

# Discovering Computers

Technology in a World of Computers,  
Mobile Devices, and the Internet

## Chapter 8

### Digital Storage



# Objectives Overview

---

Differentiate  
between storage  
and memory

Describe the  
characteristics of  
internal hard disks

Identify uses of  
external hard disks  
and RAID

Describe the  
benefits of solid-  
state drives

Differentiate among  
various types of  
memory cards and  
USB flash drives

# Objectives Overview

---

Discuss the benefits  
and uses of cloud  
storage

Describe characteristics  
of and differentiate  
among types of optical  
discs

Explain types of  
enterprise storage

Identify uses of  
magnetic stripe cards,  
smart cards, RFID tags,  
and microfilm and  
microfiche

# Storage

---

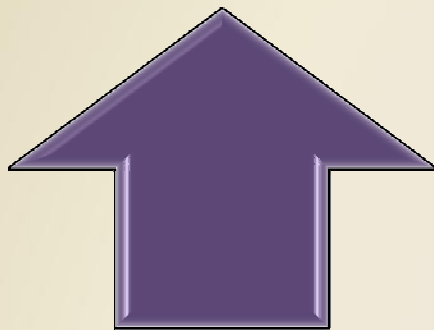
A storage medium is the physical material on which a computer keeps data, information, programs, and applications

Cloud storage is another storage option, in which the actual online storage media used is transparent to the user

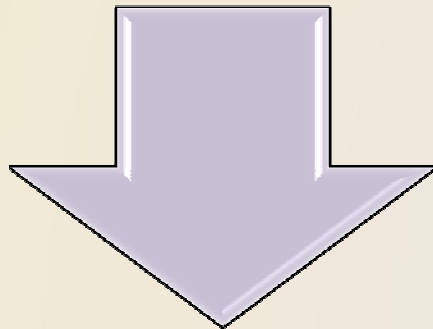
# Storage

---

- A **storage device** is the hardware that records and/or retrieves items to and from storage media



**Reading** is the process of transferring items from a storage medium into memory



**Writing** is the process of transferring items from memory to a storage medium

# Storage



# Storage

- **Capacity** is the number of bytes a storage medium can hold


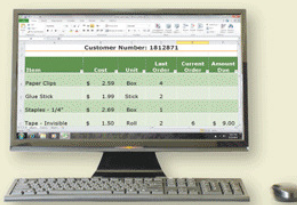






**Table 8-1 Terms Used to Define Storage**

Storage Term	Approximate Number of Bytes	Exact Number of Bytes
Kilobyte (KB)	1 thousand	$2^{10}$ or 1,024
Megabyte (MB)	1 million	$2^{20}$ or 1,048,576
Gigabyte (GB)	1 billion	$2^{30}$ or 1,073,741,824
Terabyte (TB)	1 trillion	$2^{40}$ or 1,099,511,627,776
Petabyte (PB)	1 quadrillion	$2^{50}$ or 1,125,899,906,842,624
Exabyte (EB)	1 quintillion	$2^{60}$ or 1,152,921,504,606,846,976
Zettabyte (ZB)	1 sextillion	$2^{70}$ or 1,180,591,620,717,411,303,424
Yottabyte (YB)	1 septillion	$2^{80}$ or 1,208,925,819,614,629,174,706,176



# Storage

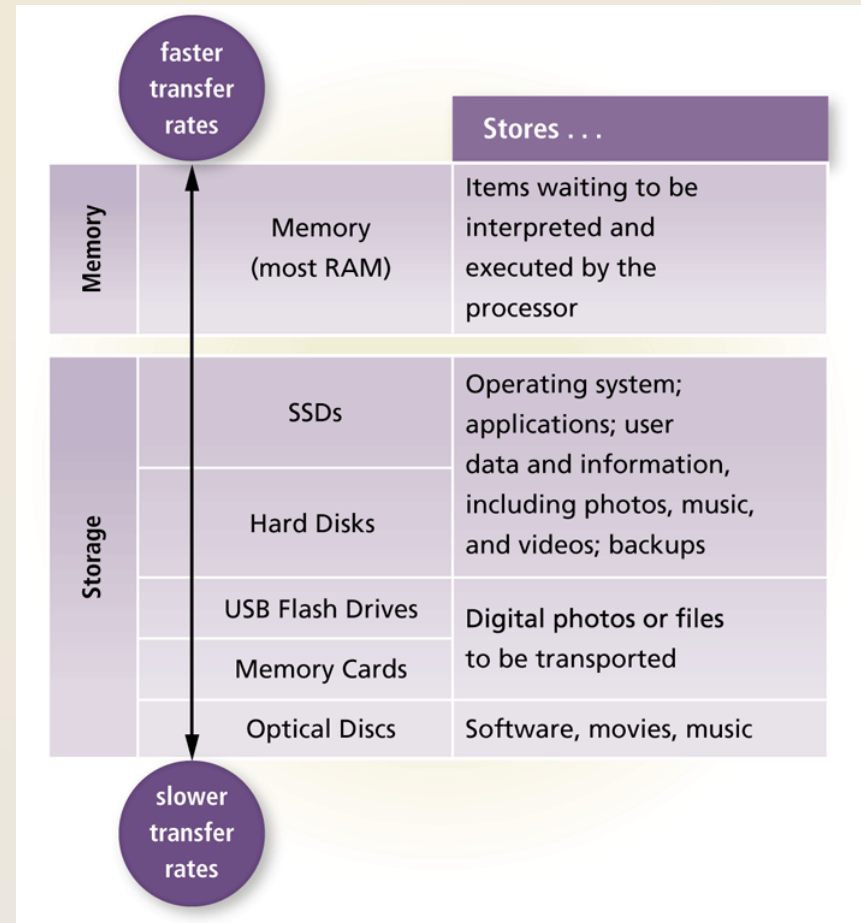
- Items on a storage medium remain intact even when you turn off a computer or mobile device

An Illustration of Volatility			
State of Computer	Screen Display Volatile	Contents of Most RAM Volatile	Contents of Storage Nonvolatile
		 invisible tape \$1.50 per roll 6 rolls \$9.00 total due	
			



