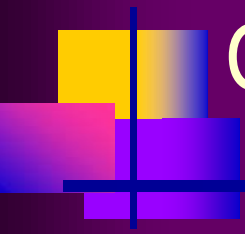
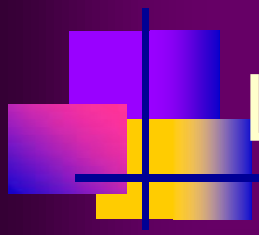


Chapter 4

Storage

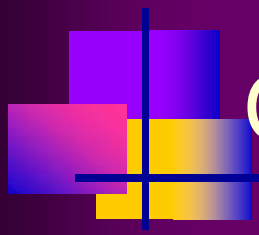


Learning Objectives

- Explain the difference between storage systems and memory.
- Name several general properties of storage systems.
- Identify the two primary types of magnetic disk systems and describe how they work.

Learning Objectives, *cont'd.*

- Discuss the various types of optical disc systems available and how they differ from each other and from magnetic systems.
- List at least three other types of storage systems.
- Summarize the storage alternatives for a PC, including which storage systems should be included in all PCs and when the other systems would be appropriate.



Overview

- This chapter covers:
  - Common characteristics of storage systems
  - Magnetic disk storage
  - Optical disc storage
  - Magnetic tape and other types of storage systems

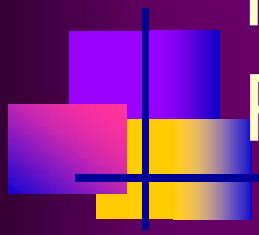
Properties of Storage Systems: Physical Parts

- Involve two physical parts: a *storage device* and a *storage medium*.
- Can be *internal* (configured into the system unit), or *external* (separate devices).
- Media must often pass by a *read/write head* in the storage device to be read from or written to.

Properties of Storage Systems: Nonvolatility Property

- Storage media are **nonvolatile**:
  - When power to the device is shut off, data stored on the medium remains.
  - This is in contrast to most types of memory, which are **volatile**.

Properties of Storage Systems: Removable vs. Fixed Media



- *Fixed media*: typically faster and less expensive
- *Removable media*: unlimited capacity and can be easily transported and secured

Properties of Storage Systems: Random vs. Sequential Access

- *Sequential access:* records in a file can be retrieved only in the same sequence in which they are physically stored (like tape)

- *Direct access (random access):* records can be retrieved in any sequence, independent of physical storage (most disks and optical media)

Properties of Storage Systems: Logical vs. Physical Representation

- *Logical file representation* refers to the user's view of the way data is stored.

- *Physical file representation* is the actual physical way the data is stored on the storage media as viewed by the computer.

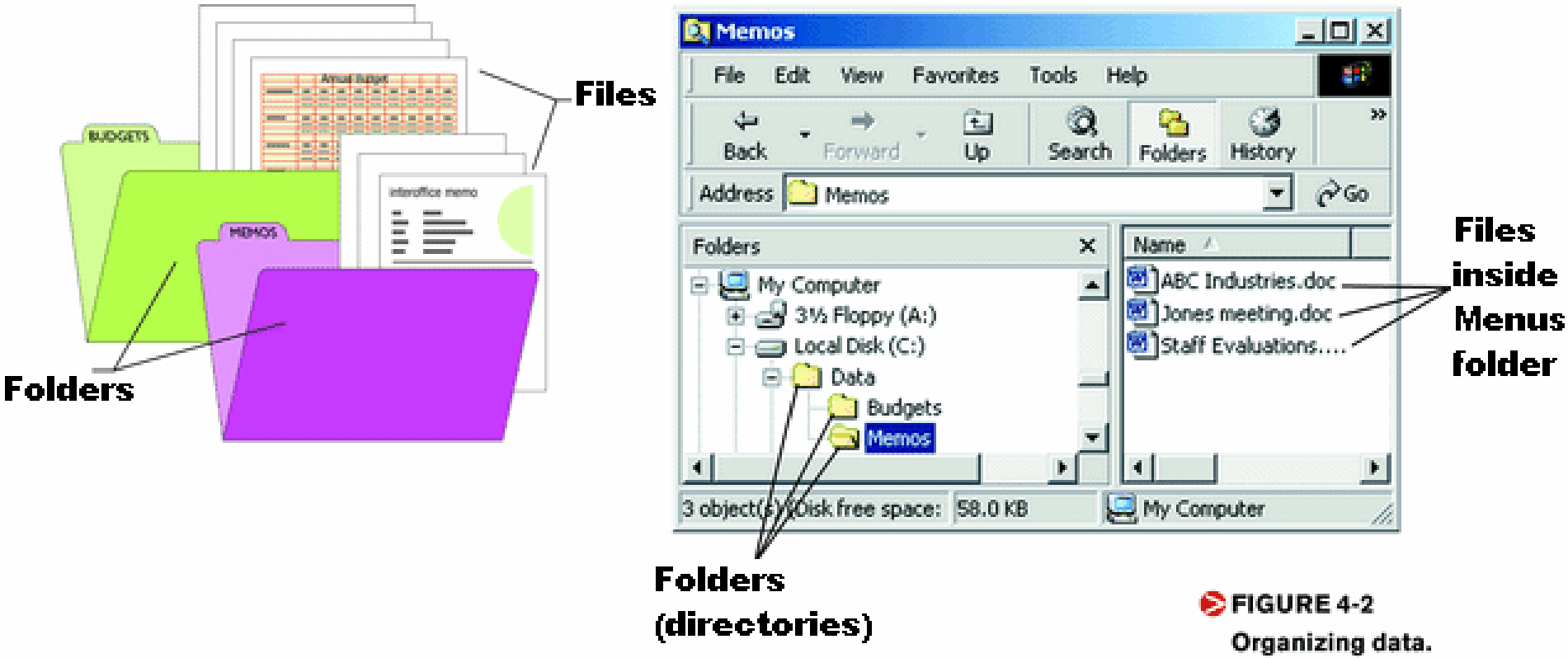
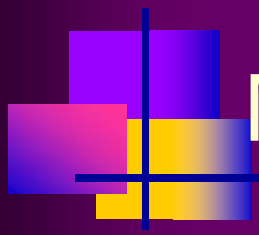


