

Memory

Computers use memory

They need memory to store **data** and **instructions**

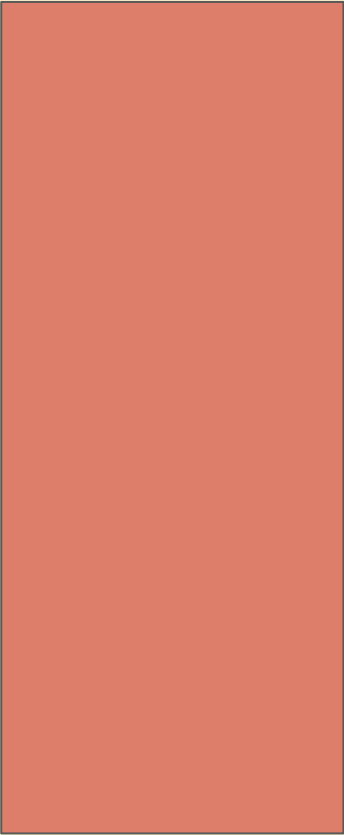
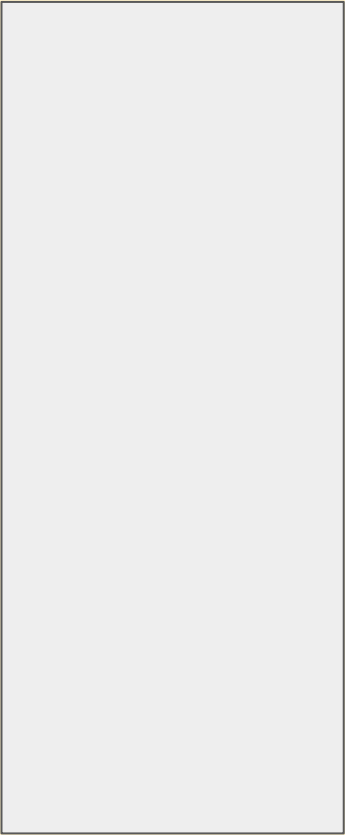
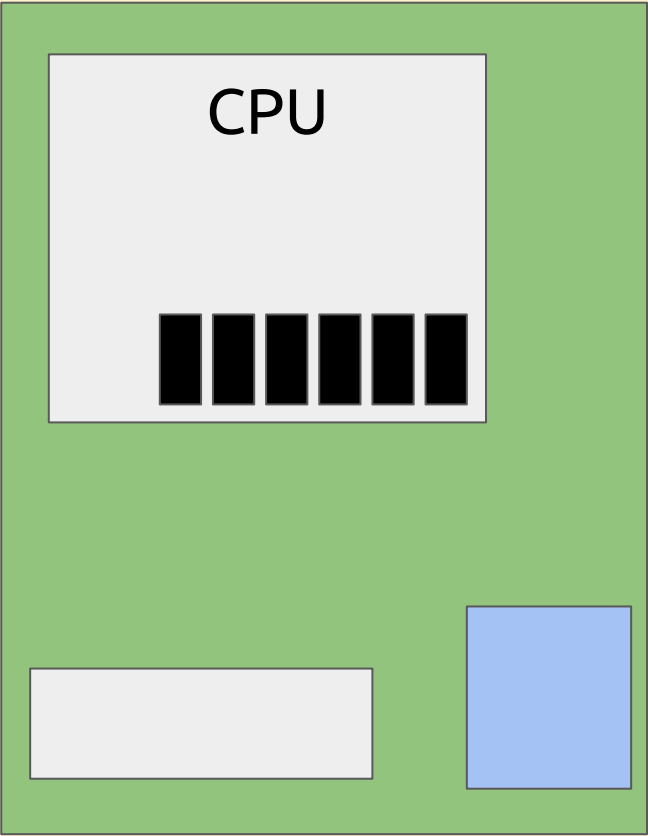
These are both stored as binary data

When the computer processes data it needs to move it into different areas of memory

