CSI 3131
Operating systems

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Course objectives

- Know the basic concepts of operating systems.

- Define and prove the need for operating systems.

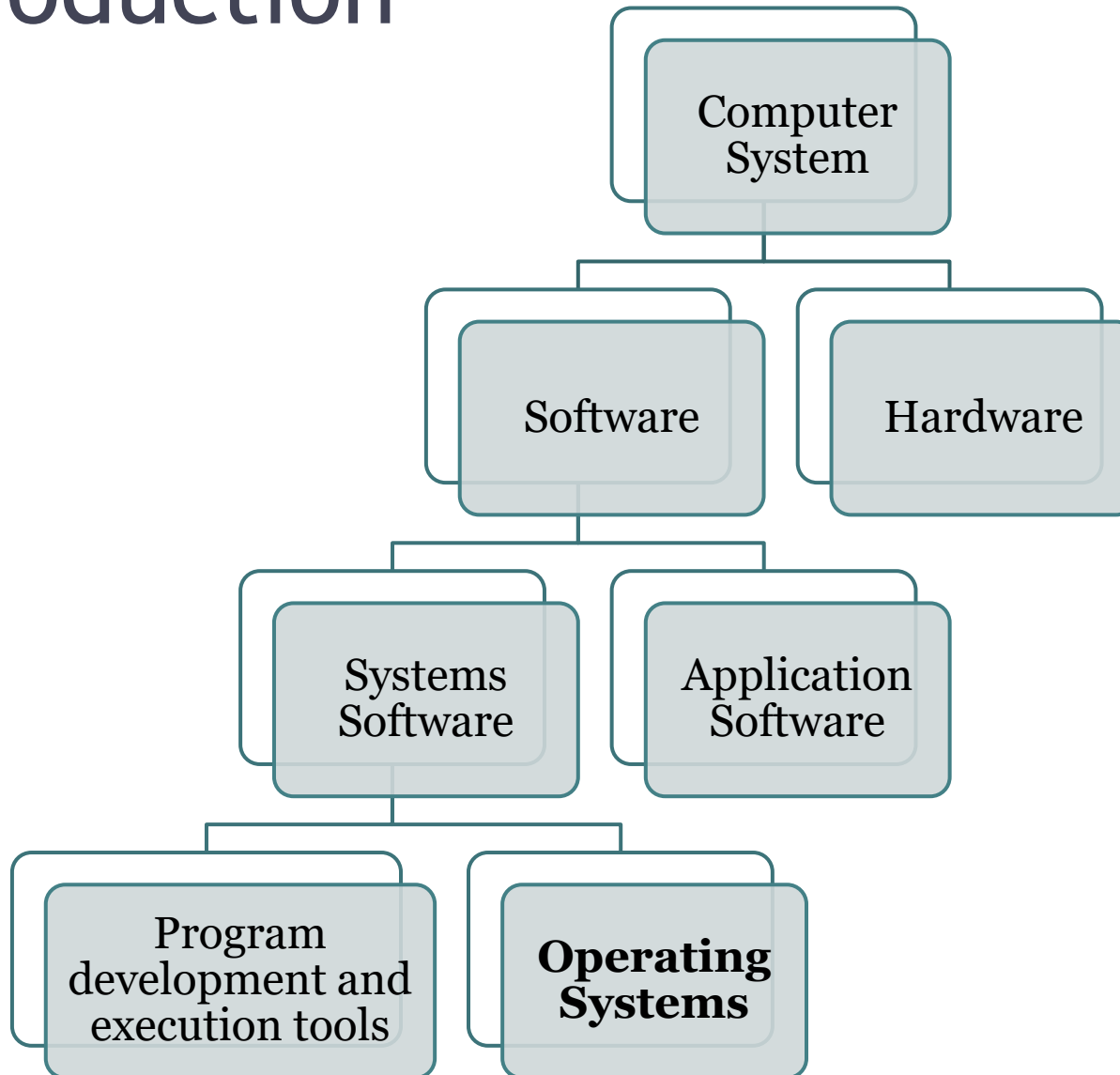- Understand the functionalities of an operating system.

