

Chapter 1: Introduction

BIT 3103 Computer Operating
Systems

Overview

- What Operating Systems Do
- Computer-System Organization
- Functions of Operating System

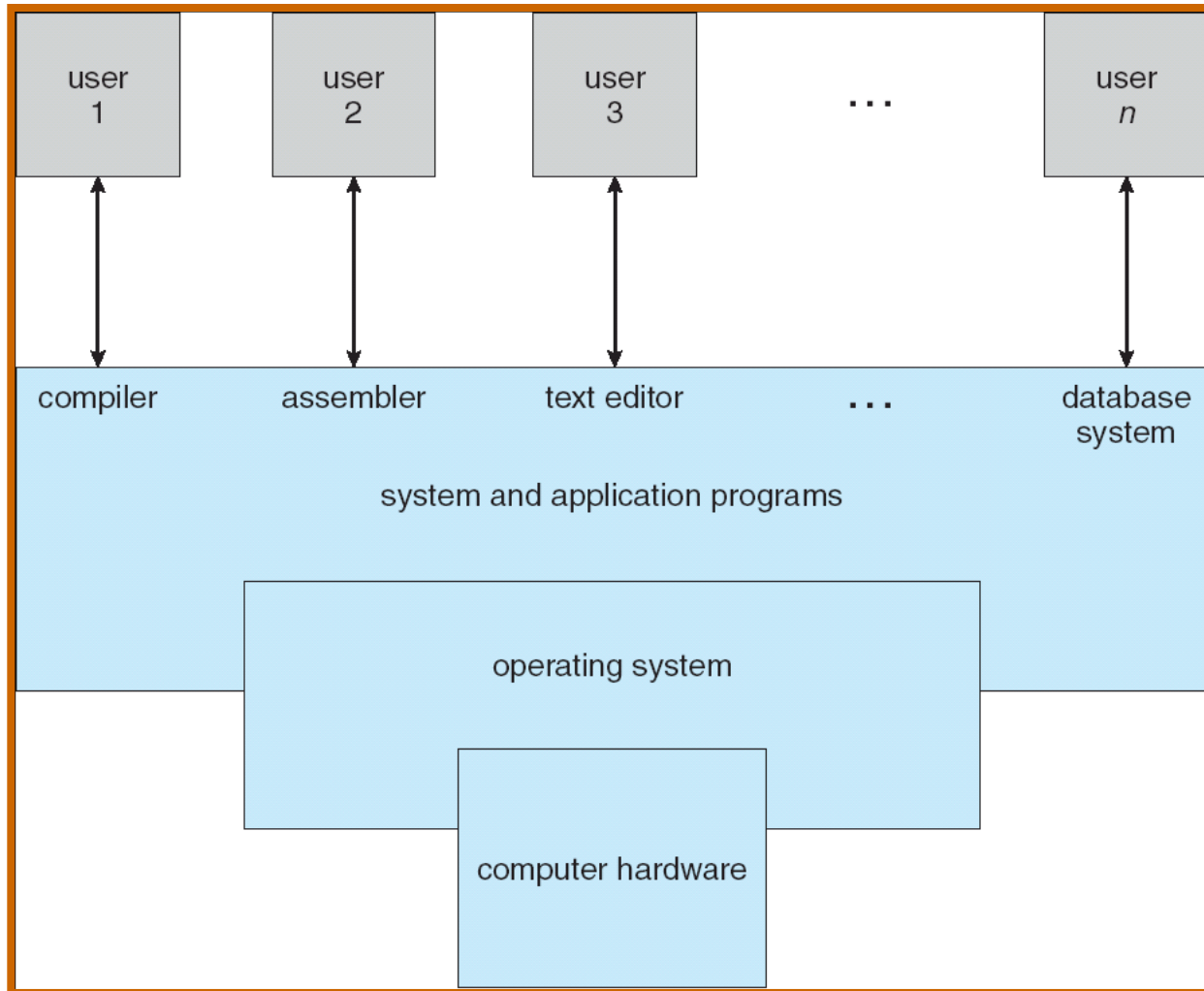
Objectives

- To provide a grand tour of the major operating systems components
- To provide coverage of basic computer system organization

What is an Operating System?

