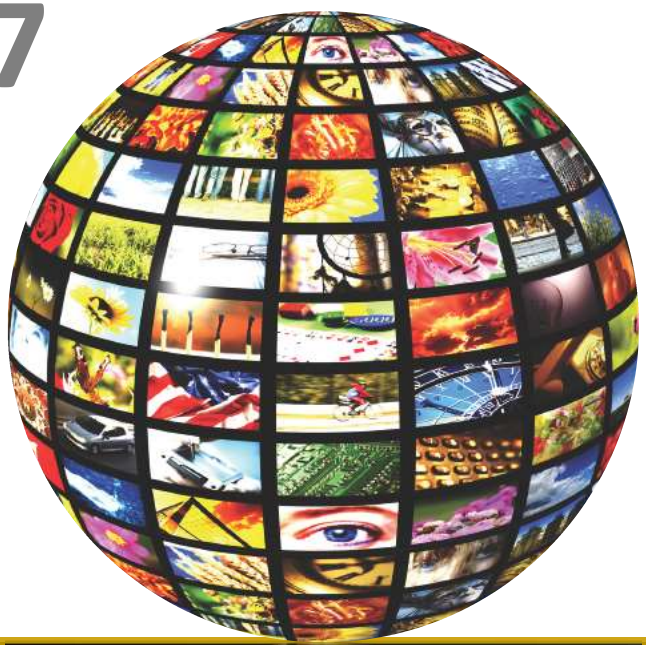
Chapter 7



Secondary Storage

Chapter 7

Learning Objectives

1. Distinguish between primary and secondary storage.
2. Identify the important characteristics of secondary storage, including media, capacity, storage devices, and access speed.
3. Describe hard-disk platters, tracks, sectors, cylinders, and head crashes.
4. Compare internal and external hard drives.
5. Compare performance enhancements including disk caching, RAID, file compression, and file decompression.
6. Define optical storage including compact discs, digital versatile discs, and Blu-ray discs.
7. Define solid-state storage, including solid-state drives, flash memory cards, and USB drives.
8. Define cloud storage and cloud storage services.
9. Describe mass storage, mass storage devices, enterprise storage systems, and storage area networks.

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.
- In this chapter, you learn about the many types of secondary storage devices including their capabilities and limitations.

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Storage

- Primary storage is:
  - Volatile storage
    - Loses content when the computer loses power
  - Temporary storage
  - Random Access Memory (RAM)
- Secondary storage is:
  - Nonvolatile storage
    - Stores programs and data regardless of power
  - Permanent storage
    - Permanently saves information for future use

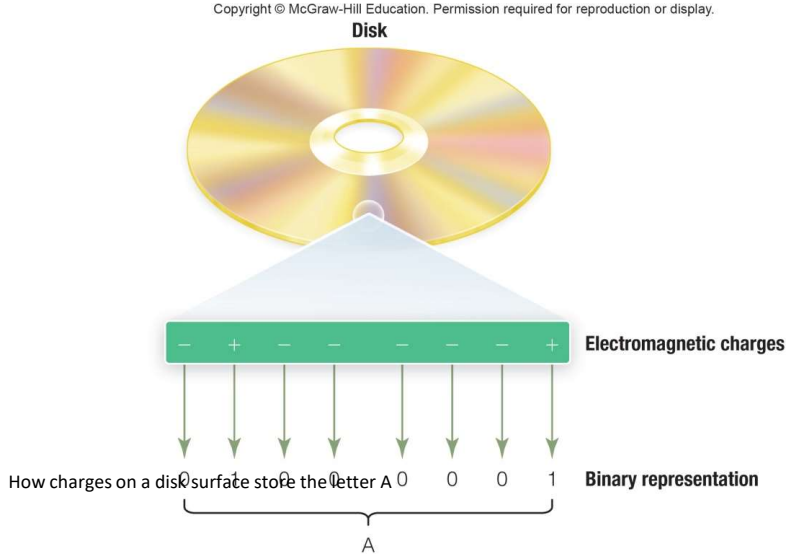
Secondary Storage Characteristics

- Secondary storage characteristics
  - Media
    - Physical materials that holds data and programs
  - Capacity
    - How much the media can hold
  - Storage devices
    - Hardware that reads data and programs
  - Access speed
    - Amount of time required to retrieve data from storage
    - Writing is the process of saving information to storage
    - Reading is the process of accessing information from storage

