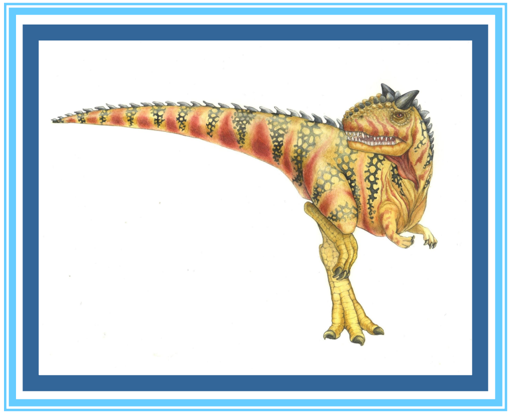
Chapter 2: Operating-System Structures

Lecture 5



Recap

- Operating System Services
- User Operating System Interface
- System Calls

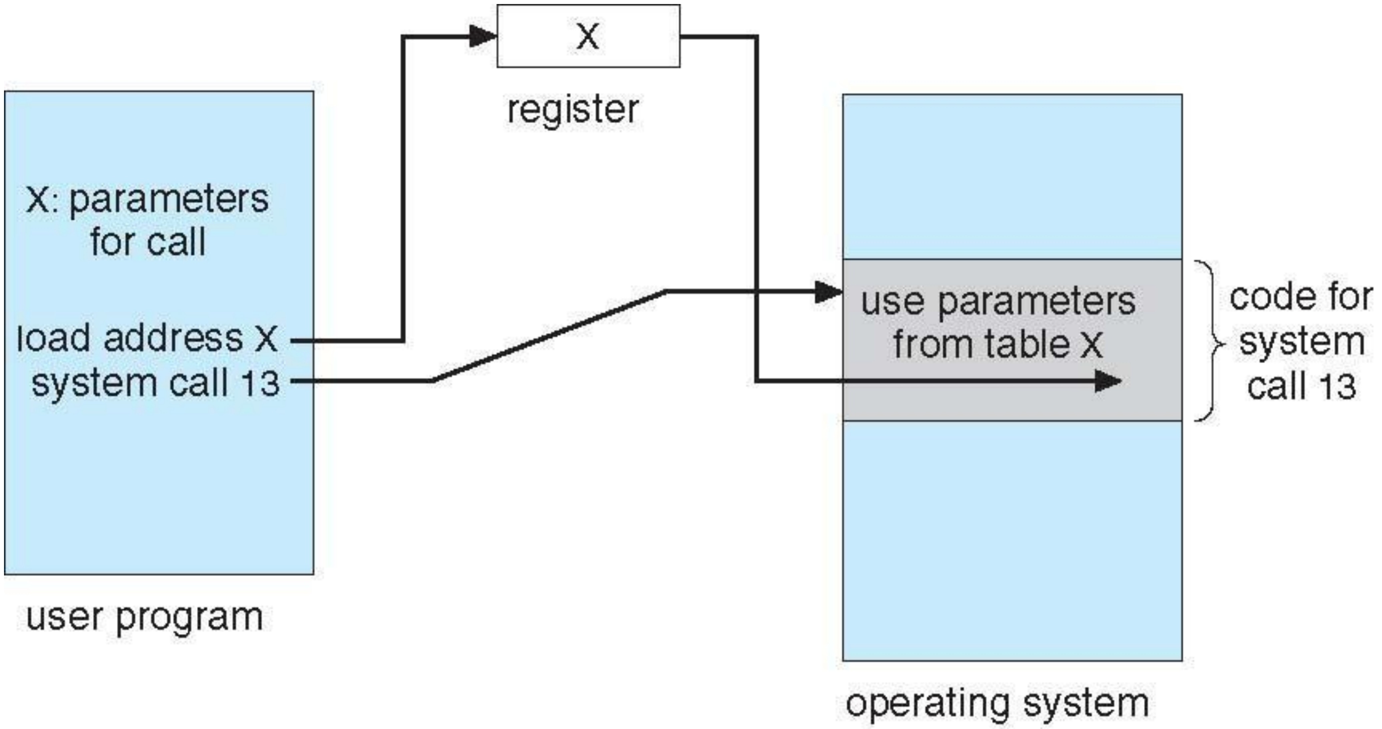
Objectives

- System Call parameter passing
- Types of System Calls
- System Programs
- Types of System Programs

