Configuring RAID on Smart-1 225/3050/3150

Administration Guide

30 June 2014
Important Information

Latest Software
We recommend that you install the most recent software release to stay up-to-date with the latest functional improvements, stability fixes, security enhancements and protection against new and evolving attacks.

Latest Documentation
The latest version of this document is at: (http://supportcontent.checkpoint.com/documentation_download?ID=32479)
To learn more, visit the Check Point Support Center (http://supportcenter.checkpoint.com).
For more about this release, see the Smart-1 Appliances home page (http://supportcontent.checkpoint.com/solutions?id=sk98931).

Revision History

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 June 2014</td>
<td>Changes:</td>
</tr>
<tr>
<td></td>
<td>• CfgSpanAdd parameter defaults: Stripe size to 256. Cache policy to Direct (&quot;CfgSpanAdd Parameter Details&quot; on page 10).</td>
</tr>
<tr>
<td></td>
<td>• Smart-1 3150 RAID Battery (on page 17)</td>
</tr>
<tr>
<td>25 May 2014</td>
<td>First release of this document</td>
</tr>
</tbody>
</table>

Feedback
Check Point is engaged in a continuous effort to improve its documentation. Please help us by sending your comments (mailto:cp_techpub_feedback@checkpoint.com?subject=Feedback on Configuring RAID on Smart-1 225/3050/3150 Administration Guide).
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RAID on Smart-1 225/3050/3150

RAID combines multiple Hard Disk Drives (HDDs) into a logical unit for the purposes of data redundancy and for better performance. It lets the appliance continue to work if there is a disk failure.

You must configure RAID if you change:
- The default RAID mode, or
- The number of HDDs.

If you replace an HDD, do not configure RAID. The new HDD is synchronized automatically.

This document shows how to:
- Change the RAID configuration on Smart-1 3050 and Smart-1 3150.
- Add HDDs to Smart-1 3150, and configure RAID on the new HDDs.
- Monitor RAID synchronization.

Note - Only RAID firmware updates provided by Check Point are supported.

Related documents:
- Smart-1 225/3050/3150 Appliances Getting Started Guide (http://supportcontent.checkpoint.com/documentation_download?ID=32309)
- Smart-1 225/3050/3150 Installing and Removing Hard Disk Drives (http://supportcontent.checkpoint.com/documentation_download?ID=32420)

RAID Levels and Storage Options

<table>
<thead>
<tr>
<th>Model</th>
<th>Smart-1 225</th>
<th>Smart-1 3050</th>
<th>Smart-1 3150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default RAID mode</td>
<td>1</td>
<td>10</td>
<td>6 for 6, 8, 10 HDDs 60 for 12 HDDs</td>
</tr>
<tr>
<td>Supported RAID modes</td>
<td>1</td>
<td>5, 10</td>
<td>5 for 6,8,10,12 HDDs 6 for 6,8,10,12 HDDs 10 for 8,12 HDDs 50 for 6,8,10,12 HDDs 60 for 8,10,12 HDDs</td>
</tr>
<tr>
<td>Default storage</td>
<td>2 x 2TB HDDs</td>
<td>4 x 2TB HDDs</td>
<td>6 x 2TB HDDs</td>
</tr>
<tr>
<td>Optional storage</td>
<td></td>
<td>+2, +4 or +6 HDDs</td>
<td>Supported RAID Modes when adding HDDs without reconfiguring the existing RAID: 5 or 10 for 4 HDDs 5 or 6 for 6 HDDs.</td>
</tr>
</tbody>
</table>
Configuring RAID on Smart-1 225

There is need to configure RAID for the Smart-1 225. The mirrored disk is rebuilt automatically.

At first boot up, it takes two hours for the hard disks to fully synchronize. You can use the appliance while the disks are synchronizing. If you reboot the appliance before the hard disks are synchronized, the synchronization starts again at the next boot.

Configuring RAID on Smart-1 3050 and Smart-1 3150

To configure RAID on Smart-1 3050 and Smart-1 3150, you must connect to the RAID CLI, clear the existing RAID configuration, and then create Virtual Drives. A Virtual Drive is an abstraction of a storage system.

