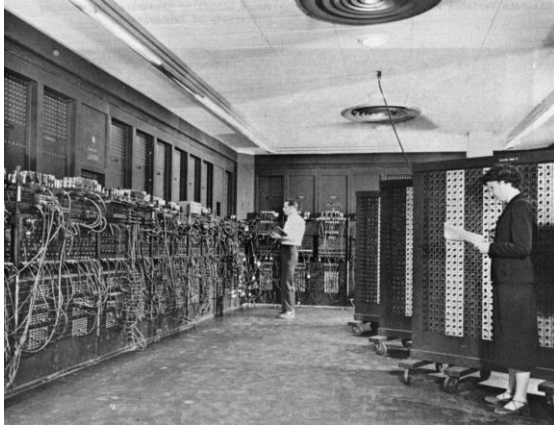


Retreat: Introduction to Computer Systems

Chundong Wang

What is a computer?



ENIAC (1940s)



Desktop (1990s)



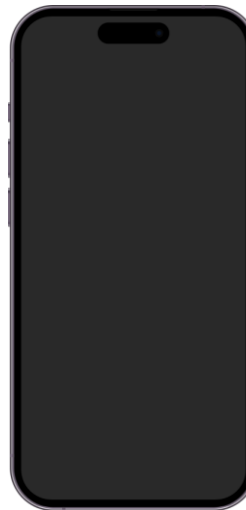
Laptop (2020s)



Raspberry Pi (2020s)



Car (2020s)



Smartphone (2020s)

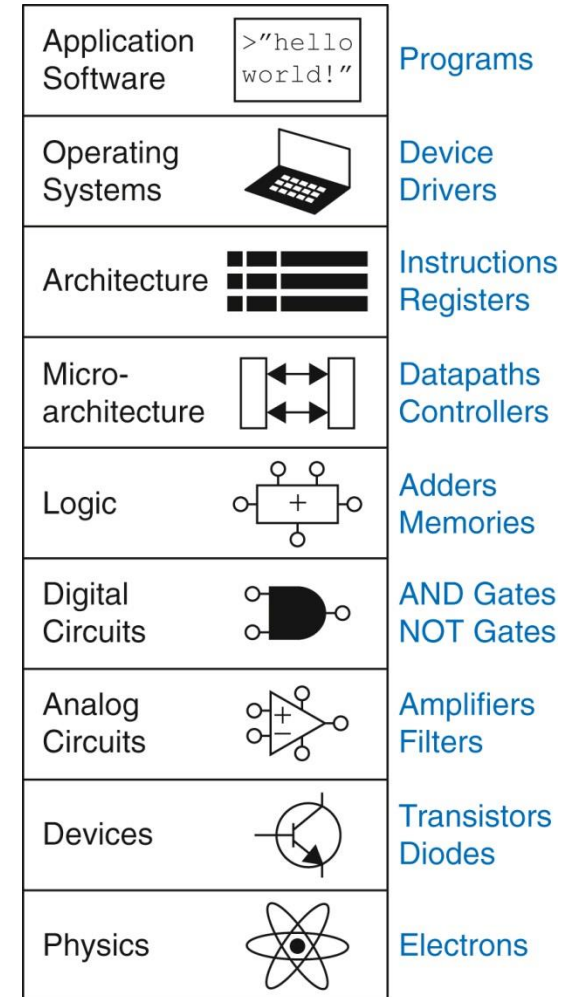
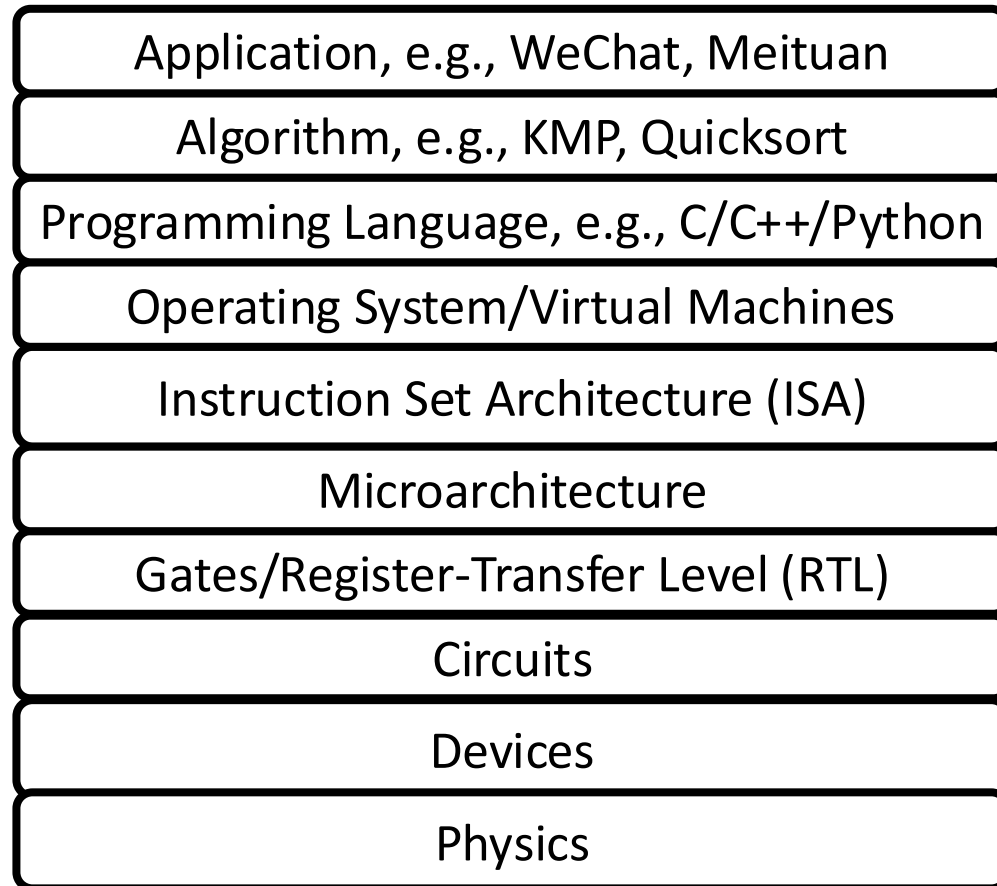


