CS2100 COMPUTER ORGANISATION

Lecture #1

Introduction

From High-Level Languages to Computer Organisation
(AY2024/25 Semester 2)

Blended Learning Format

- Lecture slides and videos will be uploaded in advance.
- We have recitations every Monday face-to-face and over Zoom (hybrid) to answer your questions and do additional exercises.
  - First meeting on **13 January 2025, 10am – 12nn.**
  - Hybrid: LT8 and Zoom

- You may post questions on netlify QnA
  https://sets.netlify.app/module/676ca3a07d7f5ffc1741dc65

QnA website

Lecture #1: Introduction

1. Programming Languages
2. C Programming Language
3. Abstraction
4. So, What is a Computer?
5. Why Study Computer Organisation?

1. Programming Languages

Programming language: a <u>formal</u> language that specifies a set of <u>instructions</u> for a computer to implement specific algorithms to <u>solve problems</u>.

3. Abstraction (1/3)

- **High-level language**
  - Level of abstraction closer to problem domain
  - Provides productivity and portability

- **Assembly language**
  - Textual and symbolic representation of instructions

- **Machine code (object code or binary)**
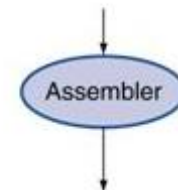 - Binary bits of instructions and data

High-level language program (in C)

```
swap(int v[], int k)
{int temp;
    temp = v[k];
    v[k] = v[k+1];
    v[k+1] = temp;
}
```

Compiler
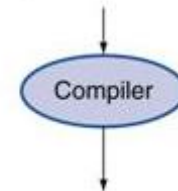
Assembly language program (for MIPS)

```
swap:
    muli $2, $5,4
    add  $2, $4,$2
    lw   $15, 0($2)
    lw   $16, 4($2)
    sw   $16, 0($2)
    sw   $15, 4($2)
    jr   $31
```
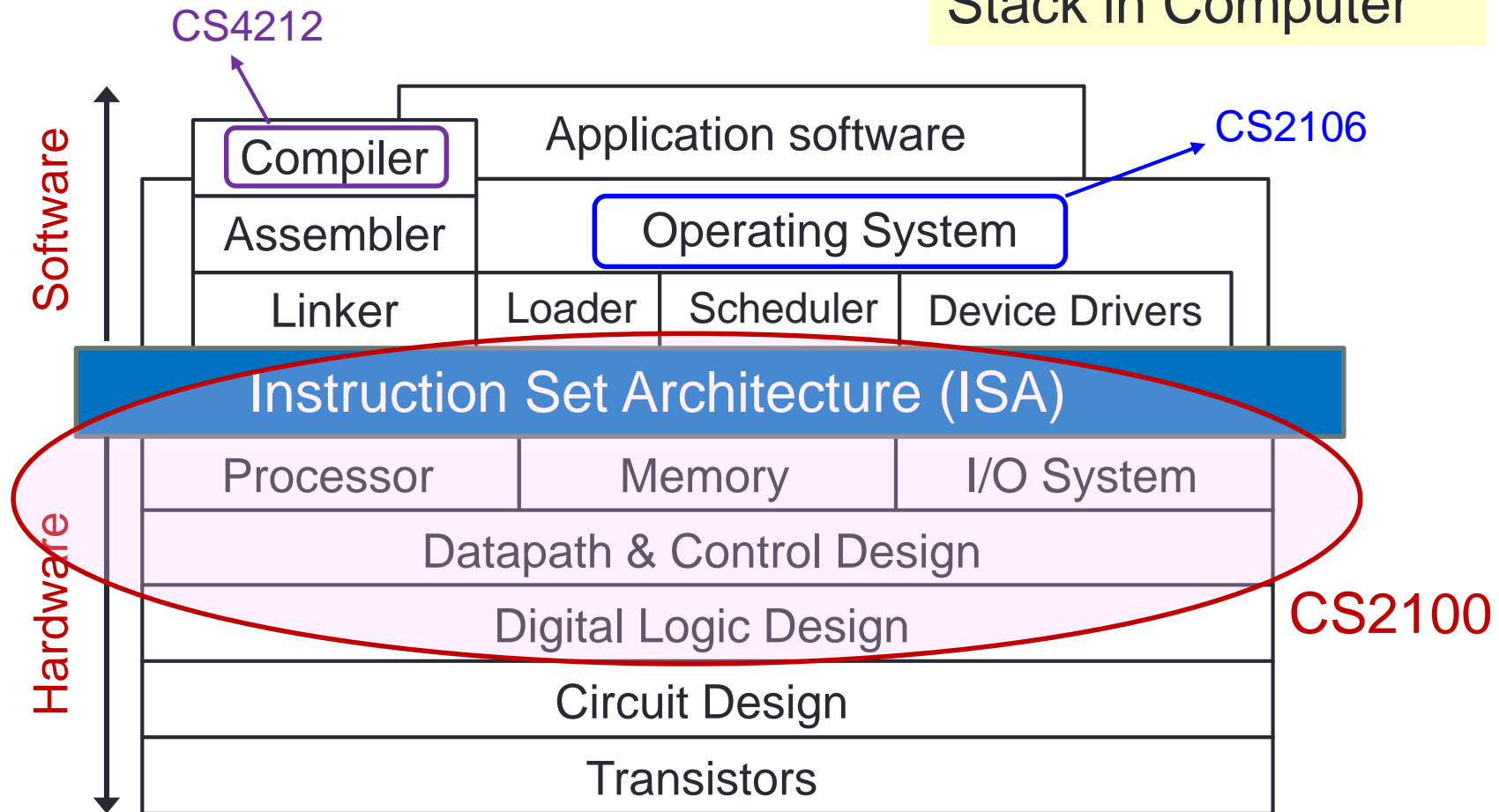
Assembler

