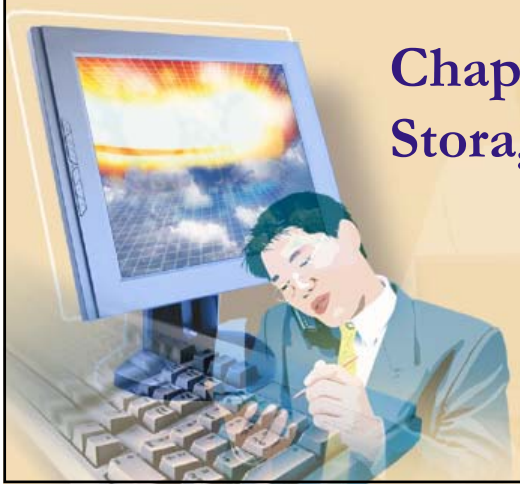
Discovering Computers 2005
A Gateway to Information



Chapter 7
Storage

Chapter 7 Objectives

- Discuss the various types of items that users store on computer media
- Differentiate between storage devices and storage media
- Describe the characteristics of a floppy disk drive
- Identify the uses of Zip disks
- Describe the characteristics of a hard disk
- Identify the advantages of using an Internet hard drive
- Describe the characteristics of CDs and DVDs
- Differentiate among CD-ROMs, CD-RWs, DVD-ROMs, and DVD+RWs
- Identify the uses of tape
- Discuss PC Cards and the various types of miniature storage media
- Identify uses of microfilm and microfiche

Next

Storage

What is storage?

- Holds data, instructions, and information for future use
- Storage medium is physical material used for storage
  - Also called secondary storage

p. 348 Fig. 7-1

Next

Storage

What is capacity?

- Number of bytes (characters) a storage medium can hold

Kilobyte (KB)	1 thousand
Megabyte (MB)	1 million
Gigabyte (GB)	1 billion
Terabyte (TB)	1 trillion
Petabyte (PB)	1 quadrillion
Exabyte (EB)	1 quintillion
Zettabyte (ZB)	1 sextillion
Yottabyte (YB)	1 septillion

p. 350

Next

Storage

How does volatility compare?

- Storage medium is nonvolatile—contents retained when power is off
- Memory is volatile—holds data and instructions temporarily

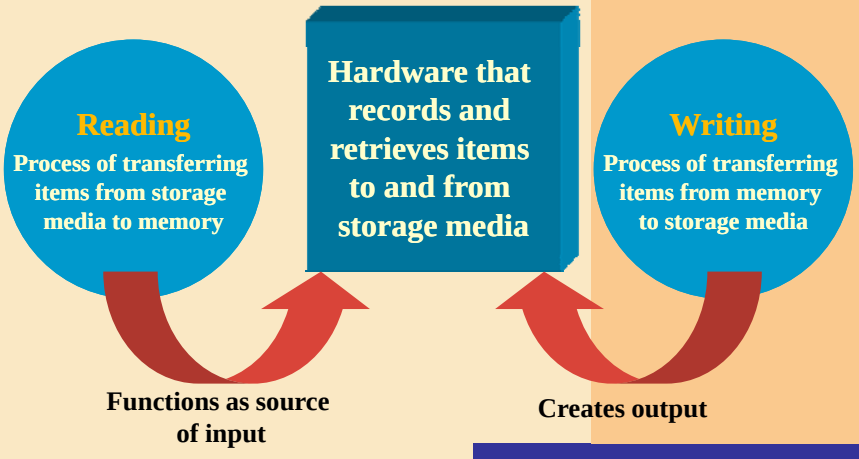
		ON	OFF
Volatile	Screen Display	Display appears	Display disappears
Volatile	Memory (most RAM) (chips on motherboard)	Data and instructions available to user	Data and instructions erased
Nonvolatile	Storage Medium (floppy disks, Zip disks, hard disks, CDs)	Contents available to user	Contents retained

p. 350

Next

Storage

What is a storage device?



p. 350

Next

Storage

What is access time?

