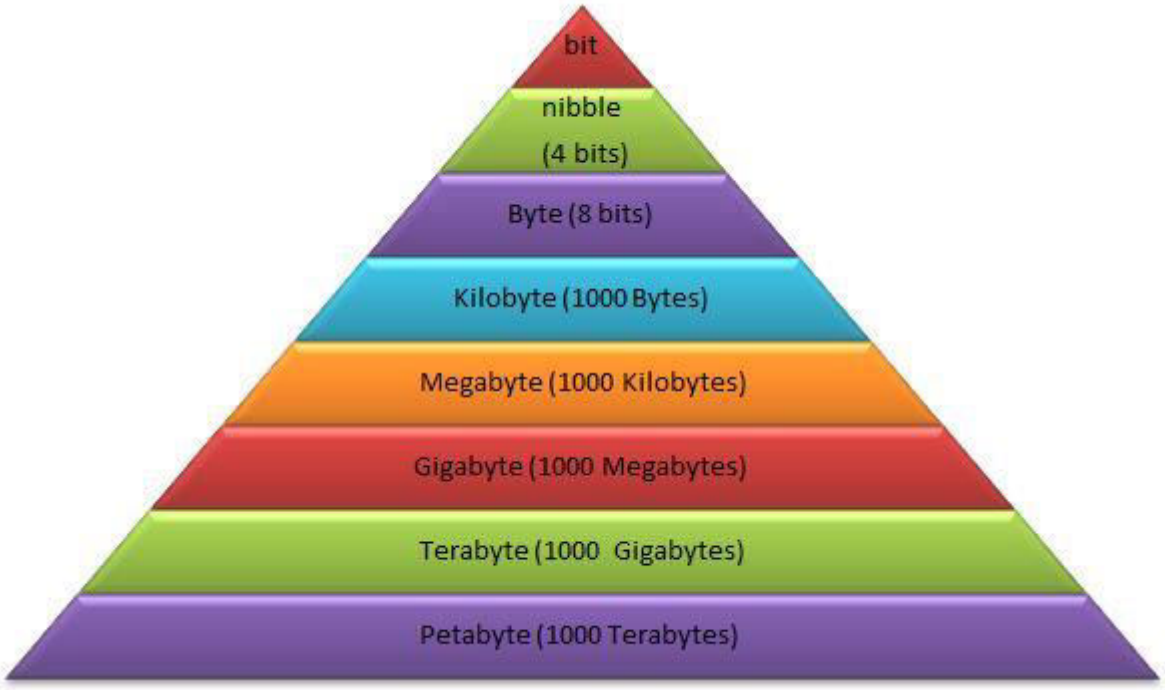
Units of storage

1. Introduction to data sizes

Bits, bytes, kilobytes, megabytes, gigabytes, terabytes and petatbytes are all used to describe disk space, data storage or the capacity of system memory.

The picture below shows how each size is related to the others.



You need to be able to define each of these different sizes and to place them into the correct order from smallest to largest.

You should also to be able to identify the most suitable storage capacity for a given scenario.

This section also explains why data needs to be converted into binary format to be processed.

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2. Bit, nibble and byte

Bit

A single bit is the smallest size of digital data and has only two values - zero and one.

Roll over the image to see the two types of binary bits

Byte

A 'byte' contains 8 bits, for example 11101001 is a byte.

A single keyboard character that you type, such as the letter A or the letter T takes up one byte of storage.

Roll over the image to see the letter A in binary format (ascii code)

Nibble

This is not a very commonly used term compared to bit and byte. It is the term given to a group of four bits. Therefore two nibbles make a byte.

The reason it is not very common is because most microprocessors use groups of 8 bits and higher i.e. They use one or more bytes to process data. Not many devices make use of a nibble.

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3. Kilobyte - KB

A kilobyte is generally thought of as 1,000 bytes.

However, to be completely correct, it is actually 1,024 bytes which is 2 to the power of 10.

To help you visualise the storage capacity of a kilobyte, the text contained in the box below has just over a 1000 characters. It takes a kilobyte to store this amount of text.

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Images usually take up more storage space than text characters. The image below will help you put storage sizes into context.

Storage size = 7 kilobytes

This is a small image with little colour range and so only needs a few kilobytes of storage. A fully detailed, full colour image takes much more.

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4. Megabyte - MB

A Megabyte is generally thought of as one million bytes or 1,000 kilobytes.

To help you visualise how much information can be stored in a megabyte, remember the block of text on the previous page? Well a megabyte would be able to store 1000 copies of that text. It would be the equivalent of around 300 essays.

PowerPoint presentations on the other hand can be quite large. For example, a ten slide presentation with an image on each slide and a theme applied to the slide backgrounds could be 2 or 3 megabytes in size.

A typical MP3 song can be anywhere between 3 to 5 megabytes in size.

A CD can store up to 650 megabytes of data.

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5. Gigabyte - GB

A Gigabyte is equivalent to 1,000 Megabytes.

It can be written as GB or gbyte but not Gb (which is used for gigabit).

1 Gigabyte could hold the contents of about 10 metres of books on a book shelf.

A DVD can store a Hollywood blockbuster film which would be around 4-8 gigabytes in size.

The SDC image storage card in a digital camera holds some gigabytes of data

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6. Terabyte - TB

A Terabyte is equivalent to 1,000 GB or a million megabytes.

Hard disks are now measured in Terabytes. Typical 1 to 10 TB

A 1TB hard disk can hold about 150 complete high definition movies which on average take up about 6GB of storage.

The same amount of space could store 350,000 mp3 music tracks.

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7. Petabyte - PB

A petabyte is equivalent to 1,000 TB

Data centers and supercomputers use petabytes of memory.

In 2020 it is estimated that humans alone create 2,500 PB of data every single day, this does not include the vast amount of data created between machines in the 'internet of things'.

Soon we will need to use the next size up as well, namely the Exabyte (EB) which is also called a quintillion.

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8. Why binary?

We have been discussing the sizes of binary data from a single bit all the way up to a petabyte.

But why do we need to consider data to be most useful in binary form?

The answer, is that computers are used to process and store data - and computers can only use binary numbers.

Therefore all images, text, sound, music and numbers have to be converted into binary form before they can be handled by a computer.

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9. Summary

- A single bit is the smallest digital size, it has only two values zero and one
- A byte is 8 bits.
- A single text character can be stored in a byte
- A nibble is 4 bits but is not used much
- A kilobyte (1KB) is roughly 1000 bytes (actually 1024 bytes)
- Small images are typically a few tens of kilobytes
- A megabyte (1MB) is 1000 kilobytes
- An MP3 music track is about 3-5MB
- A gigabyte (1GB) is 1000 megabytes
- A typical high definition movie is about 5GB
- A terabyte (1TB) is 1000 gigabytes
- Modern hard disks are measured in terabyte capacities
- A petabyte (1PB) is 1000 terabytes
- Data centres and supercomputers use petabytes of storage
- Binary is important because it is the only type of data a computer can handle.
- All data that needs to be processed by a computer has to be converted into binary data