RAID:

RAID – Redundant Array of Independent Disks

- The storage which we are used in laptop computers are single disk but in servers, data centers, cloud computing we used multiple disk, means RAID technology.
- RAID saves data in multiple disk.
- RAID is a set of multiple hard disk, which are in the network.
- As additional memory in form of cache, can improve system performance, in the same way additional disks can also improve system performance.
- In RAID, we use an array (multiple) of disks. These disks operate independently.
- Since there are many disks, separate and multiple I/O requests can be handled in parallel if the data required is on separate disks.
- A single I/O operation can be handled in parallel if the data required is distributed across multiple disks

Benefits of RAID:

- RAID technology prevents data loss due to disk failure.
- RAID technology can be implemented in hardware or software.
- Servers make use of RAID technology.
- To prevent fail of Operating system RAID technology is beneficial.

RAID TECHNOLOGY:

There are 7 levels of RAID schemes.

They are-

1. RAID 0,
2. RAID 1,
3. RAID 2,
4. RAID 3,
5. RAID 4,
6. RAID 5,
7. RAID 6.

Out of above 7 RAIDs, RAID Level 2, 3 and 4 are much complicated and outdated.
RAIDs 0,1,5 and 6 are used in servers now a days.

The common characteristic in all these levels is:

- A set of physical disk drives.
- The operating system views these separate disks as a single logical disk.
- Data is distributed across the physical drives of the array.
- Redundant disk capacity is used to store parity information.
- Parity information can help in recovering data in case of disk failure

PARITY CHECK: A parity check is the process in which accurate data transmission between nodes during communication is checked.

HOW TO PARITY CHECK:

1. A parity bit is appended to the original data bits to create an even or odd bit number; the number of bits with value one.
2. The source then transmits this data via a link to the destination.
3. Transferred bits are checked and verified at the destination.
4. If number of bits at destination are same as the number of bits at source than data is considered as accurate.

RAID Level 0:

- RAID 0 implementation requires minimum 2 disks.
- There is no redundancy in RAID 0.
- RAID level 0 divides data into block units and writes them across a number of disks.
- As data is placed across multiple disks, it is also called “data striping”.
- There is no parity checking of data.
- So if data in one drive gets corrupted then all the data would be lost. Thus RAID 0 does not support data recover.
- Spanning is another term that is used with RAID level 0 because the logical disk will span all the physical drives.

RAID Level 0- Advantages:

- Data process is very fast.

- Throughput (speed) is increased because :
    - Multiple data requests probably not on same disk.
    - Disks seek in parallel.
    - A set of data is likely to be striped across multiple disks.
- Implementation is easy.
- No overhead of parity calculation

RAID Level 0 –Disadvantages.

- Not provide fault tolerant.
- The failure of just one drive will result in all data in an array being lost.
- Should not be used in mission critical environments
- No backup facility.

RAID LEVEL 1:

- The other name of RAID Level 1 is “mirroring” as it copies data onto two disk drives simultaneously.
- Minimum two hard disk are required.
- As same data is placed on multiple disks, it is also called “data mirroring”
- No striping its uses on mirroring.
- The automatic duplication of the data means there is little likelihood of data loss or system downtime.
- Data striping is used as in RAID 0, but in RAID 1 each logical strip is mapped to two separate physical drives
- Thus every disk in the array has a mirror disk that contains the same data
- Data can be read from either disk but is written on both disks
- A read request can be executed by either of the two disks
- A write request means that both the disks must be updated. This can be done in parallel
- There is no overhead of storing parity information
- Recovery from failure is simple. If one drive fails we just have to access data from the second drive
- Generally RAD 1 is used for Operating system.

RAID Level 1 – Advantages:

- Main advantage is RAID 1 provides fault tolerance.

- Provides data redundancy.
- If one disk fails, the other automatically takes over, so continuous operation is maintained.
- RAID 1 is used to store systems software (such as drivers, operating systems, compilers, etc) and other highly critical files.

RAID Level 1 – Disadvantages:

- Main disadvantage is cost. Since data is duplicated, storage costs increase.

RAID Level 2:

- In RAID 2 mechanism, all disks participate in the execution of every I/O request.
- The spindles of individual disk drives are synchronized so that each disk head is in the same position on each disk at any given time.
- Data striping is used.
- Error correcting code is also calculated and stored with data
- Not implemented in practice due to high costs and overheads

RAID Level 3:

- RAID 3 required minimum 3 disk.
- RAID 3 perform Byte-level striping with dedicated parity.
- Data is divided into byte units and written across multiple disk drives.
- Parity information is stored for each disk section and written to a dedicated parity drive.
- All disks can be accessed in parallel Data can be transferred in bulk. Thus high speed data transmission is possible
- In case of drive failure, the parity drive is accessed and data is reconstructed from the remaining devices.
- Once the failed drive is replaced, the missing data can be restored on the new drive
- RAID 3 can provide very high data transfer rates

RAID Level 4:

- RAID Level 4 is same as RAID Level 3.
- RAID 4 required minimum 3 disk.
- RAID 4 perform block-level striping with dedicated parity.

RAID Level 5:

- RAID 5 is very important RAID, which is used in servers, datacenters or large computing centers.
- RAID 5 required minimum 3 disk.
- RAID 5 perform Byte-level striping with distributed parity.
- RAID 5 include striping and mirroring.
- Minimum 3 hard disk are required in RAID 5.
- 1 hard disk is used to store parity bits, when data gets corrupted.
- RAID 5 also do error checking which is also known as parity checking.

How RAID 5 do error checking?
When data in a disk gets corrupted or errored, than what the content that errored hard disk contain gets copied into the new hard disk, which we replaced.

RAID Level 6:

- RAID 6 is same concept of RAID 5, but its have a extra parity bit storage than RAID 5.
- RAID 6 required minimum 4 disk.
- RAID 6 perform Byte-level striping with double distributed parity.
- In RAID 6, backup of parity storage will get store in another storage too. That means there are 2 parity backup

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