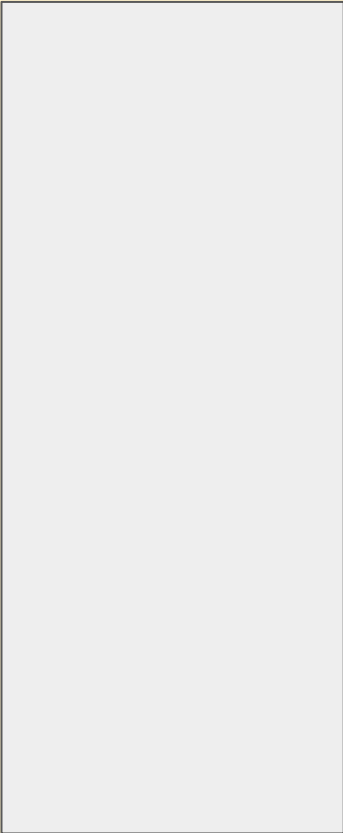
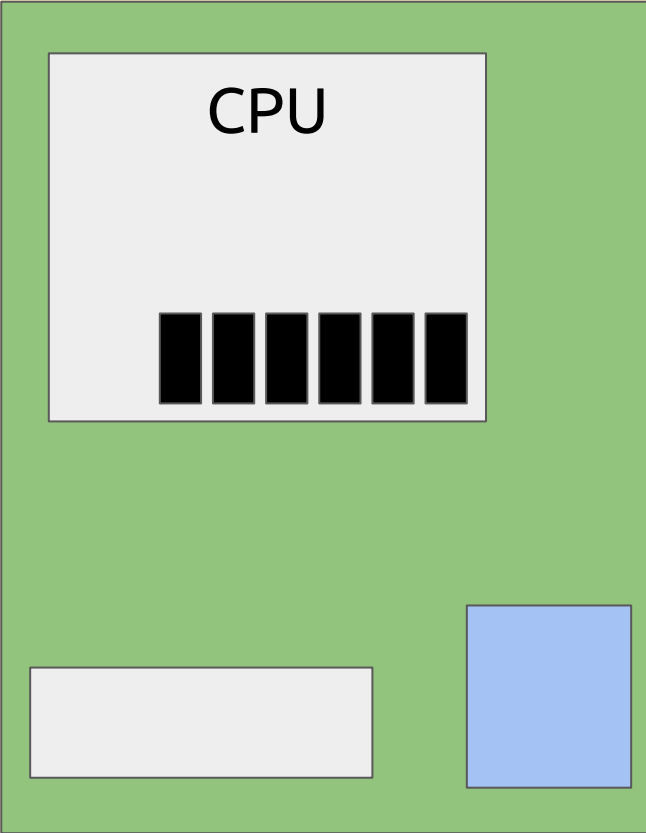
Memory