Important - Configuring RAID erases all data on the disks.

To connect to the RAID CLI
1. Connect the end of a serial cable that has a RJ-45 jack to the Console port on the appliance.
2. Connect the other end of the serial cable to a computer.
3. On the computer, connect to the appliance using a terminal emulation application such as PuTTY.
   - Make sure the Speed (baud rate) is set to 9600
   - No IP address is necessary
4. Reboot the appliance.
   - If the appliance is off, use the power switch to turn on the appliance.
   - If the appliance is on, reboot the appliance. At the prompt, type `reboot`
   You will see boot messages on the console.

This example shows the boot process of an appliance configured with RAID 5 and 3 Virtual Drives

<table>
<thead>
<tr>
<th>Disk</th>
<th>RAID Level</th>
<th>Virtual Drive</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>255</td>
<td>RAID5</td>
<td>Virtual Drive</td>
<td>1992294MB</td>
</tr>
<tr>
<td>255</td>
<td>RAID5</td>
<td>Virtual Drive</td>
<td>1992294MB</td>
</tr>
<tr>
<td>255</td>
<td>RAID5</td>
<td>Virtual Drive</td>
<td>1734594MB</td>
</tr>
</tbody>
</table>

0 JBOD(s) found on the host adapter
0 JBOD(s) handled by BIOS
3 Virtual Drive(s) found on the host adapter.
3 Virtual Drive(s) handled by BIOS
Press <Ctrl><H> for WebBIOS or press <Ctrl><Y> for Preboot CLI

5. When prompted, press Ctrl+Y

You are in the RAID CLI.

To configure RAID on the Smart-1 3050 and Smart-1 3150:
1. At the $ prompt: Clear the configuration of the disks made by the RAID Controller on this appliance. Run:
   
   ```bash
   $ CfgClr -a0
   ```

2. Clear the configuration made by a different RAID Controller. Run:
   
   ```bash
   $ CfgForeign -Clear -a0
   ```
3. Make sure the Hard Disk Drives (HDDs) have the Firmware state of Unconfigured(good). To do this, run this command on every HDD, one by one:
   
   ```
   $ PDInfo -PhysDrv[<HDDslot>] -a0
   <HDDslot> identifies the physical location of the HDD in the appliance.
   ```

   **For Smart-1 3050:**

<table>
<thead>
<tr>
<th>64:0</th>
<th>64:1</th>
<th>64:2</th>
<th>64:3</th>
</tr>
</thead>
</table>

   **For Smart-1 3150:**

   | 245:0 | 245:1 | 245:2 | 245:3 |
   | 245:4 | 245:5 | 245:6 | 245:7 |
   | 245:8 | 245:9 | 245:10 | 245:11 |

   For example, for the leftmost HDD in the Smart-1 3050, run:
   
   ```
   $ PDInfo -PhysDrv[64:0] -a0
   ```

   **Output:**

   ```
   Last Predictive Failure Event Seq Number: 0
   PD Type: SATA
   Raw Size: 1.819 TB [0xe8e088b0 Sectors]
   Non Coerced Size: 1.818 TB [0xe8d088b0 Sectors]
   Coerced Size: 1.817 TB [0xe8b6d000 Sectors]
   Firmware state: Unconfigured(good), Spun Up
   SAS Address(0): 0x4433221103000000
   Connected Port Number: 2(path0)
   FDE Capable: Not Capable
   FDE Enable: Disable
   Secured: Unsecured
   Locked: Unlocked
   Foreign State: None
   Device Speed: 6.0Gb/s
   Link Speed: 6.0Gb/s
   Media Type: Hard Disk Device
   Drive: Not Certified
   Exit Code = 0x0
   ```

   To change physical drives state to Unconfigured(good), run:
   
   ```
   $ PDMakeGood -PhysDrv[<HDDslot0>,<HDDslot1>,...] -a0
   ```

   Where each HDDslot value represents the location of an HDD with the state Unconfigured(Bad).

   Do not run this command on an HDD with state Unconfigured(Good).

   **Note** - the output of the `PDInfo` command includes the size of the HDD.

   You must now create Virtual Drives.
Creating Virtual Drives

Create Virtual Drives from an array of HDDs (physical disks). Use the table to find out how many virtual drives to create.