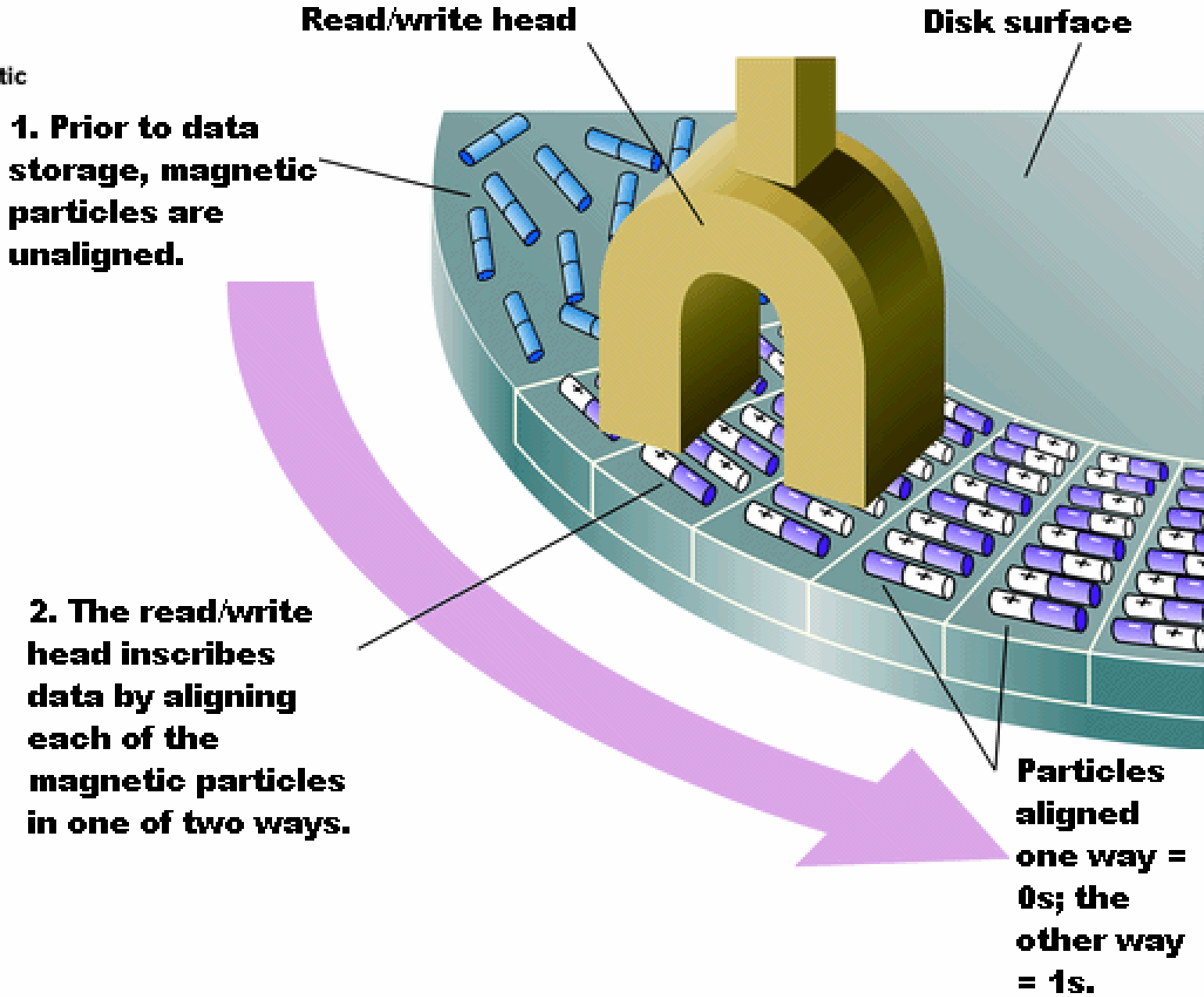
FIGURE 4-2
Organizing data.