- Time it takes storage device to locate item on storage medium
- Time required to deliver item from memory to processor

faster transfer rates

slower transfer rates

	Stores …
Primary Storage	
Memory (most RAM)	Items waiting to be interpreted and executed by the processor
Secondary Storage	
Hard Disk	Operating system, application software, user data and information
CDs and DVDs	Software, backups, movies, music
Miniature Storage Media	Digital pictures or small files to be transported
Tape	Backups
Floppy Disk	Small files to be transported

p. 350

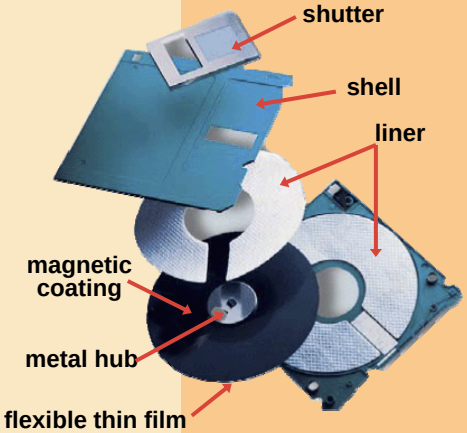
Next

Floppy Disks

What is a floppy disk?

- Portable, inexpensive storage medium (also called diskette)

Thin, circular, flexible film enclosed in 3.5” wide plastic shell



p. 351 Fig. 7-5

Next

Floppy Disks

What is a floppy disk drive?

- **Device that reads from and writes to floppy disk**
  - One floppy drive, named drive A
  - If two floppy drives, second designated as drive B
- **Also called secondary storage**

Floppy disk drive built into a desktop computer

External floppy disk drive attaches to a computer with a cable

p. 352 Fig. 7-6

Next

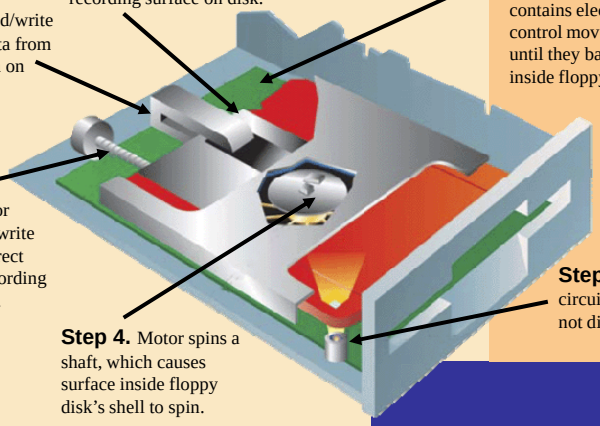
Floppy Disks

How does a floppy disk drive work?

Step 1. When you insert the floppy disk into drive, shutter moves to the side to expose the recording surface on disk.

Step 2. When you initiate a disk access, circuit board on drive that contains electronics sends signals to control movement of read/write heads until they barely touch surface (film) inside floppy disk's shell.

Step 6. Read/write heads read data from and write data on floppy disk.



Step 5. Motor positions read/write heads over correct location on recording surface of disk.

Step 3. For write instructions, circuit board verifies whether or not disk can be written on.

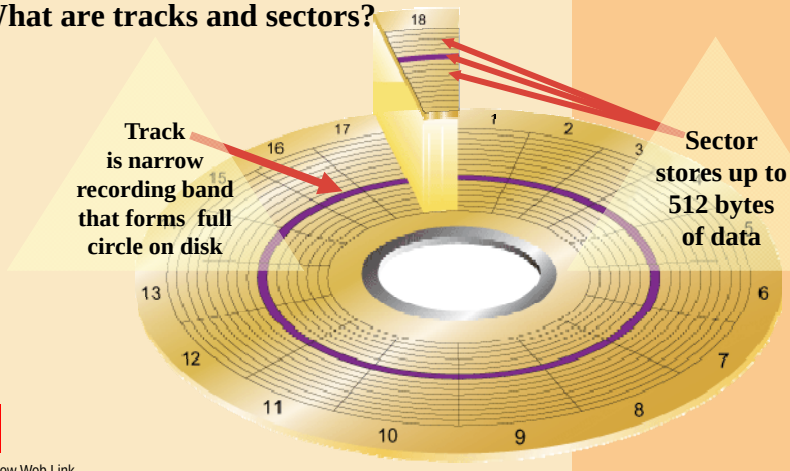
Step 4. Motor spins a shaft, which causes surface inside floppy disk's shell to spin.

p. 352 Fig. 7-7

Next

Floppy Disks

What are tracks and sectors?



