

Hardware versus Software RAID on Linux Workstations

Mini-White Paper



- Introduction 2
- Comparison 2
 - System Performance 2
 - Storage Performance 2
 - Management/Maintenance 2
 - Features 2
 - Flexibility 2
 - Migration 3
 - Availability 3
 - Simplicity 3
 - Hardware Costs 3
 - Administrative Costs 3
 - Supportability 3
- Conclusion 3

Introduction

This document will discuss a variety of factors to consider when choosing between hardware and software RAID configurations on Linux workstations.

Comparison

Hardware RAID versus software RAID in regards to a variety of considerations.

System Performance

- Hardware RAID may better balance system performance through asynchronous performance and offloading of processors, although there may be performance losses due to issues such as PCI resource conflicts. However, with modern processing capabilities, there is usually no performance loss seen with a software RAID solution.
- System performance also depends on other factors such as other hardware being used, processor speeds, or RAID level.

Storage Performance

- Software RAID usually performs better than hardware RAID in terms of raw disk performance. This is especially true in systems with multiple processors, whether this be multiple physical processors or dual-core systems. The RAID level being used does not generally have an effect on storage performance.
- Software RAID generally offers higher peak performance than hardware RAID and this can be improved more by the quality of hardware used.

Management/Maintenance

- One of the biggest reasons for using hardware RAID is the availability of management tools provided by the hardware controllers/drivers. Hardware RAID provides support for array management via provided tools. With software RAID, these sorts of management procedures must be performed manually, which can be more daunting for users who are less comfortable with the inner workings of their operating system.

Features

- Hardware RAID controllers usually come with a variety of useful features such as a dedicated XOR engine, automatic RAID migration support, online capacity expansion, hot swaps and hot spares, and battery backup. Sometimes, common RAID maintenance procedures can be completed automatically with hardware RAID; this is a matter of convenience for users.

Flexibility

- Software RAID is generally more flexible in terms of using a variety of hard disks and controllers, including ones that have never been qualified together.
- Software RAID allows the use or mixing of more block device types, whereas hardware RAID is usually constrained to a single disk type.
- Software RAID also allows for more RAID levels through layering, while hardware RAID is constrained to whatever subset of levels the hardware manufacturer decides to support.

Migration

- Hardware RAID level migration tends to be much simpler than in software RAID.

Availability

- Since hardware RAID requires specific hardware drivers, it is not always available on Linux workstations as a certain hardware manufacturer may not provide Linux support.
- Software RAID support is only available in kernel 2.4 and later. The RAID-6 level is only available on software RAID with the 2.6 kernel, whereas hardware RAID is available across all platforms.

Simplicity

- Software RAID has long been considered to be more complex to manage than hardware RAID. Software RAID exposes the management of each device to the user while hardware RAID uses logical block device representation.
- Software RAID requires the user to understand the entire chain of reliances in the array, unlike hardware RAID which often has an “express” setup capability that requires far less understanding on the user’s part.
- Software RAID allows setup to be scripted, usually generically over many configurations. If configuration isn’t available for a hardware RAID device, the manual configuration is often more difficult than with software RAID.

Hardware Costs

- Software RAID is almost always cheaper in terms of hardware because of the wider range of hardware choices in terms of disk drives and disk controllers, as well as not requiring the extra cost of the hardware RAID controller.

Administrative Costs

- Software RAID has higher administrative costs due to the exposed complexity of the RAID solution and the testing being migrated from vendor to user.
- Hardware RAID offers more management features which reduce user administrative costs.

Supportability

- Hardware RAID offers higher levels of support and testing, but only on the specific configurations that have been supported by the hardware manufacturer. For this reason, hardware RAID controllers often restrict what devices can be used, while software RAID makes no assumptions about the components being used.
- Software RAID also keeps the raw disks and partitions exposed so that server firmware and boot management can use them. Hardware RAID has the logical block device exposed so that it emulates common device geometry and behavior.

Conclusion

The primary reason for choosing hardware RAID over software RAID is that of convenience. Hardware RAID offers features to improve usability and ease of maintenance for users, whereas software RAID requires much more manual configuration. However, software RAID offers equal if not improved performance and greatly increased flexibility over hardware RAID. In the end, the decision between hardware and software RAID comes down to personal preference. Please see the [HP Workstations User Manual for Linux](#) for details on software RAID configuration.

© 2006 Hewlett-Packard Development Company, L.P. The information contained herein is subject to change without notice. The only warranties for HP products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.

439279-001, October 2006