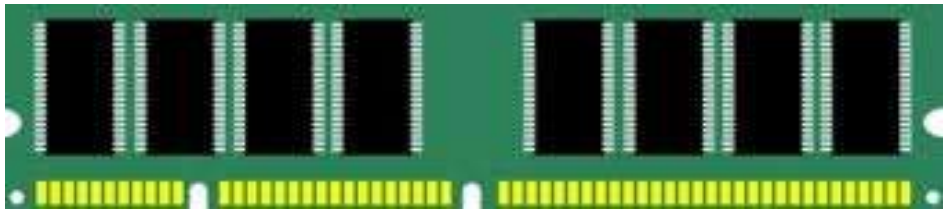
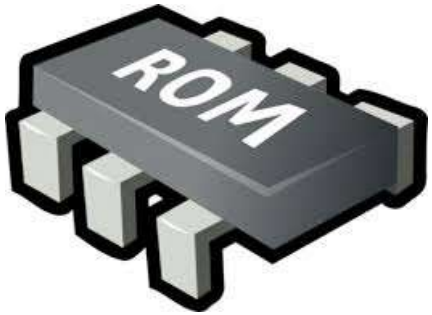




describe what is in these devices when the computer is turned off.

Memory types

NIS PhM Astana– Computer Science

Grade 11

11.3.4.1 explain the differences between RAM and ROM memory

Activity 1. Watch the video and answer the questions

- https://www.youtube.com/watch?v=p3q5zWCw8J4

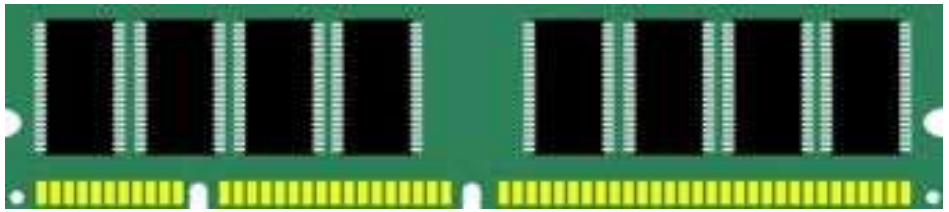
How computer memory works?

Memory

- The memory inside the computer is known as the main memory.
- Data is stored on the RAM and cache.
- These are known as **volatile** memory. This means that when the power is switched off the data on the memory is lost.

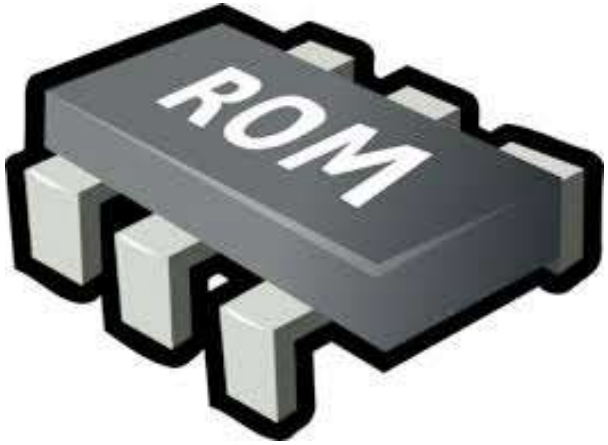
RAM

- Stands for Random Access Memory
- The RAM is used for the operating system, applications that are being run on a computer and any data in use.
- The RAM basically holds the data that we are currently working on.



ROM

- ROM stands for Read Only Memory.
- A computer will have a ROM chip that usually stores the data the manufacturer has put on there
- This data tells the computer how to boot up when it is switched on
- ROM is read only and therefore can not be changed. This means it is also an example of non volatile memory