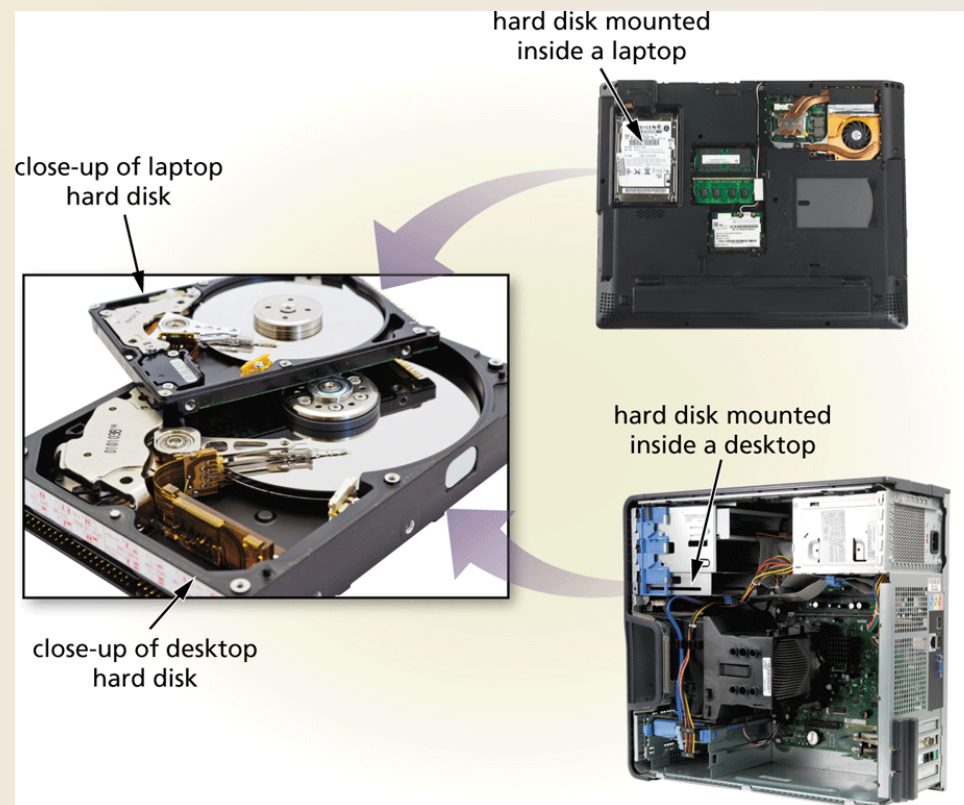
# Storage

- **Access time** measures:
  - The amount of time it takes a storage device to locate an item on a storage medium
  - The time required to deliver an item from memory to the processor



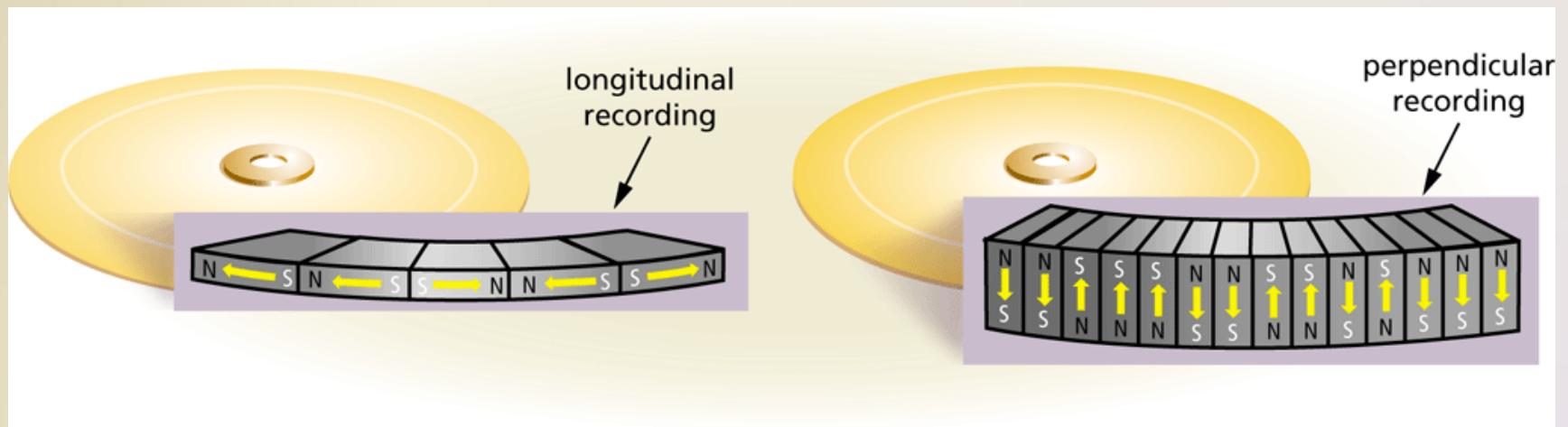
# Hard Disks

- A **hard disk** contains one or more inflexible, circular platters that use magnetic particles to store data, instructions, and information



