LSI

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Understanding CacheVault® Modules

Systems Engineering Note

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Legal Notice

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For a comprehensive list of changes to this document, see the Revision History.

Understanding CacheVault

This document provides some basic information about the functionality and operation of LSI's CacheVault modules. It is designed to be a primer that outlines the important aspects of a CacheVault module for users of LSI's MegaRAID adapters. It also provides information that will help you correctly interpret normal CacheVault behavior.

1 Overview of CacheVault Modules

One of the functions supported by LSI's MegaRAID adapters is the ability to protect volatile data stored in cache memory in the case of a power failure. This function is called cache offload, and it can only be used if the MegaRAID adapter is connected to one of LSIs CacheVault modules. A CacheVault module provides just enough power to the critical adapter components to allow the memory to write volatile data to non-volatile storage and then shuts down the adapter.

Depending on which write policy is chosen when the adapter is configured, the cache can be lost entirely or written to non-volatile memory in the event of a power loss. For this reason it is important to understand the available configurations, and to make the most informed configuration choices to best manage data protection.

1.1 Cache Configurations

Below is a brief look of adapter cache settings that can be set using the various adapter software that LSI provides for our MegaRAID adapters such as StorCLI, HII, and MegaRAID Storage Manager.

1.1.1 Read Policy

Displays the read cache policy for the virtual drive. For any profile, by default, if the drive is an SSD, the No Read Ahead option is displayed. Otherwise, the Default option is displayed. The possible options follow:

- Default – A virtual drive property that indicates whether the default read policy is Read Ahead or No Read Ahead
- Read Ahead – Permits the adapter to read requested data and store the additional data related to the read in cache memory, anticipating that the data is required soon.
- No Read Ahead – Specifies that the adapter does not use Read Ahead for the current virtual drive.

1.1.2 Write Policy

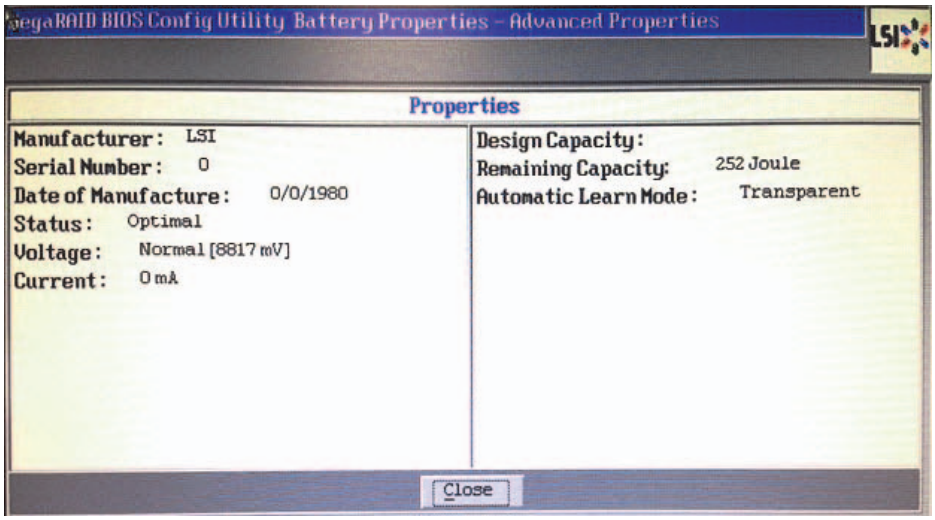
Displays the write cache policy for the virtual drive. For any profile, if the drive is an SSD drive, the Write Through option is displayed. Otherwise, the Always Write Back option is displayed. The possible options follow:

- Default – A virtual drive property that indicates whether the default write policy is Write Through or Write Back.
- Write Through – Data is written directly to the drive and eliminates the risk of losing cached data in case of power failure. However, it might result in slower performance.
- Write Back – In Write-Back Caching mode, the controller sends a data transfer completion signal to the host when the controller cache has received all of the data in a drive write transaction. Data is written to the drive subsystem in accordance with policies set up by the controller. These policies include the amount of dirty/clean cache lines, the number of cache lines available, and elapsed time from the last cache flush.
- Force Write Back – In this mode, Cache Policy is forced to Write back even when battery is not functional. If the battery is non-functional or missing, data will not be protected by cache offload.

2 Understanding CacheVault Functions and Features

CacheVault modules can be configured using various software utilities. This section contains a screenshot of the WebBIOS utility's Battery Properties screen for illustrative purposes, however, these concepts are ubiquitous across all of LSI's configuration utilities. Among other things, each utility can be used to define cache offload settings and to retrieve status information related to the CacheVault power modules.

Figure 1



What the WebBIOS utility reports to this screen can change depending on a number of factors including but not limited to the type of CacheVault module connected to the adapter and the design of the adapter itself. For more information regarding the information displayed in our various utilities, consult the Software User Guide that accompanies your adapter or contact your LSI support representative.

