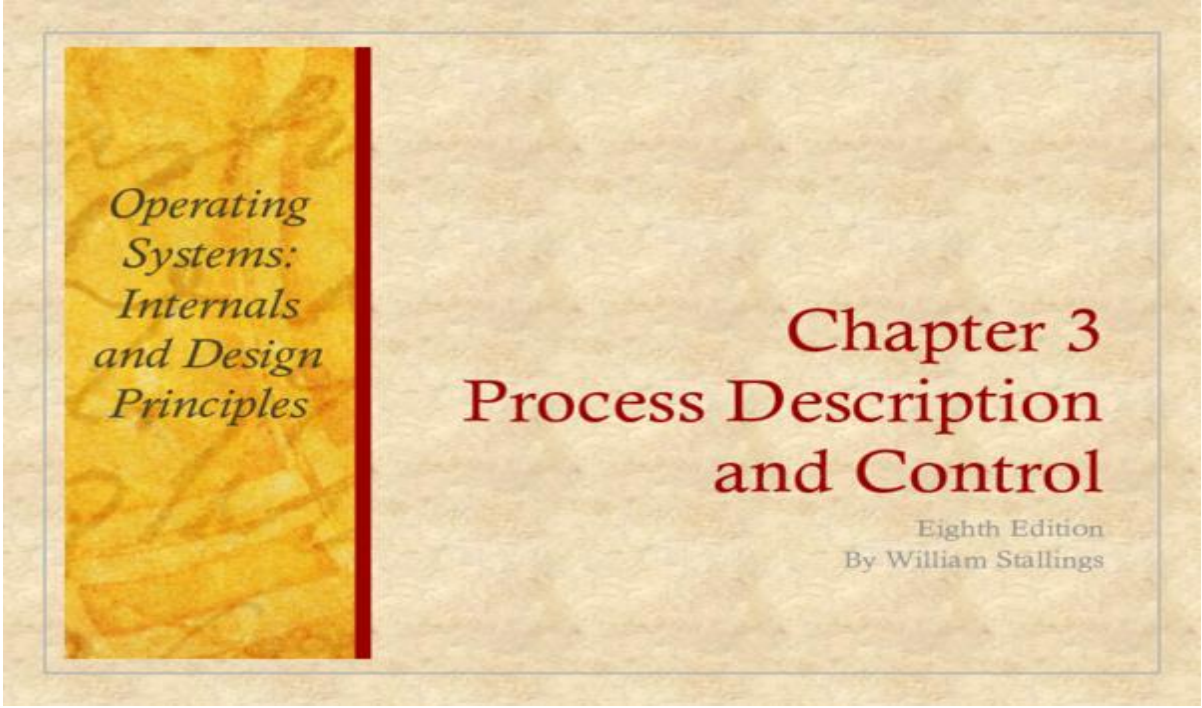
Cyber Security Engineering Department
Lecturs Prepared by Assist. Prof. Imad Matti

Operating Systems Concepts

Chapter 3

Operating system process Description and components



Prepared by Assist . Prof .

