Introduction to Database

- A database is a computerized record keeping system.

- As such, the purpose of a database is to store a collection of logically related data

- Databases are used whenever a large amount of data is needed to be stored and retrieved quickly and easily

- The database not only stores data, but also a description of the data.

Storage

Storage is the place where data is held Temporarily or Permanently for later use.

Types of storage:

- Magnetic Storage

  - Diskettes
  - Hard Disk
  - Cartridges
  - Magnetic Tapes

- Optical Storage

  - CD
  - DVD
  - Blue Ray

Types of storage - Magnetic Storage:

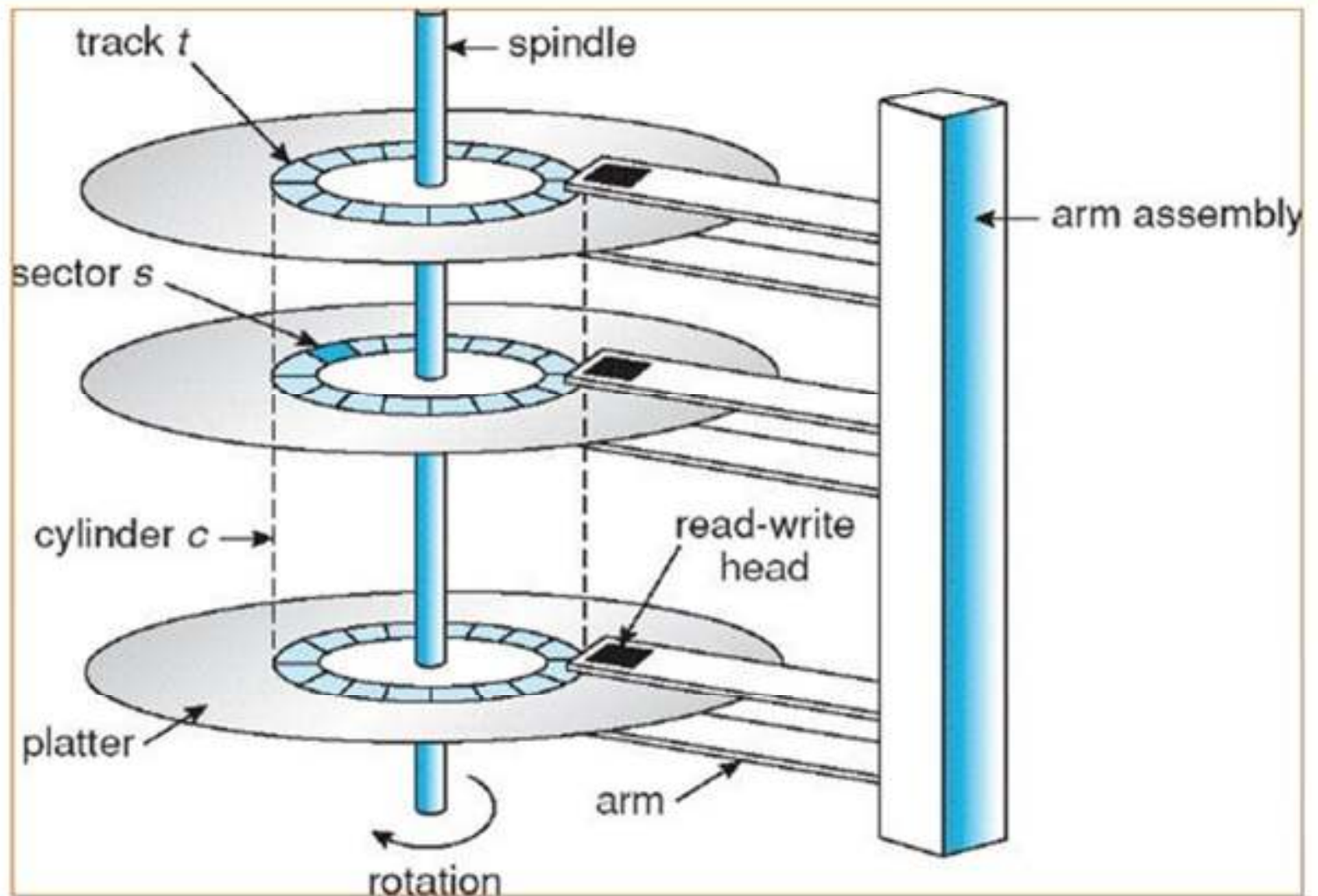|	
OVER COAT	Layer of Carbon and thin layer of lubrication
MAGNETIC COAT	Ferromagnetic material of 50 – 100 nm thickness
UNDER COAT	Ni – P layer
SUBSTRATE	Aluminum Layer coated with reactive binder that reduces corrosion

Types of storage - Hard Disk (Magnetic Storage):

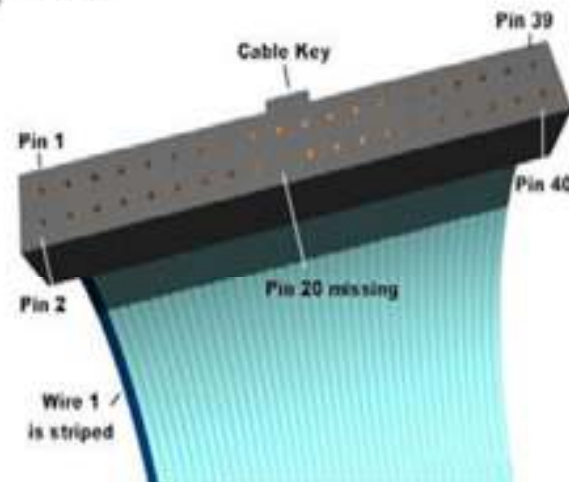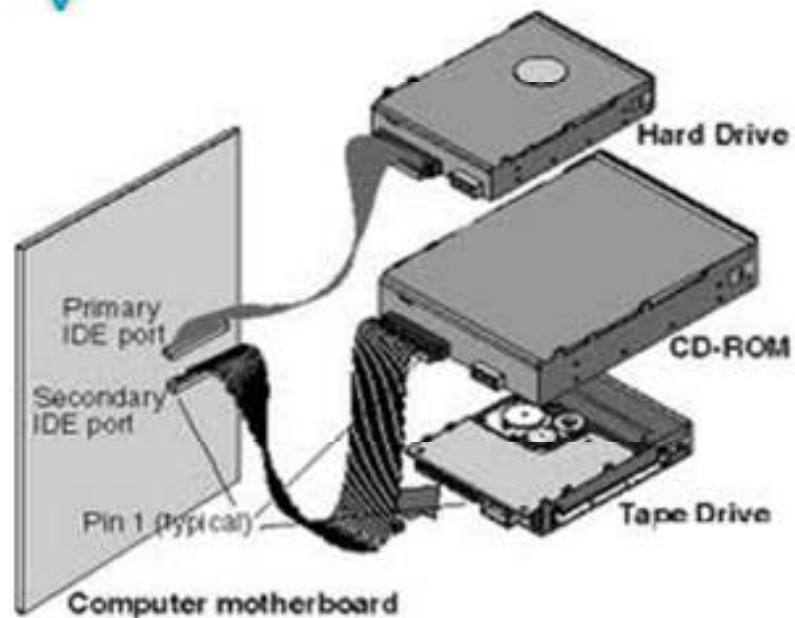# Storage

Magnetic Storage-Hard disk(Contd…)

Storage

Magnetic Storage-Hard disk(Contd…)

Types of hard disk interface:

- IDE
- SCSI
- SATA

IDE cable

Types of hard disk interface(contd…)

Hard Drive

CD-ROM

Tape Drive

Primary IDE port

Secondary IDE port

Pin 1 (typical)

Computer motherboard

GRAY- CONNECT TO SLAVE

60 WIRES FLAT CABLE

BLACK - CONNECT TO MASTER
40P IDC CONNECTOR 2X20

BLUE - CONNECT TO MOTHERBOARD

Cable Key

Pin 39

Pin 1

Pin 40

Pin 2

Pin 20 missing

Wire 1 is striped

IDE connector

Storage Technology

- Magnetic Storage

  Diskettes
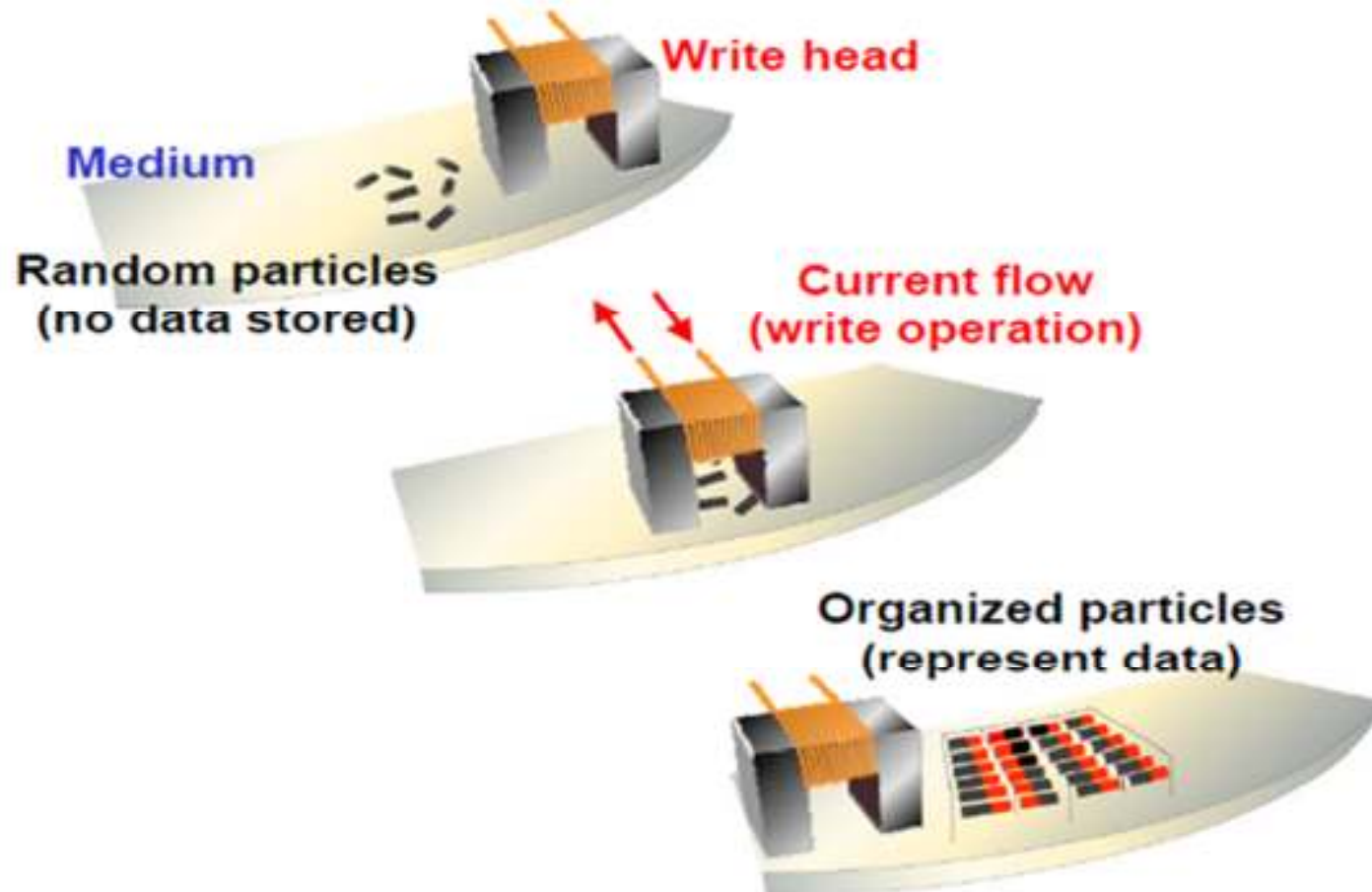 Hard Disk
  Cartridges
  Magnetic Tapes

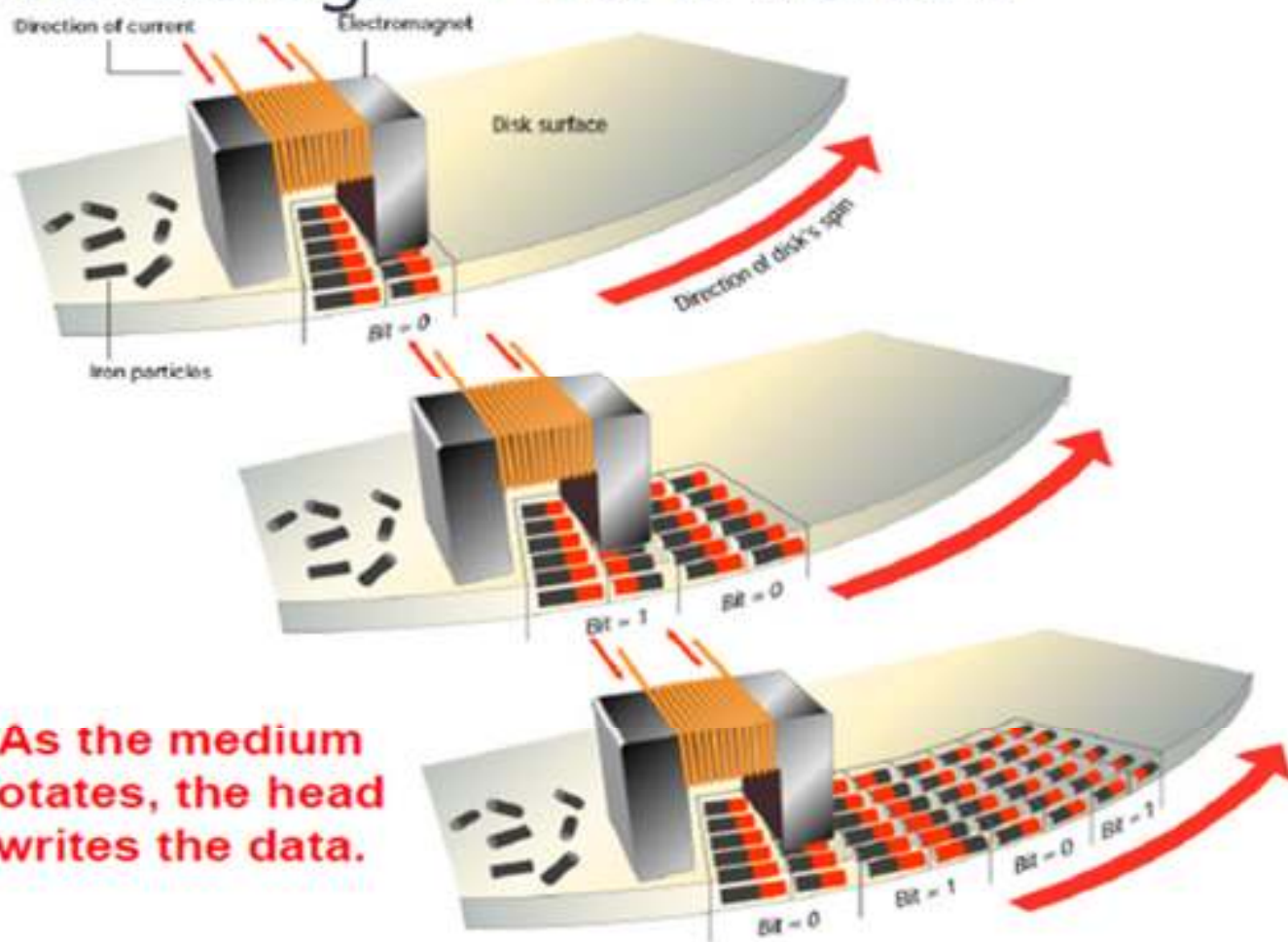- Optical Storage

  CD
  DVD
  Blue Ray

Storage Technology
Magnetic Storage:

OVER COAT	Layer of Carbon and thin layer of lubrication
MAGNETIC COAT	Ferromagnetic material of 50 – 100 nm thickness
UNDER COAT	Ni – P layer
SUBSTRATE	Aluminum Layer coated with reactive binder that reduces corrosion

Magnetic Storage – How it works ?

Write head

Medium

**Random particles
(no data stored)**

**Current flow
(write operation)**

**Organized particles
(represent data)**

Magnetic Storage – How it works ?

As the medium rotates, the head writes the data.

