

Chapter Seven

Storage

**Discovering
Computers 2011**

Living in a Digital World



Objectives Overview

Differentiate between storage devices and storage media

Describe the characteristics of an internal hard disk including capacity, platters, read/write heads, cylinders, sectors and tracks, revolutions per minute, transfer rate, and access time

Discuss the purpose of network attached storage devices, external and removable hard disks, and hard disk controllers

Describe the various types of flash memory storage

Objectives Overview

Describe cloud storage and explain its advantages

Describe the characteristics of optical discs

Differentiate among various types of optical discs: CDs, archive discs and Picture CDs, DVDs, and Blu-ray Discs

Identify the uses of tape, magnetic stripe cards, smart cards, microfilm and microfiche, and enterprise storage

Storage

Storage holds data, instructions, and information for future use

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

Storage



Storage

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

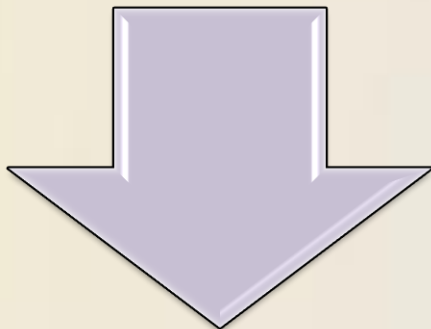
Storage Terms		
Storage Term	Approximate Number of Bytes	Exact Number of Bytes
Kilobyte (KB)	1 thousand	2^{10} or 1,024
Megabyte (MB)	1 million	2^{20} or 1,048,576
Gigabyte (GB)	1 billion	2^{30} or 1,073,741,824
Terabyte (TB)	1 trillion	2^{40} or 1,099,511,627,776
Petabyte (PB)	1 quadrillion	2^{50} or 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

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



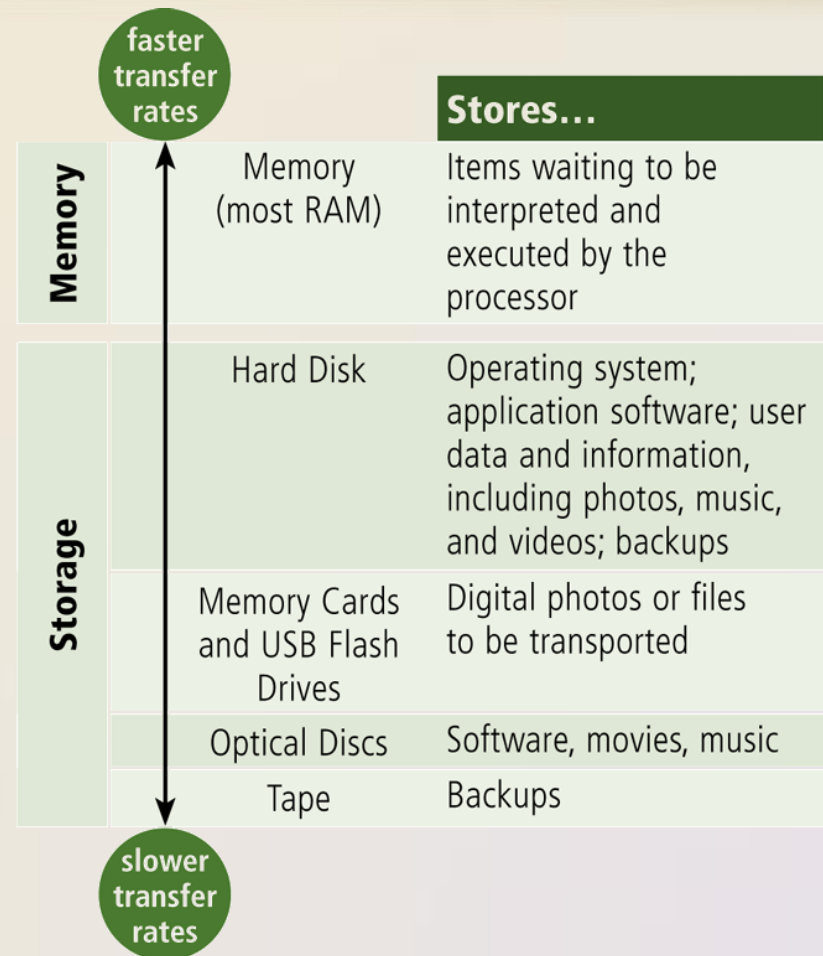
Reading is the process of transferring items from a storage medium into memory



