Storage Basics

- Storage is a term used for the components of a digital device designed to hold data permanently.
- A data storage system has two main components: a storage medium and a storage device
  - Storage medium – the hard drives, CDs, DVDs, flash drives, solid-state drives, and memory cards that contains data
  - Storage device – The mechanical apparatus that records and retrieves data from a storage medium
  - Each storage technology has its advantages and disadvantages, so review its durability, dependability, speed, capacity, and cost before buying.

Storage Basics – Durability

- Durability is the resistance to damage from handling and environmental factors such as dust, humidity, heat, and cold. –
- Can be measured in lifespan or in write cycles (the number of times data can be written and revised).

Storage Basics - Speed

- Speed is the rate at which data can be stored or accessed. Faster is better.

- Can be measured by data transfer rate (the number of megabytes per second that are read or written by the storage device).

Storage Topologies

1. **Parallel Topologies**
2. **Serial storage topologies**
3. **Device topologies**
    - **Hard Drives**
    - **Bridging Devices**

- **Parallel Topologies :-** As the Small Computer System Interface sidebar indicates, this popular architecture supports most modern storage formats, regardless of the connection or transport topology used. Because systems can easily package and transport SCSI commands, delivered in command descriptor blocks (CDBs), across many mediums, they can link multiple devices to various types of buses.

- **Serial storage topologies :-** Serial transports have provided access to storage on servers since the advent of networking. Although network-attached storage (NAS) is a fairly new term, most major PC and server operating systems have provided shared data storage for quite some time.

- **Device Topologies :-** Hard drives, CD-ROMs, tape drives, and other fixed-connectivity devices have little life past their original topology. The storage industry has expended much effort ensuring that customers who have purchased a device cannot easily move it to a new deployment when technology changes.

- **Hard drives :-** ATA drives, currently only available in parallel form, do not allow attachment outside the servers or boxes where the connections exist. This limitation forces any ATA drive deployment into a bridged, or protocol-converted, operation for use as an external storage topology—an increasingly common practice in departmental and enterprise storage deployments.

- **Bridging Devices :-** For PCs, protocol conversion aims to expand the base of existing products for particular manufacturers rather than address problems with device sharing. No practical applications exist for sharing storage devices on PC platforms, as the entry cost for individual storage devices is low enough to allow a separate purchase decision.

What is storage area network (SAD)

A storage area network (SAN) is a dedicated network that is tailored to a specific environment-combining servers, storage systems, networking switches, software and services.

Why Storage area network are important

Computer memory and local storage resources might not provide enough storage, storage protection, multiple-user access, or speed and performance for enterprise applications.

SAN vs NAS

Storage Area Network (SAN) is used for transferring the data between the servers and the storage devices' fiber channels and switches. In SAN (Storage Area Network), data is identified by disk block. Protocols that are used in SAN are SCSI (Small Computer System Interface), SATA (Serial Advanced Technology Attachment), etc.

Network Attached Storage (NAS) data is identified by file name as well as byte offset. In-Network Attached Storage, the file system is managed by Head units such as CPU and Memory. In this for backup and recovery, files are used instead of the block-by-block copying technique.

SAN	NAS
SAN stands for Storage Area Network.	NAS stands for Network Attached Storage.
In SAN (Storage Area Network), data is identified by disk block.	In NAS (Network Attached Storage), data is identified by file name as well as byte offset.
In SAN (Storage Area Network), the file system is managed by servers.	In NAS (Network Attached Storage), file system is managed by Head unit.
SAN (Storage Area Network) is more costly.	NAS (Network Attached Storage) is less expensive than SAN.
SAN(Storage Area Network) is more complex than NAS.	NAS (Network Attached Storage) is less complex than SAN.

What is RAID (Redundant Arrays of Independent Disks)

RAID is a technique that makes use of a combination of multiple disks instead of using a single disk for increased performance, data redundancy, or both. The term was coined by David Patterson, Garth A. Gibson, and Randy Katz at the University of California, Berkeley in 1987.

Different RAID Levels

1. RAID-0 (Stripping)
2. RAID-1 (Mirroring)
3. RAID-2 (Bit-Level Stripping with Dedicated Parity)
4. RAID-3 (Byte-Level Stripping with Dedicated Parity)
5. RAID-4 (Block-Level Stripping with Dedicated Parity)
6. RAID-5 (Block-Level Stripping with Distributed Parity)
7. RAID-6 (Block-Level Stripping with two Parity Bits)

1. RAID-0 (Stripping)

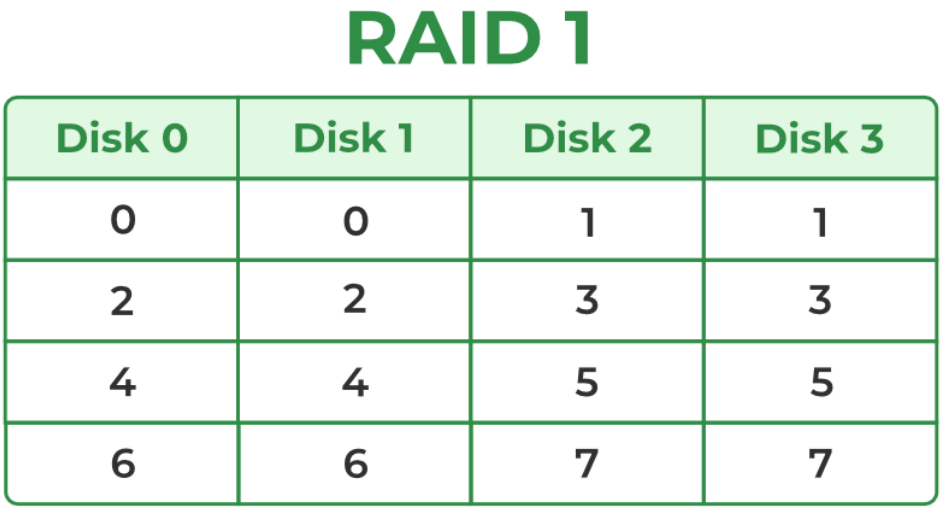
- Blocks are “stripped” across disks.

RAID 0

Disk 0	Disk 1	Disk 2	Disk 3
0	1	2	3
4	5	6	7
8	9	10	11
12	13	14	15

2. RAID-1 (Mirroring)

- More than one copy of each block is stored in a separate disk. Thus, every block has two or more)copies, lying on different disks.



RAID-3 (Byte-Level Stripping with Dedicated Parity)

- It consists of byte-level striping with dedicated parity striping.
- At this level, we store parity information in a disc section and write to a dedicated parity drive.
- Whenever failure of the drive occurs, it helps in accessing the parity drive, through which we can reconstruct the data.

RAID 3

Disk 0	Disk 1	Disk 2	Disk 3
15	16	17	P(15, 16, 17)
18	19	20	P(18, 19, 20)
21	22	23	P(21, 22, 23)
24	25	26	P(24, 25, 26)

What is Disk Management

The range of services and add-ons provided by modern operating systems is constantly expanding, and four basic operating system management functions are implemented by all operating systems. These management functions are briefly described below and given the following overall context. The four main operating system management functions (each of which are dealt with in more detail in different places) are:

- Process Management
- Memory Management
- File and Disk Management
- I/O System Management

Window Dynamic Disk

Dynamic Disk is one of hard drive configurations that most commonly used in Windows systems. You can convert a basic disk to dynamic disk. On a basic disk, the storage space will be divided into one or multiple partitions to keep data, while a dynamic disk sets several segments called "volume" to store data.