Plan

- Introduction

- Definition of operating systems

- Main features:

  - Process management

  - Memory management

  - File management system

Introduction

• Windows
• Mac
• Unix
• FreeBSD
• Solaris
• Linux
• Debian
• …

Introduction

Computer System → Software, Hardware

Software → Systems Software, Application Software

Systems Software → Program development and execution tools, **Operating Systems**

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Definition of operating systems

- **Intermediary between the computer and the applications / users.**

- Computer: a set of resources (physical + logical)

- **Physical resources** : cpu, memory, peripherals

- **Logical resources** : files, processes

Definition

✓ Provide a simplified access interface to resources.

✓ Manage the efficient and equitable sharing of resources.
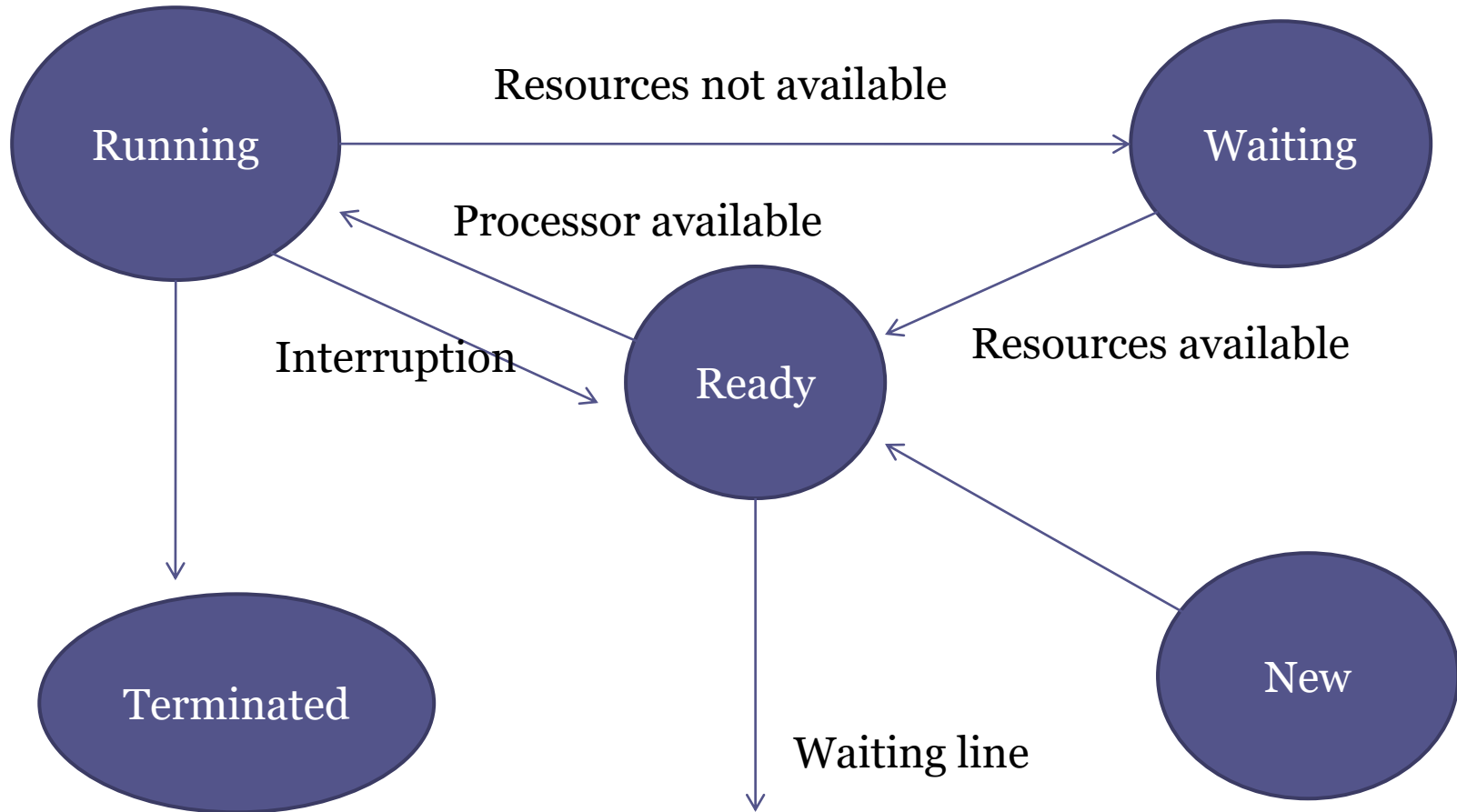
✓ Ensure access control to resources.

