The Eighth Meeting

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


internal hard disk
external hard disks
network attached storage device
Storage
solid state drive
memory cards
miniature hard disk
USB flash drive
magnetic stripe card
microfilm
smart card
optical disc
cloud storage
ExpressCard module

Storage

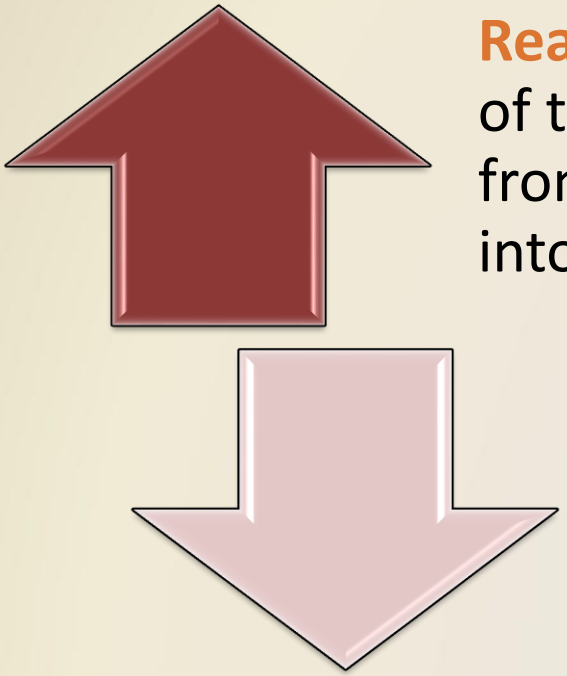
- **Capacity** is the number of bytes a storage medium can hold

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

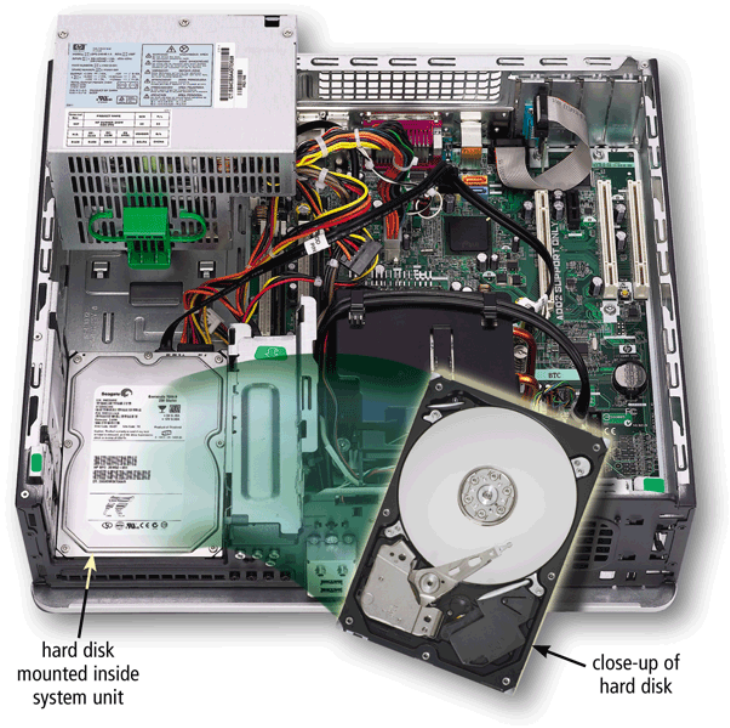


Reading is the process of transferring items from a storage medium into memory

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

Hard Disks

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



Hard Disks

- Characteristics of a hard disk include:

