LINUX STORAGE

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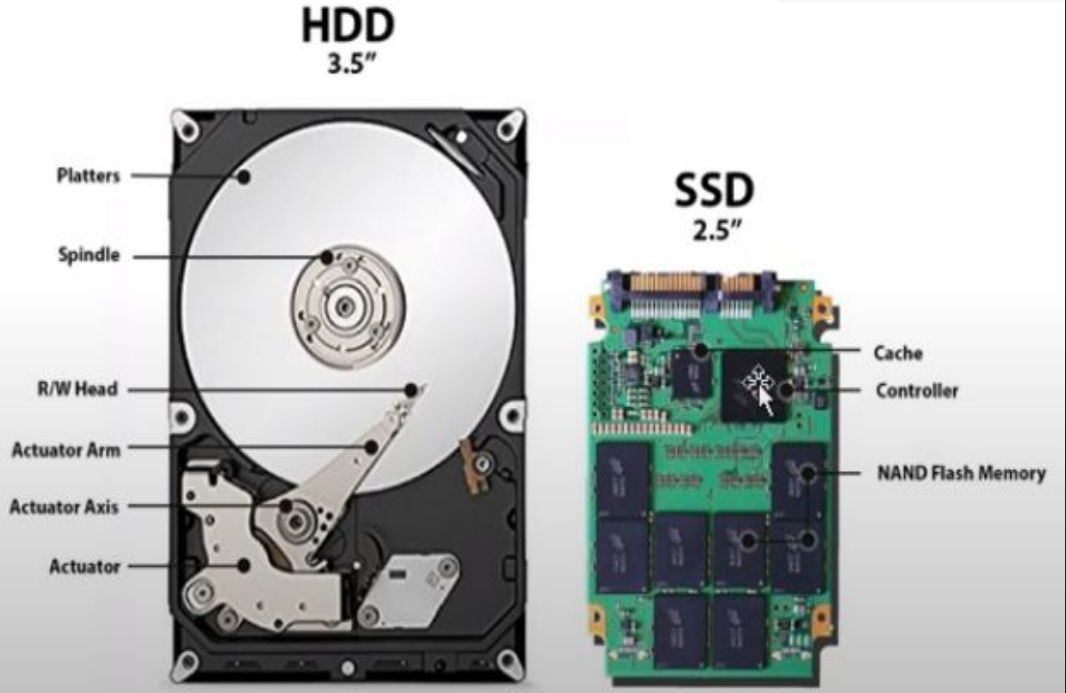
HDD – Traditional way Of storage.

SSD – Modern way of Storage.

SSD has higher performance than HDD.



IOPS vs Throughput

Hard Drive Storage performance is evaluated its IOPS

IOPS means → Input Output Per Second
Throughput means → How much data can handle in seconds.

EBS SSD storage types categorized based on its IOPS capacity

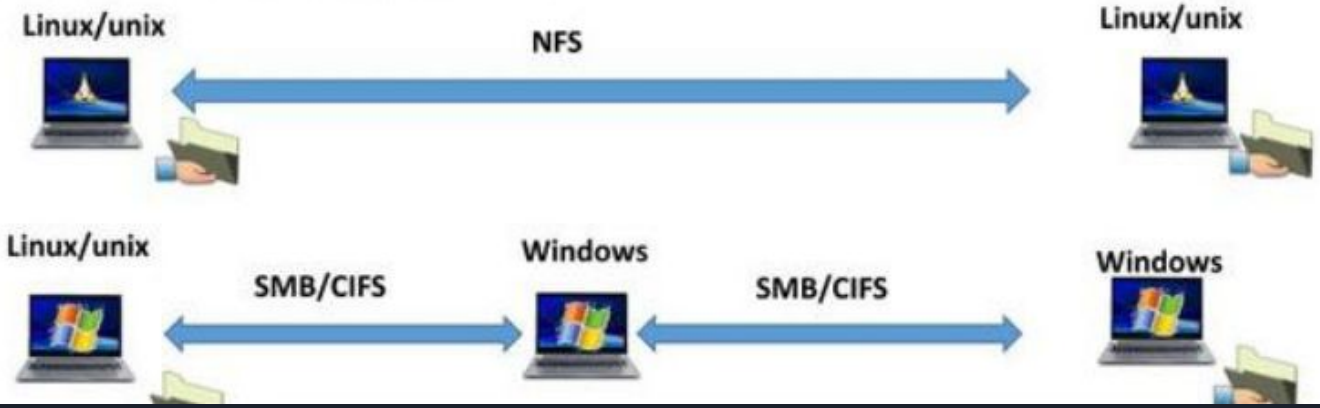
EBS HDD storage types categorized based on its throughput capacity

- **Direct-attached storage (DAS)**

  Direct-attached storage (DAS) is attached directly to the computer system mother board connectors or through usb. Examples of DAS include hard drives, CDROM/DVD , external hard drives, optical disc drives, pendrive etc.

  Amazon provide these facility through **EBS (Elastic Block Storage service)**

- **Network-attached storage (NAS)**
  - NAS uses file-based protocols for sharing folders using NFS for Linux/UNIX, SMB/CIFS for windows.
  - It is a shared folder over the network.
  - Amazon provide these facility through **EFS (Elastic File system)** service.
  - A shared folder cannot be formatted.



