



## Chapter 8

### Secondary Storage

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## Introduction

Data storage has expanded from text and numeric files to include digital music files, photographic files, video files, and much more. These new types of files require secondary storage devices with much greater capacity than floppy disks. In this chapter, you will learn about the many types of secondary storage devices including their capabilities and limitations.

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## Storage

- **Primary storage**
  - Volatile storage
  - Temporary storage
- **Secondary storage**
  - Nonvolatile storage
  - Permanent storage
- **Secondary storage characteristics**
  - Media
  - Capacity
  - Storage devices
  - Access speed

RAM



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## Secondary Storage Devices

- Most desktop microcomputer systems have floppy disks, hard disks, and optical disk drives
- Are used to save, back up, and transport data files and programs

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## Floppy Disks

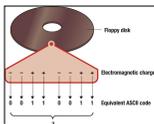
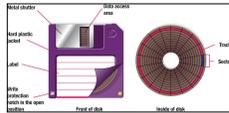
- Portable or removable storage media
- Typically used to store and transfer small word processing, spreadsheet, and other types of files
- **Floppy disk drives (FDD)**
  - Store data and programs
  - Retrieves data by reading electromagnetic charges
  - Also called flexible disks and floppies

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## Traditional Floppy Disk

- Most common type is **2HD** “two-sided, high-density”
- **Attributes**
  - **Shutter**
  - **Labels**
  - **Write-protection notch**
  - **Tracks**
  - **Sectors**



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## High Capacity Floppy Disks

- Known as a **floppy-disk cartridge**
- Require special disk drives
- Most widely used is the Zip disk
  - 100 MB, 250 MB or 750 MB capacity
  - Used to store multimedia, database, large text, and spreadsheet files



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## Hard Disks

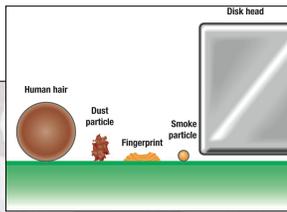
- Use thicker, metallic platters for storage
- Faster than a floppy diskette
- Large capacity
- **Sensitive instruments**
- There are three types of hard disks:
  - **Internal Hard Disk**
  - **Hard-disk cartridge**
  - **Hard-disk pack**
- **Performance Enhancements**

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## Materials that Cause a Head Crash

- **Head crash** is a disaster for a hard disk



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## Internal Hard Disk

- Located inside system unit
- Designated as the C drive
- Advantages over floppies
  - Capacity
  - Access speed

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## Hard-Disk Cartridges

- Removable hard disks
- Used to complement internal hard disk
- Capacities of 20 to 100 GB
- Iomega is one of the most widely used



Hard-disk cartridge



PC Card Hard Disks

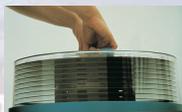
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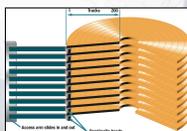
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## Hard-Disk Packs

- Removable hard disk
- Massive storage capacity
- Common in mainframes
- Are utilized by banks and credit card companies



Type	Description
Internal	Fast access to applications, fixed
Cartridge	Complement to internal hard disk, removable
Disk pack	Massive storage capacity, removable



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## Performance Enhancements

- Disk caching
- Redundant arrays of inexpensive disks (RAID)
- File compression and decompression



Technique	Description
Disk caching	Uses cache and anticipates data needs
RAID	Linked, inexpensive hard-disk drives
File compression	Reduces file size
File decompression	Expands compressed files

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## Optical Disks

- Hold over 50 gigabytes of data
- Attributes
  - Lands
  - Pits
- Three types
  - Compact Disc (CD)
  - Digital Versatile Disc (DVD)
  - Hi-Def Disc



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## Compact Disc

- Optical format
- From 650 MB to 1 GB capacity
- Rotation speeds vary
- Three basic types
  - Read only: CD-ROM
  - Write once: CD-R
  - Rewriteable: CD-RW



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## Digital Versatile Disc

- Digital Versatile Disc or Digital Video Disc (DVD)
- Similar to CDs, but can store more data
- Three basic types
  - Read only: DVD-ROM
  - Write once: DVD+R; DVD-R
  - Rewritable: DVD+RW; DVD-RW; DVD-RAM



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## High-Definition Disc

- Next generation of **optical disc**
- Far greater capacity than DVDs
- Three basic types
  - Read only
  - Write once
  - Rewriteable
- Two competing **hi def** formats
  - HD DVD
  - Blu-Ray (which officially won the war this year..)

Format	Typical Capacity	Description
CD	650 MB to 1 GB	Once the standard optical disc
DVD	4.7 GB to 17 GB	Current standard
HD DVD	15 GB to 45 GB	Hi-def format, similar to DVD
Blu-Ray	25 GB to 50 GB	Hi-def format, large capacity

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## Other Types of Secondary Storage

- **Solid-state storage**
- **Internet hard drives**
- **Magnetic tape**

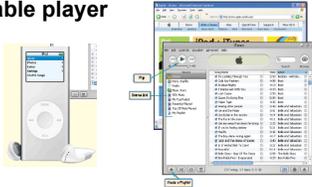


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## Ipods and Music From The Internet

- The Internet can be used as a medium to locate and play music
- A user can create compact discs, or transfer music to a portable player
- Requirements
  - Software
  - Hardware
  - Internet



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## Solid-State Storage

- **Flash memory cards**
  - Widely used in notebook computers
  - Used to record MP3 music files
- **USB drives**
  - Key ring flash memory devices or flash drives
  - Connects to a USB port



Flash memory card



Key ring flash memory

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## Internet Hard Drives

- Known as i-drive or online storage
- Low cost and can access information from any location using the Internet
- Oriented to either businesses or individuals



Focus	Company	Location
Individual	iBackup	www.ibackup.com
Individual	xDrive	www.xdrive.com
Business	Amerivault	www.amerivault.com
Business	Iron Mountain Digital	www.ironmountain.com

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## Magnetic Tape

- External storage
- Provides sequential access
  - Information stored in sequence
  - Slower than disks which provide **direct access**
- **Magnetic tape streamers** or **tape cartridges** used by both mainframes and microcomputers



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## Holographic Storage

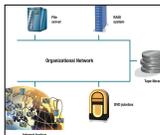
- Holographic storage is computer storage that uses laser beams to store computer-generated data in three dimensions.
- Imagine having 50 hours of high definition video on a single disk, 50,000 songs on a postage stamp, or 500,000 x-rays on a credit card ([http://www.inphase-technologies.com/technology/default.asp?subn=2\\_1](http://www.inphase-technologies.com/technology/default.asp?subn=2_1))

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## Mass Storage Devices

- Mass storage refers to the tremendous amount of secondary storage required by large organizations
- Mass storage devices are specialized high-capacity secondary storage devices
- **Enterprise storage system** promotes efficient and safe use of data across networks within organizations



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## Careers In IT

- **Software engineers** analyze users' needs and create application software
- **General employer requirements**
  - Bachelors degree in computer science
  - Extensive knowledge of computers and technology
  - Good communication and analytical skills
- **Software engineers can expect to earn an annual salary of \$53K to \$88K**



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## A Look to the Future

### Your Entire Life Recorded on a Single Disk

- **Future secondary storage disks could eventually store one terabyte**
- **Experiments with three dimensional storing**
- **Video of an entire life**
- **Technology is being used to rapidly scan photos and videos**



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