⟶The OS is a resource manager that implements a virtual machine.
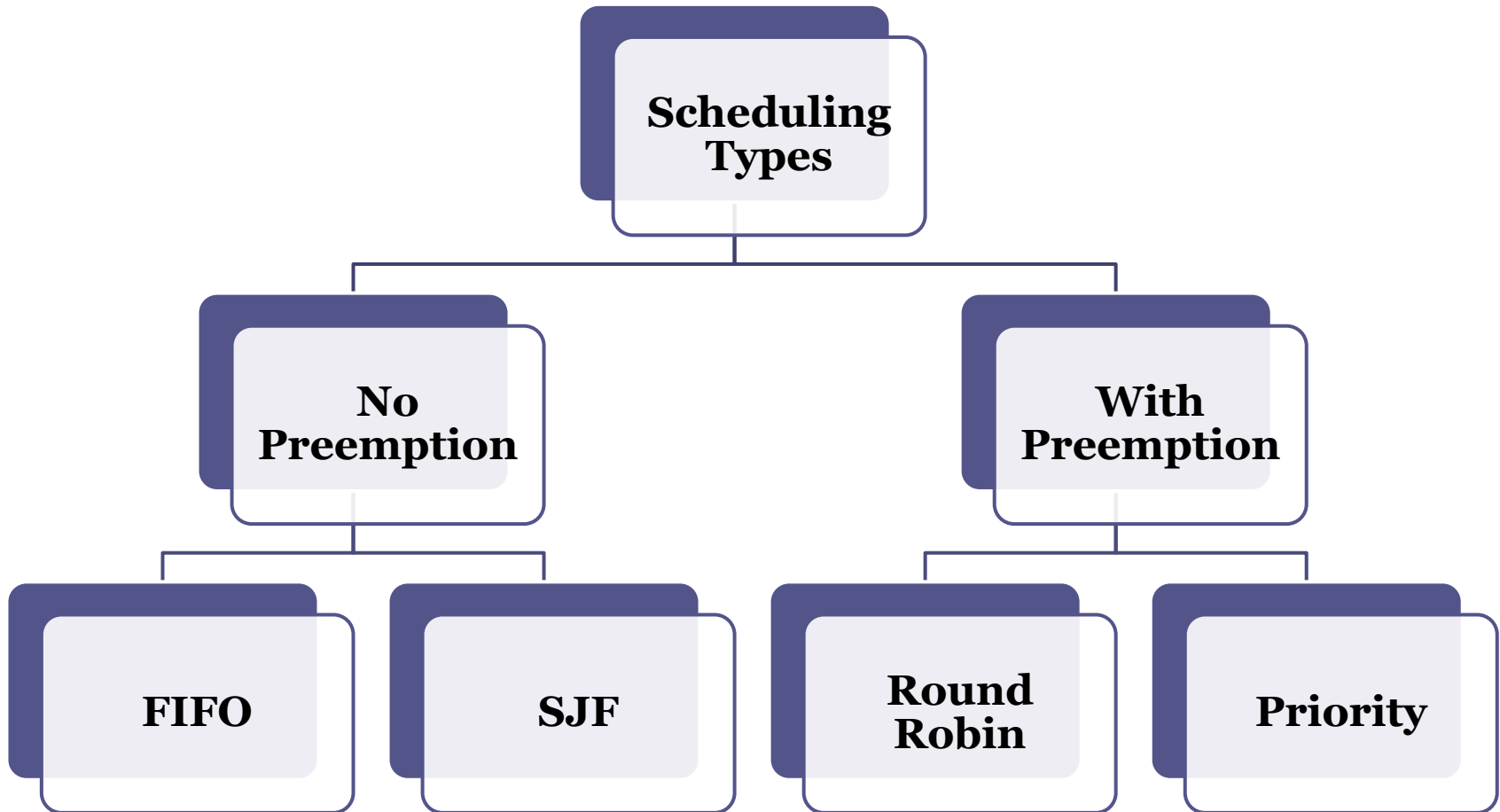
Process management

