



## **Storage**

**Objective:** *Compare and Contrast Storage Types.*

As we wrap up our look at the inner workings of a computer, let's take a deeper dive into the different types of storage used by computer systems. We've already discussed how computers need other types of storage for various purposes. There are two major categories of storage: volatile storage and non-volatile storage. In this lesson, we'll learn everything we need to know about the following topics:

- Volatile Vs Non-volatile
- Local Storage Types
- Local Networking Storage Types
- Cloud storage service

### **Volatile Storage**

Volatile storage is storage that is designed to be temporary. The most common example of volatile storage is the random-access memory RAM on the computer's motherboard. RAM is high-speed, but it's also relatively expensive. Ram contains all the data that a computer is actively working with. However, it is volatile storage, so the RAM contents are only there once the computer is turned on. If you turn it off, the contents of the RAM are erased when you turn it back on again. A typical desktop or laptop computer might have 8 to 32 gigabytes of RAM, but more powerful computers and services may have hundreds of gigabytes of RAM.

### **Non-Volatile storage**

Nonvolatile stores are just a fancy way to say permanent storage. Nonvolatile storage comes in many different forms, but the common characteristic they share is that once you write something to nonvolatile storage, it stays there until you delete it, even if you turn off the power.

We measure nonvolatile storage devices in two ways. First, we measure the total storage capacity of the device in bytes and the different multiples of bytes that you learned about earlier. It's common for a typical computer to have hard drives or solid-state drives that can store 500 GB, 1 TB, or more data. Second, we measured the speed at which storage devices can store and retrieve data. We measure this using a unit called input-output operations per second (IOPS).

### **Magnetic Hard Drives**



Some non-volatile storage is local to a computer system. We've already talked about the use of magnetic hard disk drives HDD. Magnetic drives provide inexpensive stores that is relatively slow. Magnetic hard drives contain platters of magnetic material that spin around very quickly inside the computer, where a head reads and writes magnetic charges to the disk. For this reason, magnetic hard drives are also commonly known as spinning disk drives.

### **Solid State Drives**

Solid-state drives (SSDs) are a modern replacement for magnetic drives. Instead of using spinning magnetic disks, they use stored electric charges and have no moving parts. This makes solid-state drives less likely to break and allows them to work more quickly than magnetic drives, but those benefits come with cost. Solid state drives are more expensive than magnetic drives.

### **USB Flash Drives**

Flash drives use the same technology as solid-state drives but in a removable form flash drives are fairly inexpensive but they have limited storage capacity when compared to solid-state drives.

### **Secure Digital Drives**

SD cards are a proprietary format of flash drives and have the distinctive appearance shown here. These cards are primarily used as storage for cameras, tablet computers, and other portable devices due to their small size.

### **Optical Drives**

Optical drives use lasers to encode data onto removable disk that may be stored separately from the computer system.

- Compact disc CD's were the original optical storage medium. Allowing the storage is up to 680 megabytes of data on a single disk.
- Digital video disc DVD's increase the density of storage allowing the storage of up to 17 gigabytes of data on a single disk
- Blu-ray disc DVD's have the highest capacity of any optical format allowing the storage of up to 128 gigabytes of data on a single disk.

There are different Types of each of these optical media:

- Read only disk are recorded at the factory and users may not change the data stored on them.
- Recordable disk allows users to write data to them, but that data is then permanently stored on the disk and may not be erased or modified.
- Rewritable disk are erasable and may be reused after recording data on them.



	<b>Compact Disc</b>	<b>Digital Video Disc</b>	<b>Blu-Ray Disc</b>
<b>Read Only</b>	CD-ROM	DVD	BD-ROM
<b>Recordable</b>	CD-R	DVD-R	BD-R
<b>Rewritable</b>	CD-RW	DVD-RW	RW

When optical drives read and write data to disk, they spin the disk rapidly in the drive and use a laser to read and write data. Therefore optical drives, like HDD's are examples of spinning disc media.

### **Enterprise Storage Services**

Organizations generally don't want to manage large quantities of removable media or store data on drives attached to individual computers. Instead they offer to have centralized enterprise storage services that store data in a single location where it can be accessed by many different users.

### **Cloud Storage**

Today, cloud storage services allow organizations to outsource storage using services provided by a vendor who manages those storage resources and makes them available to users wherever they reside.

### **File Servers**

Businesses that choose not to use cloud services may operate their own centralized storage services that meet the needs of their employees. They often do this by running a file server, which is just a computer with a lot of storage installed in it. The file server sits on the network, and users can access it from their computers.

Network-attached storage (NAS) systems are self-contained file servers that plug directly into a network to provide users with access to shared storage space.

