

Software RAID Functionality on Dell Value Line Servers

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Dell White Paper

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1 Introduction

The new PowerEdge T110, R210, T310, and R510 Servers from Dell have new RAID software. This white paper discusses the architecture, advantages, implementation in the Dell value line servers and the usage.

The operating system (OS) driver software is responsible for the software RAID operations, and the RAID task runs on the CPU of the system. RAID runs the kernel disk code.

Software (SW) RAID solutions are low-cost and entry-level solutions that offer major advantages over the existing hardware RAID solution in value line servers. They are positioned for SMB servers. This gives the hard disks increased performance with minimal hardware.

Software RAID in Dell value line servers is implemented in two ways.

- Minimal RAID: This pure software solution (PERC S100) leverages the I/O controller hub (ICH) chipset on the platform motherboard, which enables a SATA-only competitive solution at no extra cost.
- Value RAID: This is a hybrid solution with a SAS IOC HBA option and SW RAID (PERC S300) offered as a SAS/SATA solution upgrade. The hardware helps to overcome some of the weaknesses of pure software RAID. Such solutions usually come with additional hardware.

2 Software RAID in Dell Servers

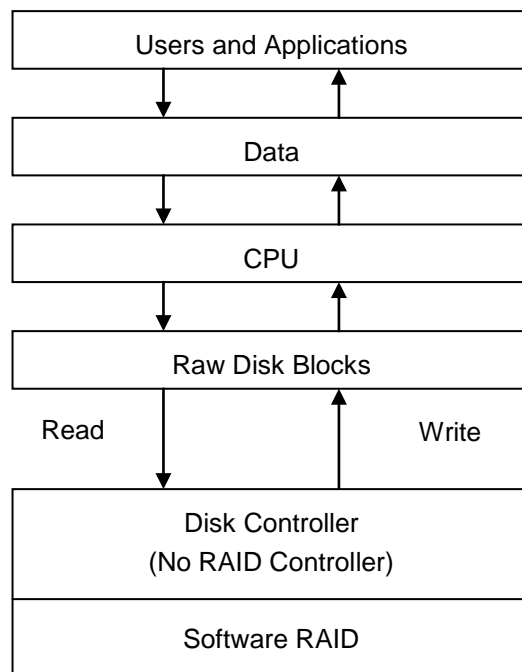


Figure 1. Data Flow from Application to PERC S100/S300

PERC S100/PERC S300 Option ROM is an interface that creates a RAID such as initializing the disks, which stores the RAID specific metadata on the selected hard disks that would be part of the RAID. At this point, the RAID specified by the user in the option ROM is not fully active. The RAID becomes active as soon as the OS has loaded the RAID driver software. All the RAID management tasks can only be done when the OS is installed.

After the OS is loaded, user application sends the DATA for processing to the CPU because all the RAID Operations in a software RAID uses system CPU Cycles. This is because the software RAID controllers do not have the intelligence to perform RAID operations. System CPU processes the DATA

and performs read/write operations to and from the disk. It also sends the data blocks into the disks. The controller stores the data blocks, as well as the addresses where the data has to be stored, onto the hard disks.

The virtual disks (VD) created in one system can be moved to another system with the same configuration if the controller (PERC S100 /PERC S300) is the same in both systems.

3 PERC S100 Implementation

PERC S100 is a pure software solution, supported by Peak P55 express or ICH10r chipset. Option ROM for PERC S100 is integrated as part of system BIOS and an onboard SATA controller is used as channel to transfer the data to HDD. To make the PERC S100 functional, change the SATA setting to RAID mode in the system BIOS. The RAID becomes active when the OS has loaded the S100 driver software. SATA 2 hard disks, SSDs, and internal SATA tape device (RD1000) are supported. [Figure 2](#) shows the PERC S100 Option ROM and the menu options

