Chapter 7
Storage

Differentiate between storage and memory

Identify various types of storage media and devices

Explain how a floppy disk stores data

Identify the advantages of using high-capacity disks

Describe how a hard disk organizes data

Identify the advantages of using an Internet hard drive

Explain how a compact disc stores data

Understand how to care for a compact disc

Differentiate between CD-ROMs, CD-RWs, DVD-ROMs and DVD+RWs

Identify the uses of tape

Understand how an enterprise storage system works

Explain how to use PC Cards and other miniature storage media

Identify uses of microfilm and microfiche

Chapter 7 Objectives

What is storage?

• Media and devices used to store and retrieve data, instructions, and information

How does storage differ from memory?

• Stores items for future use, rather than temporarily
• Storage is nonvolatile, rather than volatile

How does volatility compare?

Contents of storage retained when power is off

Screen display and contents of most RAM (memory) erased when power is off

What is a storage device and a storage medium?

Storage device

Hardware that records and retrieves items to and from a storage medium

Storage medium

Physical material on which a computer keeps data, instructions, and information
What is reading and writing?

Reading: Process of transferring data, instructions, and information from a storage medium into memory.
Serves as a source of input.

Writing: Process of transferring items from memory to a storage medium.
Serves as a source of output.

What is access time?

• Amount of time it takes device to locate item on disk.
• Defines speed of disk storage device.

What is capacity?

• Number of bytes (characters) storage medium can hold.

<table>
<thead>
<tr>
<th>Storage Term</th>
<th>Abbreviation</th>
<th>Number of bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kilobyte</td>
<td>KB</td>
<td>1 thousand</td>
</tr>
<tr>
<td>Megabyte</td>
<td>MB</td>
<td>1 million</td>
</tr>
<tr>
<td>Gigabyte</td>
<td>GB</td>
<td>1 billion</td>
</tr>
<tr>
<td>Terabyte</td>
<td>TB</td>
<td>1 trillion</td>
</tr>
<tr>
<td>Petabyte</td>
<td>PB</td>
<td>1 quadrillion</td>
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</tbody>
</table>

What is a floppy disk?

• Portable, inexpensive storage medium.
• Today’s standard disk is 3.5” wide.

What are the parts of a floppy disk?

• Thin, circular, flexible film enclosed between two liners.

How are floppy disk drives designated?

• Drive A: One floppy drive.
• Drive B: Two floppy drives.
**Floppy Disks**

1: Shutter moves to expose recording surface on disk
2: Signal sent to control movement of read/write heads and disk
3: If write instruction, circuit board verifies whether disk can be written to
4: Motor causes floppy disk to spin
5: Motor positions read/write heads over correct location on disk
6: Read/write heads read data from or write data on the floppy disk

**What are tracks and sectors?**
- Track is narrow recording band that forms full circle on disk surface
- Sector can store up to 512 bytes of data

80 tracks per side X 18 sectors per track X 2 sides per disk X 512 bytes per sector = 1,474,560 bytes

**What is formatting?**
- Process of preparing disk for reading and writing
- Formatting marks bad sectors as unusable

**How do you care for a floppy?**
- Proper care helps maximize disk's life
- Floppy disk can last at least seven years
- Avoid exposure to heat and cold
- Avoid exposure to magnetic fields
- Avoid exposure to contaminants such as dust, smoke, or salt air
- Keep disks in a storage tray when not using them
- Never open the shutter and touch the disk's recording surface

**What is a write-protect notch?**
- Small opening with a cover that you slide
- Protects floppy disks from being erased accidentally

**High-Capacity Disks**

**What is a high-capacity disk drive?**
- Uses disks with capacities of 100 MB and greater
- Primarily used to backup files and transfer files

**Zip® drive**
Uses a Zip® disk that can store 100 MB or 250 MB of data

**Built-in Zip® drive**
What is a backup?
- Duplicate of file, program, or disk that you can use if original is lost, damaged, or destroyed.