Imad Matti

AL-mamoon University College / Cyber security engineering Department

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3. O/S System Components

3.1 Process Management

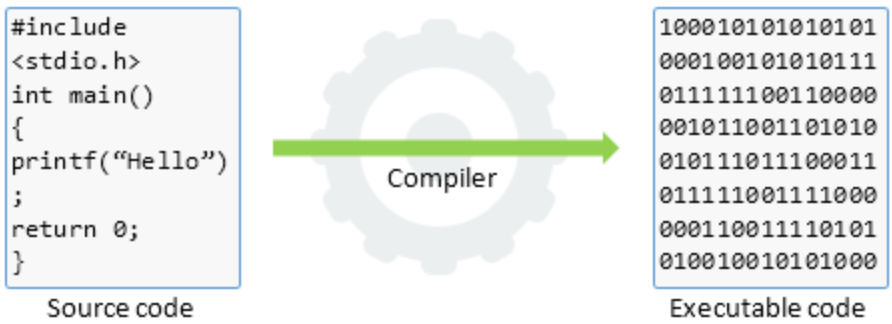
Program

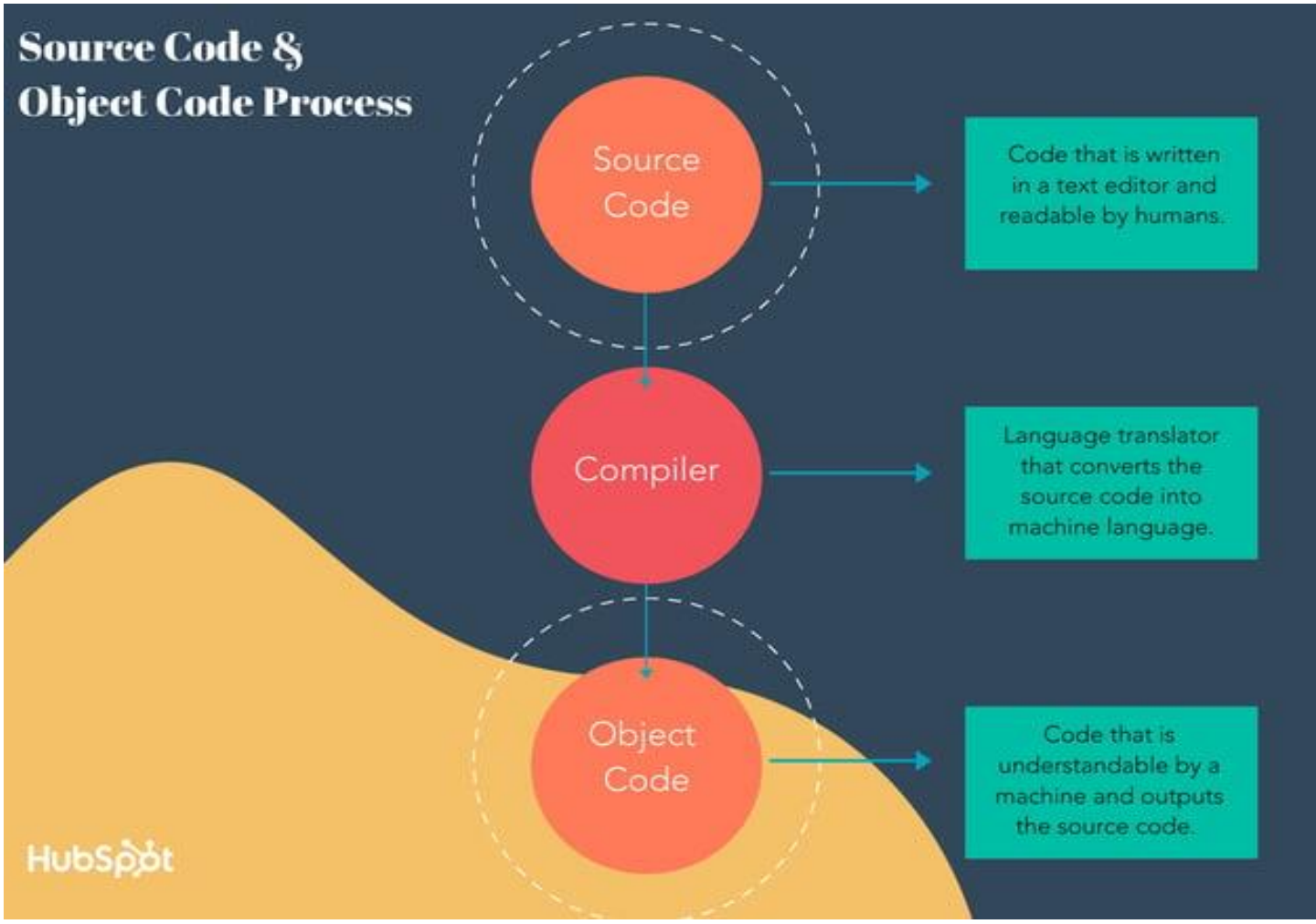
A program is a piece of code which may be a single line or millions of lines. A computer program is usually written by a computer programmer in a programming language. For example, here is a simple program written in C programming language −