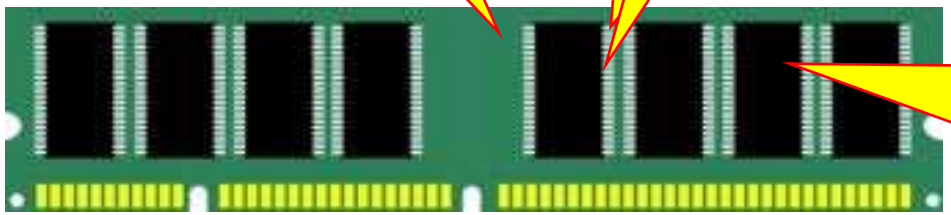
RAM & ROM

Data for the files you are working on is saved on the RAM until you click the save button. This means you could lose them until you click save (as they are stored in volatile storage)

Therefore the more RAM you

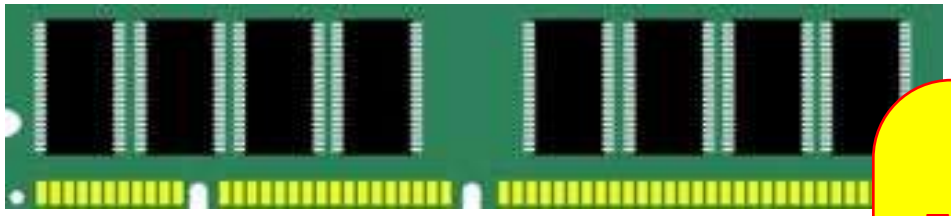
So why do we not just store data straight away on the HDD and forget about the RAM?

Secondary Storage



It takes a lot longer for the data to be retrieved and stored on the HDD than the RAM so saving it on the HDD all the time would slow down your computer a lot

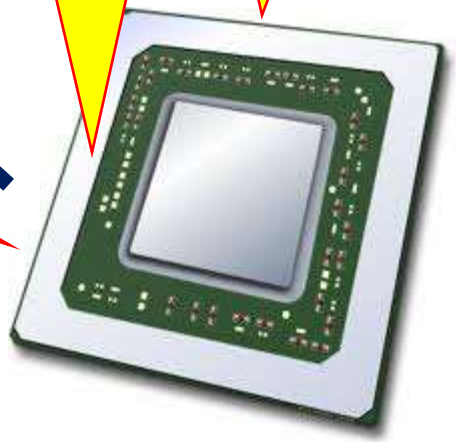
What next



So now data is in the

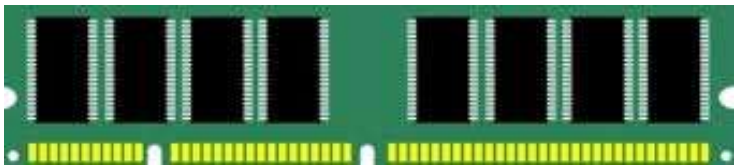
A computer will only have a small amount of cache but the more it has, the quicker the CPU can process data and the quicker your computer will run

Data stored on the cache is very quick for the CPU to access. Therefore data that the CPU is going to process is taken from the RAM and put onto the cache

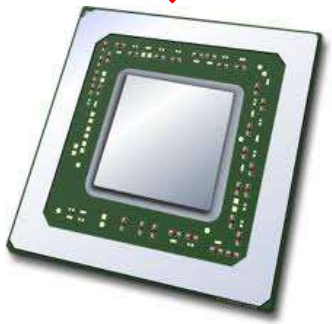


Amounts of storage

Secondary Storage: e.g. hard drive, USB, SD Card, CD etc will have a large amount of storage for a relatively cheap price. For example a typical computer will now have a build in hard drive of around 1TB. All of this type of storage is non volatile



Primary Storage: You will have less RAM and it can be quite expensive. A typical computer may now have around 8Gb of RAM built in. This type of storage is volatile

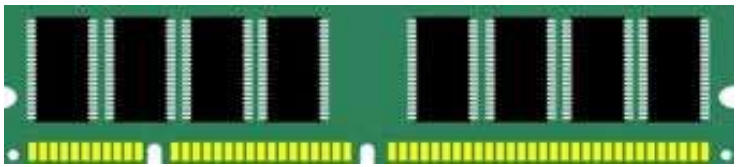


Primary Storage: The cache memory is often built into the CPU and only has a small amount of memory. This can be very expensive. This type of storage is volatile

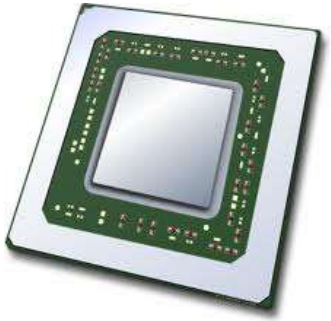
Transferring Data

Non Volatile so stores data when power is turned off.