There are a number of different areas of memory that make up a computer system

Motherboard



Motherboard

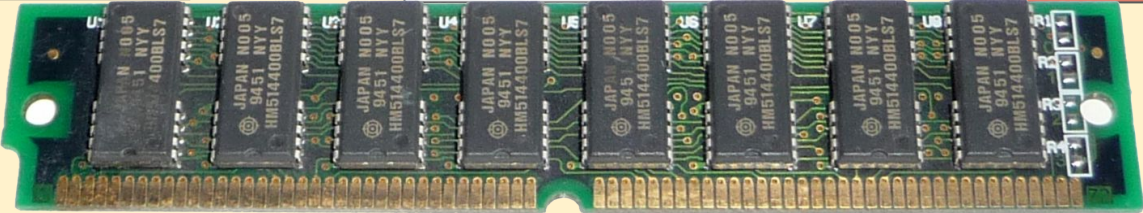
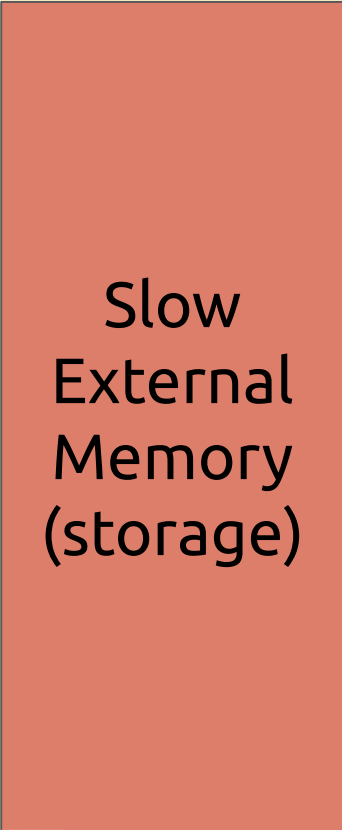
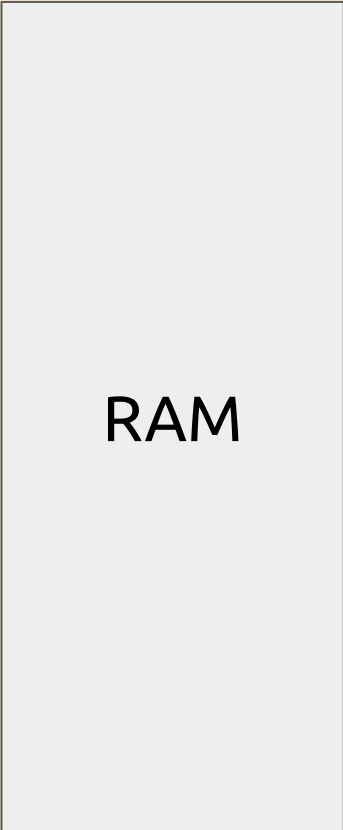
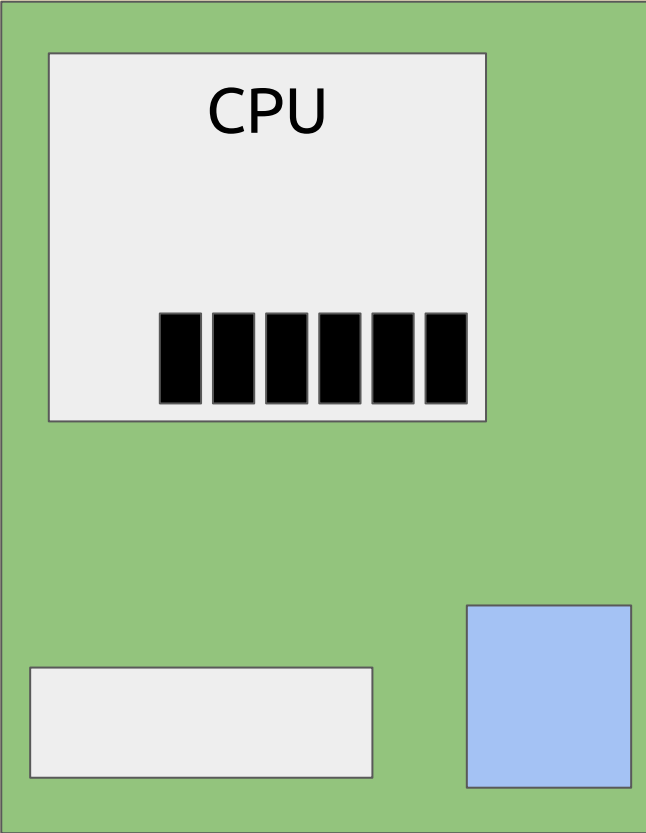


Slow
External
Memory
(storage)

