

DEMYSTIFYING THE BYTE CONVERSION

In terms of measures of capacity or size, computer scientists prefer to count things using powers of two. This system is convenient because digital computers use the binary number system. Table 1 shows the powers of 2 that are most often used. As the table shows, the abbreviation for 2^{10} is K, where the K comes from the stem “kilo”. The prefix *kilo* is used because 1024 is closest to 1000. Similarly, the prefix *mega* is used for 2^{20} because its value is closest to 1,000,000. When these units are used to specify storage capacity of a machine, we really do mean the exact power of 2. For example, a machine that has 8 megabytes of memory has 8×2^{20} bytes, or 8,388,608 bytes of memory.

Table 1: Commonly used powers of 2 and their abbreviations

Power of 2	Value	Abbreviation
2^{10}	1,024	Kilo or K
2^{20}	1,048,576	Mega M
2^{30}	1,073,741,824	Giga or G
2^{40}	1,099,511,627,776	Tera or T

A directory Temp2 will be used in the following examples with real data results obtained from the NT Resource Kit utility Diruse.exe.

diruse Temp2 results in 674369228 bytes

diruse /k Temp2 results in 658563.92 KB

diruse /m Temp2 results in 643.13 MB

Example:

Convert bytes to MB

$$\left(\frac{674369228 \text{ bytes}}{1}\right)\left(\frac{1 \text{ MB}}{2^{20} \text{ bytes}}\right) = 643.13 \text{ MB}$$

Example:

Convert bytes to GB

$$\left(\frac{674369228 \text{ bytes}}{1}\right)\left(\frac{1 \text{ GB}}{2^{30} \text{ bytes}}\right) = 0.628 \text{ GB}$$

Example:

Convert KB to MB

$$\left(\frac{1 \text{ KB}}{1}\right)\left(\frac{2^{10} \text{ bytes}}{1 \text{ KB}}\right)\left(\frac{1 \text{ MB}}{2^{20} \text{ bytes}}\right) = \frac{1 \text{ MB}}{1024 \text{ KB}} = \frac{1 \text{ MB}}{2^{10} \text{ KB}}$$

Thus $1024 \text{ KB} = 1 \text{ MB}$

additionally, $1024 \text{ MB} = 1 \text{ GB}$

and, $1024 \text{ GB} = 1 \text{ TB}$

658563.92 KB to MB

$$\left(\frac{658563.92 \text{ KB}}{1}\right)\left(\frac{1 \text{ MB}}{1024 \text{ KB}}\right) = 643.13 \text{ MB}$$

Example:

$2^{20} \text{ KB} = 1 \text{ GB}$ because

$$\left(\frac{1 \text{ KB}}{1}\right)\left(\frac{2^{10} \text{ bytes}}{1 \text{ KB}}\right)\left(\frac{1 \text{ GB}}{2^{30} \text{ bytes}}\right) = \frac{1 \text{ GB}}{2^{20} \text{ KB}}$$

Convert 658563.92 KB to GB

$$\left(\frac{658563.92 \text{ KB}}{1}\right)\left(\frac{1 \text{ GB}}{2^{20} \text{ KB}}\right) = 0.628 \text{ GB}$$

Example:

$2^{30} \text{ KB} = 1 \text{ TB}$ because

$$\left(\frac{1 \text{ KB}}{1}\right)\left(\frac{2^{10} \text{ bytes}}{1 \text{ KB}}\right)\left(\frac{1 \text{ TB}}{2^{40} \text{ bytes}}\right) = \frac{1 \text{ TB}}{2^{30} \text{ KB}}$$

Example:

$2^{20} \text{ MB} = 1 \text{ TB}$ because

$$\left(\frac{1 \text{ MB}}{1}\right)\left(\frac{2^{20} \text{ bytes}}{1 \text{ MB}}\right)\left(\frac{1 \text{ TB}}{2^{40} \text{ bytes}}\right) = \frac{1 \text{ TB}}{2^{20} \text{ MB}}$$

Example:

$1024 \text{ GB} = 1 \text{ TB}$ because

$$\left(\frac{1 \text{ GB}}{1}\right)\left(\frac{2^{30} \text{ bytes}}{1 \text{ GB}}\right)\left(\frac{1 \text{ TB}}{2^{40} \text{ bytes}}\right) = \frac{1 \text{ TB}}{2^{10} \text{ GB}} = \frac{1 \text{ TB}}{1024 \text{ GB}}$$

Table 2: Byte Conversions

1024 bytes (2^{10})	=	1 KB
2^{20} bytes	=	1 MB
2^{30} bytes	=	1 GB
2^{40} bytes	=	1 TB
1024 KB (2^{10})	=	1 MB
2^{20} KB	=	1 GB
2^{30} KB	=	1 TB
1024 MB (2^{10})	=	1 GB
2^{20} MB	=	1 TB
1024 GB (2^{10})	=	1 TB