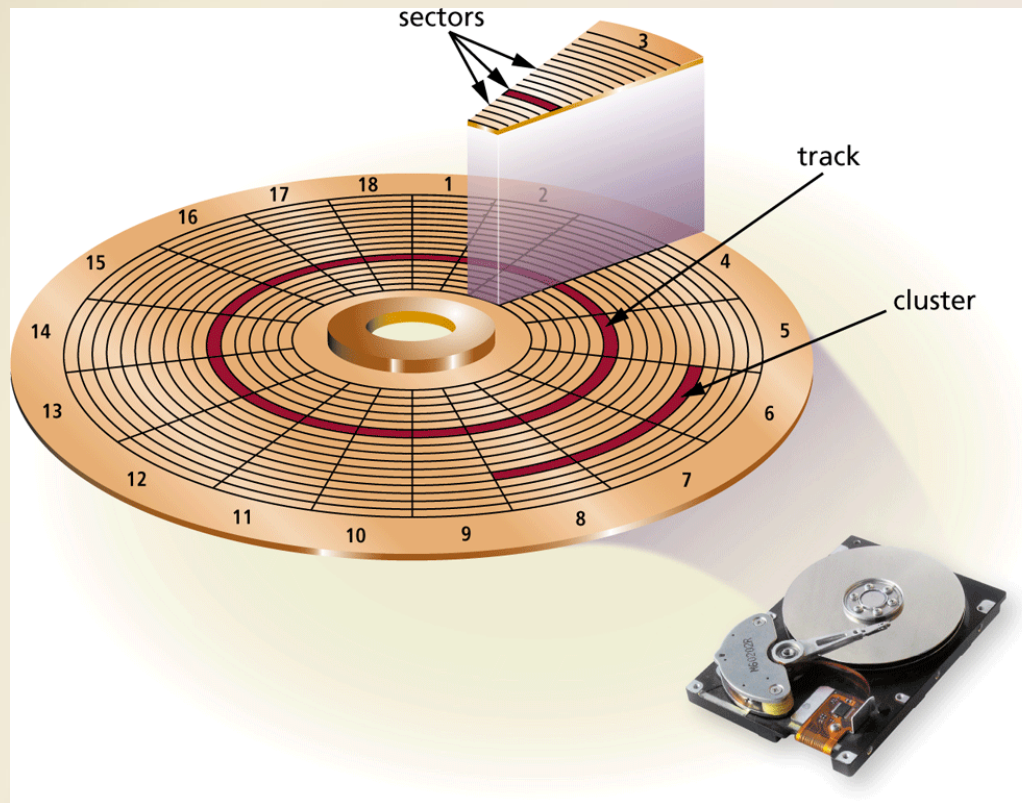
# Hard Disks

- Hard disks can store data using longitudinal recording or perpendicular recording



# Hard Disks

- **Formatting** is the process of dividing the disk into tracks and sectors



# Hard Disks

---

- Characteristics of a hard disk include:

Tracks

Sectors

Platters

Form factor

Read/write  
head

Revolutions  
per minute

# Hard Disks

## How a Hard Disk Works

### Step 1

The circuit board controls the movement of the head actuator and a small motor.

### Step 2

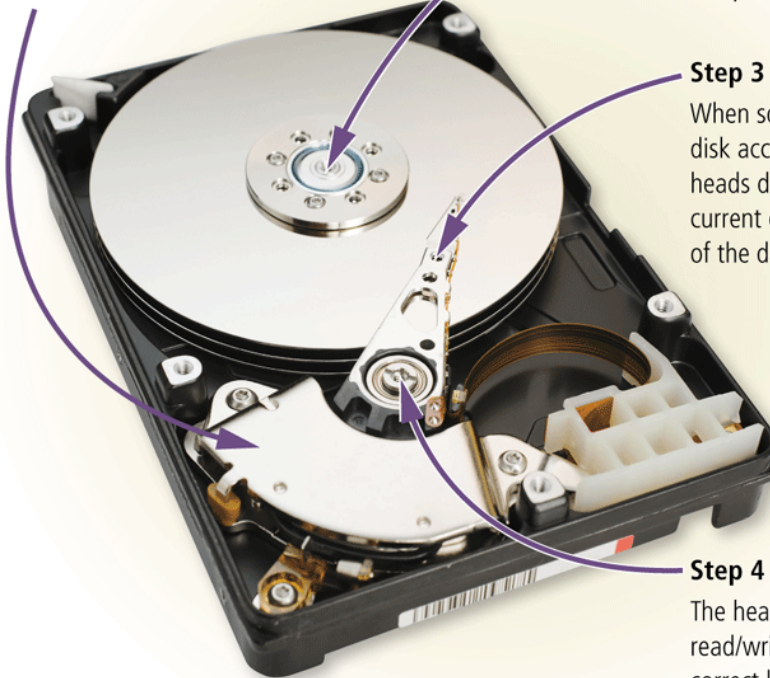
A small motor spins the platters while the computer is running.

### Step 3

When software requests disk access, the read/write heads determine the current or new location of the data.

### Step 4

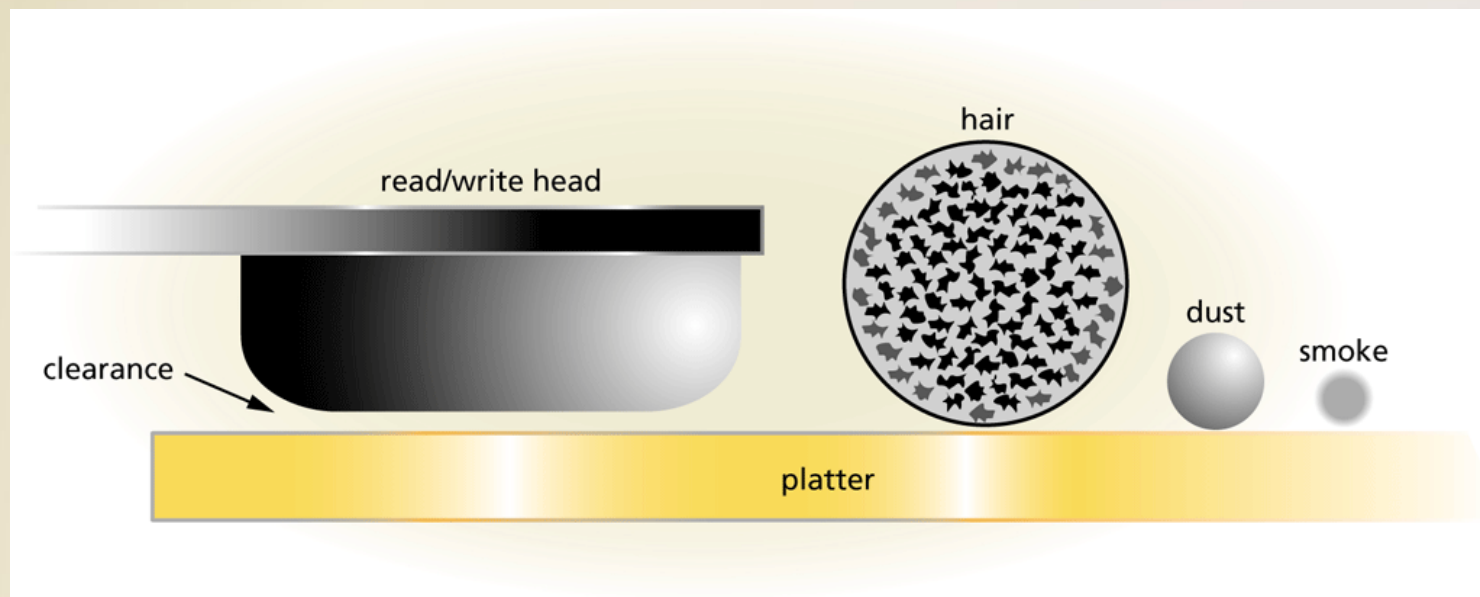
The head actuator positions the read/write head arms over the correct location on the platters to read or write data.





