9.12.6 RAID Facts

Redundant Array of Independent Disks (RAID), also called Redundant Array of Inexpensive Disks, is a disk subsystem that combines multiple physical disks into a single logical storage unit.

- Depending on the configuration, a RAID array can improve performance, provide fault tolerance, or both.
- RAID can be implemented through hardware (using a special RAID disk controller) or software.
- Hardware RAID is more expensive, but provides much better performance than software RAID.

The following table describes common RAID levels.

RAID Level	Description
RAID 0 (Striping)	A stripe set breaks data into units and stores the units across a series of disks by reading and writing to all disks simultaneously. Striping: - Provides an increase in performance. - Does not provide fault tolerance. A failure of one disk in the set means all data is lost. - Requires a minimum of two disks and may contain up to 32 disks. - Has no overhead because all disk space is available for storing data. This is the fastest of all RAID types. However, note that it does not provide fault tolerance.

RAID 5 (Striping with Distributed Parity)	A RAID 5 volume combines disk striping across multiple disks with parity for data redundancy. Parity information is stored on each disk. If a single disk fails, its data can be recovered using the parity information stored on the remaining disks. RAID 5 volumes:
	- Provide fault tolerance
	- Provide an increase in performance
	- Do not provide fault tolerance if two or more disks fail
	- Require a minimum of three disks
	- Have an overhead of one disk in the set for parity information: (1 / *n* - 1)
	  - A set with three disks has 33% overhead
	  - A set with four disks has 25% overhead
	  - A set with five disks has 20% overhead

RAID 1 (Mirroring)	A mirrored volume stores data to two duplicate disks simultaneously. If one disk fails, data is present on the other disk, and the system switches immediately from the failed disk to the functioning disk. Mirrored volumes: - Provide fault tolerance. - Do not increase performance. - Require two disks. - Have a 50% overhead. Data is written twice, meaning that half of the disk space is used to store the second copy of the data. Overhead is 1 / *n* where *n* is the price of the second disk. - RAID 1 is the most expensive fault tolerant system.

RAID 0+1	RAID 0+1 combines disk striping (0) and disk mirroring (1). Multiple disks are striped, creating a single volume. A second set of disks is then added to mirror the first set. RAID 0+1 volumes:
	- Provide fault tolerance.
	  - Data is available if one or more disks in a single set fails.
	  - Data is lost if two disks in different mirrored sets fail.
	- Provide an increase in performance.
	- Require an even number of disks with a minimum of four disks.
	- Have a 50% overhead.

RAID 1+0	RAID 1+0 combines disk mirroring (1) and disk striping (0). Multiple disks are configured into two mirrored arrays, which are then striped across the other set. RAID 1+0 volumes:
	- Provide fault tolerance.
	  - Data is available if one or more disks in a single set fails.
	  - Data is available even if two disks in different sets fail.
	- Provide an increase in performance.
	- Require an even number of disks and a minimum of four disks.
	- Have a 50% overhead.
	- Are the fastest, most fault tolerant, and most expensive arrays. RAID 1+0 performs better and provides more fault tolerance than RAID 0+1 arrays.