

Tlemcen University
Computer Science Department
1st Year Engineer

"Introduction to operating system 1"

Session 2: Overview of the UNIX system

Academic year: 2023-2024

Outline

❑ Introduction

- *Definition and functions of an operating system*
- *History of the Unix (Linux) operating system*

❑ Presentation of the Unix system

- *Unix users*
- *The main functions*
- *Structure of the Unix system*
- *How Linux works*
- *The Shell*

❑ Opening and closing a session

- *Opening a session*
- *Creating/changing a password*
- *Closing a session*

Introduction

❑ What is an operating system?

- *An operating system (OS) is a set of programs that manage the hardware resources of a computer and make these resources available to the user, so that the user can use the computer effectively.*
- *An operating system is a meta-program, a program that manages the computer's hardware resources and interacts with users to run other programs.*
- *Examples of operating systems:*
 - *Windows, Mac OS, Unix, OS/2, BeOS, AmigaOS, Plan 9, etc.*

□ An operating system can be defined :

- *By component*

- *Divide it down into major components to get an overall idea of the system: memory, CPU and peripherals*

- *By functions (what can it be used for?)*

OS objectives

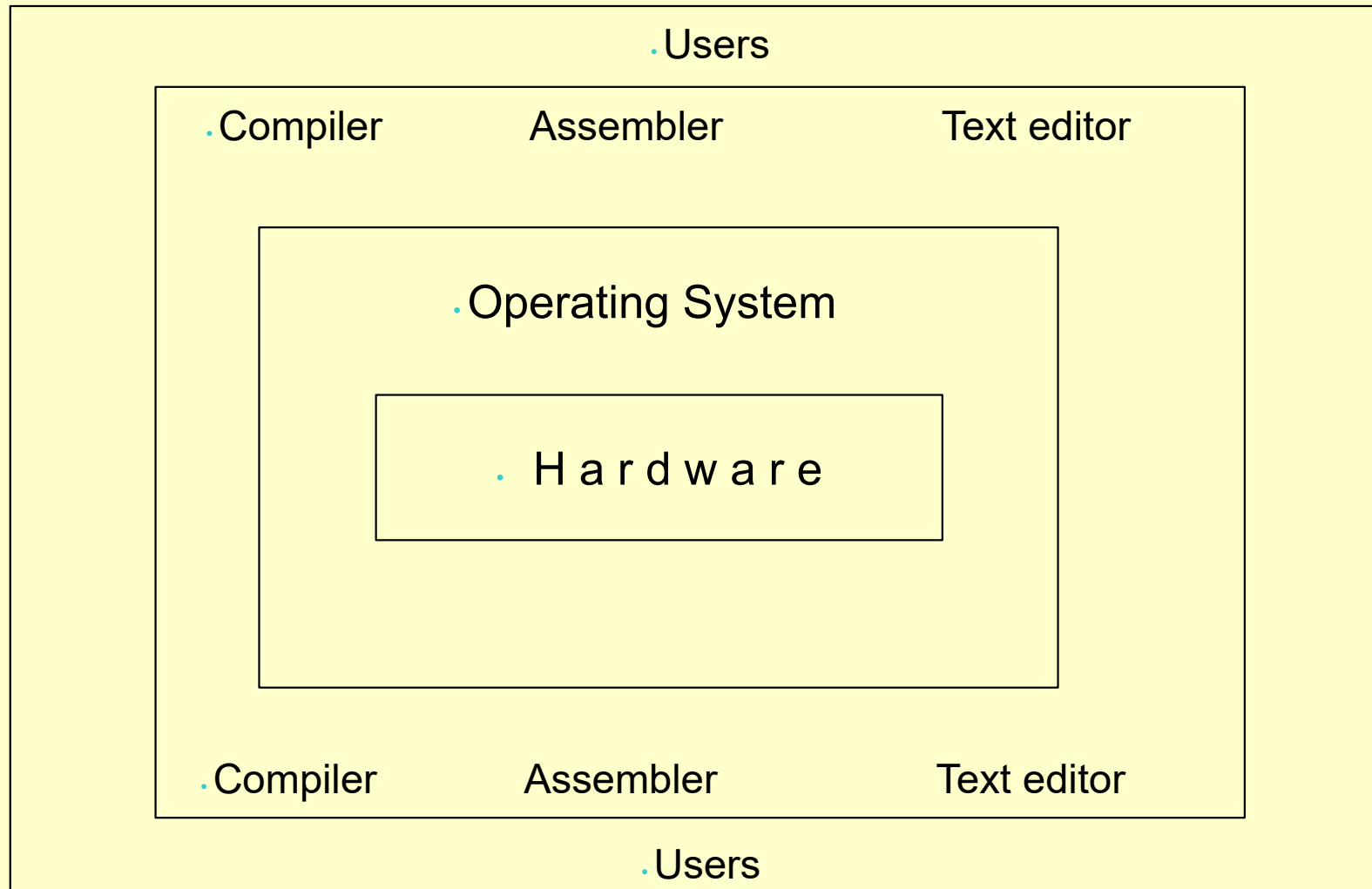
❑ Resource management (efficiency)