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

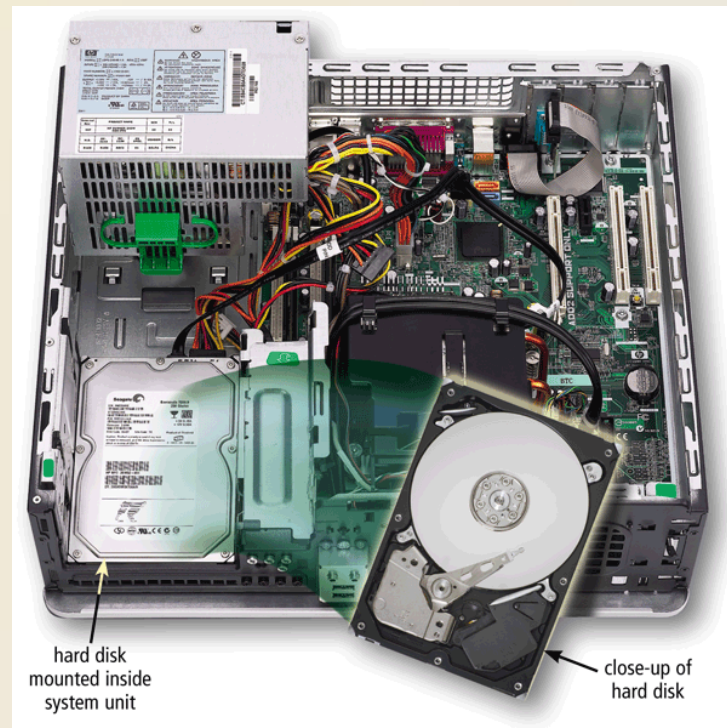
Storage

- **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



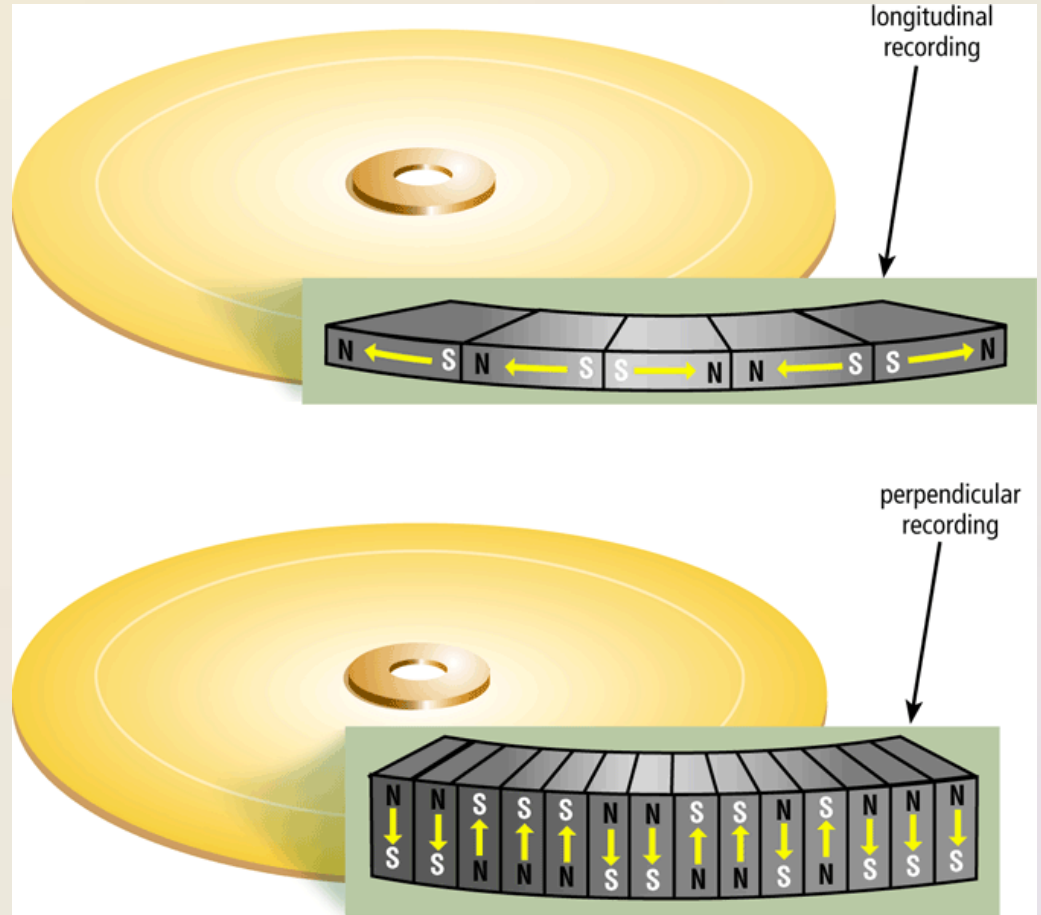
Hard Disks

- 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



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Hard Disks

- Characteristics of a hard disk include:

Capacity

Platters

Read/Write
Heads

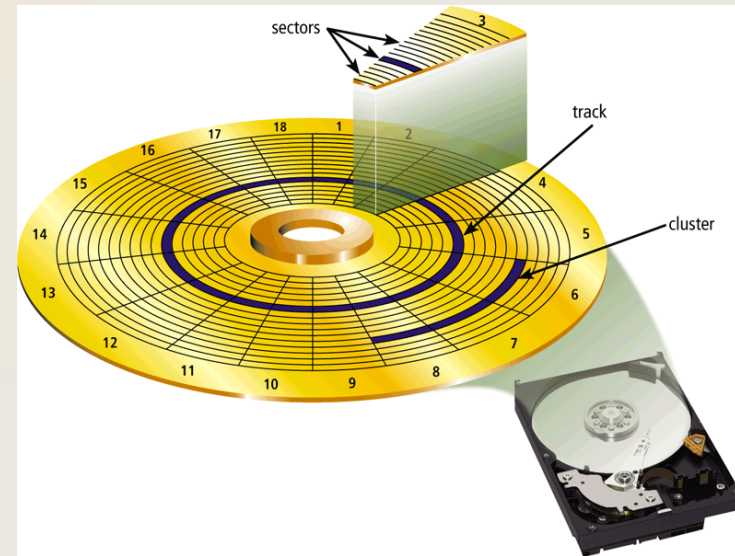
Cylinders

Sectors and
Tracks

Revolutions
per Minute

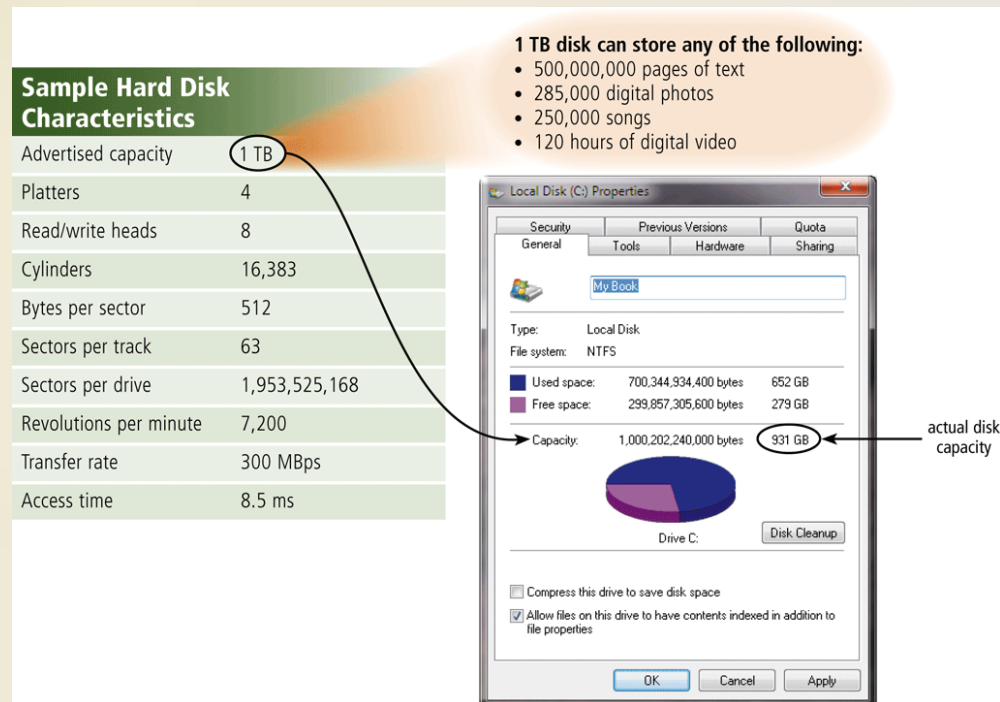
Transfer
Rate

Access Time

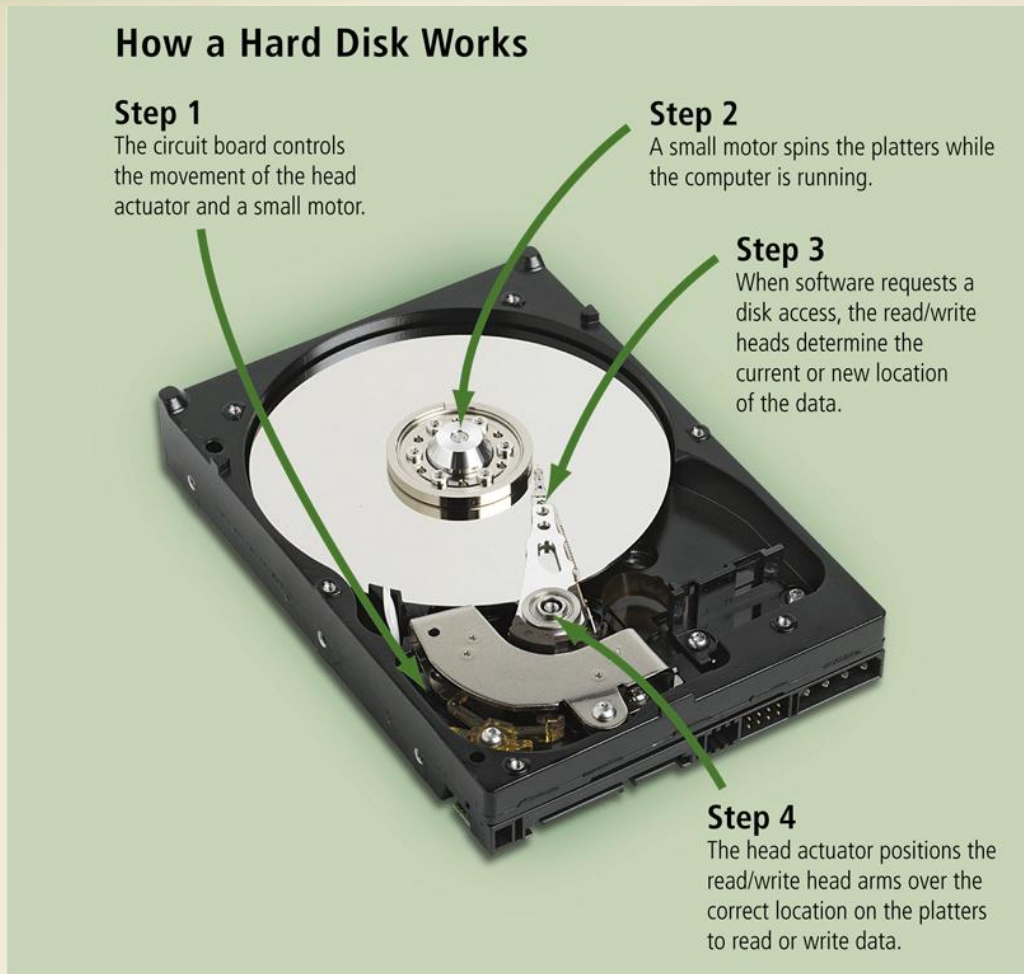


Hard Disks

- **Formatting** is the process of dividing the disk into tracks and sectors so that the operating system can store and locate data and information on the disk