Click to view Web Link, click Chapter 7, Click Web Link from left navigation, then click Floppy Disks below Chapter 7

p. 353 Fig. 7-8

Formatting prepares disk for use and marks bad sectors as unusable

Next

Floppy Disks

How do you compute a disk's storage capacity?

- **Multiply number of sides, number of tracks, number of sectors per track, and number of bytes per sector**
  - For high-density disk: 2 sides × 80 tracks × 18 sectors per track × 512 bytes per sector = 1,474,560 bytes

Characteristics of a 3.5-inch High-Density Floppy Disk

Capacity:	**1.44 MB**
Sides:	**2**
Tracks:	**80**
Sectors per track:	**512**
Sectors per disk:	**2880**

p. 354 Fig. 7-9

Next

Floppy Disks

How do you care for a floppy?

- **Proper care helps maximize disk's life**
- **Floppy disk can last at least seven years**

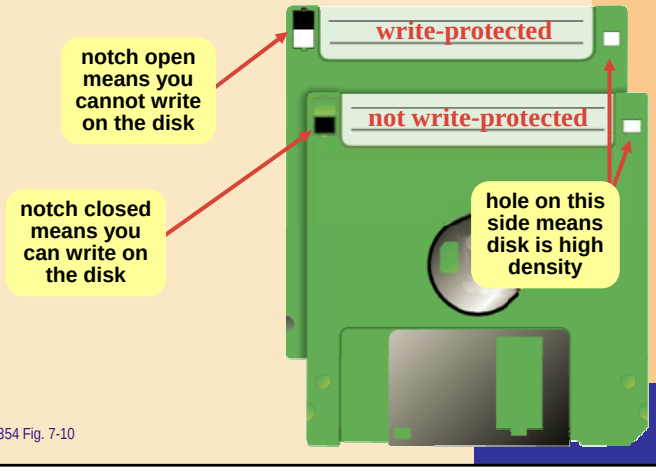
p. 354

Next

Floppy Disks

What is a write-protect notch?

- **Small opening with a cover that you slide**
- **Protects floppy disk from being erased accidentally**



p. 354 Fig. 7-10

Next

Zip® Disks

What is a Zip disk?

- **Magnetic medium that stores 100 MB to 750 MB of data**
- **Used to back up and to transfer files**
  - **Backup** is duplicate of file, program, or disk in case original is lost
- **Zip disks require a Zip drive—high capacity drive that reads from and writes on a Zip disk**

Click to view Web Link, click Chapter 7, Click Web Link from left navigation, then click Zip Disks below Chapter 7

p. 355 Fig. 7-11

Next

Hard Disks

What is a hard disk?

- **High-capacity storage**
- **Consists of several inflexible, circular platters that store items electronically**
- **Components enclosed in airtight, sealed case for protection**

Click to view Web Link, click Chapter 7, Click Web Link from left navigation, then click Hard Disk below Chapter 7

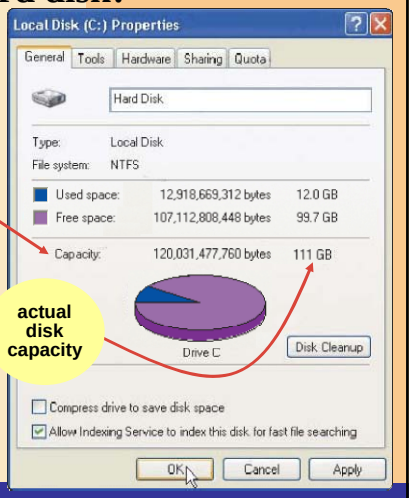
p. 355 Fig. 7-12

Next

Hard Disks

What are characteristics of a hard disk?

Sample Hard Disk Characteristics	
Advertised capacity	120 GB
Platters	3
Read/write heads	6
Cylinders	16,383
Bytes per second	512
Sectors per track	63
Sectors per drive	234,441,648
Revolutions per minute	7,200
Transfer rate	133 MB per second
Access time	8.9 ms

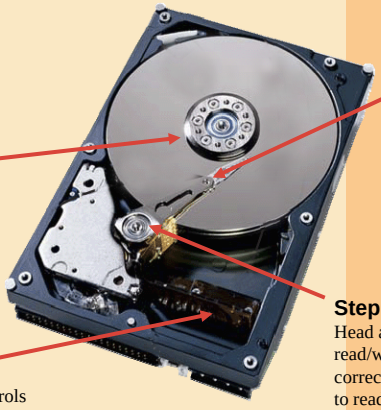


p. 356 Fig. 7-13

Next

Hard Disks

How does a hard disk work?