- *OS makes the most of the machine's resources*
- *Making the best use of resources for maximum performance*
- *There are two types of resources:*
 - *Hardware: central memory, CPU and peripherals*
 - *Software :*
 - *File: a collection of data on a storage medium, grouped together according to certain mechanisms.*
 - *Process: a running program,*

❑ Virtual machine (easy to use)

- *OS aims to satisfy the user by providing a user-friendly environment for operating the machine.*

OS: Machine /User



Services provided by the operating system

- ❑ An operating system must provide the following services:
 - *A command interface for the user*
 - *Support for program creation*
 - *File management*
 - *Management of programs and applications*
 - *An interrupt service (software and hardware)*
 - *Input/output management and associated hardware.*
 - *Services for networks and associated hardware.*
 - *Measurement of computer statistics and performance.*

History of UNIX

- ❑ The origins of Unix date back to the late 1960s at Bell Labs.
 - *This laboratory, in collaboration with MIT, was developing an operating system called "Multics".*
 - *In 1969, Ken Thompson, one of the staff at Bell Labs, developed a game called "Space Travel" on Multics, and then on other operating systems.*
 - *K. Thompson wrote, in collaboration with Dennis Ritchie, a file management system, a few basic utilities such as cp and rm, and a shell.*
 - *In 1970, Brian Kernighan, another collaborator with Thompson, suggested the name "UNIX", a pun on "Multics".*

- The rise of Unix is very closely linked to the C language.
 - Originally, the first Unix was written in assembler, then K. Thompson created a new "B" language.
 - In 1971, D. Ritchie in turn wrote a new "C" language, based on the B language.
 - In 1973, almost all of Unix was rewritten in C (95% was in C).
 - This made Unix the first system in the world to be written in a portable language (not in assembler).
 - In 1974, Unix was distributed to universities (Berkeley and Columbia). It consisted of :
 - a simple, modular file system,
 - a unified interface to peripherals via the file system,
 - Multitasking
 - and a flexible, interchangeable command interpreter.

■ 1979-1984:

➤the first commercial steps In 1979, with version 7, Linux developed commercially.

■ 1984-1993: standardization

➤In 1984, System V.2 was adopted as the standard,

➤In 1985 AT&T published SVID (System V Interface Definition), which defined the application interface of the V.2 system and not its implementation,

➤In 1986, the V.3 system introduced shared libraries and RFS (Remote File Sharing),

➤In 1993, X/Open launched COSE (Common Open Software Environment). These were agreements between manufacturers to develop applications in a common environment.