Stores Operating system, application software and all data files. When required by the computer they are found on the HDD and moved to the RAM



The data held here is what is being worked on. When it is going to be needed by the CPU it is moved to the Cache. When it needs to be permanently saved or not used anymore it is moved back to the HDD



When the CPU needs data to process it first looks at the Cache. If it is not there it requests the data from the RAM which may then request it from the HDD. The data on the CPU can be processed quickly.

Activity 2.

Watching video

- https://www.youtube.com/watch?v=CPOcSGgSxiQ&feature=emb_logo

complete the following table on Difference between the RAM and ROM.

BASIS FOR COMPARISON	RAM	ROM
Basic		
Use		
Volatility		
Stands for		
Modification		
Capacity		
Cost		
Type		

BASIS FOR COMPARISON	RAM	ROM
Basic	It is a read-write memory.	It is read only memory.
Use	Used to store the data that has to be currently processed by CPU temporarily.	It stores the instructions required during bootstrap of the computer.
Volatility	It is a volatile memory.	It is a nonvolatile memory.
Stands for	Random Access Memory.	Read Only Memory.
Modification	Data in RAM can be modified.	Data in ROM can not be modified.
Capacity	RAM sizes from 64 MB to 4GB.	ROM is comparatively smaller than RAM.
Cost	RAM is a costlier memory.	ROM is comparatively cheaper than RAM.
Type	Types of RAM are static RAM and dynamic RAM.	Types of ROM are PROM, EPROM, EEPROM.

Key Differences Between RAM and ROM Memory

1. The key difference between RAM and ROM is that RAM is basically a **read-write** memory whereas, ROM is a **read only** memory.
2. RAM temporarily stores the data that have to be processed by CPU currently. On the other hands, ROM stores the instructions that are required during Bootstrap.
3. RAM is a **volatile** memory. However, ROM is a **nonvolatile** memory.
4. RAM stands for **Random Access Memory** whereas, ROM stands for **Read Only Memory**.
5. On the one hand, where the data in RAM can be **modified easily**, the data in ROM can be **hardly or never be modified**.
6. The RAM can range from 64 MB to 4 GB whereas, the **ROM** is always comparatively **smaller** than RAM.
7. RAM is **costlier** than ROM.
8. RAM can be classified into **static** and **Dynamic RAM**. On the other hands, ROM can be classified into **PROM, EPROM and EEPROM**.

Activity 3. Worksheet- Exam style questions

Q1.

Two types of memory inside a computer are RAM and ROM.

(a) Describe what is meant by

(i) RAM.

_____

_____

_____

_____

(2)

(ii) ROM.

_____

_____

_____

_____

(2)

(b) Give **one** use of ROM inside a computer.

_____

_____

(1)

(c) Give **three** uses of RAM inside a computer.

_____

_____

_____

_____

_____

_____

(3)

(Total 8 marks)

Activity 3. Worksheet - ansewrs

Mark schemes

1.

(a) (i) Random Access Memory

(ii) Read Only Memory

In each case 1 mark for name + 1 for description

4

(b) Bootstrap Program
System Constants

Any 1

1

(c) User Data
Application Software
System Software
System Variables
Buffers
Disk Cache

Any 3

3

[8]

Virtual memory
Cache memory

NIS PhM Astana– Computer Science

Grade 11

11.3.4.2 explain the purpose of virtual memory

11.3.4.3 explain the purpose of cache memory

Activity 1.

