RAID

- Why RAID

  Performance limitation of a single drive disk drive
  - Limited Capacity
  - Limited access speed
  - No fault tolerance

  RAID was introduced to mitigate this problem

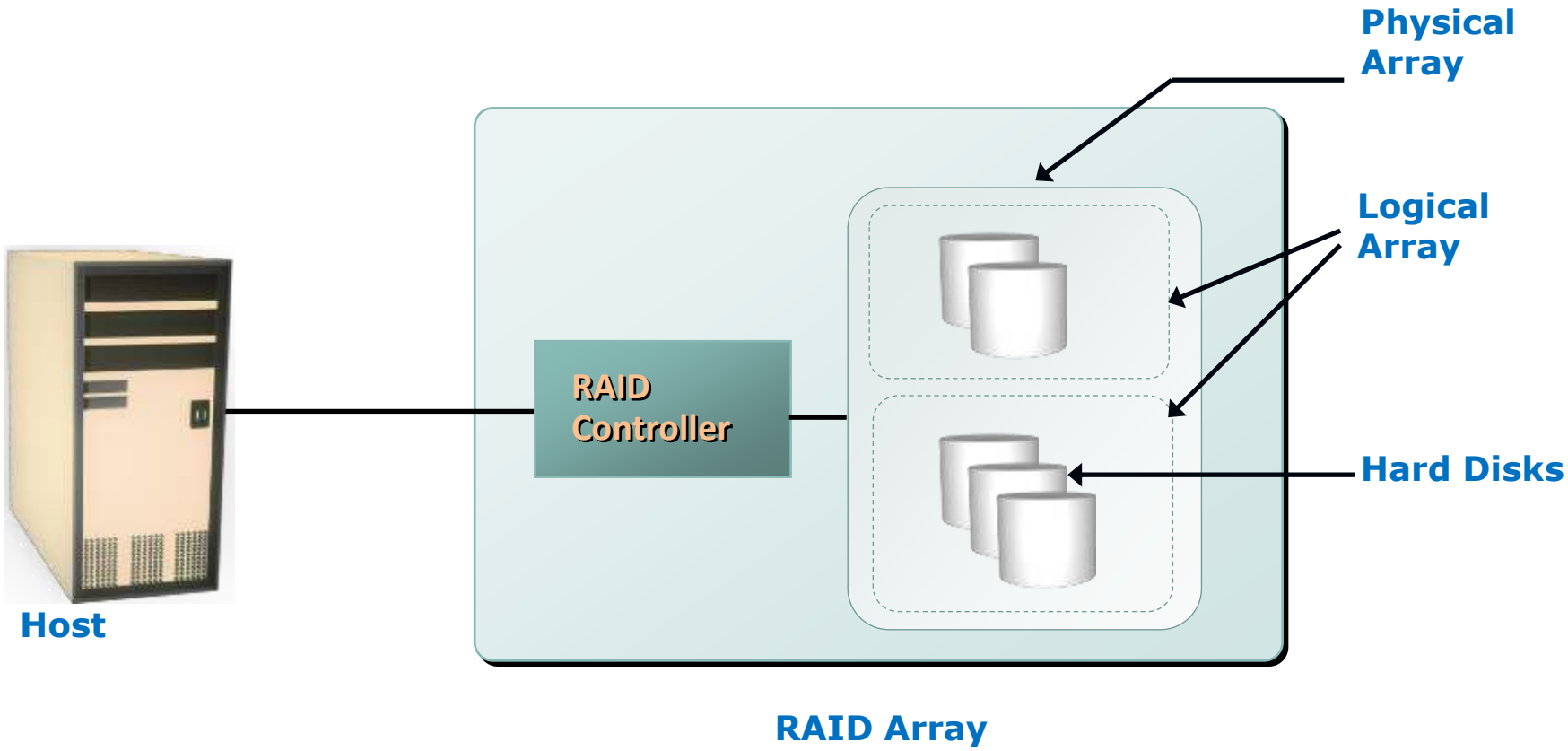
RAID

- RAID was defined as redundant array of inexpensive disks, now commonly redundant array of independent disks
- It combines multiple physical disk drive components into a single logical unit

RAID Advantages

- Fault tolerance
- Increase capacity
- Higher availability
- Increased performance
- Data redundancy

