

Chapter 1: Introduction

Dr. SUBHASIS DASH

SCHOLE OF COMPUTER ENGINEERING.

KIIT Deemed to be UNIVERSITY, BHUBANESWAR

History

- High Utilization
- Professional computer operator
- Reducing set up time
- Mode of interaction
- Automatic job sequencing

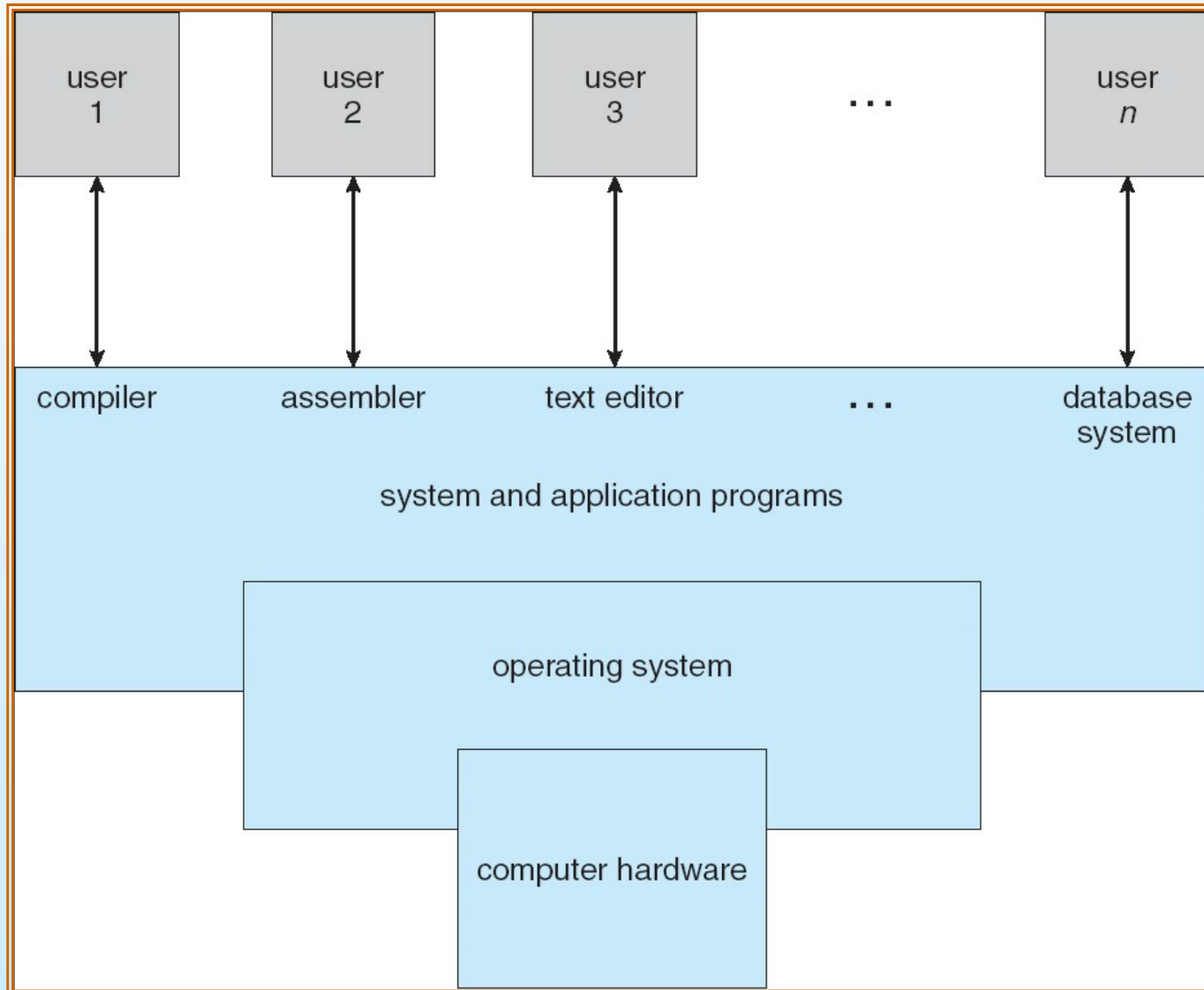
What is an Operating System?

- ❑ A collection of **system programs** entrusted with **effective utilization** of a computer.
- ❑ A program that acts as an intermediary between a user of a computer and the computer hardware.
- ❑ Operating system goals:
 - ❑ Execute user programs and make solving user problems easier.
 - ❑ Make the computer system convenient to use.
- ❑ Use the computer hardware in an efficient manner.