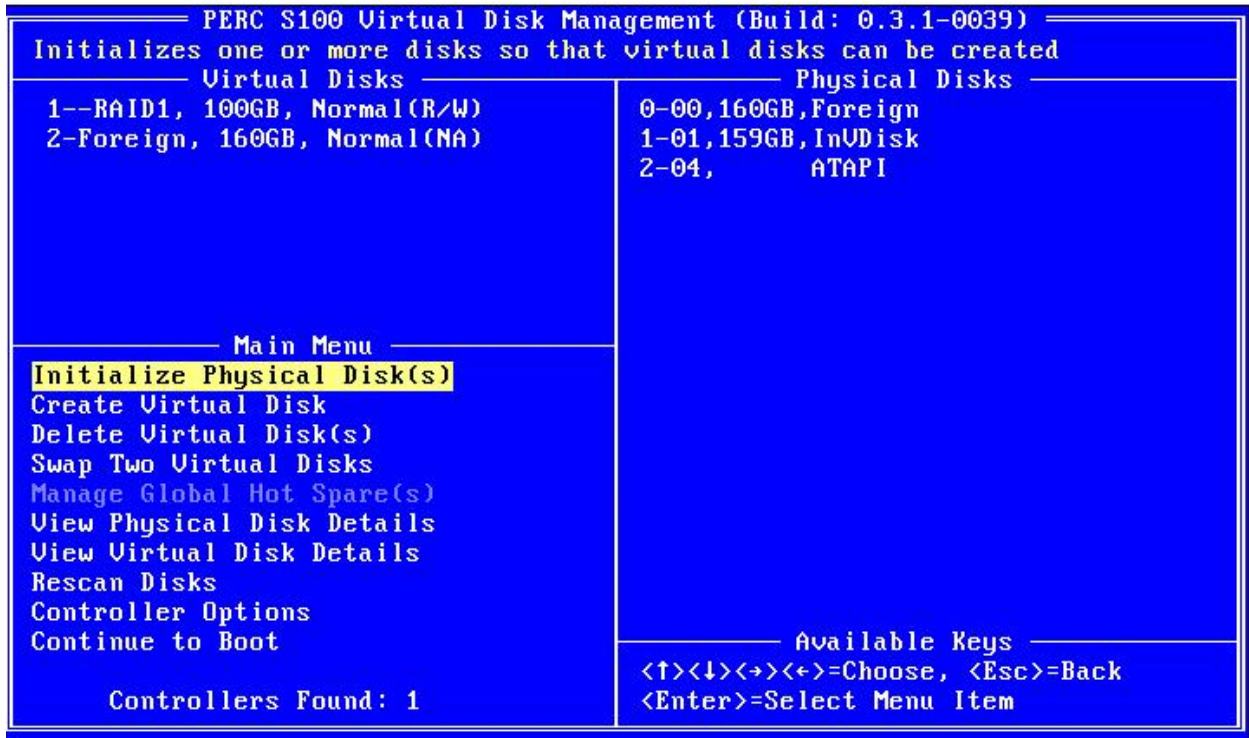


Figure 2. PERC S100 Option ROM

4 PERC S300 Implementation

PERC S300 is a hybrid solution obtained by a firmware change for the LSI 1068E SAS controller. The advantage over PERC S100 is that SAS disks are supported in PERC S300. The conversion from LSI 1068E SAS controller to PERC S300 is done using the firmware upgrade (using DRMK bootable USB in DOS method). [Figure 3](#) shows the PERC S300 Option ROM and Menu details

```

===== PERC S300 Virtual Disk Management (Build: 1.0.0-0084) =====
Deletes one or more virtual disks on this controller
----- Virtual Disks ----- Physical Disks -----
1---RAID1,159GB, Normal(R/W)      0-00,159GB,Online
                                   1-01,159GB,Online

----- Main Menu -----
Initialize Physical Disk(s)
Create Virtual Disk
Delete Virtual Disk(s)
Swap Two Virtual Disks
Manage Global Hot Spare(s)
View Physical Disk Details
View Virtual Disk Details
Rescan Disks
Controller Options
Continue to Boot

Controllers Found: 1

----- Available Keys -----
<↑><↓><+><->=Choose, <Esc>=Back
<Enter>=Select Menu Item

```

Figure 3. PERC S100 Option ROM

5 Features of Software RAID

- RAID 0,1,5, and 10 are supported
- Boot support for degraded virtual disks
- Cache support for physical and virtual disks
- Eight partial VDs can be configured under a single group
- Background initialization, check consistency, and rebuild
- Disk initialization is supported
- SMART feature monitors physical disks and attempts to detect and report potential or impending failures
- Support for CD /DVD ROMS