File servers and other enterprise storage services use a technology called redundant arrays of inexpensive disk (RAID) to protect against disk failures. The general idea behind raid technology is that the server or NAS array writes the same data to multiple disks so that if a single disk fails, the data may still be retrieved.

**Remember this:**

- Volatile storage, such as RAM, retains its contents only while a device is powered on. Nonvolatile storage, such as HDDs, SSDs, and flash drives, retains contents permanently until the data is intentionally deleted or overwritten.
- Hard drives may be either magnetic hard drive disc (HDDs) which use spinning disk, or solid-state drives (SSDs) which have no moving parts.
- Optical media may be used to store data on a removable disk. Common optical media formats include CDs, DVDs and Blu-ray disc.

**Practice Question 1**

you are operating a computer system that will work near a medical device that uses strong magnetic fields to image body parts. What type of storage is most likely to be damaged by the presence of these magnetic fields?

- A. HDD
- B. DVD
- C. SSD
- D. CD

*To answer this question, you need to know which storage media uses magnetic fields to store data. Magnetic hard drives (HDDs) do this and would likely be damaged by the medical devices.*

*Solid-state drives (SSDs) use electricity, rather than magnetism, to store data and would be less likely to be damaged.*

*Compact discs (CDs) and digital video disc( DVDs) store data in optical form, which the presence of a magnetic field would not damage.*

**The correct answer is A: HDD**

**Practice Question 2**

Which of the following storage options is an example of volatile storage?

- A. NAS
- B. Flash
- C. BD-RW
- D. RAM



Volatile storage is storage that loses its data when it is powered off. Random access memory (RAM) is temporary storage used by a computer to store data that is currently in use and loses its data when powered off. Therefore, RAM is an example of volatile storage. Network-attached storage, NAS flash drives, and Blu-ray discs all retain data when power is removed. All of these are examples of nonvolatile storage. **The correct answer is D: RAM**



## Review

### 1. Types of Storage

- **Volatile Storage:**
  - Temporary storage, loses its data when power is off.
  - Example: **RAM** (Random Access Memory)
- **Non-Volatile Storage:**
  - Permanent storage, retains data even when power is off.
  - Examples: **HDDs, SSDs, USB Flash Drives, SD Cards, and Optical Discs** (CDs, DVDs, Blu-rays).

### 2. Volatile vs. Non-Volatile Storage

- **RAM (Volatile):**
  - Fast but temporary, used for active tasks.
  - Data is lost when the computer is powered off.
- **Non-Volatile:**
  - Retains data even when powered off, such as SSDs, HDDs, and flash memory.

### 3. Storage Technologies

- **Magnetic Hard Drives (HDDs):**
  - Use magnetic platters to store data.
  - Inexpensive but slow.
- **Solid-State Drives (SSDs):**
  - Use electrical charges to store data.
  - Faster than HDDs and more durable, but more expensive.
- **USB Flash Drives:**
  - Portable, uses solid-state technology.
  - Lower storage capacity compared to SSDs.
- **SD Cards:**
  - Small-sized, used in cameras and portable devices.
  - Uses flash memory.
- **Optical Discs:**
  - Use lasers to read/write data.
  - Types: CDs, DVDs, and Blu-ray discs.

### 4. Optical Media Types:

- **Compact Discs (CDs):** Up to 680 MB.
- **Digital Video Discs (DVDs):** Up to 17 GB.
- **Blu-ray Discs:** Up to 128 GB.
- **Read-Only Discs:** Cannot be altered (e.g., **CD-ROM**).



**Student Engagement &  
Mentoring in Technology**

- **Recordable Discs:** Data can be written once (e.g., **CD-R**).
- **Rewritable Discs:** Can be written, erased, and rewritten (e.g., **CD-RW**).

## **5. Enterprise Storage**

- **File Servers:**
  - Centralized storage used by organizations for multiple users.
- **Network-Attached Storage (NAS):**
  - Self-contained file server providing shared storage over a network.
- **Cloud Storage:**
  - Storage provided by third-party vendors, accessible from anywhere via the internet.
- **RAID (Redundant Array of Inexpensive Disks):**
  - Protects against disk failures by storing data across multiple disks.





Here are 10 multiple-choice questions and answers based on the information you provided about storage types:

**Question 1:**

Which of the following is an example of volatile storage?

- A. HDD
- B. SSD
- C. RAM
- D. DVD

**Answer: C. RAM**

Explanation: RAM is volatile storage, meaning it loses its data when the computer is powered off.

---

**Question 2:**

Which type of storage retains data even when the computer is turned off?

- A. RAM
- B. HDD
- C. CPU Cache
- D. Register

**Answer: B. HDD**

Explanation: HDDs are non-volatile storage devices that retain data even after power is turned off.

