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Operating-System Services

Operating-System Services

- Operating System Services
- User Operating System Interface
- System Calls
- Types of System Calls
- System Programs

Objectives

- To describe the services an operating system provides to users, processes, and other systems

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), Graphical 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.

Operating System Services (Cont.)

- 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

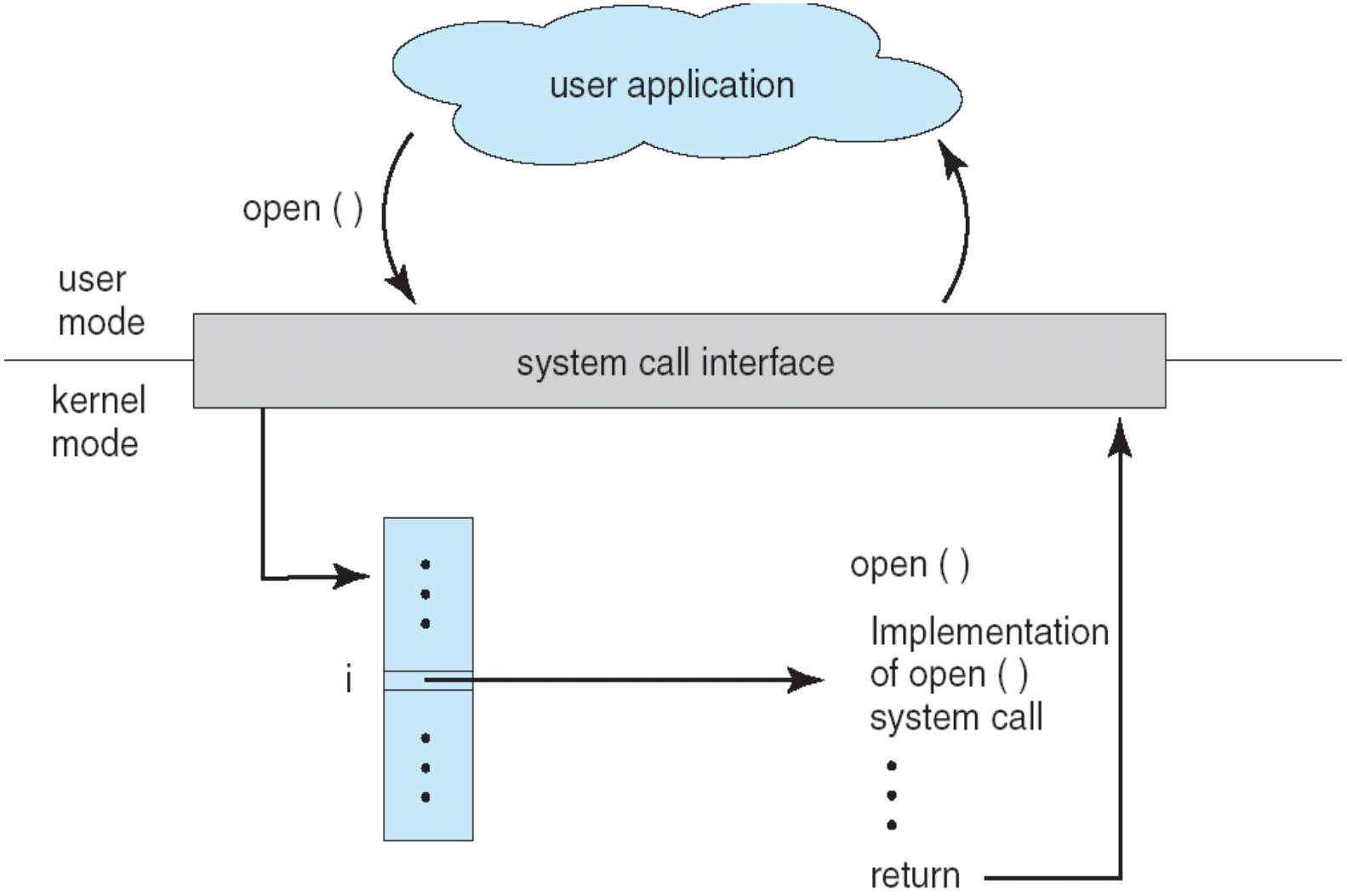
Operating System Services (Cont.)

