

Storage Fast-Reference RAID Guide

Exclusively for *Storage* magazine subscribers—use this guide as a convenient reference tool detailing the various RAID levels. Hang this up at your work station—and look for more in-depth information each month in *Storage*.

RAID-0. This technique has striping but no redundancy of data. It offers the best performance but no fault-tolerance.

RAID-1. This type is also known as disk mirroring and consists of at least two drives that duplicate the storage of data. There is no striping. Read performance is improved since either disk can be read at the same time. Write performance is the same as for single disk storage. RAID-1 provides the best performance and the best fault-tolerance in a multi-user system.

RAID-2. This type uses striping across disks with some disks storing error checking and correcting information. It has no advantage over RAID-3.

RAID-3. This type uses striping and dedicates one drive to storing parity information. The embedded error checking information is used to detect errors. Data recovery is accomplished by calculating the exclusive OR of the information recorded on the other drives. Since an I/O operation addresses all drives at the same time, RAID-3 cannot overlap I/O. For this reason, RAID-3 is best for single-user systems with long record applications.

RAID-4. This type uses large stripes, which means you can read records from any single drive. This allows you to take advantage of overlapped I/O for read operations. Since all write operations have to update the parity drive, no I/O overlapping is possible. RAID-4 offers no advantage over RAID-5.

RAID-5. This type includes a rotating parity array, thus addressing the write limitation in RAID-4. As a result, all read and write operations can be overlapped. RAID-5 stores parity information but not redundant data (although parity information can be used to reconstruct

data). RAID-5 requires at least three and usually five disks for the array. It's best for multi-user systems where performance is not critical or that do few write operations.

RAID-6. This type is similar to RAID-5 but includes a second parity scheme that is distributed across different drives. It offers extremely high fault- and drive-failure tolerance. There are few or no commercial examples currently.

RAID-7. This type includes a real-time embedded operating system as a controller, caching via a high-speed bus, and other characteristics of a stand-alone computer. One vendor offers this system.

RAID-10. Combining RAID-0 and RAID-1 is often referred to as RAID-10, which offers higher performance than RAID-1 but at a much higher cost. There are two subtypes: In RAID-0+1, data is organized as stripes across multiple disks, and then the striped disk sets are mirrored. In RAID-1+0, the data is mirrored and the mirrors are striped.

RAID-50 (or RAID-5+0). This type consists of a series of RAID-5 groups and striped in RAID-0 fashion to improve RAID-5 performance without reducing data protection.

RAID-53 (or RAID-5+3). This type uses striping (in RAID-0 style) for RAID-3's virtual disk blocks. This offers higher performance than RAID-3 but at a much higher cost.

RAID-S. This is an alternate, proprietary method for parity RAID from EMC Symmetrix. It appears to be similar to RAID-5 with some performance enhancements as well as the enhancements that come from having a high-speed disk cache on the disk array.

For more on RAID, check out the Fast Guide to RAID on SearchStorage.com – the online information resource for *Storage* magazine subscribers.