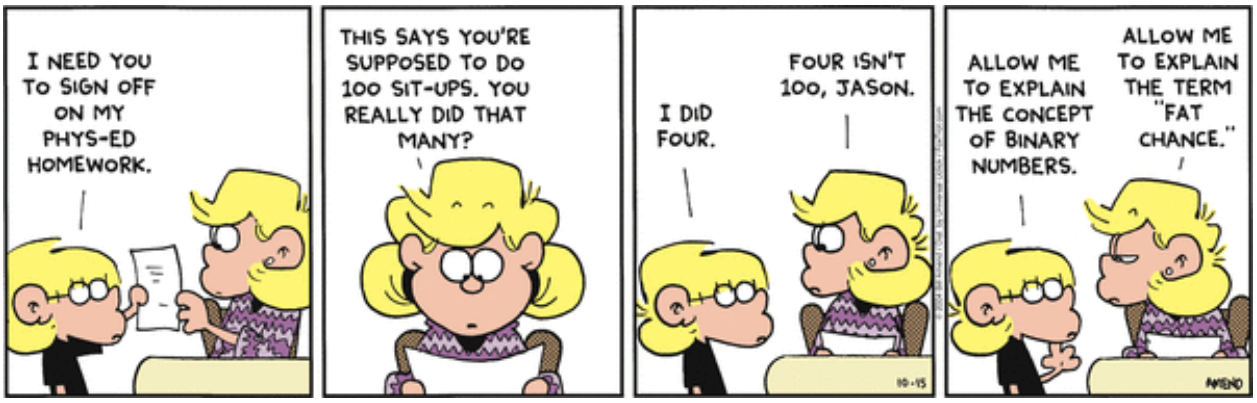
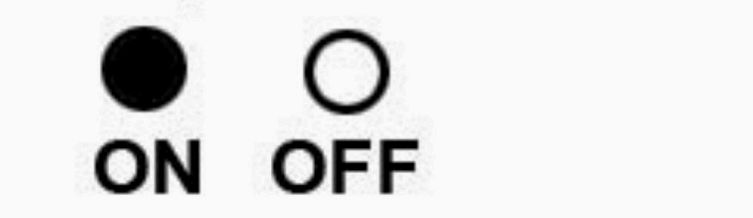
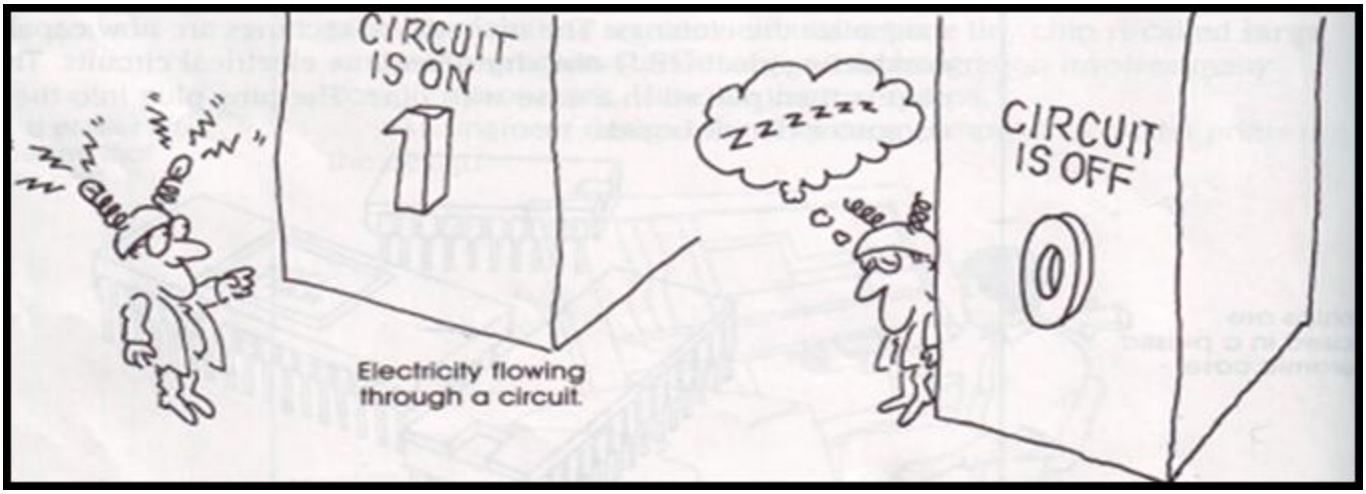
How much is 1 bit, byte, kilobyte, megabyte, gigabyte, etc.?