■ 1991- ...: Linux

- LINUX is a free implementation of the POSIX specifications with System V (AT&T) and BSD (Berkeley) extensions,
- In 1991, Linus B. Torvalds (Helsinki) used MINIX (Minix is an operating system, a Unix clone, based on a microkernel created by Professor Andrew Stuart Tanenbaum for educational purposes).
- August 1991: 1st version of LINUX 0.01. This is a rewrite of MINIX, with the addition of new functions and the distribution of sources on the Internet,
 - This version made it possible to run a number of essential GNU (free software) applications such as the gcc compiler and the bash shell,
 - Linus decided to put the source code under the GPL licence: everyone could then participate in the development of Linux under legal conditions.
- 1991-94: the anarchic development of Linux prevented it from becoming a competitive system.

- Its weak point is its file system, inherited from Minix.
- With the integration of the BSD file system (ext2fs: Second Extended Filesystem) into Linux,
 - This made Linux a reliable system and became a standard.
- Linux became a complete UNIX system compatible with other UNIX systems, offering more professional-quality services.

■ 1995

- With the advent of the Internet, Linux was able to expand among developers and also in the operating systems market.
- The emergence and development of private companies such as RedHat contributed to the evolution of Linux.
- The distributions (Red Hat, Fedora, Ubuntu, Debian, etc.) became increasingly user-friendly and easy to install, and professional services were set up to facilitate the implementation of Linux in businesses.

■ 1996

- RedHat is voted the best OS by InfoWorld.
- Start of the KDE project: development of user-friendly projects for the general public begins.

Presentation of the UNIX system

□ UNIX users

- *There are two types of person on a UNIX system:*
 - *the UNIX user*
 - *This person uses the system to produce something; the UNIX system is a tool for them.*
 - *This category includes programmers, database users, etc.*
 - *UNIX system administrator*
 - *This category of people is responsible for installing, configuring and running the UNIX system.*
- *On a UNIX system, UNIX users have limited permissions,*
 - *Certain commands are forbidden to them and they do not have access to certain parts of the system.*
 - *System administrators, on the other hand, have full rights over the system.*
- *The number of administrators is generally limited on a UNIX system (called ROOT or superuser).*

- A UNIX user belongs to one or more groups.
- Groups are used to bring users together in order to assign them common rights.
 - The main group is the user's initial group.
 - The user may belong to secondary groups.

The main functions of UNIX system

□ UNIX is an operating system whose main tasks are as follows:

■ *Resource sharing*

- *UNIX ensures that all the computer's resources (CPU, memory, etc.) are shared equally between all the processes.*
- *For example, if an application such as a database is launched and this application is time-consuming, another application can be launched in the same way.*
 - *You end up with two processes running at the same time;*
 - *The OS is responsible for ensuring that the two processes can use resources equitably and that the second process launched does not wait for the first to finish before launching itself.*
- *The ability to run several processes or tasks at the same time, in parallel, is called multitasking.*

■ *Interface with hardware*

- UNIX does not allow any process to directly access a hardware resource (hard disk, USB, keyboard,).
- These resources are accessed via special files (applications).
 - For example, to write to a USB key in the USB port, all you have to do is write to the special file in the USB port. Similarly, to read from a hard disk, you read the special file on the hard disk.

■ *Memory management*

- There are two types of memory: volatile memory and static memory,
 - When the computer is switched off and on again, all the data in volatile memory disappears, while the data in static memory is always present.
 - Volatile memory is found in RAM (Random Access Memory), static memory in a hard disk, CD or USB stick.
- In the UNIX vocabulary, memory management refers to the management of random access memory (RAM).

- *Every program that runs (process) needs memory to store the data that it manipulates.*
 - *However, a computer generally has a limited and non-extendable amount of memory.*
 - *UNIX must therefore ensure that memory is shared between all processes,*
 - *Any one process must not monopolize all the memory, otherwise the other processes would no longer be able to function (putting them into a state of starvation).*
- *In UNIX, memory is seen as a hardware resource. UNIX must therefore check that no process accesses memory directly.*

■ *File management*

- *UNIX provides the tools needed to store data and retrieve it quickly and easily.*
- *It also provides the tools to view all the files in a simple way.*
- *These files are located on storage media such as hard disks.*
- *UNIX provides a file protection mechanism.*
 - *Given that several users can work at the same time on the same machine, this is the concept of multi-users.*
 - *Each user of the system has their own files, and UNIX gives them the means to protect their files, and to grant other users the permission to access their files or not.*