Capacity

Platters

Read/Write Heads

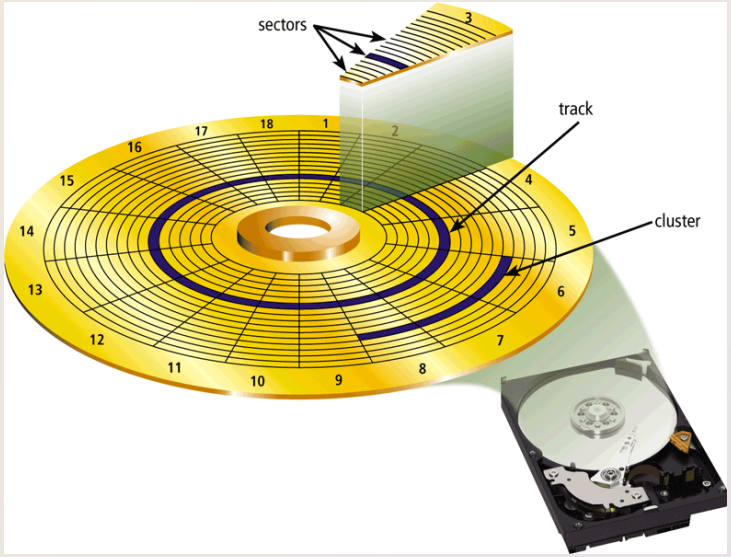
Cylinders

Sectors and Tracks

Revolutions per Minute

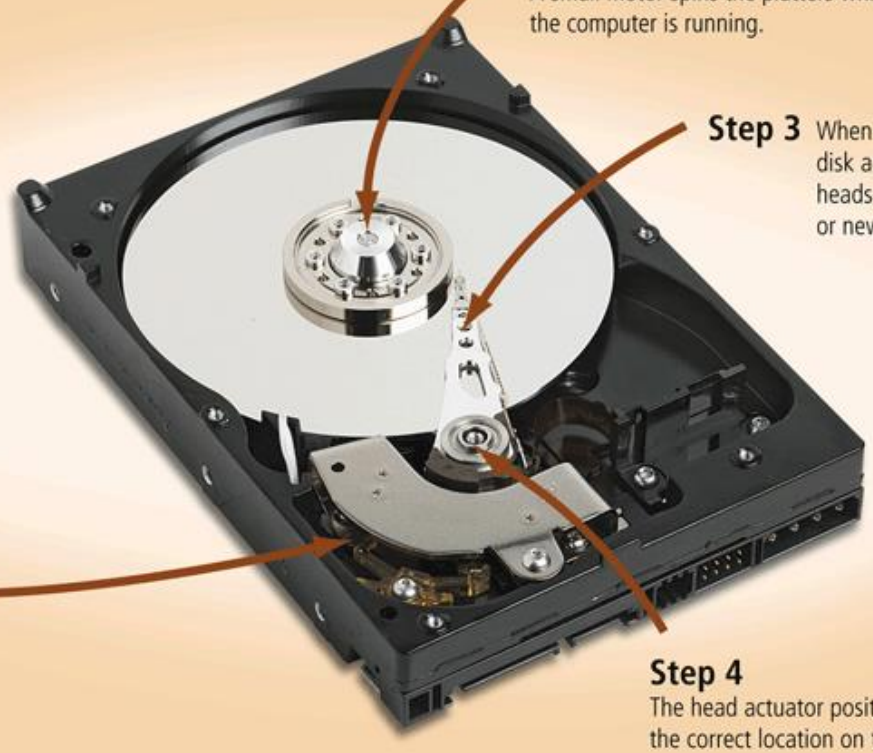
Transfer Rate

Access Time



Hard Disks

How a Hard Disk Works



Step 1
The circuit board controls the movement of the head actuator and a small motor.