RAID Array Components



RAID Array Components

- RAID Array
- RAID Controller
- Physical disks

RAID Array

RAID Controller

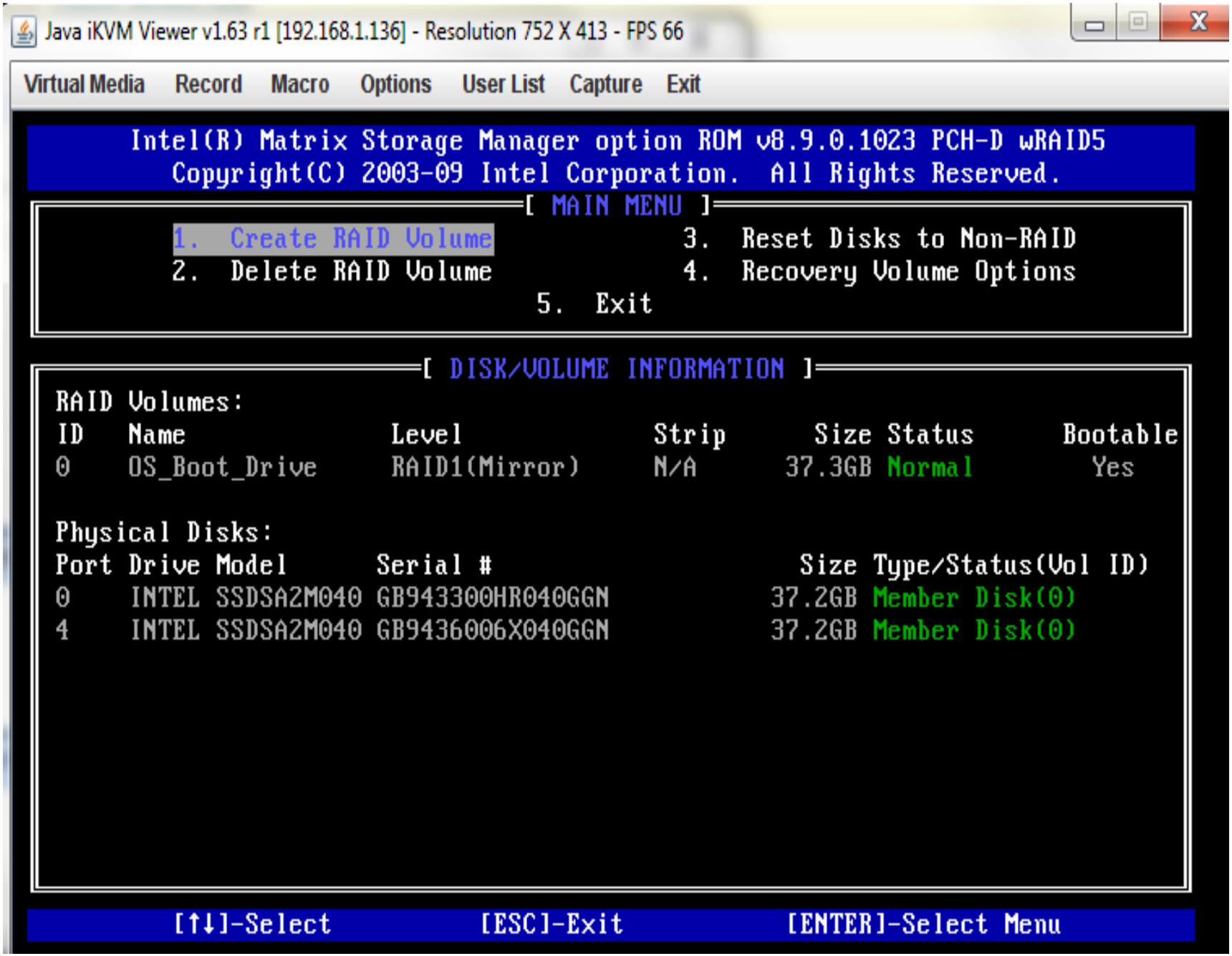
RAID Implementation Techniques

- Software RAID
- Hardware RAID

Software RAID

Software RAID uses host-based software to provide RAID function.

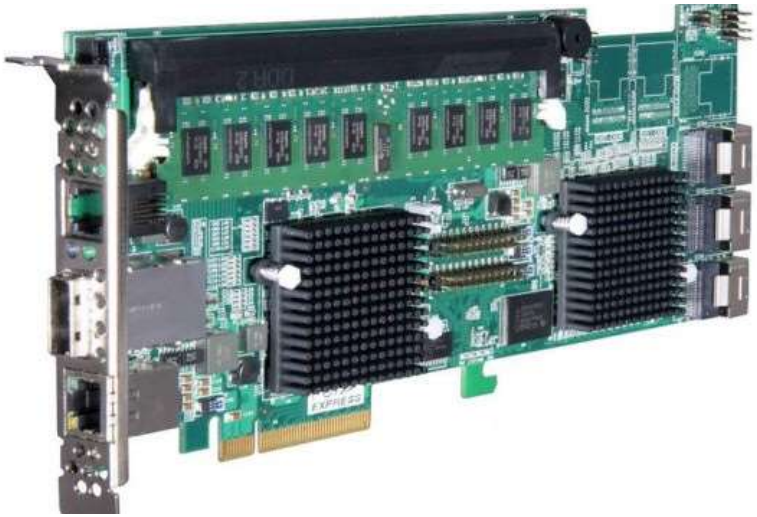
- Runs as part of the operating system
- Performance is dependent on CPU workload
- Does not support all RAID levels