Storage Technology

Magnetic Storage - Hard Disk:

Cover Mounting Holes (Cover not shown)

Base Casting

Spindle

Slider (and Head)

Actuator Arm

Actuator Axis

Actuator

Case Mounting Holes

Platters

SCSI Interface Connector

Jumper Pins

Jumper

Power Connector

Tape Seal

Ribbon Cable (attaches heads to Logic Board)

Storage Technology

track *t* — spindle

sector *s*

cylinder *c* →

platter

read-write head

arm assembly

arm

rotation

Storage Technology

Magnetic Storage - Magnetic Tape:
- Sequential storage
- Backup storage
- Tape Drive

Head Guide Assembly

Head

Tape

Cartridge

Take-up reel
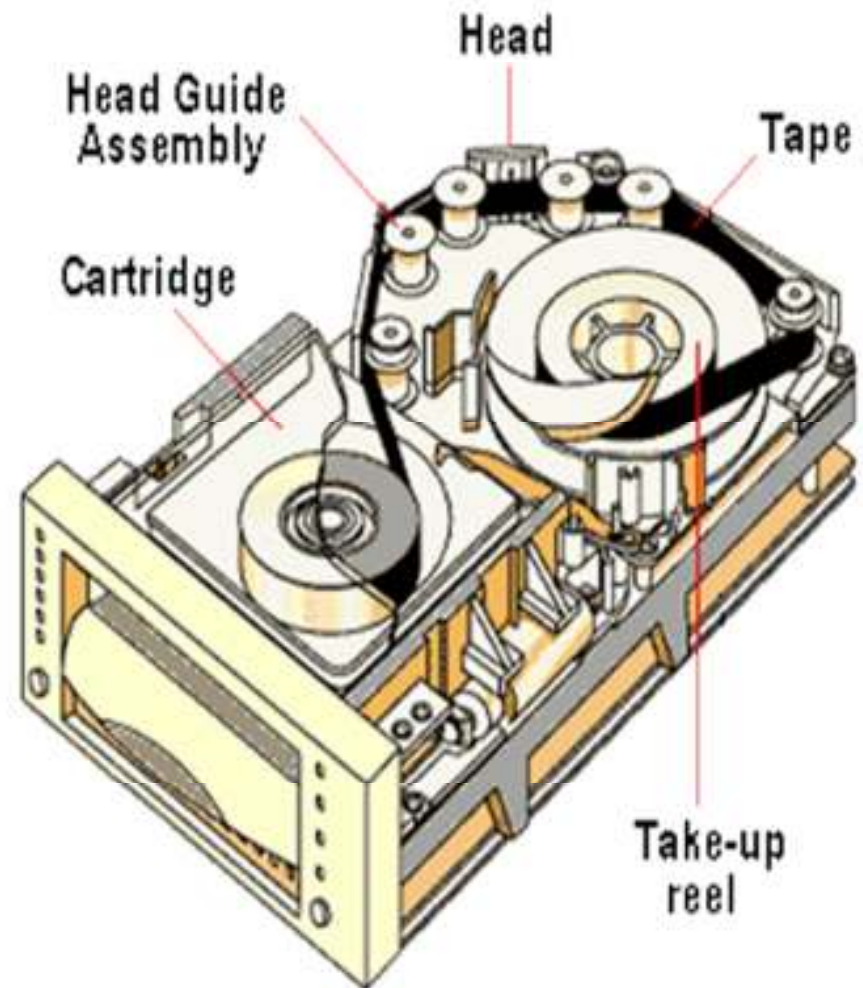
Storage Technology
Magnetic Storage – Recording Technology:

Helical Scan Recording

Rotation

Recorded

Unrecorded

Tape motion

Scanner

Linear Serpentine Recording

Beginning of Tape

End of Tape

Forward written tracks

Reverse written tracks

Storage Technology
Optical Storage:

Label
Acrylic
Aluminum
125 nm
1.2 mm
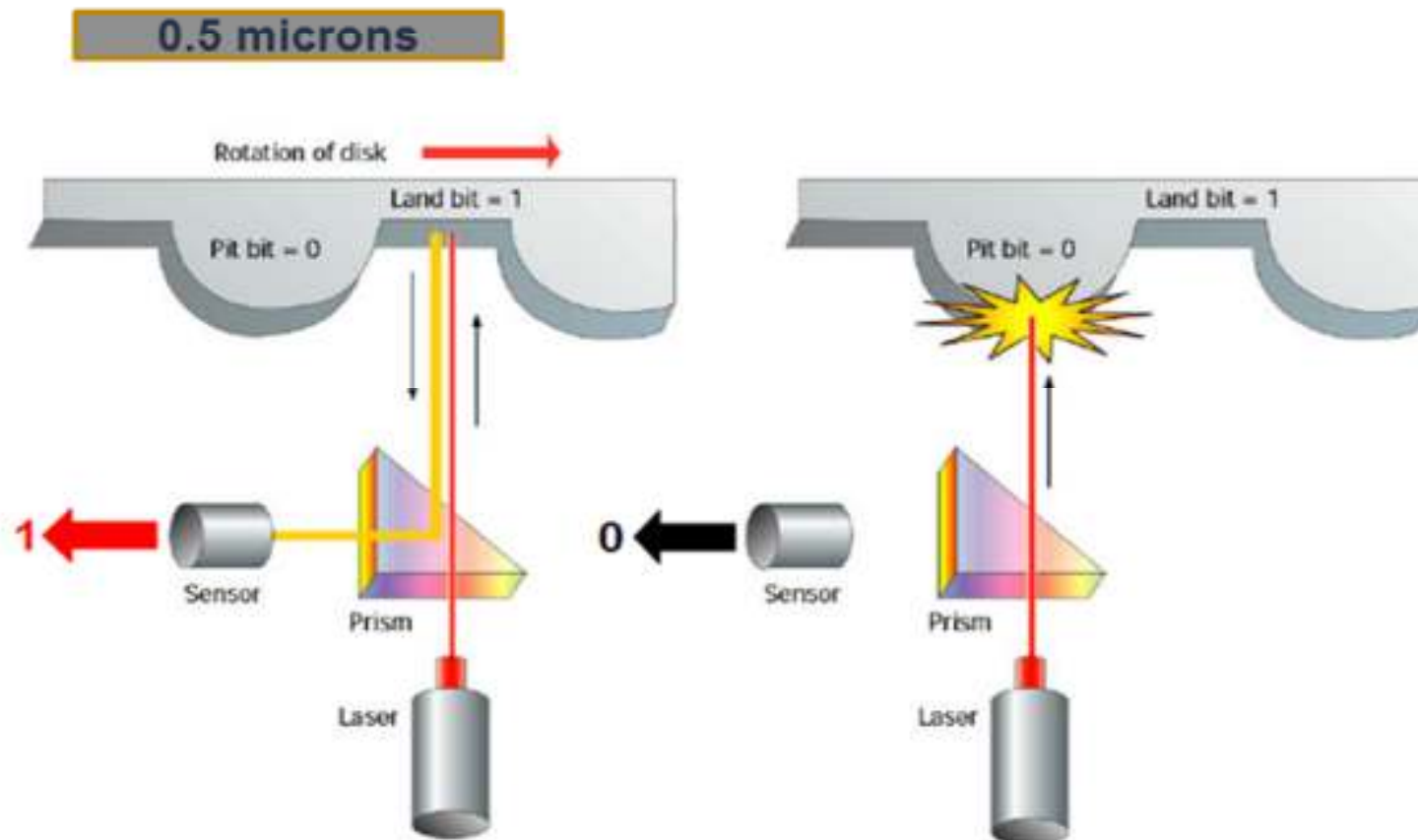Polycarbonate plastic
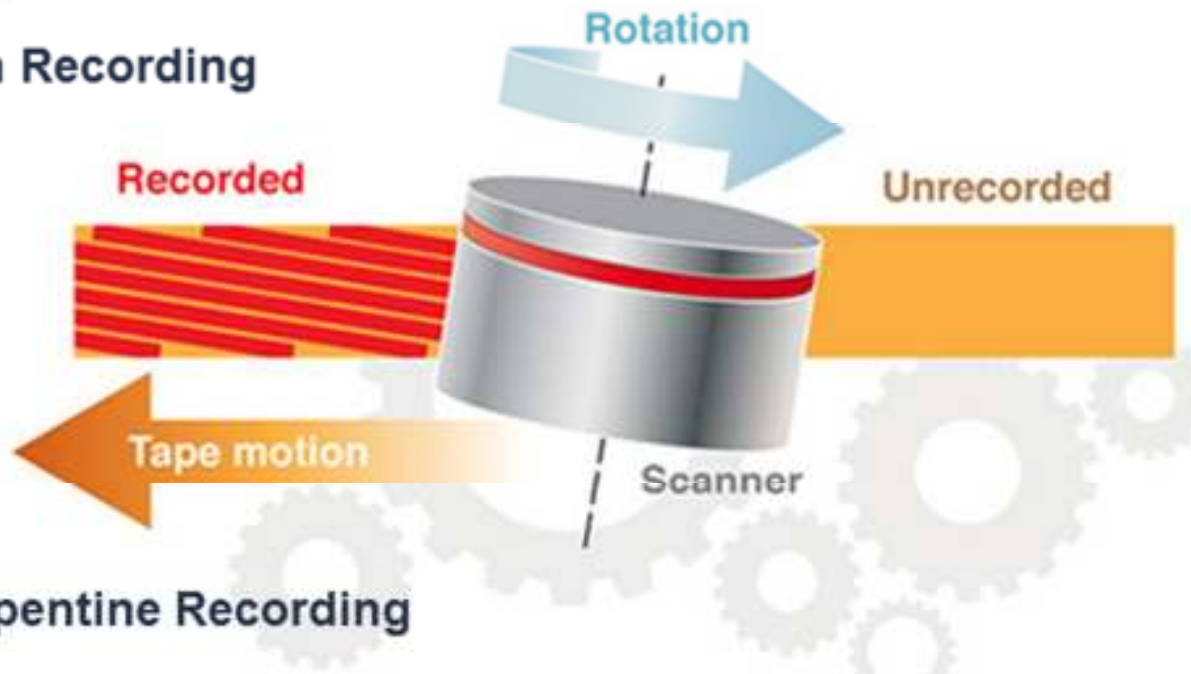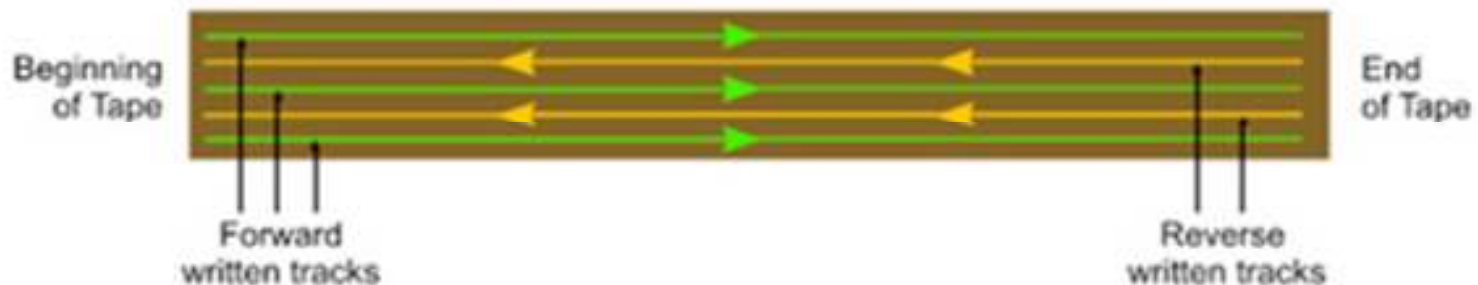
D
C
B
A
E
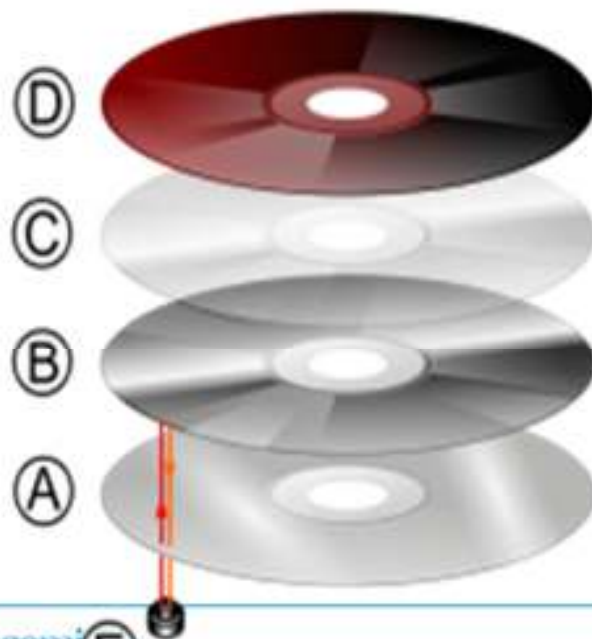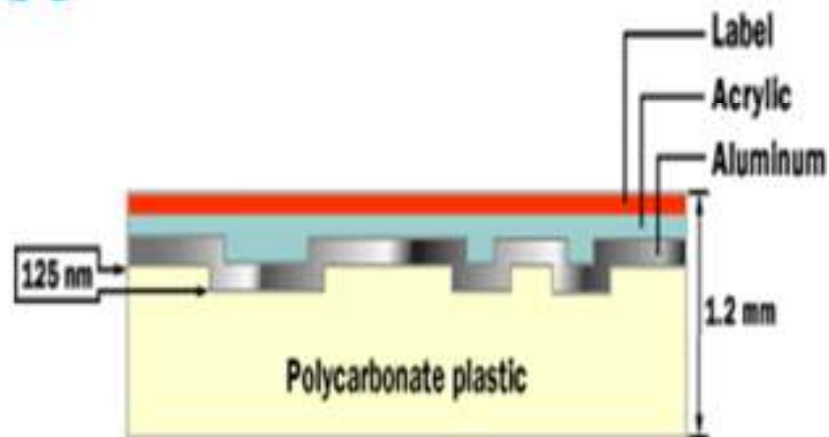
A – Polycarbonate disc layer coated with aluminum has the data encoded by using pits and lands
B – Shiny Layer reflects the laser
C – Layer of Lacquer protects the shiny layer
D – Artwork (screen printed) on top of disk
E -- Laser Beam reads the CD and reflected back to sensor.

Unwinding the CD Track would extend out to 3.5 miles (5 km)

Storage Technology

Optical Storage – Optical disk:

0.5 microns

Storage Technology

Optical Storage – CD Player:

Storage Technology

Optical Storage – DVD Disk:

- Base Layer - Polycarbonate Plastic
- Aluminum coating over the polycarbonate plastic
- Clear Protective acrylic Coating
- Semi Reflective and Fully reflective layers

Single-sided, single layer (4.7GB)

Single-sided, double layer (8.5GB)

Double-sided, double layer (17GB)

Storage

Types of Tapes – Linear Tape Open:

LTO or Linear Tape Open is a magnetic tape data media that was initiated and developed by IBM, Seagate and Hewlett-Packard

There were two forms of LTOs: Accelis and Ultrium.

> The Accelis form of LTO tapes was developed in 1997 for fast data access.

> The LTO form Ultrium is a half-inch magnetic tape with a single reel (contrasting with the 8mm double reel Accelis).

> LTO Ultrium tape uses a single reel to maximize storage capacity and thus is better suited for archival use.

> An Ultrium LTO drive is also backward compatible and contains a strong error correction algorithm that makes data recovery possible when lost data is within one track or up to 32 mm of the tape medium

> The LTO Ultrium is very popular and LTO in common usage usually refers to the LTO Ultrium as the LTO Accelis are no longer commercially available
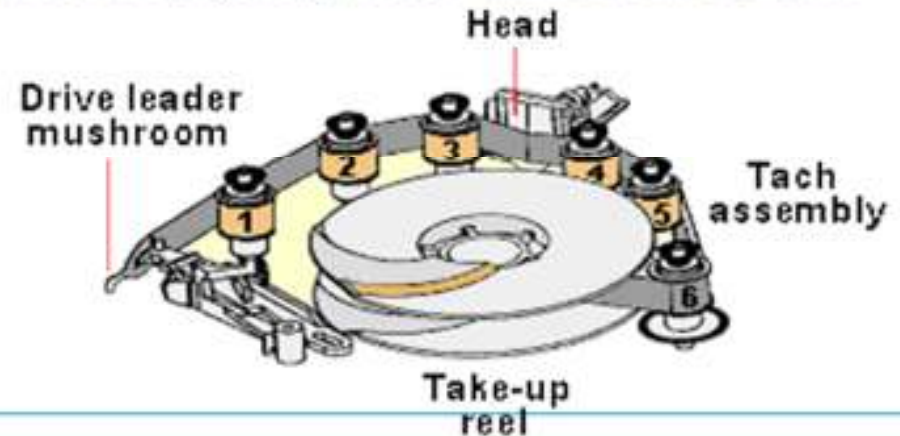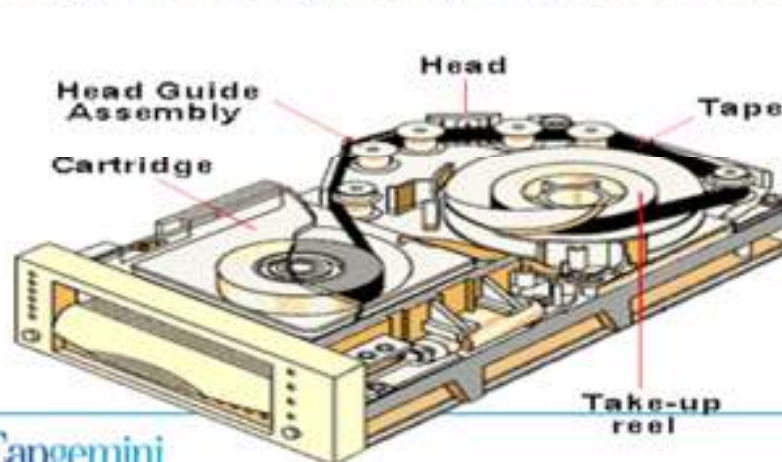
Storage
Types of Tapes – Digital Linear Tape:

➢The origins of Digital Linear Tape date back to the mid-1980s.

➢The first true DLT system emerged in 1989 and the technology was later acquired by Quantum Corporation in 1994.

➢ A number of OEMs have subsequently licensed the technology primarily for the purpose of manufacturing automated tape libraries.

➢ Effectively, DLT is an adaptation of the old reel to reel magnetic recording method where the tape cartridge performs as one reel and the tape drive as the other.

Storage

Types of Tapes – Digital Linear Tape(DLT):

➢DLT uses linear serpentine recording with multiple tracks on half-inch (12.7 mm) wide tape.

➢The cartridges contain a single reel and the tape is pulled out of the cartridge by means of a leader tape attached to the take-up reel inside the drive.

➢The drive leader tape is buckled to the cartridge leader during the load process.

➢Tape speed and tension are controlled electronically via the reel motors;

➢The tape is guided by 4 to 6 rollers that touch only the back side of the tape.