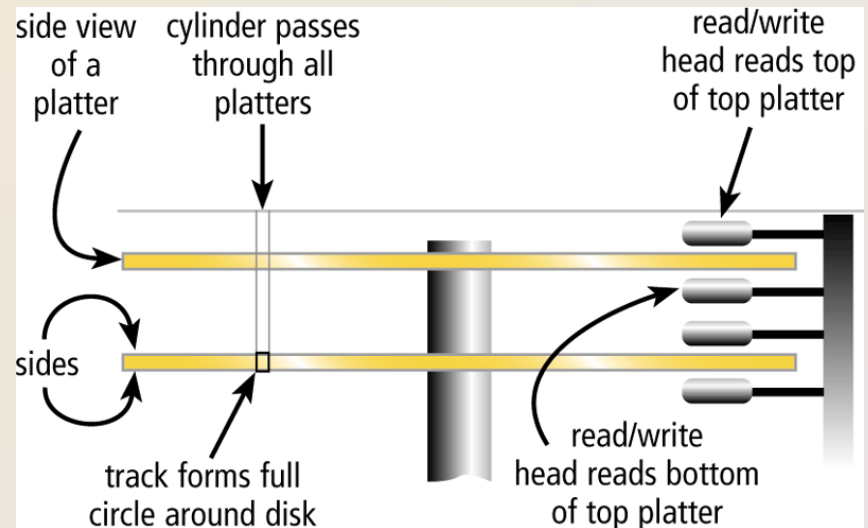


Hard Disks



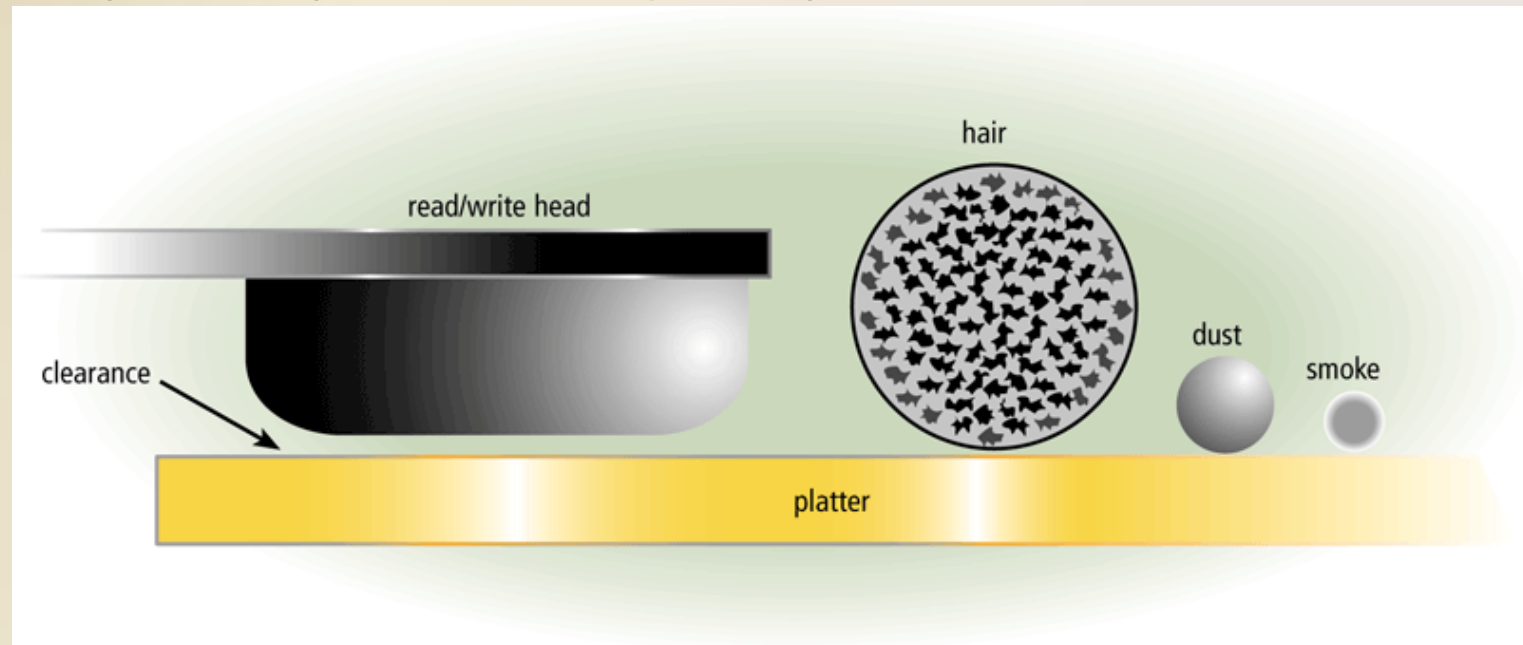
Hard Disks

- The hard disk arms move the read/write head, which reads items and writes items in the drive
 - Location often is referred to by its cylinder



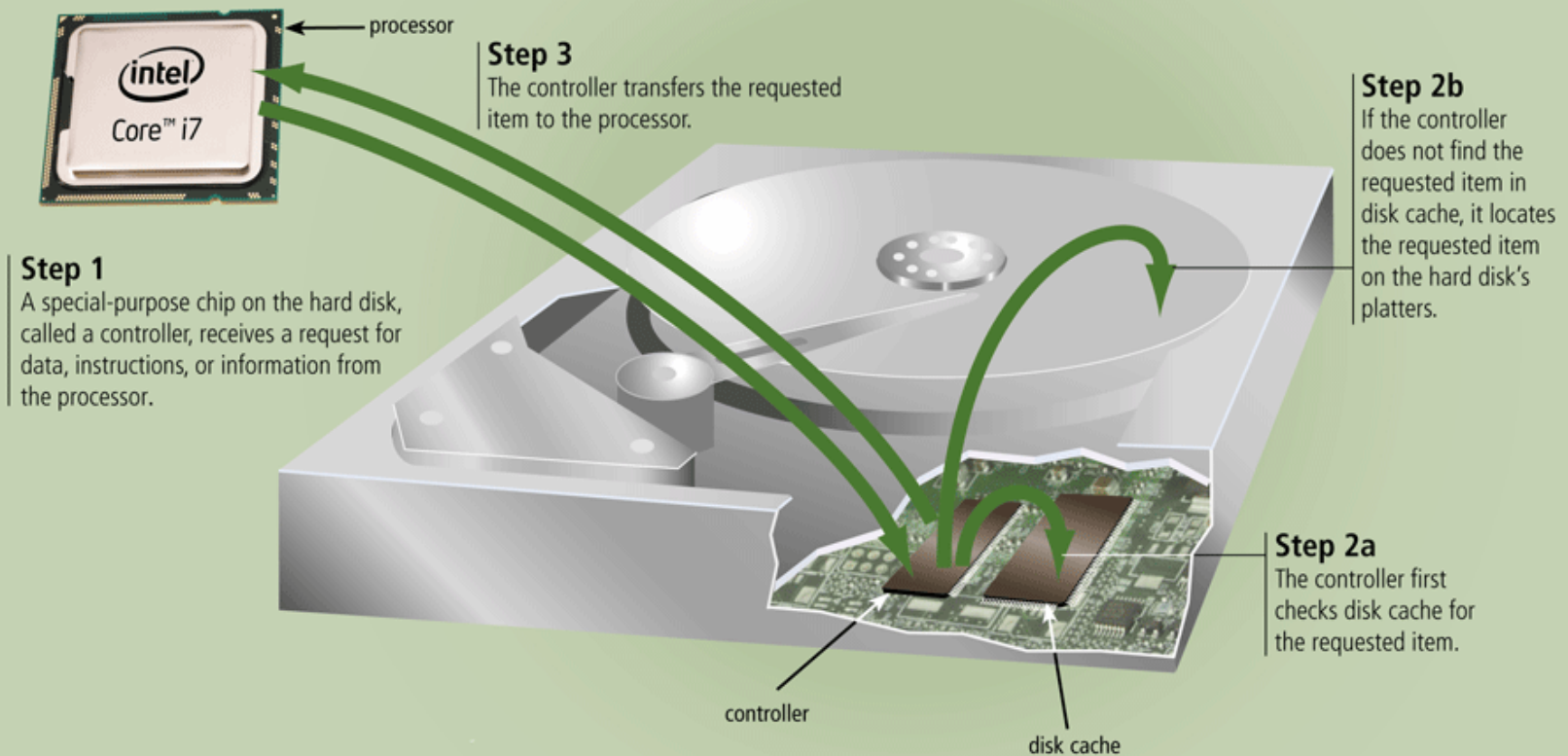
Hard Disks

- 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

How Disk Cache Works



Hard Disks

- **RAID** (redundant array of independent disks) is a group of two or more integrated hard disks
- A **network attached storage** (NAS) device is a server connected to a network with the sole purpose of providing storage



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then click Network Attached
Storage below Chapter 7

Hard Disks



An **external hard disk** is a separate free-standing hard disk that connects to your computer with a cable or wirelessly



A **removable hard disk** is a hard disk that you insert and remove from a drive



Internal and external hard disks are available in miniature sizes (miniature hard disks)

Hard Disks

- A disk controller consists of a special-purpose chip and electronic circuits that control the transfer of data, instructions, and information from a disk to and from the system bus and other components of the computer

SATA

EIDE

SCSI

SAS



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then click eSATA
below Chapter 7

Flash Memory Storage

- Flash memory chips are a type of solid state media (contains electronic components) and contain no moving parts
- **Solid state drives (SSDs)** have several advantages over magnetic hard disks:

Faster access time

Faster transfer rates

Generate less heat and
consume less power

Last longer

Flash Memory Storage



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then click Solid State Drives
below Chapter 7

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

CompactFlash
(CF)

Secure Digital
(SD)

Secure Digital
High Capacity
(SDHC)

microSD

microSDHC

xD Picture
Card

Memory Stick

Memory Stick
Micro (M2)

Flash Memory Storage



Various Memory Cards			
Media Type		Storage Capacity	Use
CompactFlash (CF)		512 MB to 100 GB	Digital cameras, smart phones, PDAs, photo printers, portable media players, notebook computers, desktop computers
Secure Digital (SD)		512 MB to 8 GB	Digital cameras, digital video cameras, smart phones, PDAs, photo printers, portable media players
SDHC		4 to 32 GB	Digital cameras
microSD		1 to 2 GB	Smart phones, portable media players, handheld game consoles, handheld navigation devices
microSDHC		4 to 16 GB	Smart phones, portable media players, handheld game consoles, handheld navigation devices
xD Picture Card		256 MB to 2 GB	Digital cameras, photo printers
Memory Stick PRO Duo		1 to 16 GB	Digital cameras, smart phones, handheld game consoles
Memory Stick Micro (M2)		1 to 16 GB	Smart phones



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Flash Memory Storage

How One Type of Memory Card Works

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.



metallic conductors

card reader/writer

memory card

write-protect switch

notch

Step 4

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

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.

controller chip

registers

flash memory chips

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.

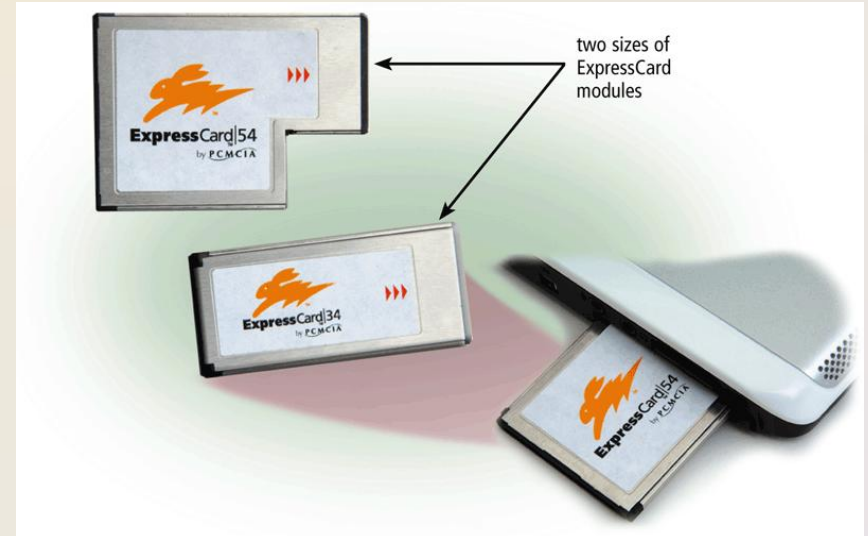
Flash Memory Storage

- **USB flash drives** plug into a USB port on a computer or mobile device (512 MB-100 GB)



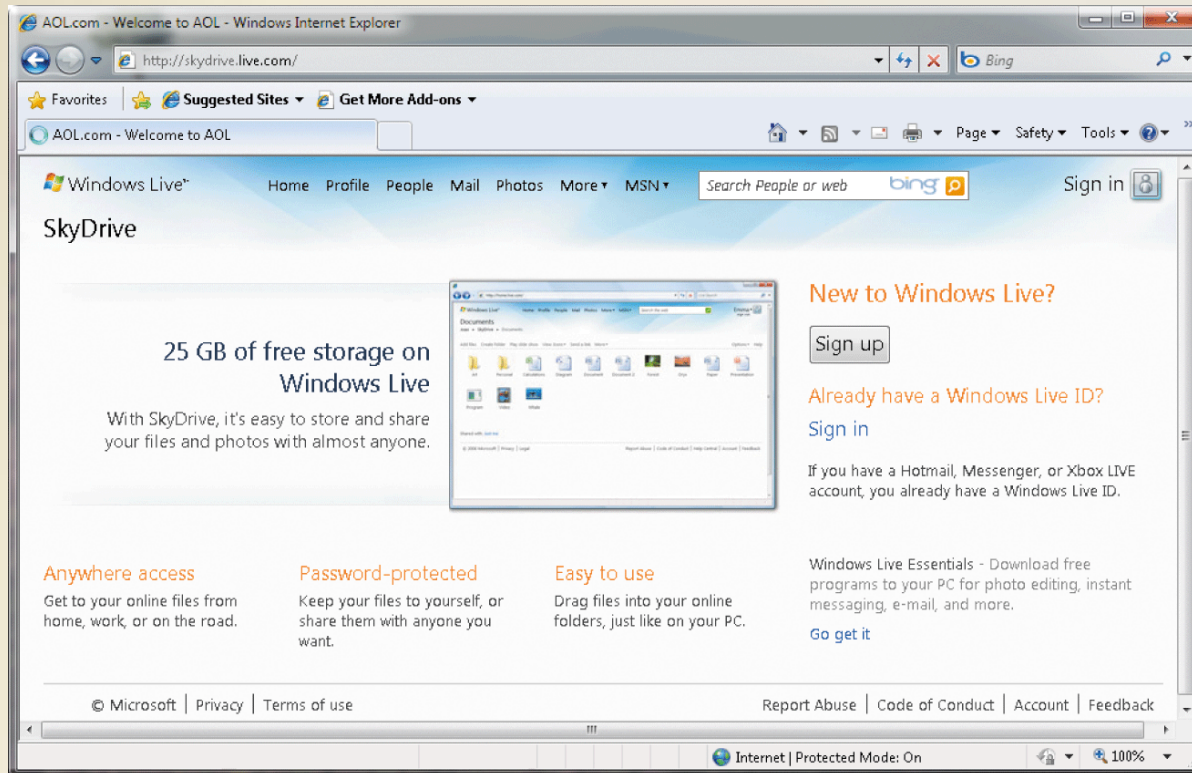
Flash Memory Storage

- An **ExpressCard module** is a removable device that fits in an ExpressCard slot
- Developed by the PCMCIA
- Commonly used in notebook computers



Cloud Storage

- **Cloud storage** is an Internet service that provides storage to computer users (may or may not be free)