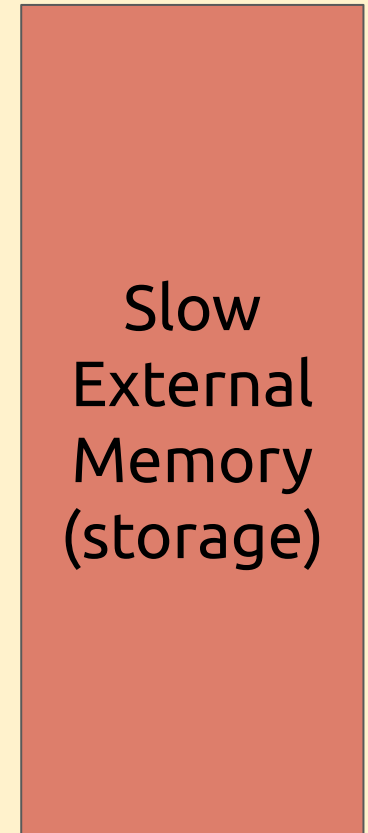
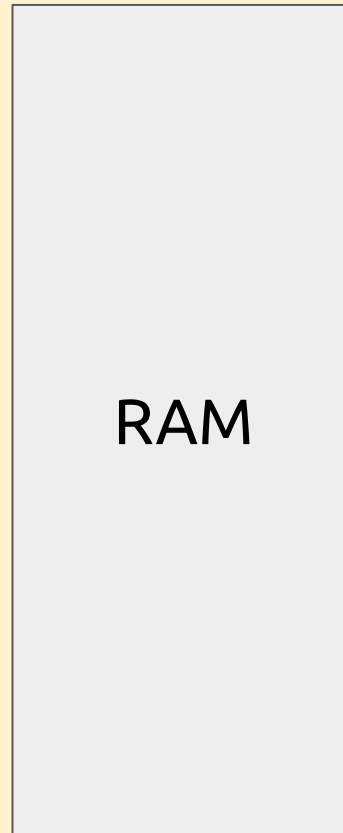
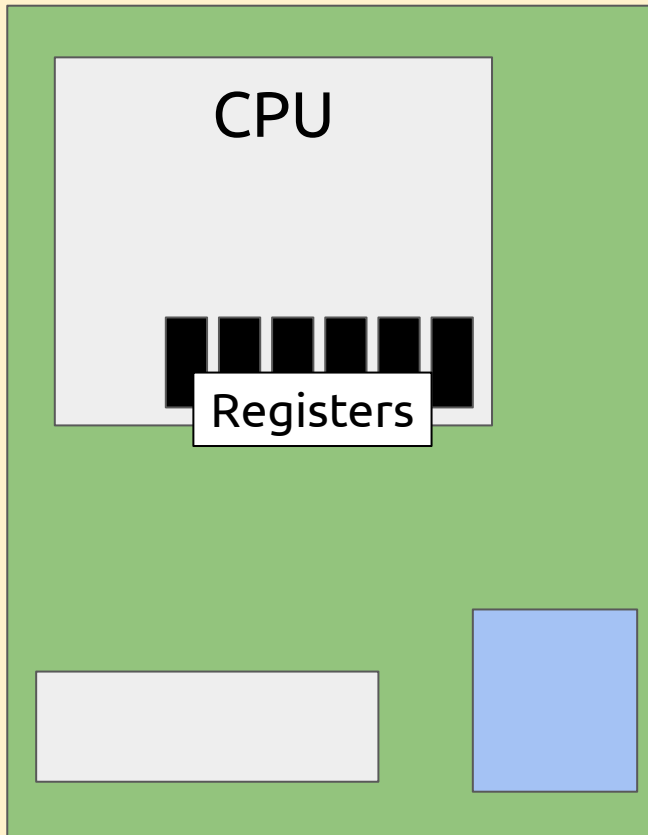
An icon of a hard drive floating above a cluster of white clouds.

For the exam, this is storage not memory

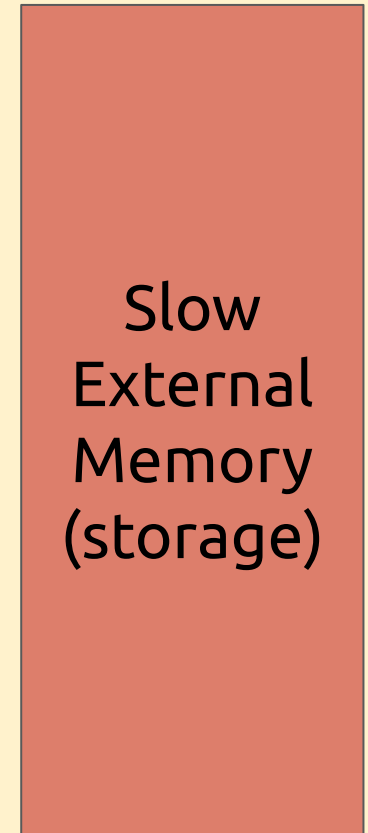
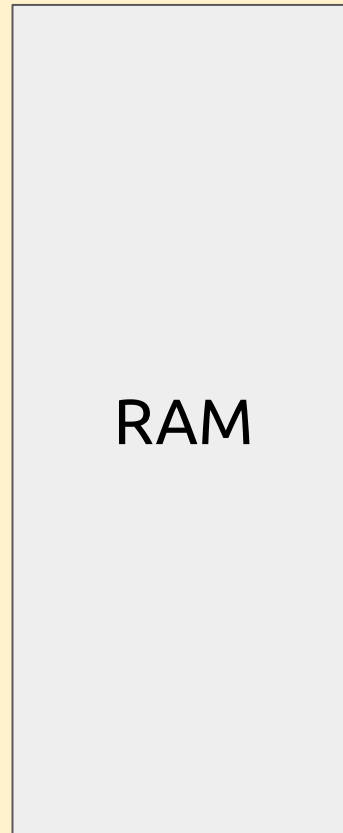
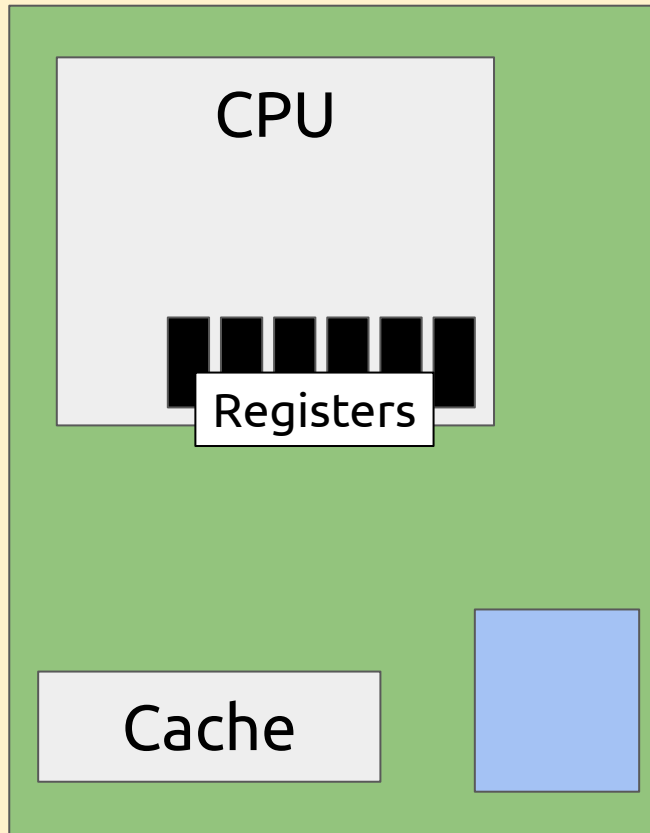
Motherboard