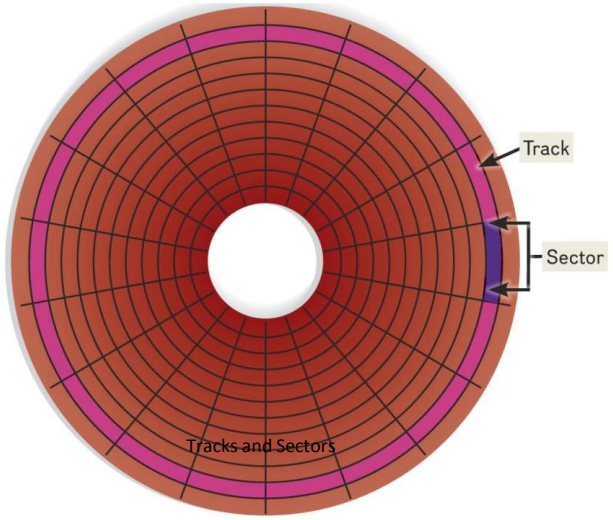
Hard Disks

Save files by altering the magnetic charges of the disk's surface to represent 1s and 0s

- Use rigid, metallic platters that are stacked one on top of one another
- Store and organize files using tracks, sectors, and cylinders



How charges on a disk surface store the letter A

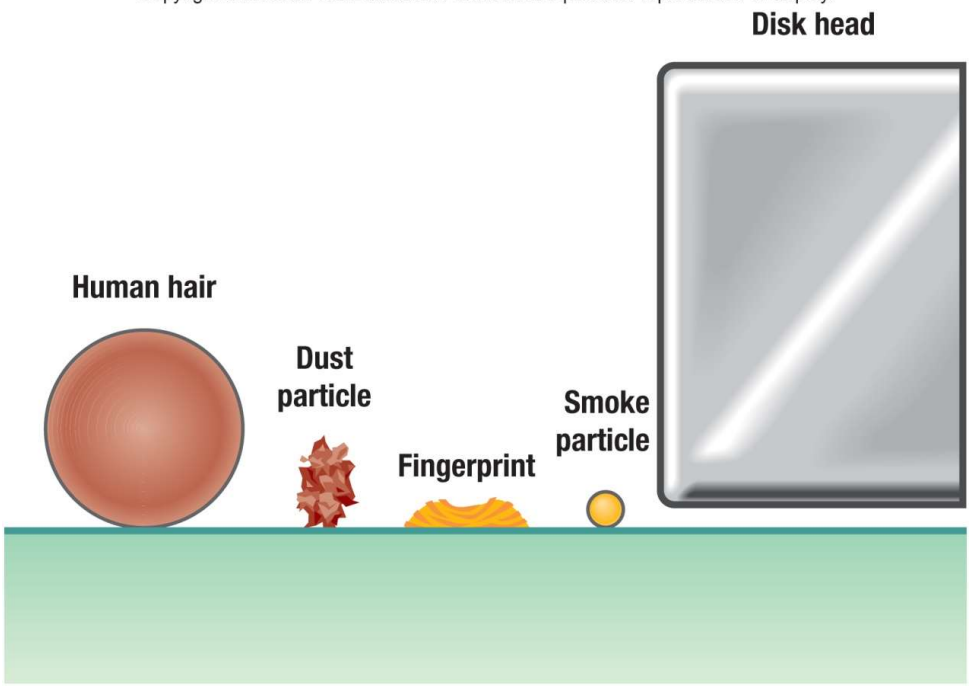


Tracks and Sectors

Head Crash

Occurs when read-write head makes contact with the hard disk's surface or with particles on its surface

- Disastrous



Types of Hard Disks

Internal

- Located inside the system unit
- Used to store programs and data files
- You should perform routine maintenance and periodically backup all important files

Courtesy of LaCie

External

- Removable
- Used to complement internal hard disk

Performance Enhancements

There are 3 ways to enhance performance.

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

Courtesy of CalDigit, Inc.