Step 1.
Circuit board controls movement of head actuator and a small motor.

Step 2.
Small motor spins platters while computer is running.

Step 3.
When software requests a disk access, read/write heads determine current or new location of data.

Step 4.
Head actuator positions read/write head arms over correct location on platters to read or write data.

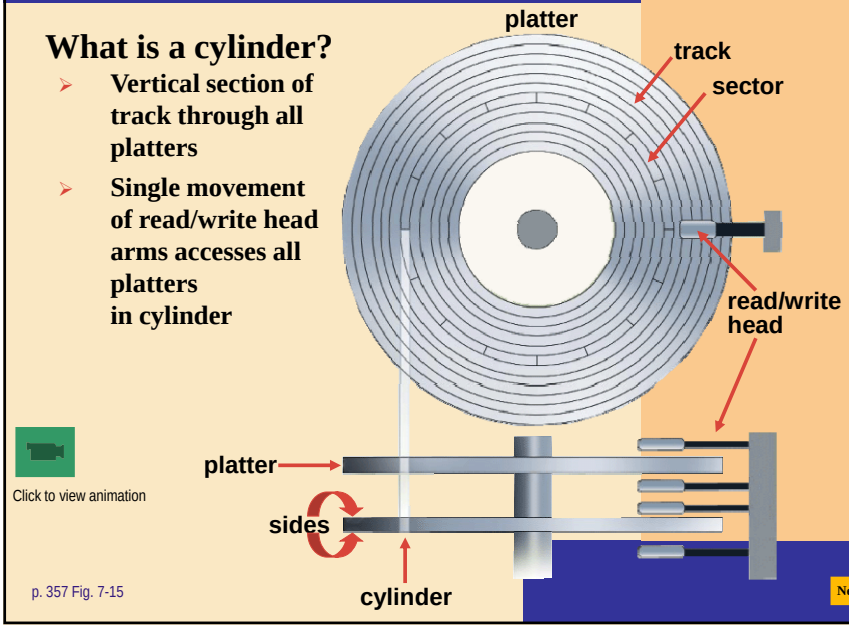
p. 357 Fig. 7-14

Next

Hard Disks

What is a cylinder?

- Vertical section of track through all platters
- Single movement of read/write head arms accesses all platters in cylinder



Click to view animation

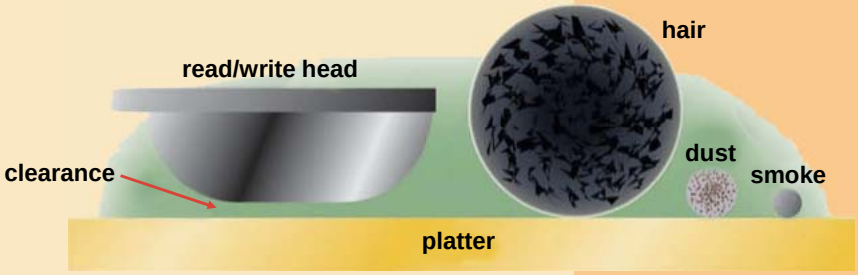
p. 357 Fig. 7-15

Next

Hard Disks

What is a head crash?

- Occurs when read/write head touches platter surface
- Spinning creates cushion of air that floats read/write head above platter
  - Clearance between head and platter is approximately two-millionths of an inch
  - A smoke particle, dust particle, or human hair could render drive unusable