➢The prime advantages DLT retains are higher storage capacity, higher data transfer rates, and higher reliability, mainly because the media does not physically touch the head in the drive

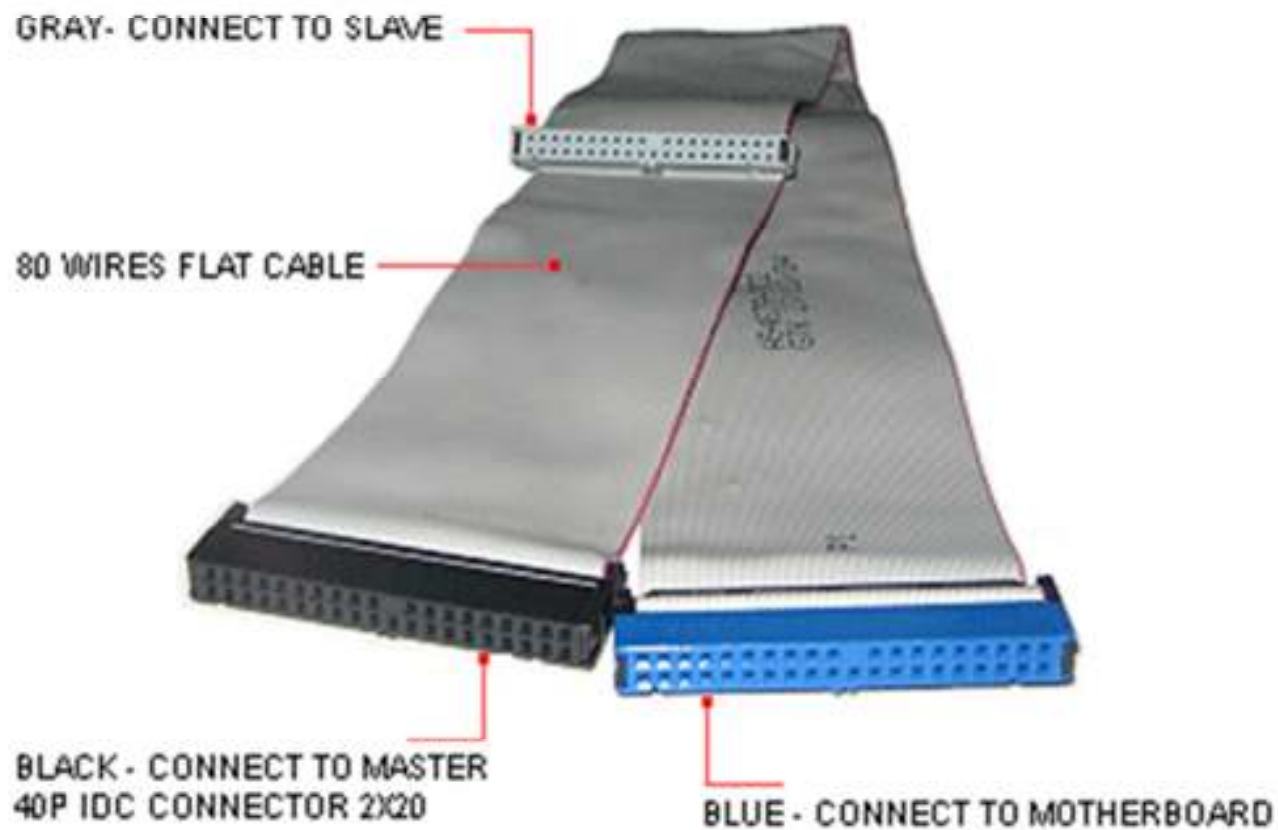# Storage

Tapes - virtual storage library:

➢ Virtual tape is an archival storage technology

➢ VTL makes it possible to save data as if it were being stored on tape although it may actually be stored on hard disk or on another storage medium.

➢ Benefits of virtual tape systems include better backup and recovery times and lower operating costs.

➢ The shift to VTL also eliminates streaming problems that often impair efficiency in tape drives as disk technology does not rely on streaming and can write effectively regardless of data transfer speeds.
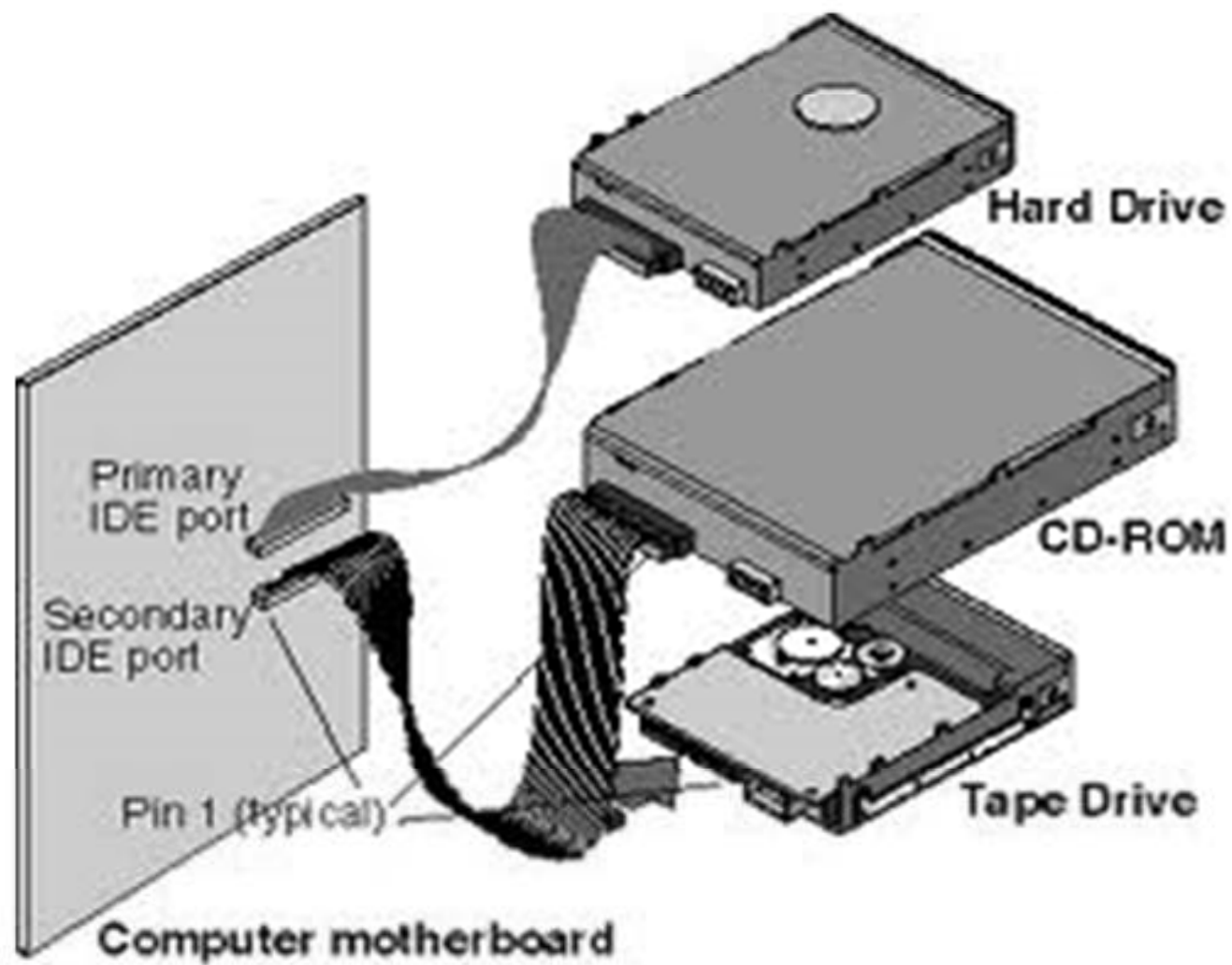
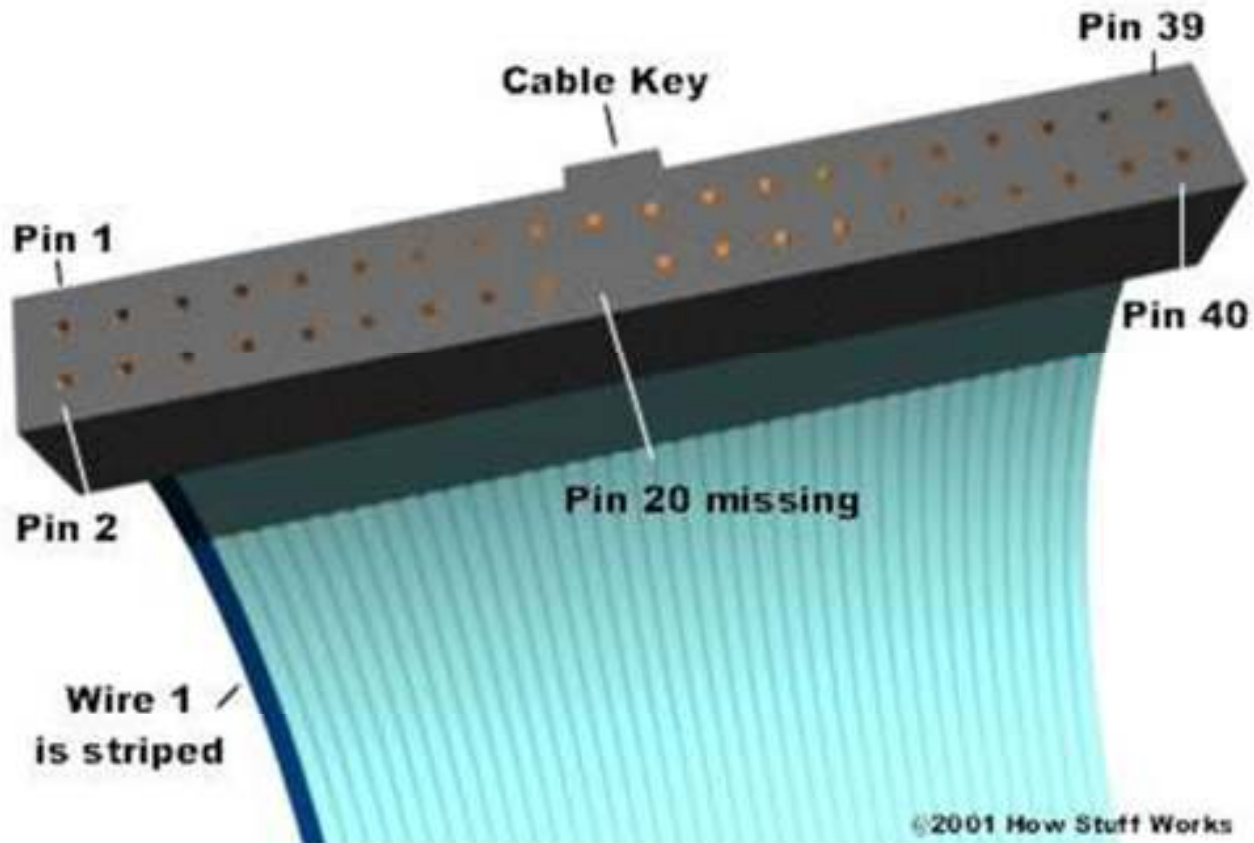# Types of Hard Disk Interface

- IDE
- SCSI
- SATA

IDE Cable:

GRAY- CONNECT TO SLAVE

80 WIRES FLAT CABLE

BLACK - CONNECT TO MASTER
40P IDC CONNECTOR 2X20

BLUE - CONNECT TO MOTHERBOARD

IDE Cable:

- Hard Drive
- CD-ROM
- Tape Drive
- Primary IDE port
- Secondary IDE port
- Pin 1 (typical)
- Computer motherboard

IDE Connector:

Pin 39

Cable Key

Pin 1

Pin 40

Pin 2

Pin 20 missing

Wire 1 / is striped

©2001 How Stuff Works

Pin	Description	Pin	Description
1	Reset	23	-IOW
2	Ground	24	Ground
3	Data Bit 7	25	-IOR
4	Data Bit 8	26	Ground
5	Data Bit 6	27	I/O Channel Ready
6	Data Bit 9	28	SPSYNC: Cable Select
7	Data Bit 5	29	-DACK 3
8	Data Bit 10	30	Ground
9	Data Bit 4	31	RQ 14
10	Data Bit 11	32	-IOCS 16
11	Data Bit 3	33	Address Bit 1
12	Data Bit 12	34	-PDIAG
13	Data Bit 2	35	Address Bit 0
14	Data Bit 13	36	Address Bit 2
15	Data Bit 1	37	-CS1FX
16	Data Bit 14	38	-CS3FX
17	Data Bit 0	39	-DA/SP
18	Data Bit 15	40	Ground
19	Ground	41	+5 Volts (Logic) (Optional)
20	Cable Key (pin missing)	42	+5 Volts (Motor) (Optional)
21	DRQ 3	43	Ground (Optional)
22	Ground	44	-Type (Optional)

SCSI:

Interface Types

➢Standard SCSI

➢Wide SCSI

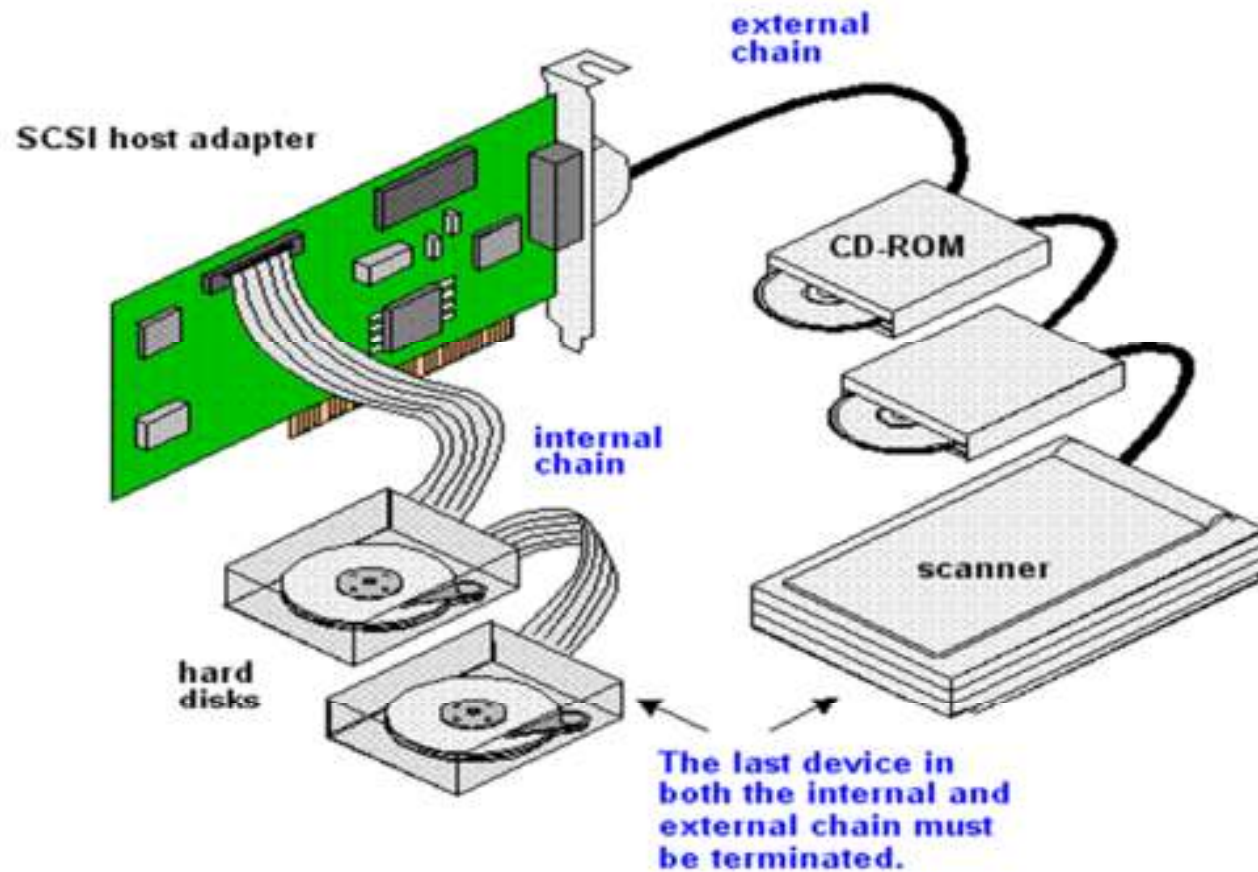## SCSI Identifiers:

➢ Controller

➢ Device

➢ Cable

➢ Connectors

Interface Types
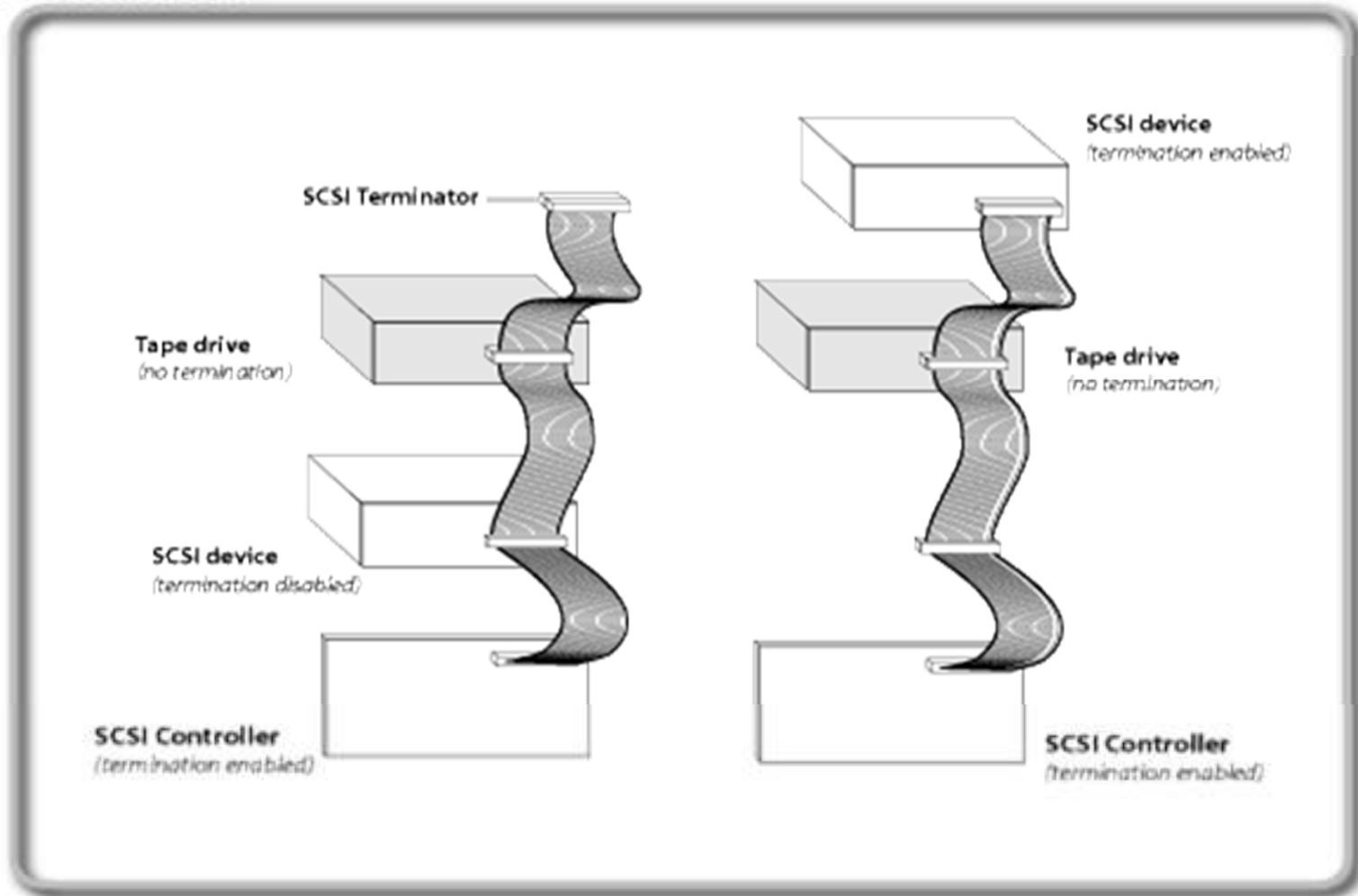
SCSI Controller:

Capgemini
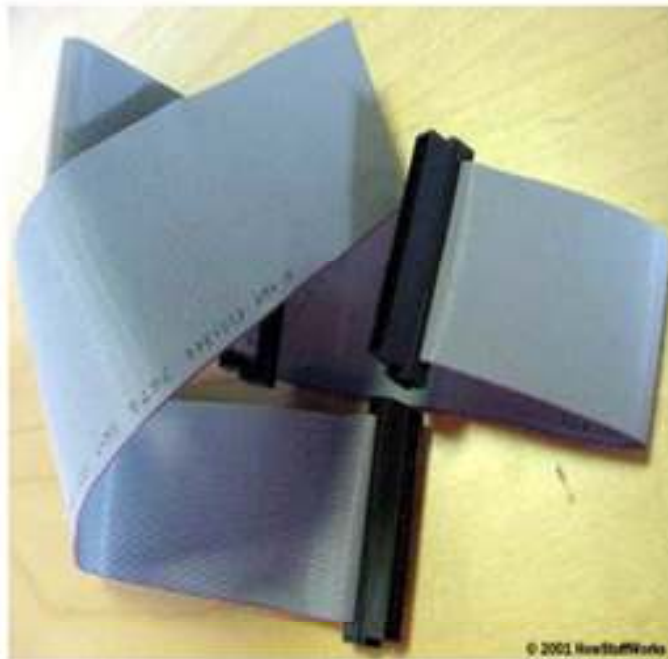
Interface Types

SCSI Device:

external chain

SCSI host adapter

CD-ROM

internal chain

scanner

hard disks

The last device in both the internal and external chain must be terminated.