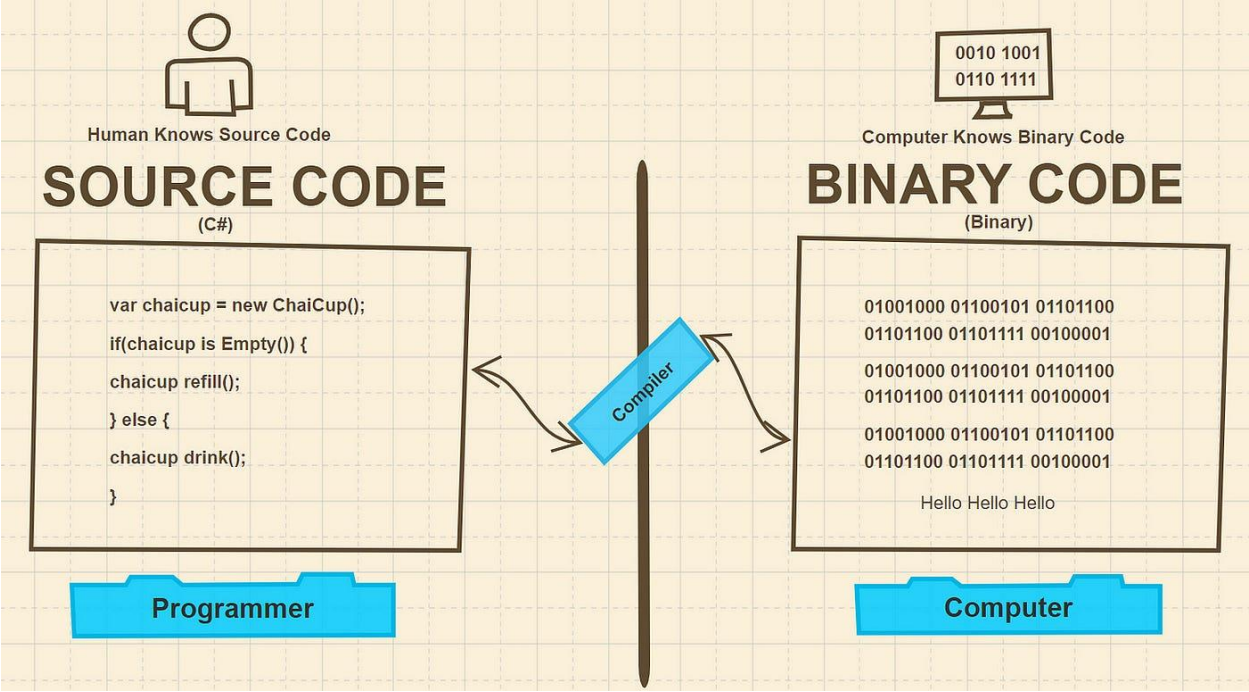
```
#include <stdio.h>

int main() {
   printf("Hello, World! \n");
   return 0;
}
```

A computer **program** is a collection of instructions that performs a specific task when executed by a computer.

When we write any programming language **code**/**program** in computer **and when we execute this program** then it becomes a **process**.




Source Code &
Object Code Process
Source Code
Code that is written in a text editor and readable by humans.
Compiler
Language translator that converts the source code into machine language.
Object Code
Code that is understandable by a machine and outputs the source code.
HubSpot



What is the Difference Between Source Code & Object Code?

Source Code	Object Code
Generated by a human	Generated by a machine
High-level code	Low-level code
Code exists in plain text	Code exists in binary format
Human understable	Machine understandable
Easy to modify	Difficult to modify
Written in various high-level languages like Java, C, C++, Python, JavaScript or assembly language	Written by an assembler, compiler, or any form of translator into machine language from the source code
Acts as the input to an assembler, compiler, or a type of translator	Acts as the output to an assembler, compiler, or a type of translator

HubSpot

- **Process**: is a **program** in execution.

- **Process**: is a unit of work within the system.

- **Process**: is an active entity.

A process is essentially running software.

- **Program**: is a passive entity.

- System processes:

a- O/S processes.

- **Examples**: manage memory, handle device drivers, perform scheduling, and implement system calls.

b- User processes

- **Examples**: applications like text editors, web browsers, games, and any other software that a user might run.

The O/S is responsible for the following activities in connection with process management:

1- Creation and deletion of both user and system processes.

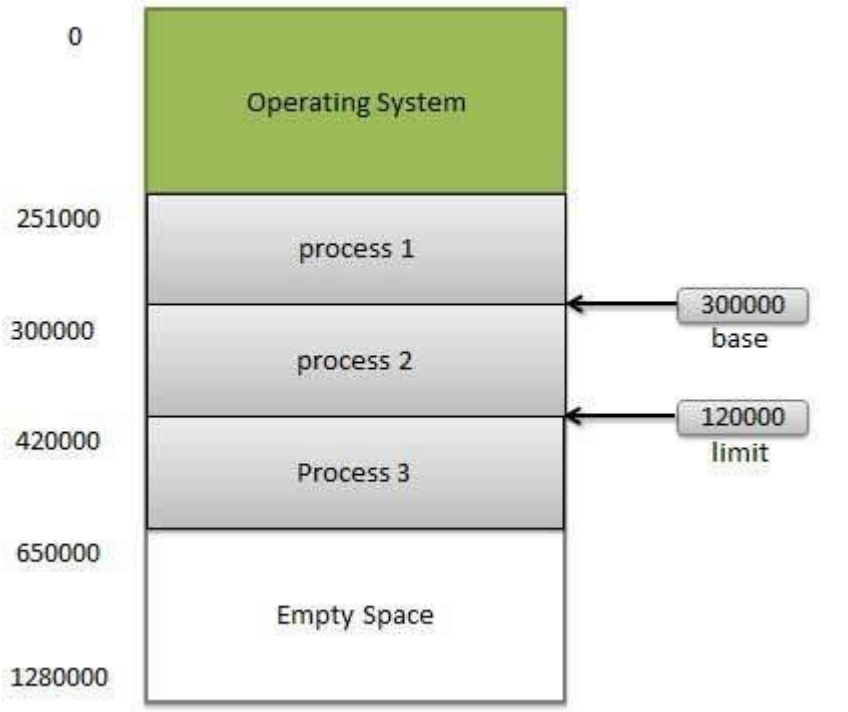
2- Suspension and resumption processes.