p. 358 Fig. 7-16

Next

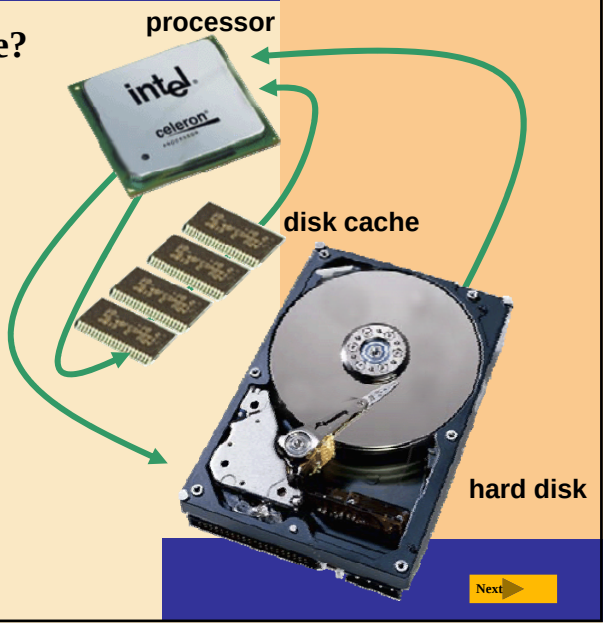
Hard Disks

What is a disk cache?

- Portion of memory that processor uses to store frequently accessed items

first request for data—to disk cache

second request for data—to hard disk



p. 358 Fig. 7-17

Next

Hard Disks

What are external hard disks and removable hard disks?

- Used to back up or transfer files

Removable hard disk—hard disk that you insert and remove from hard disk drive

External hard disk—freestanding hard disk that connects to system unit

p. 359 Fig. 7-18

Next

Hard Disks

What is a disk controller?

Chip and circuits that control transfer of items from disk

EIDE (**E**nhanced **I**ntegrated **D**rive **E**lectronics) controller supports four hard disks, provides connections for CD and DVD drives

SCSI (**S**mall **C**omputer **S**ystem **I**nterface) controller supports up to fifteen devices including hard disks, CD and DVD drives, tape drives, printers, scanners, network cards

p. 359

Next

Hard Disks

What is an Internet hard drive?

- **Service on Web that provides storage for minimal monthly fee**
- **Files can be accessed from any computer with Web access**
- **Large files can be downloaded instantaneously**
- **Others can be authorized to access your data**

Click to view Web Link, click Chapter 7, Click Web Link from left navigation, then click Internet Hard Drives below Chapter 7

p. 360 Fig. 7-19

Next

CDs and DVDs

What are CDs and DVDs?

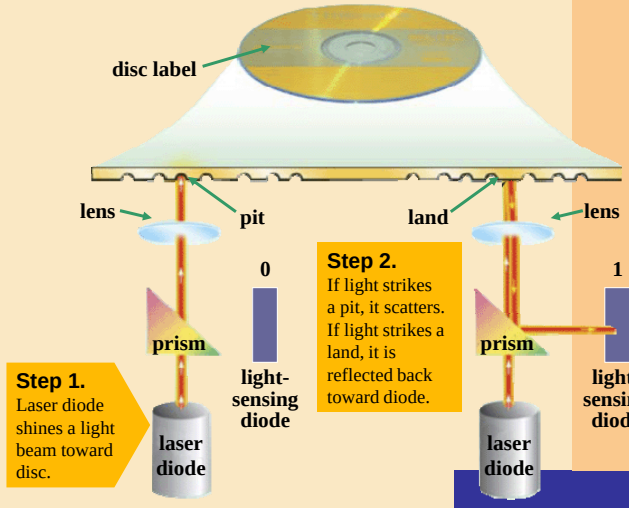
- Flat, round, portable metal discs made of metal, plastic, and lacquer
- Can be read only or read/write
- Most PCs include CD or DVD drive, most play audio CDs

p. 361 Fig. 7-20

Next

CDs and DVDs

How does a laser read data on a CD or DVD?



Step 1. Laser diode shines a light beam toward disc.

Step 2. If light strikes a pit, it scatters. If light strikes a land, it is reflected back toward diode.

Step 3. Reflected light is deflected to a light-sensing diode, which sends digital signals of 1 to computer. Absence of reflected light is read as digital signal of 0.

