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Features



Text, Bytes and Videotape

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Understanding bits and bytes

With 8 bits, we have $2^8 = 256$ possibilities (each bit can be zero or one, and the possibilities multiply together). We call 8 bits a byte. The very common ASCII system makes each letter of the alphabet, both capital and small (plus punctuation and some other symbols) correspond to a number from 0 to 255 (for example $a=97$, $b=98$ and so on), so one letter can be expressed with one byte.

Thus the word "Shannon" takes 7 bytes. A page of a book (with 50 characters per line, 50 lines per page) takes 2,500 bytes, so a 400 page book takes 1,000,000 bytes. As with metres and kilometres, we need some new units, or we'd need a lot of zeroes! Hence we write that a page is approximately 2.5KB, and a book is approximately 1 MB (something strange happens here in that KB ("kilobyte") = $1,024 = 2^{10}$ bytes, not 1000 as you might expect). It's easiest to keep track of things with powers of 2 like this. The next largest unit is 1MB ("megabyte") = $1,048,576 = 2^{20}$ bytes, and then 1GB ("gigabyte") = 2^{30} bytes.

Text, Bytes and Videotape



Bits and bytes

Image from [DHD photo gallery](#)

Computers often represent a pixel of colour with 3 bytes. This is like mixing paint – the amount of red in the mixture varies from 0 to 255, the amount of green varies from 0 to 255, the amount of blue from 0 to 255. A computer monitor showing 800×600 pixels therefore needs $3 \times 800 \times 600 = 1,440,000$ bytes – more than a whole book – just to fill the screen. A picture really is worth more than a thousand words!

As for a movie, we need $60 \times 60 \times 24 = 86,400$ pictures per hour (60 minutes per hour, 60 seconds per minute, 24 frames per second). That is, we need $1,440,000 \times 86,400 = 124,416,000,000$ bytes or 115.8GB to store an hour of film.

A CD-R can typically store about 700MB, a DVD can store about 4GB. It's clear we have to do something clever (that is, data compression) to fit a movie on a disc.

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