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

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How does a hard disk work?
1: Circuit board controls movement of head activator and small motor
2: Small motor spins platters
3: When software requests disk access, read/write heads determine location of data
4: Head actuator positions read/write head arms over correct location on platters to read or write data

What is a cylinder?
- Location of a single track through all platters
- Single movement of read/write head arms can read same track on all platters

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

What is a disk cache?
- Portion of memory processor uses to store frequently accessed items
What is a partition?
- Formatted hard disk divided into separate areas called partitions
- Each partition functions as if it were a separate hard disk drive

Next

drive C
Designation for first partition or for a single partition on hard disk

drive D
Designation for second partition on hard disk

one hard disk divided into two partitions

What is a removable hard disk?
- Disk drive in which a plastic or metal case surrounds the hard disk so you can remove it from the drive
- Used for backup or to transfer files

Peerless stores up to 20 GB

Jaz stores up to 2 GB

How does RAID work?
- Disk system that duplicates data, instructions, and information to improve data reliability
  - Mirroring has one backup disk for each disk
  - Striping stores data across multiple disks

What Windows utilities maintain a hard disk drive?

System Tools

What is an Internet hard drive?
- Service on Web that provides storage to computer users
- Most offer free storage
- Revenues come from advertisers

driveway.com

What are advantages of an Internet hard drive?
- Large audio, video, and graphics files can be downloaded to an Internet hard drive instantaneously
- Files can be accessed from any computer or device with Web access
- Others can be authorized to access data from your Internet hard drive
- Allows offsite backups of data
Compact Discs

What is a compact disc (CD)?
• Storage medium
• Most PCs include some type of compact disc drive
• Available in variety of formats

How do you use a compact disc?
• CD drives can read compact discs, including audio discs

How does a laser read data on a compact disc?
1: Laser diode shines light beam toward compact disc
2: If light strikes pit, it scatters. If light strikes land, it is reflected back toward laser diode.
3: Reflected light deflected to light-sensing diode, which sends digital signal of 1. Absence of reflected light read as digital signal of 0.

How is data stored on a compact disc?
• Typically stores items in single track
• Track divided into evenly sized sectors that store items

How should you care for a compact disc?
1: Do not expose to excessive heat or sunlight
2: Do not eat, smoke, or drink near a disc
3: Do not stack
4: Do not touch underside
5: Store in jewel box when not in use
6: Hold disc by its edges

What is a jewel box?
• Protective case for compact disc
CD-ROMs

What is a CD-ROM?
• Compact disc that uses same laser technology as audio CDs for recording music
• Cannot erase or modify contents
• Typical CD-ROM holds about 650 MB
• Commonly used to distribute software and games

CD-ROMs

What is the data transfer rate of a CD-ROM drive?
- 40X
  40 X 150 KB per second = 6,000 KB per second or 6 MB per second
- 75X
  75 X 150 KB per second = 11,250 KB per second or 12.25 MB per second

CD-R and CD-RW

What is a CD-R (compact disc-recordable)?
• Compact disc onto which you can record text, graphics, and audio
• Write on CD-R using CD burner (recorder) or CD-R drive and special software
  - CD-R drive can read and write both audio CDs and standard CD-ROMs
  - Cannot erase disc’s contents

CD-R and CD-RW

What is a CD-RW (compact disc-rewritable)?
• Erasable disc you can write on multiple times
• Must have a CD-RW disc, CD-RW software, and CD-RW drive

CD-R and CD-RW

How is an audio CD created?
Step 1: Artist composes song and creates CD
Step 2a: Song stored on audio CD and purchased by user
OR
Step 2b: Song compressed and stored on Internet
Step 3a: User inserts audio CD into CD-ROM drive, plays song, and copies it to hard disk
OR
Step 3b: User downloads song as audio file to hard disk
Step 4: User copies file to CD-RW disc
Step 5: User listens to song on personal computer or removes CD and listens to song on portable CD player

CD-R and CD-RW

What is a DVD-ROM (digital video disc-ROM)?
• High capacity compact disc capable of storing from 4.7 GB to 17 GB
• Must have DVD-ROM drive or DVD player to read DVD-ROM
• Primarily used for movies
• Next-generation software will be delivered on DVD
**DVD-ROMs**
How does a DVD-ROM store data?
- Two layers of pits are used, where lower layer is semitransparent
- Laser can read through it to upper layer
- DVD+RW is a rewritable DVD

<table>
<thead>
<tr>
<th>Sides</th>
<th>Layers</th>
<th>Storage Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>4.7 GB</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>8.5 GB</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>9.4 GB</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>17 GB</td>
</tr>
</tbody>
</table>

**Tapes**
What is tape?
- Magnetically coated ribbon of plastic capable of storing large amounts of data and information at a low cost
- Primarily used for backup