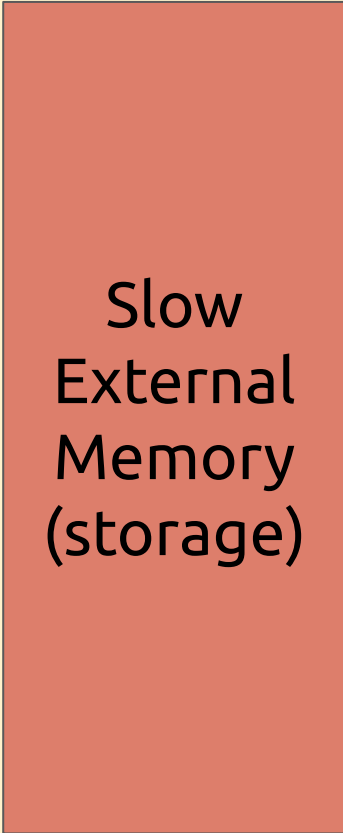
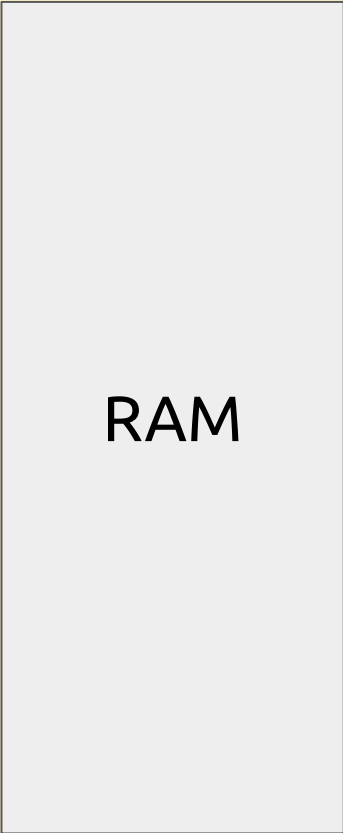
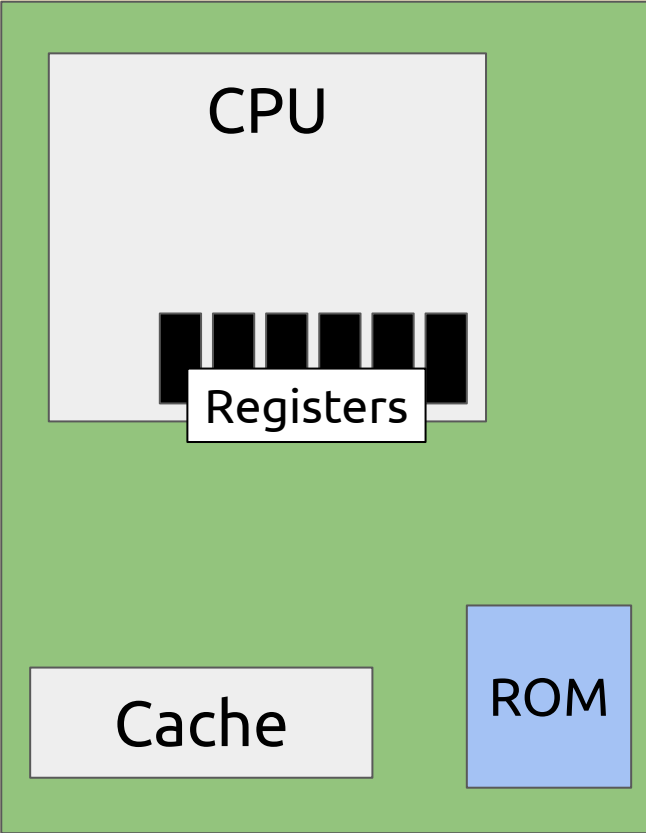
Motherboard