The benefits of Unix

□ Portability

- *Software is portable when it can run on different machines.*

□ Multi-user

- *The Unix system allows several users to access system resources.*

□ Multi-tasking

- *Unix allows users to perform more than one task at a time.*

□ File system

- *Allows a hierarchical structure*

□ Modular programs

- *The system is made up of utilities, each designed for a specific task.*

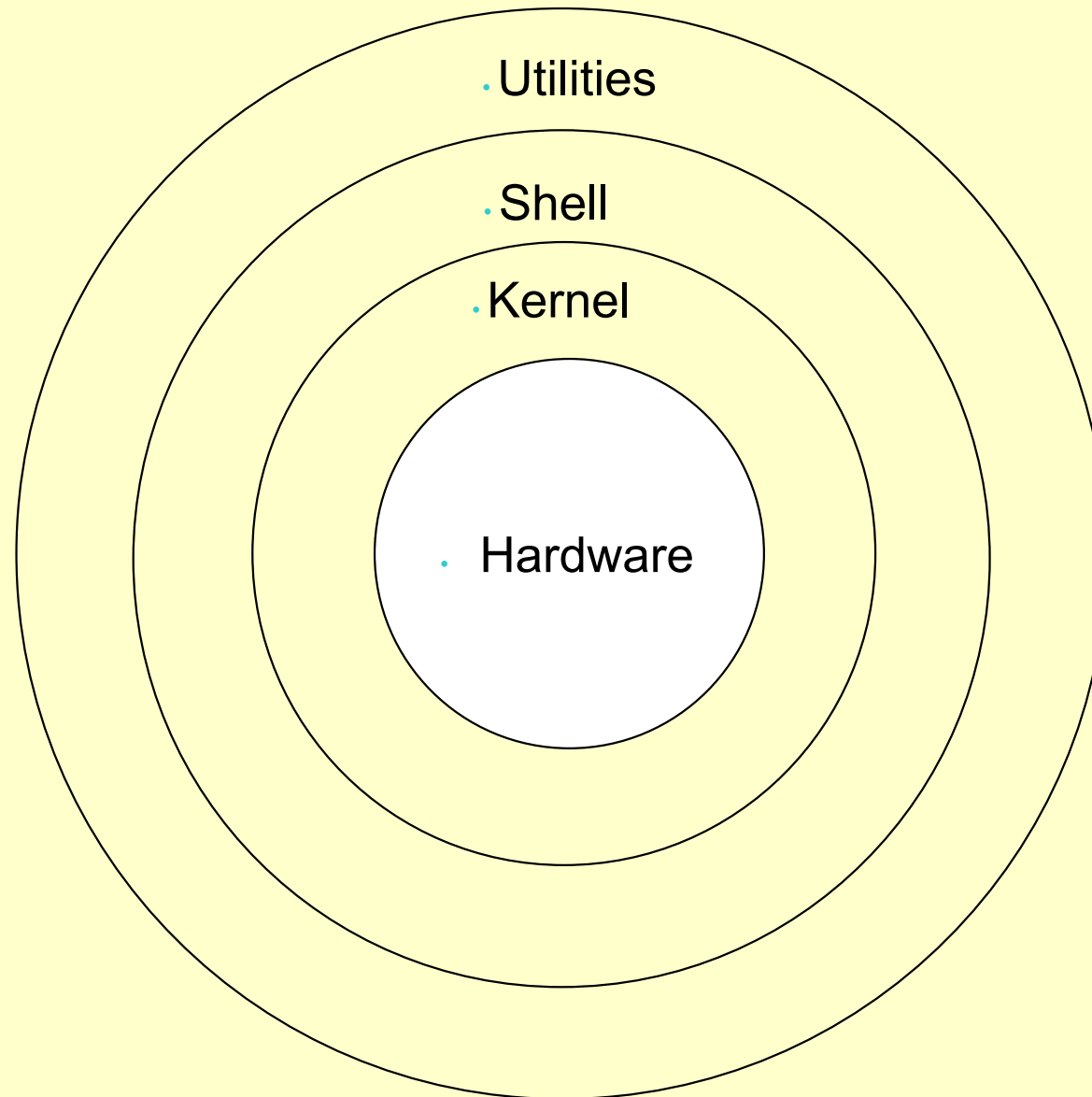
□ User interface

- *It is essentially command-oriented*

Unix structure

- ❑ The structure of Unix is made up of four concentric layers:
 - *The central kernel: contains the basic process and memory management functions. It is a time-sharing allocation automaton.*
 - *The complete kernel: contains the input/output interface drivers.*
 - *Shell: is the command interpreter through which the user interacts with Unix.*