Interface Types

SCSI Terminator:

SCSI Terminator

SCSI device
(termination enabled)

Tape drive
(no termination)

Tape drive
(no termination)

SCSI device
(termination disabled)

SCSI Controller
(termination enabled)

SCSI Controller
(termination enabled)

Interface Types

SCSI Cable:

Interface Types

SCSI Connectors:

SCSI 50 Pin Connector

DataPro

SCSI 68 Pin Connector

© Laluna

SCSI 80 Pin Connector

Single Connector Attachment
(SCA80) Female
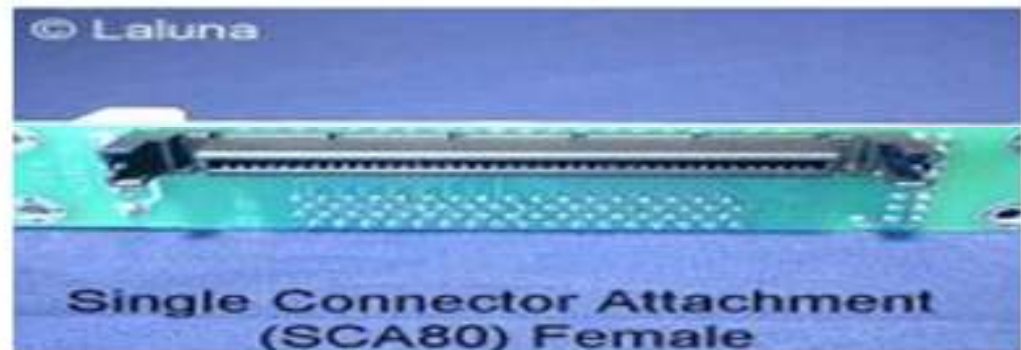
Interface Types

SCSI Types:

➤ SCSI-1

➤ SCSI-2

➤ SCSI-3

Capgemini
CONSULTING. TECHNOLOGY. OUTSOURCING

Name	Specification	# of Devices	Bus Width	Bus Speed	MBps
Asynchronous SCSI	SCSI-1	8	8 bits	5 MHz	4 MBps
Synchronous SCSI	SCSI-1	8	8 bits	5 MHz	5 MBps
Wide	SCSI-2	16	16 bits	5 MHz	10 MBps
Fast	SCSI-2	8	8 bits	10 MHz	10 MBps
Fast/Wide	SCSI-2	16	16 bits	10 MHz	20 MBps
Ultra	SCSI-3 SPI	8	8 bits	20 MHz	20 MBps
Ultra/Wide	SCSI-3 SPI	8	16 bits	20 MHz	40 MBps
Ultra2	SCSI-3 SPI-2	8	8 bits	40 MHz	40 MBps
Ultra2/Wide	SCSI-3 SPI-2	16	16 bits	40 MHz	80 MBps
Ultra3	SCSI-3 SPI-3	16	16 bits	40 MHz	160 MBps
Ultra320	SCSI-3 SPI-4	16	16 bits	80 MHz	320 MBps

SATA:

Interface Types
➢ Hot plugging

➢ Native command queuing

SATA Revisions:

➢ SATA revision 1.0 (1.5 Gbit/s)

➢ SATA revision 2.0 (3 Gbit/s)

➢ SATA revision 3.0 (6 Gbit/s)

SATA Cables:

➢ Data Connector

➢ Power Connector
  ▪ Standard
  ▪ Slim Line

➢ ESATA

SATA Data Connector:

PIN#	FUNCTION
1	GROUND
2	A+ (transmit)
3	A- (transmit)
4	GROUND
5	B- (receive)
6	B+ (receive)
7	GROUND

Power Connector:

STANDARD

SLIM LINE

ESATA:

SATA to ESATA:

To eSATA port

**eSATA - SATA
converter cable
(AASA2SAP15C)**

**External SATA
cable (AASAEDC3F)**

**To SATA storage
device**
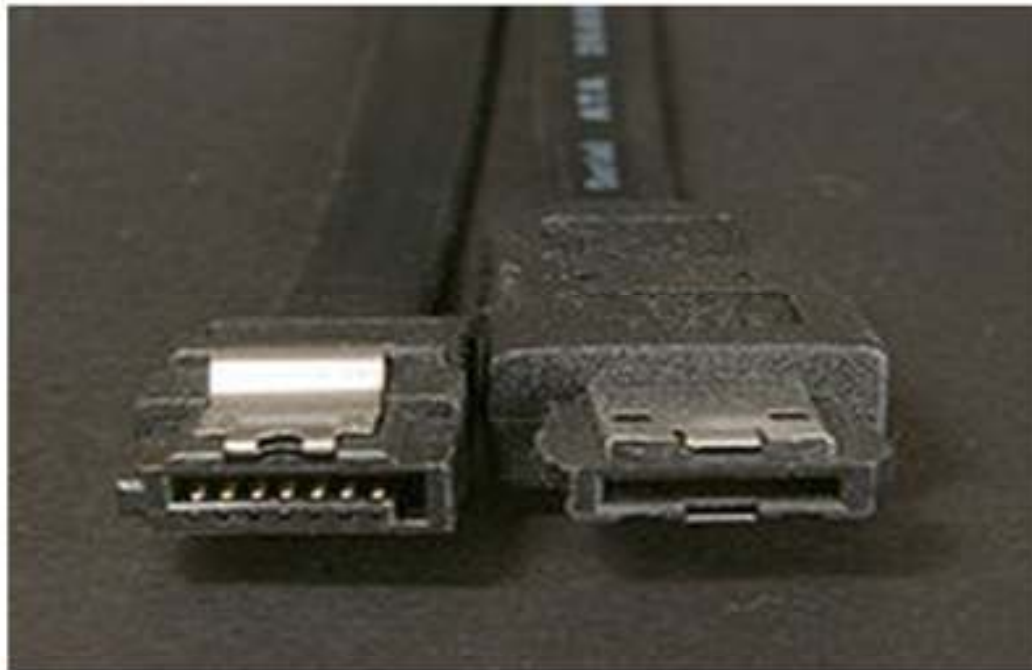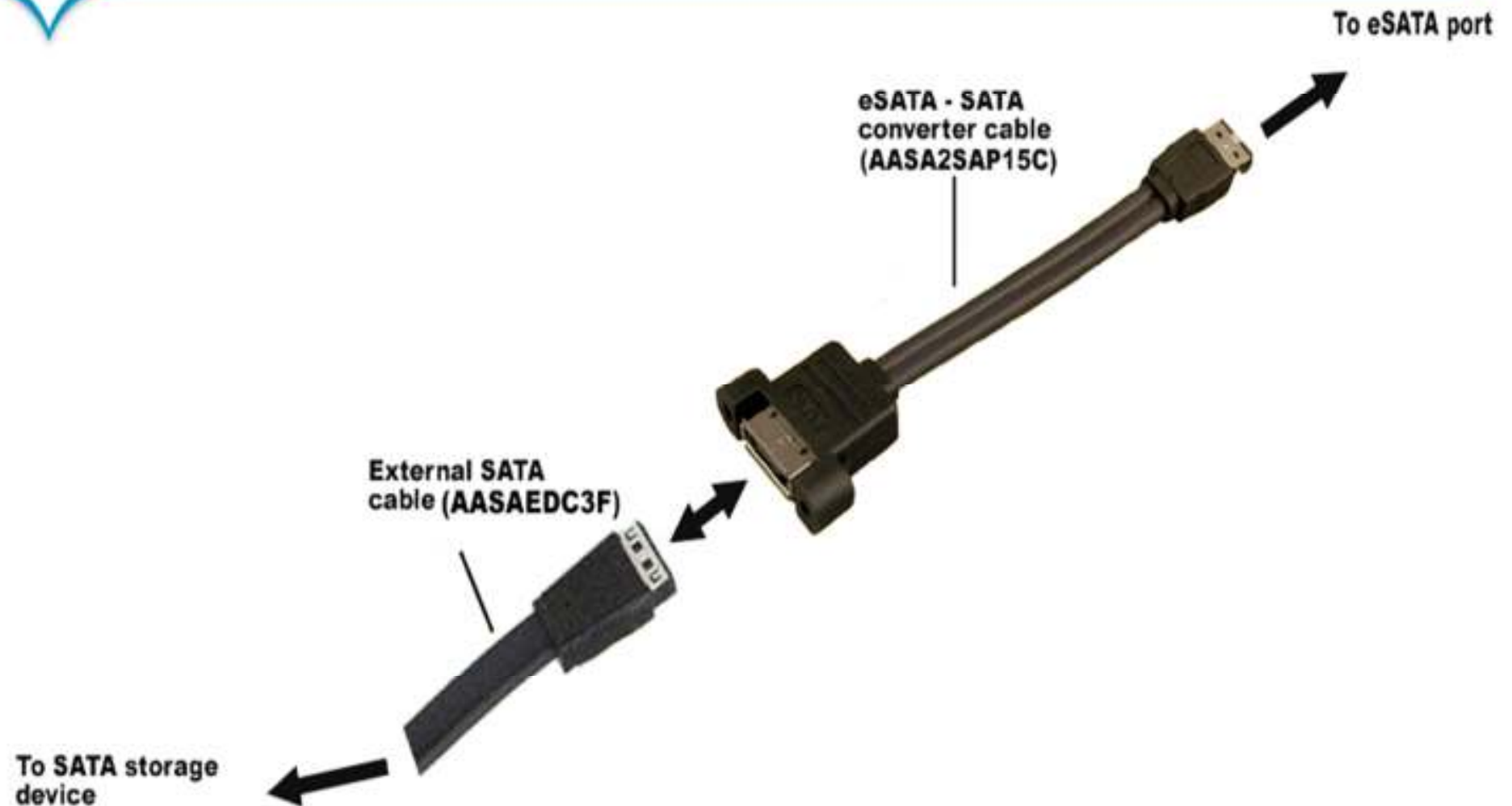
Interface Types

Fiber Channel P2P:

Point-to-Point

| Host |^N ←——→ ^N| Storage |

Fiber Channel Arbitrated Loop:

Arbitrated Loop

NL Storage
NL
Host
NL
NL
NL
NL Storage

Public Loop with Hub

Host
NL
Hub —FL— Switch
NL
NL
Storage

Capgemini
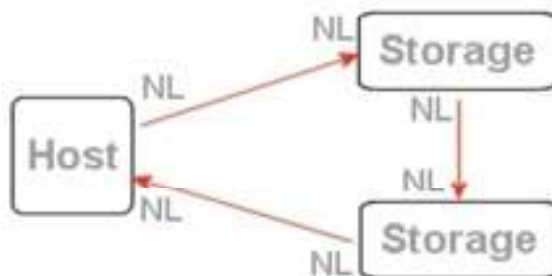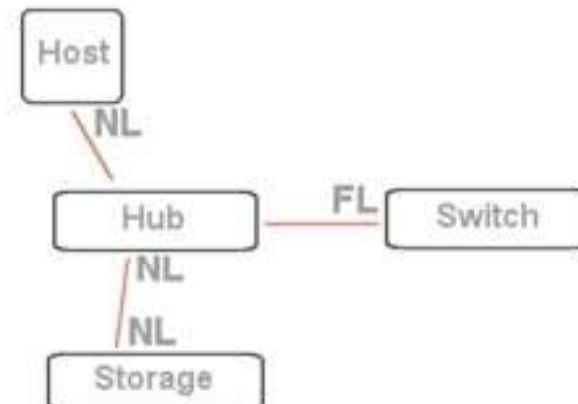
Fiber modality	Speed (MByte/s)	Distance
Singlemode Fiber	1600	0.5 m - 10 km
		0.5 m - 2 km
	800	2 m - 10 km
		2 m - 1.4 km
	400	2 m - 10 km
		2 m - 4 km
		2 m - 2 km
	200	2 m - 50 km
		2 m - 10 km
		2 m - 2 km
	100	2 m - 50 km
		2 m - 10 km
		2 m - 2 km

Capgemini

Fiber modality	Speed (MByte/s)	Distance
Multimode Fiber	1600	0.5 m - 125 m
		0.5 m - 100 m
		0.5 m - 35 m
		0.5 m - 15 m
	800	0.5 m - 190 m
		0.5 m - 150 m
		0.5 m - 50 m
		0.5 m - 21 m
	400	0.5 m - 400 m
		0.5 m - 380 m
		0.5 m - 150 m
		0.5 m - 70 m
	200	0.5 m - 500 m
		0.5 m - 300 m
		0.5 m - 150 m
	100	0.5 m - 860 m
		0.5 m - 500 m
		0.5 m - 300 m
		2 m - 500 m
		2 m - 175 m

DIRECT ATTACHED STORAGE

NETWORK ATTACHED STORAGE

STORAGE AREA NETWORK

Capgemini
CONSULTING TECHNOLOGY OUTSOURCING

Direct Attached Storage:

SCSI

Fibre
Channel

RAID&
JBOD
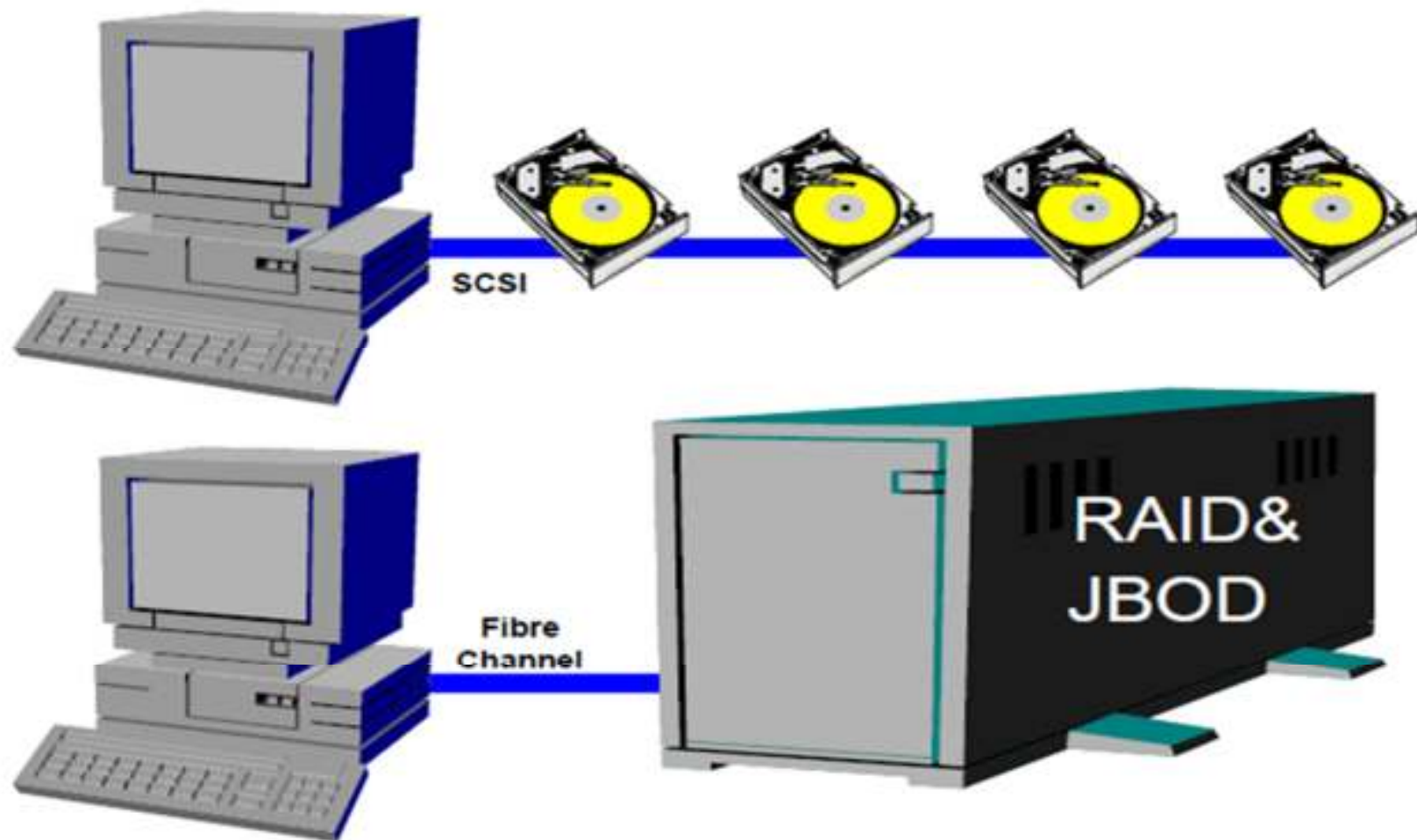
DAS Software Architecture
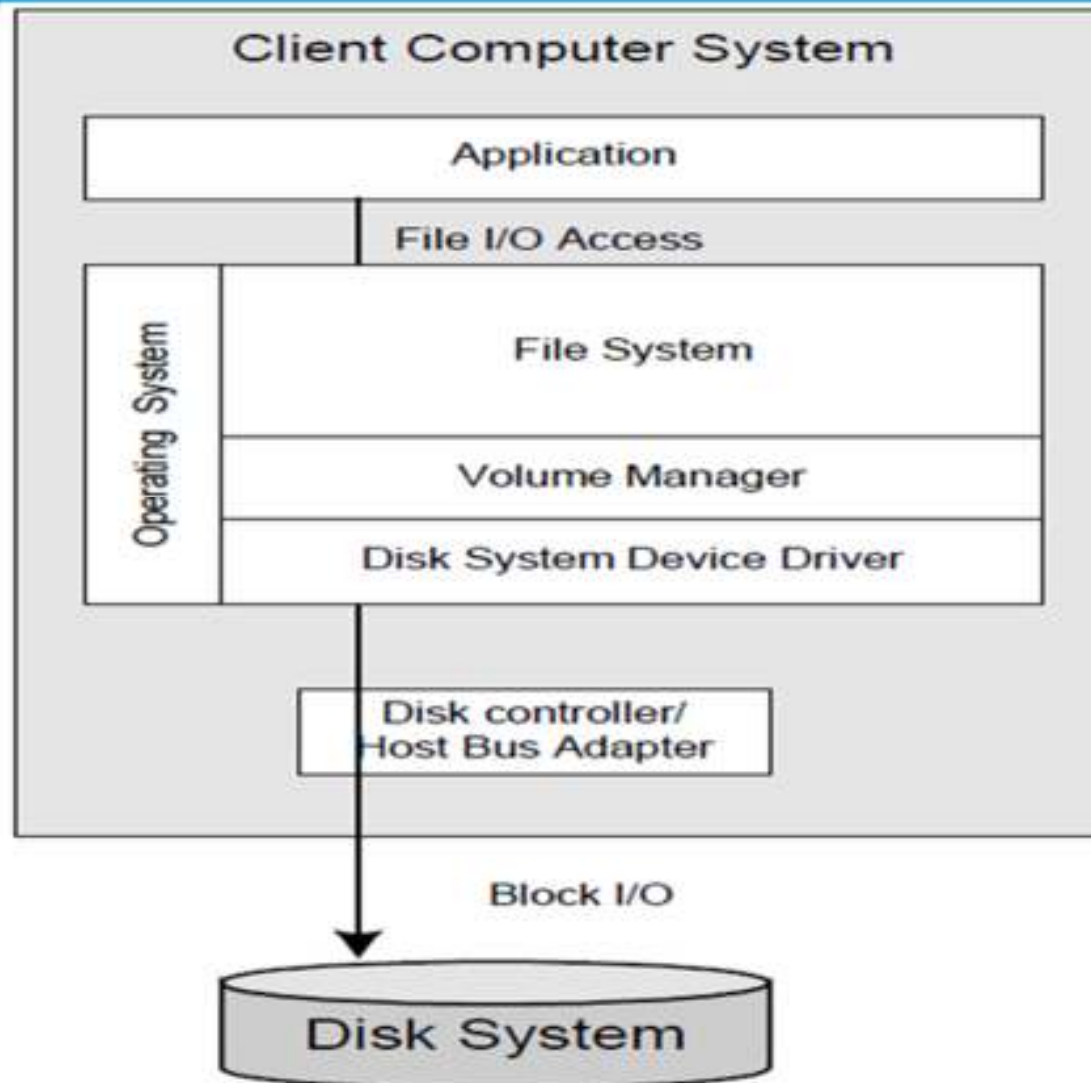
Network Attached Storage (file Oriented)