- A system software program which manage and control computer resources
- Provides user with a virtual machine

The Components of a Computer System



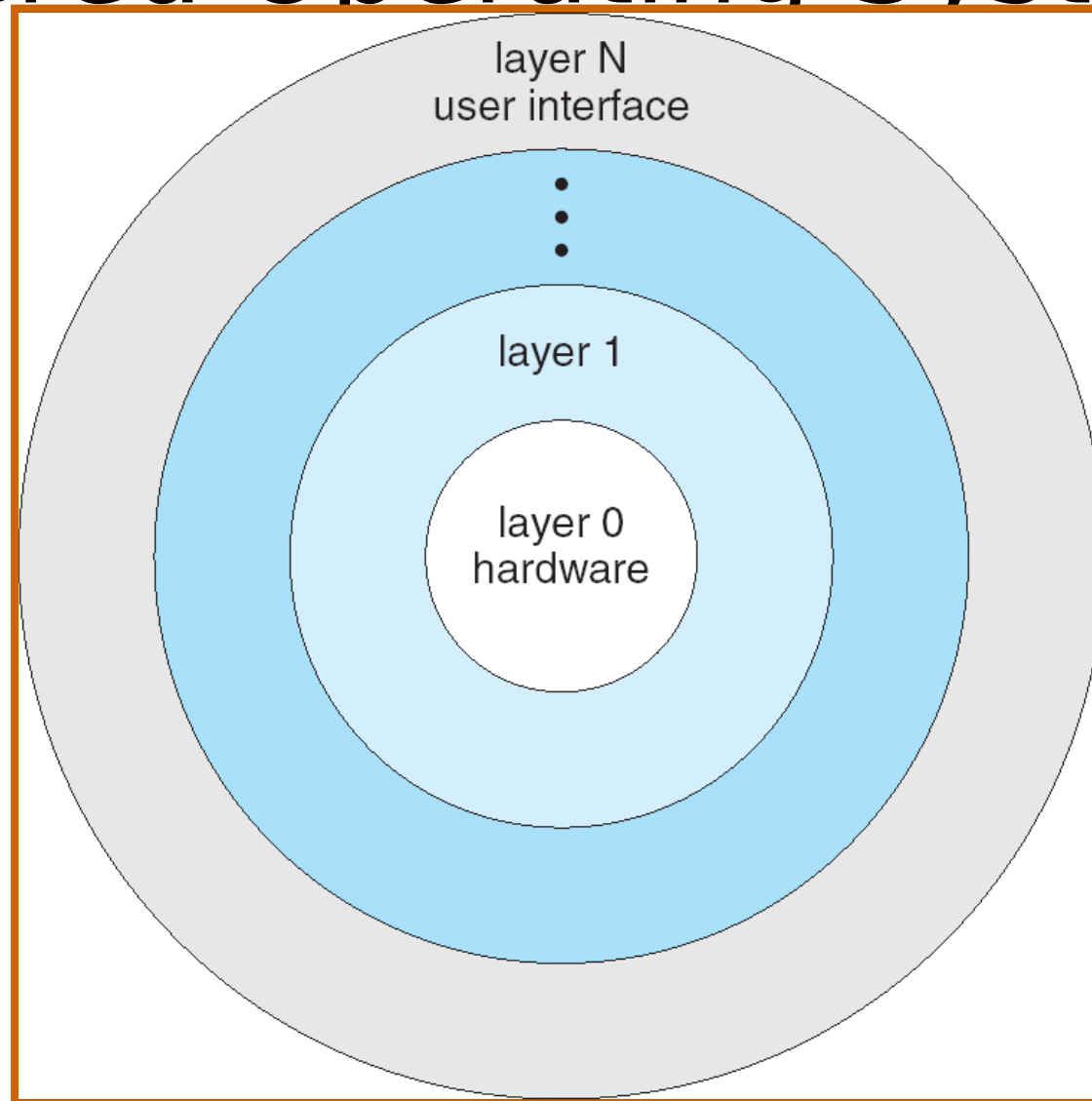
Operating System Definition

- 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

Layered Approach

- The operating system is divided into a number of layers (levels), each built on top of lower layers. The bottom layer (layer 0), interfaces with the hardware; the highest (layer N) interfaces the user interface.
- With modularity, layers are selected such that each uses functions (operations) and services of only lower-level layers

