

# RAID — Begin With The Basics

## What is RAID?

RAID stands for Redundant Array of Inexpensive Disks. RAID is a method of logically treating several hard drives as one unit. It can offer fault tolerance and higher throughput levels than a single hard drive or group of independent hard drives.

## Why Do We Need It?

RAID provides real-time data recovery when a hard drive fails, increasing system uptime and availability while protecting against loss of data. Multiple drives working together also increase system performance.

## How Does RAID Work?

RAID increases data protection and performance by duplicating and/or spreading data over multiple disks.

### Mirroring

Duplicates data from primary drive to secondary drive



### Mirroring & Striping

Mirrors data that is striped, spread evenly across multiple disks



## Levels of RAID

RAID Level	Description	Minimum # of Drives	Benefit
RAID 0	Data striping (no data protection)	2	Highest performance
RAID 1	Disk mirroring	2	Highest data protection
RAID 1E	Disk mirroring	3	Highest data protection for an odd number of disks
RAID 5	Data striping with distributed parity	3	Best cost/performance balance for multi-drive environments
RAID 5EE	Data striping with distributed parity with hotspare integrated into the array	4	The cost/performance balance of RAID 5 without setting aside a dedicated hotspare disk
RAID 6	Data striping with dual distributed parity	4	Highest fault tolerance with the ability to survive two disk failures
RAID 10	Data striping of RAID 1 arrays	4	Highest performance with highest data protection
RAID 50	Data striping of RAID 5 arrays	6	Increased capacity and performance for multi-array RAID 5 environments
RAID 60	Data striping of RAID 6 arrays	8	Highest fault tolerance with the highest data protection



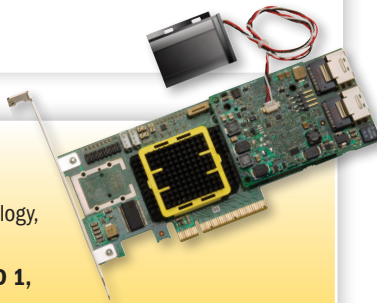
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## Types of RAID Implementation

Type	Description	Advantages	Ideal for
<b>Software-based</b>	Included in the operating system (OS), such as Windows®, NetWare, and Linux. All RAID functions are handled by the host CPU which can severely tax its ability to perform other computations.	<ul style="list-style-type: none"> <li>• Low price</li> <li>• Only requires a standard HBA</li> </ul>	Best used for large block applications such as data warehousing or video streaming. Also where servers have the available CPU cycles to manage the I/O intensive operations certain RAID levels require.
<b>Hardware-based</b>	Processor-intensive RAID operations are off-loaded from the host CPU to enhance performance. Battery-back write back cache can dramatically increase performance while minimizing risk of data loss.	<ul style="list-style-type: none"> <li>• Data protection and performance benefits of RAID</li> <li>• More robust fault-tolerance features and increased performance vs. software-based RAID</li> </ul>	Best used for small block applications such as transaction oriented databases and web servers.
<b>External hardware</b>	Connects to the server via a standard HBA or controller. RAID functions are performed on a microprocessor located on the external RAID controller independent of the host.	<ul style="list-style-type: none"> <li>• OS independent</li> </ul>	Build high-capacity storage systems for high-end servers

### Recommend Adaptec RAID Products

Adaptec by PMC delivers the industry's most trusted RAID technology, built on two decades of pioneering RAID leadership. We offer the industry's most advanced data protection, including **RAID 0, RAID 1, RAID 1EE, RAID 5, RAID 6, RAID 10, RAID 50, RAID 60, and Copyback Hot Spare.**



## Glossary

**Copyback Hot Spare:** When a failed drive is replaced, data is automatically copied from the hot spare back to the replaced drive, allowing the hot spare to remain in the same spot.

**Dual Drive Failure Protection (RAID 6, 60):** Provides double redundancy and the ability to sustain two drive failures. Data is striped across at least 4 physical drives and a second parity scheme is used to store and recover data.

**Fault Tolerance:** The ability of a system to continue to perform its functions even when one or more of its hard disk drives have failed.

**Hot Spare:** A spare hard drive which will automatically be used to replace a failed member of a redundant disk array.

**Hot Swap:** The ability to replace a failed member of a redundant disk array with a good drive without bringing down the server or interrupting transactions that involve the other devices.

**Mirroring (RAID 1):** Provides data protection by duplicating all data from a primary drive onto a secondary drive.

**Parity:** A form of data protection used by RAID 5 to re-create the data of a failed drive.

**RAID 0:** See "Striping."

**RAID 1:** See "Mirroring."

**RAID 1E:** See "Striped Mirroring."

**RAID 5:** Combines data striping (for enhanced performance) with distributed parity (for data protection) to provide a recovery path in case of failure.

**RAID 5EE:** See "Hot Space."

**RAID 6:** See "Dual Drive Failure Protection."

**RAID 10:** Combines RAID 0 (data striping) and RAID 1 (disk mirroring).

**RAID 50:** Combines multiple RAID 5 sets with data striping (RAID 0) to increase capacity and performance without adding disks to each RAID 5 array.

**RAID 60:** Combines multiple RAID 6 sets with data striping (RAID 0) to increase capacity and performance without adding disks to each RAID 6 array.

**Striped Mirror (RAID 1E):** Combines data striping from RAID 0 with data mirroring from RAID 1 to extend RAID 1 data availability across an odd number of disks.

**Striping (RAID 0):** Spreads data evenly over multiple drives to enhance performance. Because there is no redundancy scheme, it does not provide data protection.

**Hot Space (RAID 5EE):** Provides the protection of RAID 5 and adds a hot spare disk to the array. This extra drive enhances RAID 5 performance with higher I/Os per second.

For more information:  
[www.adaptec.com](http://www.adaptec.com)

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