For details of how to do the calculation, see Advanced: Calculating the Number of Virtual Drives (on page 18).

The maximum supported size of a Virtual Drive is 1.8TB. The default physical size of an HDD is 2.0TB. After configuring Virtual Drives with the maximum supported size, some space remains. To use the remaining space, create a Virtual Drive for the remaining space.

<table>
<thead>
<tr>
<th>Raid Mode</th>
<th>Number of HDDs</th>
<th>Available usable storage (TB)</th>
<th>Number of Virtual Drives to create</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>5.4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>12.6</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>16.2</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>19.8</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>7.2</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>10.8</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>14.4</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>18</td>
<td>11</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>3.6</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>8</td>
<td>7.2</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>10.8</td>
<td>7</td>
</tr>
<tr>
<td>50</td>
<td>6</td>
<td>7.2</td>
<td>5</td>
</tr>
<tr>
<td>50</td>
<td>8</td>
<td>10.8</td>
<td>7</td>
</tr>
<tr>
<td>50</td>
<td>10</td>
<td>14.4</td>
<td>9</td>
</tr>
<tr>
<td>50</td>
<td>12</td>
<td>18</td>
<td>11</td>
</tr>
<tr>
<td>60</td>
<td>8</td>
<td>7.2</td>
<td>5</td>
</tr>
<tr>
<td>60</td>
<td>10</td>
<td>10.8</td>
<td>7</td>
</tr>
<tr>
<td>60</td>
<td>12</td>
<td>14.4</td>
<td>9</td>
</tr>
</tbody>
</table>
Configuring RAID on Smart-1 3050 and Smart-1 3150

Syntax Notation

<table>
<thead>
<tr>
<th>Character</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td>[]</td>
<td>optional, except where noted as required.</td>
</tr>
<tr>
<td>&lt; &gt;</td>
<td>variable</td>
</tr>
<tr>
<td>None</td>
<td>required</td>
</tr>
</tbody>
</table>

Syntax for RAID level 5 or 6

For these RAID levels, create one disk array.

```
CfgLDAdd -R5|-R6[<HDDslot0>,<HDDslot1>,...] [ WT | WB ] [ NORA | RA | ADRA ] [ Direct | Cached ] [ CachedBadBBU | NoCachedBadBBU ] [ -szX [ -szY [ .. ]] [ -strpszM ] -a0
```

Example for RAID level 6

To configure RAID 6 on Smart-1 3150 with 6 HDDs (physical drives), create:
- One array
- 4 Virtual Drives with 1.8TB each
- 1 Virtual Drive for the remaining space

```
Run                                           Explanation
$ -CfgClr -a0                                 Clear the configuration of the disks made by the RAID Controller on this appliance
$ -CfgForeign -Clear -a0                       Clear the configuration made by a different RAID Controller
Create 4 Virtual Drives. Sizes are in MB
$ -CfgLDAdd -R6[245:0,245:1,245:2,245:3,245:4,245:5] -a0
Create 1 Virtual Drive for the remaining space
$ -LDInit -Start -Lall -a0                     Initialize the RAID
$ -AdpSetProp reconrate 0 -a0                 Disable interactive warnings during boot
```

Syntax for RAID level 10

- For 8 HDDs, create 2 groups of 4 HDDs.
- For 12 HDDs, create 3 groups of 4 HDDs.

In each group, make two arrays. In each array, put 2 HDDs.

```
CfgSpanAdd -R10 -Array0[<HDDslot0>,<HDDslot1>,...] -Array1[<HDDslot0>,<HDDslot1>,...] [ WT | WB ] [ NORA | RA | ADRA ] [ Direct | Cached ] [ CachedBadBBU | NoCachedBadBBU ] [ -szX [ -szY [ .. ]] [ -strpszM ] -a0
```

Example for RAID level 10

To configure RAID 10 on Smart-1 3150 with 12 HDDs (physical drives):
- Create 6 Virtual Drives with 1.8TB each
- Discard remaining space
**Configuring RAID on Smart-1 3050 and Smart-1 3150**