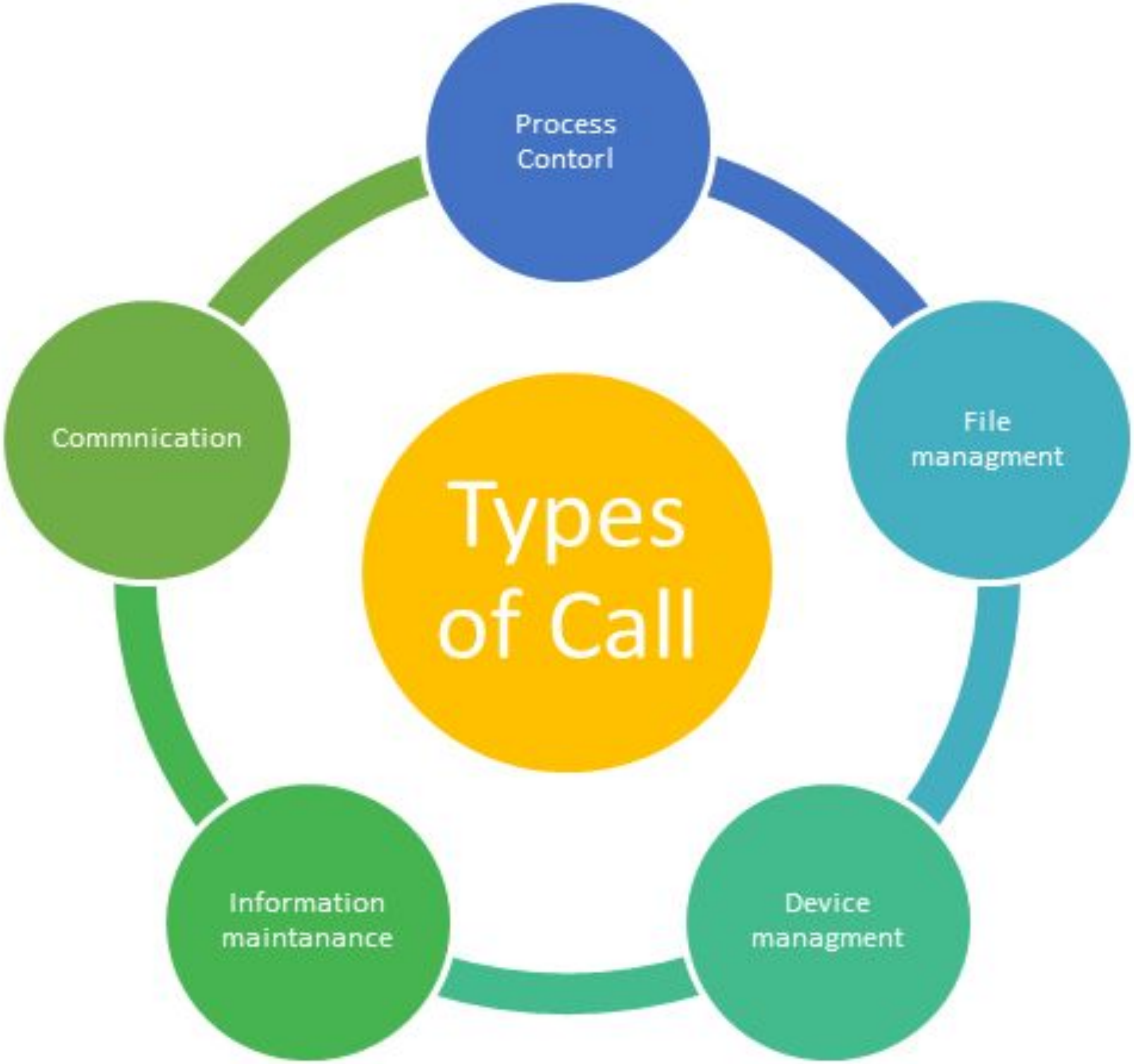
System Call Parameter Passing

- Often, more information is required than simply identity of desired system call
  - Exact type and amount of information vary according to OS and call
- Three general methods used to pass parameters to the OS
  - Simplest: pass the parameters in registers
    - 4 In some cases, may be more parameters than registers
  - Parameters stored in a block, or table, in memory, and address of block passed as a parameter in a register
    - 4 This approach taken by Linux and Solaris
  - Parameters placed, or **pushed**, onto the **stack** by the program and **popped** off the stack by the operating system
  - Block and stack methods do not limit the number or length of parameters being passed

Parameter Passing via Table