3- Providing mechanisms for process synchronization.

4- Providing mechanisms for process communication.

5- Providing mechanisms for process deadlocks handling.

3.2 Memory Management



The O/S is responsible for the following activities in connection with memory management:

1- Keep track of which parts of memory are currently being used and y whom.

2- Decide which processes are to be loaded into memory when space becomes available.

3- Allocate and de-allocate memory space as needed.

3.3 File Management

- **File**: is a collection of related information defined by its creator.
- **Files** represent programs and data.

The O/S is responsible for the following activities in connection with file management:

1- Creation and deletion files.

2- Creation and deletion directories.

3- Mapping files onto secondary storage.

4- Backup files on stable (nonvolatile) storage media.

3.4 I/O System Management

a- General device driver interface.

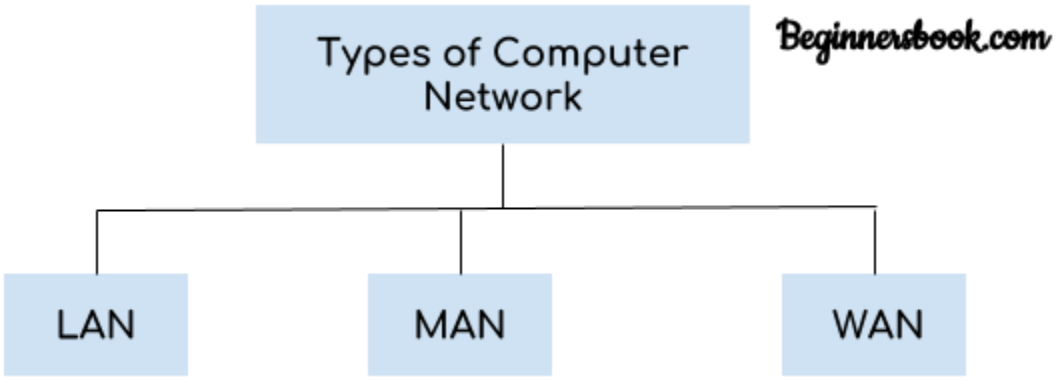
b- Driver for hardware devices.

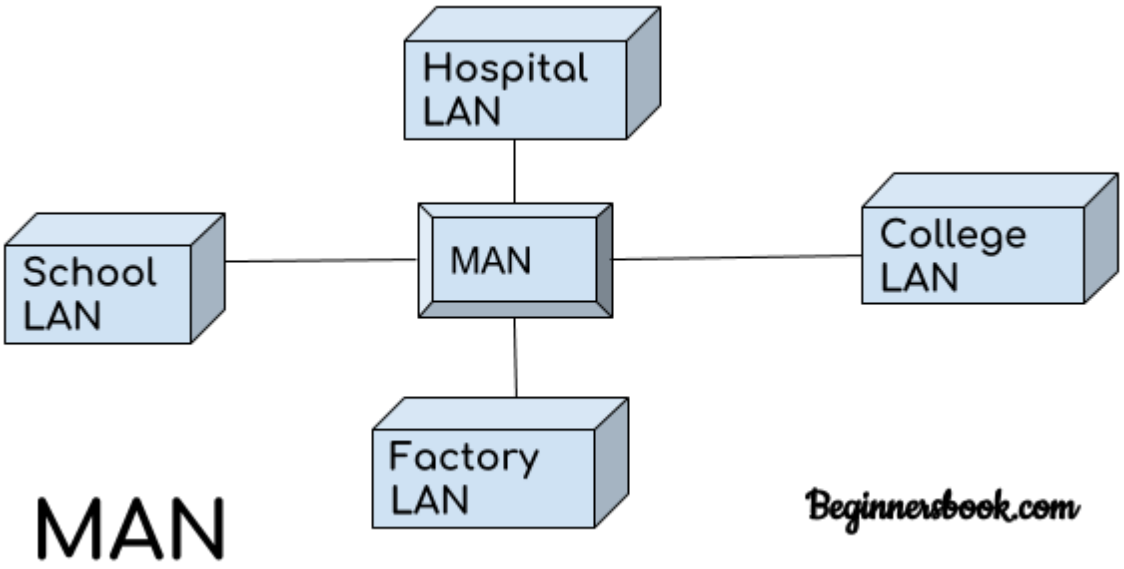
3.5 Secondary Storage Management.