Supercomputer, data center (2020s)

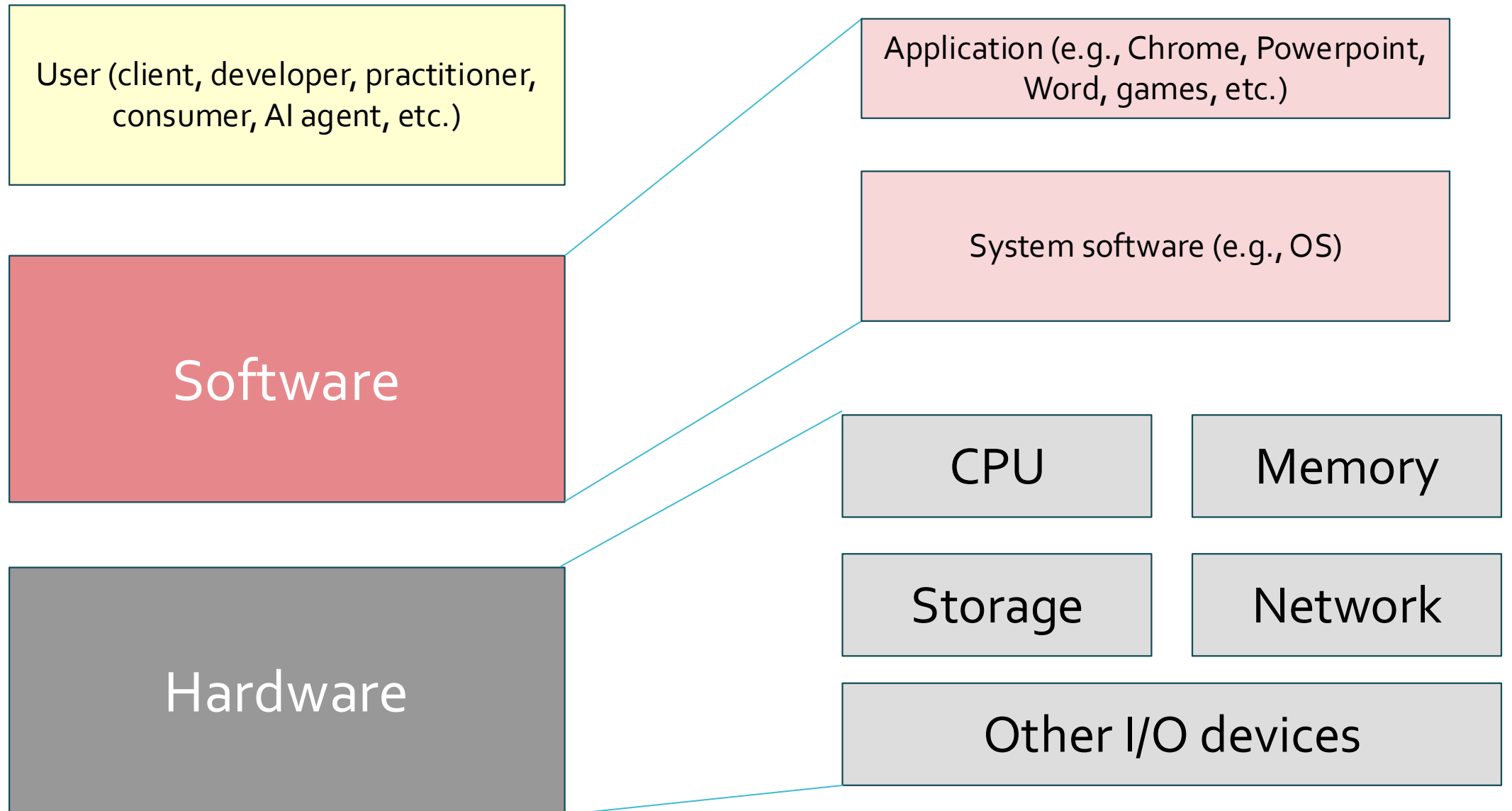
What is a computer?