### Run

<table>
<thead>
<tr>
<th>Command</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>$ -CfgClr -a0</code></td>
<td>Clear the configuration of the disks made by the RAID Controller on this appliance</td>
</tr>
<tr>
<td><code>$ -CfgForeign -Clear -a0</code></td>
<td>Clear the configuration made by a different RAID Controller</td>
</tr>
<tr>
<td><code>$ CfgSpanAdd -R10 -Array0[245:0,245:1] -Array1[245:2,245:3] -sz1887436 -sz1887436 -a0</code></td>
<td>Create 2 arrays for 4 HDDs. In each array put 2 HDDs. Sizes are in MB.</td>
</tr>
<tr>
<td><code>$ -LDInit -Start -Lall -a0</code></td>
<td>Initialize the RAID</td>
</tr>
<tr>
<td><code>$ -AdpSetProp reconrate 0 -a0</code></td>
<td>Disable interactive warning during boot</td>
</tr>
</tbody>
</table>

### Syntax for RAID level 50 or 60

For these RAID levels, create two disk arrays. Each array must have half the total number HDDs.

```
CfgSpanAdd -R50| -R60 -Array0[<HDDslot0>,<HDDslot1>,...] -Array1[<HDDslot0>,<HDDslot1>,...] [ WT | WB ] [ NORA | RA | ADRA ] [ Direct | Cached ] [ CachedBadBBU | NoCachedBadBBU ] [-szX [ -szY [ .. ]]] [-strpszM ] -a0
```

### Example for RAID level 60

To configure RAID 60 on Smart-1 3150 with 12 HDDs (physical drives), create:

- Two arrays, with 6 HDDs in each array
- 8 Virtual Drives with 1.8TB each
- 1 Virtual Drive for the remaining space

<table>
<thead>
<tr>
<th>Command</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>$ -CfgClr -a0</code></td>
<td>Clear the configuration of the disks made by the RAID Controller on this appliance</td>
</tr>
<tr>
<td><code>$ -CfgForeign -Clear -a0</code></td>
<td>Clear the configuration made by a different RAID Controller</td>
</tr>
<tr>
<td><code>$ -LDInit -Start -Lall -a0</code></td>
<td>Initialize the RAID</td>
</tr>
<tr>
<td><code>$ -AdpSetProp reconrate 0 -a0</code></td>
<td>Disable interactive warning during boot</td>
</tr>
</tbody>
</table>
### CfgSpanAdd Parameter Details

These are the CfgSpanAdd command parameters, for all RAID levels.

Use default parameter values, unless stated otherwise.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-R5</td>
<td>-R6</td>
</tr>
</tbody>
</table>
| [<HDDslot0>,<HDDslot1>,... ] | For RAID level 5 or 6  
The HDDs in the array that make up the Virtual Drive.  
<HDDslotX> represents the location of an HDD. The square brackets [ and ] are required. |
| -Array0{[<HDDslot0>, <HDDslot1>,...]} -Array1{[<HDDslot0>, <HDDslot1>,...]} [ ... ] | For RAID level 10,50 or 60:  
Specify multiple arrays of HDDs. Note that the first array starts from 0, not 1. All HDD arrays must have the same number of HDDs. There must be at least two arrays. <HDDslotX> represents the location of an HDD. The square brackets [ and ] are required. |
| [ WT | WB ] | Select a write cache policy: WT (Write through) or WB (Write back). For Smart-1 3050, WT is recommended. For Smart-1 3150 WB is recommended. See Smart-1 3150 RAID Battery (on page 17)  
Default: WB |
| [ NORA | RA | ADRA ] | Select a read policy: NORA (No read ahead), RA (Read ahead), ADRA (Adaptive read ahead). It is not recommended to change the default value.  
Default: RA |
| [ Direct | Cached ] | Select a cache policy.  
Default: Direct |
| [ CachedBadBBU | NoCachedBadBBU ] | Whether to use write cache when the BBU is bad.  
Default: CachedBadBBU |
| [-szX [-szY [ .. ]]] | The size of the Virtual Drive, where X is a decimal number of Mbytes. (The actual size of the Virtual Drive may be smaller, because the driver requires the number of blocks from the HDDs in each Virtual Drive to be aligned to the stripe size). If multiple size options are specified, the Virtual Drives are configured in the order of the options in the command line.  
The configuration of a particular Virtual Drive fails if the unused size of the array of HDDs is smaller than the specified size.  
Default: All the available size on the HDD. |
| [ -strpszM ] | The stripe size in Mbytes. Possible values are 8, 16, 32, 64, 128, 256, 512, or 1024.  
Default: 256 |
| -a0 | The identifier of the adapter card of the internal RAID Controller. This parameter is required. |
Adding Hard Disk Drives to Smart-1 3150

