# System Administration
# Session - 3

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# RAID

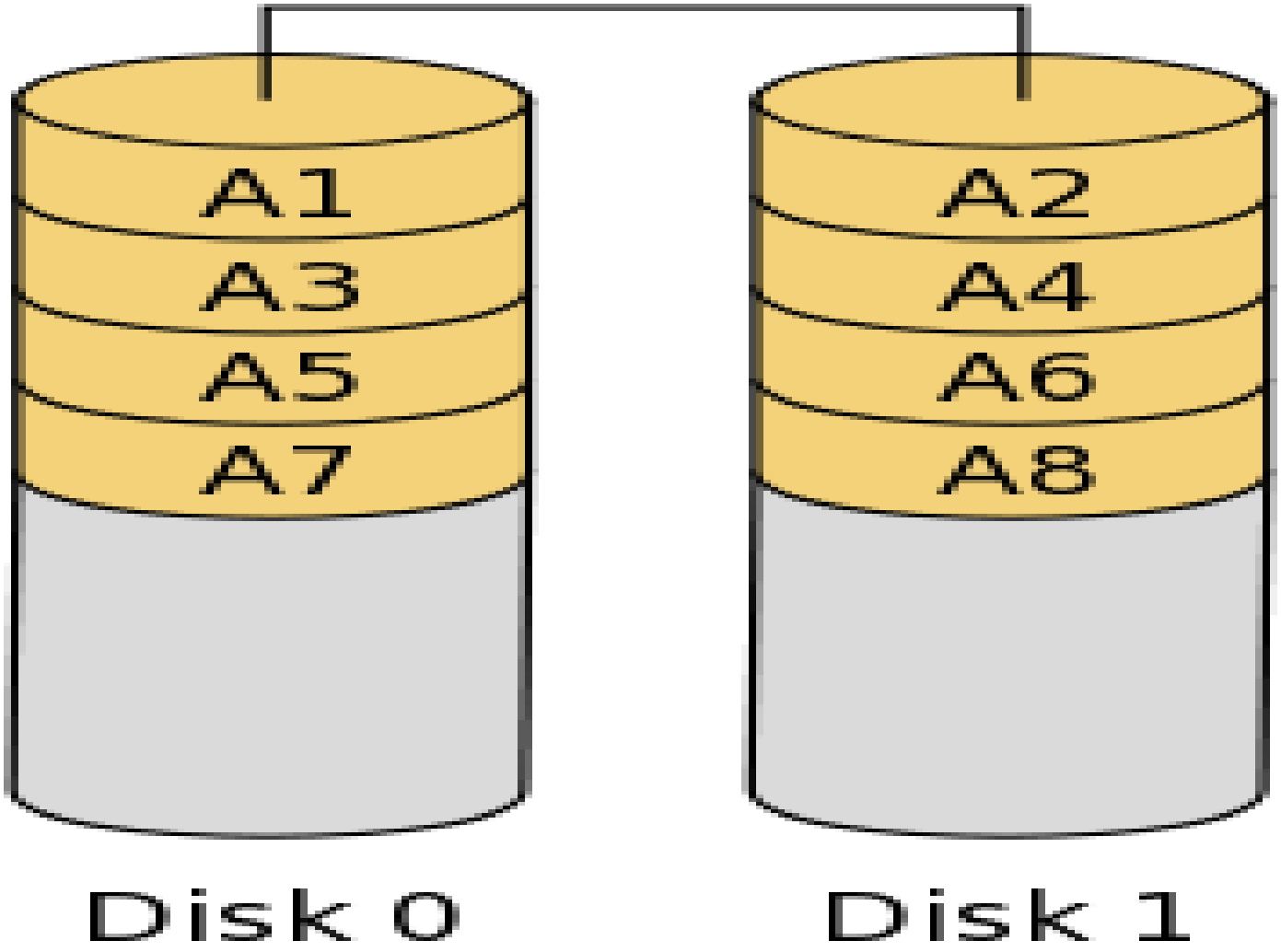
# RAID

- Redundant Array of Independent Disks (Changed from its original term Redundant Array of Inexpensive Disks).
- A technology that provides increased storage functions and reliability through redundancy.
- Achieved by combining multiple disk drive components into a logical unit, where data is distributed across the drives in one
- of several ways called "RAID levels".