The O/S is responsible for the following activities in connection with secondary storage management:

a- Free Space management.
b- Storage Allocation.
c- Disk scheduling.

3.6 Networking

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College LAN
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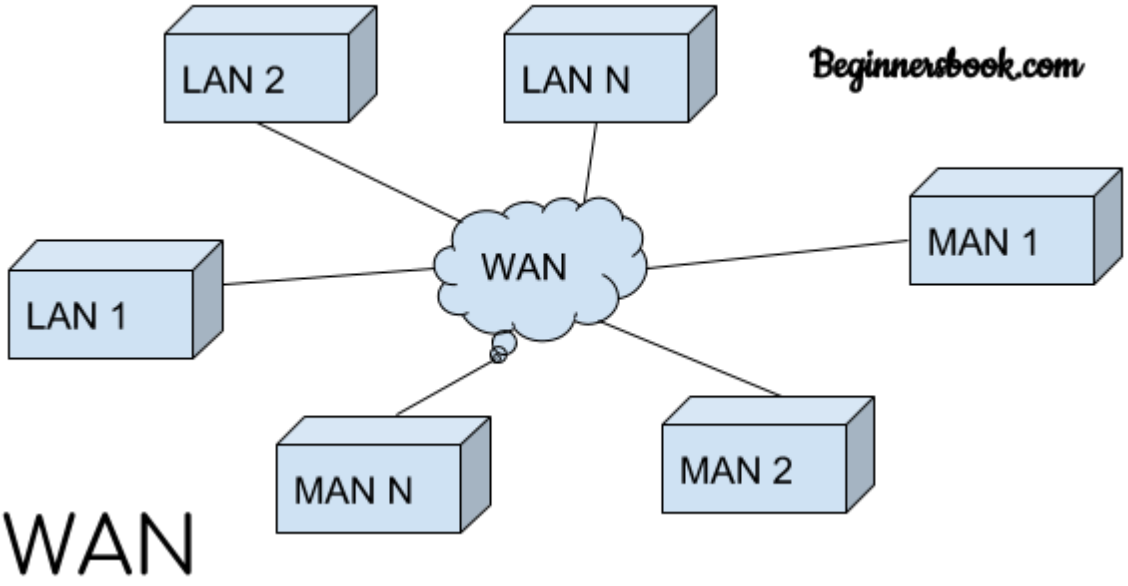
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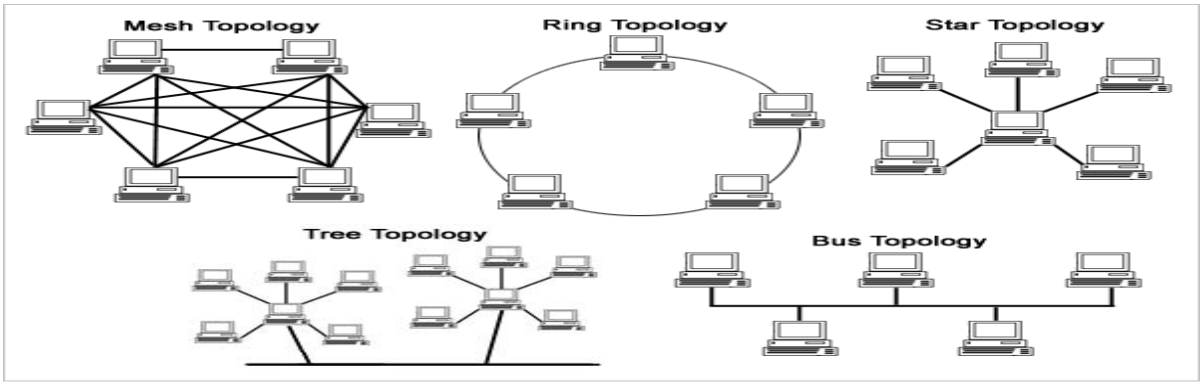


Collection of processes, each process has its local memory and clock, the processors communicates with one another through communication lines, such as high speed buses or telephone lines.