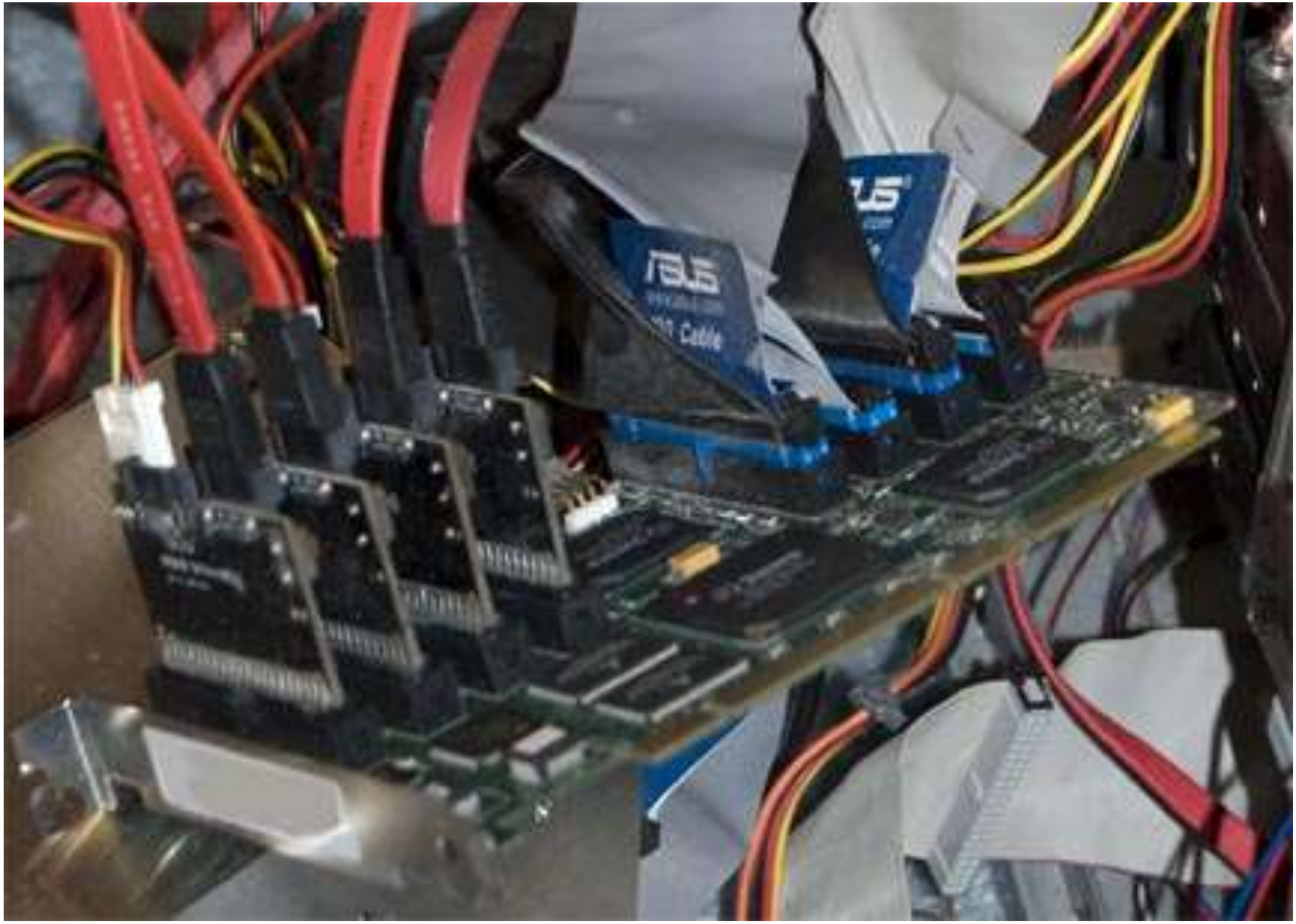

Java iKVM Viewer v1.63 r1 [192.168.1.136] - Resolution 752 X 413 - FPS 66
Virtual Media
Record
Macro
Options
User List
Capture
Exit
Intel(R) Matrix Storage Manager option ROM v8.9.0.1023 PCH-D wRAID5
Copyright(C) 2003-09 Intel Corporation. All Rights Reserved.
[MAIN MENU]
1. Create RAID Volume
2. Delete RAID Volume
3. Reset Disks to Non-RAID
4. Recovery Volume Options
5. Exit
[DISK/VOLUME INFORMATION]
RAID Volumes:
ID Name Level Strip Size Status Bootable
0 OS_Boot_Drive RAID1(Mirror) N/A 37.3GB Normal Yes
Physical Disks:
Port Drive Model Serial # Size Type/Status(Vol ID)
0 INTEL SSDSA2M040 GB943300HR040GGN 37.2GB Member Disk(0)
4 INTEL SSDSA2M040 GB9436006X040GGN 37.2GB Member Disk(0)
[↑↓]-Select
[ESC]-Exit
[ENTER]-Select Menu

Hardware RAID

In this technique , a specialized hardware controller is implemented either on the host or on the array.

- Controls all drives attached to it
- Translation of I/O requests between logical disks and physical disks
- Data regeneration in the event of disk failures.




ASUS

RAID comparison

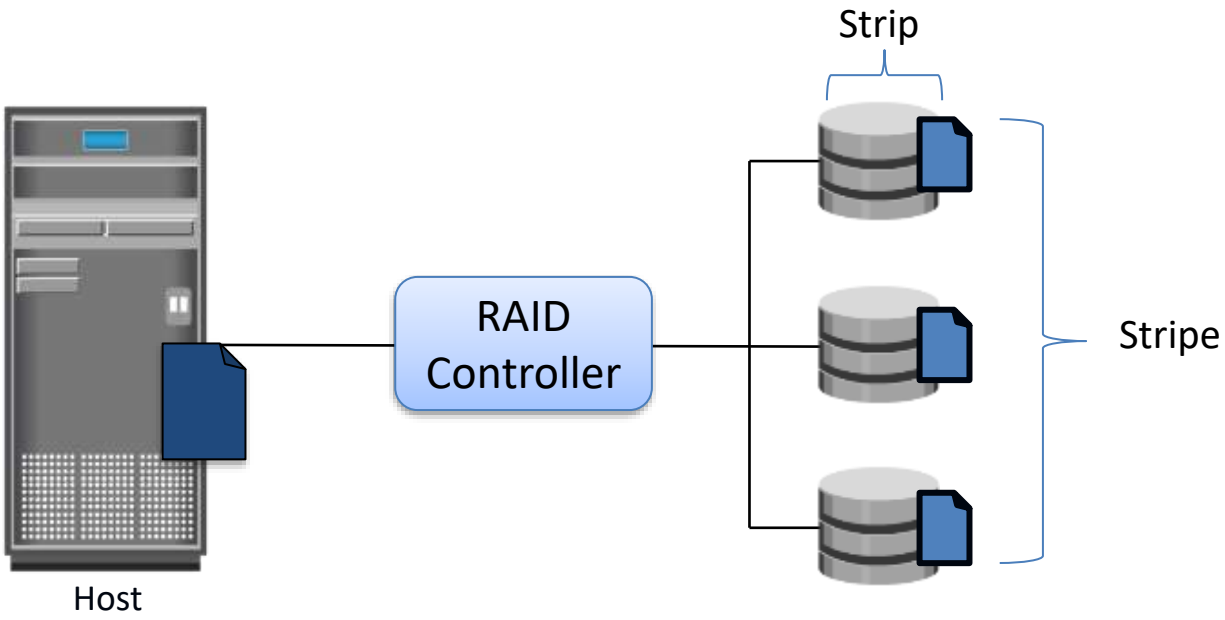
Software RAID	Hardware RAID
Low performance	High performance
Low cost	High cost
Does not need RAID controller	RAID controller needed
Does not supports all RAID levels(RAID 0,1)	Supports all RAID levels