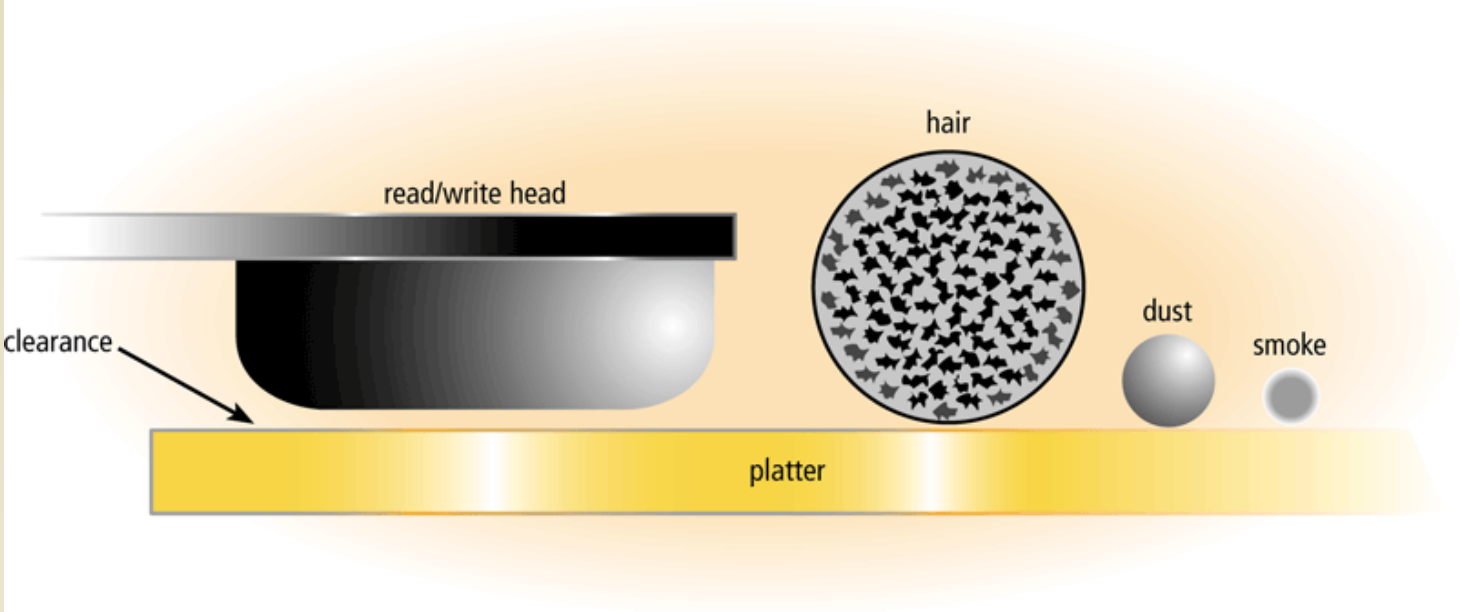
Step 2
A small motor spins the platters while the computer is running.

Step 3 When software requests a 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

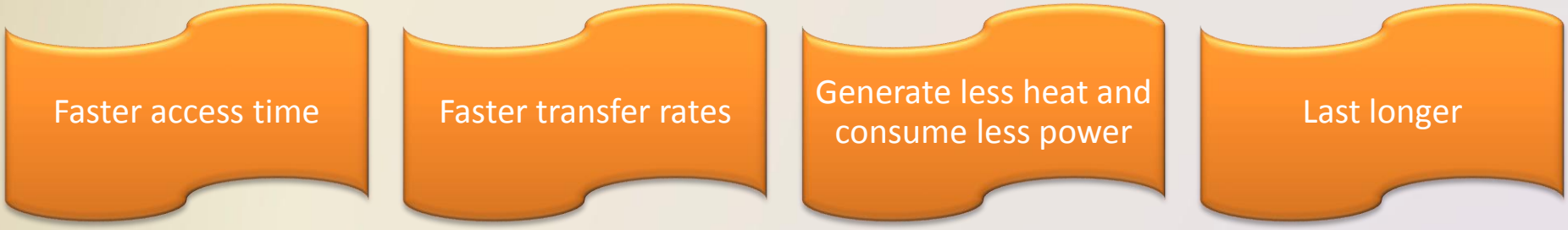
An **external hard disk** is a separate free-standing hard disk that connects to your computer with a cable or wirelessly

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 (**pocket hard drive**)

Flash Memory Storage

- Flash memory chips are a type of **solid state media** and contain no moving parts
- **Solid state drives** (**SSDs**) have 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