6 SW RAID Integration with Dell Storage Management Software

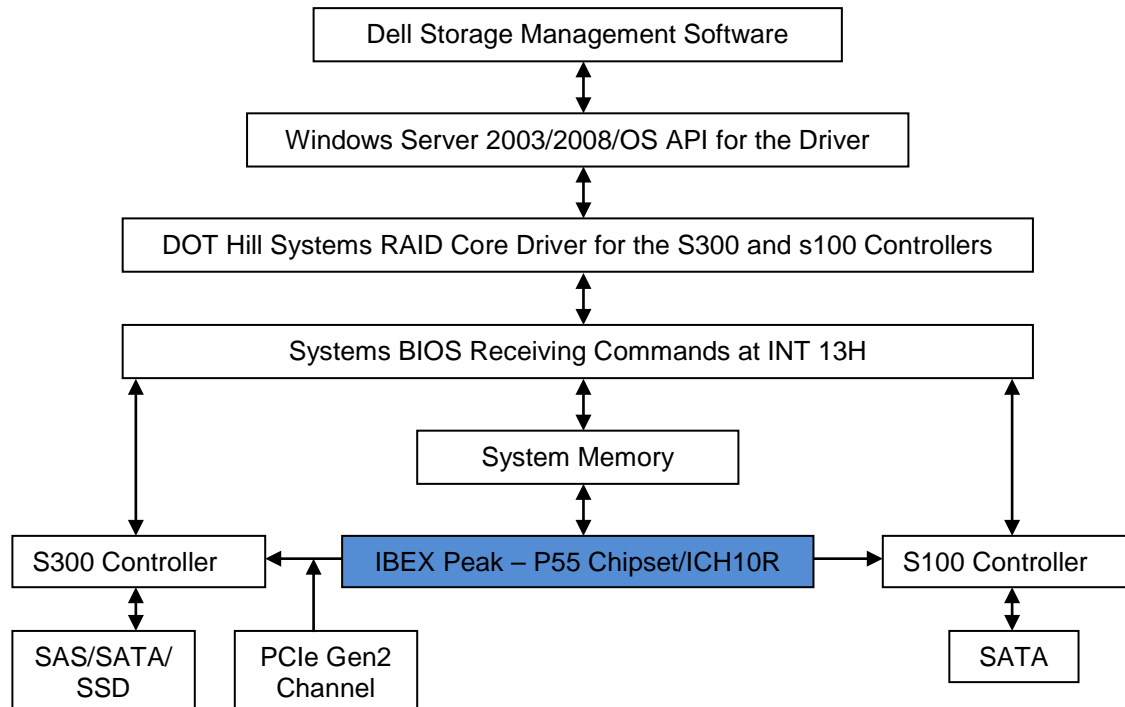


Figure 4. Communication Between Dell SW and PERC S100/S300

Figure 4 shows communication between Dell storage software and PERC S100/PERC S300 Software RAID Solutions, which are also called PERC S100 and PERC S300. They have been integrated into Dell Storage Management software that provides all the major functionalities performed on PERC S100 and PERC S300 after the OS is installed and the driver software has been loaded. Some of the main features that OMSS supports for software RAID solution are listed in the following sub-sections.

6.1 Device Discovery

- Controllers
- Backplane
- Physical Drives
- Virtual Drives

Discovery is responsible for querying the SW RAID stack.

6.2 Consistency Check

This can be initiated and cancelled by the user. OMSS exposes this as a re-synching task.

6.3 Create Virtual Disk

6.3.1 RAID Levels Supported

VDs can be created by RAID levels 0, 1, 5, and 10.

6.3.2 Protocol and Media Type Mixing

VDs may be created only when drives are all the same protocol and media type.

6.3.3 Background Initialization

The virtual disk create task invokes the background initialization automatically. Because there is no automatic restart of the background initialization by firmware as with PERC controllers, the automatic background initialization task runs and OMSS does not allow it to be cancelled.

6.3.4 Drive Rules

- A set of physical drives can host multiple Logical Drives (LDs).
- LDs can be of different RAID levels.
- LDs can use different physical drives with some/all/none overlap in their usage. For example, part of a drive creates a volume with the OS installed on it. The remaining space of this drive appears in the create VD wizards and may be used.

6.3.5 Stripe Size

Stripe size cannot be specified by user at create VD time. The stripe size is automatically set by the SW RAID based on the total capacity and number of disks assigned to the virtual disk RAID levels.

6.3.6 Rebuild

- Affected logical drives track drive rebuilds. OMSS exposes this rebuilding and reports progress.
- A drive may participate in one or more simultaneous rebuilds. OMSS provides distinct alerts for the rebuilds, but the UIs display the lowest progress.

6.3.7 Reconfigure

A VD cannot be transformed to another RAID level. The VD size may be grown if there is sufficient space in all of its physical drives or if an additional drive is added to the VD.

6.3.8 Spare Assignment

- A dedicated hotspare (DHS) may be assigned to a virtual disk only if the drive is of sufficient size and is of the same protocol and media type as of the virtual disk. Mixing is not supported.
- A global hotspare (GHS) may be assigned regardless of the number of VD's, their protocol, or their size, but GHS starts based on the availability of the size of the VD and the protocol.
- If sufficient free space is left, a drive may be a member of one or more VD's at the same time it functions as a DHS.

6.4 Event Management and Monitoring

Software RAID events are mapped to OMSS alerts. SMART alerts are also supported in OMSS for PERC S100 and PERC S300. Events include informational, warning, and critical alerts.

7 Advantages of Software RAID Solution

- Provides unique and easy-to-manage features not available in previous solutions provided in the Dell Value Line servers.
- Low-cost solution for Dell Value Line Servers because no minimal hardware is required.
- Dedicated GUI and software for RAID creation and management.