Cloud Storage

Cloud Storage Providers

Web Site Names	Type of Storage Provided	Other Services
Box.net, IDrive, Windows Live SkyDrive	Backup or additional storage for any type of file	
Flickr, Picasa	Digital photos	Photo editing and photo management
YouTube	Digital videos	
Facebook, MySpace	Digital photos, digital videos, messages, and personal information	Social networking
Google Docs	Documents, spreadsheets, presentations	Productivity suite
Gmail, Windows Live Hotmail, Yahoo! Mail	E-mail messages	
Amazon EC2, Amazon S3, Nirvanix	Enterprise-level storage	Web services, data center services

Cloud Storage

- Users subscribe to cloud storage for a variety of reasons:

Access files from any computer

Store large files instantaneously

Allow others to access their files

View time-critical data and images immediately

Store offsite backups

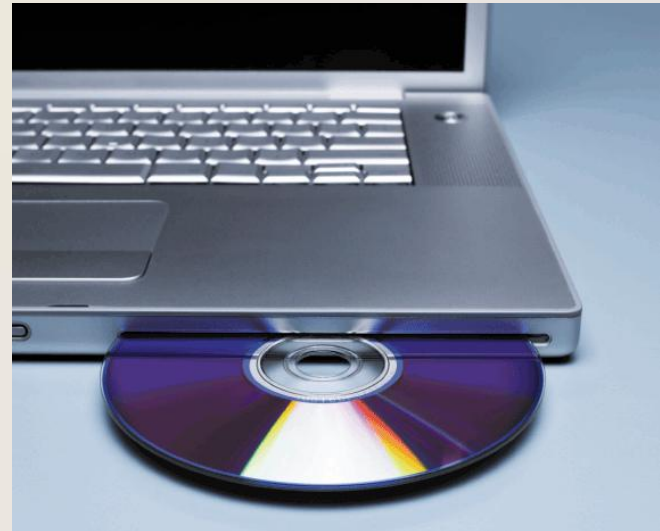
Provide data center functions



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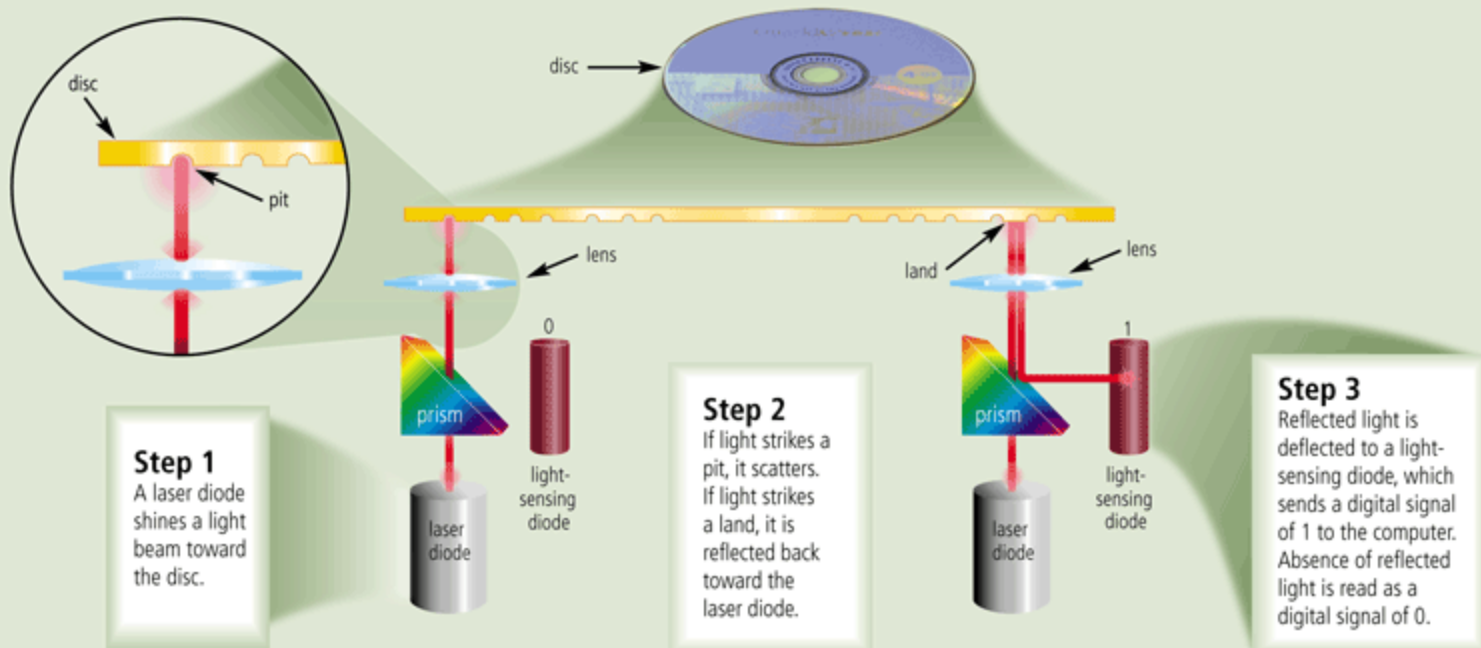
Optical Discs

- An optical disc consists of a flat, round, portable disc made of metal, plastic, and lacquer that is written and read by a laser
- Typically store software, data, digital photos, movies, and music
- Read only vs. rewritable