**Enterprise Storage Systems**
What is an enterprise storage system?
- Strategy that focuses on availability, protection, organization, and backup of storage in a company

**PC Cards**
What are uses of PC Cards?
- Handheld devices use to augment internal storage

<table>
<thead>
<tr>
<th>Category</th>
<th>Thickness</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td>3.3 mm</td>
<td>RAM, SRAM, flash memory</td>
</tr>
<tr>
<td>Type II</td>
<td>5.0 mm</td>
<td>Modem, LAN, GPIO, sound, TV tuner, storage</td>
</tr>
<tr>
<td>Type III</td>
<td>10.5 mm</td>
<td>Rotating storage such as a hard disk</td>
</tr>
</tbody>
</table>

**Miniature Mobile Storage Media**
What is miniature mobile storage media?
- Handheld devices use to augment internal storage

<table>
<thead>
<tr>
<th>Device Name</th>
<th>Storage Capacity</th>
<th>Type, Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>CompactFlash</td>
<td>40 MB</td>
<td>Cartridge, digital cameras, camcorders</td>
</tr>
<tr>
<td>Memory Stick</td>
<td>2 to 256 MB</td>
<td>Memory Card, digital cameras, camcorders, printers, calculators, cellular telephones</td>
</tr>
<tr>
<td>Microdrive</td>
<td>1 GB</td>
<td>Memory Card, digital cameras, camcorders, music players, video cameras</td>
</tr>
<tr>
<td>SmartMedia</td>
<td>2 to 128 MB</td>
<td>Memory Card, digital cameras, camcorders, personal digital assistants, cellular telephones</td>
</tr>
</tbody>
</table>
Miniature Mobile Storage Media

How is miniature storage media used?

• Handheld devices, such as players and wallets, read or display contents of miniature storage media such as memory cards

What is a smart card?

• Stores data on thin microprocessor embedded in credit card

What are the types of smart cards?

• Intelligent smart card contains processor and has input, process, output, and storage capabilities
• Memory card has only storage capabilities

What is electronic money?

• Means of paying for goods and services over the Internet
• Also called e-money or digital cash

Bank issues unique digital cash numbers that represent an amount of money. When you purchase digital cash, the amount of money is withdrawn from your bank account. To use the card, swipe it through a card reader.

Microfilm and Microfiche

What are microfilm and microfiche?

• Store microscopic images of documents on a roll or a sheet of film
• Images recorded using a computer output microfilm (COM) recorder

Life expectancies of various media compare:

<table>
<thead>
<tr>
<th>Media Type</th>
<th>Guaranteed Life Expectancy</th>
<th>Potential Life Expectancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tape</td>
<td>2 to 5 years</td>
<td>20 years</td>
</tr>
<tr>
<td>Compact Disc</td>
<td>5 years</td>
<td>50 to 100 years</td>
</tr>
<tr>
<td>Microfilm</td>
<td>100 years</td>
<td>200 years</td>
</tr>
</tbody>
</table>
Summary

What are suggested storage devices for the Home user?
- 3.5-inch HD floppy disk drive
- 250 MB Zip® drive
- 40 GB hard disk
- Internet hard drive
- CD-ROM drive
- CD-RW/DVD drive

Summary

What are suggested storage devices for the SOHO user?
- 3.5-inch HD floppy disk drive
- 60 GB hard disk
- Internet hard drive
- CD-ROM drive
- CD-RW/DVD drive
- 20 GB Peerless drive

Summary

What are suggested storage devices for the Mobile user?
- 3.5-inch HD floppy disk drive
- 10 GB hard disk
- 1 GB PC Card hard disk
- Internet hard drive
- CD-RW/DVD drive

Summary

What are suggested storage devices for the Large Business user?
- 3.5-inch HD floppy disk drive
- 80 GB hard disk
- CD-ROM drive
- CD-RW/DVD drive
- Microfilm or microfiche
- Smart card reader
- RAID
- Tape drive
- Enterprise storage system

Summary of Storage

- Memory versus storage
- Floppy disks
- High-capacity disks
- Hard disks
- Compact discs
- CD-ROMs
- CD-R and CD-RW

(Continued)
Summary of Storage

- DVD+RW and DVD-ROM
- Tapes
- Enterprise storage systems
- PC Cards
- Miniature mobile storage media
- Microfilm and microfiche

Chapter 7 Complete