Windows Workstation

Windows Workstation

UNIX Workstation

UNIX Workstation

Windows NT Server

UNIX NT Server

LAN

NAS Device
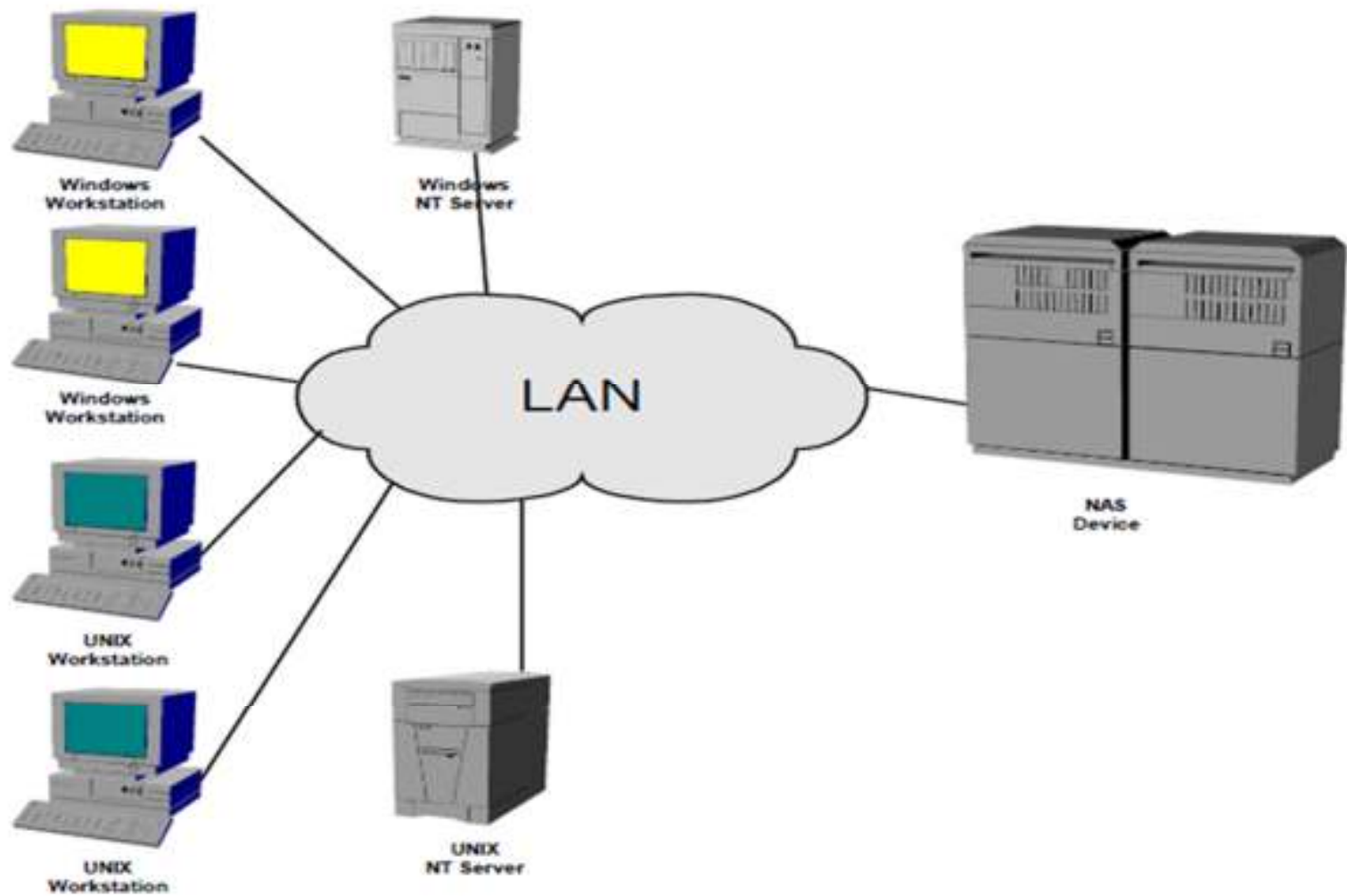
NAS Software Architecture
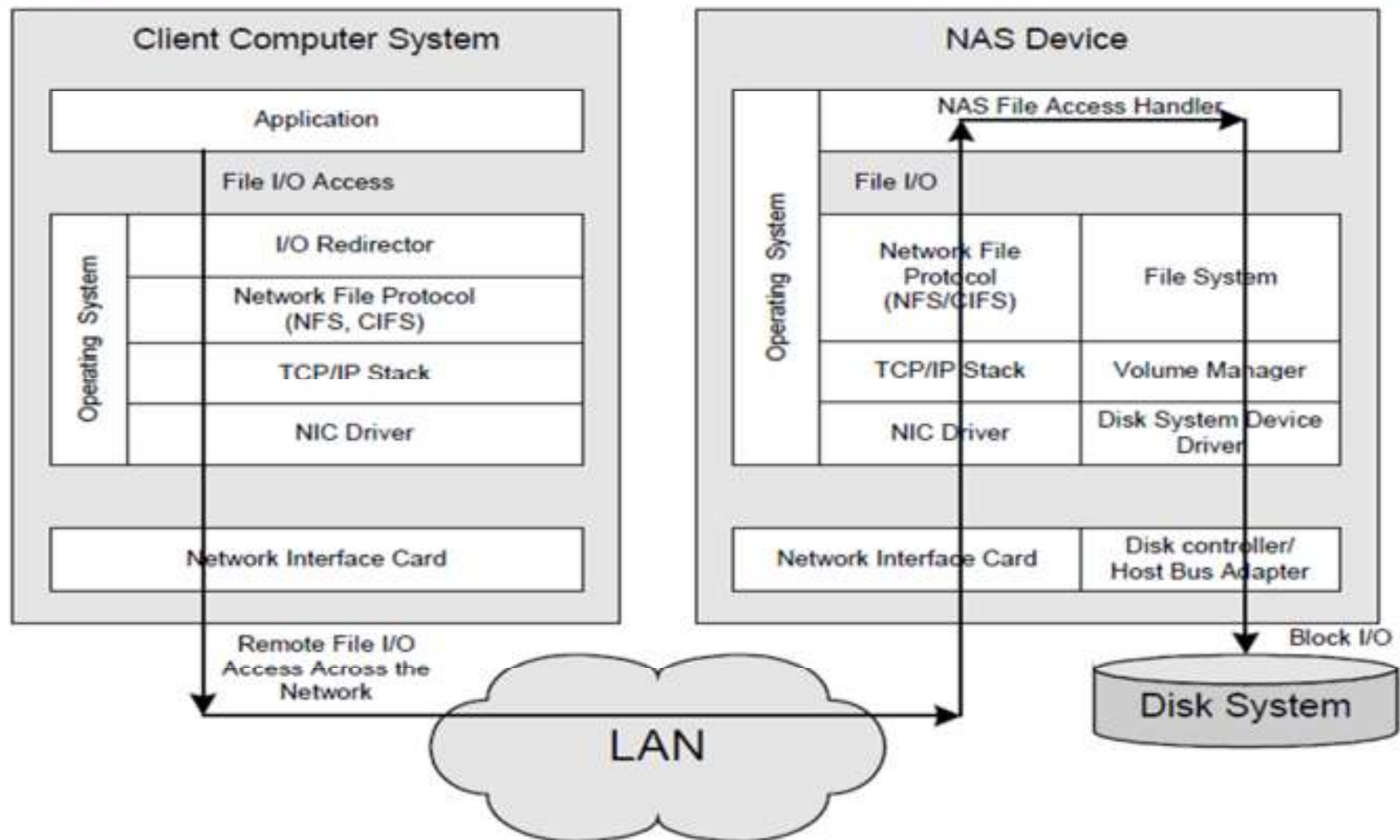
Storage Area Network (block Oriented)

SAN Software Architecture

Client Computer System

Application
File I/O Access

Operating System	File System	
	Volume Manager	
	Fibre Channel Stack	iSCSI Protocol
		TCP-IP Stack
	HBA Driver	NIC Driver

Fiber Channel HBA	Ethernet NIC

Remote Block I/O carried in SAN protocol packets

SAN

Disk System
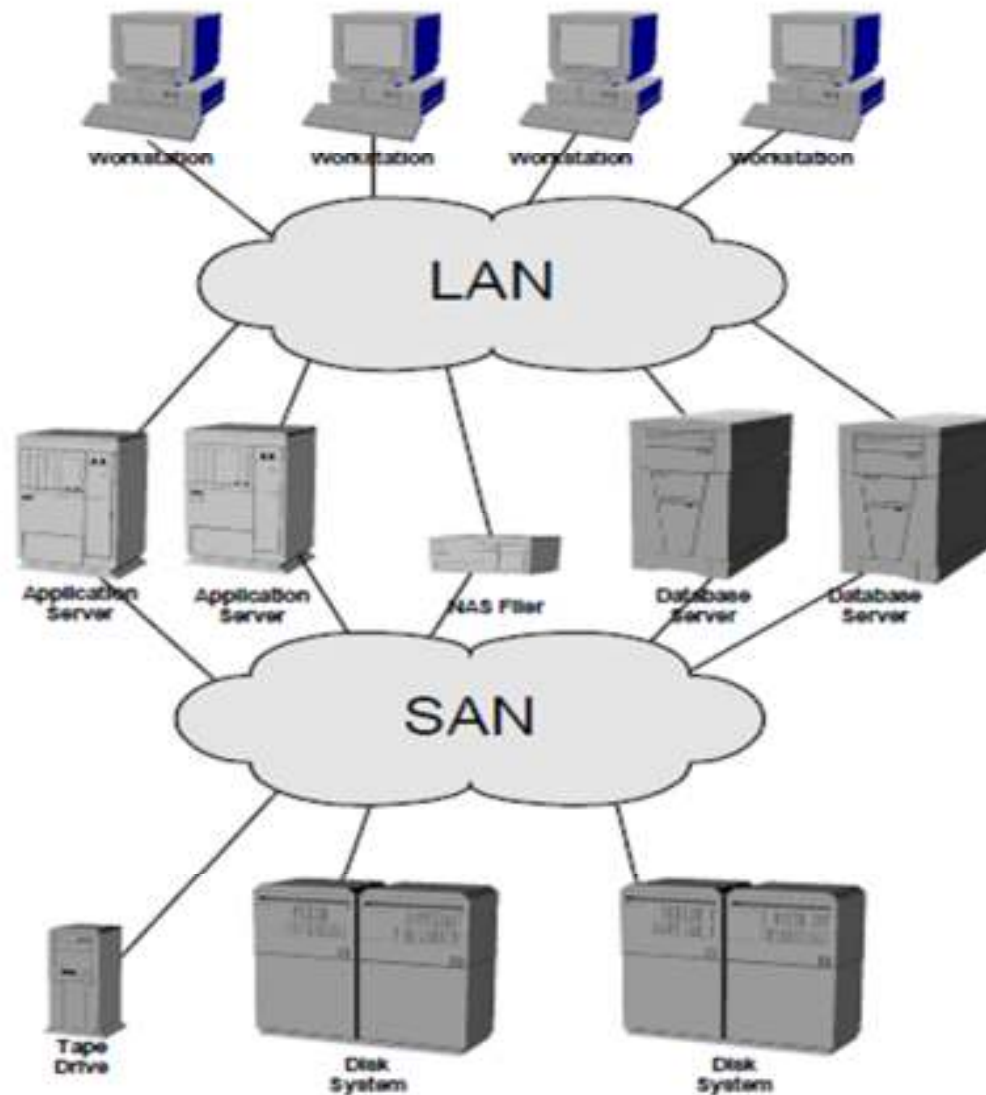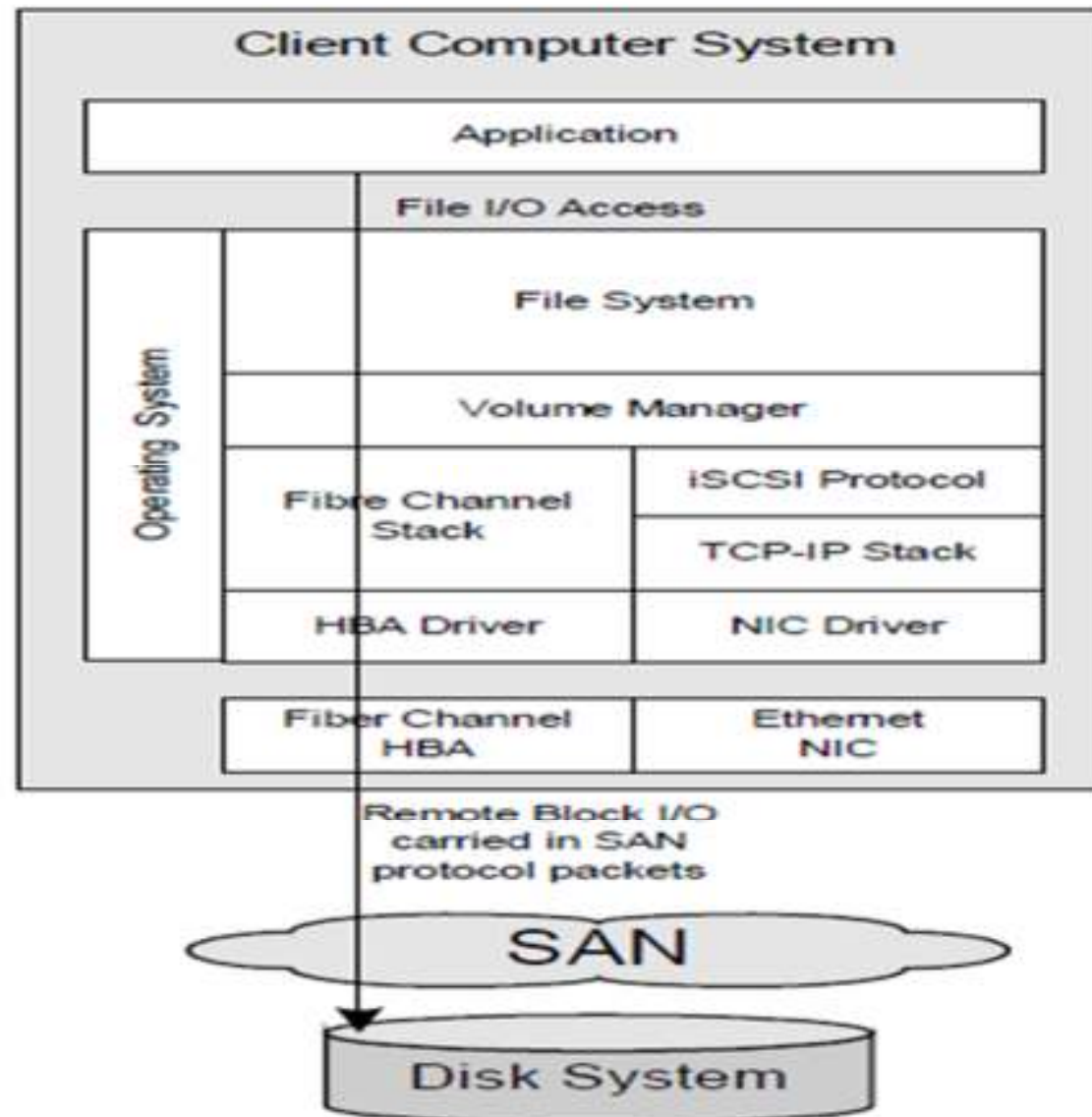
SAN - Logical Unit Number:

➢ Logical unit number is a number that is a used to identify a logical unit.