- A process is a running program.

- **Problem:** A processor can only execute one instruction at a time.

- **Goal :** Share one (or more) processor between different programs (processes).

Process management

Process management

```
                    ┌─────────────┐
                    │ Scheduling  │
                    │   Types     │
                    └─────────────┘
            ┌──────────┴──────────┐
    ┌───────────────┐       ┌───────────────┐
    │      No       │       │     With      │
    │  Preemption   │       │  Preemption   │
    └───────────────┘       └───────────────┘
      ┌─────┴─────┐           ┌─────┴─────┐
  ┌──────┐    ┌──────┐    ┌────────┐  ┌──────────┐
  │ FIFO │    │ SJF  │    │ Round  │  │ Priority │
  │      │    │      │    │ Robin  │  │          │
  └──────┘    └──────┘    └────────┘  └──────────┘
```

File management system

- A file is a logical storage unit for information.

File attributes:

- Name, size, type, protection, date, owner, …

File operations:

- Creation, Write / Read, Delete,

- Concatenation (Append) …

File management system

File Type: executable, command, text, ...

- Some OS support and recognize file type, others don't.

Examples:

- Windows uses the file name suffixes:.exe,

   .bat,.txt,.com...

- Unix does not support file typing.

File management system

Goal :

* organize files

Several organizations:

* single level directory

* two-level directory structure

* tree organization (Unix, Ms-Dos)

Operations:

* navigation, listing, ...

Memory management

- Allow memory sharing.

- Allocate memory blocks to different tasks.

- Protect used memory spaces

- Optimize the amount of available memory.

➡️ Goal: Organize the memory as well as possible to get the maximum performance?

Memory management

Monoprogramming

P 12 MB

Available memory **10 MB**

Multiprogramming

P1 6 MB	P2 2 MB	P3 4 MB

Available memory 10 MB

- **Physical** memory is expensive.
- **Secondary** memory (disks, extended memory, …) inexpensive.

Use secondary memory "as" RAM memory.

Memory management: Virtual memory

- Provide an address space independent of that of physical memory.

- Ability to run programs larger than physical memory.

 Address space > physical space

- Ease of the implementation of multiprogramming.

Memory management: Virtual memory

Principle:

- If a program *A* wants to run when there is no more space in memory ??

  → Swap a piece of another program to secondary memory and replace it with a piece of *A*.

- A program is divided into pieces which we call **pages**, of fixed size.

- Memory is divided into pages of the same size.