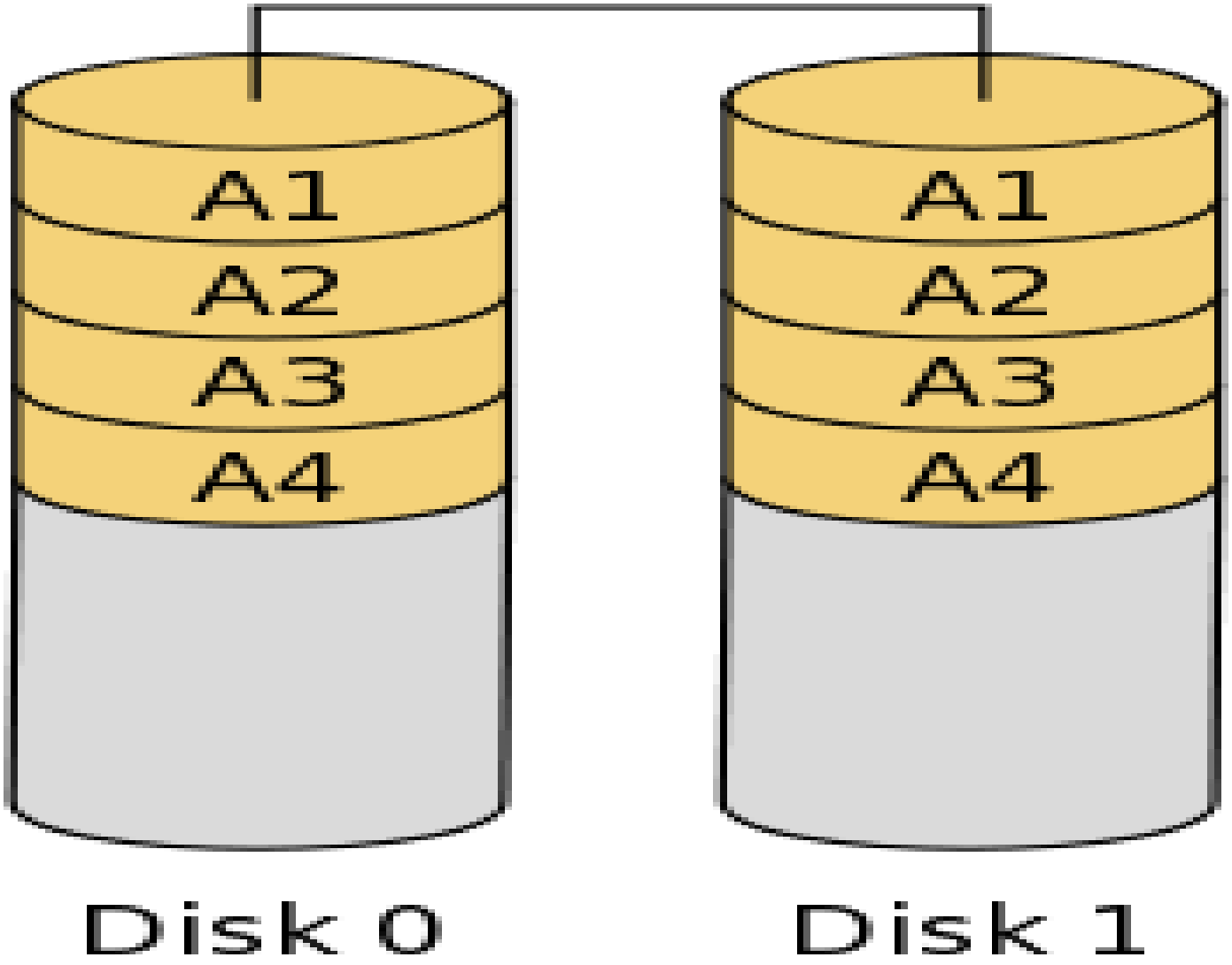
# RAID

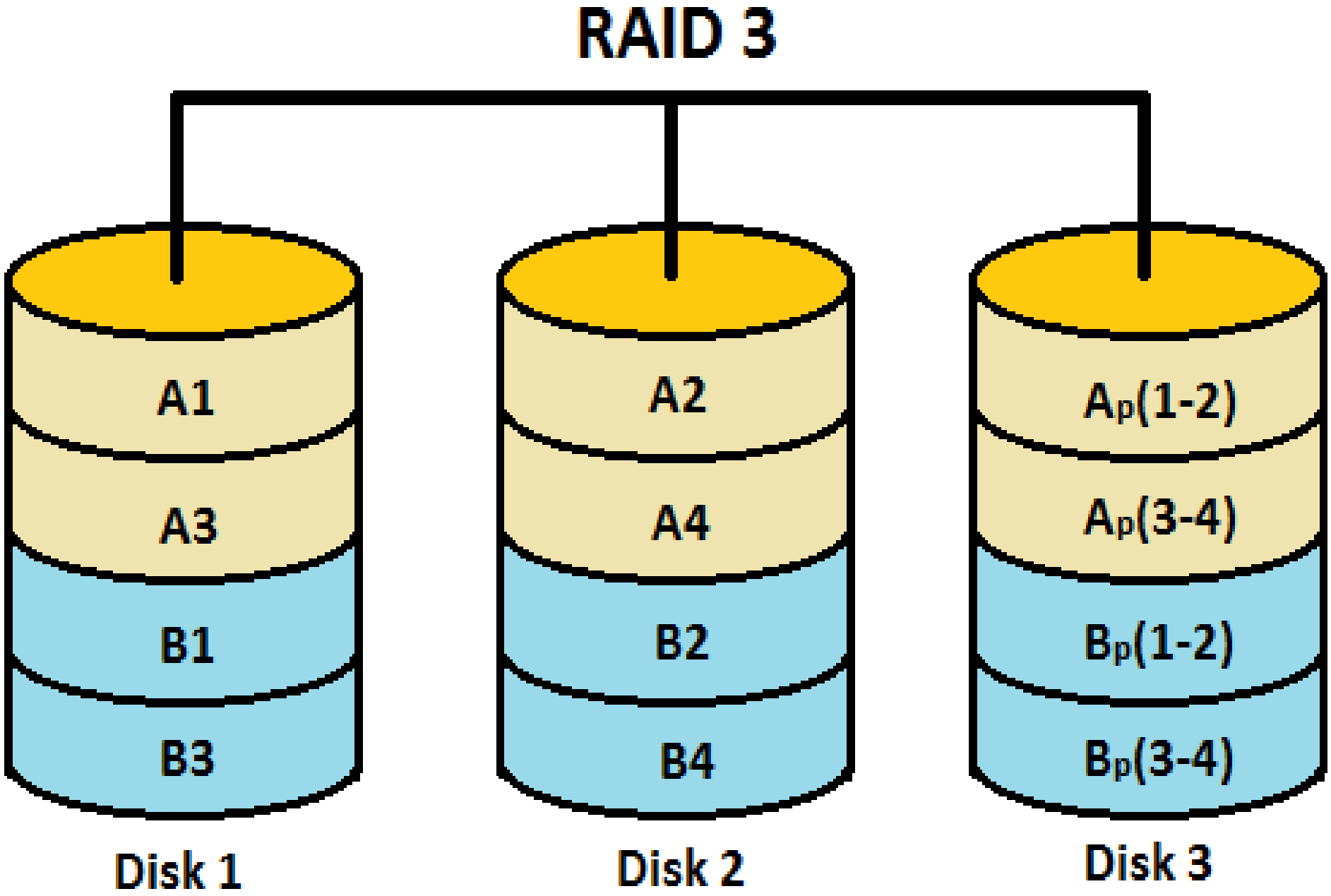
- RAID is now used for computer data storage schemes that can divide and replicate data among multiple physical disk drives, are said to be in a RAID array, which is addressed by the operating system as one single disk.