Layered Operating System



Computer Startup

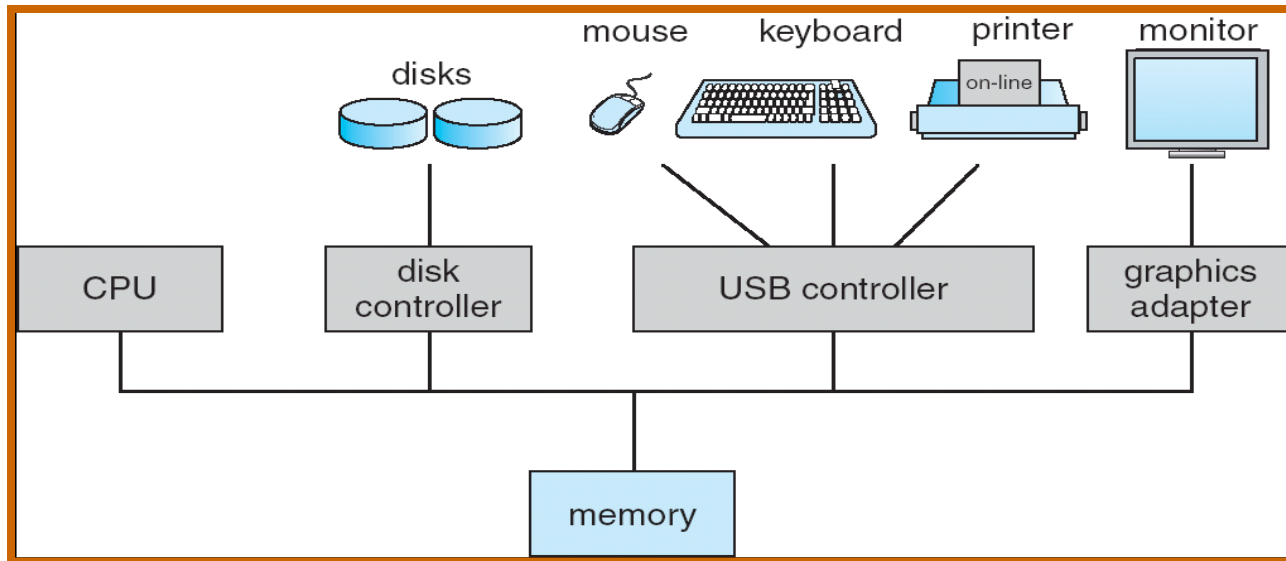
- **bootstrap program** is loaded at power-up or reboot
 - Typically stored in ROM or EEPROM, generally known as **firmware**
 - Initializes all aspects of system
 - Loads operating system kernel and starts execution

Computer System

Organization

- Computer system operation
 - One or more CPUs, device controllers connect through common bus providing access to shared memory
 - Concurrent execution of CPUs and devices competing for memory cycles

Computer System Organization



Examples of operating systems

- Microsoft family – MS- DOS, Windows 95, windows 98, windows NT
- Unix
- Linux
- Ubuntu
- etc

Features of OS

- **Explain the following features of an OS**
 - **Multiprogramming**
 - **Multiprocessing**
 - **Timesharing**
 - **Multitasking**
 - **Virtual Memory concept**

Functions of an operating System

- Provision of User interface
 - Command language interface
 - Graphical user interface
- Process Scheduling – determine which process to execute next
- I/o Handling
- Resource allocation and accounting

- **Resource allocation and accounting**
 - **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

- Interrupt handling
- Network (Communication) control - –
Processes may exchange information, on the same computer or between computers over a network
- Error Handling - 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

Memory Management

- All data in memory before and after processing
- All instructions in memory in order to execute
- Memory management determines what is in memory when
 - Optimizing CPU utilization and computer response to users
- Memory management activities
 - Keeping track of which parts of memory are currently being used and by whom
 - Deciding which processes (or parts thereof) and data to move into and out of memory
 - Allocating and deallocating memory space as needed

Storage Management

- OS provides uniform, logical view of information storage
 - Abstracts physical properties to logical storage unit - **filesystem**
 - Each medium is controlled by device (i.e., disk drive, tape drive)
 - Varying properties include access speed, capacity, data-transfer rate, access method (sequential or random)
- File-System management
 - Files usually organized into directories
 - Access control on most systems to determine who can access what
 - OS activities include
 - Creating and deleting files and directories
 - Primitives to manipulate files and dirs
 - Mapping files onto secondary storage
 - Backup files onto stable (non-volatile) storage media

Protection and Security

- **Protection** – any mechanism for controlling access of processes or users to resources defined by the OS
- **Security** – defense of the system against internal and external attacks
 - Huge range, including denial-of-service, worms, viruses, identity theft, theft of service
- Systems generally first distinguish among users, to determine who can do what
 - User identities (**user IDs**, security IDs) include name and associated number, one per user
 - User ID then associated with all files, processes of that user to determine access control
 - Group identifier (**group ID**) allows set of users to be defined and controls managed, then also associated with each process, file
 - **Privilege escalation** allows user to change to effective ID with more rights