Magnetic Disk Systems

- **Magnetic disks** are the most important storage medium in computers today.
- Two popular types:
  - *floppy disks*
  - *hard disks*
- Data is written by magnetizing particles on the disks in a certain way to represent 1s and 0s.

FIGURE 4-3
Storing data on magnetic disks.



Floppy Disks

- Physical properties
  - Most are 3½ inches in diameter and hold 1.44 megabytes.

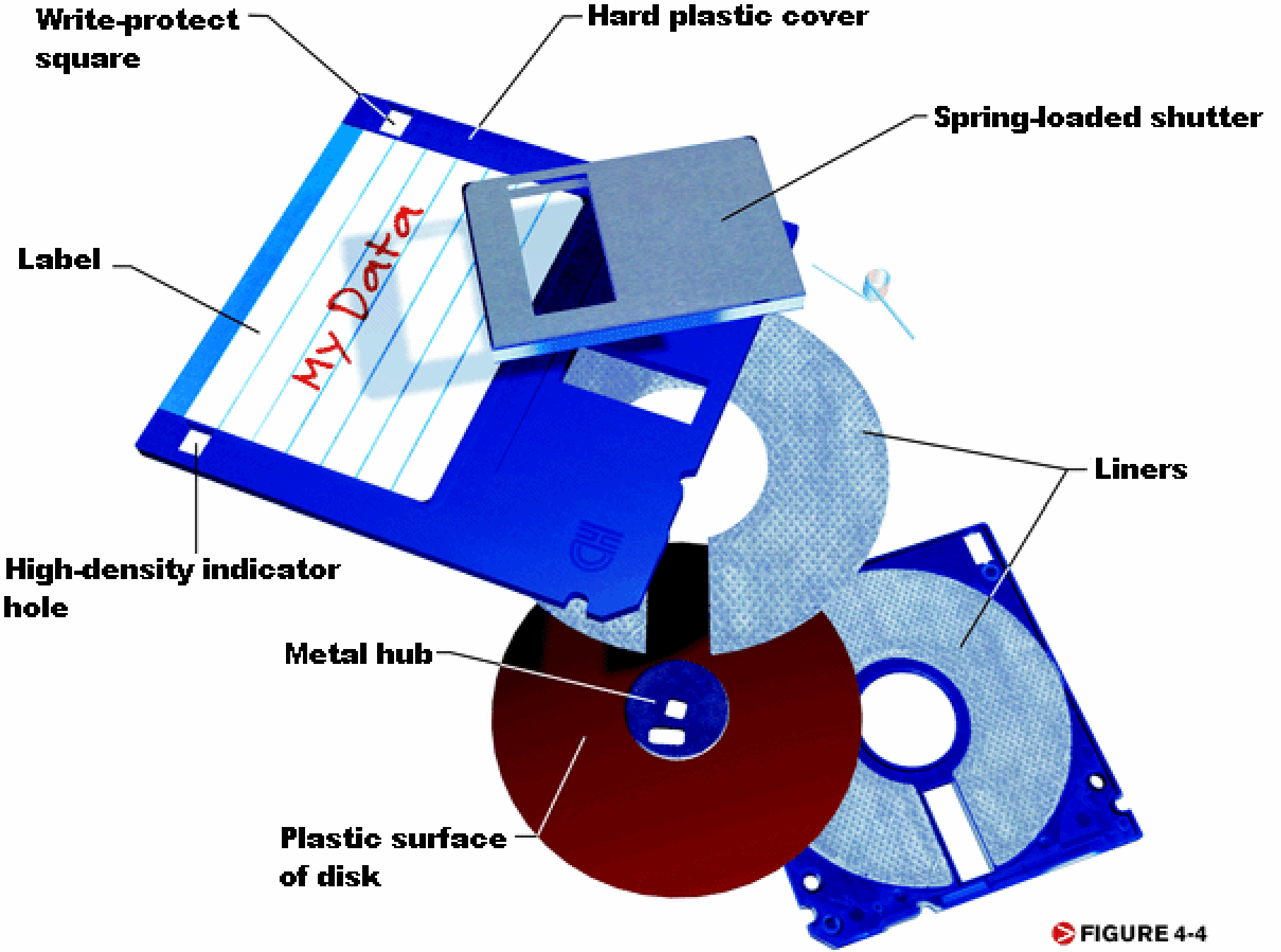
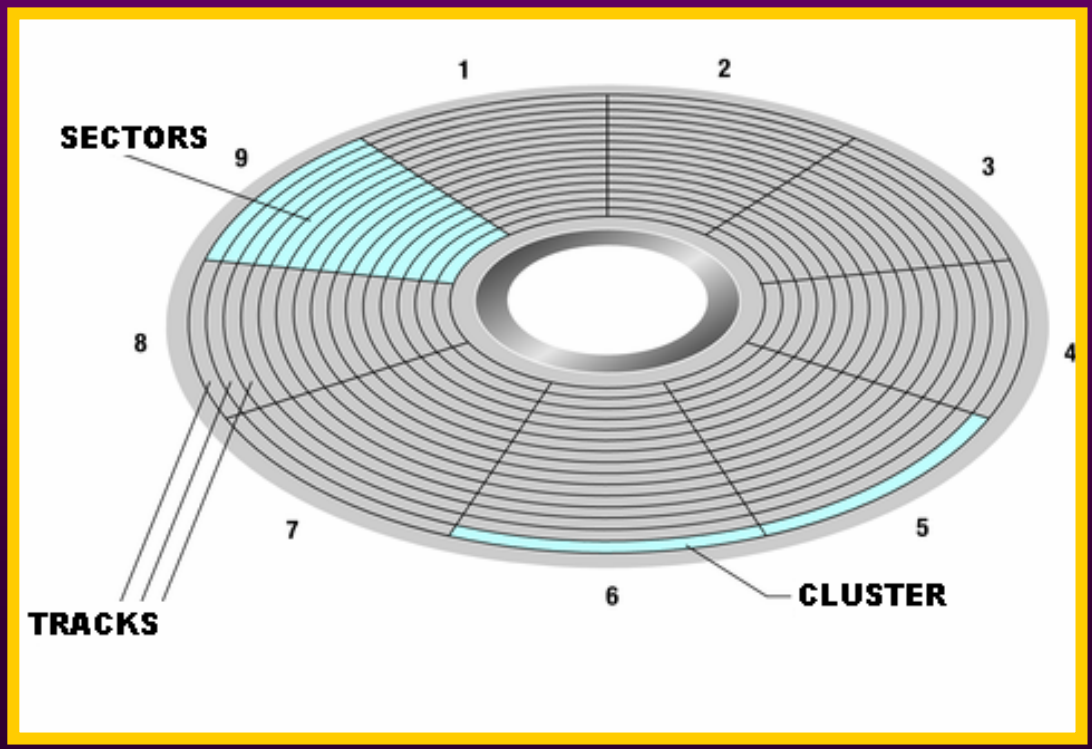


FIGURE 4-4
The anatomy of a floppy disk.

Floppy Disks, *cont'd.*

- Tracks, sectors, and clusters
  - The disk's file directory keeps track of the contents of the disk.