# RAID 0

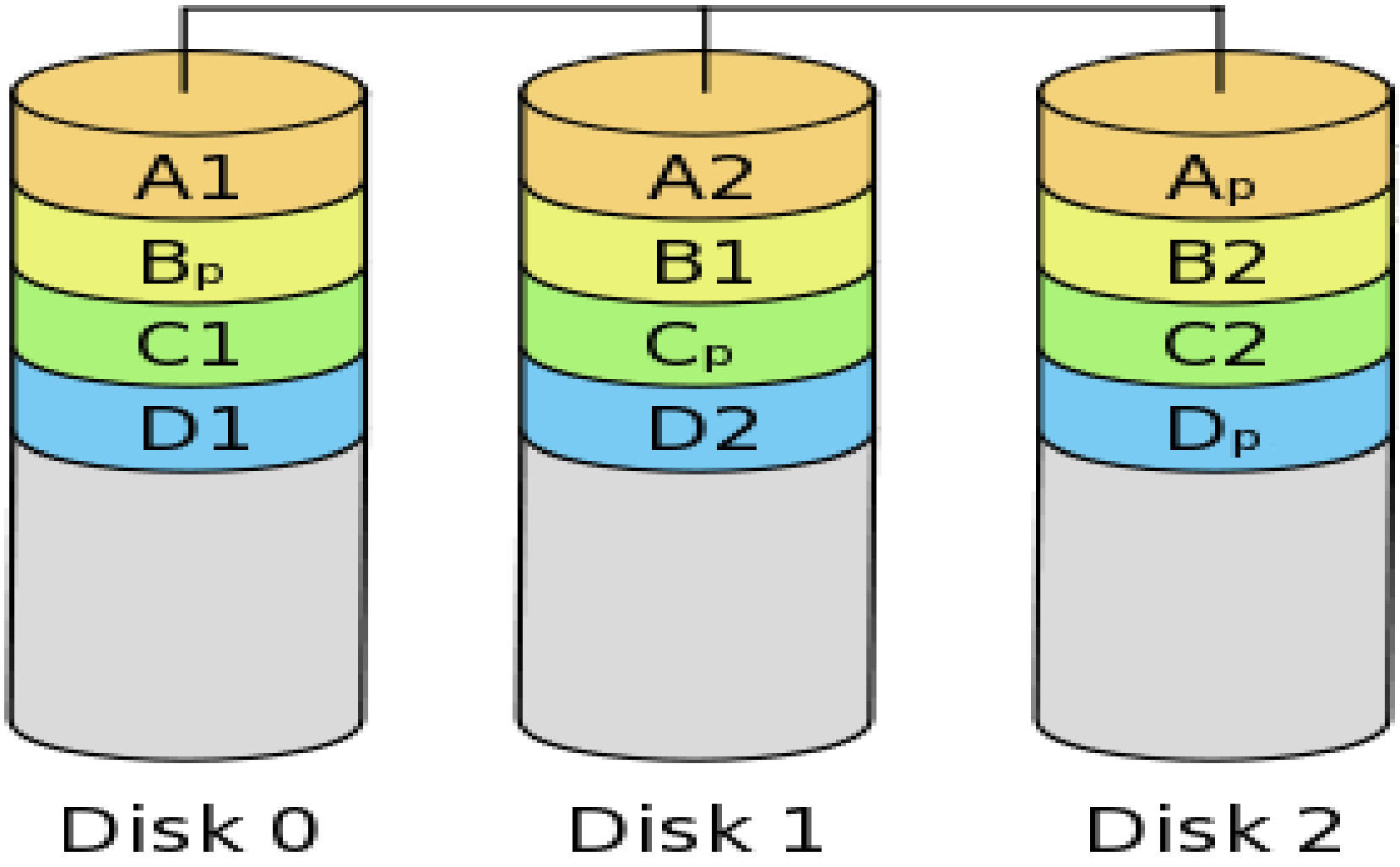


# RAID 1

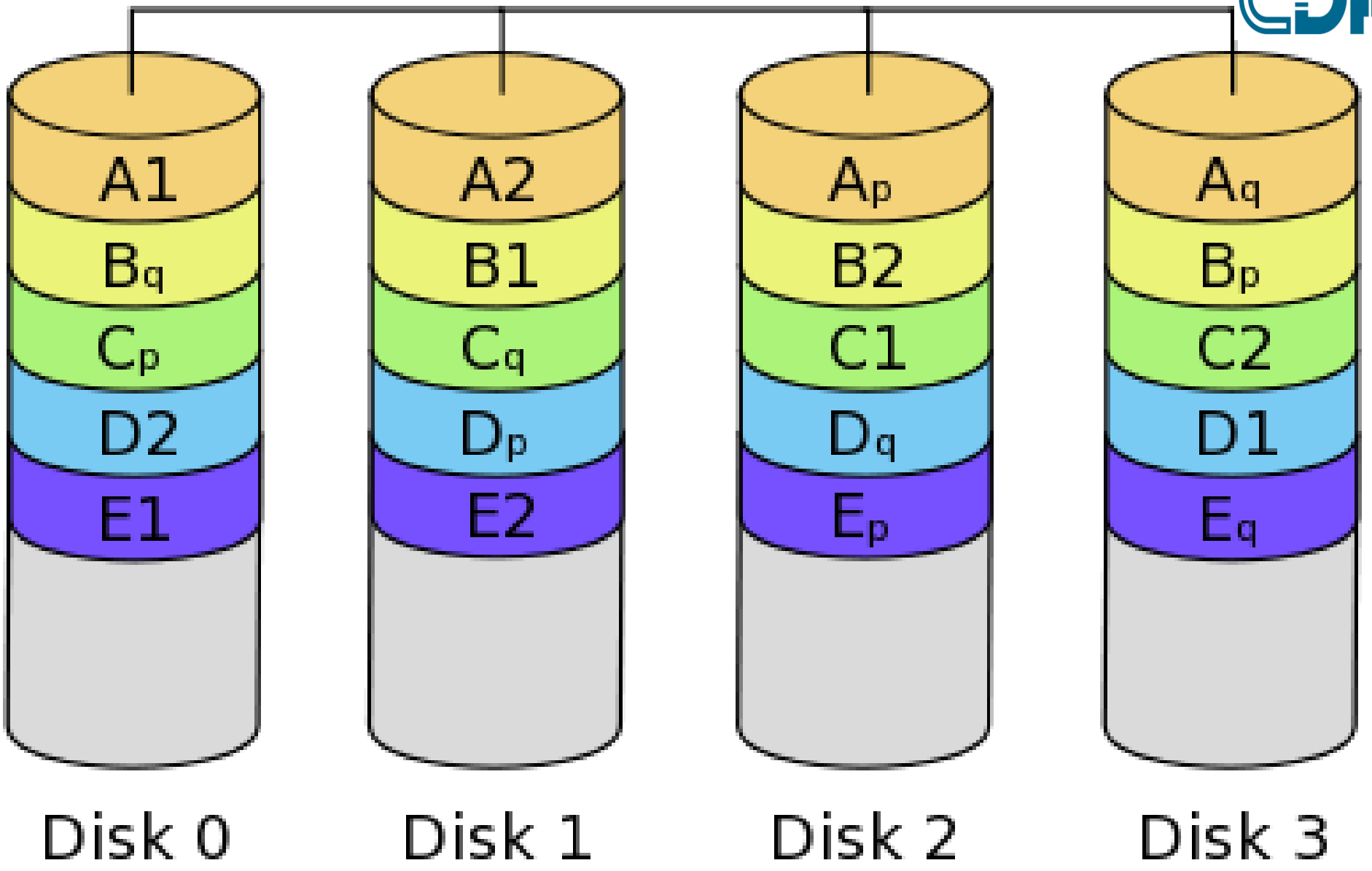



RAID 3
A1
A3
B1
B3
A2
A4
B2
B4
Ap(1-2)
Ap(3-4)
Bp(1-2)
Bp(3-4)
Disk 1
Disk 2
Disk 3

