QUANTIFYING BITS AND BYTES

▶ **How can I tell the difference between bits and bytes?**
The ads for digital devices often include lots of abbreviations relating to bits and bytes. A few key concepts can help you understand what these abbreviations mean. Even though the word *bit* is an abbreviation for *binary digit*, it can be further abbreviated, usually as a lowercase *b*.

On older digital devices, bits were handled in groups, and terminology from that era is still used. A group of eight bits is called a **byte** and is usually abbreviated as an uppercase *B*.

Transmission speeds are usually expressed in bits, whereas storage space is typically expressed in bytes. For example, a cable Internet connection might transfer data from the Internet to your computer at 8 mega*bits* per second. In an iPod ad, you might notice that it can store up to 60 giga*bytes* of music and video.

▶ **What do the prefixes *kilo-, mega-, giga-,* and *tera-* mean?** When reading about digital devices, you'll frequently encounter references such as 50 kilobits per second, 1.44 megabytes, 2.8 gigahertz, and 2 terabytes. *Kilo*, *mega*, *giga*, *tera*, and similar terms are used to quantify digital data as shown in Figure 1-29.

Bit	One binary digit	Gigabit	2^{30} bits
Byte	8 bits	Gigabyte	2^{30} bytes
Kilobit	1,024 or 2^{10} bits	Terabyte	2^{40} bytes
Kilobyte	1,024 or 2^{10} bytes	Petabyte	2^{50} bytes
Megabit	1,048,576 or 2^{20} bits	Exabyte	2^{60} bytes
Megabyte	1,048,576 or 2^{20} bytes		

In common usage, *kilo*, abbreviated as K, means a thousand. For example, $50K means $50,000. In the context of computers, however, 50K means 51,200. Why the difference? In the decimal number system we use on a daily basis, the number 1,000 is 10 to the third power, or 10^3. For digital devices where base 2 is the norm, a kilo is precisely 1,024, or 2^{10}. A **kilobit** (abbreviated Kb or Kbit) is 1,024 bits. A **kilobyte** (abbreviated KB or Kbyte) is 1,024 bytes. Kilobytes are often used when referring to the size of small computer files.

The prefix *mega* means a million, or in the context of bits and bytes, precisely 1,048,576 (the equivalent of 2^{20}). A **megabit** (Mb or Mbit) is 1,048,576 bits. A **megabyte** (MB or MByte) is 1,048,576 bytes. Megabytes are often used when referring to the size of medium to large computer files.

In technology lingo, the prefix *giga* refers to a billion, or precisely 1,073,741,824. As you might expect, a **gigabit** (Gb or Gbit) is approximately 1 billion bits. A **gigabyte** (GB or GByte) is 1 billion bytes. Gigabytes are commonly used to refer to storage capacity.

Computers—especially mainframes and supercomputers—sometimes work with huge amounts of data, and so terms such as *tera* (trillion), *peta* (thousand trillion), and *exa* (quintillion) are also handy.

TERMINOLOGY NOTE

What's a kibibyte? Some computer scientists have proposed alternative terminology to dispel the ambiguity in terms such as *mega* that can mean 1,000 or 1,024. They suggest the following prefixes:

Kibi = 1,024

Mebi = 1,048,576

Gibi = 1,073,741,824

FIGURE 1-29

Quantifying Digital Data

TRY IT!

Fill in the correct abbreviation (B, MB, KB, or GB):

My iPhone has 8 ☐ of storage space.

I uploaded a high-resolution 8- ☐ graphic.

You can download my resume; the file is only 8 ☐ .