➢ Device addressed by the SCSI protocol or a fiber channel

➢ It can be used with any read write devices such as tape drive and so on.
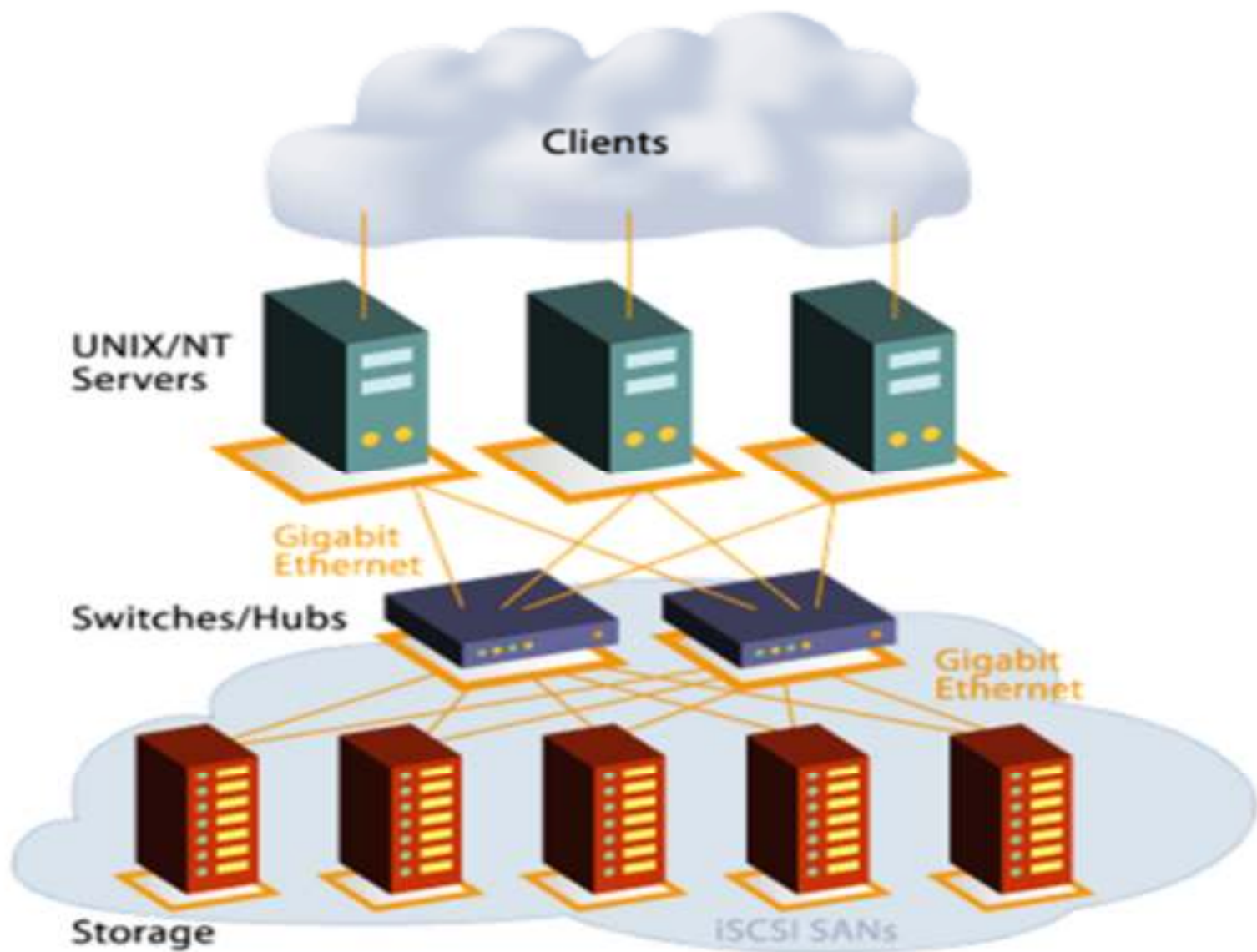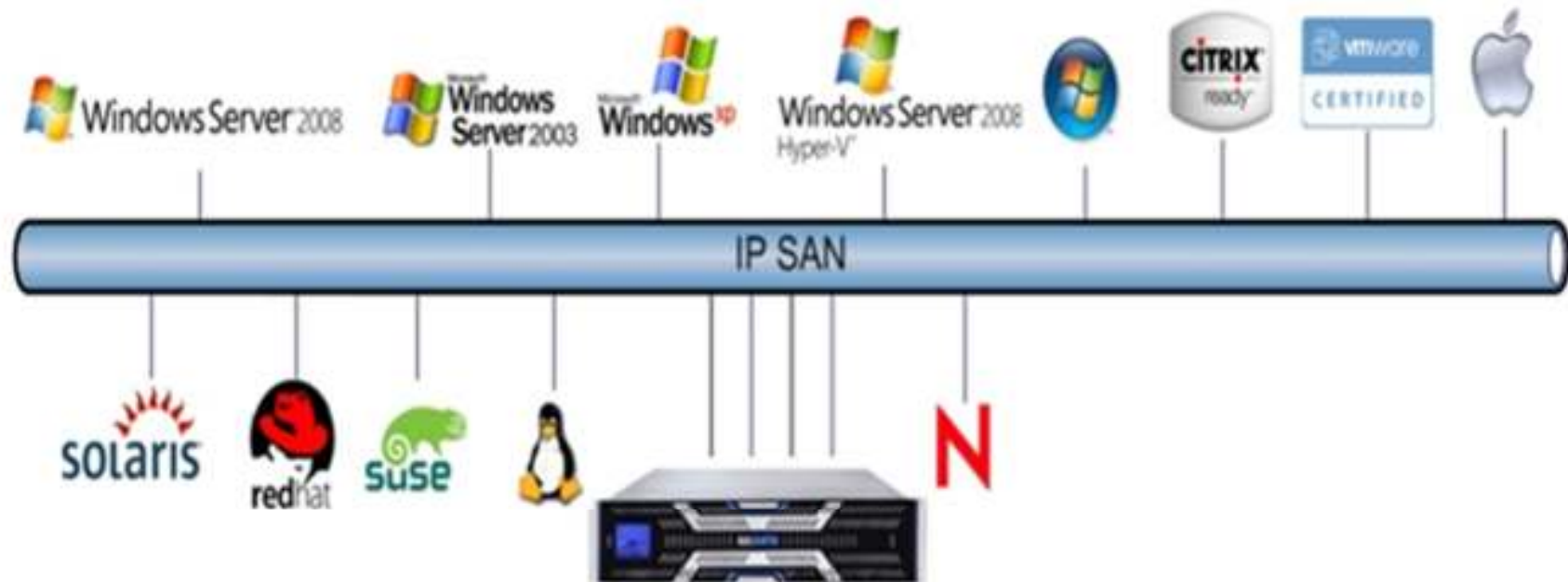
➢ In SCSI it is a 64 bit identifier.

SAN - Zoning:

Client 1

Target Portal
10.10.10.2

int gig1/1
10.10.10.2

iSCSI Proxy PWWN
22:3e:00:05:30:01:88:04

Storage PWWN
50:06:04:82:bf:cf:e0:53

MDS

Target Portal
10.10.10.2

Client 50

— Ethernet
— Fibre Channel
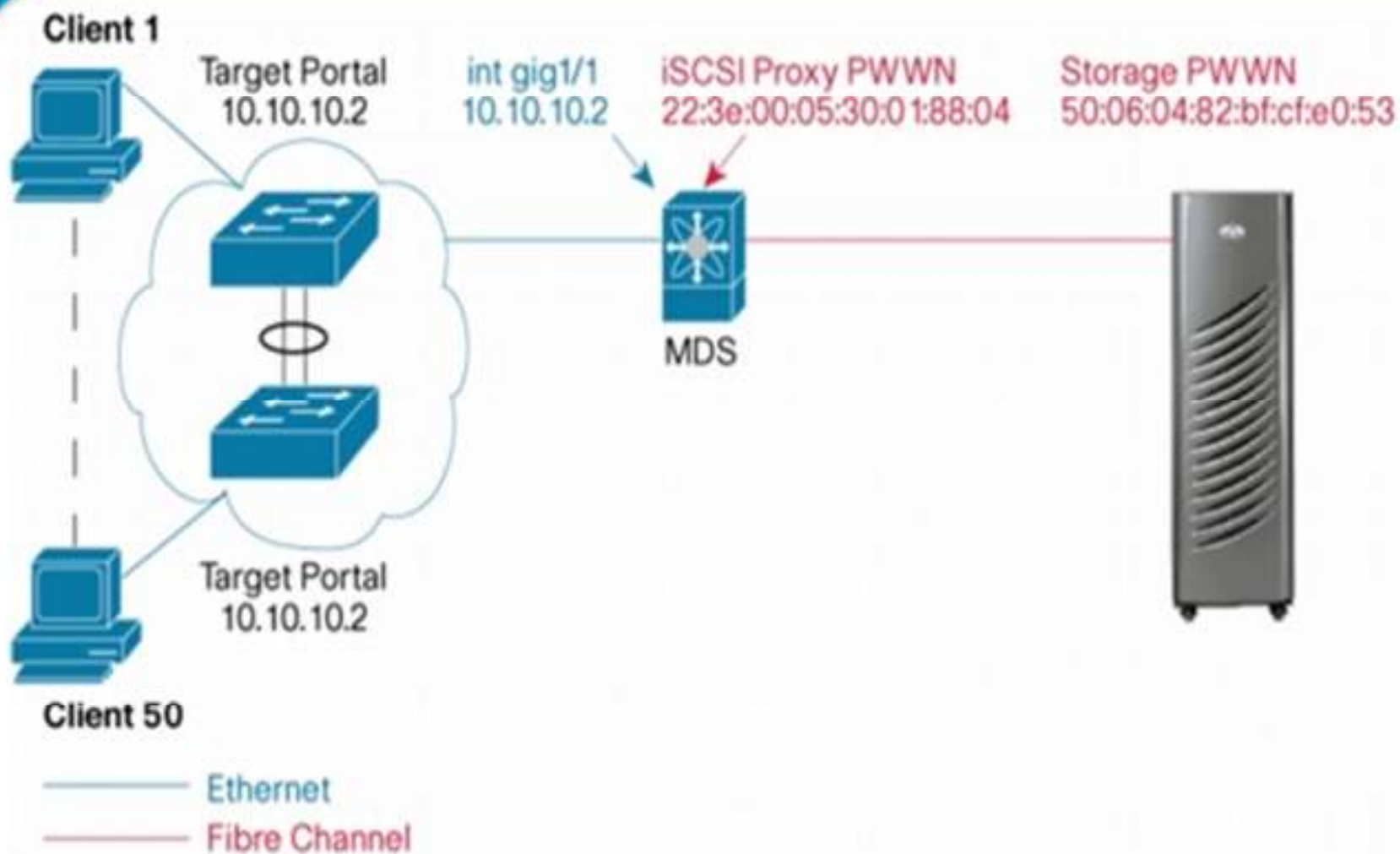
SAN - iSCSI

iSCSI data transfer flow

Server with HBA

IP network

Clients

UNIX/NT Servers

Gigabit Ethernet

Switches/Hubs

Gigabit Ethernet

Storage

iSCSI SANs
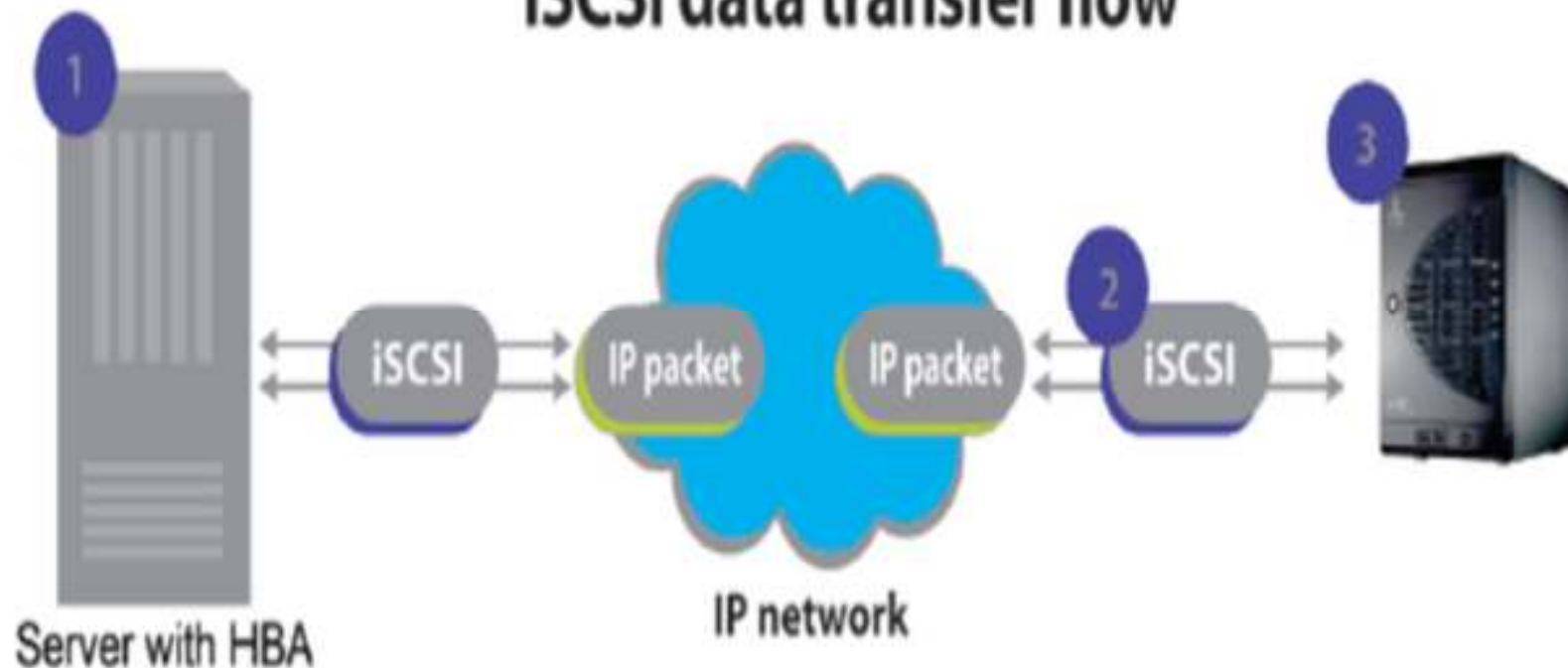
Supported Operating Systems for iSCSI

REDUNDANT

ARRAY OF

INDEPENDENT

DISKS

Raid Levels

RAID 0

RAID 1

RAID 2

RAID 3

RAID 4

RAID 6

RAID 5

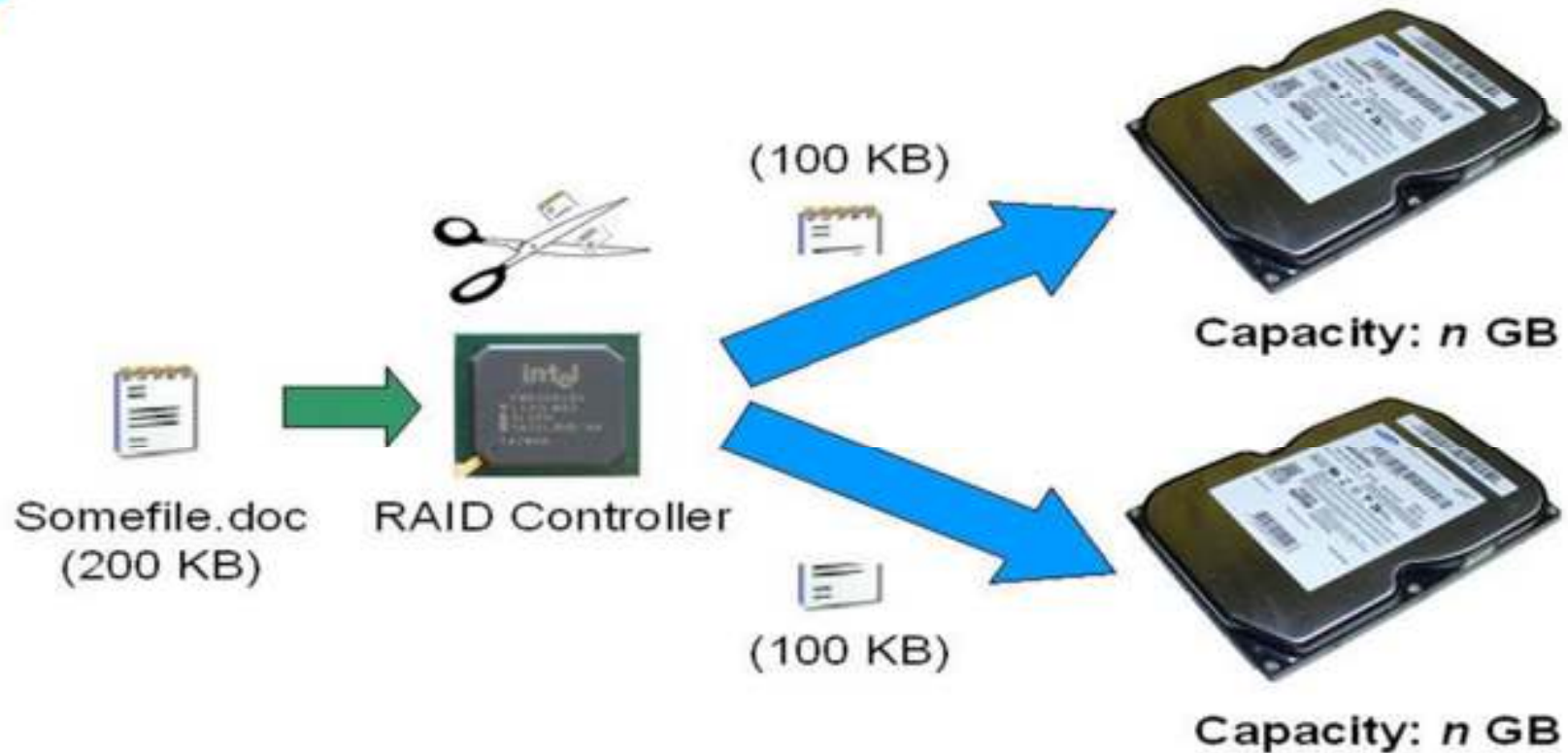**RAID 10**

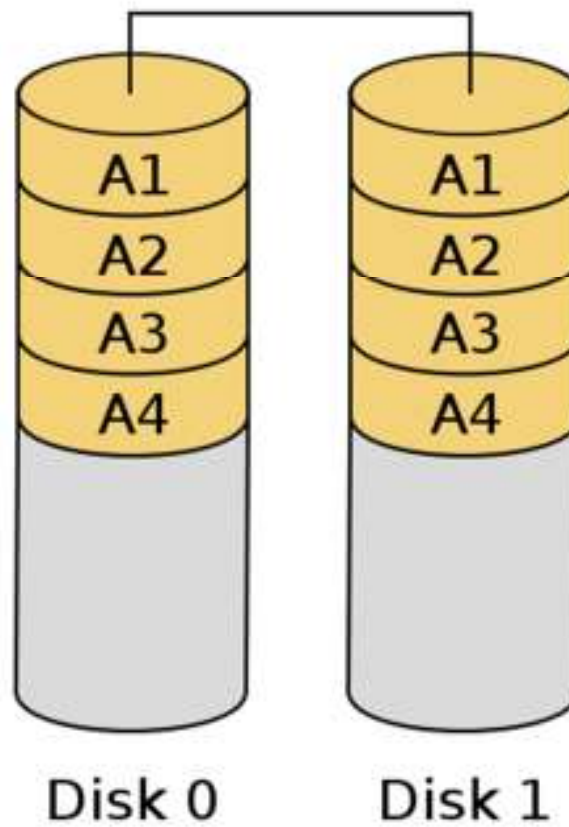# RAID 0

Block-level striping without parity or mirroring.