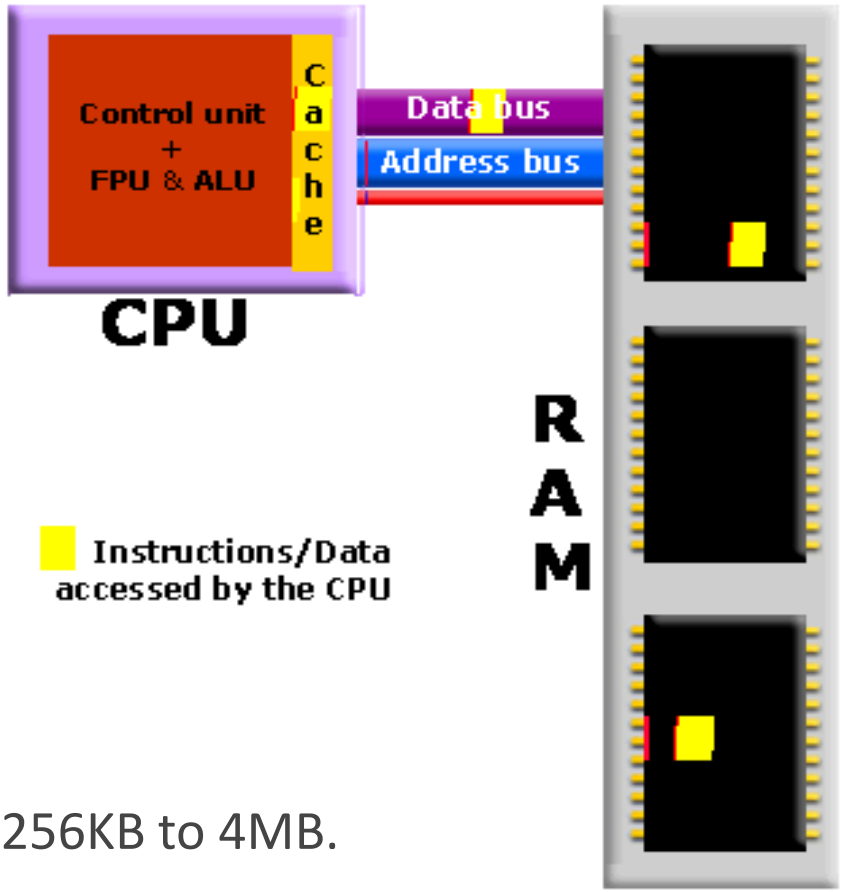
What is cache memory?

Cache memory is a small amount of very fast memory that is built into the CPU. It acts like a **buffer** (a temporary store) between the CPU and RAM.

Watch video until 2.33 mins:
https://www.youtube.com/watch?v=yi0FhRqDJfo

SUMMARY: Cache memory is very fast memory that is built into the CPU. The larger the cache size the less time the CPU has to spend accessing RAM so programs will execute faster.

•Many CPU designs have two levels of cache memory, the fastest (L1) is divided into a data cache and an instruction cache. The second (L2) cache is slightly slower and sits between the L1 cache and RAM. The L1 cache and L2 cache can be clearly seen on this enlarged labelled image of a CPU.



•Typical cache memory sizes range from 256KB to 4MB.

Factors affecting CPU performance

Task: Place the following memory and storage locations in the correct order within the graph below:

Type & size of cache memory:

One bottleneck that can occur is the access speed of main memory. Reading from and writing to main memory is much slower than the speed at which the processor can work.