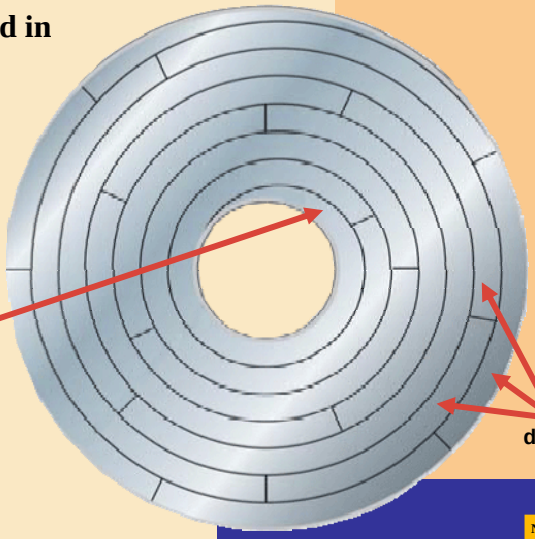
p. 362 Fig. 7-21

Next

CDs and DVDs

How is data stored on a CD or DVD?

- Typically stored in single track
- Track divided into evenly sized sectors that store items

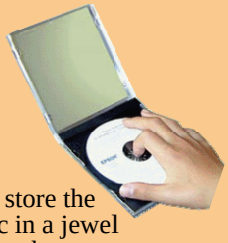


p. 362 Fig. 7-22

Next

CDs and DVDs

How should you care for a CD or DVD?



Do store the disc in a jewel box when not in use

Do hold a disc by its edges

p. 362 Fig. 7-23

Next

CDs and DVDs

What is a CD-ROM?

- Compact disc read-only memory
- Cannot erase or modify contents
- Typically holds 650 MB to 1 GB
- Commonly used to distribute multimedia and complex software

Click to view Web Link, click Chapter 7, Click Web Link from left navigation, then click CD-ROMs below Chapter 7

p. 363 Fig. 7-24

Next

CDs and DVDs

What is the data transfer rate of a CD-ROM drive?

Ranges from 48X to 75X or faster

75X

75X is 150 KBps (KB per second)

75 × 150 KBps = 11,250 KBps or 12.25 MBps

48X: 48 × 150 KBps = 7,200 KBps or 7.2 MBps

p. 364

Next

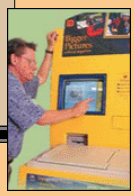
CDs and DVDs

What is a Picture CD?

Stores digital versions of roll of film

Film developers offer Picture CD service

Can be modified using photo editing software



Step 1.
Drop off film to be developed. Mark the Picture CD box on the film-processing envelope.

Step 2.
When you pick up prints and negatives, a Picture CD contains digital images of each photograph.

Step 3.
At home, print images from Picture CD on your ink-jet photo printer.

At a store, print images to Picture CD at kiosk.

Click to view Web Link, click Chapter 7, Click Web Link from left navigation, then click Picture CDs below Chapter 7

p. 365 Fig. 7-25

Next

CDs and DVDs

What are CD-Rs and CD-RWs?

CD-R (compact disc-readable) —disc you can write on once

CD-RW (compact disc-rewritable) — erasable disc you can write on multiple times

Must have CD recorder or CD-R drive

Cannot erase disc's contents

Must have CD-RW software and CD-RW drive

Click to view Web Link, click Chapter 7, Click Web Link from left navigation, then click CD-Rs and CD-RWs below Chapter 7

p. 366

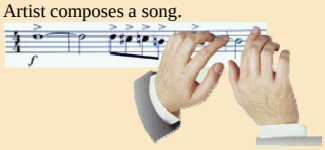
Next

CDs and DVDs

How is an audio CD created?

- **From a purchased CD. . .**

Step 1.
Artist composes a song.

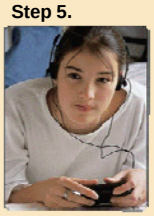


Step 2.
Song is stored on audio CD and purchased by user.

Step 3.
User inserts audio CD into CD drive, plays song, and rips desired tracks onto hard disk.

Step 4.
User copies file to a CD-RW disc.

Step 5.



User listens to song on a personal computer or removes CD and listens to song on a portable CD player.

p. 366 Fig. 7-26

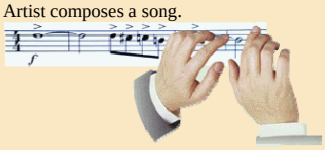
Next

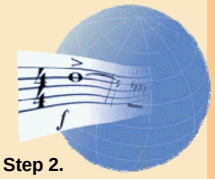
CDs and DVDs

How is an audio CD created?

- **From the Internet. . .**

Step 1.
Artist composes a song.