Solid-State Storage

Solid–state devices (SSDs) have no moving parts

- Solid-state drives
  - Faster and more durable than hard disks
  - Access to slash memory or solid state storage
- Flash memory cards
  - Widely used in laptops, smartphones, GPS navigation systems
- USB Drives (or Flash Drives)
  - Connect to USB port
  - Capacity of 1 GB to 256 GB
  - Portable

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Courtesy of Kingston Technology Company, Inc

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Optical Discs

- Hold over 128 gigabytes (GB) of data
- Use reflected light to represent data
  - Lands represent 1s and 0s on the disc
  - Pits are bumpy areas on the disc that, when light is reflected, determine the 1s and 0s
  - Use tracks and sectors to organize and store files but only use a single track unlike the hard drive

Optical Disc Types

Format	Typical Capacity	Description
CD	700 MB	Once the standard optical disc
DVD	4.7 GB	Current standard
Blu-ray	50 GB	Hi-def format, large capacity

Optical Disc Formats

Type	Access	Description
CD-ROM	Compact disc – read only mode	Cannot be written to or erased
CD-R	Compact disc – recordable	Can be written to
CD-RW	Compact disc – rewritable	Can be written to and erasable

Cloud Storage

The Internet acts as a "cloud" of servers

- Applications provided as a service rather than a product
- Supplied by servers that provide cloud storage or online storage

Store any file

Drive starts you with 15 GB of free Google online storage, so you can keep photos, stories, designs, drawings, recordings, videos – anything.

Cloud Storage Services

Benefits / Advantages

- Maintenance
- Hardware upgrades
- File sharing and collaboration

Disadvantages

- Access speed
- File Security

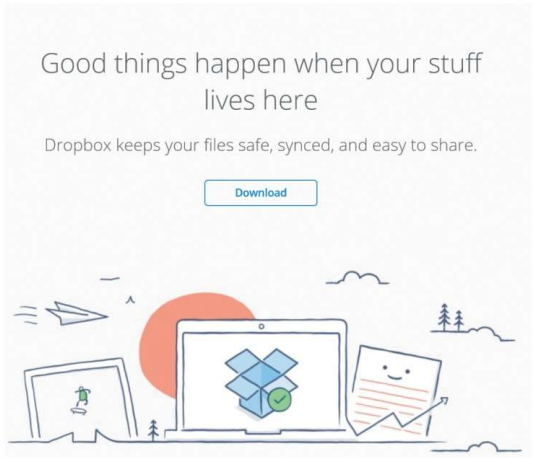
Cloud Storage Service Companies

Company	Location
Dropbox	www.dropbox.com
Google	drive.google.com
Microsoft	www.skydrive.com
Amazon	amazon.com/cloud
Apple	www.icloud.com

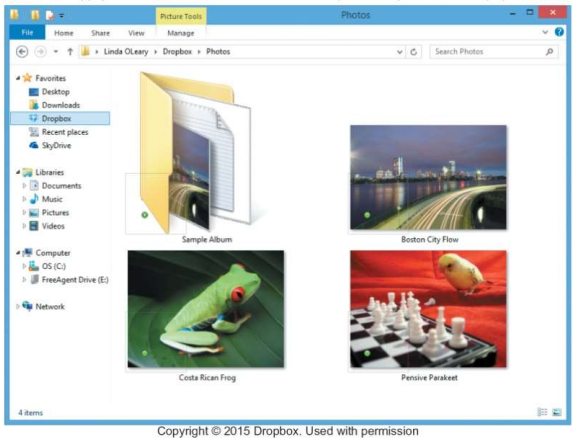
Making IT Work for You ~ Cloud Storage

Using a cloud storage service makes it easy to upload and share files with anyone.

