system interface

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Outline

Operating system services

- Operating systems provide an environment for execution of programs and services to programs and users.
- It provides certain services to programs and to the users of those programs.
- The specific services provided, differ from one operating system to another, but can be identified to common classes.
- These operating system services are provided for the convenience of the programmer, to make the programming task easier.

Operating system services

- User interface - Almost all operating systems have a user interface (UI). Types of UI:
  Command-line interface(CLI), which uses text commands and a method for entering them.
  Batch interface, inwhich commands and directives to control those commands are entered into files, and those files are executed.
  Graphical user interface (GUI), which uses a window system with a pointing device to direct I/O, choose from menus, and make selections and a keyboard to enter text.

- 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)

Operating system services

- I/O operations - A running program may require I/O, which may involve a file or an I/O device. For efficiency and protection, users usually cannot control I/O devices directly. Therefore, the operating system must provide a means to do I/O.

- File system manipulation - The file system is of particular interest. 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.

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- Error detection – OS needs to be constantly aware of possible errors. Errors may occur in the CPU and memory hardware , in I/O devices and in the user program . For each type of error, the operating system should take the appropriate action to ensure correct and consistent computing.

- Resource allocation - When multiple users or multiple jobs running concurrently, resources must be allocated to each of them.

- Accounting - To keep track of which users use how much and what kinds of computer resources, OS collects usage statistics for various resources. This record keeping may be used for accounting (so that users can be billed) or simply for accumulating usage statistics.

Operating system services

- 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 defend external I/O devices from invalid access attempts
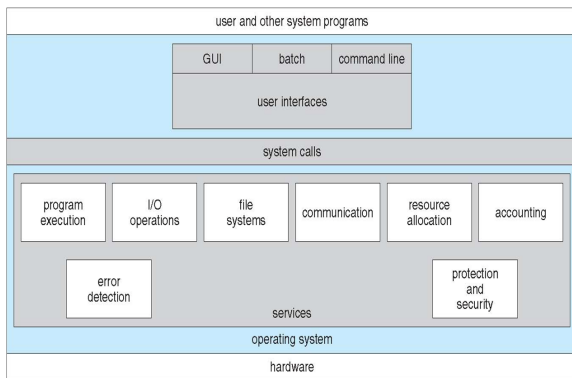
Operating system services

Figure: View of Operating system services

User and Operating system interface

- Command-line interface or command interpreter (CLI):
  It uses text commands and a method for entering them (say, a keyboard for typing in commands in a specific format with specific options).

- Graphical user interface (GUI):
  Here, the interface is a window system with a pointing device to direct I/O, choose from menus, and make selections and a keyboard to enter text.

Command-line interface

- Some operating systems include the command interpreter in the kernel.

- Others, such as Windows and UNIX, treat the command interpreter as a special program that is running when a job is initiated or when a user first logs on (on interactive systems).

- On systems with multiple command interpreters to choose from, the interpreters are known as shells.

- For example, on UNIX and Linux systems, a user may choose among several different shells, including the Bourne shell, C shell, Bourne-Again shell, Korn shell, and others.

- The main function of the command interpreter is to get and execute the next user-specified command. The MS-DOS and UNIX shells operate in this way.

Command-line interface

The commands can be implemented in two general ways:

- In one approach, the command interpreter itself contains the code to execute the command.

- An alternative approach—used by UNIX, among other operating systems implements most commands through system programs. In this case, the command interpreter does not understand the command in any way; it merely uses the command to identify a file to be loaded into memory and executed.

Choice of interface

- The choice of whether to use a command-line or GUI interface is mostly one of personal preference.

- System administrators who manage computers and power users who have deep knowledge of a system frequently use the command-line interface. For them, it is more efficient, giving them faster access to the activities they need to perform.

- Indeed, on some systems, only a subset of system functions is available via the GUI, leaving the less common tasks to those who are command-line knowledgeable.

- Further, command line interfaces usually make repetitive tasks easier, in part because they have their own programmability.

- Most Windows users are happy to use the Windows GUI environment and almost never use the MS-DOS shell interface.