

Megabytes (MB) and Megabits (Mb)

John Allen, Feb 2020

Our usual number system

We normally use the Decimal number system, or the *base-10 numeral system*, that requires 10 different numerals - the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

Computer number system

A computer processor only knows two conditions - on or off. Therefore it uses the binary number system, or the *base-2 numeral system*. This system uses only two symbols "0" and "1". Each digit is called a "bit".

A bit is represented by lower case "b", for example 100 megabits = 100Mb.

So when a computer counts ...

Decimal system	Binary system
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111
8	1000
9	1001
10	1010
.....
256	11111111

32 bit, 64 bit computer processors

Most of the original computers used 8 bit processors, so they were very limited in the speed of arithmetic work, and maximum amount of Random Access Memory (RAM) they could access.

The maximum number that 8 bits could hold is 256.

Today, most computers have 32 bit or 64 bit processors. 64 bits can hold a very large number - 18,446,744,073,709,551,616. So processing is much faster, and they can handle large amounts of RAM.

To utilise the 64 bit CPU, the operating system and applications also need to be 64 bit versions.

So what is a Byte

These 8 bit chunks are called **bytes**. A textual character such "1", "a", "A" or "?", or a control character such as *carriage return*, or *new line*, is represented using unique **8 bit code**. One of these 8 bit codes is called a **byte**.

A byte is represented by upper case "B", for example 100 Megabytes = 100MB

Since a byte is 8 bits, therefore 100MB = 800Mb.

The main 8-bit code set used the **ASCII code set** (American Standard Code for Information Interchange). See <https://www.ascii-code.com/>.

This 8 bit code is still used to define text and control characters, even with modern 64 bit systems.

For example:

Character	ASCII Code
3	00110100
Semicolon ;	00111011
Upper case G	01000111
Lower case g	01100111
Carriage return	00001101

*Computer memory, disk capacity, and data transfer speeds (except for the Internet) are usually specified in **bytes**.*

Internet speed – Packets

Internet speed is usually specified in **bits** per second, usually **Mbps** (Megabits per second) or **Gbps** (Gigabits per second).

The internet operates on small “packets” of data. Everything you do on the Internet involves packets. For example, every web page that you receive arrives as a series of packets, and every e-mail you send leaves as a series of packets. Each packet may travel on a different route to its destination, depending on “traffic flow”.

Each packet carries part of the web site or email message, along with information that will help it get to its destination -- the sender's IP address, the intended receiver's IP address, how many packets this web site or e-mail message has been broken into, and the number of this particular packet. A typical packet may comprise:

- Header - 96 bits
- Trailer - 32 bits
- Data - 896 bits.

Downloads are faster than uploads

Internet download speeds are usually about 10 times faster than internet upload speeds because internet systems are designed to give priority to downloads, such as video-streaming and file downloads.

Typical internet speeds

Basic NBN speeds from Telstra: <https://www.telstra.com.au/internet/nbn/nbn-speeds-explained>

Peak: **9Mbps** download, **0.8 Mbps** upload

Off-peak: **11Mbps** download, **0.9 Mbps** upload

ADSL2+

I get about 15 Mbps download and 2 Mbps upload.

Mobile broadband using 4G network

I get 20 Mbps download and 0.6 Mbps upload

Kilo, Mega, Giga, Tera

1 kilobit (Kb) = 1000 bits	1 Megabit (Mb) = 1000 Kb	1 Gigabit (Gb) = 1000 Mb	1 Terabit (Tb) = 1000 Gb
1 kilobyte (KB) = 1000 bytes	1 Megabyte (MB) = 1000 KB	1 Gigabyte (GB) = 1000 MB	1 Terabyte = 1000 GB

Exercises

Try this internet speed test in your browser

<http://iinet.speedtestcustom.com/>

The resulting download and upload speeds are in Mbps (Megabits per second).

Download a file in your browser, for example <https://www.openoffice.org/download/>, or copy a large file to a USB stick and observe the progress – the Download speed is in MBps (Megabytes per second). (Remember, one byte = 8 bits.)

To see the download speed while downloading a file in a browser, click on Settings/downloads.

For file copying, the data transfer speed is displayed in the progress window