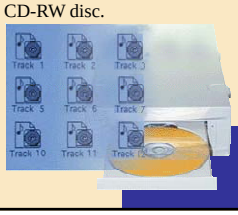
Step 2.
Song is compressed and stored on the Internet.

Step 3.
User pays for and downloads song as audio file onto a hard disk.

Step 5.

User listens to song on a personal computer or removes CD and listens to song on a portable CD player.

Step 4.
User copies file to a CD-RW disc.



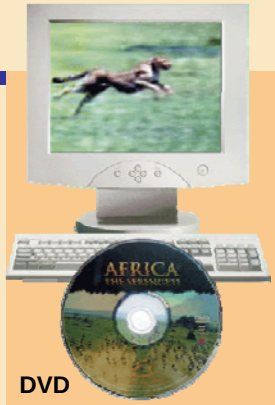
p. 366 Fig. 7-26

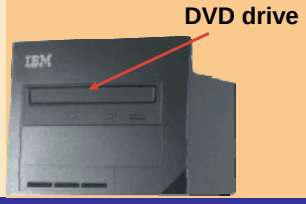
Next

CDs and DVDs

What is a DVD-ROM (digital versatile disc-ROM or digital video disc-ROM)?

- **High capacity disc capable of storing 4.7 GB to 17 GB**
- **Must have DVD-ROM drive or DVD player to read DVD-ROM**
- **Stores databases, music, complex software, and movies**





Click to view Web Link, click Chapter 7, Click Web Link from left navigation, then click DVDs below Chapter 7

p. 368 Fig. 7-27

Next

CDs and DVDs

How does a DVD-ROM store data?

- **Two layers of pits are used, lower layer is semitransparent so laser can read through**
- **Some are double-sided**
- **DVD+RW is a rewritable DVD**

DVD-ROM Storage Capacities

Sides	Layers	Storage Capacity
1	1	47 GB
1	1	8.5 GB
2	1	9.4 GB
2	2	17 GB

Click to view video

p. 368 Fig. 7-28

Next

Tape

What is tape?

- Magnetically coated plastic ribbon capable of storing large amounts of data at low cost
- Primarily used for backup

Click to view Web Link, click Chapter 7, Click Web Link from left navigation, then click Tape below Chapter 7

p. 370 Fig. 7-29

Next

Tape

How is data stored on a tape?

- Sequential access
  - Reads and writes data consecutively, like music tape
  - Unlike direct access — used on floppy disks, Zip disks, hard disks, CDs, and DVDs — which can locate particular item immediately

Popular Types of Tape

Name	Abbreviation	Storage Capacity
Digital audio tape (also called digital data storage)	DAT (also called DDS)	2 GB to 240 GB
Digital linear tape	DLT	20 GB to 229 GB
Linear tape-open	LTO	100 GB to 200 GB
Quarter-inch cartridge	QIC	40 MB to 50 GB
Travan	TR	8 GB to 50 GB

p. 370 Fig. 7-30

Next

PC Cards

What is a PC Card?

- Adds capabilities to computer
- Credit-card-sized device commonly used in notebook computers

PC Cards

Category	Thickness	Use
Type I	3.3 mm	RAM, SRAM, flash memory
Type II	5.0 mm	Modem, LAN, SCSI, sound, TV turner, hard disk, or other storage
Type III	10.5 mm	Rotating storage such as a hard disk

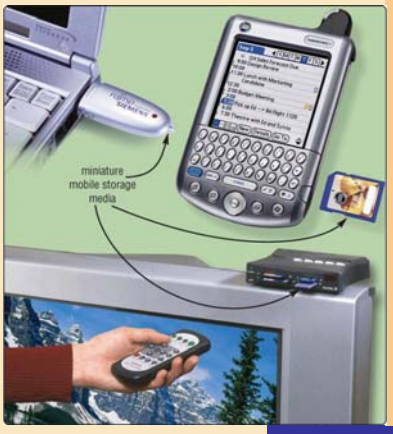
p. 370 Figs. 7-31–7-32

Next

Miniature Mobile Storage Media

What is miniature mobile storage media?

- Storage for small mobile devices



p. 371 Fig. 7-33

Next

Miniature Mobile Storage Media

What are common types of miniature mobile storage media?