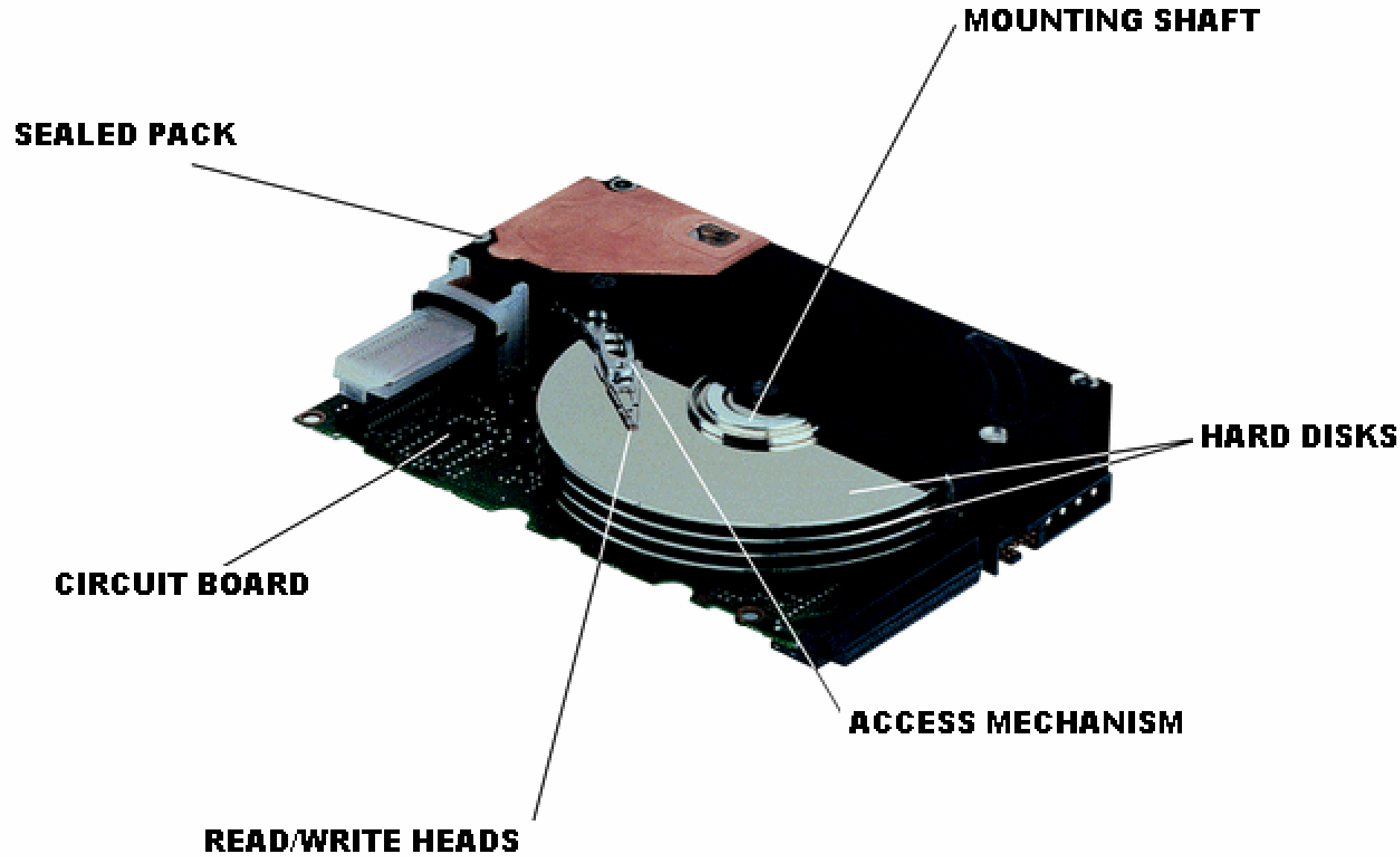
Floppy Disks, *cont'd.*

- Using floppy disks
  - Must be inserted into the proper drive in the proper direction
  - Should not be removed when the disk is being accessed
- Superdiskettes
  - Zip drives, SuperDisk drives, HiFD drives