You can add storage to the Smart-1 3150 and configure RAID on the added Hard Disk Drives (HDDs).

When adding storage without reconfiguring the existing RAID, the resulting RAID configuration has two RAID arrays without combined nested RAID. For example, two arrays of RAID 6, not RAID 60.

**To add new hard disk drives:**
1. Log in to the appliance.
2. Enter Expert mode.
3. Change the current directory. Run
   ```bash
   # cd /opt/MegaRAID/MegaCli/
   ```
4. Install an HDD:
   a) Hold the hard drive casing and insert the HDD into the slot.
   b) Push the extraction handle to close it.
      The hard disk drive clicks into position.
5. Do Step 4 again for all the HDDs.
6. Make sure the appliance recognizes the new HDDs by running:
   ```bash
   # MegaCli -PDList -a0 -NoLog | grep "Enclosure Device ID:\|Slot Number:\|Firmware state:
   ```
   This is an example output for an appliance to which 6 HDDs were added:
   ```bash
   Enclosure Device ID: 245
   Slot Number: 0
   Firmware state: Online
   Enclosure Device ID: 245
   Slot Number: 1
   Firmware state: Online
   Enclosure Device ID: 245
   Slot Number: 2
   Firmware state: Online
   Enclosure Device ID: 245
   Slot Number: 3
   Firmware state: Online
   Enclosure Device ID: 245
   Slot Number: 4
   Firmware state: Online
   Enclosure Device ID: 245
   Slot Number: 5
   Firmware state: Online
   Enclosure Device ID: 245
   Slot Number: 6
   Firmware state: Unconfigured(good), Spun down
   Enclosure Device ID: 245
   Slot Number: 7
   Firmware state: Unconfigured(good), Spun down
   Enclosure Device ID: 245
   Slot Number: 8
   Firmware state: Unconfigured(good), Spun down
   Enclosure Device ID: 245
   Slot Number: 9
   Firmware state: Unconfigured(good), Spun down
   Enclosure Device ID: 245
   Slot Number: 10
   Firmware state: Unconfigured(good), Spun down
   Enclosure Device ID: 245
   Slot Number: 11
   Firmware state: Unconfigured(good), Spun down
   ```
- Enclosure Device ID: 245 identifies the Smart-1 3150 appliance.
- Slot number identifies the physical location of the HDD in the appliance:

<table>
<thead>
<tr>
<th>Slot 0</th>
<th>Slot 1</th>
<th>Slot 2</th>
<th>Slot 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slot 4</td>
<td>Slot 5</td>
<td>Slot 6</td>
<td>Slot 7</td>
</tr>
<tr>
<td>Slot 8</td>
<td>Slot 9</td>
<td>Slot 10</td>
<td>Slot 11</td>
</tr>
</tbody>
</table>

Make sure the HDDs have the Firmware state of Unconfigured(good) or Unconfigured(bad). In the example output, the HDDs in Slot 6 to Slot 11 are in state Unconfigured(good).