Computer System Structure

- Computer system can be divided into four components
 - Hardware – provides basic computing resources
 - ▶ CPU, memory, I/O devices
 - Operating system
 - ▶ Controls and coordinates use of hardware among various applications and users
 - Application programs – define the ways in which the system resources are used to solve the computing problems of the users
 - ▶ Word processors, compilers, web browsers, database systems, video games
 - Users
 - ▶ People, machines, other computers

Four Components of a Computer System



Operating System objective

- ❑ System Configuration
- ❑ User Requirement
- ❑ Environment

S/W INFRASTRUCTURE ADD ON BARE H/W

Operating System Definition

- ❑ OS is a **resource allocator**
 - ❑ Manages all resources
 - ❑ Decides between conflicting requests for efficient and fair resource use
- ❑ OS is a **control program**
 - ❑ Controls execution of programs to prevent errors and improper use of the computer

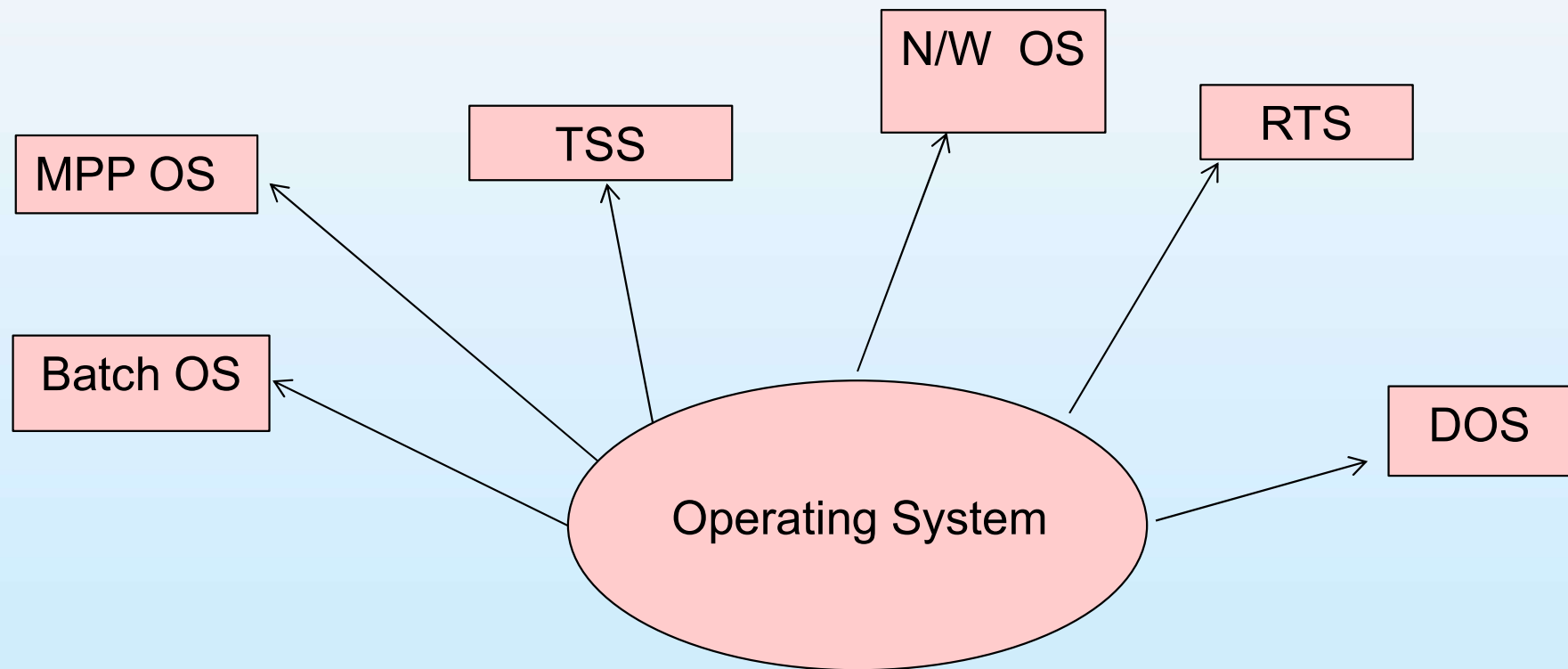
Operating System Definition (Cont.)