CompactFlash

Smart Media

Secure Digital

Memory Stick

Microdrive

xD Picture Card

Click to view Web Link, click Chapter 7, Click Web Link from left navigation, then click Flash Memory Cards below Chapter 7

p. 372

Next

Miniature Mobile Storage Media

What is a card reader?

- **Reads information stored on miniature mobile storage media**
- **Type of card determines type of card reader needed**

p. 373 Fig. 7-35

Next

Miniature Mobile Storage Media

What is a smart card?

- Stores data on microprocessor embedded in small card
- Input, process, output, and storage capabilities

Click to view Web Link, click Chapter 7, Click Web Link from left navigation, then click Smart Cards below Chapter 7

p. 373 Fig. 7-37

Next

Miniature Mobile Storage Media

What is e-money (electronic money)?

- Means of paying for goods and services over the Internet
  - Also called digital cash
- Bank issues unique digital cash numbers that represent amount of money
- Money is withdrawn from your bank account
- Sometimes placed on smart card

Click to view video

p. 374

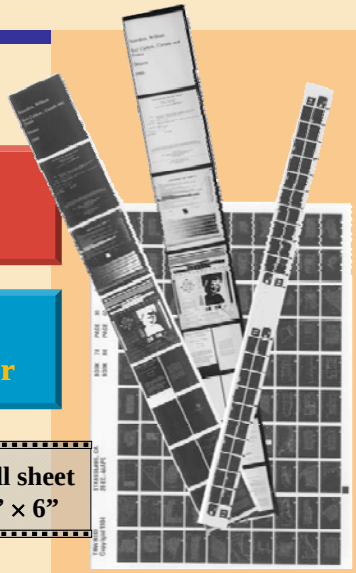
Next

Microfilm and Microfiche

What are microfilm and microfiche?

Store microscopic images of documents on roll or sheet of film

Images recorded using computer output microfilm recorder



Microfilm — 100- to 215-foot roll of film	Microfiche — small sheet of film, usually 4” × 6”

p. 374 Fig. 7-38

Next

Microfilm and Microfiche

How do life expectancies of various media compare?

- **Microfilm and microfiche have longest life of any storage media**

Media Life Expectancies

Media Type	Guaranteed Life Expectancy	Potential Life Expectancy
Magnetic disks	3 to 5 years	20 to 30 years
CDs and DVDs discs	5 to 10 years	50 to 100 years
Microfilm	100 years	500 years

p. 375 Fig. 7-39

Next

Putting It All Together

What are recommended storage devices for home users?

Home

- 3.5-inch high-density floppy disk drive
- 250 MB Zip drive
- 80 GB hard disk
- Internet hard drive
- CD or DVD drive
- Card reader/writer

p. 375 Fig. 7-40

Next

Putting It All Together

What are recommended storage devices for small office/home office (SOHO) users?

Small Office/
Home Office (SOHO)

- 3.5-inch high-density floppy disk drive
- 750 MB Zip drive
- 100 GB hard disk
- Internet hard drive
- CD or DVD drive
- External hard drive for backup

p. 375 Fig. 7-40

Next

Putting It All Together

What are recommended storage devices for mobile users?

Mobile

- 3.5-inch high-density floppy disk drive
- 2 GB PC Card hard disk or USB Flash Drive
- 40 GB hard disk
- Internet hard drive
- CD or DVD drive
- Card reader/writer
- External or removable hard disk for backup

p. 375 Fig. 7-40

Next

Putting It All Together

What are recommended storage devices for large business users?

Large Business

- 3.5-inch high-density floppy disk drive
- 160 GB hard disk
- CD or DVD drive
- Smart card reader
- Tape drive
- Network storage server
- 40 TB hard disk system
- CD-ROM or DVD-ROM server
- Microfilm or microfiche

p. 375 Fig. 7-40

Next

Putting It All Together

What are recommended storage devices for power users?

Power

- 3.5-inch high-density floppy disk drive
- CD or DVD drive
- 250 GB hard disk
- Internet hard drive
- External or removable hard disk for backup

p. 375 Fig. 7-40

Next

Summary of Storage

- Floppy disks
- Zip disks
- Internal hard disks
- External hard disks
- Removable hard disks
- CD-ROMs
- CD-RWs
- DVD-ROMs
- DVD+RWs
- Tape
- PC Cards
- Flash memory cards and other miniature mobile storage media
- Microfilm and microfiche

Chapter 7 Complete