Hard Disks

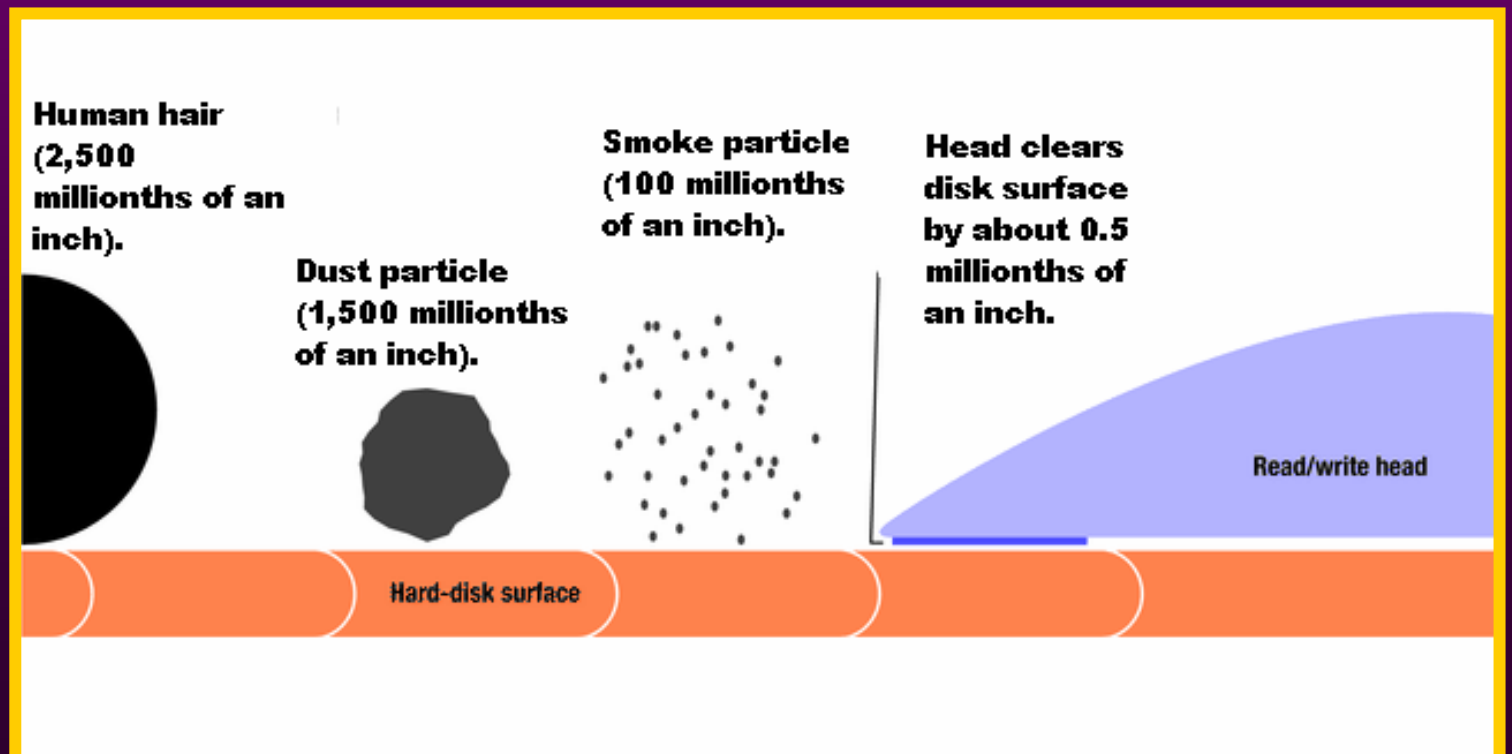
- Physical properties
  - Permanently sealed inside the hard drive—allows faster speeds than removable systems
- Hard disk addressing
  - Disk cylinder—the collection of tracks located in the same location on a set of hard disk surfaces

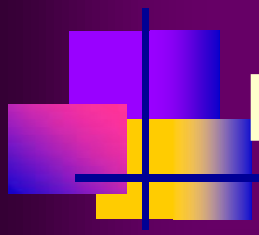
FIGURE 4-8
A hard disk drive.



Hard Disks, *cont'd.*

- Reading and writing data
  - Obstacles on a hard-disk system can damage the surface and read/write head.