 - *Tools and applications: the set of programs and utilities that have been developed to enhance the system.*

Cont'



Cont'

- ❑ The operating system is a set of programs grouped together in what is known as a kernel.
- ❑ Processes cannot access hardware resources directly,
 - *In fact, processes use the kernel to access them, using a set of commands called UNIX "system calls".*
 - *These system calls control two main components of the kernel,*
 - *The process manager,*
 - *Its role is to ensure that processes run and access memory fairly, and it is also known as the scheduler.*
 - *It interacts with the file subsystem through a specific set of system calls such as: open, close, read, write...*

➤ *the file management system.*

– *Its role is to manage the file system, particularly in terms of access rights, file space allocation and free space recovery.*

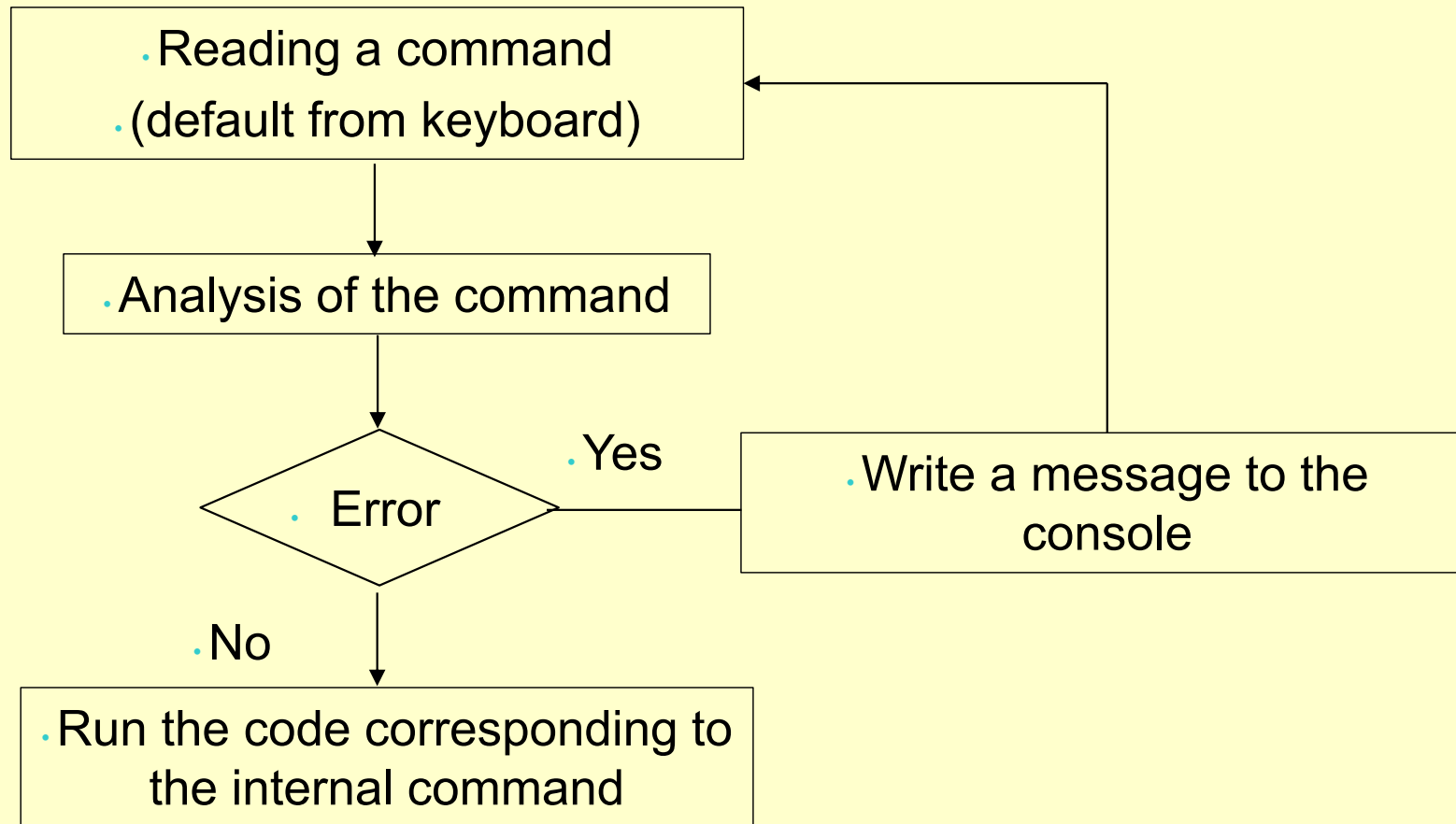
➤ *These two kernel components access the hardware directly.*