Memory management

Virtual address space

Disk

Physical memory

0	3
1	X
	0
	X
	2
	1
	X
N-1	X

page

Frame

Pagination

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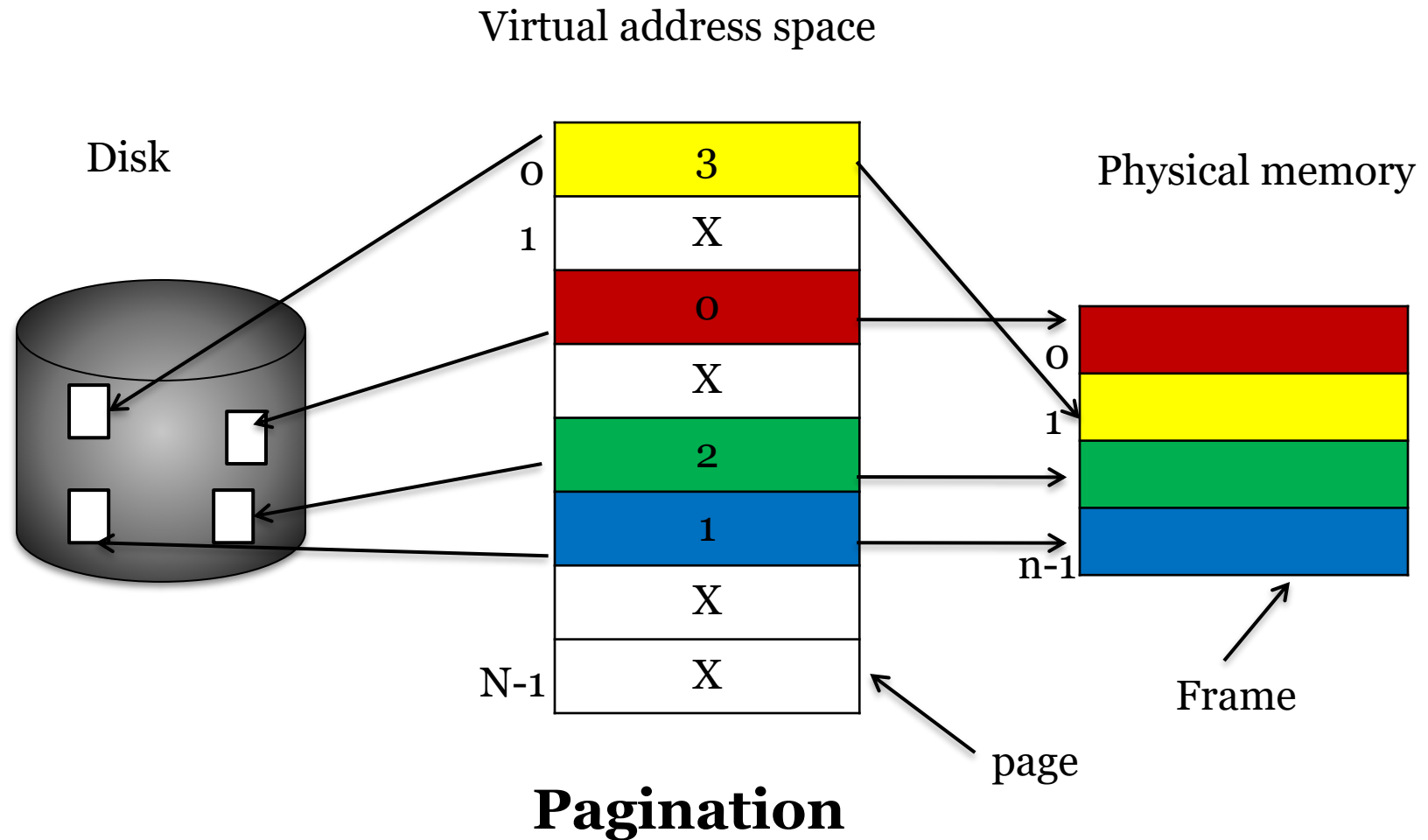
Pagination algorithms

Many algorithms:

* **FIFO** - First In First Out: chronological order of

   loading;

* **LRU** - Least Recently Used : chronological order of use;

* **LFU** - Least Frequently Used ;

* **Random** : randomly ;

* ...

Thank You!

Ευχαριστώ

ขอบคุณ

Vielen Dank

Teşekkürler

Merci

Dmnvwd

شكراً

متشكرم

Gracias

Grazie

Bedankt

Dankie

THANK YOU

Obrigado!

Köszönettel

شكريا

Díky

謝謝

WAD MAHAD SAN TAHAY

감사합니다

GADDA GUEY

Urakoze