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

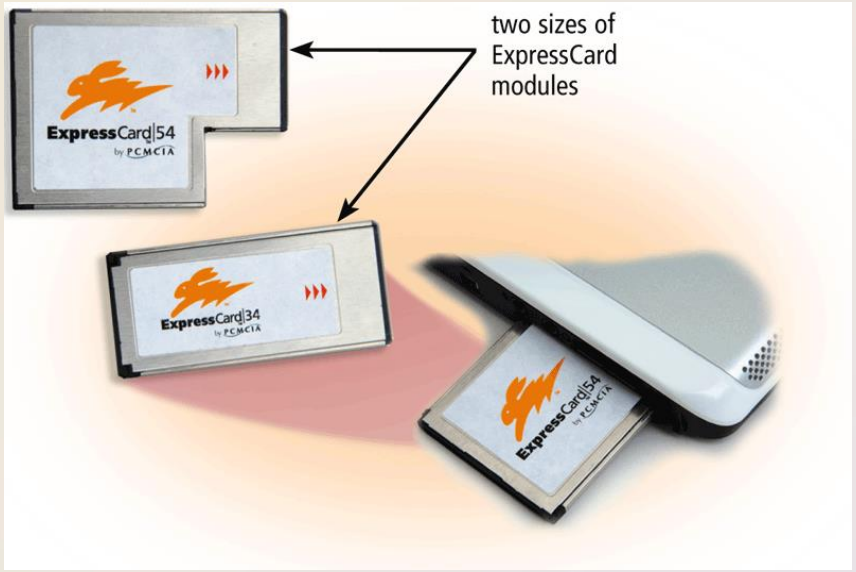
Media Type		Storage Capacity	Use
CompactFlash (CF)		512 MB to 100 GB	Digital cameras, smart phones, PDAs, photo printers, portable media players, notebook computers, desktop computers
Secure Digital (SD)		512 MB to 8 GB	Digital cameras, digital video cameras, smart phones, PDAs, photo printers, portable 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