- A computer is a programmable machine
 - Takes input
 - Processes it using stored instructions (programs)
 - Stores (keeps) data
 - Produces output
- Hardware + Software, working together

A full stack



A modular diagram



Applications

- With one or multiple aims
 - The simplest one: print “Hello World”
- Complicated ones
 - LLM inference
 - Google Chrome, Firefox browsers
 - Word, Powerpoint, Excel
 - Games
- Generally written in high-level language
- Algorithms inside
 - For example, Dijkstra's algorithm in a map app

Aims
Algorithms
Implementation

System software

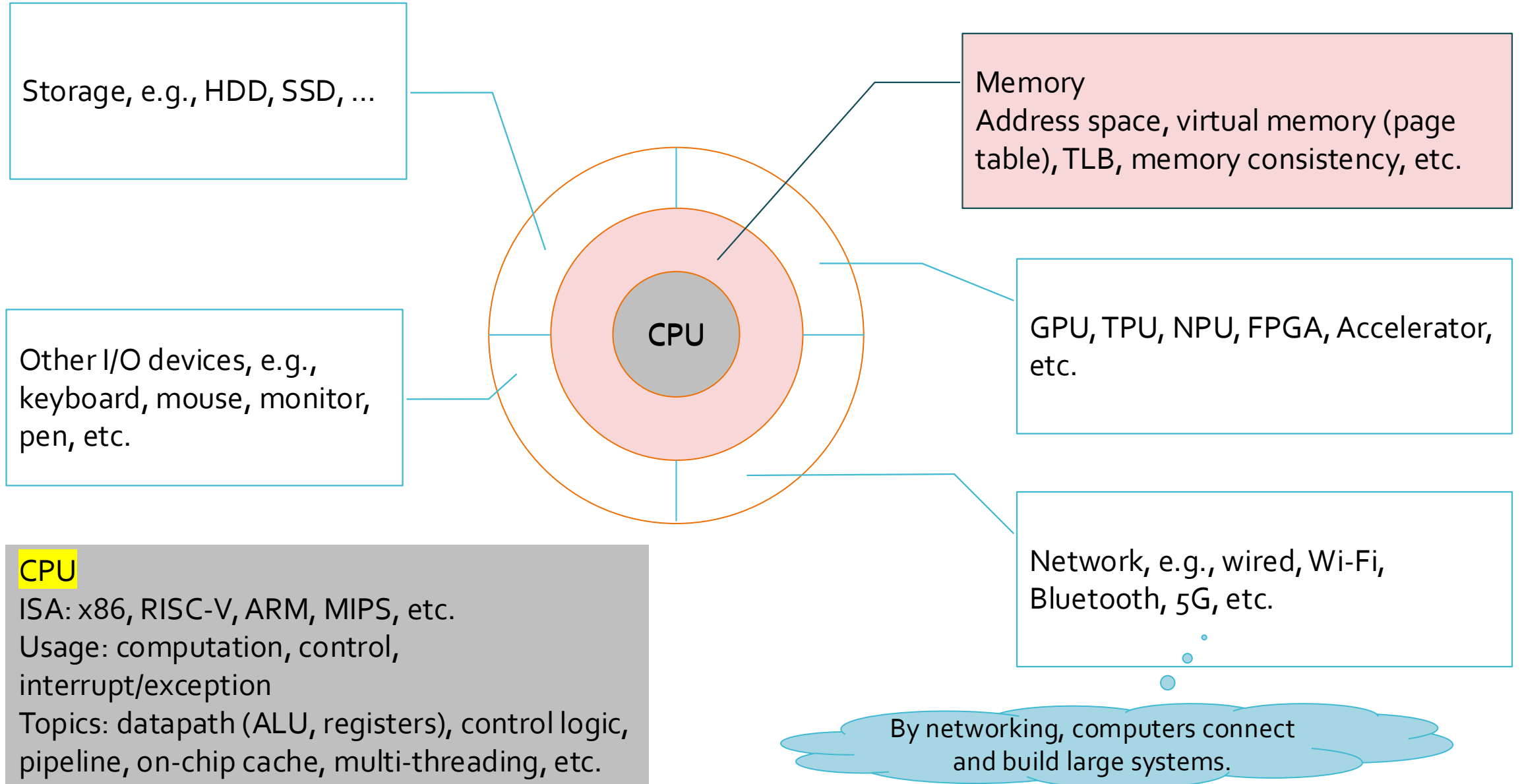
- Operating System
 - .e.g., Windows, Linux, Solaris, etc.
- Hypervisor (virtual machine)
 - e.g., QEMU, VMware, VirtualBox, Zen
- Compiler
 - e.g., GCC/G++
- Other tools

Resource manager; Abstraction provider; Security controller; Error handler; etc.