Binary machine language program (for MIPS)

```
00000000101000010000000000011000
00000000000110000001100000100001
10001100011000100000000000000000
10001100111100100000000000000100
10101100111100100000000000000000
10101100011000100000000000000100
00000011111000000000000000001000
```
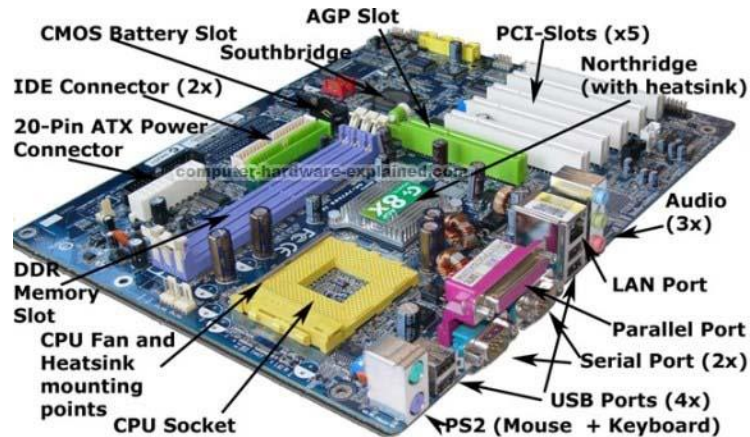
3. Abstraction Layers (2/3)

Hardware/Software Stack in Computer

CS4212

CS2106

Software				
Compiler	Application software			
Assembler	Operating System			
Linker	Loader	Scheduler	Device Drivers

Instruction Set Architecture (ISA)

Hardware			
Processor	Memory	I/O System
Datapath & Control Design		
Digital Logic Design		
Circuit Design		
Transistors		