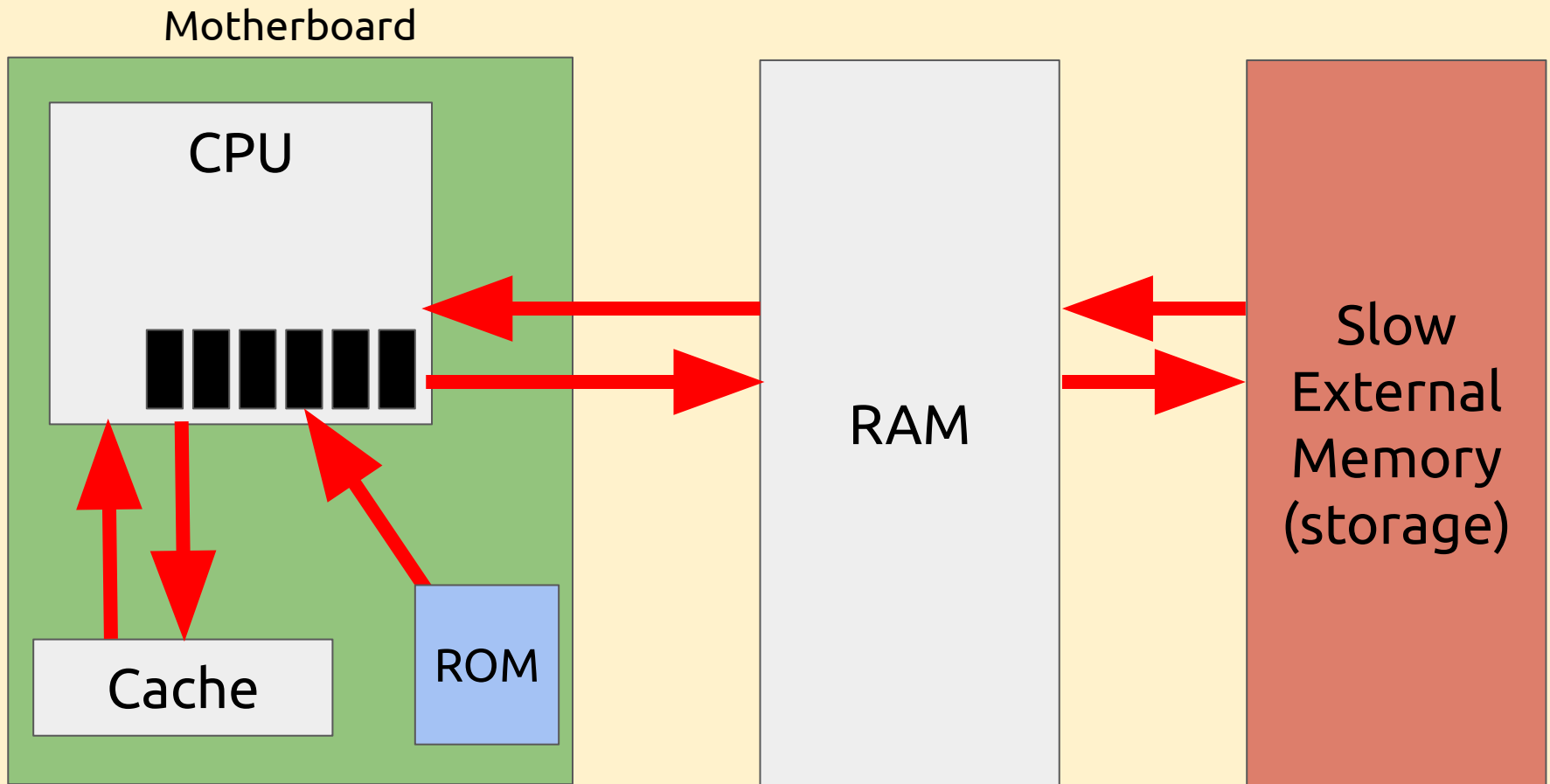


Motherboard



Motherboard





Memory

There are 4 types of memory you need to know about:

1. **RAM**
2. **ROM**
3. **Registers** - locations inside the CPU
4. **Caches** - locations close to the CPU used to store recently used data

Memory

4. Caches:

Quick memory locations close to CPU - so quick to transfer into/out of

Used to store data and instructions most recently used - so things that need using a lot can quickly be moved back into registers in the CPU rather than fetched from RAM

Memory

3. Registers:

Specialised, quick memory locations in the CPU.

Data and instructions are copied into registers from RAM and processed as part of the Fetch-Decode-Execute cycle

Data stored here only whilst it's being actively used in a process - then dumped into cache

Main Memory

Main memory is the memory the CPU can access directly

It is the CPU's working memory where **data and instructions** are stored

Made up of:

- **RAM** (mainly)
- **ROM**

It doesn't include registers or caches...

Main Memory

Main memory is the memory part of the **von Neumann architecture**

It was von Neumann's idea to be able to store data or instructions in the same memory address. This made general purpose computers possible rather than the hard-wired, single purpose machines that existed in 1945

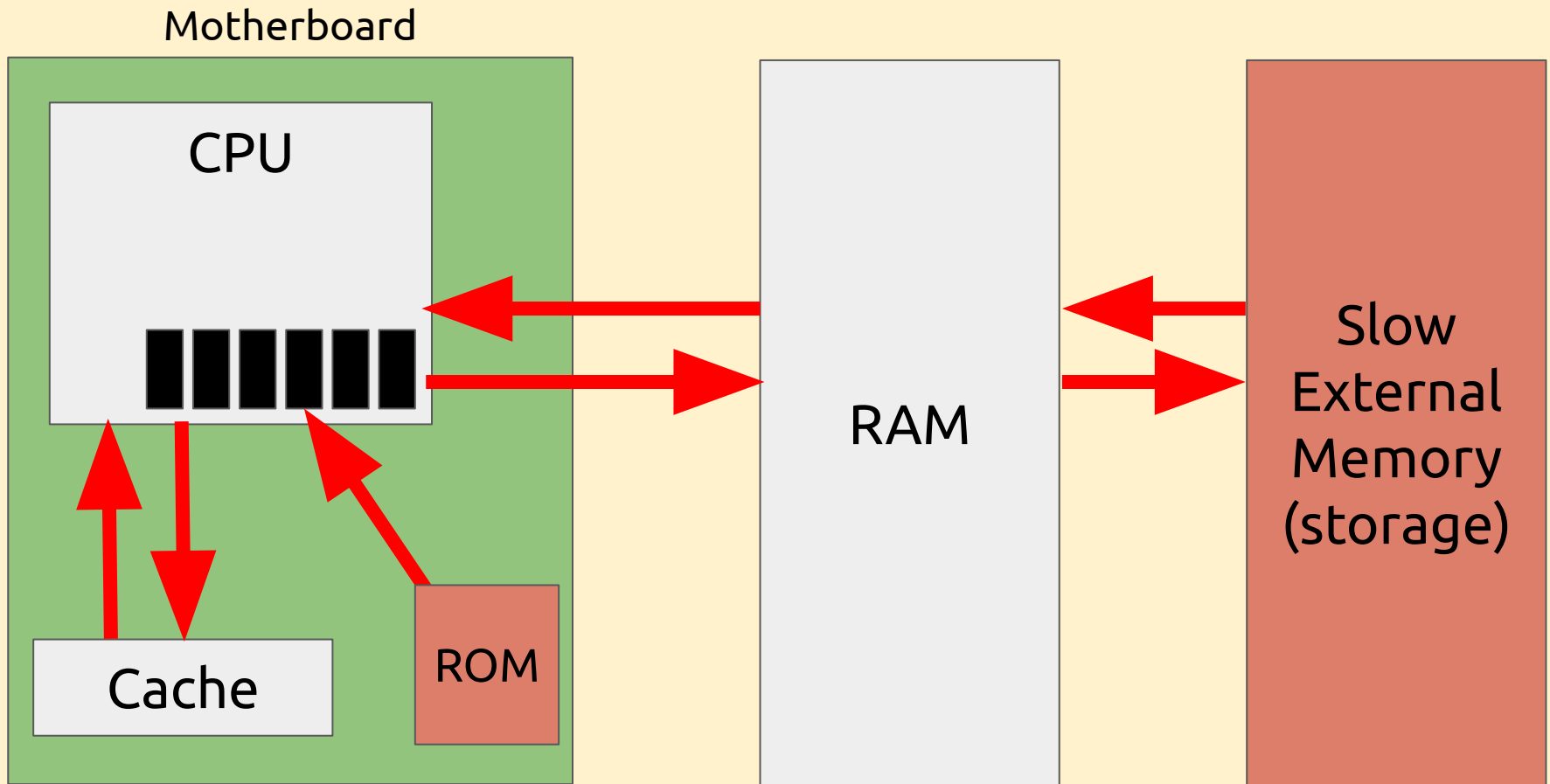
Main Memory

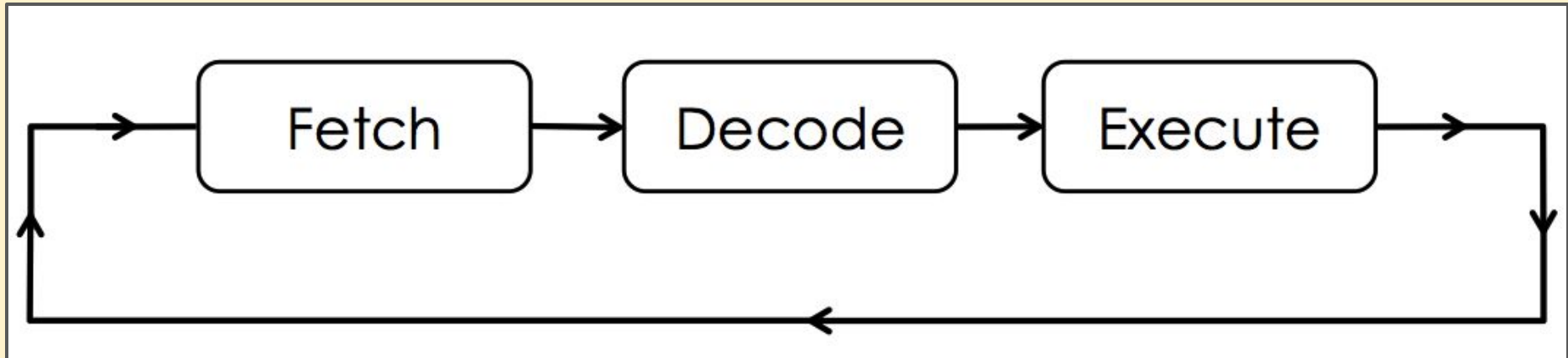
Instructions are **fetch**ed from main memory into the CPU where they are **dec**oded and then **exec**uted

Data is **fetch**ed from main memory into **reg**isters as part of executing instructions