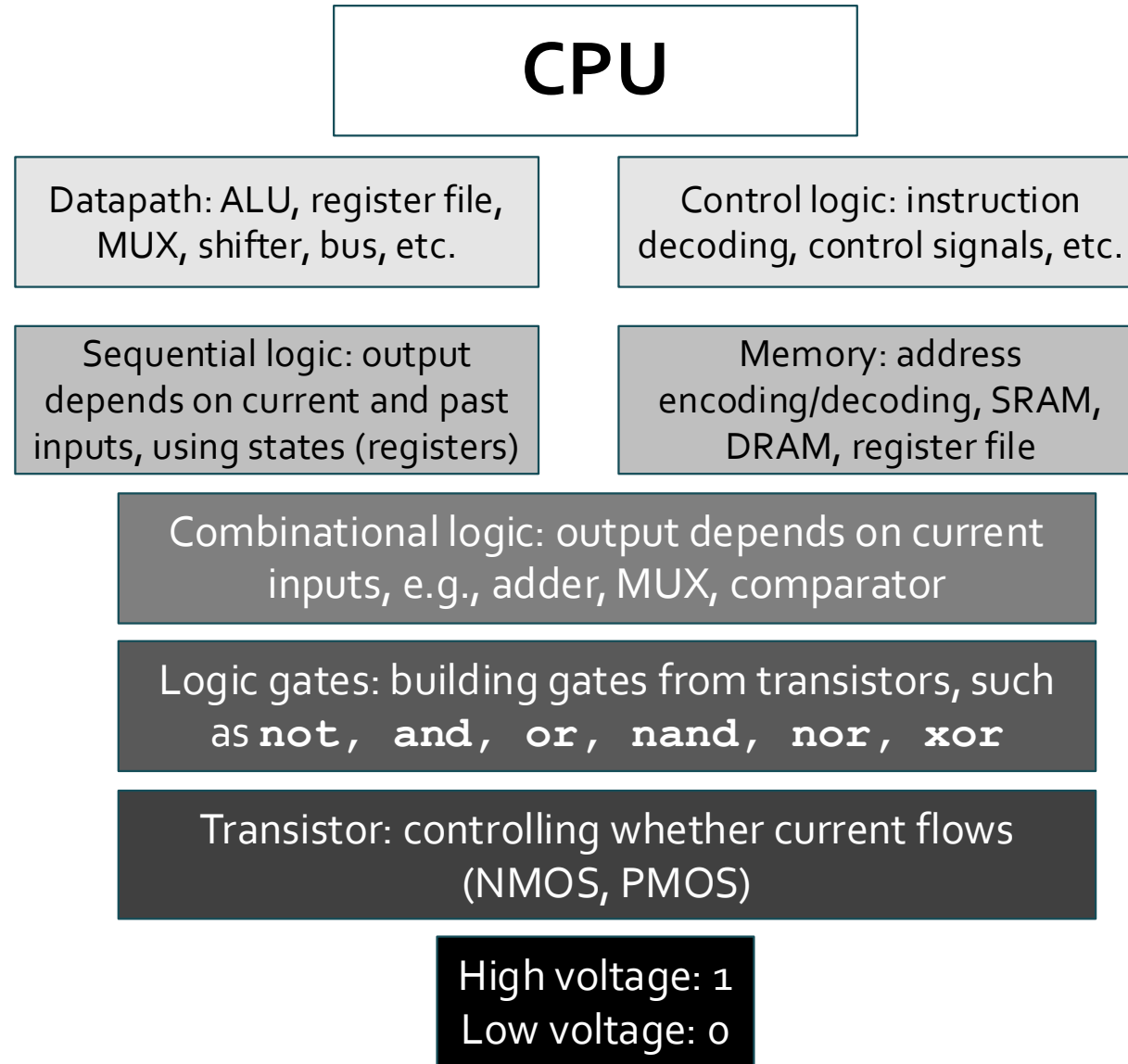
VM lifecycle management; Hardware/software virtualization; Isolation; resource management; etc.

Converting source code to target code; code generation and optimization, etc.

Hardware



Hardware: from Physics to Computer Science



Software