Bit

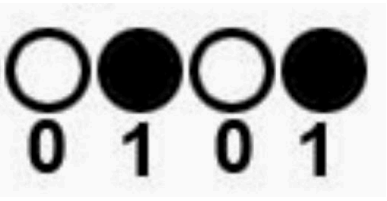
A bit is a **single binary digit** with value of either a 1 or 0 (on or off).





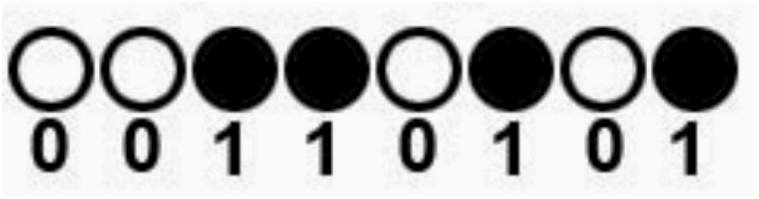
Nibble

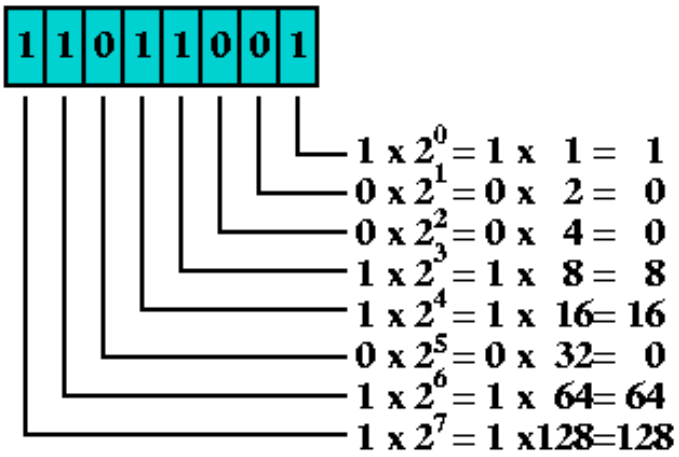
A Nibble is **4 bits**.



Byte

A Byte is **8 bits**.





$1 + 8 + 16 + 64 + 128 = 217$

0 0 0 0 0 0 0 0 Lowest value = 0

1 1 1 1 1 1 1 1 Highest value = 255

256 possible combinations of 8 bits

$2x2x2x2x2x2x2x2 = 2^8 = 256$

# of hex digits in 1 byte?

8th square = 128 pieces of rice

256 total in 1st row

Kilobyte (KB)

A Kilobyte is 1,024 bytes.

Megabyte (MB)

A Megabyte is 1,048,576 bytes or 1,024 Kilobytes

- 873 pages of plaintext (1,200 characters)
- 4 books (200 pages or 240,000 characters)

Gigabyte (GB)

A Gigabyte is 1,073,741,824 (2^{30}) bytes. 1,024 Megabytes, or 1,048,576 Kilobytes.

- 894,784 pages of plaintext (1,200 characters)
- 4,473 books (200 pages or 240,000 characters)
- 341 digital pictures (with 3MB average file size)
- 256 MP3 audio files (with 4MB average file size)
- 1 650MB CD

Terabyte (TB)

A Terabyte is 1,099,511,627,776 (2^{40}) bytes, 1,024 Gigabytes, or 1,048,576 Megabytes.