Types of System Calls



Types of System Calls

- Process control
  - create process, terminate process
  - end, abort
  - load, execute
  - get process attributes, set process attributes
  - wait for time
  - wait event, signal event
  - allocate and free memory
  - Dump memory if error
  - **Debugger** for determining **bugs, single step** execution
  - **Locks** for managing access to shared data between processes

Types of System Calls

- File management
  - create file, delete file
  - open, close file
  - read, write, reposition
  - get and set file attributes
- Device management
  - request device, release device
  - read, write, reposition
  - get device attributes, set device attributes
  - logically attach or detach devices

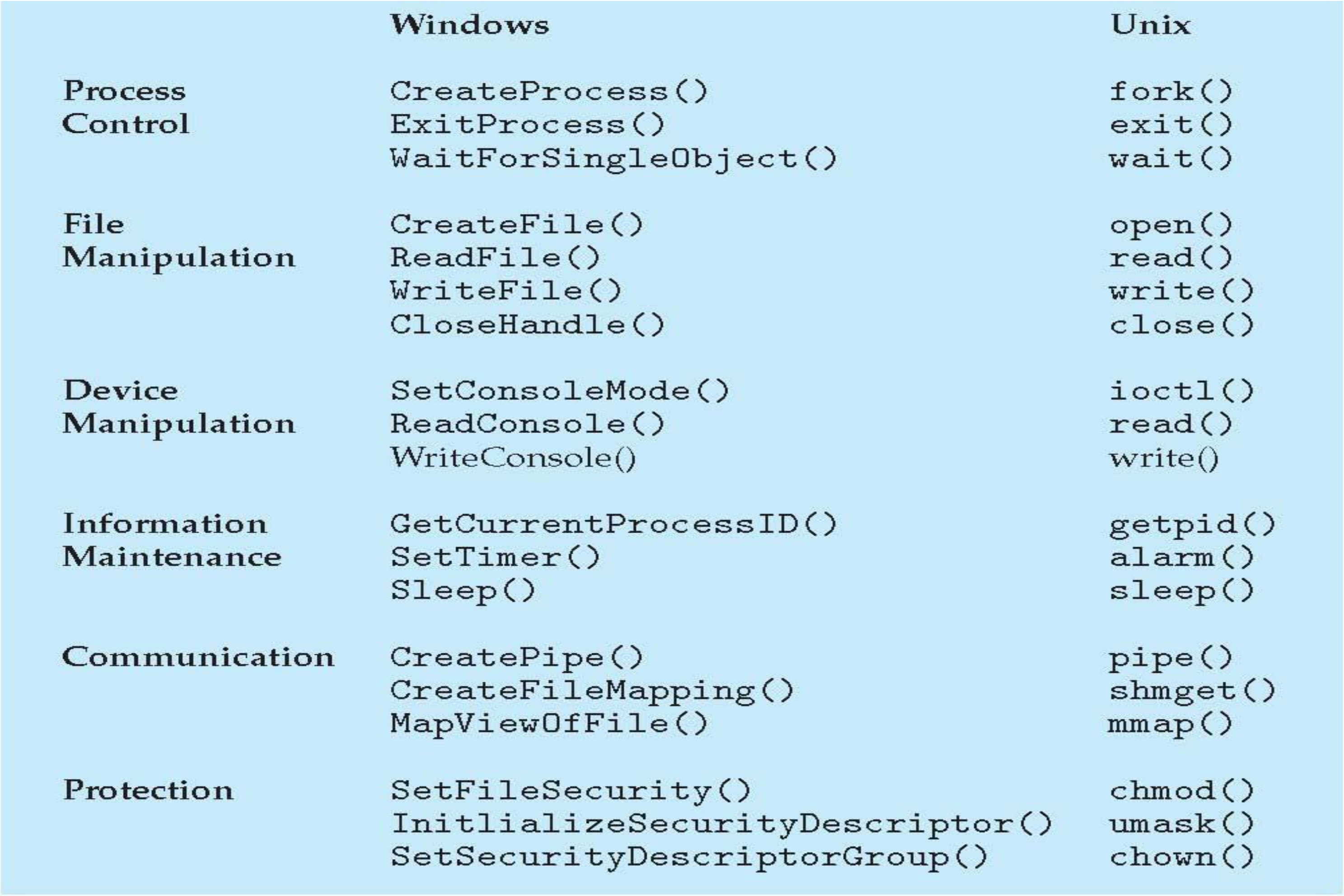
Types of System Calls (Cont.)