3 Understanding Pack Energy

It is important to understand how to interpret reports of pack energy from LSI software utiilities because this value can be different depending on the state of the adapter you are using. This section explains why this happens and how to correctly interpret the pack energy reporting in LSI software.

NOTE This section will refer to pack energy throughout. However, not all LSI software use this term. Some will use the more general term "capacity". These two terms refer to the same concept that is the level of charge in Joules. They are interchangeable.

3.1 Overview

Pack Energy represents the actual amount of energy that exists in a CacheVault module. It is a dynamic value that is a function of the CacheVault module's capacitance and voltage and measured in joules. The following is a list of important concepts related to pack energy.

- **Design Capacity:** This is the capacity that the CacheVault module is designed to work at.
- **Cutoff Voltage:** Cutoff Voltage is the lower voltage limit at which the CacheVault is considered fully discharged and stops supplying power to the adapter. This does not mean the CacheVault module has zero voltage, but rather that it has fallen below a useful level of charge.

- **Total Pack Energy:** Pack Energy represents the actual amount of energy that exists in a CacheVault module. It is a dynamic value that is a function of the CacheVault module's capacitance and voltage, and it is measured in joules.
- **Usable Energy:** This is the amount of energy that exists inside a CacheVault module above the cutoff voltage. This is the total amount that can be used for Cache Offload.
- **Unusable Energy:** This is the amount of energy that exists inside a CacheVault module below the cutoff voltage. This is the amount of energy below which there is not enough to complete a cache offload.

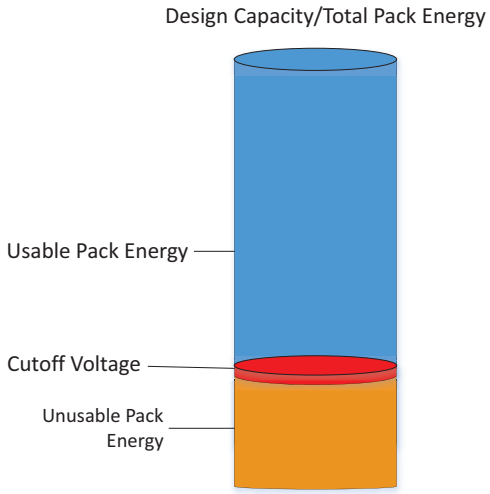
3.2 Pack Energy in SAS 2 Controllers vs. SAS 3 Controllers

LSI has MegaRAID adapters that use one of two available series of controllers: SAS 2 and SAS 3. Each series will use the MegaRAID CacheVault modules in a similar way with only one significant difference. That is the different controllers can and do report different pack energy values when used with identical CacheVault modules.

This is caused by a difference in how pack energy is calculated and reported to LSI software when using one controller versus another. In SAS2 controllers, total pack energy is reported as the sum of usable and unusable energy while a SAS 3 controller reports only the usable energy as pack energy. In other words, the value reported when a pack energy value is calculated by firmware and reporting in software is higher in a SAS 2 controller because it adds in the unusable energy value, where a SAS 3 controller removes unusable energy from the calculation.

Though this difference in reporting does exist, it does not effect the functionality of the CacheVault module. The only difference a user will see is that a SAS 2 controller will report slightly high joules when reporting pack energy.

Figure 2 Example of Capacity Reporting



3.3 Fluctuations in Pack Energy Reporting

The pack energy value reported in LSI utilities is a value derived from the capacitance and the voltage of the CacheVault module. This means that the value of pack energy can fluctuate as the voltage and capacitance change. However, the capacitance of the CacheVault module is a relatively static number at ~7.2 farads and will only change slightly as the module ages. Voltage, however, is a far more dynamic value that will change depending on what state the CacheVault module is in.

For Example, immediately following a relearn of the CacheVault module, the voltage can spike as high as ~10.8V, but, as relearn completes, the module will slowly taper off to a normal voltage of 9.5V. Additionally, if the pack energy is called during cache offload, the pack energy will report lower because the voltage is being drained.These dynamic values are normal and safe, and should not raise concerns for the user.

NOTE In the event that your CacheVault module is behaving erratically, or behaves in a way not outlined in this document, contact your support representative using the information in the following section.

4 Technical Support

For assistance with installing, configuring, or running your card, contact an LSI Technical Support.

Website: www.lsi.com > Support > Find Support Documentation and Downloads.

Email: www.lsi.com/company/contact/pages/support.aspx

Phone Support: www.lsi.com/support/pages/call-us.aspx

1-800-633-4545 (North America)

00-800-5745-6442 (International)

5 Revision History

Table 1 Revision History

Version and Date	Description of Changes
Version 1.0, April 2014	Initial release of the document.

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