CS2100
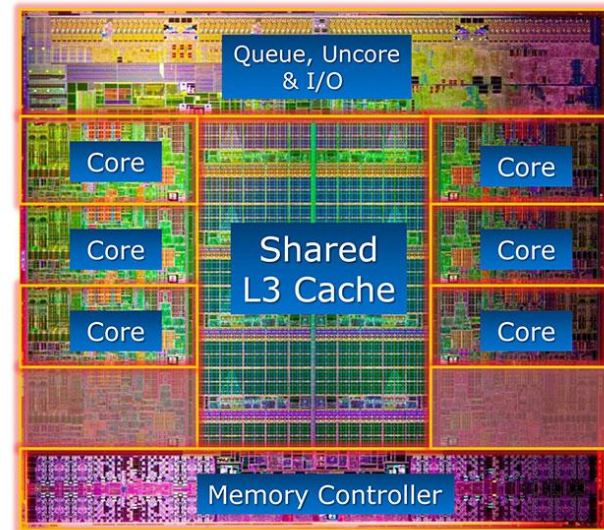
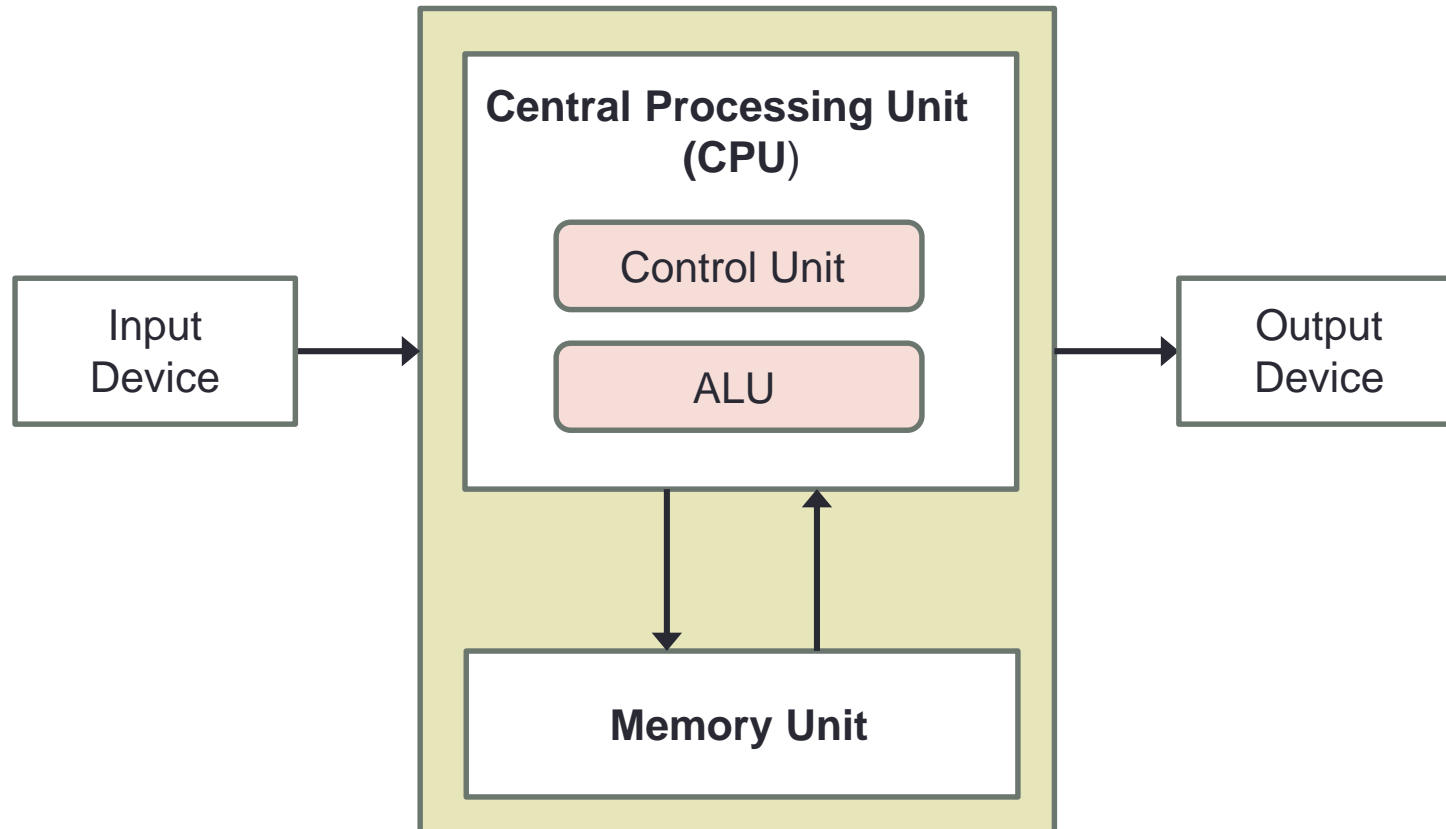# 4. So, What is a Computer? (4/6)