RAID techniques

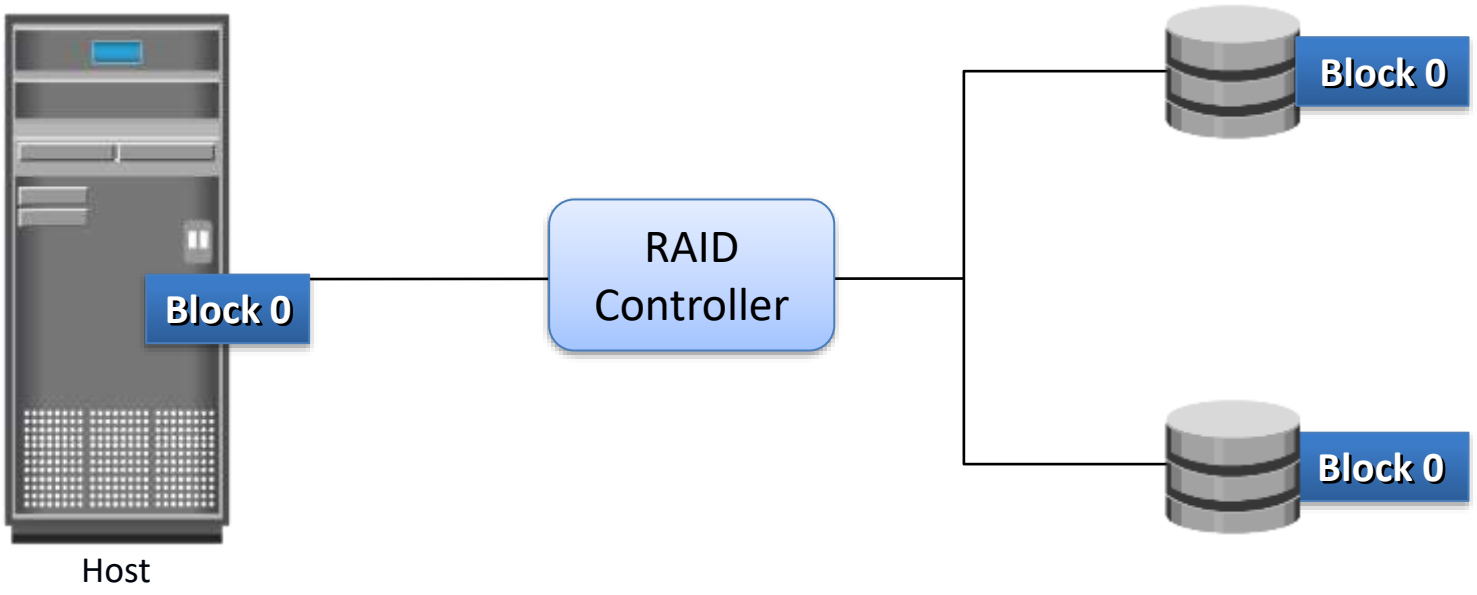
Three key techniques used for RAID are:

- Striping
- Mirroring
- Parity

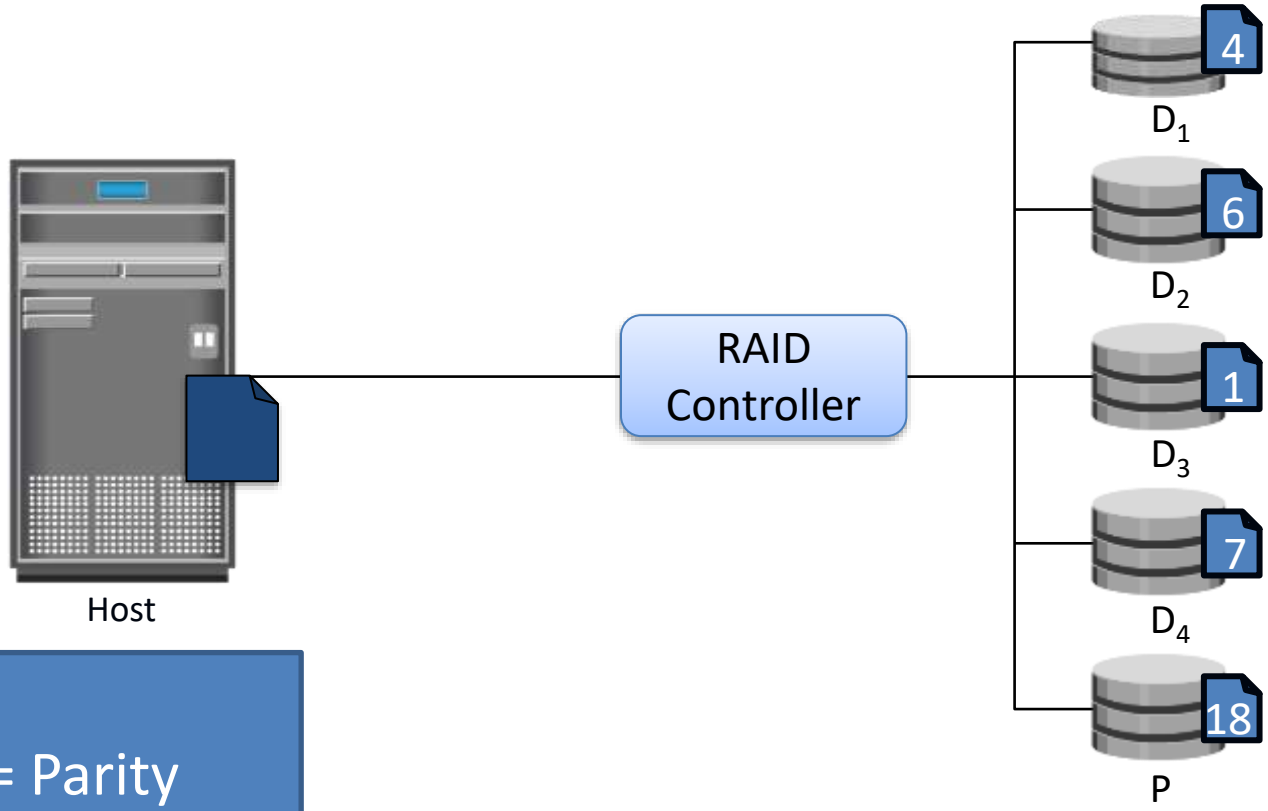
RAID Technique – Striping



RAID Technique – Mirroring



RAID Technique – Parity



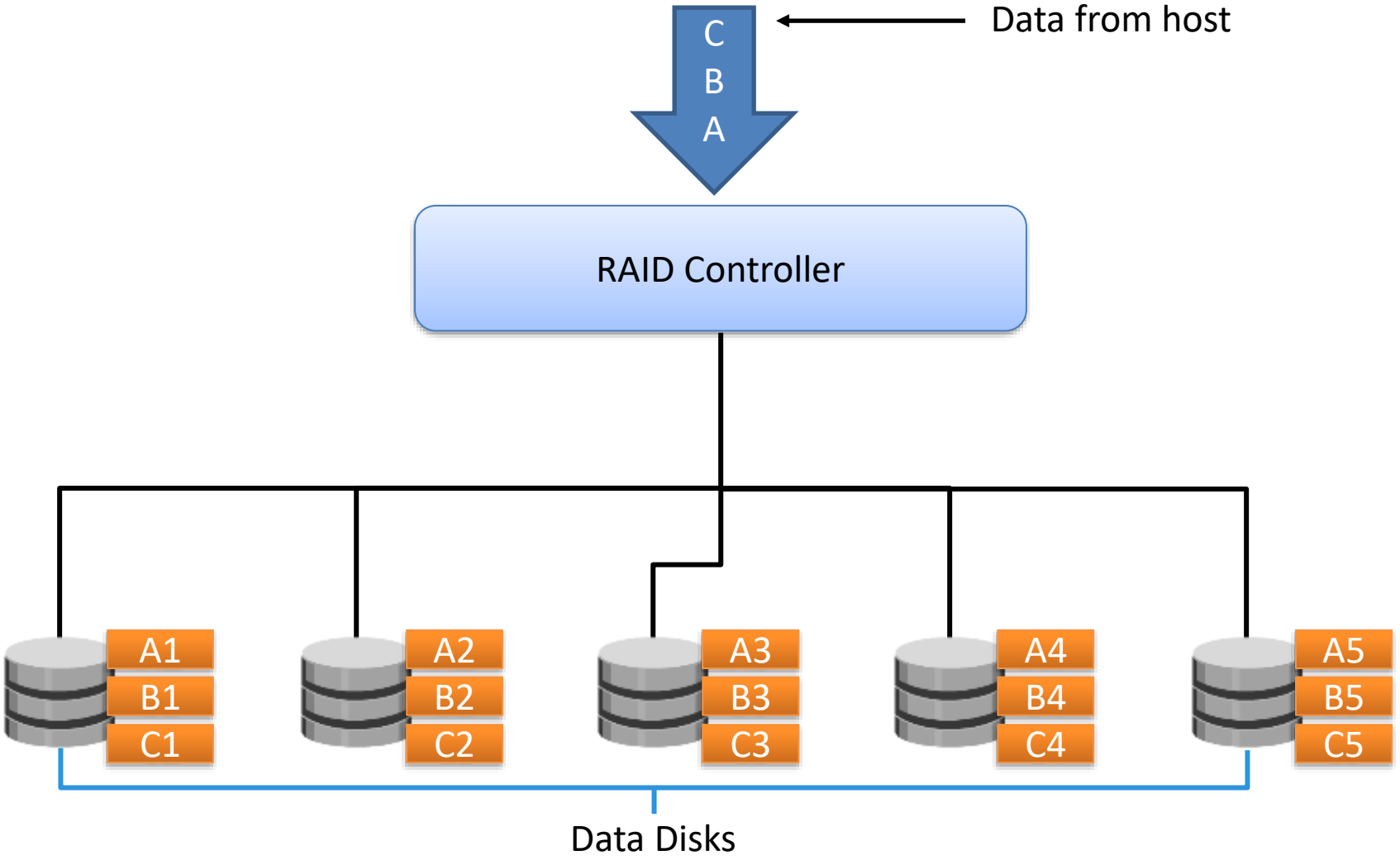
A XOR B = Parity
A XOR Parity = B
B XOR Parity = A