- 916,259,689 pages of plaintext (1,200 characters)
- 4,581,298 books (200 pages or 240,000 characters)
- 349,525 digital pictures (with 3MB average file size)
- 262,144 MP3 audio files (with 4MB average file size)
- 1,613 650MB CD's
- 233 4.38GB DVD's
- 40 25GB Blu-ray discs

Petabyte (PB)

A Petabyte is 1,125,899,906,842,624 (2^{50}) bytes, 1,024 Terabytes, or 1,048,576 Gigabytes.

- 938,249,922,368 pages of plaintext (1,200 characters)
- 4,691,249,611 books (200 pages or 240,000 characters)
- 357,913,941 digital pictures (with 3MB average file size)
- 268,435,456 MP3 audio files (with 4MB average file size)
- 1,651,910 650MB CD's
- 239,400 4.38GB DVD's
- 41,943 25GB Blu-ray discs

Forbes May 2018

There are 2.5 quintillion bytes (10^{18}) of data created each day at our current pace.

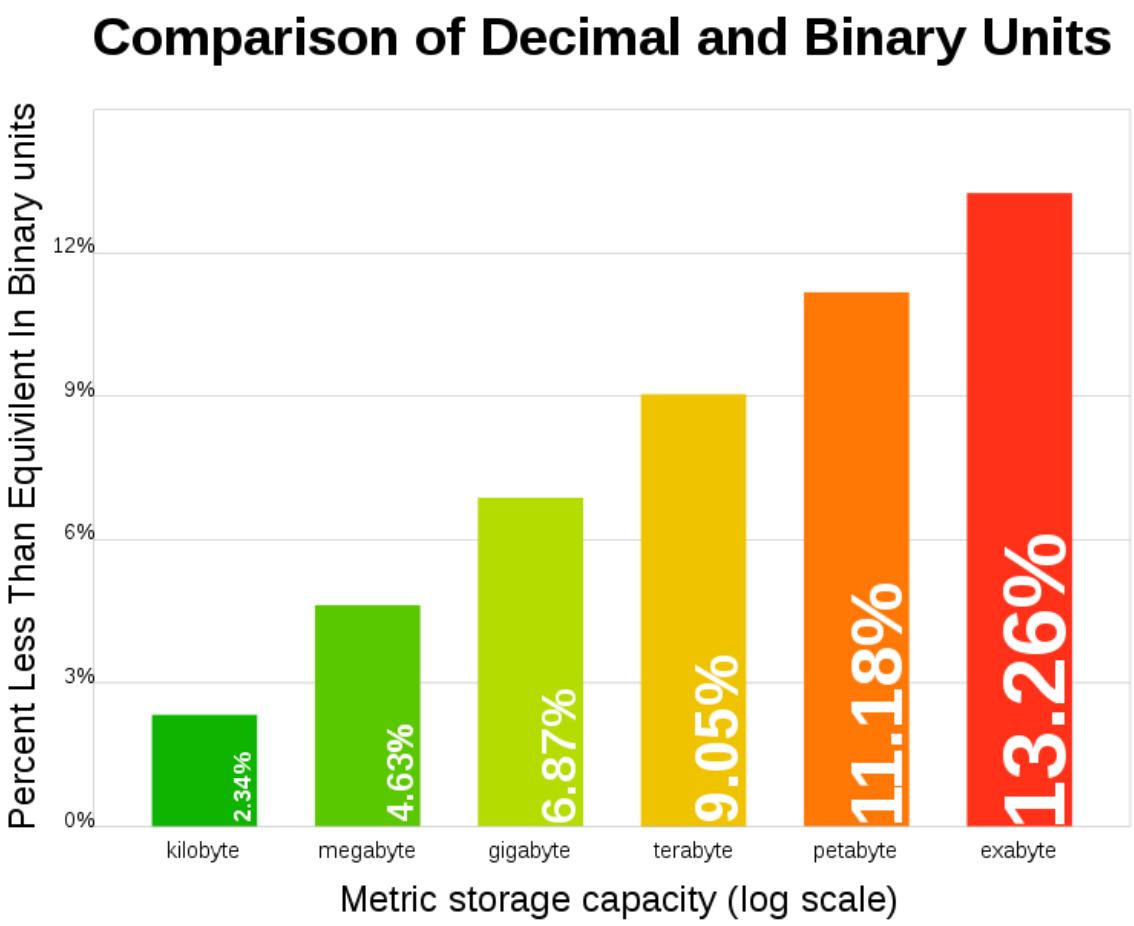
That pace is only accelerating with the growth of the Internet of Things (IoT).

