RAID 1(+0): breaking mirrors and rebuilding drives

How to, 3rd edition

Introduction

When using a configuration with RAID 1(+0) volumes attached to Smart Array controllers, it may be necessary to break a mirror and rebuild the drives. For example:

• When a drive in a RAID 1(+0) volume fails, the controller essentially breaks the mirror. An administrator subsequently can regain fault tolerance and resynchronize the mirror by inserting a replacement drive and allowing the controller to rebuild the drive automatically.

• As a precaution against a future failure situation, an administrator can break a mirror by removing half of the mirrored drives (which are saved as the system backup), replace them with other drives, and allow the controller to automatically rebuild the new drives to restore fault tolerance. (Reverting to a previous backup is more complex and is explained later in this paper.)

• When increased capacity is required, an administrator can replace half of the drives in a RAID 1 or RAID 1+0 array with larger capacity drives and rebuild the new drives. Afterwards, the administrator can replace the other half of the drives and allow them to rebuild in the other direction. Once all drives in the array are of larger capacity, the administrator can use the Array Configuration Utility (ACU) to increase the logical drive size or to configure additional volumes.

• When troubleshooting drives or testing software configurations, an administrator can use half the mirror drives as a backup copy and then revert to that backup copy if a software configuration (for example, an operating system patch) is unsuccessful.

HP provides two utilities for configuring an array on a Smart Array controller:

• Options ROM for Configuring Arrays (ORCA) – A simple ROM-Based configuration utility that runs on all operating systems

• Array Configuration Utility (ACU) – A versatile, browser-based utility that provides maximum control over configuration parameters

This paper explains two methods for safely breaking a RAID 1(+0) mirror and rebuilding drives in configurations with RAID1(+0) volumes. The new ACU "splitting mirror" feature is available only on newer controller models and with the latest ACU versions. The legacy method for manually breaking a RAID 1(+0) mirror is supported on all Smart Array controller models.

Table 1 shows which Smart Array controller models support the new ACU "Splitting a Mirrored Array" mechanism and which controllers support the manual mechanism described in this white paper.

Table 1. Smart Array controllers supporting ACU and manual methods of breaking RAID 1(+0) mirrors

Supported Controllers	ACU Method	Manual Method
All SAS Smart Array controller models	x	x
Smart Array 6i, 641, 642, 6402, 6404 (with firmware version 2.58 or higher only)	x	x
Integrated Smart Array		x
SMART-2/P, SMART-2/E, SMART-2SL, SMART-2DH		x
Smart Array 221, 3100ES, 3200, 431, 4200, 4250ES, 5i, 5i Plus, 532, 5312, 5302, 5304		x

Splitting a mirrored array using the Array Configuration Utility

This functionality, available in some controller models and ACU versions, splits an array that consists of one or more RAID 1(+0) logical drives into two identical new arrays consisting of RAID 0 logical drives. This functionality is useful when replicating a configuration or building a backup before performing a risky operation. Note that this is a bit different from the manual method, in which the volumes remain in their original RAID 1 or RAID 1+0 configuration after being split. Also note that this method does not require splitting other arrays attached to the controller at the same time.

IMPORTANT
You cannot split an array if it contains logical drives in RAID 0, RAID 5, or RAID ADG configurations.

NOTE
You can split or remirror an array only when the server is offline and operating in the Standard configuration mode of the ACU GUI.

To split a mirrored array using the Array Configuration Utility, complete the following steps:

1. Take the server offline.
2. Insert the CD that contains ACU into the CD-ROM drive.
3. Open ACU, and stay in Standard configuration mode (the default).
4. Select the controller that contains the array to be split.
5. In the Configuration View panel, select the array.
6. In the Select a Task panel, click **Split Mirrored Array.**
7. Click **OK.**
8. When ACU has finished splitting the array, shut down system.

9. Remove the physical drives that constitute one of the new arrays.

IMPORTANT
If you do not remove one of the arrays, the server will be unable to distinguish between the two new arrays after the server is restarted (next step) because the arrays will be identical.

10. Restart the server.

Recombining a split mirrored array using ACU

NOTE
You can split or remirror an array only when the server is offline and operating in the Standard configuration mode of the ACU GUI.

To remirror an array using ACU, complete the following steps:

1. Take the server offline.
2. Insert the drives that contain the other half of the split array.
3. Insert the CD that contains ACU into the CD-ROM drive.
4. Open ACU, and stay in Standard configuration mode (the default).
5. Select the controller that contains the array to be remirrored.
6. In the Configuration View panel, select the array to use as the source array in the recombined mirrored array.
7. In the Select a Task panel, click **Re-Mirror Array.**
8. Select the array that is to be mirrored to the source array. (This is usually the array that was originally split out of the original mirrored array. However, it can be another array if it is of the correct size.)

CAUTION
All data on the second array will be destroyed.

9. Click **OK.**
10. When ACU has finished recombining the split array, restart the server.

For more information or to download the Array Configuration Utility, please refer to this URL:
http://h18004.www1.hp.com/products/servers/proliantstorage/software-management/acumatrix/index.html

Breaking a mirror and rebuilding the array using the manual method

CAUTION

Use the following procedure for configurations with only one array on the controller. If multiple arrays are configured on a single controller, all arrays (and consequently all logical drives within each array) must be broken and restored together. Because of the added complexity, this method of creating a quick backup of the logical drives is strongly discouraged in configurations with multiple arrays per controller.