Actual parity calculation is a bitwise XOR operation

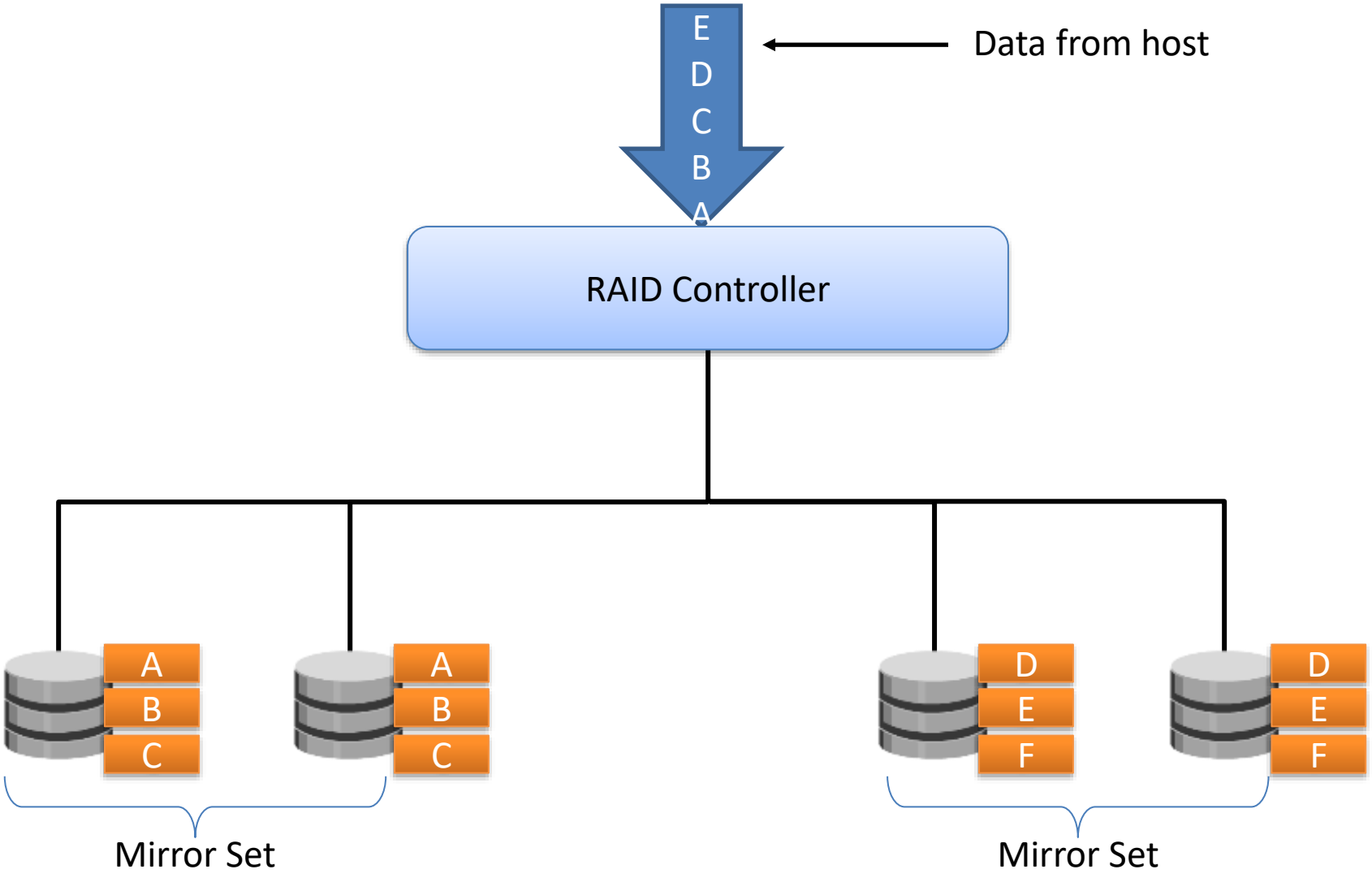
RAID Levels

- Commonly used RAID levels are:
  - RAID 0 – Striped set with no fault tolerance
  - RAID 1 – Disk mirroring
  - RAID 1 + 0 – Nested RAID
  - RAID 3 – Striped set with parallel access and dedicated parity disk
  - RAID 5 – Striped set with independent disk access and a distributed parity
  - RAID 6 – Striped set with independent disk access and dual distributed parity

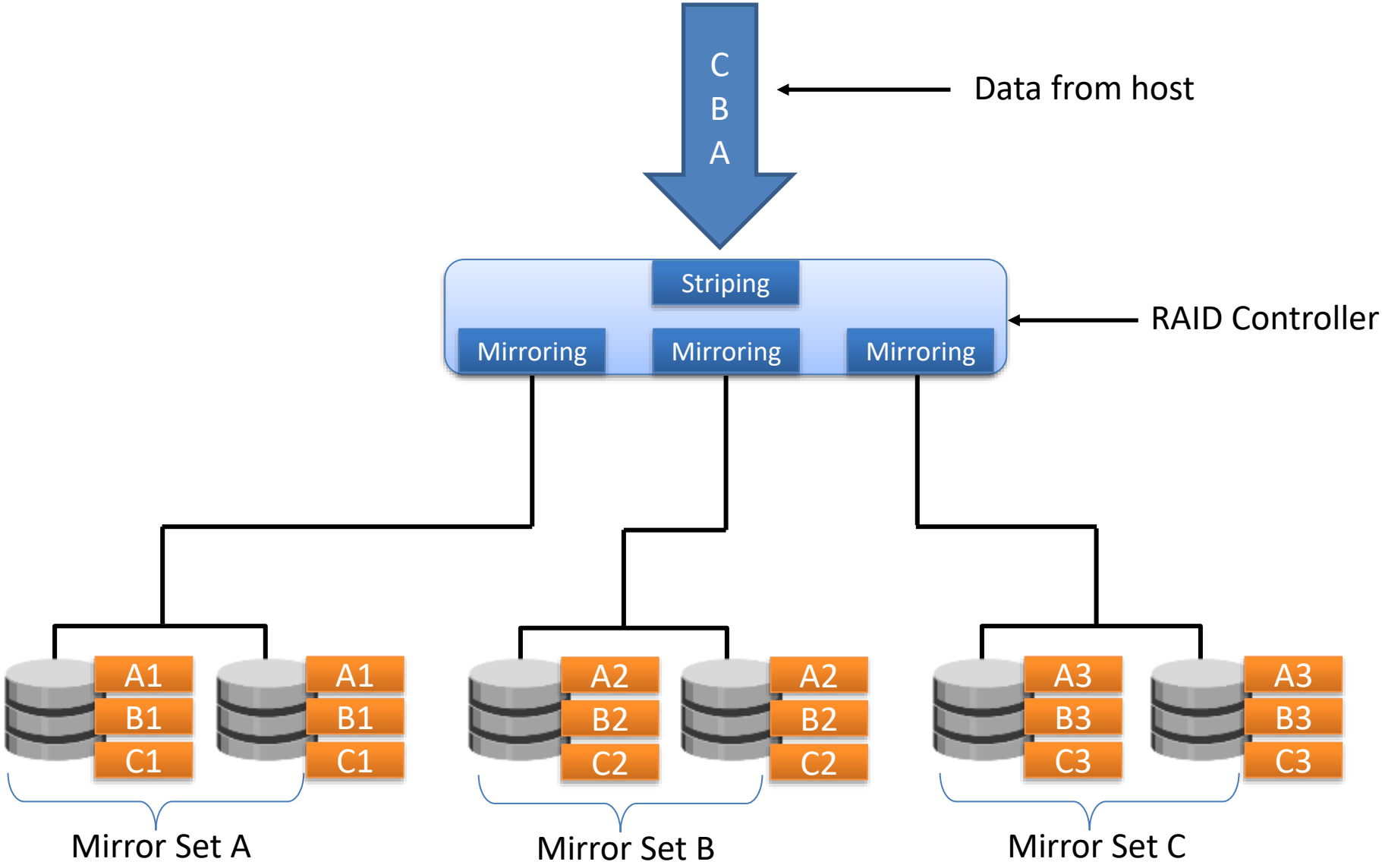
RAID 0


Data from host
C
B
A
RAID Controller
A1
B1
C1
A2
B2
C2
A3
B3
C3
A4
B4
C4
A5
B5
C5
Data Disks