7. If an HDD is in Offline state, turn off the appliance, and install the HDD again.
8. Make sure that the added HDDs have the Firmware state of Unconfigured(good). For every HDD with a Firmware state of Unconfigured(bad), run this command, one HDD at a time:

   ```
   # ./MegaCli -PDMakeGood -PhysDrv[<HDDslot>] -a0
   Where <HDDslot> = 245:Slot_Number
   For example, for the lower left HDD in the appliance, run:
   # ./MegaCli -PDMakeGood -PhysDrv[245:8] -a0
   Make sure that the state of the HDD changes to Unconfigured(good).
   
   9. Clear the configuration made by a different RAID Controller. Run:
   # ./MegaCli -CfgForeign -Clear -a0
   You must now create Virtual Drives.

Creating Virtual Drives when Adding HDDs

Create Virtual Drives from an array of the added HDDs (physical disks). Use the table to find out how many virtual drives to create.

For details of how to do the calculation, see Advanced: Calculating the Number of Virtual Drives (on page 18).

The maximum supported size of a Virtual Drive is 1.8TB. The default physical size of an HDD is 2.0TB. After configuring Virtual Drives with the maximum supported size, some space remains. To use the remaining space, create a Virtual Drive for the remaining space.

<table>
<thead>
<tr>
<th>Raid Mode</th>
<th>Number of HDDs to add</th>
<th>Available usable storage (TB)</th>
<th>Number of Virtual Drives to create</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>5.4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>7.2</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>3.6</td>
<td>3</td>
</tr>
</tbody>
</table>

Syntax Notation

<table>
<thead>
<tr>
<th>Character</th>
<th>Meaning</th>
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<td></td>
<td>OR</td>
</tr>
<tr>
<td>[ ]</td>
<td>optional, except where noted as required.</td>
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<tr>
<td>&lt; &gt;</td>
<td>variable</td>
</tr>
<tr>
<td>None</td>
<td>required</td>
</tr>
</tbody>
</table>
### Syntax for RAID level 5 or 6

For these RAID levels, create one disk array.

```
./MegaCli CfgLDAdd -R5[-R6[<HDDslot0>,<HDDslot1>,...]] [ WT | WB ] [ NORA | RA | ADRA ] [ Direct | Cached ] [ CachedBadBBU | NoCachedBadBBU ] [ -szX [ -szY [ ... ]] ] [ -strpszM ] -a0
```

### Example for RAID level 6

To add 6 HDDs (physical drives) with RAID 6 to Smart-1 3150, create:

- One array
- 4 Virtual Drives with 1.8TB each
- 1 Virtual Drive for the remaining space

<table>
<thead>
<tr>
<th>Run</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td># ./MegaCli -CfgLDAdd -R6[245:6,245:7,245:8,245:9,245:10,245:11] -a0</td>
<td>Create 1 Virtual Drive for the remaining space</td>
</tr>
<tr>
<td># ./MegaCli -LDinit -Start -L5,6,7,8,9 -a0</td>
<td>Initialize the RAID</td>
</tr>
</tbody>
</table>

For the parameter details, see [CfgSpanAdd Parameter Details (on page 10)](#).

### Syntax for RAID level 10

```
CfgSpanAdd -R10 -Array0[<HDDslot0>,<HDDslot1>,...]-Array1[<HDDslot0>,<HDDslot1>,...][ WT | WB ] [ NORA | RA | ADRA ] [ Direct | Cached ] [ CachedBadBBU | NoCachedBadBBU ] [ -szX [ -szY [ ... ]] ] [ -strpszM ] -a0
```

### Example for RAID level 10

To add RAID level 10 on 4 HDDs to an existing RAID array on 8 HDDs, create

- 2 arrays, with 2 HDDs in each array.
- 2 Virtual Drives with 1.8TB each
- 1 Virtual Drive for the remaining space

<table>
<thead>
<tr>
<th>Run</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td># ./MegaCli -CfgSpanAdd -R10 -Array0[245:8,245:9] -Array1[245:10,245:11] -a0</td>
<td>Create 1 Virtual Drive for the remaining space</td>
</tr>
<tr>
<td># ./MegaCli -LDinit -Start -L5,6,7 -a0</td>
<td>Initialize the RAID</td>
</tr>
</tbody>
</table>

For the parameter details, see [CfgSpanAdd Parameter Details (on page 10)](#).
Verifying the Virtual Drive Configuration

Make sure that the configuration of the Virtual Drives is correct.

Syntax

When configuring RAID for the first time, run from the RAID CLI:

```
$ LDInfo -Lx -a0
```

When adding HDDs to the RAID configuration, run in Expert mode

