



## THE RAID CHALLENGE – MAXIMIZING BENEFITS WHILE MASKING COMPLEXITY

“Modern storage systems offer a choice of RAID levels, to provide availability and performance benefits to a broad range of businesses and applications.”

### WHAT IS RAID??

RAID (Redundant Array of Independent Disks) is a method of having multiple disks work together to deliver more reliable storage than individual disks. Combining physical disks gives administrators more flexibility in storage capacity, performance, and reliability as they strive to meet service level objectives. By providing a simple form of storage virtualization, RAID lets you optimize the storage environment and obtain the maximum benefits for your applications.

	Comparison to Regular Disks
<p><b>RAID 5</b></p> <p>Usable: 500 GB</p> <p>600 GB</p>	<p>Better reliability</p> <p>Better performance</p>
<p><b>RAID 1</b></p> <p>Usable: 100 GB</p> <p>100 GB data 100 GB mirror</p>	<p>Highest reliability</p> <p>Better performance</p>
<p><b>RAID 0</b></p> <p>Usable: 200 GB</p> <p>100 GB 100 GB</p>	<p>Less reliability</p> <p>Better performance</p>

### RAID LEVELS – BALANCING TRADE-OFFS

Modern storage systems offer various RAID levels. Each RAID level provides different capacity, performance, and availability characteristics, at the cost of additional hardware and administrative effort.

Selecting the right RAID level means balancing trade-offs.

- RAID 1 is a mirrored configuration that consists of paired disks, each containing a complete copy of data. RAID 1 provides the highest level of availability; in addition, read performance is faster than write performance. If a disk fails, data can be recovered from its mirrored copy.
- RAID 5 groups more than two disks together, with capacity set aside for distributed parity data to ensure availability. For example, in a 6-disk RAIDset, five disks of raw capacity are offered, with one disk of capacity used for parity. If a disk fails, data can be recovered from the parity information on the remaining disks. RAID 5 offers more capacity than RAID 1, while maintaining excellent reliability. RAID 5 improves read performance, since more disks are working simultaneously. RAID 5 write performance is good for random data access, but is superior to RAID 1 for sequential workloads such as images, media streaming, backup or disaster replication.
- RAID 0 stripes data across multiple disks or RAID sets. Because read/write tasks are now shared by more disks, RAID 0 improves overall performance. While RAID 0 alone provides no improvements in reliability over individual disks, RAID 0 can be used in combination with other RAID levels. For example, RAID 10 stripes data over multiple RAID 1 sets, and RAID 50 stripes data over multiple RAID 5 sets. The result of these combinations is improvements in both reliability and performance.

## RAID STATES AFFECT BEHAVIOR

RAID operations include various functional states, and RAID levels behave differently while in these states. During the Normal state, reads and writes are functioning properly.

Other states include Forming or Scrubbing (initial organization of RAID sets), Degraded (a disk has failed, but the RAIDset remains functional), Degraded and Repairing (data is being reconstructed onto a spare disk), and Failed (the RAIDset has failed and cannot be recovered). Although they occur infrequently, these compromised states affect performance and reliability – and as a result, service levels. Administrators should consider the impact of all RAID states on service levels when choosing RAID levels.

## SPARE DISKS ADD PROTECTION

Since RAID leverages multiple disks for reliability and performance, best-practice RAID configurations include spare disks that can be utilized in case of disk failures. Operating without configured spare disks increases the risk of data loss. Without spare disks, administrators must recognize a disk failure, configure a spare, and execute the activation process; these activities take significant time, resulting in lengthy periods of unprotected data. Automatic configuration and utilization of spare disks provides a solution to this critical problem.

### ✓ RAID Solution Checklist ✓

Does the RAID Solution Support Your Requirements for:

- Capacity
- Reliability
- Overall performance
- Performance during each RAID state
- Automatic RAID set up
- Automatic sparing configuration
- Automatic spare utilization

## FULLY AUTOMATIC RAID – THE INDUSTRY’S NEW DIRECTION

RAID offers flexibility and benefits, but also adds management complexity. The storage industry is beginning to focus on ways to make RAID configuration and management automatic; this minimizes costs and enables businesses to meet service-level objectives easily, and without additional expertise.

An automatic RAID solution enables administrators to choose RAID levels based solely on functional benefits. This allows administrators to focus more time on servicing business needs, and less time servicing the infrastructure.

“Automatic configuration and management make RAID easy to use and enable businesses to withstand failures in the storage environment.”



110 Spit Brook Road, Building ZKO2, Nashua, NH 03062  
Tel 603.579.9762 / Fax 603.579.6910 / [www.equallogic.com](http://www.equallogic.com)