# Hard Disks

- A head crash occurs when a read/write head touches the surface of a platter
- Always keep a backup of your hard disk





# Hard Disks

---

- Disk cache, sometimes called a buffer, consists of a memory chip(s) on a hard disk that stores frequently accessed data, instructions, and information
- The larger the disk cache, the faster the hard disk

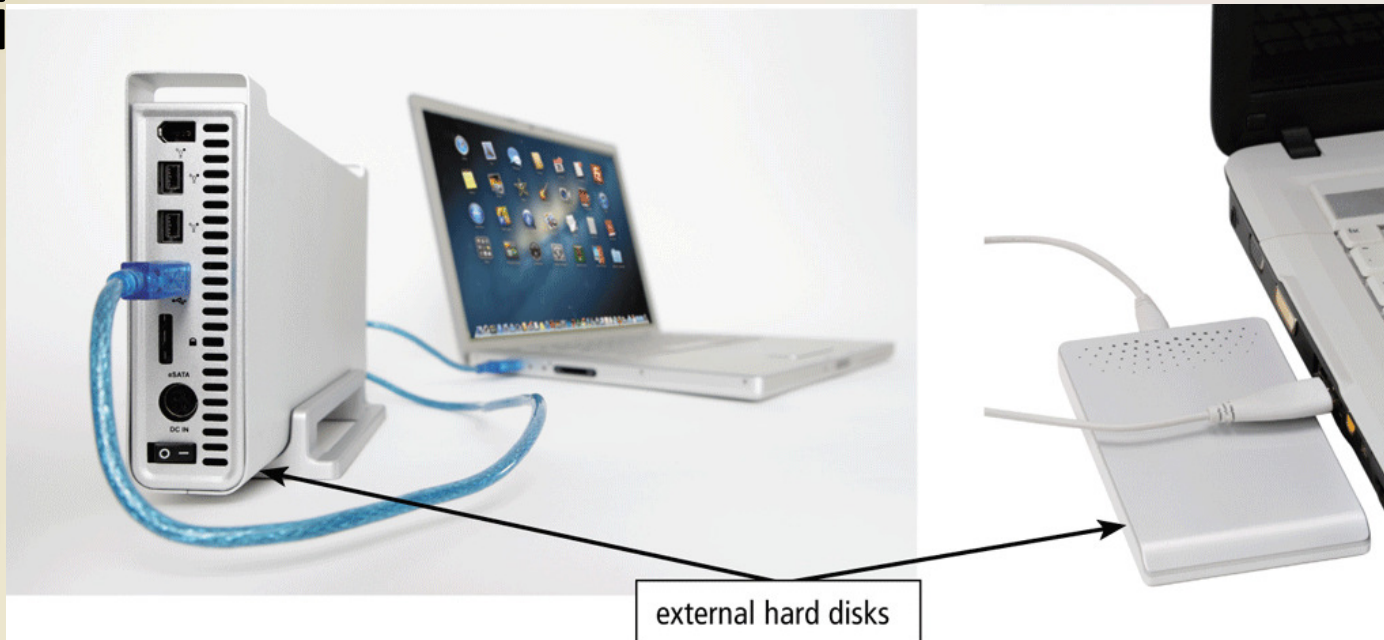
# Hard Disks

- **RAID** (redundant array of independent disks) is a group of two or more integrated hard disks



# Hard Disks

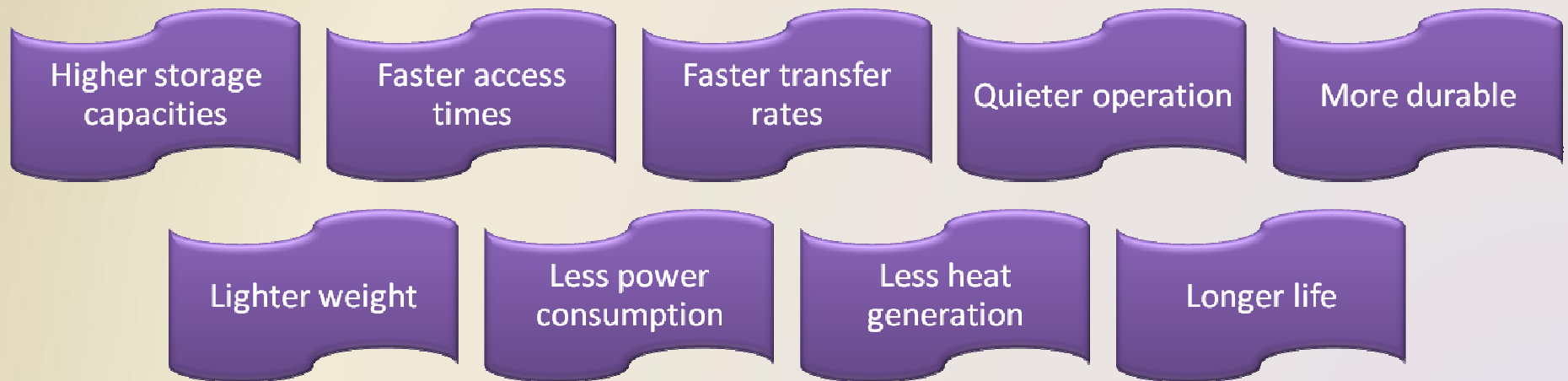
- An **external hard disk** is a separate freestanding storage device that connects with a cable to a USB port or other port on a computer or mobile device



# Flash Memory Storage

---

- Flash memory chips are a type of solid state media and contain no moving parts
- An **SSD (solid state drive)** has several advantages over magnetic hard disks:



# Flash Memory Storage



# Flash Memory Storage

- A **memory card** is a removable flash memory device that you insert and remove from a slot in a computer, mobile device, or card reader/writer

CF

SDHC

SDXC

miniSD

microSD

microSDHC

microSDXC

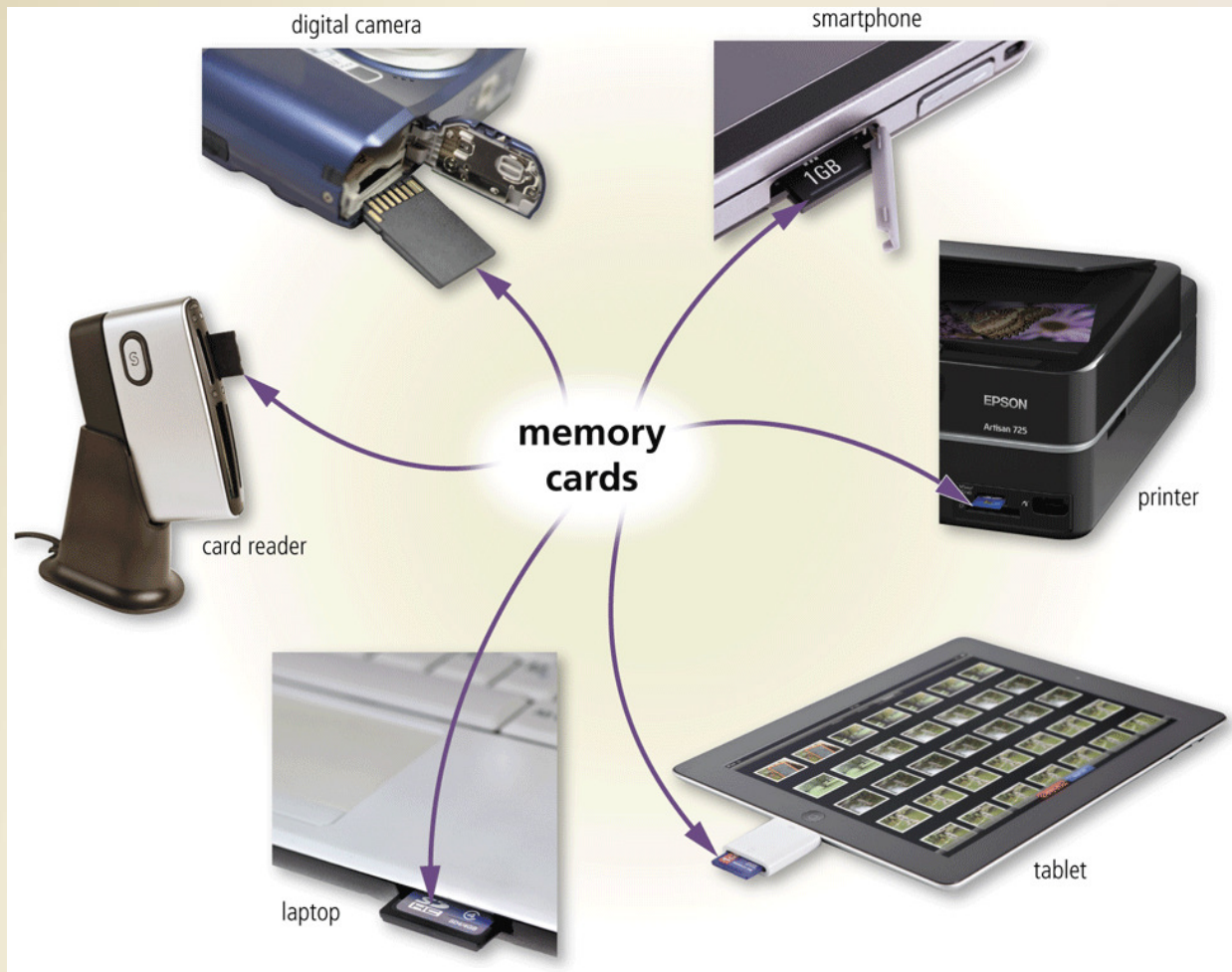
xD Picture  
Card

Memory Stick  
PRO Duo

M2



# Flash Memory Storage





# Flash Memory Storage

## How SD Cards Work

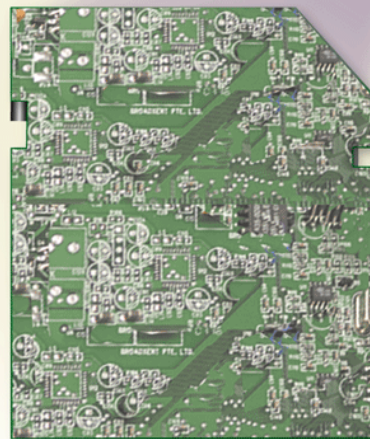
### Step 1

When you insert a memory card in a card reader/writer or card slot, the memory card's metallic conductors make contact with connectors in the card reader/writer or card slot, allowing the transfer of photos and other items between the card and the reading/writing device.



### Step 2

A notch on the side of the memory card prevents the card from accidentally slipping out of the card reader/writer or card slot.



### Step 3

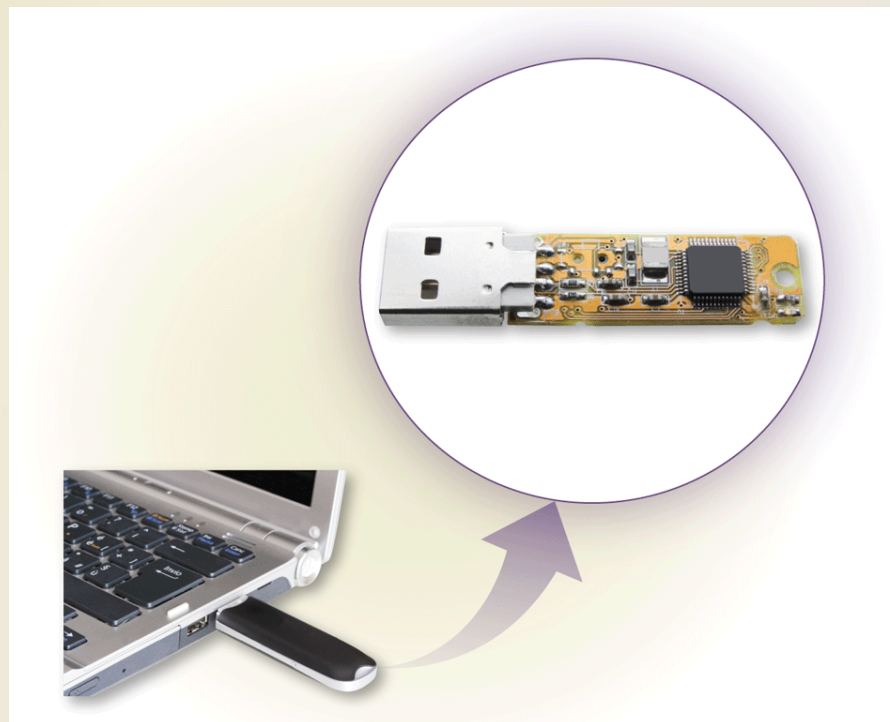
Flash memory chips store photos and other types of data and information. When requested, the controller transfers items stored on the flash memory chips to the metallic conductors, using registers for temporary storage, as needed.