Disk 0   Disk 1

RAID 0 – Example:

(100 KB)

Capacity: *n* GB
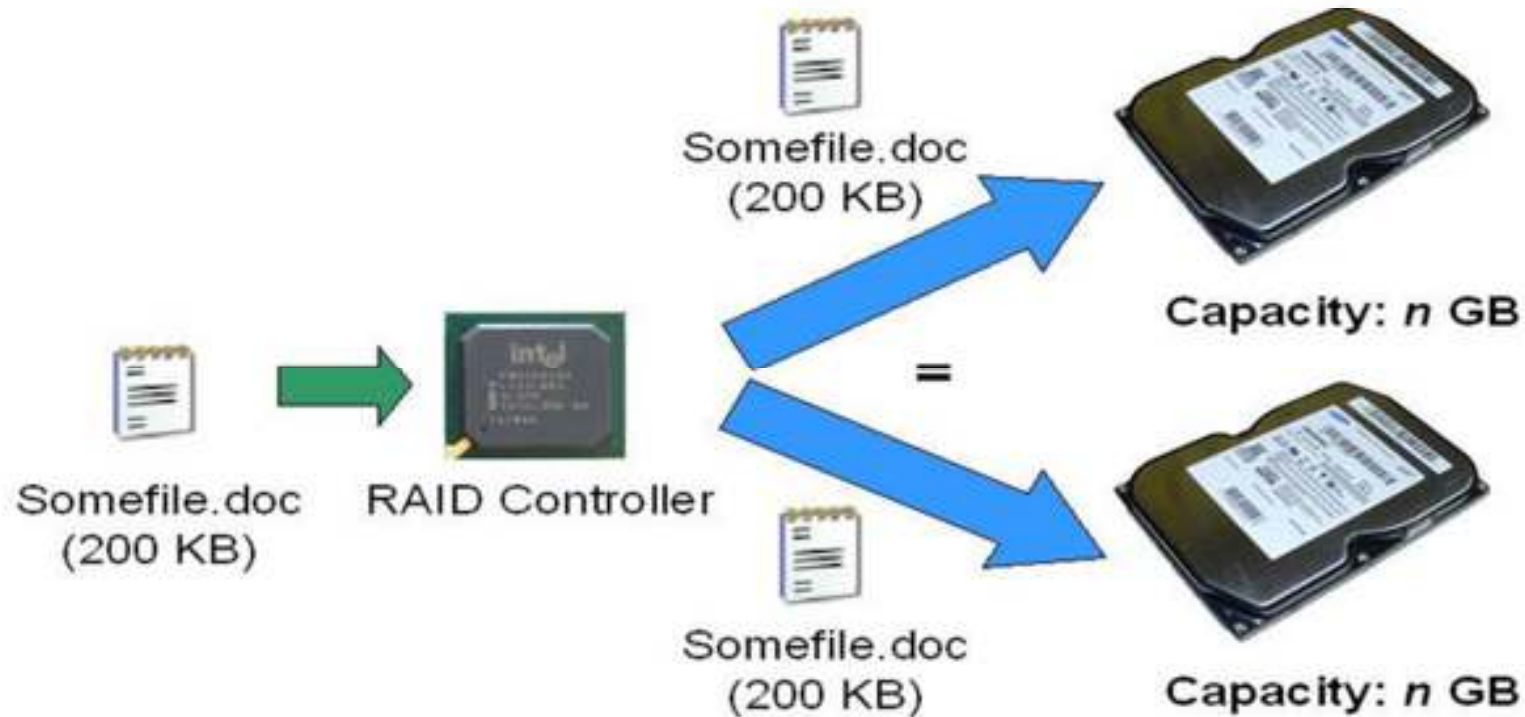
Somefile.doc
(200 KB)

RAID Controller

(100 KB)
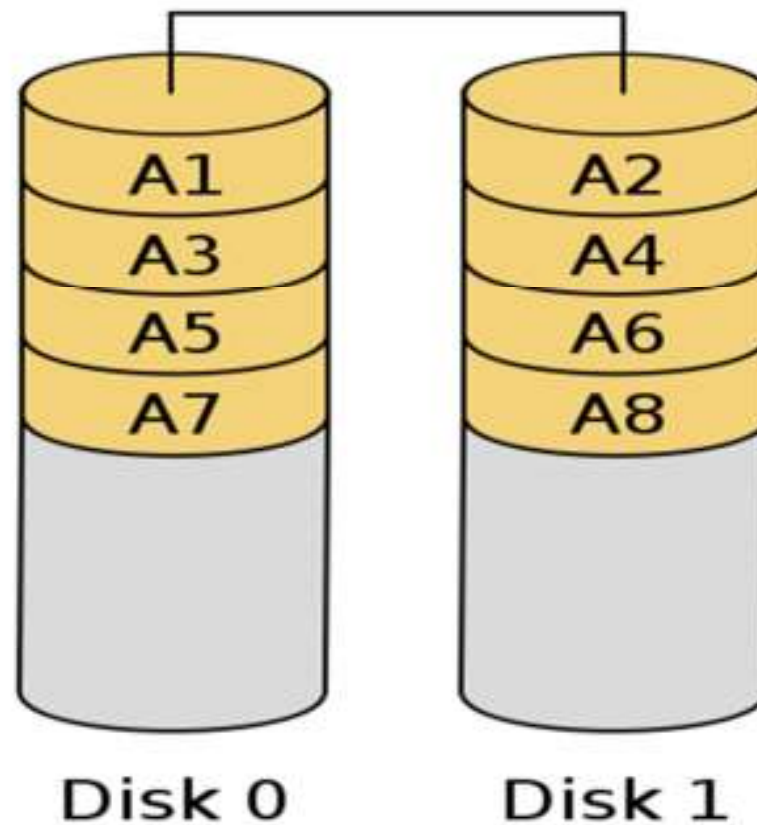
Capacity: *n* GB

RAID0 (Data Striping)
Total Capacity: *n* x 2

RAID 1

Mirroring without parity or striping.

RAID 1 – Example:

Somefile.doc
(200 KB)

RAID Controller

Somefile.doc
(200 KB)

Somefile.doc
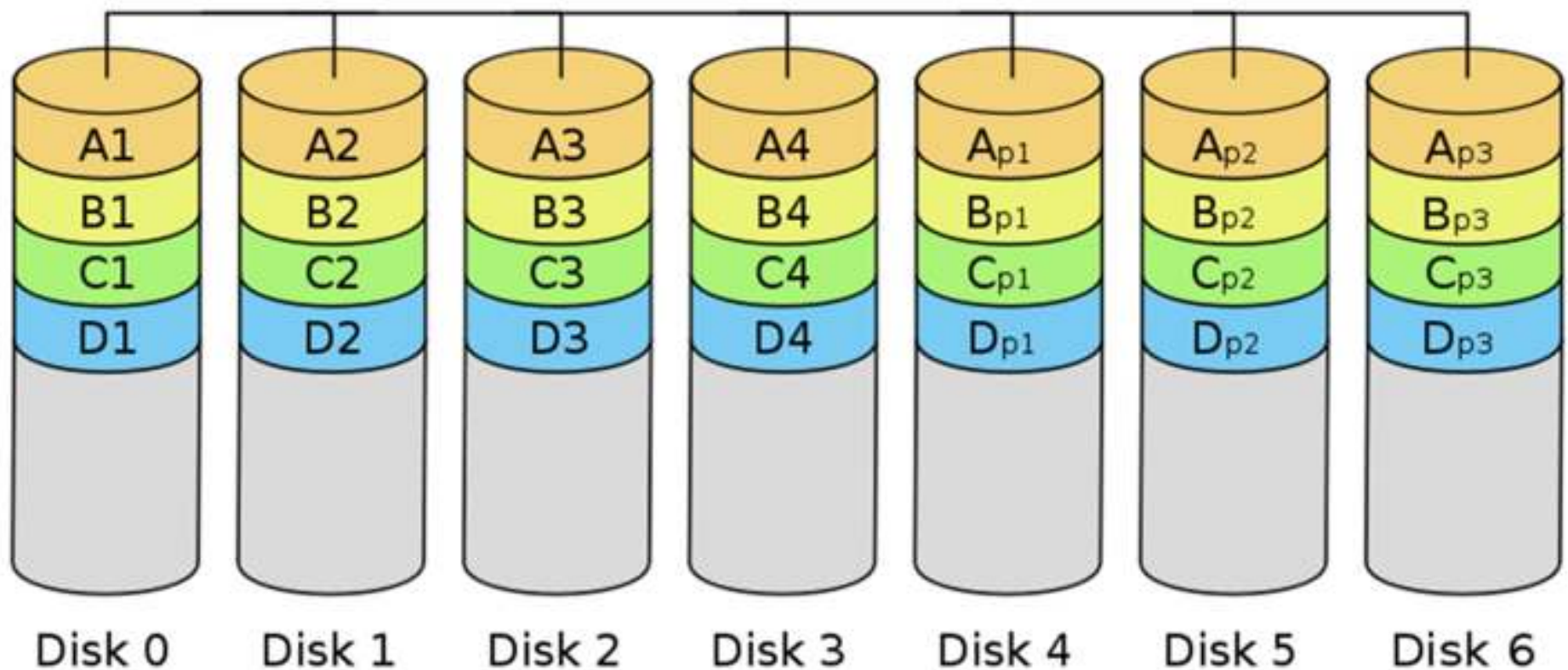(200 KB)

Capacity: *n* GB

=

Capacity: *n* GB

RAID1 (Data Mirroring)
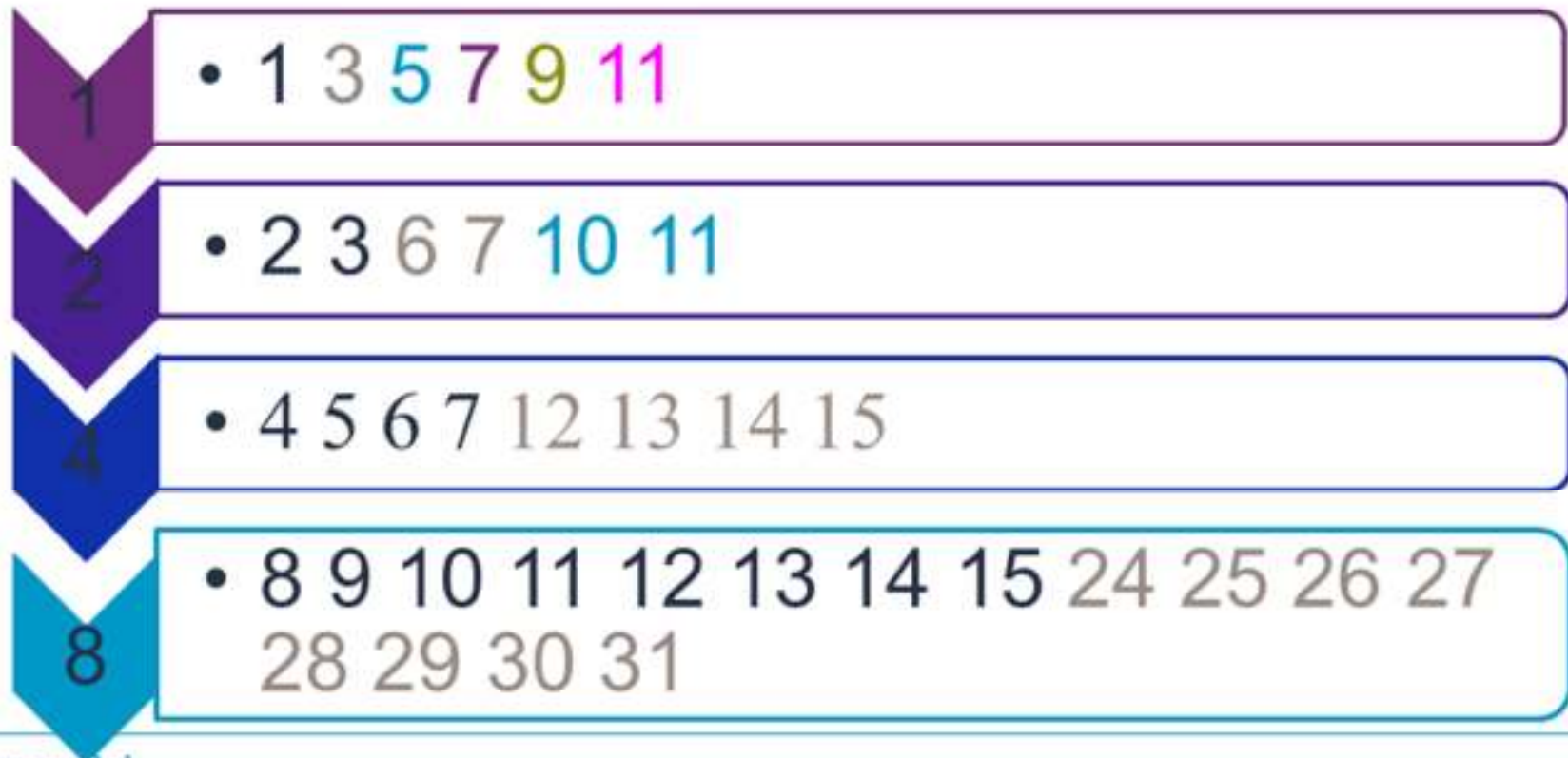## Total Capacity: *n* GB

RAID 2

Bit-level striping with dedicated Hamming-code parity.

RAID 2 – Example:

How to find the **hamming code** ?

Note :Before that we should know parity check

PARITY CHECK

1
- 1 3 5 7 9 11

2
- 2 3 6 7 10 11

4
- 4 5 6 7 12 13 14 15

8
- 8 9 10 11 12 13 14 15 24 25 26 27 28 29 30 31

CODE WORD :

INPUT (8 Bit Data) :10010001

Step 1) 0 * 1 * 0 0 1 * 0 0 0 1

Step 2) 0 0 1 * 0 0 1 * 0 0 0 1

Step 3) 0 0 1 1 0 0 1 1 0 0 0 1

Answer: 0 0 1 1 0 0 1 1 0 0 0 1

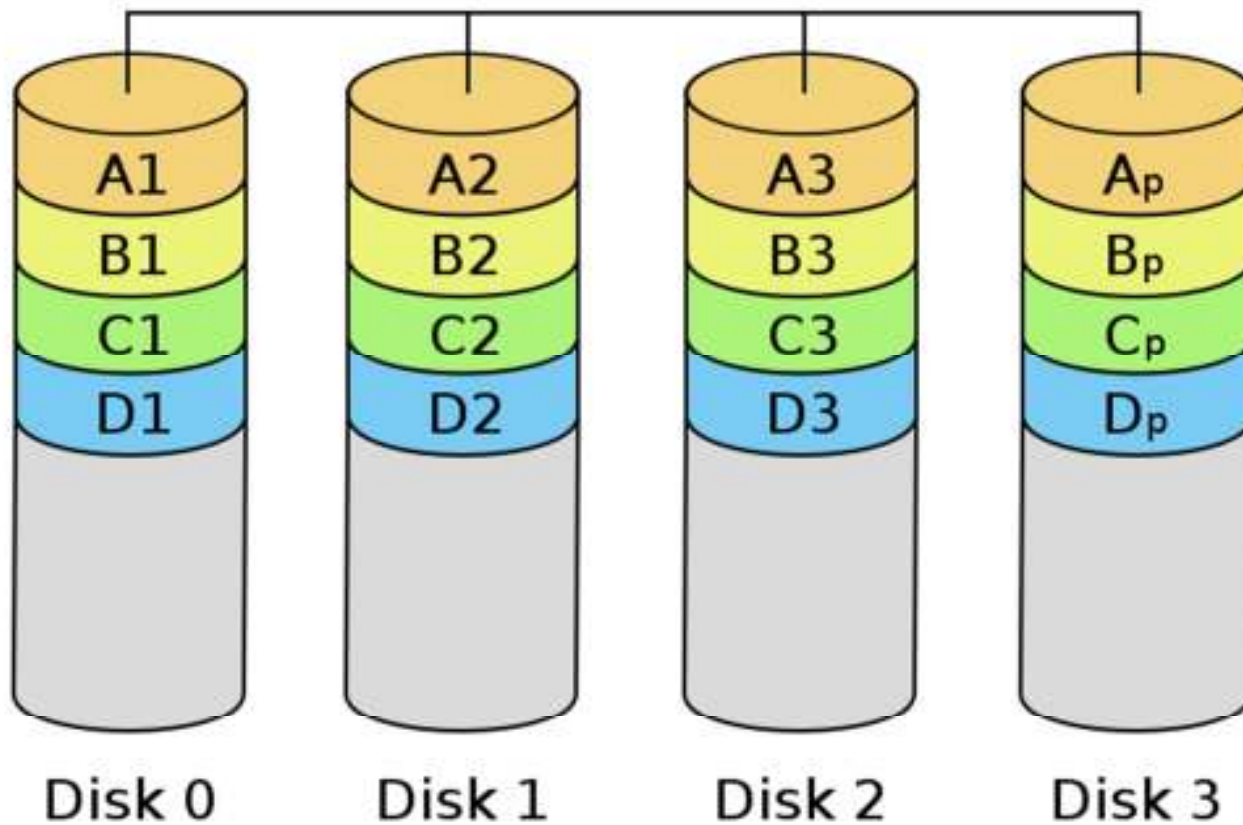RESULT = ODD = '1', EVEN = '0'