Flash Memory Storage

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

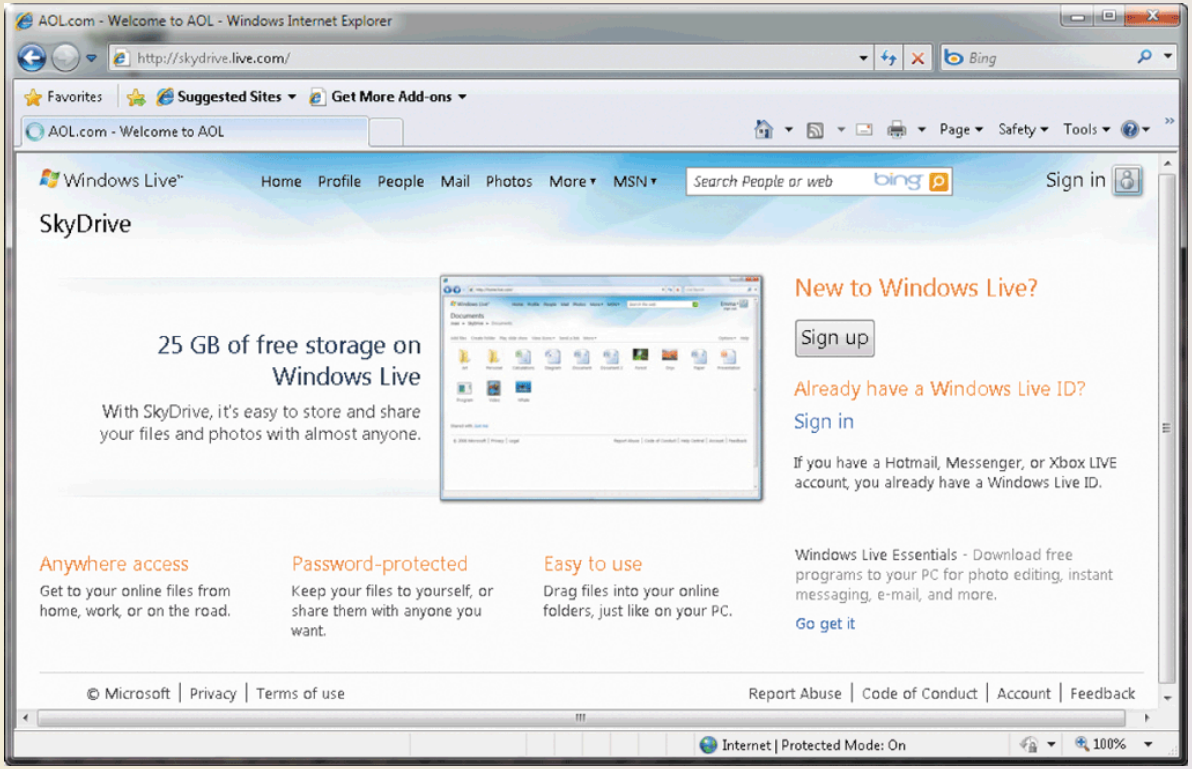
Flash Memory Storage

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



Cloud Storage

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



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

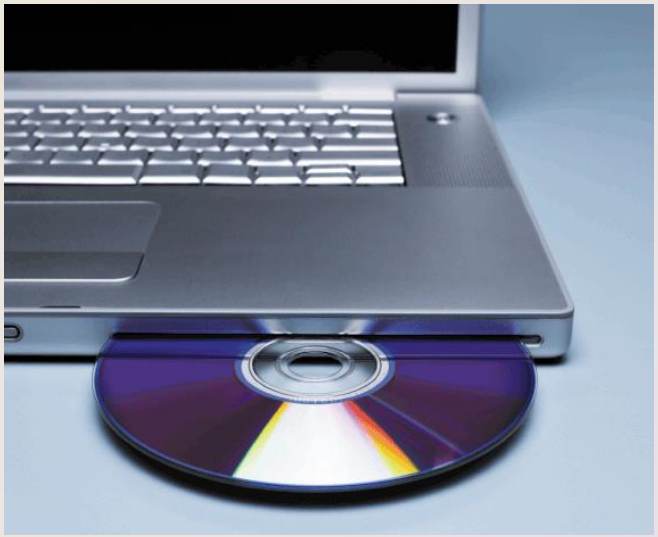
Cloud Storage

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

  - Access files from any computer
  - Allow others to access their files
  - View time-critical data and images immediately
  - Store offsite backups
  - Provide data center functions

Optical Discs

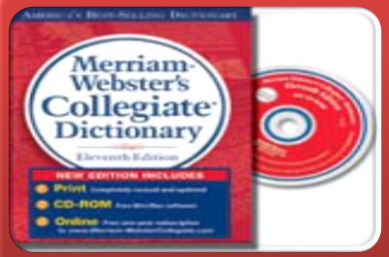
- An **optical disc** consists of a flat, round, portable disc made of metal, plastic, and lacquer that is written and read by a laser
- Typically store software, data, digital photos, movies, and music
- Read only vs. rewritable



Optical Discs

- 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
- Stored in jpg file format
- Cost is determined by the number of photos being stored

Picture CD

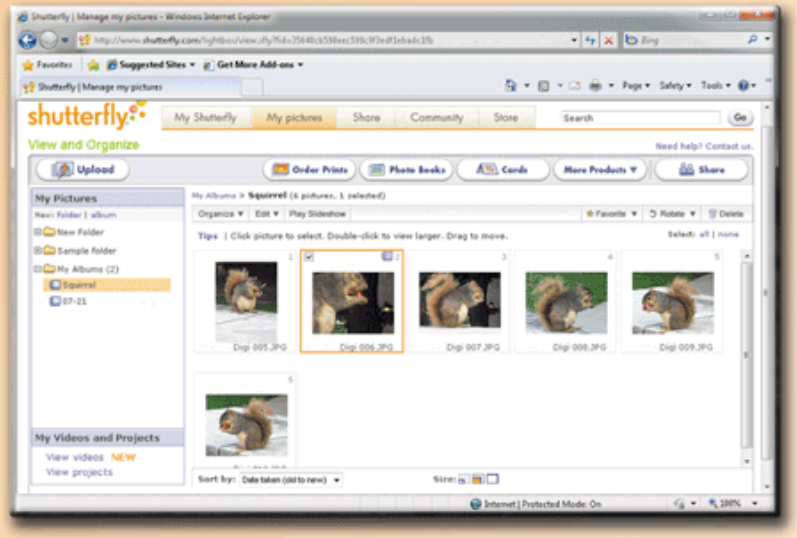
- Single-session CD-ROM that stores digital versions of film
- Costs about $3 per roll of film
- Many photo centers offer Picture CD services