### Step 4

Some memory cards contain write-protect switches, which prevent you from accidentally erasing photos and other items stored on the flash memory chips.

# Flash Memory Storage

- **USB flash drives** plug into a USB port on a computer or mobile device



# Cloud Storage

- **Cloud storage** is an Internet service that provides storage to computer or mobile device users



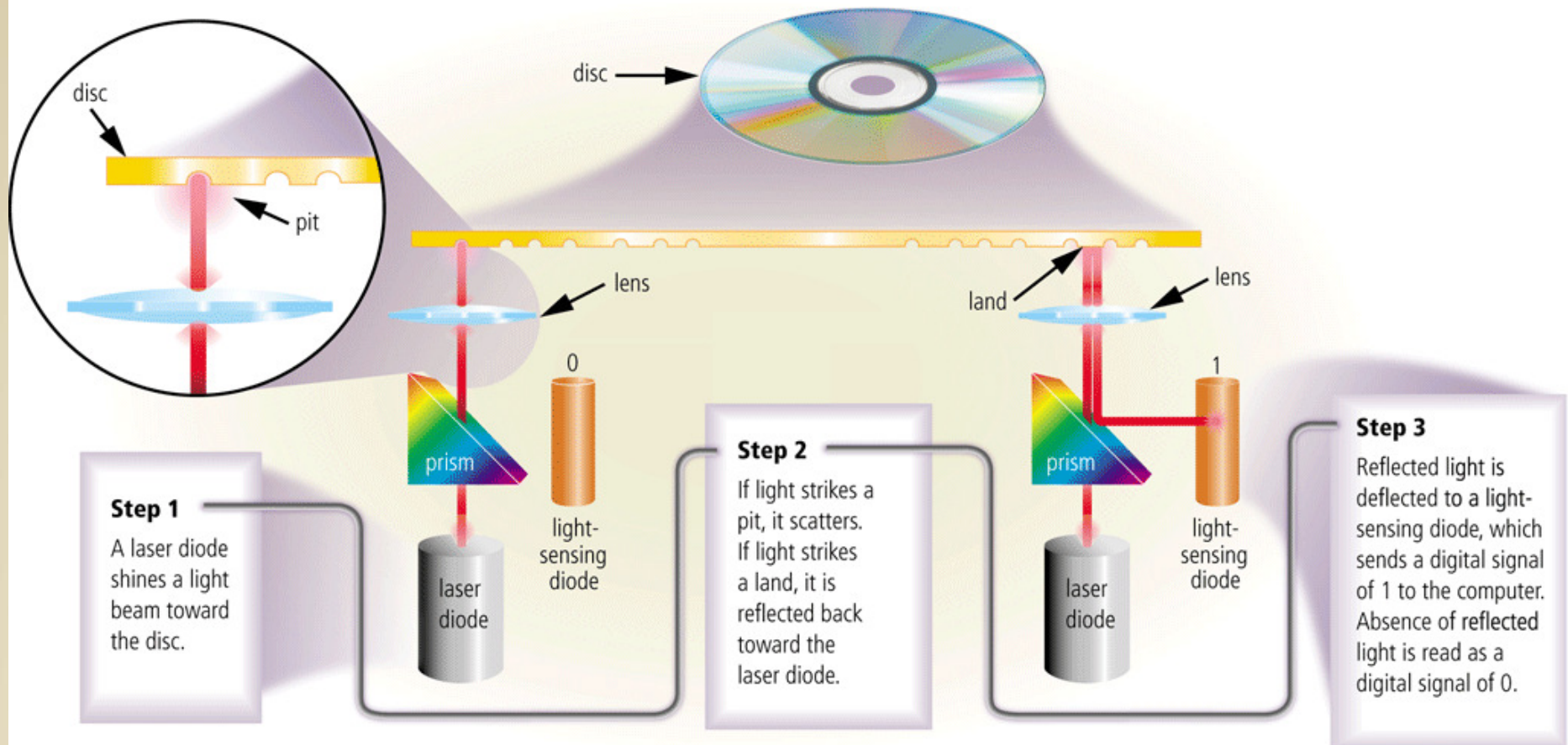
# Optical Discs

- An **optical disc** consists of a flat, round, portable disc made of metal, plastic, and lacquer that is written and read by a laser