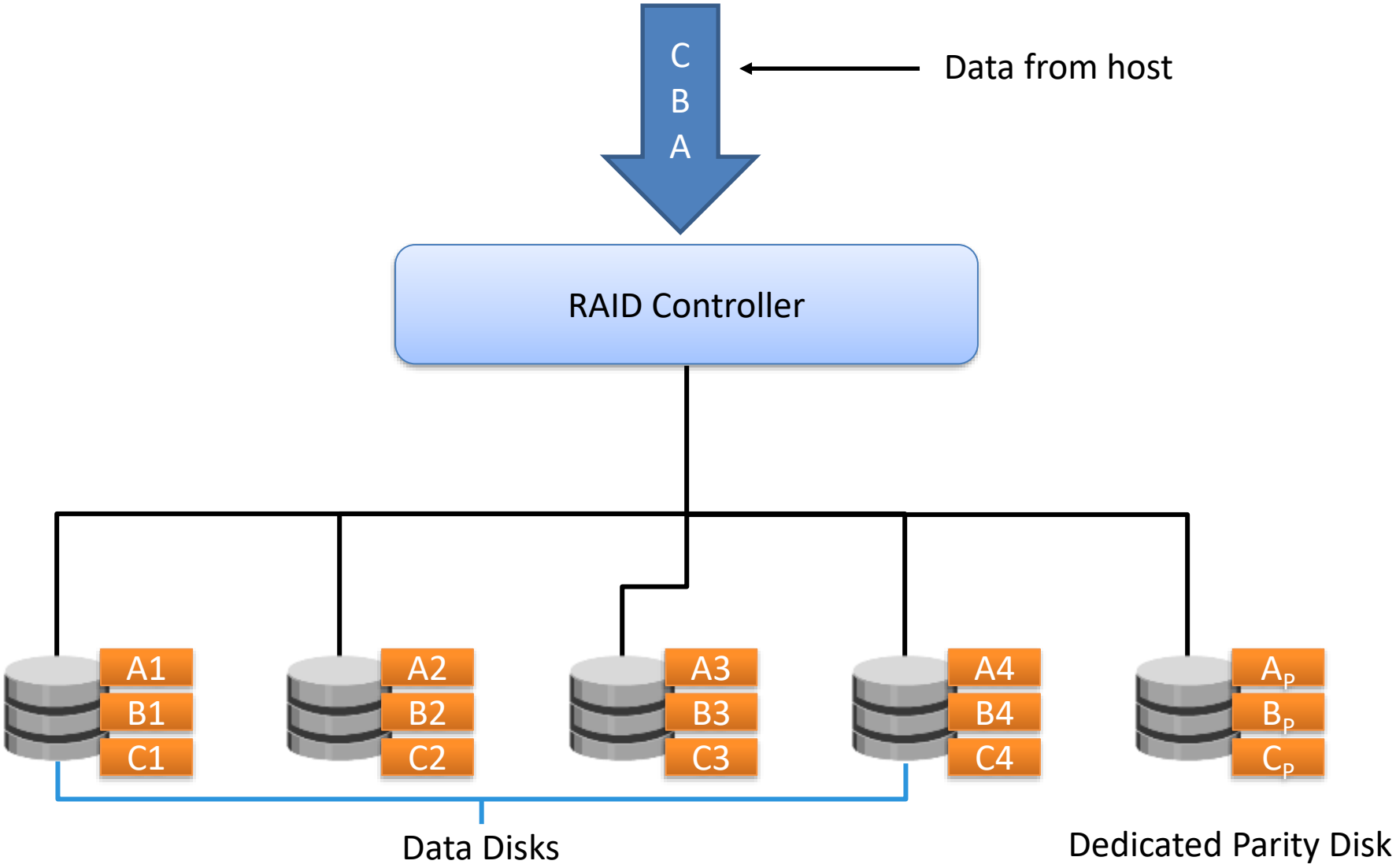
RAID 1


E
D
C
B
A
Data from host
RAID Controller
A
B
C
A
B
C
D
E
F
D
E
F
Mirror Set
Mirror Set