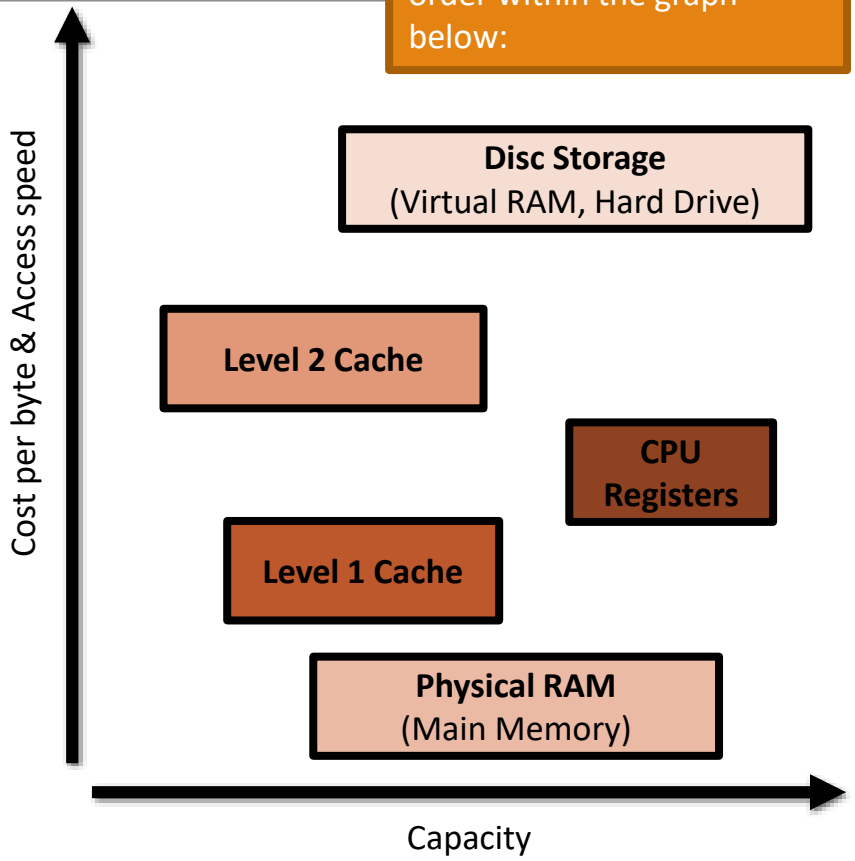
Cache memory is an intermediary between the main physical RAM and the CPU. The cache makes any data frequently used by the CPU available much more quickly.

Because the processor doesn't need to access main memory as often, it can work faster, increasing the performance of the CPU.

There are different levels of cache:

- Level 1 cache is extremely fast (between 2-64KB)
- Level 2 cache is fast and (256KB-2MB)
- Some CPUs also have Level 3 cache

Cache memory is, however much more expensive.



Factors affecting CPU performance

Task: Place the following memory and storage locations in the correct order within the graph below:

Type & size of cache memory:

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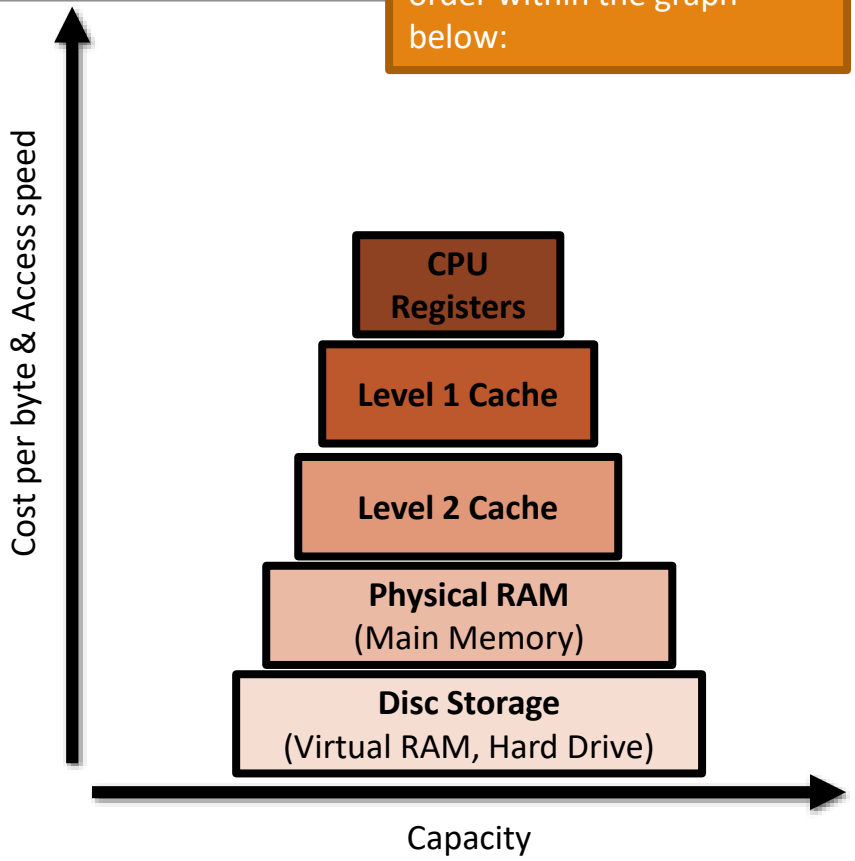


