





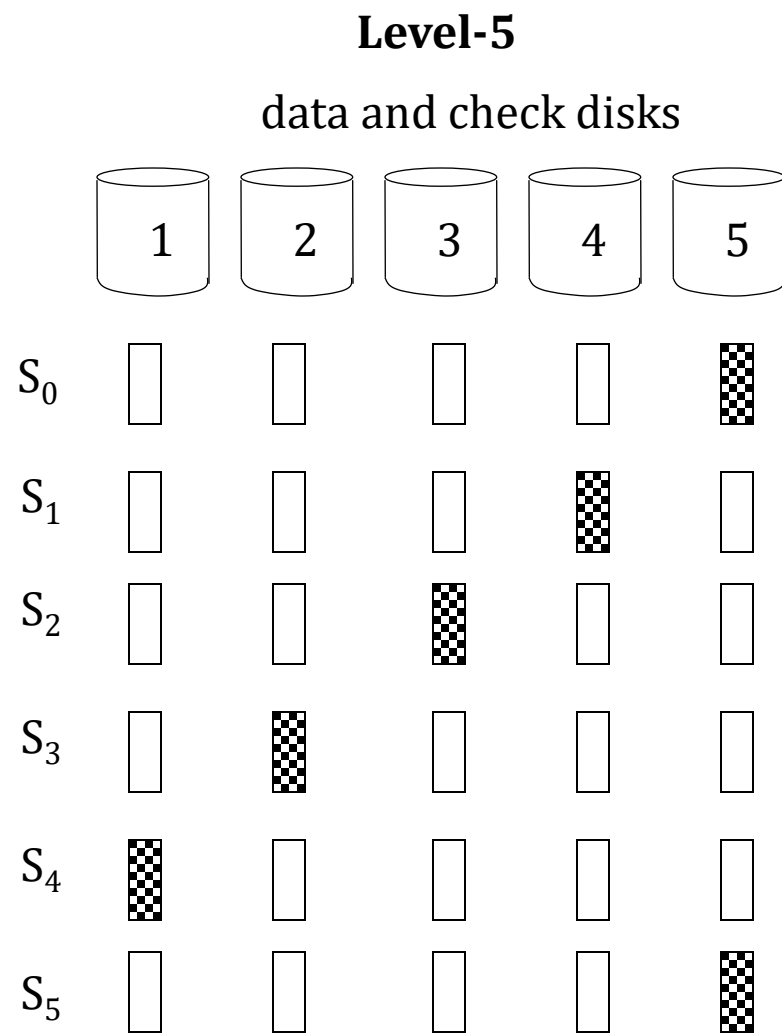
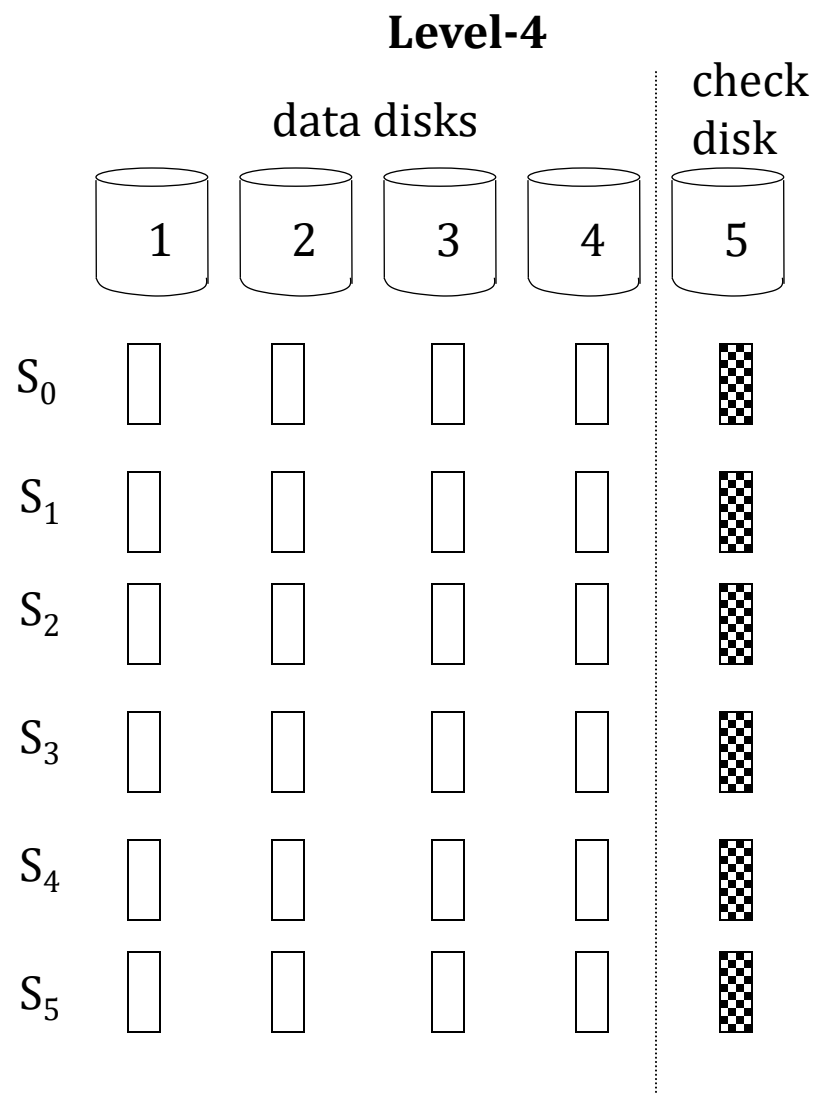
CSE3103 : Database FALL 2020