□ The kernel manages the basic tasks of the system:

- *System initialization,*
- *Resource management,*
- *Process management,*
- *File management,*
- *I/O management*

□ The Shell

- *To operate the machine, the user has access to software or a utility that allows commands to be entered directly.*
 - *This utility is called the **Shell**.*
- *Its role is to interpret user commands before transmitting them to the kernel,*
 - *This is why it is also called the command interpreter.*
- *There are several types of Shell, differing in syntax and the range of commands.*
 - *The most common is the Bourne Shell (sh), but there is also the C-Shell (csh), which is similar to the C programming language, the Korn Shell, the Posix Shell and, under Linux, the Bourne Again Shell (bash).*



The Unix kernel

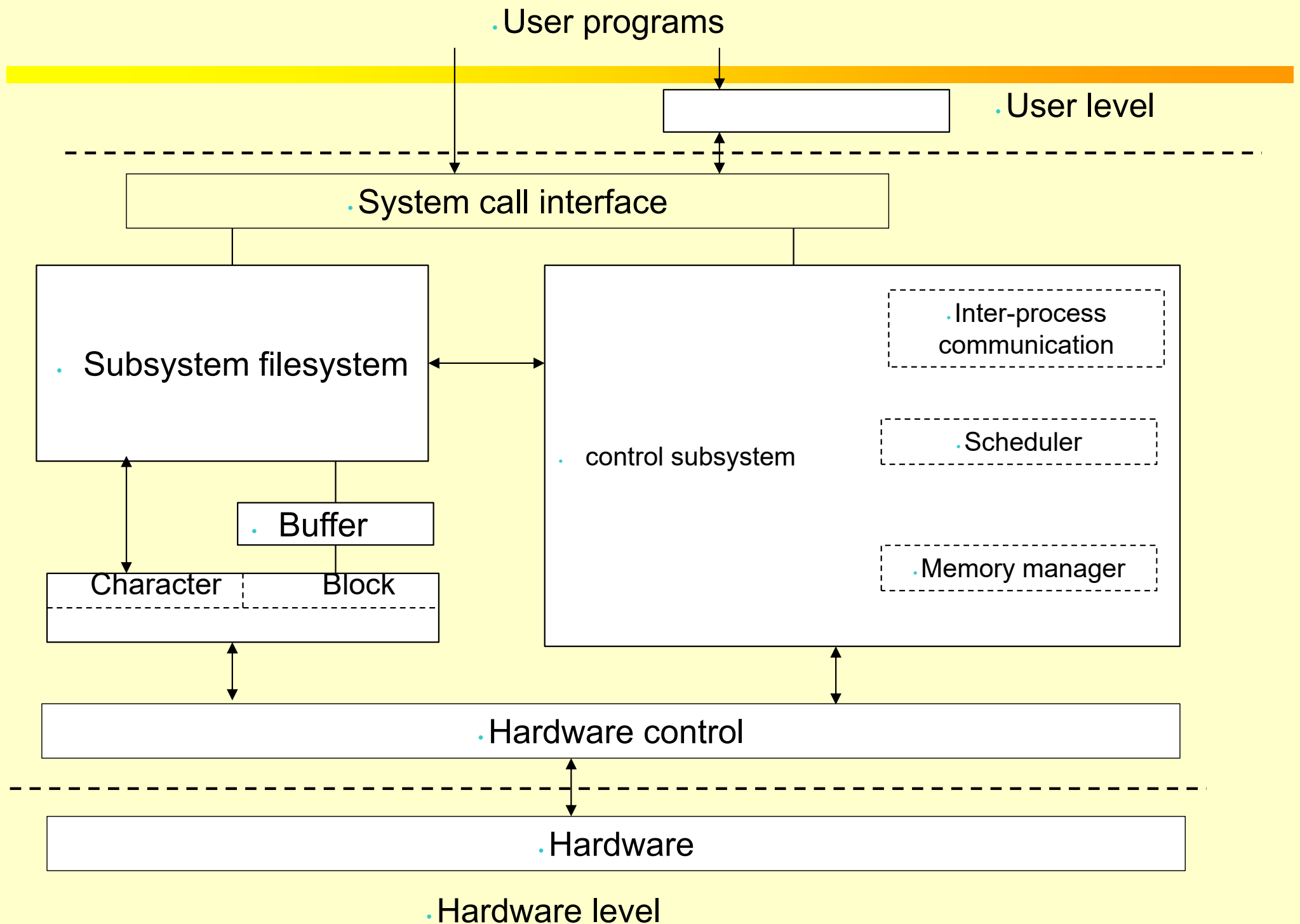
□ Kernel structure

■ *The file subsystem*

➤ *A file occupies space (for space management)*

■ *The process subsystem*

➤ *A process has a lifetime*



File management

- ❑ In Unix, a file is seen as a logical resource, not a physical one.
 - *It is a set of blocks of data that are scattered on the disk and can be recovered using assembly mechanisms.*
- ❑ File types in Unix :
 - *Ordinary files Standard files (text, executable,)*
 - *Catalogue files directories (folders)*
 - *Special files Peripherals as data sources or used as outputs*

Login and logout

❑ *Logging in*

- *Before attempting a connection, you must first ensure that you have an account on the machine,*
- *a user account characterized by a name or login and an associated password.*