Over the last two years alone 90 percent of the data in the world was generated.

Deviation between powers of 1024 and powers of 1000

Prefix	Binary ÷ Decimal		Decimal ÷ Binary	
kilo	1.024 (+2.4%)		0.9766 (−2.3%)	
mega	1.049 (+4.9%)		0.9537 (−4.6%)	
giga	1.074 (+7.4%)		0.9313 (−6.9%)	
tera	1.100 (+10.0%)		0.9095 (−9.1%)	
peta	1.126 (+12.6%)		0.8882 (−11.2%)	
exa	1.153 (+15.3%)		0.8674 (−13.3%)	
zetta	1.181 (+18.1%)		0.8470 (−15.3%)	
yotta	1.209 (+20.9%)		0.8272 (−17.3%)	

Right Column (colorful)



Hard drives are

- sold & marketed labeled using powers of **1000**
- but computers show available space using powers of **1024**

THUS ….

You might think a **terabyte** hard drive would have

- storage for 2^{50} or 1024^4 bits (using powers of 1024)
- but instead it only has 1000^4 bits (using powers of 1000)
- which is **11.8% less** than you might have thought

https://xkcd.com/394/

THERE'S BEEN A LOT OF CONFUSION OVER 1024 vs 1000, KBYTE vs KBIT, AND THE CAPITALIZATION FOR EACH.

HERE, AT LAST, IS A SINGLE, DEFINITIVE STANDARD:

SYMBOL	NAME	SIZE	NOTES
kB	KILOBYTE	1024 BYTES OR 1000 BYTES	1000 BYTES DURING LEAP YEARS, 1024 OTHERWISE
KB	KELLY-BOOTLE STANDARD UNIT	1012 BYTES	COMPROMISE BETWEEN 1000 AND 1024 BYTES
KiB	IMAGINARY KILOBYTE	$1024\sqrt{-1}$ BYTES	USED IN QUANTUM COMPUTING
kb	INTEL KILOBYTE	1023.937528 BYTES	CALCULATED ON PENTIUM F.P.U.
Kb	DRIVEMAKER'S KILOBYTE	CURRENTLY 908 BYTES	SHRINKS BY 4 BYTES EACH YEAR FOR MARKETING REASONS
KBa	BAKER'S KILOBYTE	1152 BYTES	9 BITS TO THE BYTE SINCE YOU'RE SUCH A GOOD CUSTOMER

Officially use different prefix to end the confusion

Prefixes for multiples of bits (b) or bytes (B)								
Decimal				Binary				
Value		SI		Value		IEC		JEDEC
1000	10^3	k	kilo	1024	2^{10}	Ki	kibi	K kilo
1000^2	10^6	M	mega	1024^2	2^{20}	Mi	mebi	M mega
1000^3	10^9	G	giga	1024^3	2^{30}	Gi	gibi	G giga
1000^4	10^{12}	T	tera	1024^4	2^{40}	Ti	tebi	–
1000^5	10^{15}	P	peta	1024^5	2^{50}	Pi	pebi	–
1000^6	10^{18}	E	exa	1024^6	2^{60}	Ei	exbi	–
1000^7	10^{21}	Z	zetta	1024^7	2^{70}	Zi	zebi	–
1000^8	10^{24}	Y	yotta	1024^8	2^{80}	Yi	yobi	–