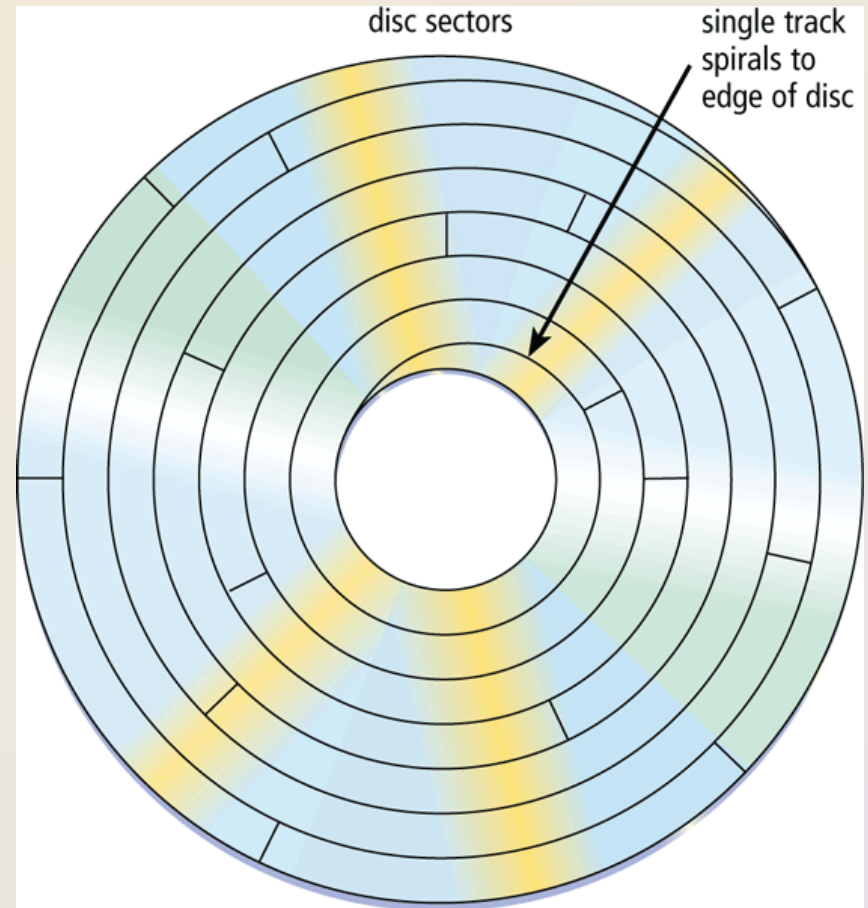
Optical Discs

How a Laser Reads Data on an Optical Disc



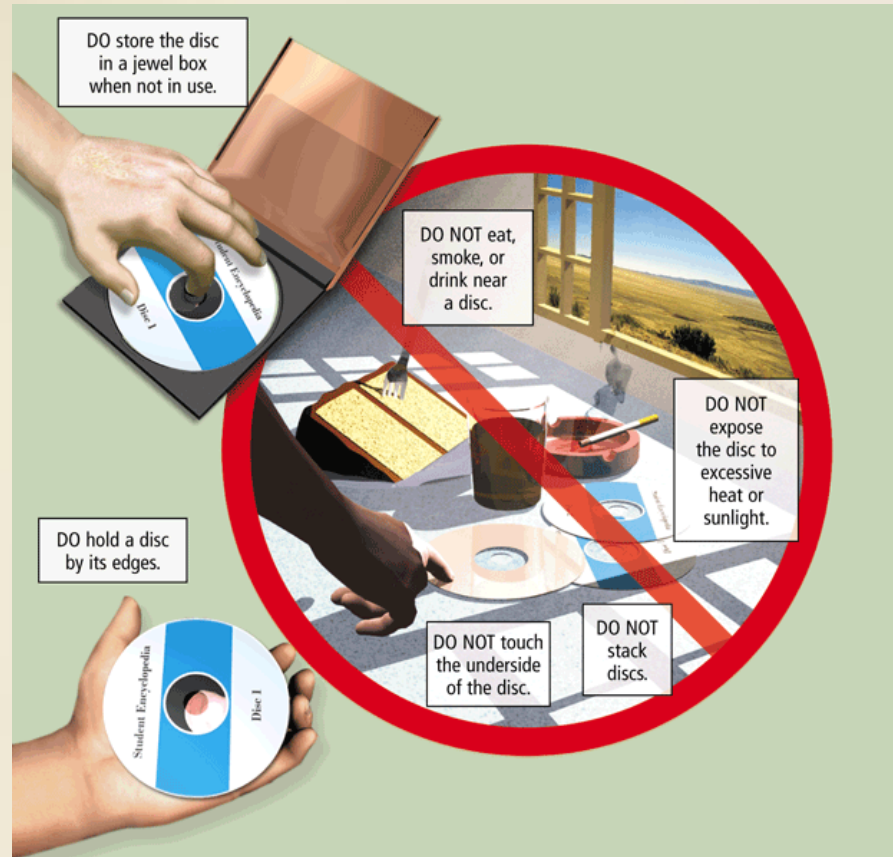
Optical Discs

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

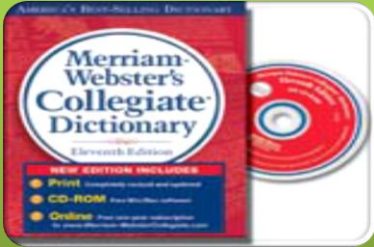


Optical Discs

- Care of optical discs



Optical Discs



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

- Read from a **CD-ROM** drive or CD-ROM player



A CD-R is a multisession optical disc on which users can write, but not erase



A CD-RW is an erasable multisession disc

- Must have a **CD-RW** drive

Optical Discs

Archive disc

- Stores photos from an online photo center
- Resolution usually is 7200 pixels per photo
- Cost is determined by the number of photos being stored

Picture CD

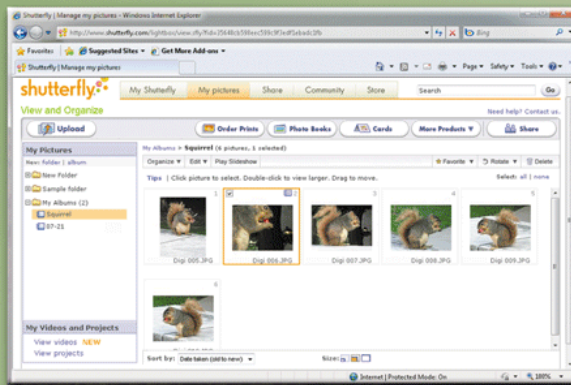
- Single-session CD-ROM that stores digital versions of film
- Typically uses a 1024 x 1536 resolution
- Many photo centers offer Picture CD services

Optical Discs

How an Archive Disc Works

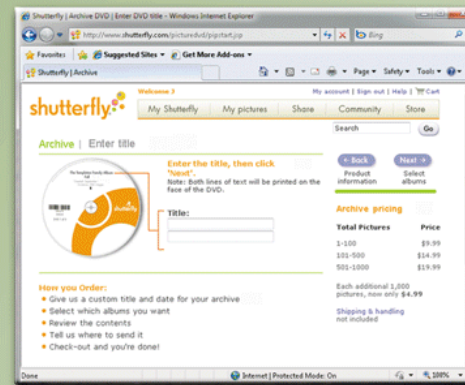
Step 1

Upload your digital photos to a photo sharing community for others to view.



Step 2

Select the photos to be stored on the archive disc and then place your order.



Step 3

Pick up your archive disc at a designated store or receive it in the mail. At home, edit and/or print images from the archive disc on your ink-jet or photo printer, or view the images on a monitor or television screen. At a store, edit and/or print images from the archive disc at a kiosk.