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RAID Level-5

- Level-5 stripes file data and check data over all the disks
 - no longer a single check disk
 - no more write bottleneck
- Drastically improves the performance of multiple writes
 - they can now be done in parallel
- Slightly improves reads
 - one more disk to use for reading

RAID Level-5



RAID Level-5

- Notice that for Level-4 a write to sector 0 on disk 2 and sector 1 on disk 3 both require a write to disk five for check information
- In Level-5, a write to sector 0 on disk 2 and sector 1 on disk 3 require writes to different disks for check information (disks 5 and 4, respectively)
- Best of all worlds
 - read and write performance close to that of RAID Level-1
 - requires as much disk space as Levels-3,4

RAID 5 analysis

- MTBF is slightly better than RAID 0. This is because failure of one disk is not quite a harm. We need more time if 2 or more disks fail.
- Performance is also as good as RAID 0, if not better. We can read and write parallel blocks of data.
- One of the drawbacks is that the write involves heavy parity calculations by the RAID controller. Write operations are slower compared to RAID 0.
- Pretty useful for general purpose uses where 'read's' are more frequent the 'write's'.

RAID Level-10

- Combine Level-0 and Level-1
- Stripe a files data across multiple disks - gives great read/write performance
- Mirror each strip onto a second disk - gives the best redundancy
- The most high performance system
- The most expensive system

Implementations

Software based RAID:

- Software implementations are provided by many Operating Systems.
- A software layer sits above the disk device drivers and provides an abstraction layer between the logical drives(RAIDs) and physical drives.
- Server's processor is used to run the RAID software.
- Used for simpler configurations like RAID0 and RAID1.

Implementations

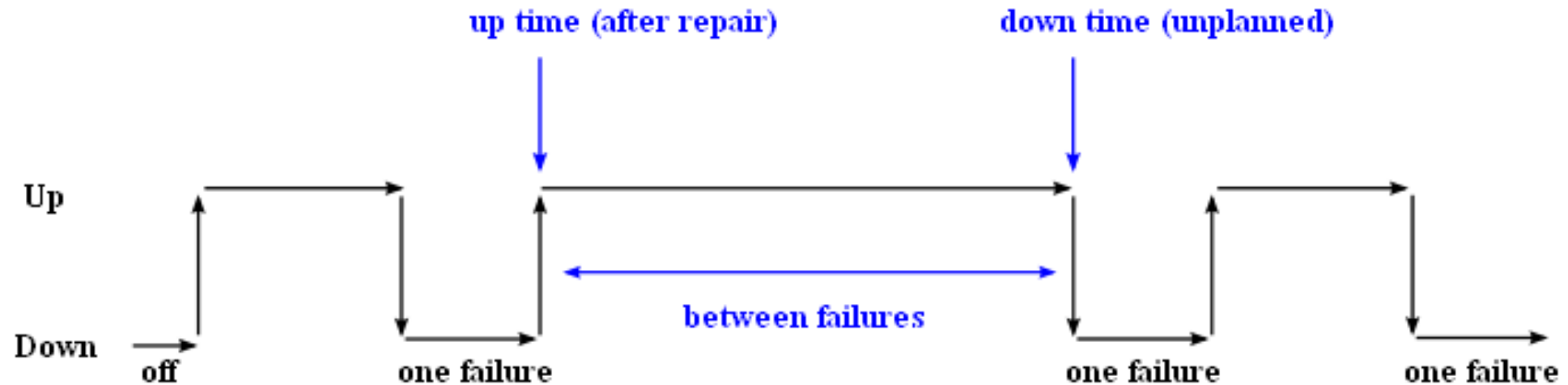


A PCI-bus-based, IDE/ATA hard disk RAID controller, supporting levels 0, 1, and 01.

Hardware based RAID:

- A hardware implementation of RAID requires at least a special-purpose RAID controller.
- On a desktop system this may be built into the motherboard.
- Processor is not used for RAID calculations as a separate controller present.

Mean Time Between Failures (MTBF)



Time Between Failures = { down time - up time }

$$\text{Mean time between failures} = \text{MTBF} = \frac{\Sigma(\text{downtime} - \text{uptime})}{\text{number of failures}}.$$

A review question

- Consider an array consisting of four 750 GB disks
- What is the storage capacity of the array if we organize it
 - As a RAID level 0 array?
 - As a RAID level 1 array?
 - As a RAID level 5 array?

The answers

- Consider an array consisting of four 750 GB disks
- What is the storage capacity of the array if we organize it
 - As a RAID level 0 array? 3 TB
 - As a RAID level 1 array? 1.5 TB
 - As a RAID level 5 array? 2.25 TB