Activity 2

1. Watch the video carefully. Answer the question.

https://learningapps.org/watch?v=p18u2cz0320

2. Arrange from "fastest, smallest and most expensive" to "slowest, largest and least expensive".:

https://learningapps.org/watch?v=pmh13ne5520

Activity 3

What is virtual memory and why is it needed?

https://www.youtube.com/watch?v=M31SS70Od08

SUMMARY: Virtual memory is memory that uses secondary storage to supplement RAM, but to the CPU it appears as if the whole program is loaded and running from RAM.

Activity 4. Answer the questions

1. Why do computers need to use virtual memory?

2. Where is the data stored when it is in virtual memory?

3. Describe a disadvantage of using virtual memory.

Why do computers need to use virtual memory?

When a computer is running the operating system and several other programs at the same time, the physical memory often becomes full. Instead of closing some programs the operating system will use ‘pretend’ or virtual memory to store some of the data

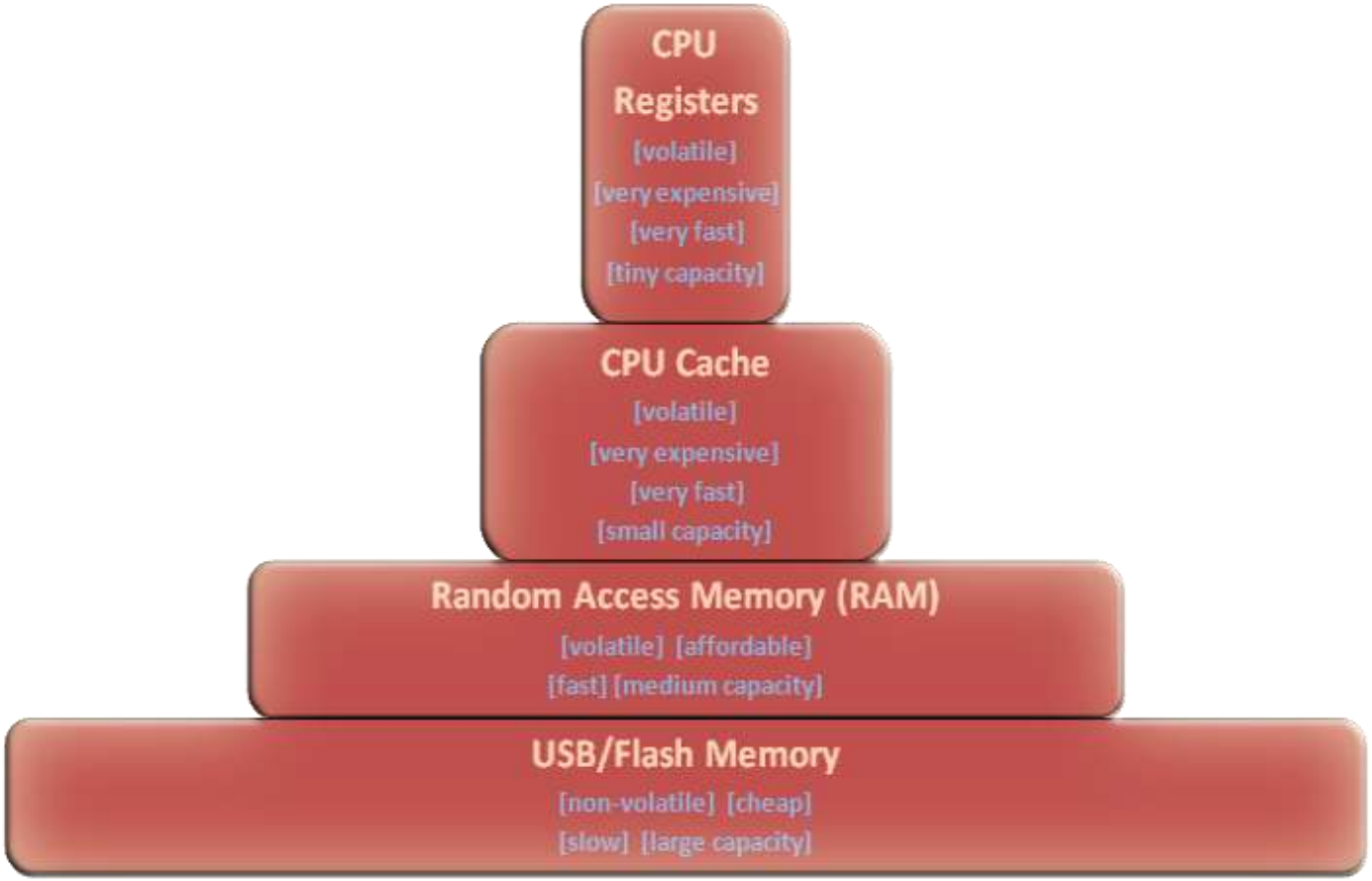
Where is the data stored when it is in virtual memory?