Hard Disks, *cont'd.*

- Disk access time
  - Factors: seek time, rotational delay, data movement time
- Disk cache
  - Strategy for speeding up system performance
- Disk standards
  - ATA/IDE and SCSI, Fibre Channel

Hard Disks, *cont'd.*

- Removable hard disk systems
  - Offer large storage capacities and portability

Hard Disks, *cont'd.*

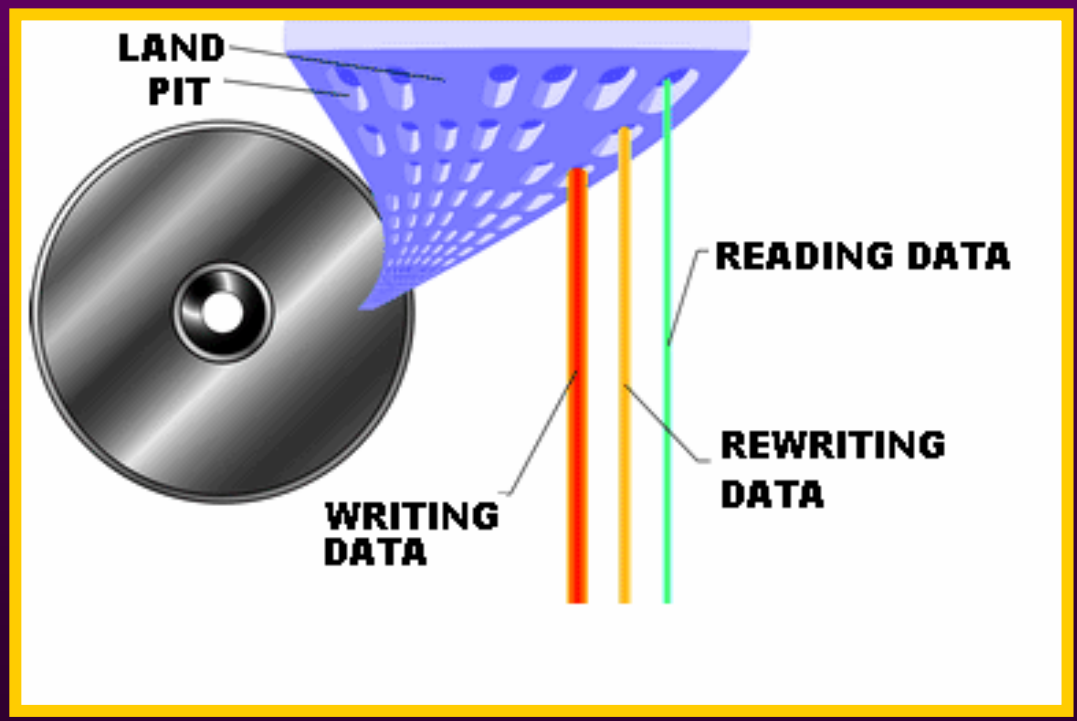
- Hard disk systems for notebooks
  - Can use either internal or removable hard drives