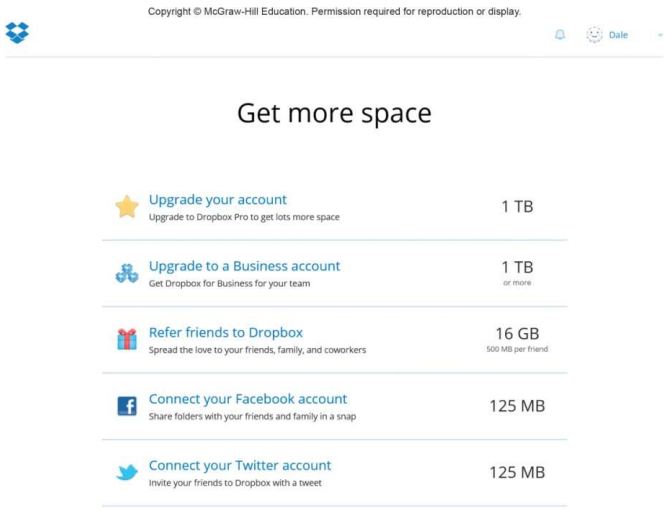
Starting Dropbox Step 1



Dropbox Step 2



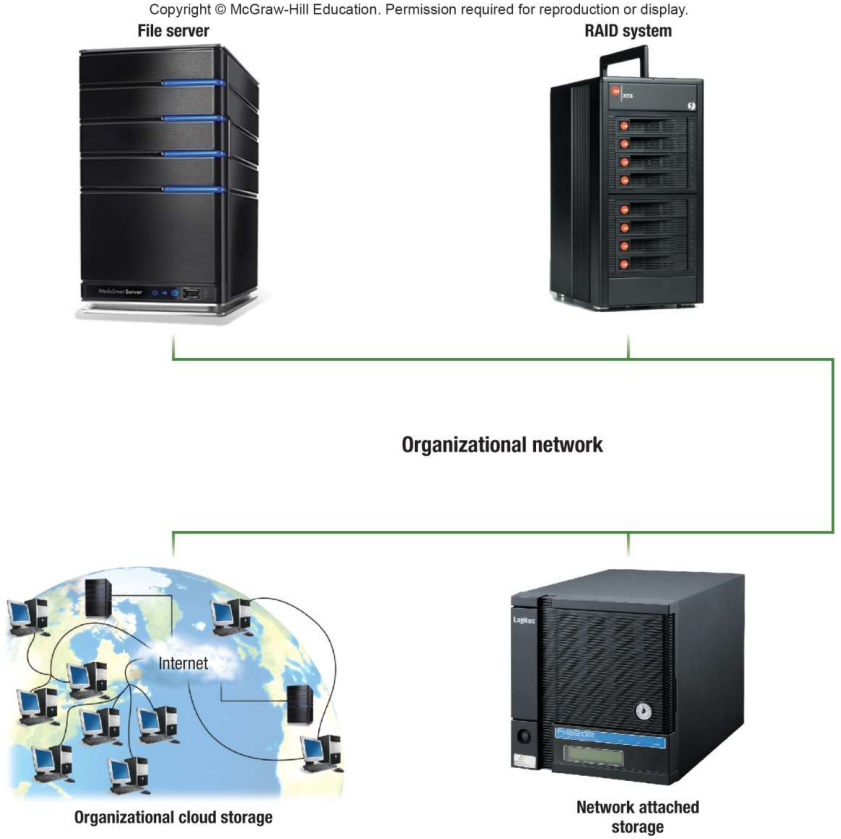
Sharing Dropbox



Mass Storage Devices

To meet the needs of organizations requiring large amounts of secondary storage requirements

- Enterprise storage system
  - Safe use of data across an organizational network
- Devices include:
  - File servers
  - Networked attached storage (NAS)
  - RAID systems
  - Organizational cloud storage



Storage Area Network (SAN)

- Architecture to link remote computer storage devices
  - Enterprise storage systems can be connected to
  - Computers to provide local system access
- User's computer provides file system, but SAN provides disk space
- House data in remote locations and still allow efficient and secure access

Careers In IT

- Disaster recovery specialists are responsible for recovering systems and data after a disaster strokes
- General employer requirements
  - Bachelors or associates degree in computer science or information systems
  - Experience in the field and skills in networking, security and DBA
  - Communication and skills and be able to handle high-sress situations
- Annual salary of $70 K to $88 K

A Look to the Future ~ Next Generation Storage

- At some point, hard drives will no longer be able to keep up
  - Looking at ways of increasing capacity without increasing size
  - Currently hard drive maxes out at 128 GB per square inch.
  - New technologies may advance this to 6.25 TG (6,250 GB) per square inch.

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Open-Ended Questions (Page 1 of 2)

1. Compare primary storage and secondary storage, and discuss the most important characteristics of secondary storage.

2. Discuss hard disks including density, platters, tracks, sectors, cylinders, head crashes, internal, external, and performance enhancements.

3. Discuss solid-state storage including solid-state drives, flash memory, and USB drives.

Open-Ended Questions (Page 2 of 2)

4. Discuss optical disks including pits, lands, CDs, DVDs, Blu-ray, and hi def.

5. Discuss cloud computing and cloud storage.

6. Describe mass storage devices including enterprise storage systems, file servers, network attached storage, RAID systems, organizational cloud storage, and storage area network systems.