```
# ./LDInfo -Lx -a0
```

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Lx</td>
<td>x is the Virtual Drive number. To specify two or more Virtual Drives, use a comma separated list. For example -L0,1,2 to specify Virtual Drives 0, 1, and 2.</td>
</tr>
</tbody>
</table>

Example

After configuring the example for RAID level 5 or 6 in Creating a Virtual Drive (“Creating Virtual Drives” on page 7) or Creating a Virtual Drive when Adding HDDs (“Creating Virtual Drives when Adding HDDs” on page 12):

```
$ LDInfo -L5 -a0
```

```
Adapter 0 -- Virtual Drive Information:
Virtual Drive: 5 (Target Id: 5)
Name: 
RAID Level: Primary-6, Secondary-0, RAID Level Qualifier-3
Size: 1.799 TB
Is VD emulated: No
State: Optimal
Strip Size: 64 KB
Number Of Drives: 6
Span Depth: 1
Default Cache Policy: WriteBack, ReadAdaptive, Direct, No Write Cache if Bad BBU
Current Cache Policy: WriteBack, ReadAdaptive, Direct, No Write Cache if Bad BBU
Access Policy: Read/Write
Disk Cache Policy: Disk's Default
Encryption Type: None
```

After configuring the example for RAID level 10 in Creating a Virtual Drive when Adding HDDs (“Creating Virtual Drives when Adding HDDs” on page 12):