---

**Question 3:**

What does RAID technology do in enterprise storage systems?

- A. Increases the speed of data transfer
- B. Protects against data loss by storing data on multiple disks
- C. Reduces the cost of cloud storage
- D. Encrypts all data stored on the network

**Answer: B. Protects against data loss by storing data on multiple disks**

Explanation: RAID (Redundant Array of Inexpensive Disks) is used to prevent data loss by writing the same data to multiple disks.

---

**Question 4:**

Which of the following is an optical media type that can store up to 128 GB of data?

- A. CD-ROM
- B. DVD
- C. Blu-ray Disc
- D. USB Flash Drive

**Answer: C. Blu-ray Disc**

Explanation: Blu-ray discs have the highest capacity of any optical storage media, up to 128 GB.

**Question 5:**

Which of the following uses magnetic platters to store data?

- A. SSD
- B. RAM
- C. HDD
- D. SD Card

**Answer: C. HDD**

Explanation: HDDs use magnetic platters to store data, unlike SSDs which use electrical charges.

---

**Question 6:**

Which of the following is the correct hierarchy for the capacity of optical discs from least to greatest?

- A. CD < DVD < Blu-ray
- B. DVD < CD < Blu-ray
- C. Blu-ray < DVD < CD
- D. CD < Blu-ray < DVD

**Answer: A. CD < DVD < Blu-ray**

Explanation: CDs have the lowest capacity (up to 680 MB), DVDs have more (up to 17 GB), and Blu-ray discs have the highest (up to 128 GB).

---

**Question 7:**

What does the term "solid-state" in Solid-State Drive (SSD) mean?

- A. It has moving parts like HDDs
- B. It uses stored electrical charges and has no moving parts
- C. It stores data using optical lasers
- D. It requires magnetic fields to store data

**Answer: B. It uses stored electrical charges and has no moving parts**

Explanation: SSDs use electrical charges to store data and have no moving parts, making them faster and more durable than HDDs.

---

**Question 8:**

Which of the following storage types would be the most affected by strong magnetic fields?

- A. SSD
- B. DVD
- C. HDD
- D. Flash Drive

**Answer: C. HDD**

Explanation: HDDs use magnetic fields to store data, so they are susceptible to damage from external magnetic sources.

---

**Question 9:**

What is the primary difference between a CD-R and a CD-RW?

- A. CD-RW can be rewritten, while CD-R can only be written once
- B. CD-R can be rewritten, while CD-RW can only be written once
- C. CD-R has more storage capacity than CD-RW
- D. CD-R uses lasers, while CD-RW does not

**Answer: A. CD-RW can be rewritten, while CD-R can only be written once**

Explanation: CD-RW (Rewritable) discs allow data to be erased and rewritten, while CD-R (Recordable) discs only allow data to be written once.

---

**Question 10:**

Which of the following is an advantage of cloud storage services?

- A. Data is stored locally on your computer
- B. Files are accessible from any location with internet access
- C. Requires no network connection
- D. Data is always free to store

**Answer: B. Files are accessible from any location with internet access**

Explanation: Cloud storage allows users to access their data from anywhere via the internet, making it a flexible storage solution.



The primary memory used in the computer is known as a *main memory*, but often it's referred to as just *memory* or *random access memory*, Officials say (RAM). It's volatile, meaning it can only retain data while powered. The *random access* part of RAM means that any arbitrary memory location can be accessed in roughly the same amount of time as any other location.

Nearly every computer has some type of secondary storage, usually a hard disk drive, HDD, or a solid-state drive, SSD. Such devices are effectively containers of bits that can be read and written and where data persists, even when the system is powered down. Storage devices are divided into regions called partitions. Operating systems implement file systems to organize the data on storage devices into files and directories. A partition must be formatted with a particular file system before the operating system can use it. Different operating systems use different file systems. Linux commonly uses the EXT extended family of file systems E XT2, E X T3, E XT 4. In contrast, In 2 minutes Windows uses FAT (*fat allocation table*) and NTFS, (NT file system). Some operating systems present storage as a *volume*, a logical abstraction built on one or more partitions. In such systems, file systems can reside on the volume rather than on the partition.

<https://youtu.be/lm01uM-pGjE?si=BE6W3vnWPCzE7jws>

**Volatile Memory Vs Non Volatile Memory | What Is The Difference?**

<https://youtu.be/BHj81z5QQc4?si=WwHzfs6Hj86oj042>

**Evolution of Data Storage Devices**

[https://youtu.be/qQYiwмамq38?si=\\_YaCy\\_TV1Ewbi390](https://youtu.be/qQYiwмамq38?si=_YaCy_TV1Ewbi390)

**Cable vs DSL vs Fiber Internet Explained**