Optical Discs

How an Archive Disc Works

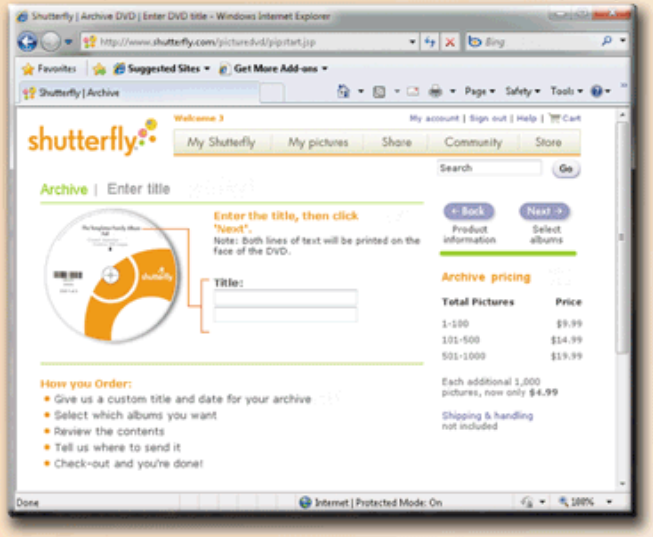
Step 1

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

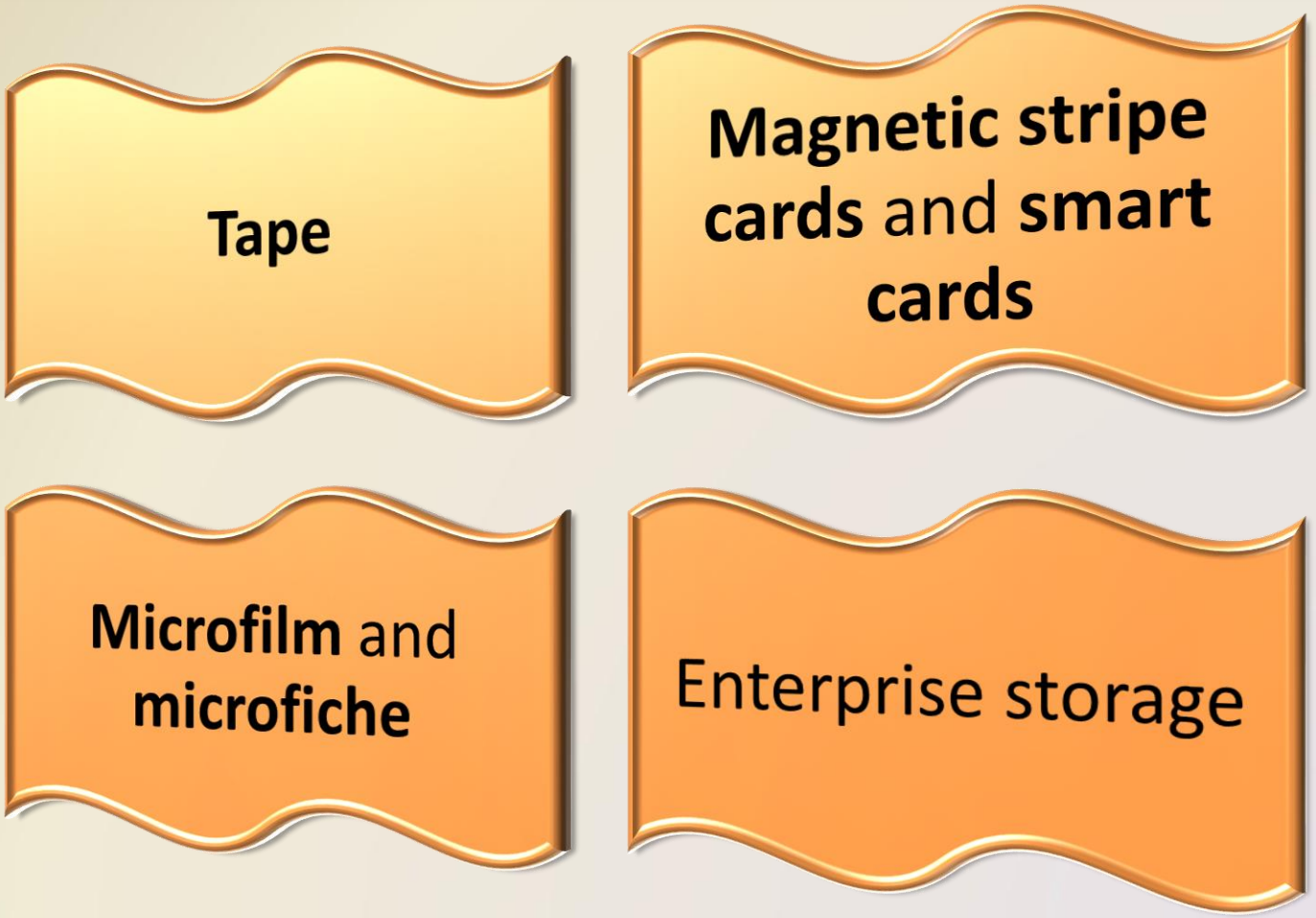
A **DVD-ROM** is a high-capacity optical disc on which users can read but not write or erase