- Information maintenance
  - get time or date, set time or date
  - get system data, set system data
  - get and set process, file, or device attributes
- Communications
  - create, delete communication connection
  - send, receive messages if **message passing model** to **host name** or **process name**
    - 4 From **client** to **server**
  - **Shared-memory model** create and gain access to memory regions
  - transfer status information
  - attach and detach remote devices

Types of System Calls (Cont.)

- Protection
  - Control access to resources
  - Get and set permissions
  - Allow and deny user access

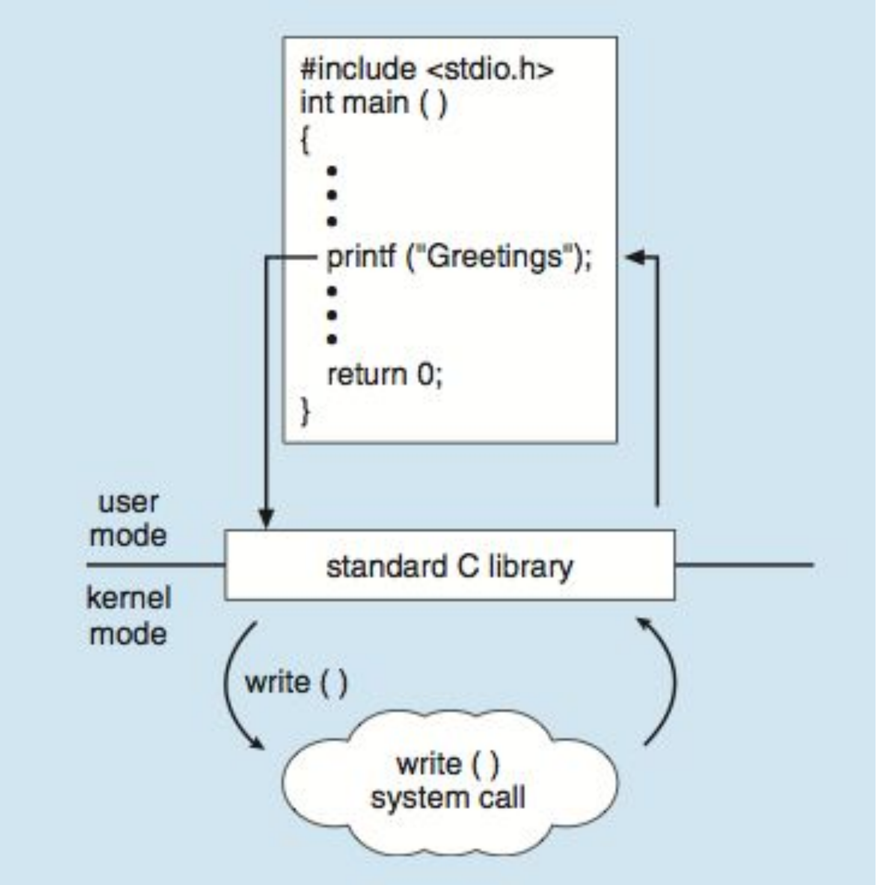
Examples of Windows and Unix System Calls



