Unit Prefixes

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☰ WHAT'S COVERED

As the capacities of digital devices grew, new terms were developed to identify the capacities of processors, memory, and disk storage space. Prefixes were applied to measurements — such as byte — to represent different orders of magnitude. Since bits and bytes are binary numbers, the prefixes were originally meant to represent multiples of 1024 (which is two to the 10th power), but have more recently been rounded to mean multiples of 1000. In this tutorial, we will examine the most common prefixes, and apply them to measurements of storage and processing speed.

Our discussion will break down like this:

1. Unit Prefixes

A **unit prefix** is a group of letters attached to the beginning of a unit of measurement. You're probably familiar with unit prefixes for measurements, such as the meter. For example, the prefix "kilo" can be added to the meter to form a kilometer, a unit of length equivalent to 1000 meters. A kilogram is a unit of weight equivalent to 1000 grams.

In these examples, the prefix multiplies the base unit by a power of 10 (1000 = 10^3). With units of digital information, such as the byte, these prefixes actually multiply the base by a power of two. This is because the byte is made of binary digits (binary meaning two).

> ↗ EXAMPLE   When adding the prefix kilo to byte, we get the kilobyte. A kilobyte is defined as 2^{10} or 1024 bytes. This can be confusing, especially since we are familiar with multiplying other measurements by 1000, not 1024, when applying the prefix kilo. Due to this confusion, it has become common and acceptable to round 1024 to 1000 when applying prefixes to bytes.

⚑ HINT

Technically, binary prefixes apply a multiplier of 2^{10} (or 1024). However, because it is easier to multiply by 1000 instead of 1024, it is acceptable to interpret the prefixes as multiples of 1000. For example, 1 gigabyte can be expressed as 1,000,000,000 bytes (1000*1000*1000), rather than 1,073,741,824 bytes (1024*1024*1024).

🗎 TERM TO KNOW

Unit Prefix

A group of letters attached to the beginning of a unit; common prefixes include kilo, mega, giga, and tera.

2. Bytes

Recall that a **byte** is a unit of digital data, consisting of binary digits made of 0s and 1s. When dealing with millions and billions of bytes, it is easier to express the size of the data using binary prefixes. The most common binary prefixes are kilobyte, megabyte, and gigabyte. In today's society, the terabyte is also becoming more popular to describe machines with very large storage capacities.

Below is a table of common prefixes and their application on the byte.

Prefix	Notation	Represents	Example
kilo	KB	1 thousand	1 KB = 1,000 bytes
mega	MB	1 million	1 MB = 1,000,000 bytes
giga	GB	1 billion	1 GB = 1,000,000,000 bytes
tera	TB	1 trillion	1 TB = 1,000,000,000,000 bytes

↗ EXAMPLE A brief email of text would be one to two kilobytes. A larger file, such as a minute-long video clip, would be 15 to 20 megabytes. Today's smartphones can have capacities of 64 gigabytes or more. A professional videographer might need a hard drive with one terabyte to store the multimedia files and software programs she needs to do her job.

☑ TRY IT

Rank the following storage sizes from smallest to largest: 5KB, 1TB, 6MB, 3GB.

What did you come up with? To solve this, it is helpful to write each measurement in one unit, such as bytes, and then compare:

5KB= 5,000 bytes
1TB= 1,000,000,000,000 bytes
6MB= 6,000,000 bytes
3GB= 3,000,000,000 bytes

So, the correct ordering of these, from smallest to largest, would be 5KB, 6MB, 3GB, 1TB

▤ TERM TO KNOW

Byte
A unit of digital data, containing a string of eight binary units (0s or 1s).

3. Hertz

Hertz is a unit of frequency named after German physicist Heinrich Hertz. This unit of frequency is defined as one cycle per second, and is used to describe the processing speed of computing devices. Hertz is abbreviated Hz, and can also be used with the prefixes mentioned above.

The same prefixes that were used with bytes can be applied to hertz. The most common prefix associated with processing speed is giga. All of the prefixes applied to hertz are multipliers of a power of 10. This differs from the prefixes applied to bits and bytes, as those prefixes are multipliers of two.

Prefix	Notation	Represents	Example
kilo	KHz	1 thousand	1 KHz = 1,000 hertz
mega	MHz	1 million	1 MHz = 1,000,000 hertz
giga	GHz	1 billion	1 GHz = 1,000,000,000 hertz
tera	THz	1 trillion	1 THz = 1,000,000,000,000 hertz

↗ **EXAMPLE** The speed of today's desktop and mobile processors are measured in gigahertz (GHz) and can range from two to four GHz.

📄 **TERM TO KNOW**

Hertz
A unit of frequency used to describe the speed of computing devices; abbreviated Hz.

📋 **SUMMARY**

Several **prefixes** can be applied to the beginning of measures to represent much larger quantities. In computing, common measurements include the byte, a unit of data, and the **hertz**, a unit of frequency or speed. The most common prefixes applied to the byte are kilo, mega, giga, and tera, which represent multiples of 1000 from one prefix to the next. For example, 1 kilobyte equals 1000 **bytes**, 1 megabyte equals 1000 kilobytes, 1 gigabyte equals 1000 megabytes, and so on. These same prefixes can be used with the hertz; however, the most common unit of processing speed is the gigahertz (GHz), which is 1 million hertz.

Source: Derived from Chapter 2 "Information Systems for Business and Beyond" by David T. Bourgeois. Some sections modified for brevity.
https://www.saylor.org/site/textbooks/Information%20Systems%20for%20Business%20and%20Beyond/Textbook.html

📄 **TERMS TO KNOW**

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