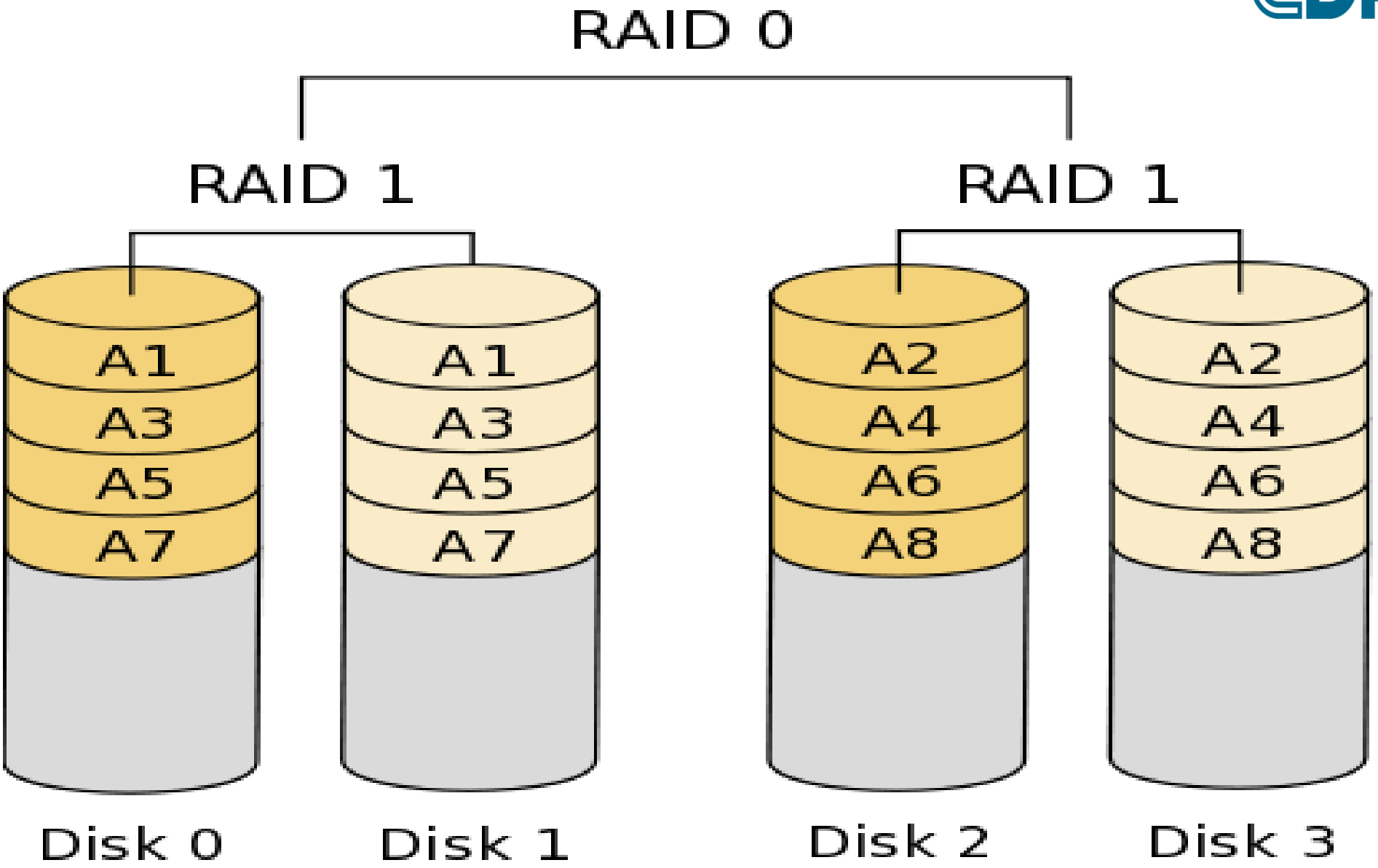
# RAID 5



# RAID 6


A1
Bq
Cp
D2
E1
A2
B1
Cq
Dp
E2
Ap
B2
C1
Dq
Ep
Aq
Bp
C2
D1
Eq
Disk 0
Disk 1
Disk 2
Disk 3

# RAID 10


RAID 0
RAID 1
RAID 1
A1
A3
A5
A7
A1
A3
A5
A7
A2
A4
A6
A8
A2
A4
A6
A8
Disk 0
Disk 1
Disk 2
Disk 3

# RAID Levels

## RAID 0 (Block-level striping without parity or mirroring)

- Zero redundancy.
- Improved performance and additional storage.
- No fault tolerance.
- Any disk failure destroys the array.
- Does not implement error checking, so any error is uncorrectable.
- More disks in the array means higher bandwidth, but greater risk of data loss.