- **Storage Area Network (SAN)**

  A storage-area network (SAN) is a dedicated high-speed network block level data storage, It can be formatted.

  It provide shared pools of storage devices to multiple servers in the form of LUN.

  Fiber cable, bus adapters (HBAs) and fiber switches are used to provide SAN storage.

  ISCSI target make use of normal network over cat5/6 cables to provide LUN over SAN storage.

Filesystems: Linux uses various file systems to organize and manage data on storage devices. Common file systems include ext4, XFS, Btrfs, and others. Each filesystem has its own features and performance characteristics.

Logical Volume Manager (LVM): LVM allows for more flexible management of storage by providing an abstraction layer between physical storage devices and the filesystem. It allows for resizing, snapshots, and dynamic volume management.

RAID (Redundant Array of Independent Disks): RAID allows multiple disks to be combined into a single logical unit, providing enhanced performance, redundancy, or both. Various RAID levels offer different features like data mirroring, striping, and parity.

Cloud Storage: Cloud-based storage solutions like Amazon S3, Google Cloud Storage, or Microsoft Azure Blob Storage can be accessed and utilized by Linux systems to store and retrieve data over the internet.

Commands

df: The `df` command displays the amount of disk space used and available on file systems. **`df -h`** displays disk space usage in a human-readable format with sizes in megabytes (MB) or gigabytes (GB).

du: The `du` command is used to estimate the disk space used by files and directories. For example, **`du -sh /path/to/directory`** shows the total size of the directory in a human-readable format.

lsblk: The `lsblk` command lists information about block devices, such as hard drives and SSDs, and their partitions. For example, **`lsblk`** **or `lsblk -f`** provides a concise overview of block devices and their file system types.

Attributes

NAME: The device name, which represents the block device or partition name (e.g., `/dev/sda`, `/dev/sdb1`).

MAJ:MIN: The major and minor device numbers associated with the block device or partition.

RM: Indicates whether the device is removable or not. "0" represents a non-removable device, while "1" indicates a removable device.

SIZE: The total size of the block device or partition, usually displayed in bytes.

MOUNTPOINT: The mount point where the file system is mounted. If the device is not mounted, this column will be empty.

LOOP Devices?

Mounting Disk Images: Loop devices allow you to mount disk images, such as ISO files or disk image files, as if they were physical disks.

Software Development and Testing: Loop devices are beneficial for software development and testing scenarios.

Virtual Machine Disk Images: Loop devices are frequently used to mount virtual machine disk images. This allows you to inspect and modify the contents of the virtual disk, extract files, or perform maintenance tasks on virtual machine storage without launching the virtual machine itself.

Linux File System

File system is responsible for organizing and managing files, directories, and metadata on storage devices. The file system provides a structure and set of operations for creating, reading, writing, and deleting files, as well as managing permissions and access control.

Ext4, XFS, NTFS, F2FS, ISO 9660 etc.

Mounting

Mounting involves attaching a file system to a specific directory in the Linux file system hierarchy, known as the mount point. By mounting a partition or a storage device, you make its contents accessible to the system and users. The `mount` command is used to mount partitions or network file systems.

Mounting

Mounting a Partition: To mount a partition, you need to specify the partition device file and the mount point. For example, `mount /dev/sda1 /mnt` mounts the partition `/dev/sda1` to the directory `/mnt`.

Automounting: To automatically mount a partition at boot time, you can add an entry to the `/etc/fstab` file. This file contains information about partitions and their mount options. The `mount -a` command can be used to mount all partitions listed in `/etc/fstab`.

Unmounting: To safely remove a mounted file system, the `umount` command is used. For example, `umount /mnt` unmounts the file system mounted at `/mnt`. It is important to unmount partitions before disconnecting or modifying the storage device.

Partitioning

Partitioning involves dividing a storage device into separate sections called partitions. Each partition can be treated as an independent storage unit with its own file system. Partitioning allows for better organization, efficient space allocation, and the ability to have multiple operating systems or different file systems on the same device. Common partitioning tools in Linux include **`fdisk`**, **`parted`**, and `gdisk`.

Partitioning

fdisk: The `fdisk` command is a widely used partitioning tool. It allows you to create, delete, and modify partitions on a storage device. For example, `fdisk /dev/sda` opens the `fdisk` utility for the device `/dev/sda`.

parted: `parted` is another popular partitioning tool that provides more advanced features and supports newer disk technologies. It offers a user-friendly interface and allows operations such as creating, resizing, and moving partitions. For example, `parted /dev/sda` opens the `parted` utility for the device `/dev/sda`.

Sudo fsdisk /dev/sda

Sector Size: A disk stores data in small, fixed-size units called sectors. In this case, each sector on the disk is 512 bytes in size. This means that the disk divides its storage space into chunks of 512 bytes, and data is read from or written to the disk in these 512-byte increments.

I/O Size: I/O (Input/Output) size refers to the data transfer size between the disk and the system.

- Minimum I/O size: 512 bytes - This means that the smallest amount of data that the disk can efficiently read or write at a time is 512 bytes.

- Optimal I/O size: 512 bytes - This indicates that the disk performs most effectively when reading or writing data in 512-byte chunks.

Partition Doc