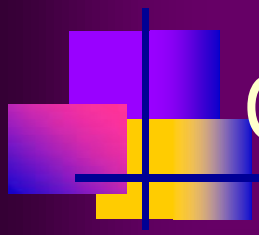
Hard Disks, *cont'd.*

- Hard disk systems for large computer systems
  - May use a system consisting of multiple hard drives; RAID is a recent trend

Optical Discs

- Laser beams write and read data packed at very tight storage densities, several times finer than that of a typical magnetic disk.



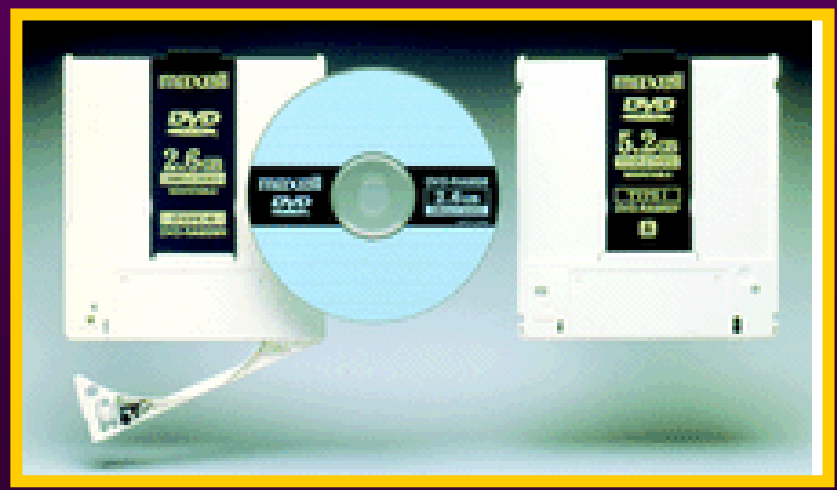


CDs

- CDs are permanently etched when data is stored on the disc.
- **Recordable (CD-R)** discs can be written to, but not erased and rewritten.
- **Rewritable (CD-RW) CDs** can be used in the same way as magnetic disks—data can be stored and erased as needed.

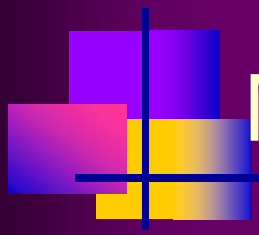
DVDs

- DVDs are read-only and may replace VHS as the movie media of choice.
- **Rewritable DVDs (DVD-RAM** or **DVD+RW)** allow users to record on DVD discs.



Magneto-Optical Discs

- *M-O discs* use a combination of magnetic and optical technologies.
- Can store up to 5.2 GB per disc.