# Optical Discs

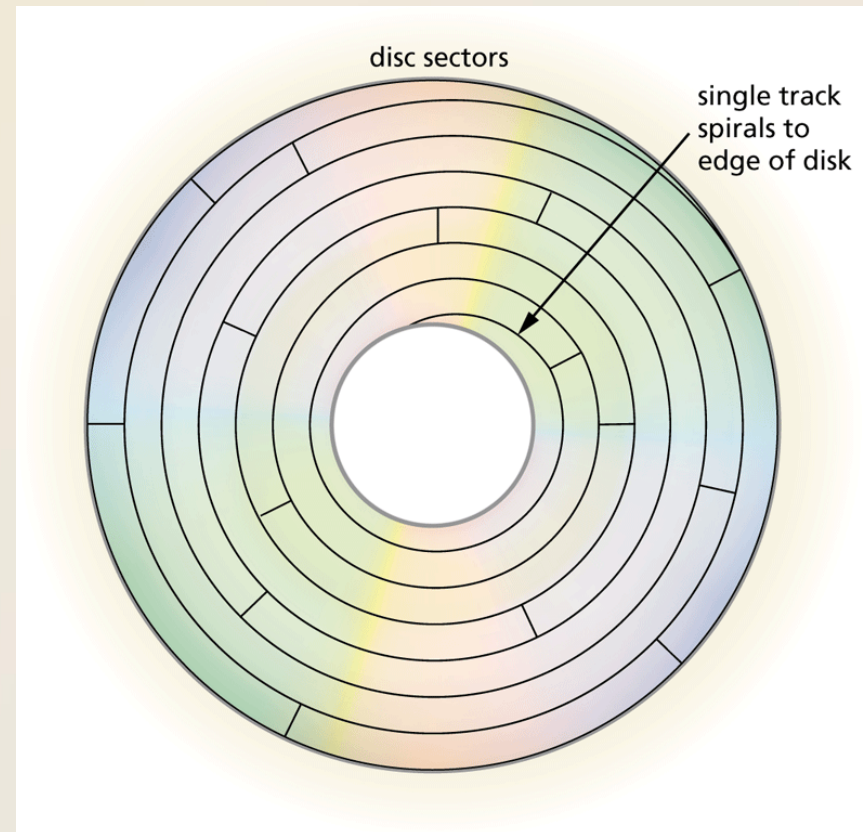
## How a Laser Reads Data on an Optical Disc





# Optical Discs

- Optical discs commonly store items in a single track that spirals from the center of the disc to the edge of the disc
- Track is divided into evenly sized sectors



# Optical Discs

A **CD-ROM** can be read from but not written to

- Single-session disc

A **CD-R** is an optical disc on which users can write once, but not erase

A **CD-RW** is an erasable multisession disc



# Optical Discs

---

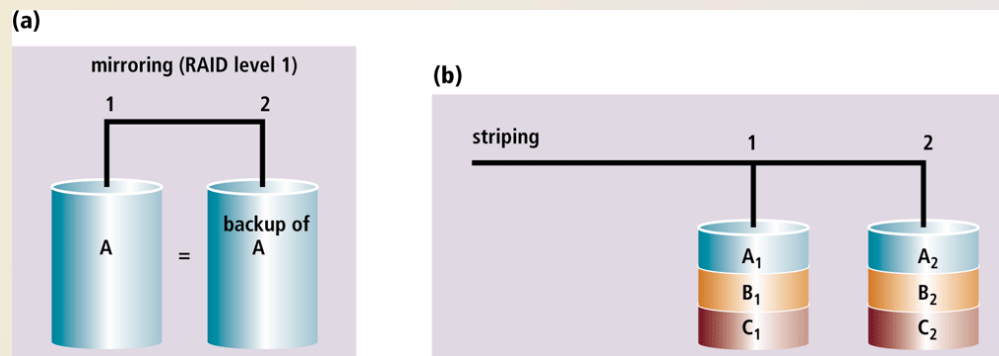
A **DVD-ROM** is a high-capacity optical disc on which users can read but not write on or erase

A **DVD-R** or **DVD+R** are competing DVD-recordable WORM formats, on which users can write once but not erase

**DVD-RW**, **DVD+RW**, and **DVD+RAM** are high-capacity rewritable DVD formats

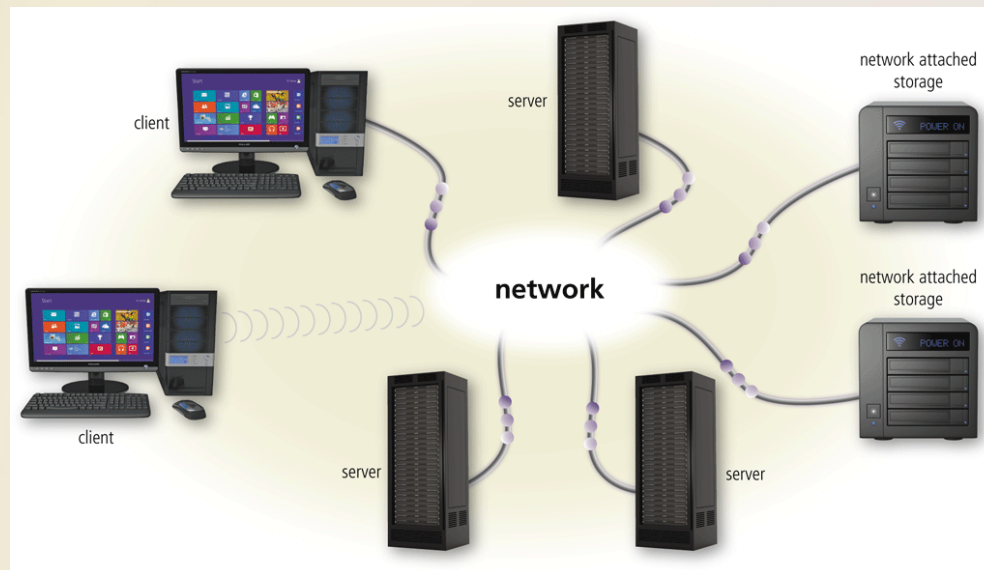
# Enterprise Storage

- Enterprise hardware allows large organizations to manage and store data and information using devices intended for heavy use, maximum efficiency, and maximum availability
  - RAID duplicates data, instructions, and information to improve data reliability