- No universally accepted definition
- “Everything a vendor ships when you order an operating system” is good approximation
 - But varies wildly
- “The one program running at all times on the computer” is the **kernel**. Everything else is either a system program (ships with the operating system) or an application program

Computer Startup

- **bootstrap program** is loaded at power-up or reboot
 - Typically stored in ROM or EPROM, generally known as **firmware**
 - Initializes all aspects of system
 - Loads operating system kernel and starts execution

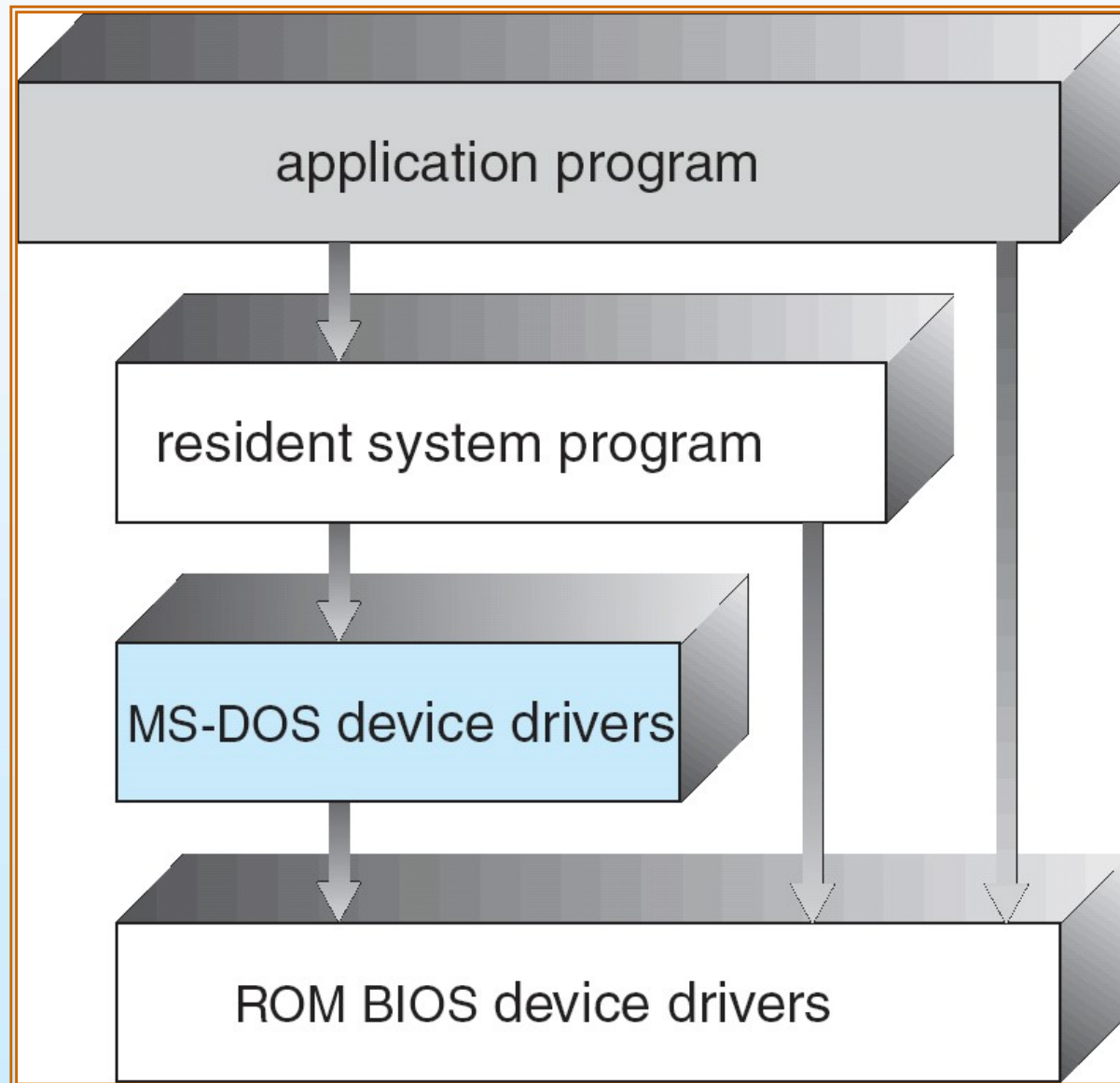
Evolution of Modern operating System



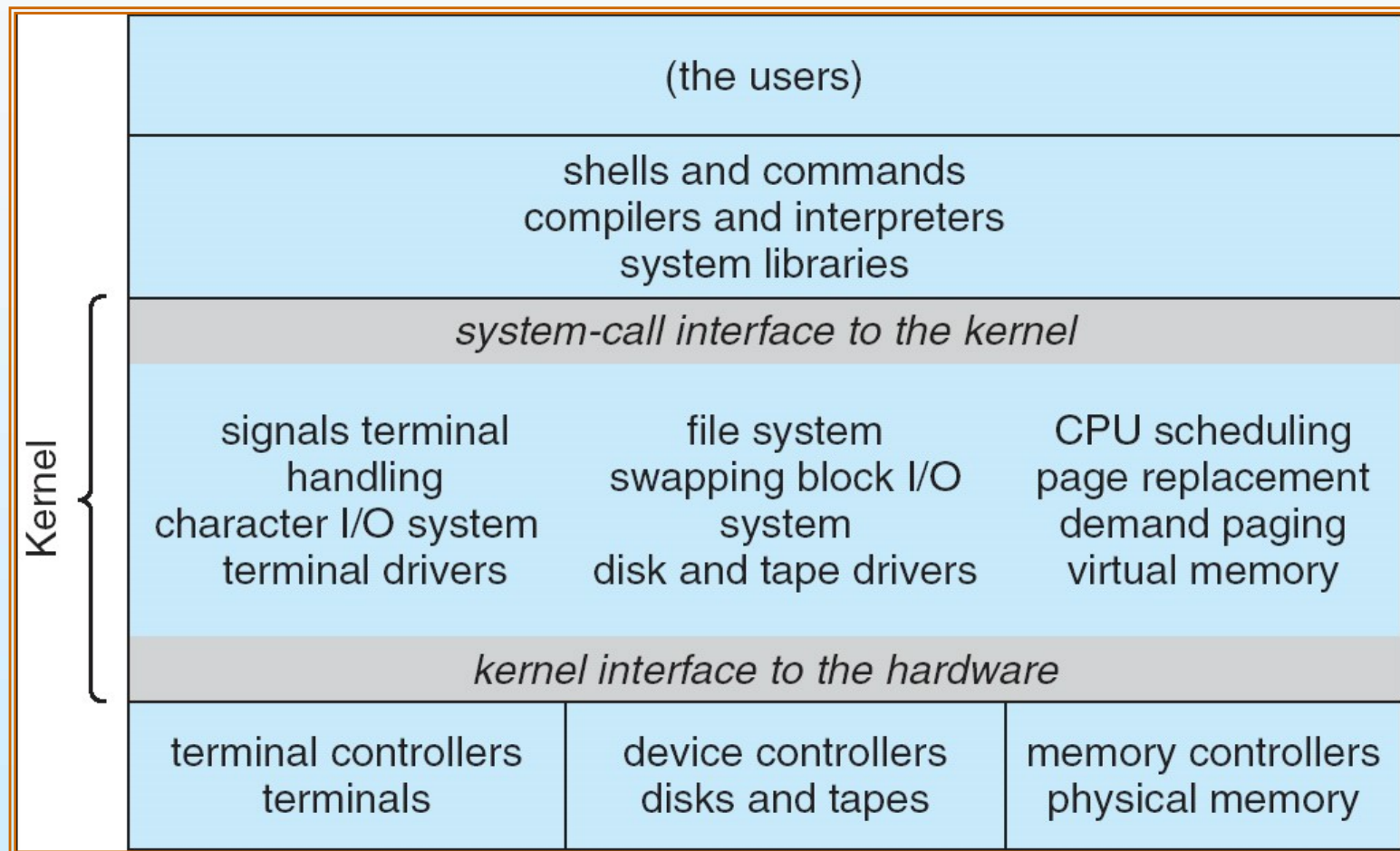
Operating System Structure

- **Multiprogramming** needed for efficiency
 - **The main objective is to maximize CPU use.**
 - Single user cannot keep CPU and I/O devices busy at all times
 - Multiprogramming organizes jobs (code and data) so CPU always has one to execute
 - A subset of total jobs in system is kept in memory
 - One job selected and run via **job scheduling**
 - When it has to wait (for I/O for example), OS switches to another job
- **Timesharing (multitasking)** is logical extension in which CPU switches jobs so frequently that users can interact with each job while it is running, creating **interactive** computing
 - **to minimize response time.**
 - **Response time** should be < 1 second
 - Each user has at least one program executing in memory \Rightarrow **process**
 - If several jobs ready to run at the same time \Rightarrow **CPU scheduling**
 - If processes don't fit in memory, **swapping** moves them in and out to run
 - **Virtual memory** allows execution of processes not completely in memory

MS-DOS Layer Structure



UNIX System Structure



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.

Operating System Services (Cont.)

- One set of operating-system services provides functions that are helpful to the user (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
 - ▶ 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.

End of Chapter 1