- **PC motherboard**

- **Intel i7 Processor**

Intel® Core™ i7-3960X Processor Die Detail
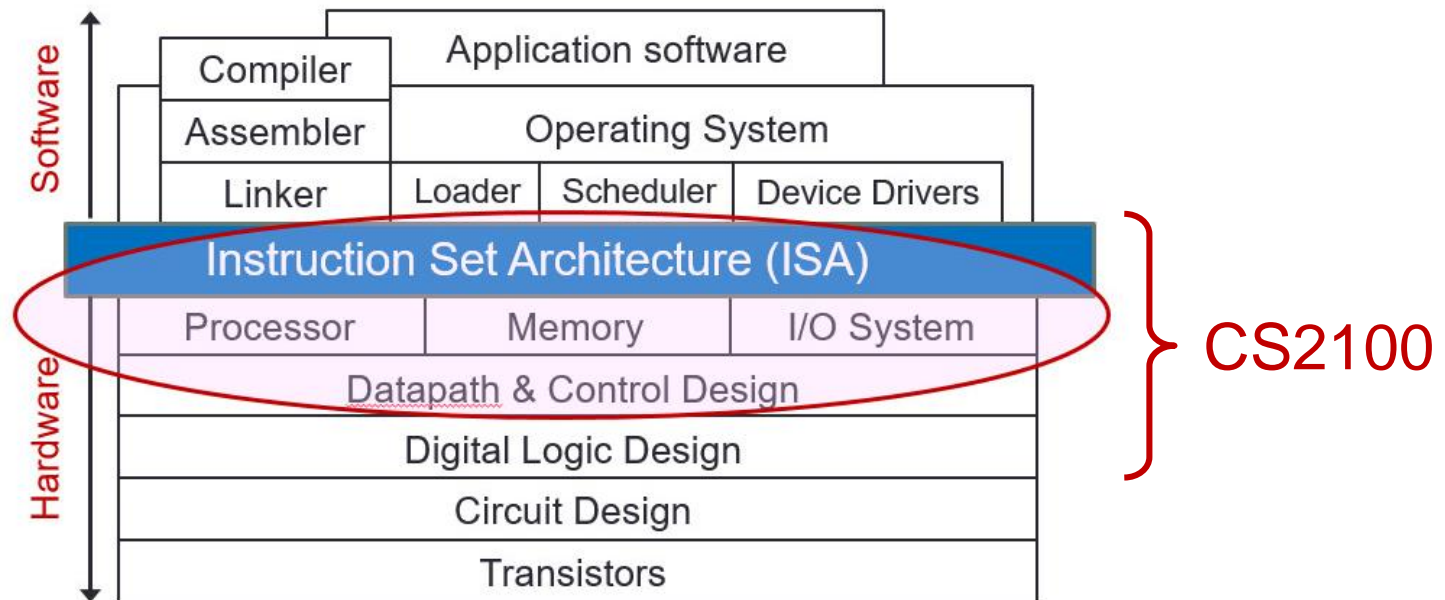
4. So, What is a Computer? (5/6)

ALU: Arithmetic/Logic Unit

5. Why Study Computer Organisation?

- **Computer organisation** is the study of internal working, structuring and implementation of a computer system.

- It refers to the level of abstraction above the digital logic level, but below the operating system level.

5. Why Study Computer Organisation?

(From user to builder)

- You want to call yourself a computer scientist/specialist.
- You want to build software people use.
- You need to make purchasing decisions.
- You need to offer "expert" advice.
- Hardware and software affect performance
  - Algorithm determines number of source-level statements (eg: CS1010, CS2030, CS2040, CS3230)
  - Language, compiler, and architecture determine machine instructions (COD chapters 2 and 3)
  - Processor and memory determine how fast instructions are executed (COD chapters 5, 6 and 7)
- Understanding performance (COD chapter 4)

End of File