```
# ./MegaCli -LDInfo -L5 -a0
```

```
Adapter 0 -- Virtual Drive Information:
Virtual Disk: 5 (Target Id: 5)
Name: 
RAID Level: Primary-1, Secondary-0, RAID Level Qualifier-0
Size: 1.799 TB
State: Optimal
Stripe Size: 64 KB
Number Of Drives per span: 2
Span Depth: 2
Default Cache Policy: WriteBack, ReadAdaptive, Direct, No Write Cache if Bad BBU
Current Cache Policy: WriteBack, ReadAdaptive, Direct, No Write Cache if Bad BBU
Access Policy: Read/Write
Disk Cache Policy: Disk's Default
Encryption Type: None
```

Make sure that the state of the Virtual Drive is Optimal.

The command output shows the RAID level in an indirect way. The actual RAID level is determined by the Span Depth. When the Span Depth is 1, the RAID Level of the Virtual Drive is determined by the
Primary value of RAID Level. When Span Depth is 2, the RAID Level is determined both the Primary and Secondary values.

In the first example, Span Depth is 1, so the RAID level is 6 (the Primary value).

In the second example, Span Depth is 2, so the RAID Level is 10 (because Secondary is 0).

On Smart-1 3150, after verifying the configuration of the Virtual Drives, you must add new storage devices to the OS.

Adding Storage Devices to the OS

After adding HDDs to Smart-1 3150, add the new storage devices to the OS.

1. Verify the Virtual Drive configuration ("Verifying the Virtual Drive Configuration" on page 14).

2. Show the new SCSI storage devices. Run:
   fdisk -l
   The output shows each Virtual Drive as a new SCSI device. At this point, each new SCSI device "...doesn't contain a valid partition table". If you added five Virtual Drives, you see five new storage devices. For example:
   /dev/sdl
   /dev/sdk
   /dev/sdj
   /dev/sdi
   /dev/sdh

3. Add the new SCSI storage devices to main OS storage, one at a time. Run:
   3150_extendstorage

4. Select a device.
   This message shows:
   Physical volume (/dev/sdx) successfully initialized
   Volume group (vg_splat) successfully extended
   where x is an alphabetic character, and Volume group (vg_splat) is the name of the main OS storage.

5. Do Step 4 again for every new storage device.

6. To exit the tool choose Quit. If no storage device is detected, the tool exits automatically.

7. Make sure that the size of the main OS storage is as expected. Run:
   vgdisplay
   Look at the value of VG Size.
   To resize logical volumes use the lvm_manager tool.
Monitoring RAID Synchronization

You can monitor the RAID status of the disks to see when the hard disks are synchronized. If you reboot the appliance before the hard disks are synchronized, the synchronization starts again at the next boot.

To monitor the RAID status of the disks - CLI:

1. Log in to the appliance.
2. Enter expert mode.
3. Use one of these tools to monitor the RAID status of the hard disks:
   - Run `raid_diagnostic`
     
     This shows data about the RAID and hard disks, with the percent synchronization done.
     
     The numbered labels on the hard disk drawers of the appliance agree with the `DiskNumber` value in the output of the `raid_diagnostic` command.
     
     This is an example output for Smart-1 225. DiskID 0 is the left hard disk. DiskID 1 is the right hard disk.

   ```
   Expert@smodule]# raid_diagnostic
   Raid Status:
   VolumeID:0 RaidLevel: RAID-1
   NumberOfDisks:2 RaidSize:465GB
   State:DEGRADED Flags: ENABLED RESYNC_IN_PROGRESS
   DiskID:0 DiskNumber:1 Vendor:ATA
   ProductID:<HDD Model> Size:465GB State:ONLINE Flags:NONE
   DiskID:1 DiskNumber:2 Vendor:ATA
   ProductID:<HDD Model> Size:465GB
     State:INITIALIZING Flags:OUT OF SYNC SyncState: 12%
   ```

   - Run `cpstat os -f raidInfo`
     
     This shows almost the same information as the `raid_diagnostic` command in tabular format.

To monitor the RAID status of the disks - Gaia WebUI:

In the Gaia WebUI, go to the Maintenance > RAID Monitoring page.

To monitor the RAID status of the disks - SmartView Monitor:

1. Open SmartView Monitor.
2. Click All Gateways.
3. Select the Smart-1 Gateway.
4. Click System Information.
5. Click RAID Volumes.

Smart-1 3150 RAID Battery

The RAID card on the Smart-1 3150 has a battery that improves RAID performance in these ways:

1. Allows a “write-back” disk-write cache policy.
   
   If the appliance loses power for more than 12 hours, the RAID write cache policy changes to “write-through”. This reduces RAID performance. A warning message shows during boot:

   ![Warning Message](image)

   To resolve this, connect power to the appliance. After 24 hours, the disk-write cache policy changes to "write-back".

2. Prevents data loss if the appliance loses power when data is being written to the HDD. The Battery Backup Unit allows the RAID card to store this data for up to 48 hours. When the appliance power is restored, the RAID card writes the data back to the HDD. If the battery is not fully charged, the RAID card can store data for less time.

   When you first turn on the appliance, the battery requires up to 24 hours to charge and reach maximum RAID performance.

To show the write cache policy:

1. Log in to the appliance.
2. Enter Expert mode.
3. Run: 
   `./LDInfo -Lx -a0`

   Where x is the Virtual Drive number. For the parameter details, see Verifying the Virtual Drive Configuration (on page 14).

Look for the Default Cache Policy and the Current Cache Policy.

To show the battery backup status:

1. Log in to the appliance.
2. Enter Expert mode.
3. Run: 
   `MegaCli_firmware_upgrade -AdpBbuCmd -aALL`

   Look at the battery status in the first line of the output. This means that the battery status is OK:

   BBU status for Adapter: 0

   This example output shows the first few lines of the details of the status of the Battery Backup Unit (BBU):
Advanced: Calculating the Number of Virtual Drives

The table in Creating a Virtual Drive ("Creating Virtual Drives" on page 7) shows the number of Virtual Drives to create. You can also calculate the number.

To calculate the number of virtual Drives to create:

Available Usable Storage = (Number of HDDs - Number of Parity Devices) x HDD Physical Size

Number of Virtual Devices to create = Round up to nearest whole number the result of: Available Usable Storage / Maximum supported size of a Virtual Drive

- Number of Parity Devices:

<table>
<thead>
<tr>
<th>Raid Mode</th>
<th>Number of HDDs</th>
<th>Number of Parity Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>60</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

- HDD Physical Size = 2.0 TB ~ 1.82 TB
- Maximum supported size of a Virtual Drive = 1.8 TB

For example:

For RAID 6 with 8 HDDs, the number of Virtual Drives to create = ((8 - 2) x 1.82) / 1.8 = 6.07. Round up to nearest whole number = 7