Magnetic Tape Systems

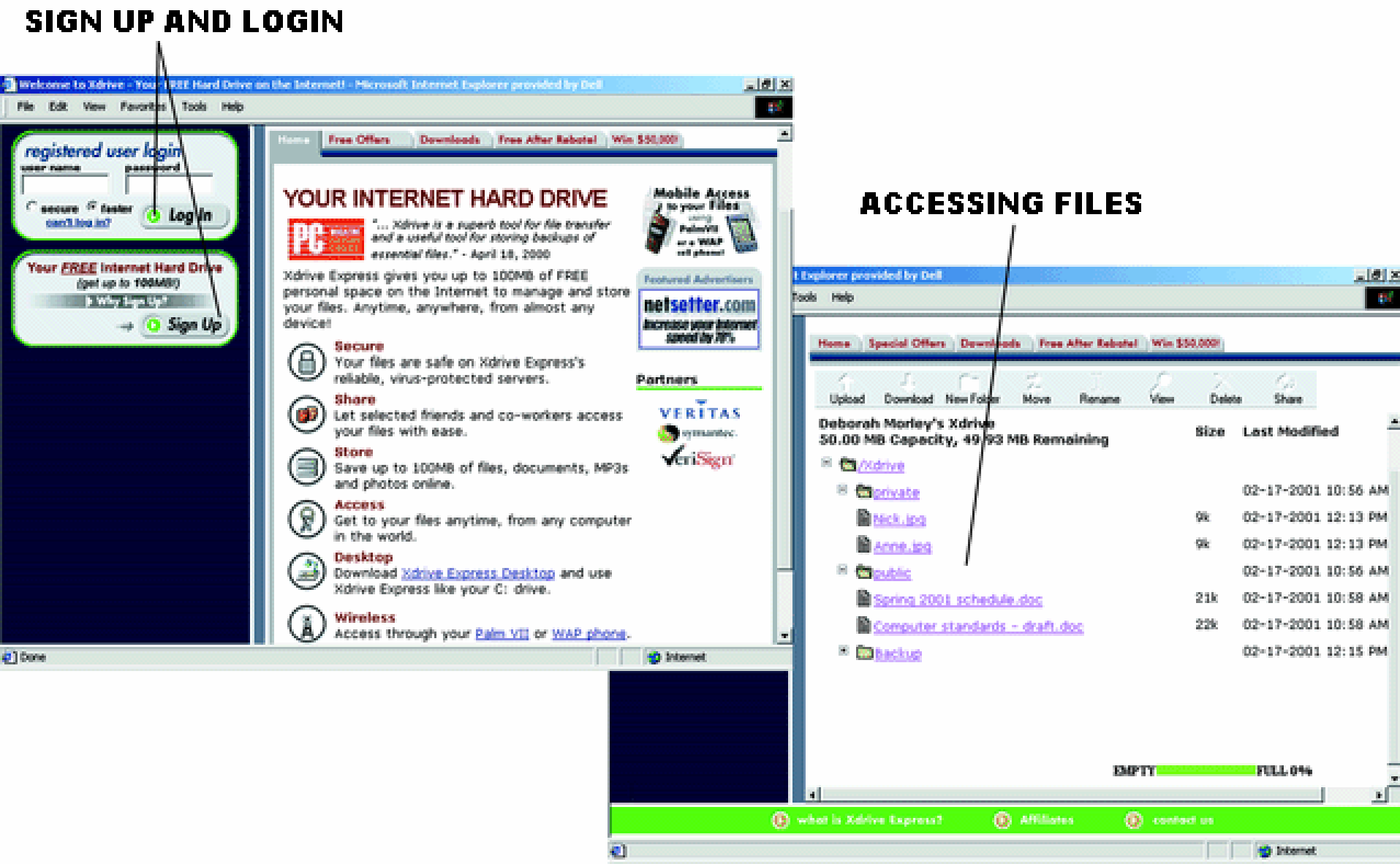
- **Magnetic tape** is used primarily for backup purposes.
- The device that reads tapes is called a *tape drive*.
- Most tape media are in the form of *cartridge tapes*, though *detachable-reel tapes* exist as well.

Online Storage

- Online storage is usually storage on a server accessible over the Internet or another network.
- Online storage can be used as a primary storage medium or for backup or distribution purposes.

FIGURE 4-19

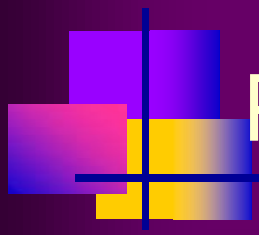
Online storage.



Smart Cards

- **Smart card**: credit-card-sized piece of plastic that contains some type of computer circuitry.
  - Holds less than a few megabytes
  - Commonly used to store prepaid amounts of digital cash, or personal information

- *Smart card readers* are attached to a PC or built into a cell phone, keyboard, or other device.



Flash Memory Devices

- Flash memory sticks
  - Size of a stick of gum; hold from 4 to 512 MB each
- Flash memory cards
  - Standards include CompactFlash, SmartMedia, Secure Digital (SD), and MultiMedia Card (MMC)
- Flash memory drives
  - Have no moving parts—are more shock-proof and portable than conventional drives

FLASH MEMORY STICKS

FLASH MEMORY CARDS

FLASH MEMORY DRIVES

Comparing Storage Alternatives

Speed, expense, portability, and compatibility

- Most PC users require
  - Hard drive
  - CD or DVD drive
  - Floppy drive