It is stored on an area of a secondary storage device e.g. hard disk drive

---

Describe a disadvantage of using virtual memory

The read/write speed of a hard drive is much slower than RAM, and the technology of a hard drive is not geared toward accessing small pieces of data at a time. If the system has to rely too heavily on virtual memory, there will be a significant performance drop



A comparison of the characteristics of different memory types

Activity 5. Answer the questions

A computer is advertised as having 4GB of RAM.

(a)Describe the purpose of RAM in a computer. (2)

_____

(b) The computer also uses virtual memory.

(i) Explain what is meant by virtual memory. (2)

_____

(ii) State why virtual memory is needed. (1)

_____

(a) Explain what is meant by a computer cache what it is used for. (2)

_____

(b) Describe the function of a web cache and a problem that may arise in its use. (3)

_____

(c) Explain how the memory used in a CPU cache is different from that used in the main RAM of the computer. (2)

_____

Answers

A computer is advertised as having 4GB of RAM. (a)Describe the purpose of RAM in a computer. (2)

Stores parts of the operating system currently used by the computer. Stores programs that are currently running. Stores data that are currently used by the computer.

(b) The computer also uses virtual memory. (i) Explain what is meant by virtual memory. (2)

A section of the hard disk is used to store items in RAM which are not being currently used.

(ii) State why virtual memory is needed. (1)

Used to allow more programs / data to be loaded when the RAM is insufficient

Answers

(a) Explain what is meant by a computer cache what it is used for. (2)

A cache is a short-term storage area. A cache is used to speed up certain computer operations by temporarily placing data, or a copy of it, in a location where it can be accessed more rapidly than normal.

(b) Describe the function of a web cache and a problem that may arise in its use. (3)

It is a folder full of recently accessed web pages in the user's computer. When a previously loaded web page is requested it is loaded from the cache far more quickly than from the Internet. A problem may arise if the web page is updated online but the cache does not realise or update its copy.

(c) Explain how the memory used in a CPU cache is different from that used in the main RAM of the computer. (2)

It is static RAM rather than dynamic RAM. It has a lower latency. It does not need to be refreshed

https://quizizz.com/admin/quiz/5e81c202653ff9001c286816/virtual-memory

https://quizizz.com/admin/quiz/5a611dddcd2fc8001b724538/computer-memory

https://quizizz.com/admin/quiz/57145d06a137cb1030432578/memory

https://quizizz.com/admin/quiz/5a941949ad771b001f320ef9/memory-and-storage

At the end of the lesson, learners reflect on their learning:

- What have you learned?
- What remained unclear for you?
- What you want to improve?