	Windows	Unix
Process Control	CreateProcess()	fork()
	ExitProcess()	exit()
	WaitForSingleObject()	wait()
File Manipulation	CreateFile()	open()
	ReadFile()	read()
	WriteFile()	write()
	CloseHandle()	close()
Device Manipulation	SetConsoleMode()	ioctl()
	ReadConsole()	read()
	WriteConsole()	write()
Information Maintenance	GetCurrentProcessID()	getpid()
	SetTimer()	alarm()
	Sleep()	sleep()
Communication	CreatePipe()	pipe()
	CreateFileMapping()	shmget()
	MapViewOfFile()	mmap()
Protection	SetFileSecurity()	chmod()
	InitlializeSecurityDescriptor()	umask()
	SetSecurityDescriptorGroup()	chown()

Standard C Library Example

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

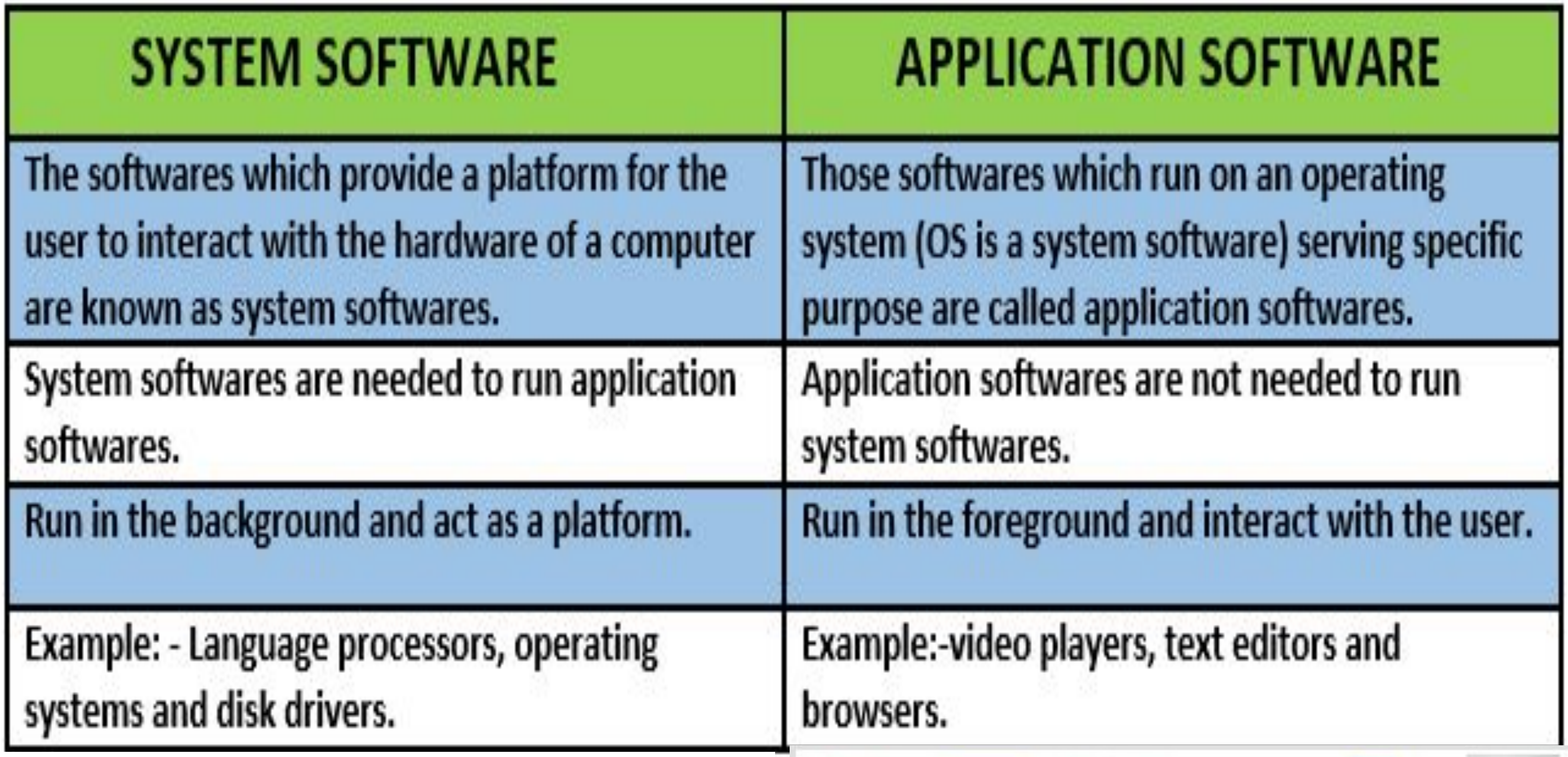


```
#include <stdio.h>
int main ( )
{
   •
   •
   •
   printf ("Greetings");
   •
   •
   •
   return 0;
}
```