System Structure

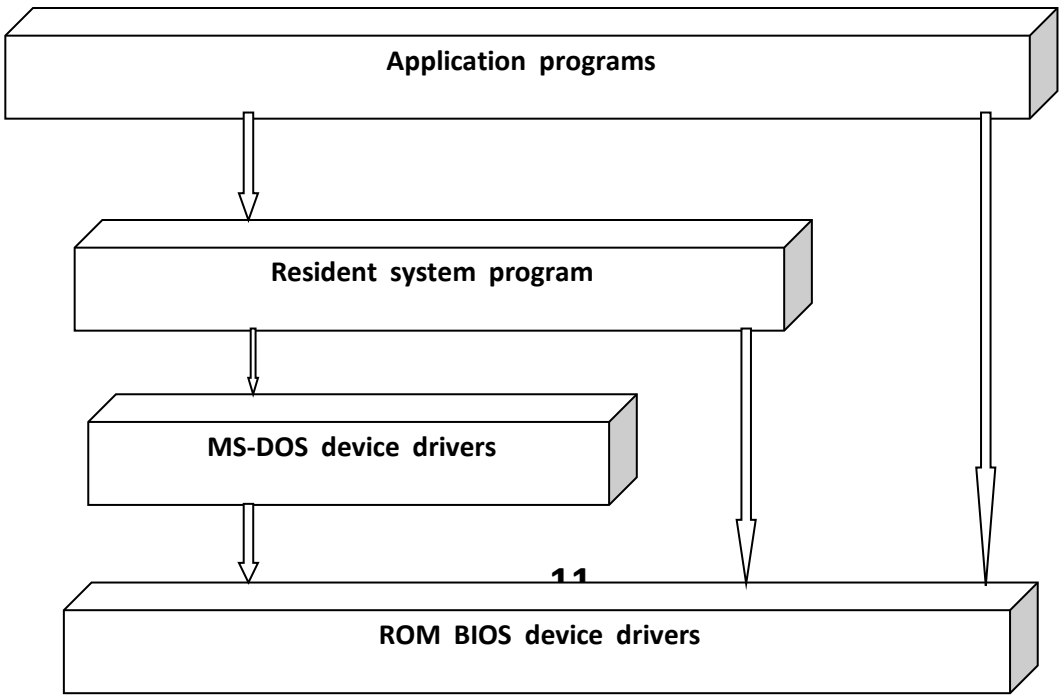
There are two approaches for the O/S structure:

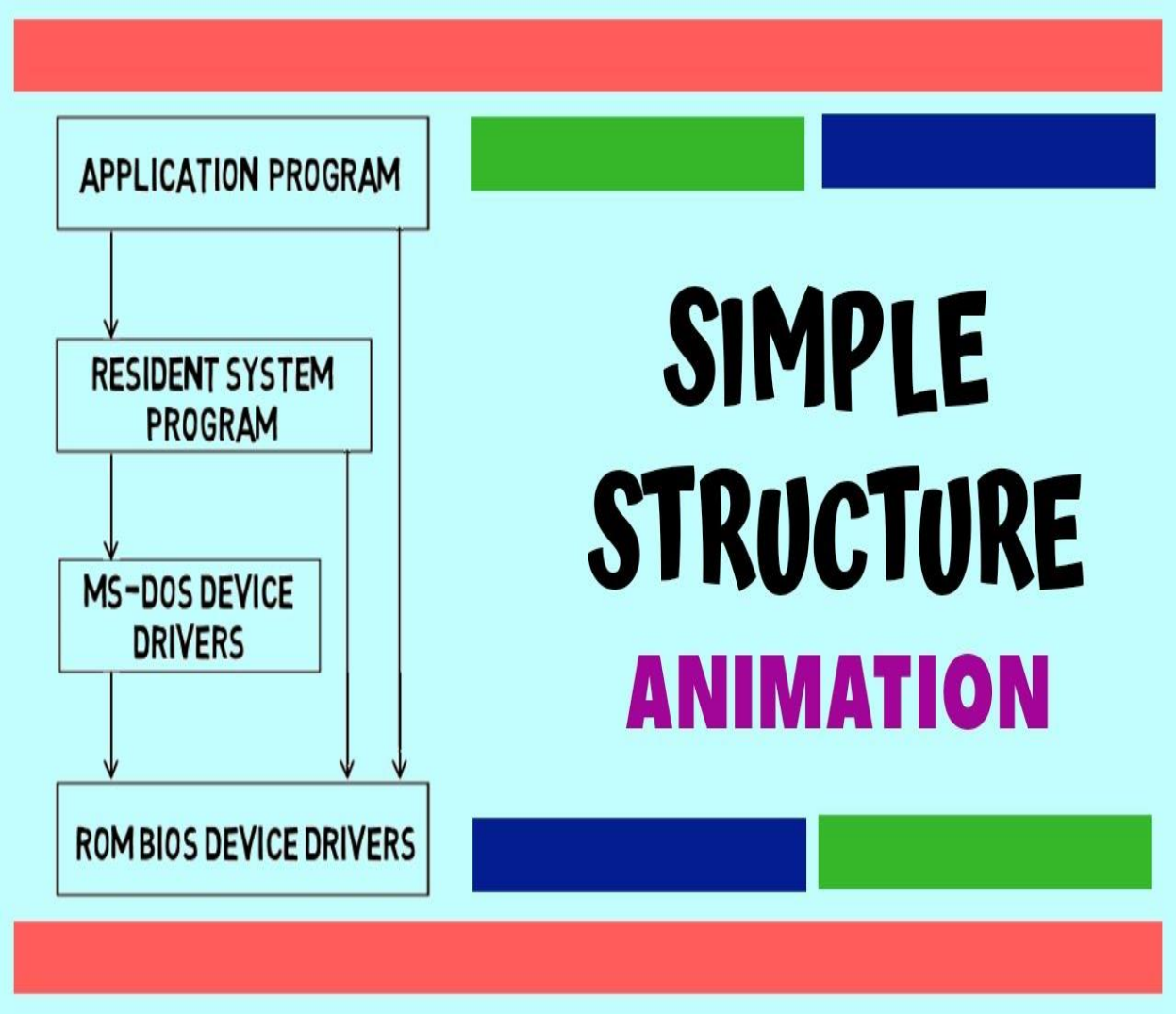
2.1 Simple Structure

Small, simple, and limited systems.

The interfaces and levels of functionality are not well separated.

Example: MS-DOS.




APPLICATION PROGRAM
RESIDENT SYSTEM PROGRAM
MS-DOS DEVICE DRIVERS
ROM BIOS DEVICE DRIVERS
SIMPLE STRUCTURE
ANIMATION

2.2 Layered Approach

Consists of breaking the O/S into number of Layers (levels), each built on top of lower layers. The bottom layer (layer 0) is the H/W, the highest (layer N) is the user interface.

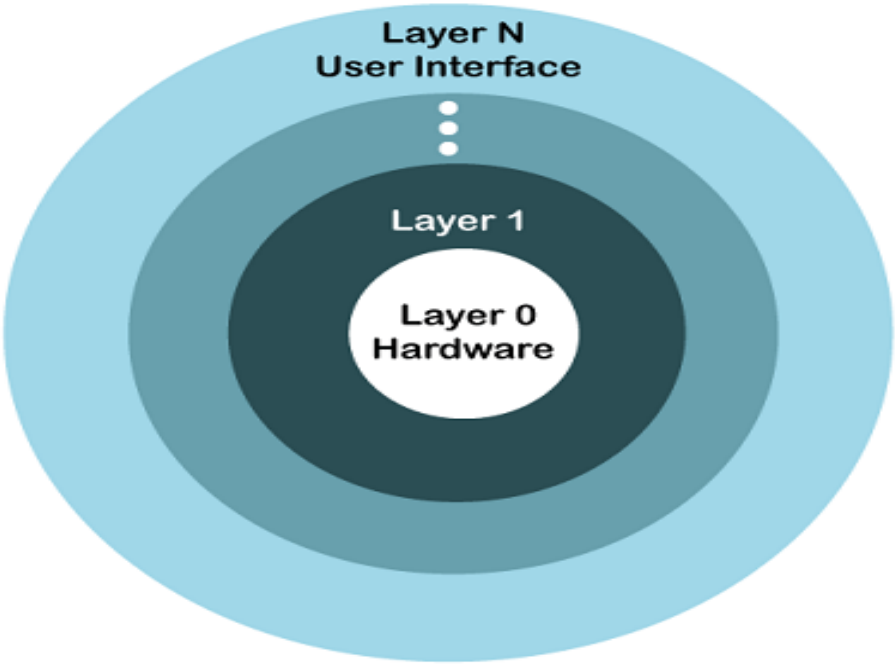
Layer 5:	user program
Layer 4:	buffering for input and output devices
Layer 3:	operator-console device driver
Layer 2:	memory management
Layer 1:	CPU scheduling
Layer 0:	Hardware