- *When you switch on the machine, it asks you to enter the login and password and then you can open a terminal from which you type your commands,*
 - *Under Linux you would have as follows: [login@localhost login]\$.*

❑ *Changing the password*

- *Once the user is logged in, they can change their password using the "passwd" or "yppasswd" command,*

- *Some UNIX systems require passwords with at least 6 characters, including 1 or 2 non-alphabetical characters.*

- *If you have forgotten your password, you must contact the system administrator (root) who is the only person authorized to unlock it.*

*>passwd Old passwd :******

Setting password for user : Mohamed

*New password :******

*Reenter password :******

❑ *Closing a session*

■ *To log out or close the session*

➤ *If you are in a non-graphical environment, simply type the following commands at the prompt:*

***gnome-session-quit** (if you are in your session) or*

sudo pkill -KILL -u username-of-the-session.

➤ *You will then be presented with the login prompt, and another user will be able to use the machine.*

➤ *You should take care to log out when you are no longer using the system, for security reasons, but also to free up the workstation.*

➤ *In a graphical environment, the commands **exit**, **logout** and **Ctrl-D** have the same effect. These commands are used to exit the terminal.*

❑ *Creating a session*

- *Only root users or users with **sudo** privileges can use the **adduser** command to create new user accounts.*

sudo adduser username

A password will then be requested for this new user

- *This session will be created in the /home directory*