System Programs

- System programs provide a convenient environment for program development and execution. They can be divided into:
    - File manipulation
    - Status information sometimes stored in a File modification
    - Programming language support
    - Program loading and execution
    - Communications
    - Background services
    - Application programs
- Most users' view of the operation system is defined by system programs, not the actual system calls

Difference between system programs and system applications



SYSTEM SOFTWARE	APPLICATION SOFTWARE
The softwares which provide a platform for the user to interact with the hardware of a computer are known as system softwares.	Those softwares which run on an operating system (OS is a system software) serving specific purpose are called application softwares.
System softwares are needed to run application softwares.	Application softwares are not needed to run system softwares.
Run in the background and act as a platform.	Run in the foreground and interact with the user.
Example: - Language processors, operating systems and disk drivers.	Example:-video players, text editors and browsers.

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** – These system programs are used to manipulate system files. This can be done using various commands like create, delete, copy, rename, print etc. These commands can create files, delete files, copy the contents of one file into another, rename files, print them etc
  - 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
  - Some systems implement a **registry** - used to store and retrieve configuration information

System Programs (Cont.)

- **File modification-** These system programs are used to manipulate system files. This can be done using various commands
  - Text editors to create and modify files
  - Special commands to search contents of files or perform transformations of the text
- **Programming-language support** – These system programs provide additional support features for different programming languages. Some examples of these are compilers, debuggers etc. These compile a program and make sure it is error free respectively.
  - Compilers, assemblers, debuggers and interpreters sometimes provided

System Programs (Cont.)

- **Program loading and execution**- The system programs that deal with program loading and execution make sure that programs can be loaded into memory and executed correctly. Loaders and Linkers are a prime example of this type of system programs.

- **Communications** - Provide the mechanism for creating virtual connections among processes, users, and computer systems. These system programs are needed for system communications such as web browsers. Web browsers allow systems to communicate and access information from the network as required.
  - 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

System Programs (Cont.)

- **Background Services**
  - Launch at boot time
    - 4 Some for system startup, then terminate
    - 4 Some from system boot to shutdown
  - Provide facilities like disk checking, process scheduling, error logging, printing
  - Run in user context not kernel context
  - Known as **services**, **subsystems**, **daemons**

- **Application programs**
- Application programs can perform a wide range of services as per the needs of the users. These include programs for database systems, word processors, plotting tools, spreadsheets, games, scientific applications etc.
  - Don’t pertain to system
  - Run by users
  - Not typically considered part of OS
  - Launched by command line, mouse click, finger poke