- 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

Other Types of Storage

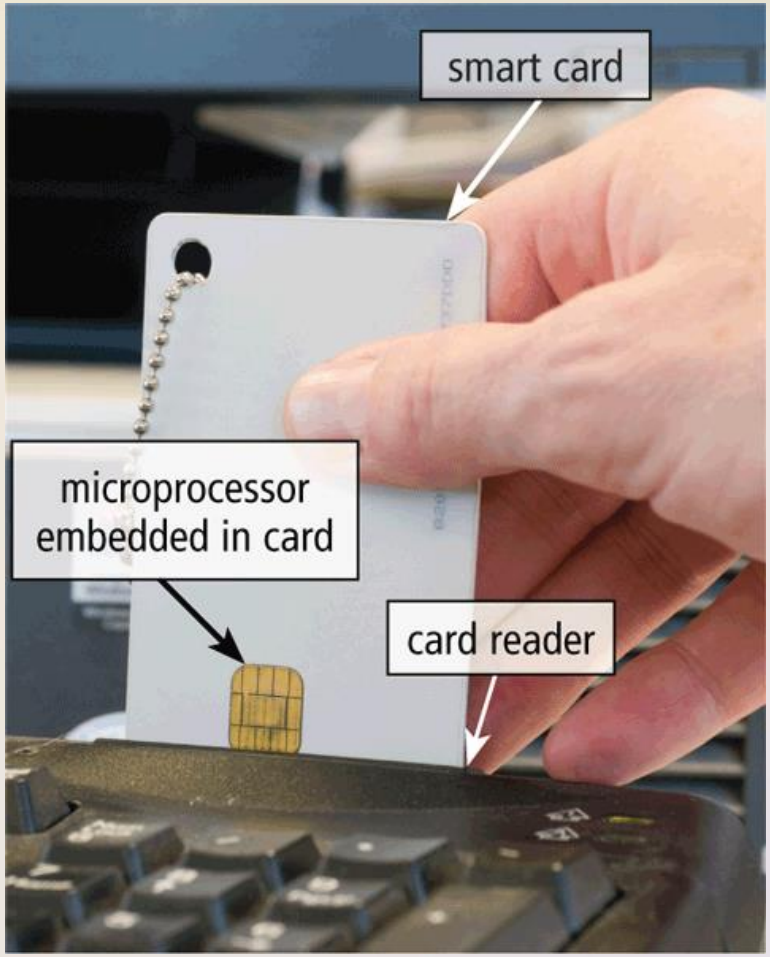


Other Types of Storage

- **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

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



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

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