Optical Discs



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

- Requires a **DVD-ROM** drive



A Blu-ray Disc-ROM (BD-ROM) has a storage capacity of 100 GB



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



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below Chapter 7

Other Types of Storage

Tape

Magnetic stripe
cards and smart
cards

Microfilm and
microfiche

Enterprise storage

Other Types of 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 (sequential access)

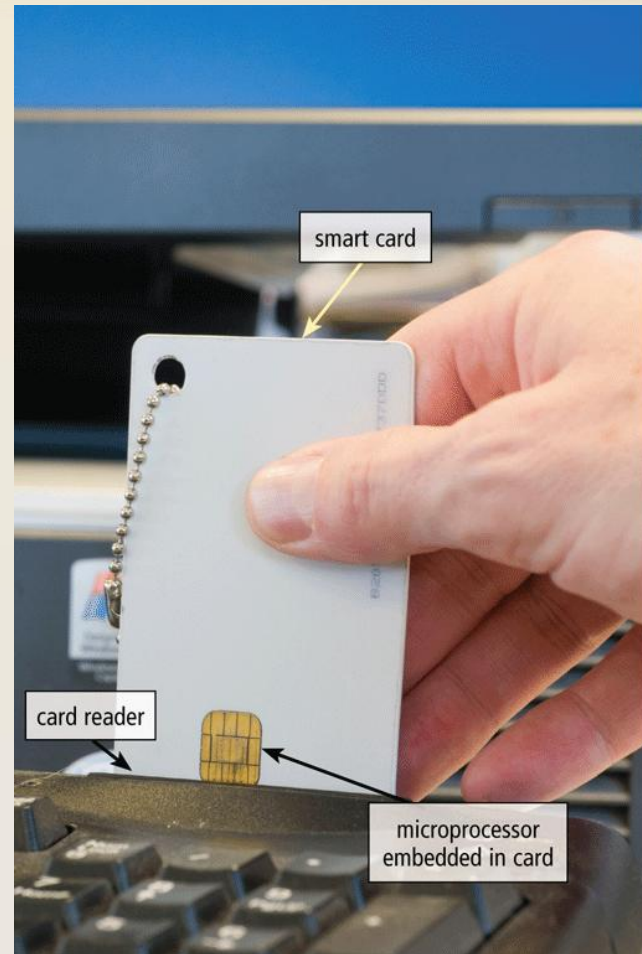


Other Types of Storage

- A **magnetic stripe card** contains a magnetic stripe that stores information
- A **smart card** stores data on a thin microprocessor embedded in the card

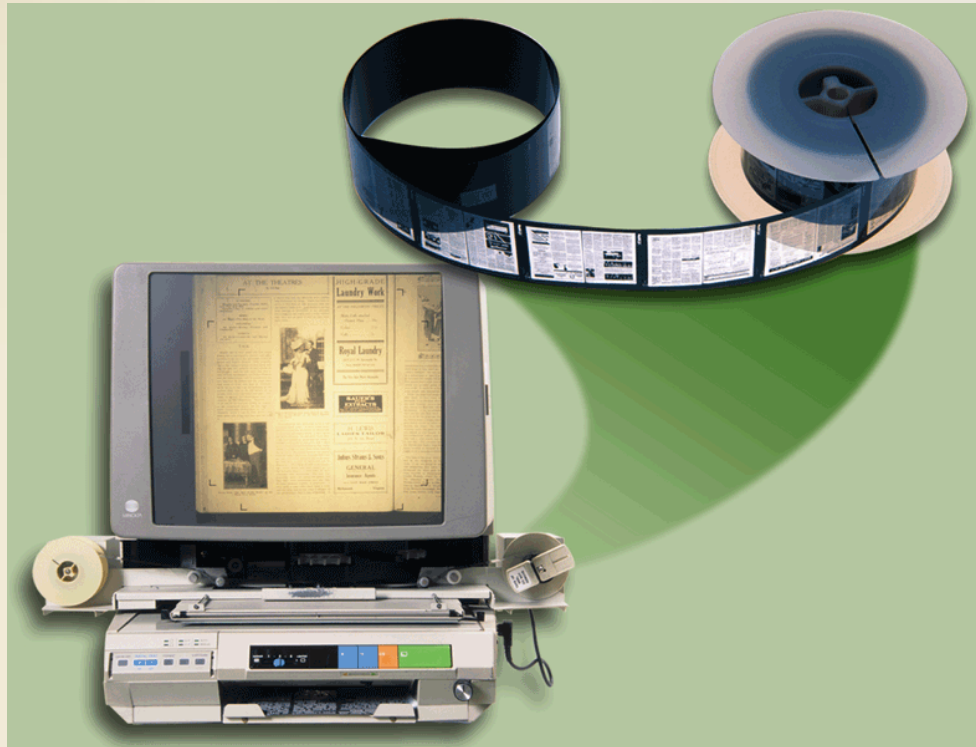


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below Chapter 7



Other Types of Storage

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



Other Types of Storage

Media Life Expectancies* (when using high-quality media)		
Media Type	Guaranteed Life Expectancy	Potential Life Expectancy
Magnetic disks	3 to 5 years	20 to 30 years
Optical discs	5 to 10 years	50 to 100 years
Solid state drives	50 years	140 years
Microfilm	100 years	500 years

* according to manufacturers of the media

Other Types of Storage

- Enterprise storage stores huge volumes of data and information for large businesses
 - Uses special hardware for heavy use, maximum availability, and maximum efficiency



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below Chapter 7

Putting It All Together



Home user

- 500 GB hard disk
- Cloud storage
- Optical disc drive
- Card reader/writer
- USB flash drive

Small Office/Home Office user

- 1 TB hard disk
- Cloud storage
- Optical disc drive
- External hard disk for backup
- USB flash drive

Mobile

- 250 GB hard disk
- Cloud storage
- Optical disc drive
- Card reader/writer
- Portable hard disk for backup
- USB flash drive

Putting It All Together



Power User

- 2.5 TB hard disk
- Cloud storage
- Optical disc drive
- Portable hard disk for backup
- USB flash drive



Enterprise User (desktop computer)

- 1 TB hard disk
- Optical disc drive
- Smart card reader
- Tape drive
- USB flash drive



Enterprise User (server or mainframe)

- Network storage server
- 40 TB hard disk system
- Optical disc server
- Microfilm or microfiche

Summary

Various storage media and storage devices

Internal hard disks, external and removable hard disks, solid state drives, memory cards, USB flash drives, ExpressCard modules, cloud storage, CDs, DVDs, and Blu-ray Discs, tape, smart cards, and microfilm and microfiche

Chapter Seven

Storage

Discovering Computers 2011

Living in a Digital World

Chapter 7 Complete

