Storage Devices Cheatsheet

A quick reference guide to different types of computer storage devices, their characteristics, and common uses. Covers primary and secondary storage, as well as key concepts.

Primary Storage (Main Memory)

RAM (Random Access Memory)

Definition	Volatile memory used to store data and instructions that the CPU is actively using. Data is lost when power is off.
Types	DRAM (Dynamic RAM), SRAM (Static RAM), SDRAM (Synchronous DRAM), DDR SDRAM (Double Data Rate SDRAM)
Characteristics	Fast access speeds, but limited storage capacity compared to secondary storage.
Use Case	Used for running applications, operating system processes, and temporary data storage.
Volatility	Volatile (data is lost when power is removed).
Cost	More expensive per unit of storage compared to secondary storage.

ROM (Read-Only Memory)

Definition	Non-volatile memory that stores firmware and boot instructions. Data is retained when power is off.
Types	PROM (Programmable ROM), EPROM (Erasable PROM), EEPROM (Electrically Erasable PROM), Flash Memory
Characteristics	Slower access speeds compared to RAM, but data is permanent.
Use Case	Stores the BIOS (Basic Input/Output System) and other essential system software.
Volatility	Non-volatile (data is retained when power is removed).
Cost	Less expensive per unit of storage compared to RAM.

Cache Memory

Definition	Small, fast memory used to store frequently accessed data, improving performance.
Types	L1 Cache, L2 Cache, L3 Cache
Characteristics	Very fast access speeds, but very limited storage capacity and high cost.
Use Case	Reduces the average time to access memory by storing frequently used data closer to the CPU.
Volatility	Volatile (data is lost when power is removed).
Cost	Most expensive per unit of storage.

Secondary Storage (External Memory)

Hard Disk Drive (HDD)

Definition	Mechanical storage device that stores data on rotating magnetic platters.
Characteristics	High storage capacity, relatively low cost per gigabyte, slower access speeds compared to SSDs.
Interface	SATA (Serial ATA), IDE (Integrated Drive Electronics), SAS (Serial Attached SCSI)
Use Case	Storing large files, operating systems, applications, and backups.
Volatility	Non-volatile (data is retained when power is removed).
Access Time	Measured in milliseconds (ms).

Solid State Drive (SSD)

Definition	Storage device that uses flash memory to store data, offering faster access times and greater durability compared to HDDs.
Characteristics	Faster access speeds, lower latency, more durable, silent operation, but higher cost per gigabyte compared to HDDs.
Interface	SATA (Serial ATA), NVMe (Non-Volatile Memory Express)
Use Case	Operating system installation, applications requiring fast load times, and high-performance computing.
Volatility	Non-volatile (data is retained when power is removed).
Access Time	Measured in microseconds (µs).

USB Flash Drive

Definition	Portable storage device that uses flash memory and connects to a computer via USB.
Characteristics	Small, portable, durable, but limited storage capacity compared to HDDs and SSDs.
Interface	USB (Universal Serial Bus) 2.0, 3.0, 3.1, 3.2
Use Case	Transferring files between computers, storing backups, and booting operating systems.
Volatility	Non-volatile (data is retained when power is removed).
Sizes	Vary from a few gigabytes to several hundred gigabytes.

Other Storage Technologies

Optical Discs

Definition	Storage media that uses lasers to read and write data.
Types	CD (Compact Disc), DVD (Digital Versatile Disc), Blu-ray Disc
Characteristics	Lower storage capacity compared to HDDs and SSDs, but durable and portable.
Use Case	Storing music, movies, software, and backups.
Volatility	Non-volatile (data is retained when power is removed).
Read/Write	Can be read-only (ROM), recordable (R), or rewritable (RW).

Magnetic Tape

Definition	Sequential access storage medium that stores data on a magnetic tape.
Characteristics	High storage capacity, low cost per gigabyte, but very slow access speeds due to sequential access.
Use Case	Archiving large amounts of data, backups, and disaster recovery.
Volatility	Non-volatile (data is retained when power is removed).
Access Method	Sequential (data must be accessed in order).
Format	LTO (Linear Tape-Open), DDS (Digital Data Storage)

Cloud Storage

Definition	Off-site storage maintained by a third party and accessed over the internet.
Characteristics	Scalable, accessible from anywhere, but relies on network connectivity and third-party security.
Use Case	Storing files, backups, and applications; sharing data across multiple devices; and collaboration.
Volatility	Non-volatile (data is retained when power is removed, but depends on the provider).
Examples	Amazon S3, Google Cloud Storage, Microsoft Azure Blob Storage
Access	Accessed via the internet using APIs or web interfaces.

Storage Concepts and Interfaces

RAID (Redundant Array of Independent Disks)

Definition	A data storage virtualization technology that combines multiple physical disk drive components into one or more logical units for data redundancy, performance improvement, or both.
Common RAID Levels	RAID 0 (striping), RAID 1 (mirroring), RAID 5 (striping with parity), RAID 10 (RAID 1+0)
Use Case	Improving data reliability, increasing storage capacity, and enhancing performance.
Benefits	Increased fault tolerance, improved read/write speeds.
Considerations	Requires a RAID controller (hardware or software).

Storage Interfaces

SATA (Serial ATA)	Common interface for connecting HDDs and SSDs to the motherboard. Offers faster data transfer rates than IDE.
NVMe (Non-Volatile Memory Express)	Interface protocol designed specifically for SSDs, providing much higher performance than SATA. Uses the PCI Express bus.
SAS (Serial Attached SCSI)	Enterprise-level interface for connecting HDDs and SSDs. Offers higher reliability and performance than SATA.
USB (Universal Serial Bus)	Versatile interface for connecting external storage devices such as USB flash drives and external hard drives.
PCIe (Peripheral Component Interconnect Express)	High-speed interface used for connecting high-performance devices such as NVMe SSDs and graphics cards.

File Systems

Definition	A method of organizing and storing files on a storage device. Provides a way to manage files, directories, and metadata.
Common File Systems	NTFS (Windows), APFS (macOS), ext4 (Linux), FAT32 (cross-platform)
Key Features	File naming conventions, directory structures, permissions, and metadata storage.
Journaling	A feature of some file systems that helps to prevent data corruption by logging changes before they are written to the disk.
Fragmentation	A phenomenon where files are stored in non-contiguous blocks on the disk, which can slow down access times. Defragmentation can help improve performance.