# RAID Levels

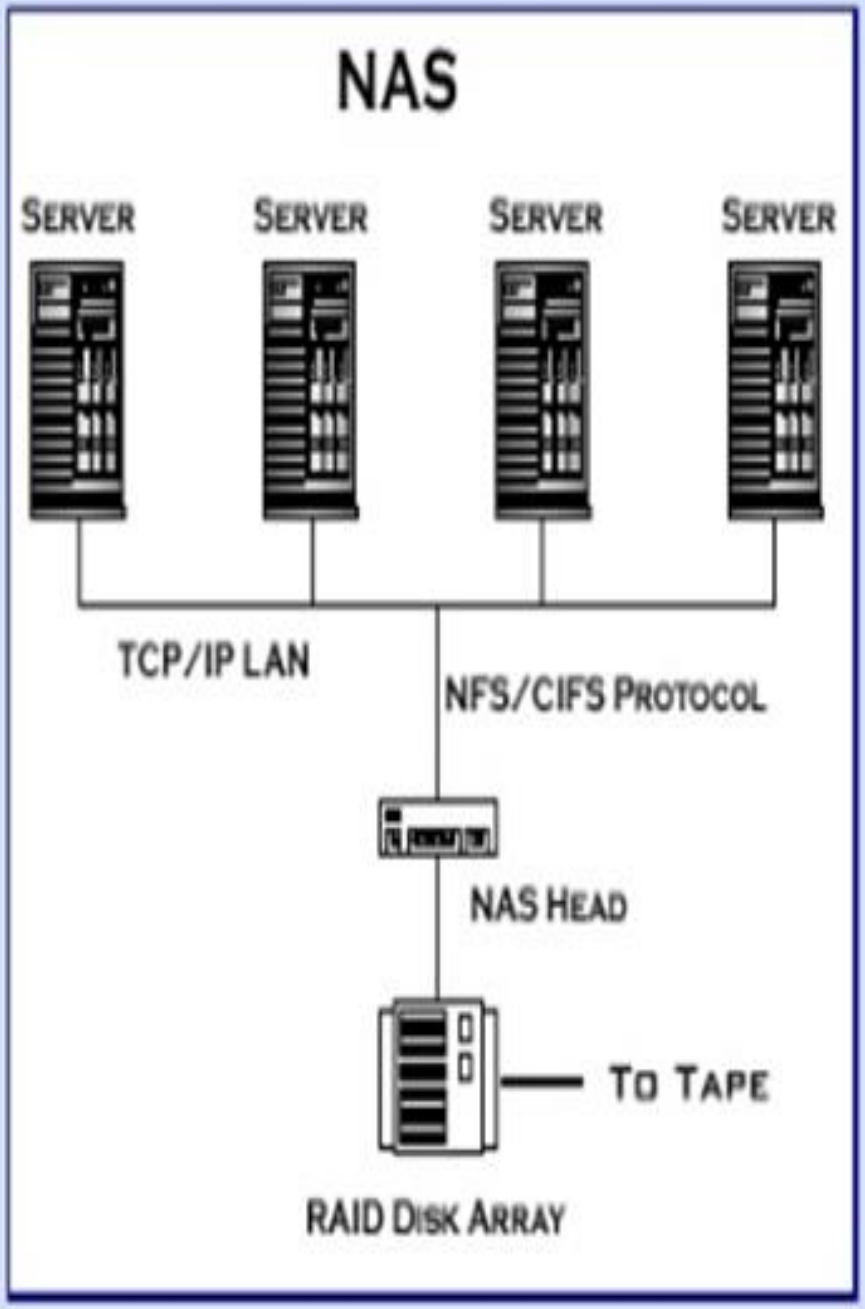
- **RAID 1 (Mirroring without parity or striping)**
  - Data is written identically to multiple disks (a "mirrored set" ) .
  - Array provides fault tolerance from disk errors or failures and continues to operate as long as at least one drive in the mirrored set is functioning.