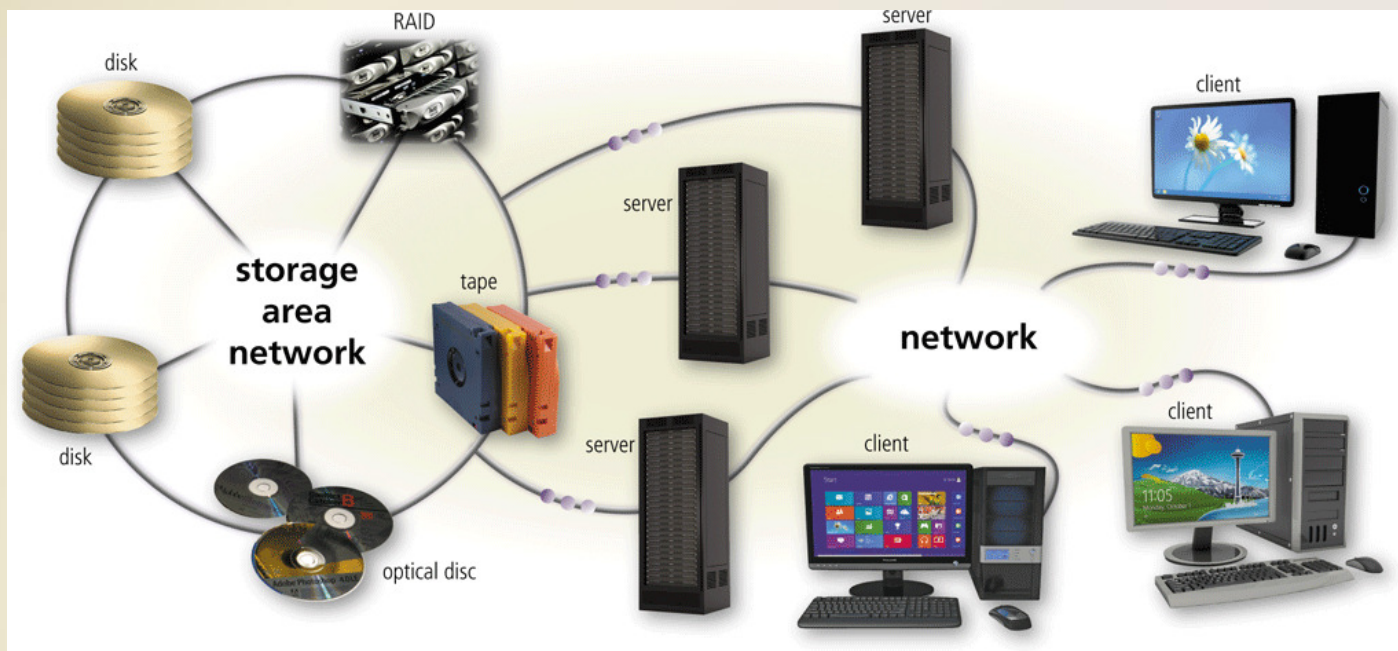
# Enterprise Storage

- **Network attached storage (NAS)** is a server that is placed on a network with the sole purpose of providing storage to users, computers, and devices attached to the network



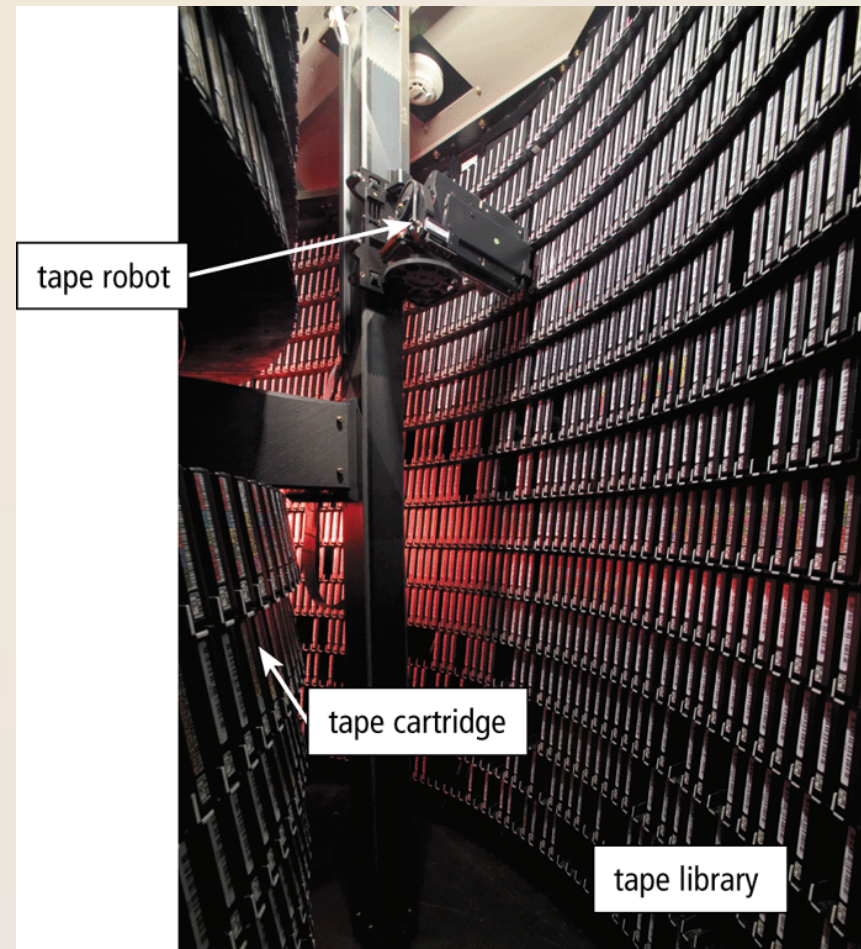
# Enterprise Storage

- A **storage area network (SAN)** is a high-speed network with the sole purpose of providing storage to other attached servers



# Enterprise Storage

- **Tape** is a magnetically coated ribbon of plastic capable of storing large amounts of data and information
- A tape drive reads and writes data and information on a tape





# Other Types of Storage

- A **magnetic stripe card** contains a magnetic stripe that stores information
- A **smart card** stores data on an integrated circuit embedded in the card



# Other Types of Storage

- The **RFID tag** consists of an antenna and a memory chip that contains the information to be transmitted via radio waves
- An RFID reader reads the radio signal and transfers the information to a computer or computing device





# Other Types of Storage

- **Microfilm** and **microfiche** store microscopic images of documents on a roll or sheet film



# Summary

---

Variety of storage options

Storage capacity and storage access times

Characteristics of hard disks, RAID, and external hard drives

Various types of flash memory storage

Advantages and various uses of cloud storage

Characteristics of optical discs

Enterprise storage options

# Discovering Computers

Technology in a World of Computers,  
Mobile Devices, and the Internet

## Chapter 8

### Digital Storage

Chapter 8 Complete