Data or instructions will sometimes need to be moved into main memory from the **hard drive**

Buses are used to move data around





Main Memory - ROM

2. Read Only Memory

Small areas of memory which never change

- located on the motherboard or in “firmware” of devices such as printers
- **non-volatile**
- can never* be changed - the contents are fixed
- used to store boot commands and BIOS
- slower and cheaper than RAM

Main Memory - RAM

1. Random Access Memory

Data and instructions fetched into CPU from RAM when required

- located in DIMM slots on the motherboard
 - more RAM can be added
- **volatile**
- can be reused (changed, deleted, overwritten) - this makes it **flexible**
- stores data or instructions as required - **flexible**

Main Memory

ROM is **non-volatile**

RAM is **volatile**

- registers and caches are also **volatile**

IMPORTANT!

Main Memory

Volatile = lost when power
turned off

Non-volatile = not lost when
power turned off

IMPORTANT!

Comparing RAM and ROM

RAM	ROM
Volatile - data lost when power turned off	Non-volatile - data NOT lost when power turned off
Data stored in it can be changed - flexible and reusable	Data can't be changed - only one use
Stores data and programs currently being used	Stores bootstrap loader and BIOS used at startup
Data and programs moved to it from secondary storage when they are needed	
More RAM can be added to DIMM slots	Integral part of the motherboard
	Slower and cheaper