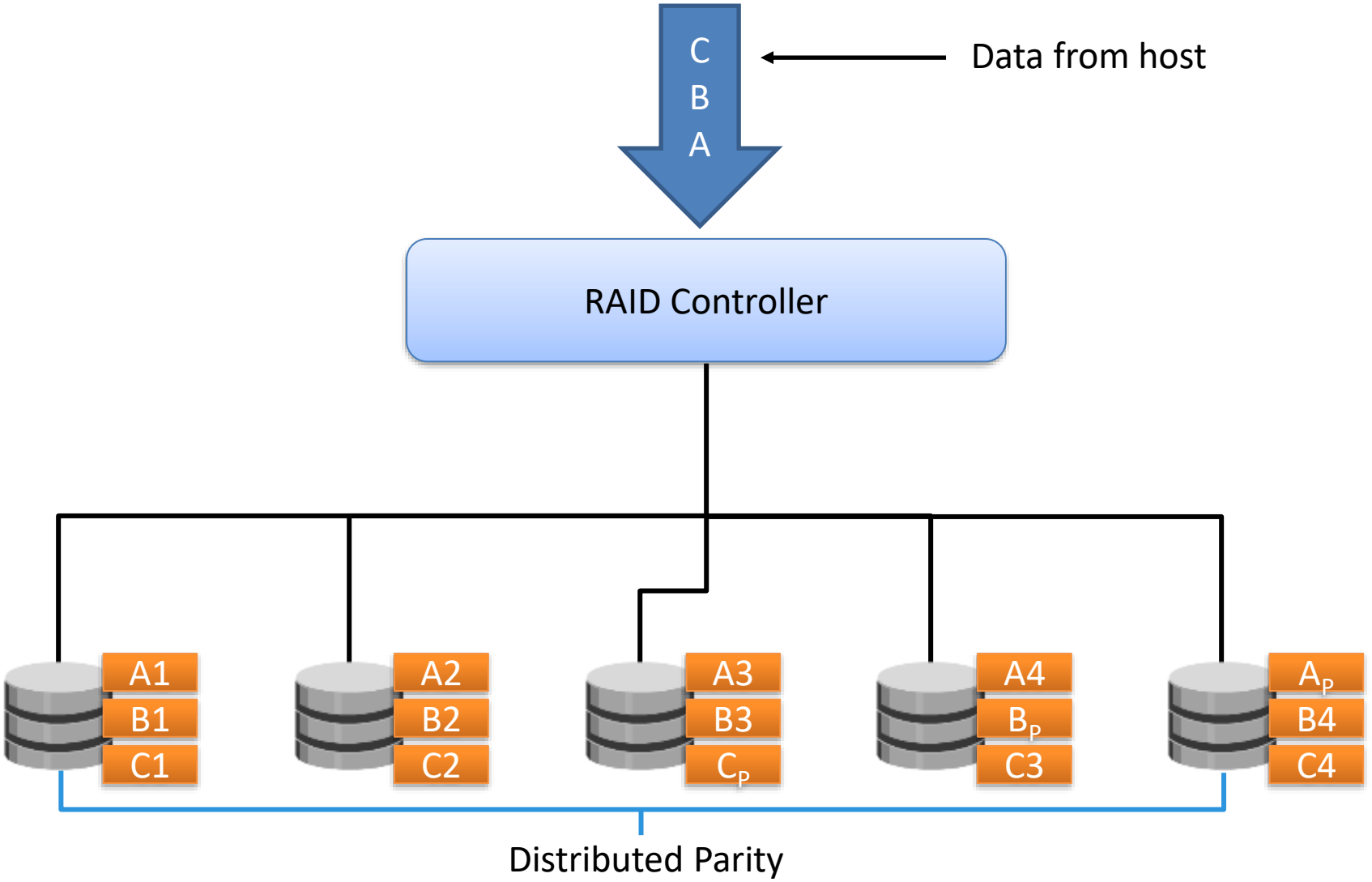
Nested RAID – 1+0



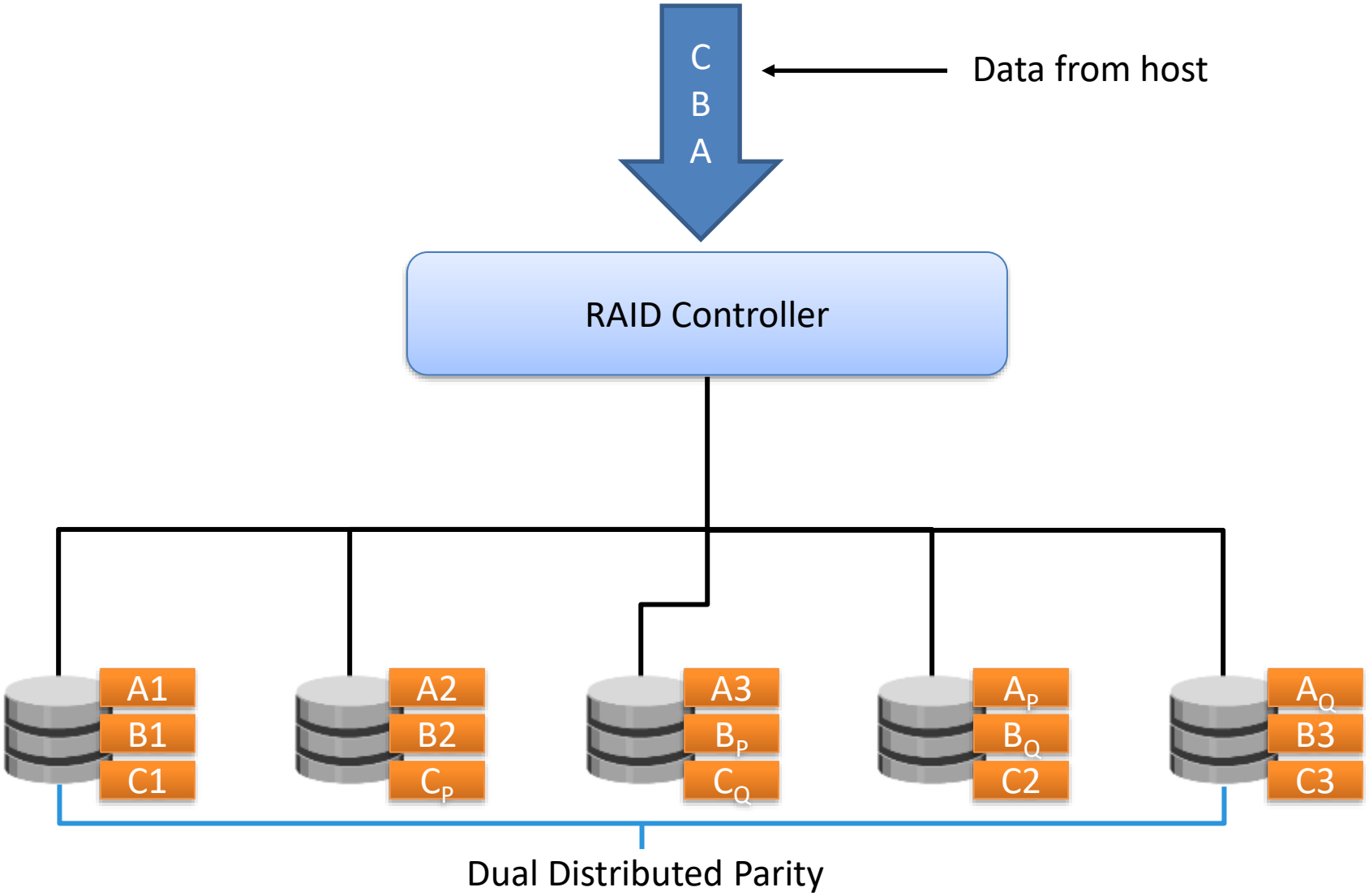
RAID 3


C
B
A
Data from host
RAID Controller
A1
B1
C1
A2
B2
C2
A3
B3
C3
A4
B4
C4
A_P
B_P
C_P
Data Disks
Dedicated Parity Disk

RAID 5


C
B
A
Data from host
RAID Controller
A1
B1
C1
A2
B2
C2
A3
B3
C_P
A4
B_P
C3
A_P
B4
C4
Distributed Parity

RAID 6


C
B
A
Data from host
RAID Controller
A1
B1
C1
A2
B2
C_P
A3
B_P
C_Q
A_P
B_Q
C2
A_Q
B3
C3
Dual Distributed Parity

THANK YOU