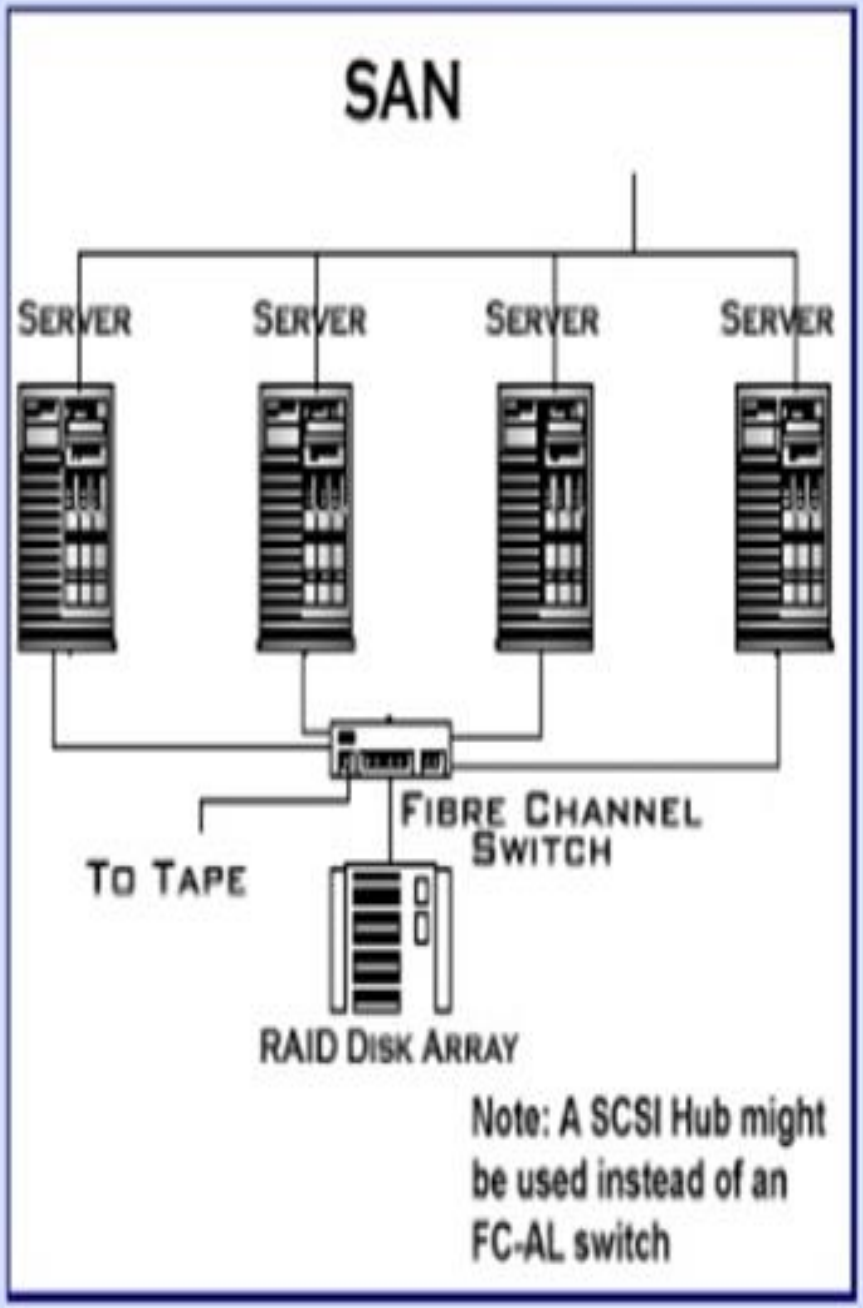
# RAID Levels

- **RAID 5 (Block-level striping with distributed parity)**
  - **Distributes parity along with the data and requires all drives to be present to operate.**
  - **Drive failure requires replacement.**
  - **The array is not destroyed by a single drive failure.**
  - **Upon drive failure, any subsequent reads can be calculated from the distributed parity such that the drive failure is masked from the end user.**
  - **The array will have data loss in the event of a second drive failure and is vulnerable until the data that was on the failed drive is rebuilt onto a replacement drive.**

# System's Requirements for RAID Configuration

- Kernel - 2.4 or later
- Driver - md with 'md_mod' module running.
- util-linux (fdisk) - Miscellaneous system utilities
- coreutils (df) - GNU core utilities
- parted (partprobe) - The GNU Parted disk partition resizing program
- mdadm Tool to administer Linux MD arrays (software RAID)
- e2fsprogs (mke2fs) - ext2/ext3/ext4 file system utilities
- mount Tools for mounting and manipulating file system


NAS
SERVER
SERVER
SERVER
SERVER
TCP/IP LAN
NFS/CIFS PROTOCOL
NAS HEAD
TO TAPE
RAID DISK ARRAY


SAN
SERVER
SERVER
SERVER
SERVER
FIBRE CHANNEL SWITCH
TO TAPE
RAID DISK ARRAY
Note: A SCSI Hub might be used instead of an FC-AL switch