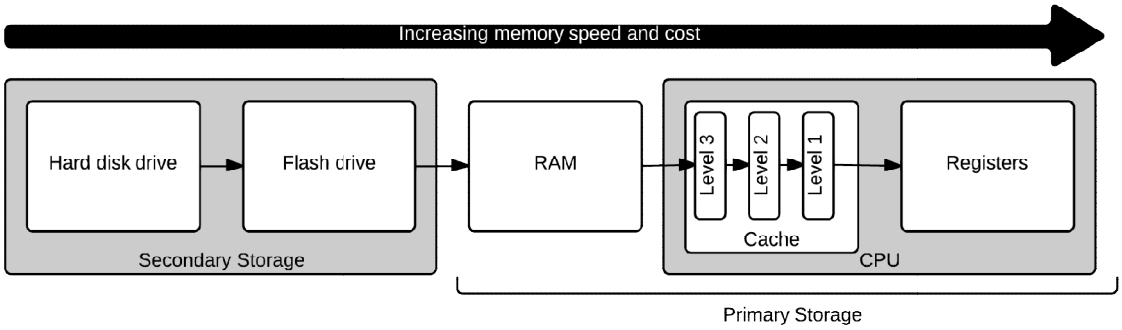
RAM, ROM & Virtual Memory - Reading

There are many different types of **memory** that are used in computers. They differ in how both their speed (how fast they read and write data) and their cost.



All **primary storage** is **volatile** which means that it needs power (the computer turned on) to keep the data stored. **Secondary storage** is **non-volatile**. It will store the data even if there is no power.

Most people know that increasing the CPU **clock speed** will increase a computer's speed. However, it is not the only part that will. Increasing the amount of **cache** will mean that the CPU doesn't need to access slower **RAM** so often. Equally, more RAM will mean that slower secondary storage doesn't need to be accessed. In modern computers, replacing a mechanical **hard disk drive** with a **solid state flash drive** will often give far greater improvement in performance than replacing the CPU.

RAM stands for **Random Access Memory**. It is called this because it is possible to **directly access** any **memory location** in a **random order**. Although other types of memory also have random access, RAM specifically refers to the type of **primary storage** that is **volatile** (loses the data if the power is turned off). When you run a program it first gets copied from the **secondary storage** (hard drive) to RAM. It is then run by the CPU which can access RAM directly. If you load data (e.g. a file) then it will get copied to RAM first before it is used by the program. This is why it often takes a long time to load programs. There are two types of RAM. **Dynamic RAM** (**DRAM**) uses a **capacitor** to store each **bit** of data. As capacitors lose their charge, DRAM must constantly read and write back what is stored in the RAM. **Static RAM** (**SRAM**) uses **transistors** to store the data. It doesn't need to be constantly refreshed, hence it is 'static'. As a result it is much faster. Both types of RAM are volatile and will lose their data if they have no power. A computers main memory of DRAM will be around 4GB. SRAM cache will be around 3MB as it is more expensive.

ROM means **Read Only Memory**. It is used to store the **BIOS** (**Basic Input/Output System**) on the computer. This is the basic software which starts the computer before the Operating System loads. Devices such as **digital cameras** will also have ROM in built with the programs to run the device. A ROM chip has its data put on when manufactured. ROM is **non-volatile**. **Flash ROM** allows the ROM chip to be wiped and new data to be written. This is how it is possible to upgrade the **firmware** on digital cameras or the BIOS. The same principal has been used in recent years for **solid state flash drives** on USB, SD Cards or Hard Drives. These are **faster** than hard disks as they don't need to move the drive head to access data. They are also **smaller** and more **durable**. Flash drives have lead to advances in technology like the development of **Smartphones** and **tablet computers**.

If a computer does not have enough memory left in RAM then it cannot run any more programs, load any more files and could crash. Modern operating systems use a dedicated area on the hard drive as **virtual memory**. If there is not enough space left in RAM then it will **swap** data from RAM to the virtual memory. When it needs it again it will swap it back. This process is time consuming which is why buying more RAM can speed up your computer.