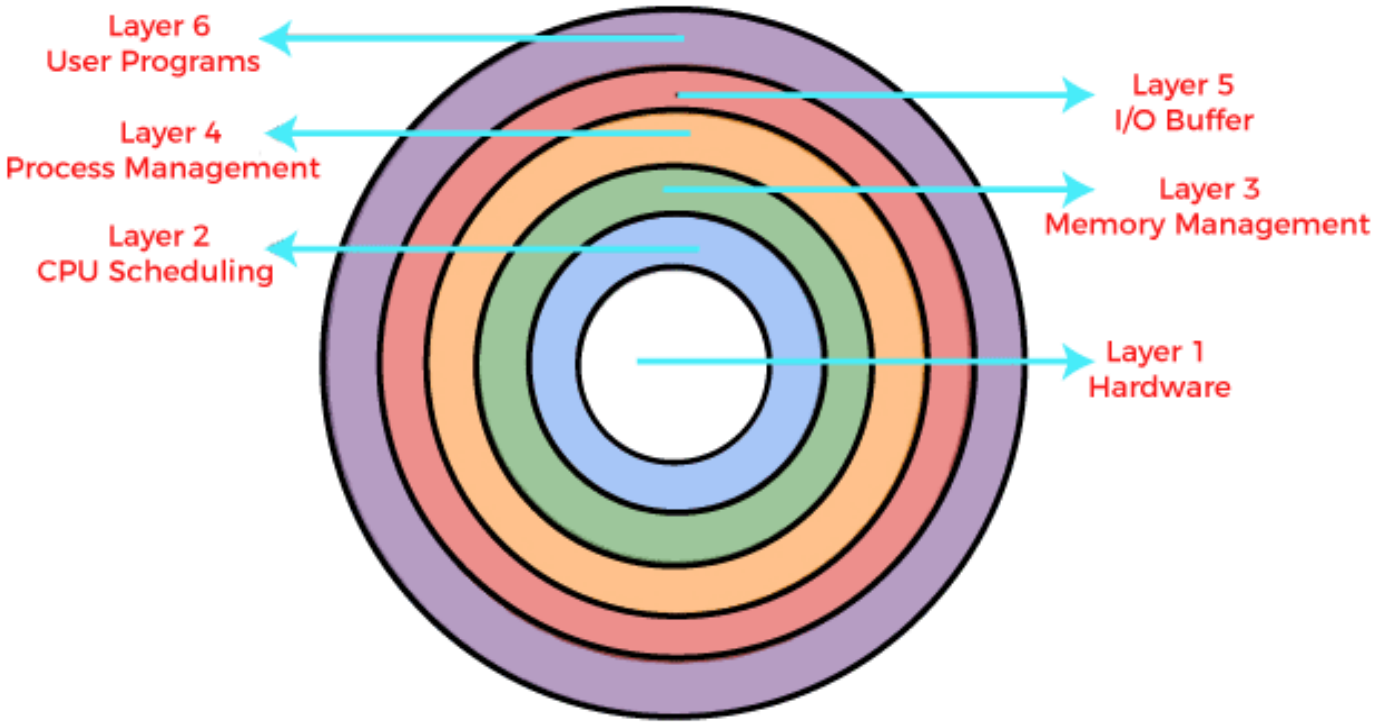
The layer structure

Advantages:

a- modularity: The layers are selected such that each uses functions (operations) and services of only lower-level layers.

b- simplifies debugging and system verification: The first layer can be debugged without any concern for the rest of the system.


Layer N
User Interface
Layer 1
Layer 0
Hardware


Layer 6
User Programs
Layer 5
I/O Buffer
Layer 4
Process Management
Layer 3
Memory Management
Layer 2
CPU Scheduling
Layer 1
Hardware

Chapter 3 home work questions

Q1: there are many names for executable program, state these names.

Q2: what are the differences between program and process?

Q3: what is the name of the software which transfers source code written by programmer to machine code known by computer?

Q4: there are many names to machine code. State these names.

Q5: what are the disadvantages of operating systems simple structure?

Q6: what are the advantages of operating systems layered structure or approach?

Answer the following MCQ (multiple choice questions):

1. One of the following is not user process
    a) Microsoft word processing
    b) Microsoft excel processing
    c) Bootstrap program
    d) Web browsers
2. Process is:
    a) Program in high level software language kept on disk
    b) Contents of main memory
    c) A program in execution
    d) A job in secondary memory

3. In layered architecture of computer system
    a) users are at the top
    b) operating system is in independent H/W and application
    c) Hardware is at the bottom
    d) All of the above

4. In layered architecture of operating system:
    a) User, application software, hardware, operating system
    b) User, operating system, application software, hardware
    c) User, operating system, hardware, application software
    d) user, application software, operating system, hardware

5. in layered approach of operating systems:
    a) bottom layer 0 is the user interface
    b) highest layer N is the user interface
    c) bottom layer N is the hardware
    d) highest layer N is the hardware

6. Job is nothing but:
    a) process
    b) program
    c) application software
    d) system software

7. which is the services of operating system
    a) process management
    b) file system management
    c) memory management
    d) all o the above