RAID 3

Byte-level striping with dedicated parity.
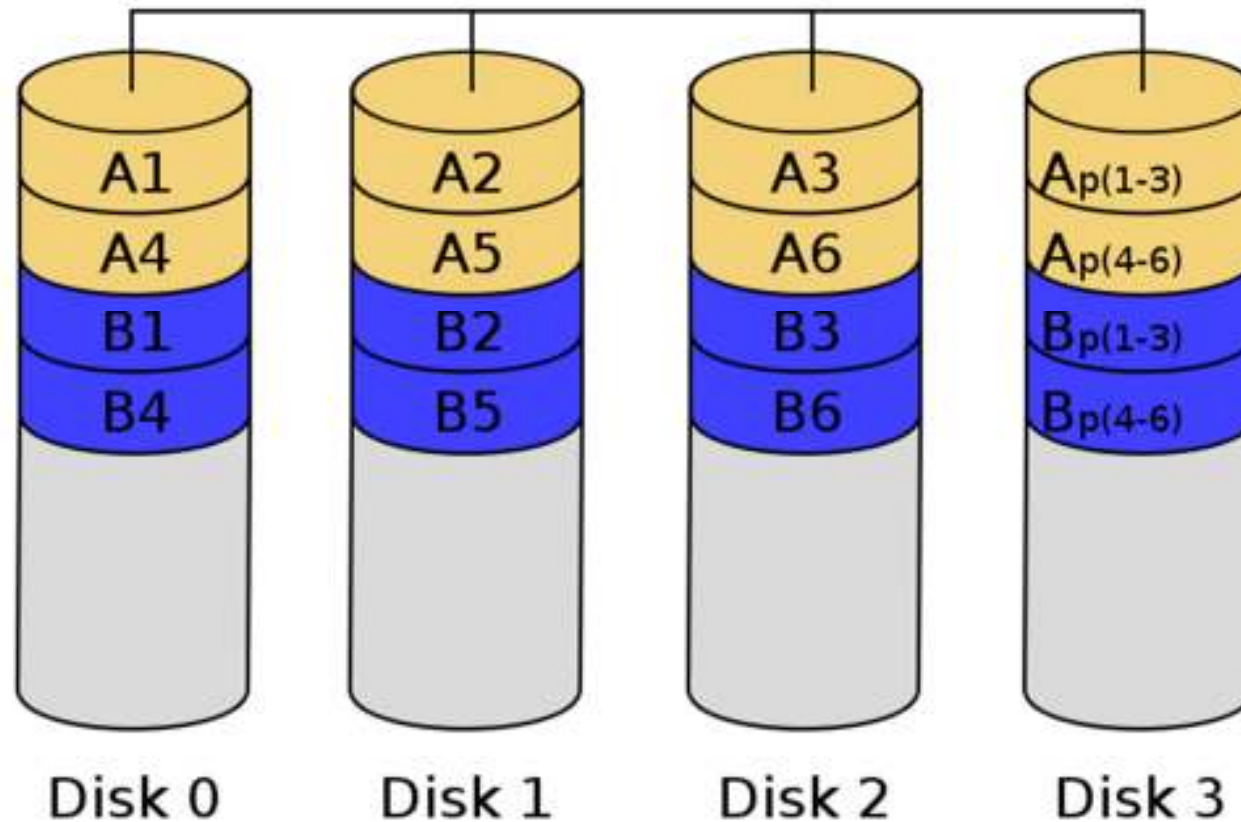
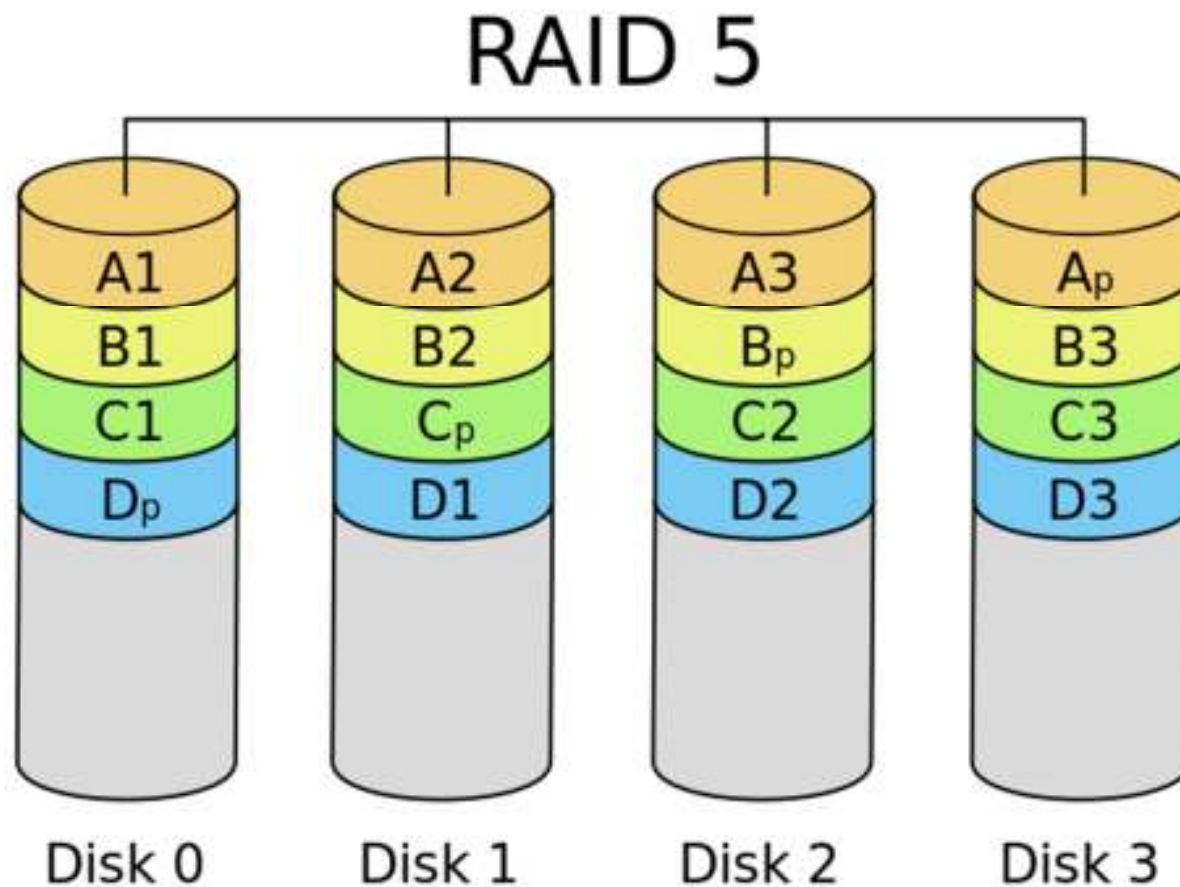# RAID 4

Block-level striping with dedicated parity.
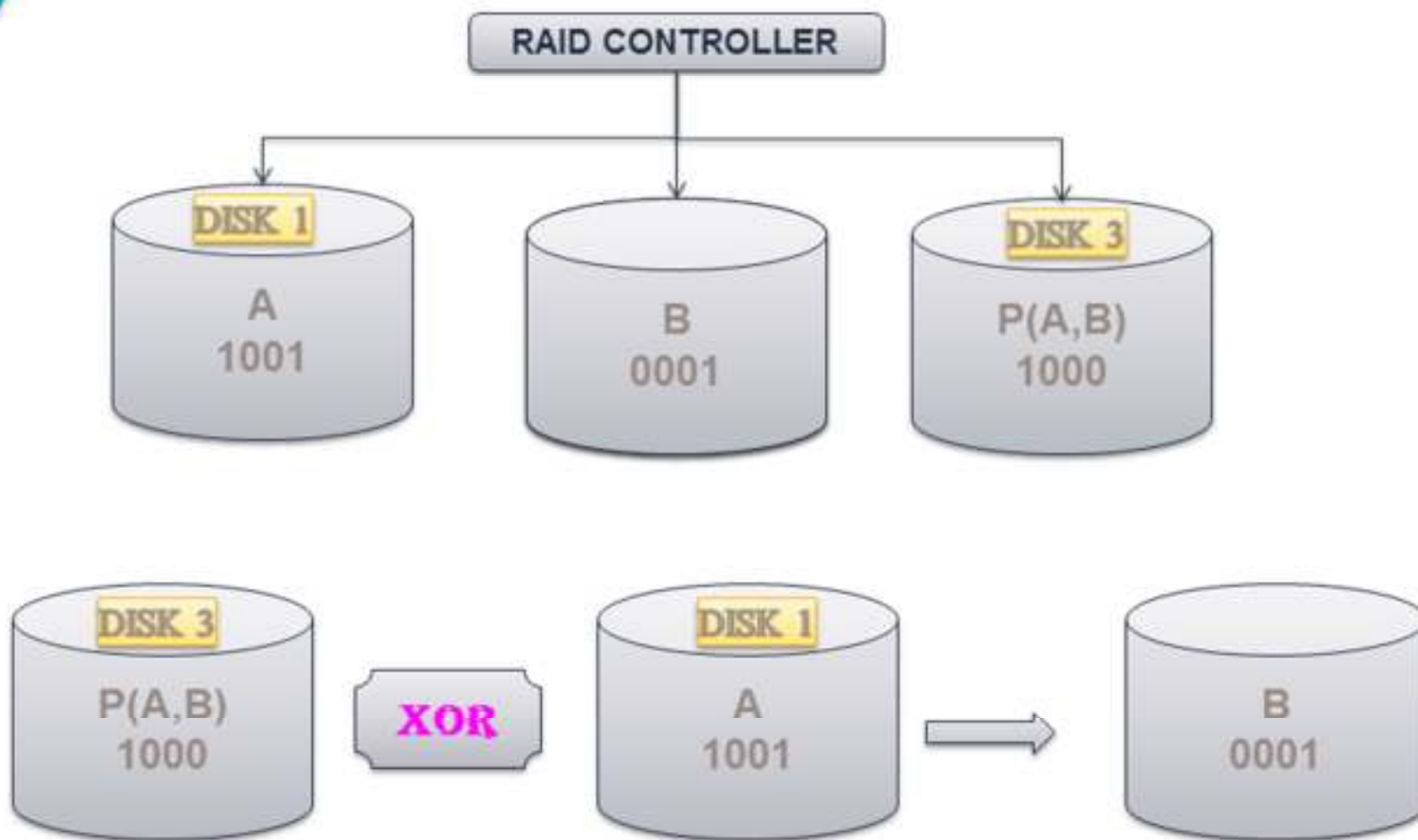
RAID 5

Block-level striping with distributed parity.

Disk 0 Disk 1 Disk 2 Disk 3
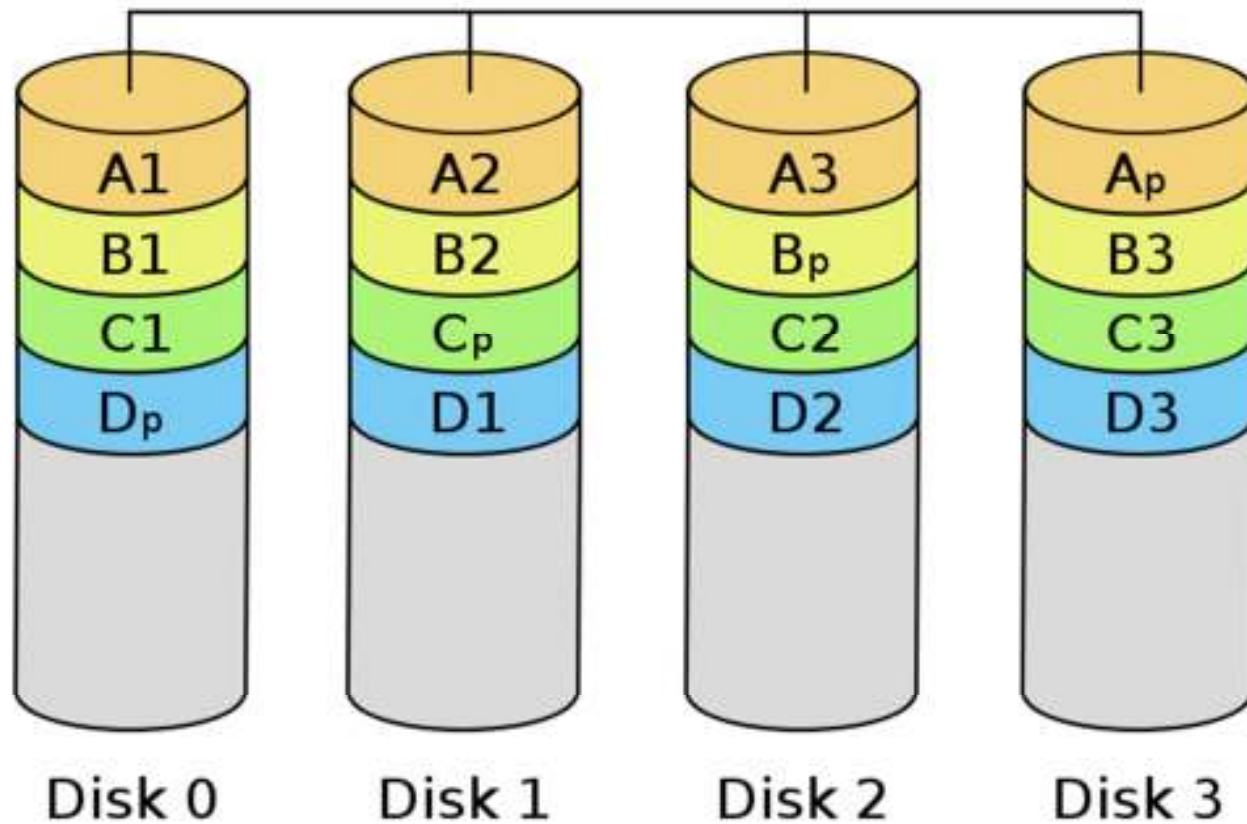
RAID 5

RAID 5 consists of block-level striping with distributed parity

RAID 5

Disk 0	Disk 1	Disk 2	Disk 3
A1	A2	A3	Ap
B1	B2	Bp	B3
C1	Cp	C2	C3
Dp	D1	D2	D3

Capgemini

RAID 5 – Example:

Block-level striping with double distributed parity.

Disk 0	Disk 1	Disk 2	Disk 3	Disk 4
A1	A2	A3	A_p	A_q
B1	B2	B_p	B_q	B3
C1	C_p	C_q	C2	C3
D_p	D_q	D1	D2	D3
E_q	E1	E2	E3	E_p
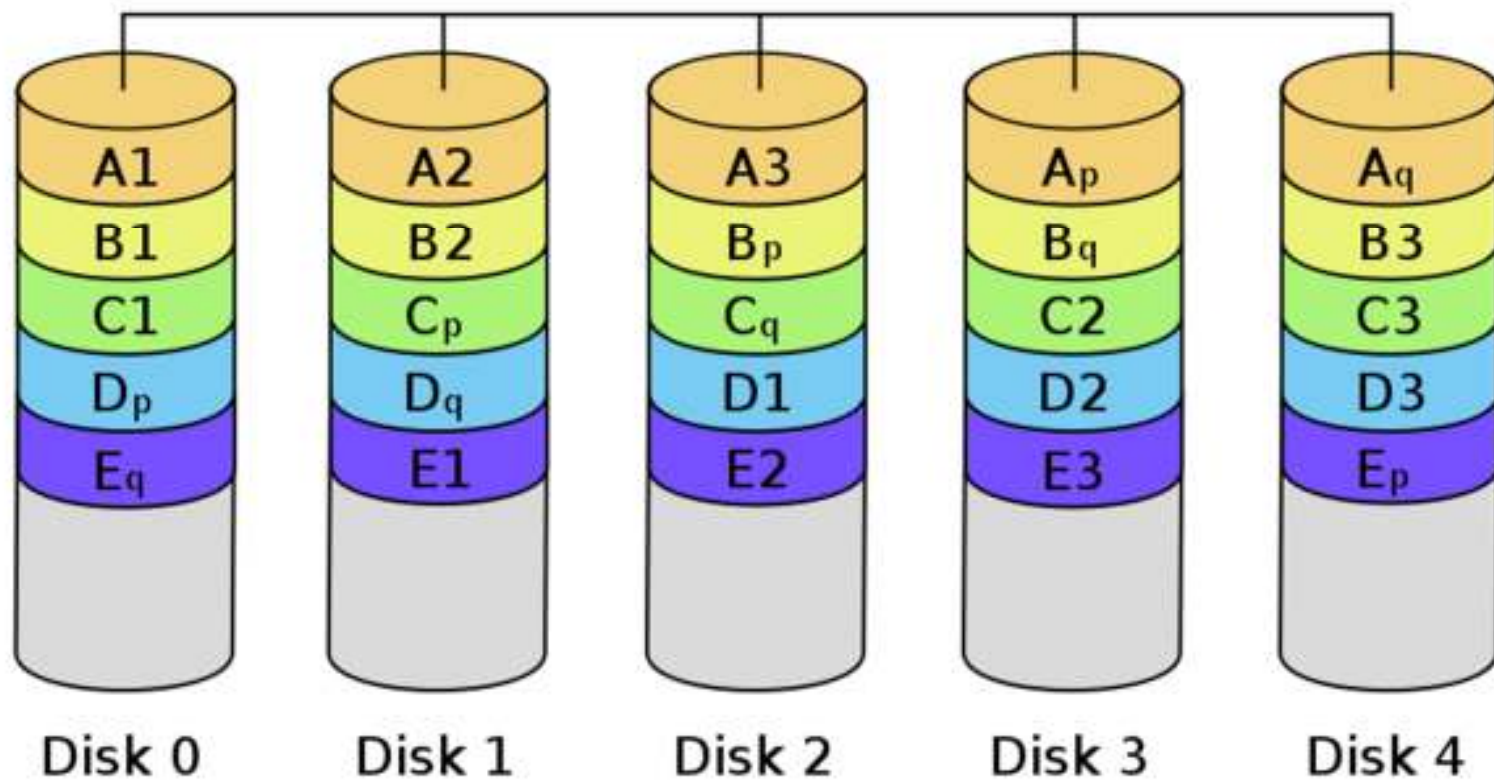
RAID 10

Very High Reliability combined with High Performance

RAID 0

RAID 1

RAID 1

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

Thank you