may need in the future. Saving is the process of copying data, instructions, and information from RAM to a storage device such as a hard disk.

Three basic types of RAM chips exist: dynamic RAM, static RAM, and magnetoresistive RAM.

- *Dynamic RAM* (*DRAM* pronounced DEE-ram) chips must be re-energized constantly or they lose their contents. Many variations of DRAM chips exist, most of which are faster than the basic DRAM. *Synchronous DRAM* (*SDRAM*) chips are much faster than DRAM chips because they are synchronized to the system clock. *Double Data Rate SDRAM* (*DDR SDRAM*) chips are even faster than SDRAM chips because they transfer data twice for each clock cycle, instead of just once, and DDR 2 is even faster than DDR. Dual channel SDRAM is faster than single channel SDRAM because it delivers twice the amount of data to the processor. *Rambus DRAM* (*RDRAM*) is yet another type of DRAM that is much faster than SDRAM because it uses pipelining techniques. Most personal computers today use some form of SDRAM chips or RDRAM chips.
- *Static RAM* (*SRAM* pronounced ESS-ram) chips are faster and more reliable than any variation of DRAM chips. These chips do not have to be re-energized as often as DRAM chips, thus, the term static. SRAM chips, however, are much more expensive than DRAM chips. Special applications such as cache use SRAM chips. A later section in this chapter discusses cache.
- A newer type of RAM, called *magnetoresistive RAM* (*MRAM* pronounced EM-ram), stores data using magnetic charges instead of electrical charges. Manufacturers claim that MRAM has greater storage capacity, consumes less power, and has faster access times than electronic RAM. Also, MRAM retains its contents after power is removed from the computer, which could prevent loss of data for users. As the cost of MRAM declines, experts predict MRAM could replace both DRAM and SRAM.

RAM chips usually reside on a **memory module**, which is a small circuit board. **Memory slots** on the motherboard hold memory modules (Figure 4-18). Three types of memory modules are SIMMs, DIMMs, and RIMMs. A *SIMM* (*single inline memory module*) has pins on opposite sides of the circuit board that connect together to form a single set of contacts. With a *DIMM* (*dual inline memory module*), by contrast, the pins on opposite sides of the circuit board do not connect and thus form two sets of contacts. SIMMs and DIMMs typically hold SDRAM chips. A *RIMM* (*Rambus inline memory module*) houses RDRAM chips. For a more technical discussion about RAM, read the High-Tech Talk article on page 218 at the end of this chapter.

WEB LINK 4-3

RAM

For more information, visit scsite.com/dc2007/ch4/weblink and then click RAM.

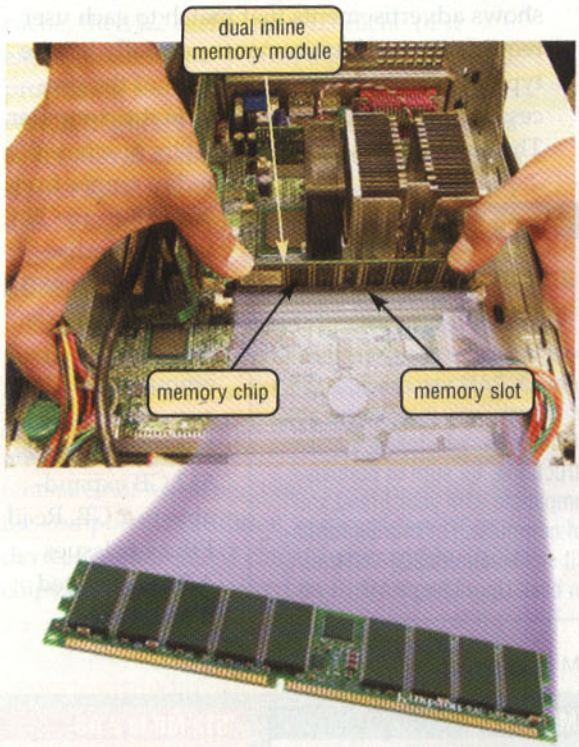

FIGURE 4-18 This photo shows a memory module being inserted in a motherboard.

RAM CONFIGURATIONS The amount of RAM necessary in a computer often depends on the types of software you plan to use. A computer executes programs that are in RAM. Think of RAM as the workspace on the top of your desk. Just as the top of your desk needs a certain amount of space to hold papers, a computer needs a certain amount of memory to store programs, data, and information. The more RAM a computer has, the faster the computer will respond.

A software package typically indicates the minimum amount of RAM it requires. If you want the application to perform optimally, usually you need more than the minimum specifications on the software package. Some programs, such as operating systems, also have specified maximums.