- **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 - CPU cycles, main memory, and file storage, I/O devices.
  - **Accounting -** To keep track of which users use how much and what kinds of computer resources
  - **Protection and security**
    - **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

System Calls

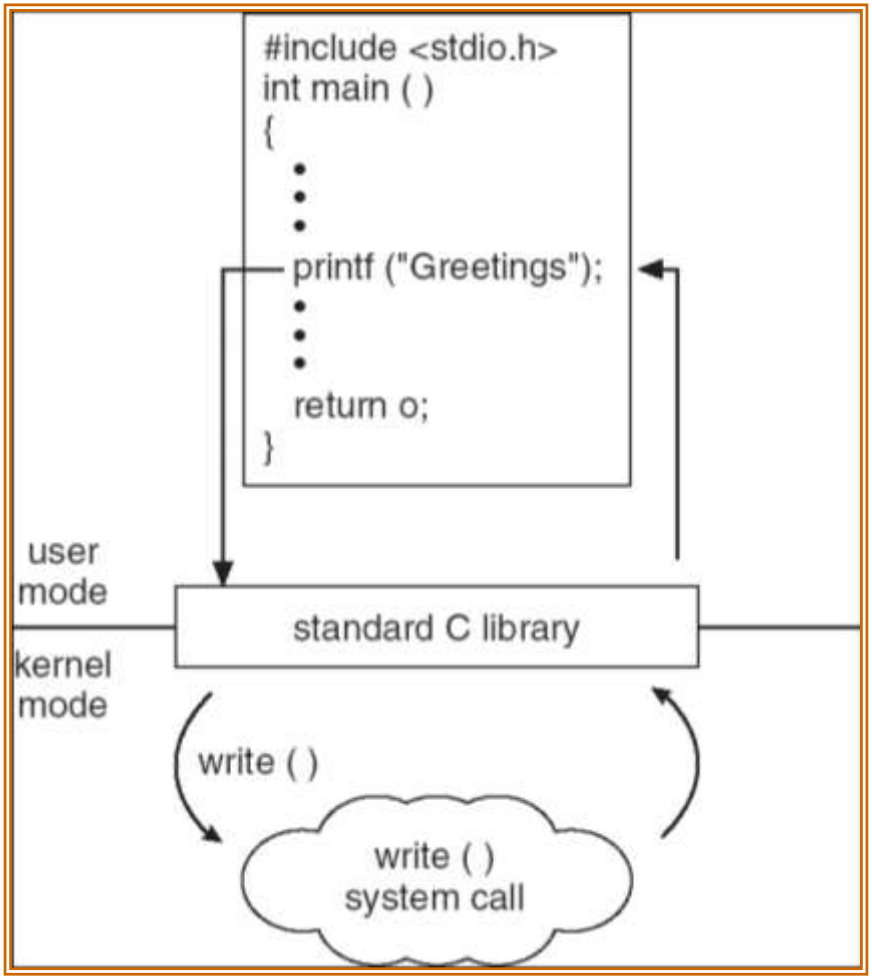
- Programming interface to the services provided by the OS
- Typically written in a high-level language (C or C++)

API – System Call – OS Relationship



Standard C Library Example

- C program invoking printf() library call, which calls write() system call



Types of System Calls

- Process control: end, abort, load, execute, create, terminate
- File management: create, delete, open, close, read, write
- Device management: request device, release device, open, close, reposition
- Information maintenance: get time/ date, set date/ time, get system data, set system data
- Communications: send/ receive messages, create/delete communication connections

System Programs

- System programs provide a convenient environment for program development and execution. They can be divided into:
  - File manipulation
  - Status information
  - File modification
  - Programming language support
  - Program loading and execution
  - Communications
  - Application programs

System Programs

- Provide a convenient environment for program development and execution
  - Some of them are simply user interfaces to system calls; others are considerably more complex
- **File management** - Create, delete, copy, rename, print, dump, list, and generally manipulate files and directories
- **Status information**
  - Some ask the system for info - date, time, amount of available memory, disk space, number of users
  - Others provide detailed performance, logging, and debugging information
  - Typically, these programs format and print the output to the terminal or other output devices

System Programs (contd)

- **File modification**
  - Text editors to create and modify files
  - Special commands to search contents of files or perform transformations of the text
- **Programming-language support** - Compilers, assemblers, debuggers and interpreters sometimes provided
- **Program loading and execution-** Absolute loaders, relocatable loaders, linkage editors, and overlay-loaders, debugging systems for higher-level and machine language
- **Communications** - Provide the mechanism for creating virtual connections among processes, users, and computer systems
  - Allow users to send messages to one another's screens, browse web pages, send electronic-mail messages, log in remotely, transfer files from one machine to another