A mirror can be broken simply by removing a drive while the server is online. However, to preserve the data on drives being removed, it is necessary to shut down the system first. If the removed drives will be used to restore the system, or if the data on the drives will be required for any reason, follow these steps *exactly* to break a mirror:
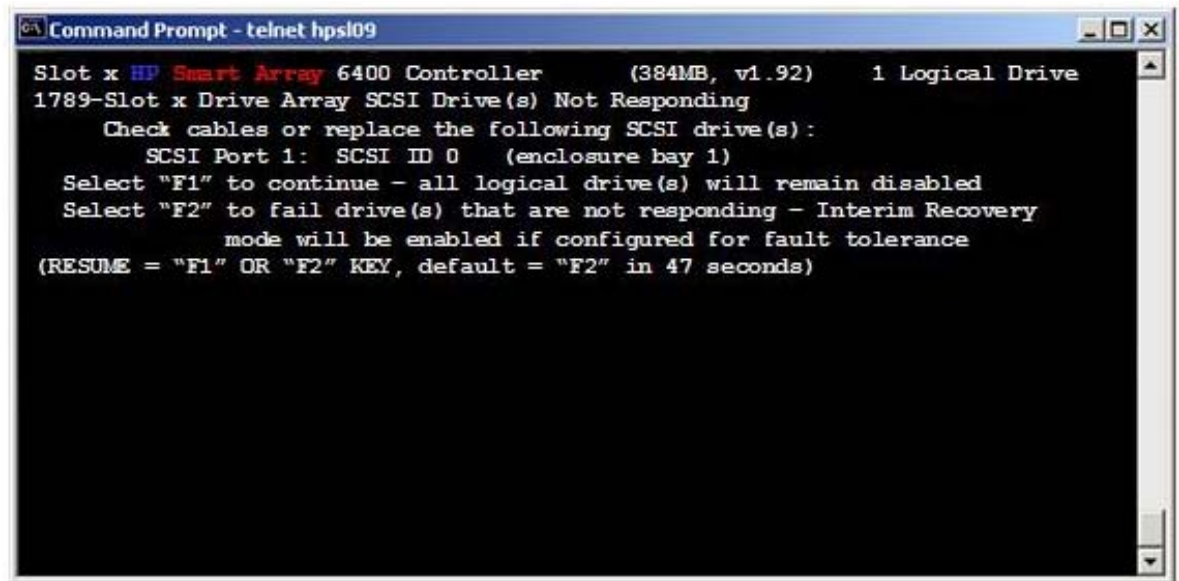
1. Verify that the controller is configured with RAID 1 (or RAID 1+0) logical drives only.
2. Shut down the operating system (to ensure clean file system shutdown) and the server.
3. With the power off, remove one half of the mirror (the backup) label each of the removed drives with its respective drive bay number, and store these drives in a safe place.

NOTE

For two-drive configurations, just remove one drive. For RAID 1+0 configurations, the first n/2 drives are always mirrored to the second n/2 drives. If the array contains more than two drives, do not remove drives that are mirrored to one another.

4. Restart the system with the remaining half of the mirror.
5. During boot-up, a message will indicate that the drives are not responding (Figure 1). Press **F2** to fail the missing drive(s) and continue in recovery mode. All drives on the controller will remain disabled until **F2** is pressed. If you press **F1** by mistake, simply reboot again and press **F2** to fail the drives.

Figure 1. A boot-up message indicates that the logical drive is still available but missing physical drives.

6. Insert a new drive into the open drive bay and the array rebuild should start automatically. If the rebuild does not start automatically, run the Array Configuration Utility to initiate the rebuild. For complete information about running ACU, refer to the resources cited at the end of this document.

7. After the rebuild is complete, proceed with the OS boot.

Rebuilding the array will bring the array back into a fault-tolerant state. If the mirror was broken simply to try an operating system patch, it is normally not necessary to make the array fault-tolerant again until after the patch is tested.

Reverting to a previous copy of a mirrored set using the manual method

This method only works if the mirrored set was originally broken using the manual method (not the new ACU method).

CAUTION

Before inserting the backup drives (in step 1 below), verify that all drives from the current array have been removed. Any drive that became part of the array during a rebuild process can OVERWRITE the BACKUP drive. Be especially careful in using hot spares, where the rebuild may have happened automatically and it is unclear whether another drive is now part of the array. To simplify this process, HP strongly recommends removing any spares before breaking the mirror and reinstalling the spares only after the array is rebuilt.

To revert to a previous copy of a mirrored set, complete the following steps:

1. With the system off, remove all drives from the array, and insert the drives containing the backup data (the image the array will revert to). The backup drives must be installed in their original locations. (If it is unclear which drive bay a backup drive came from, insert the drive into one of the drive bays where the array was created and continue with caution; it may be necessary to move it if a logical drive is not detected during boot-up).

2. Restart the system with only the backup drives installed. If no logical drives are found during boot-up (Figure 2), a drive is most likely in the wrong drive bay. If that happens, turn off the server, pull the drive out, and place it into another slot; then turn the server back on again.

Figure 2. Boot-up message indicating no logical drives were found and that the backup drives are probably in the wrong drive bays
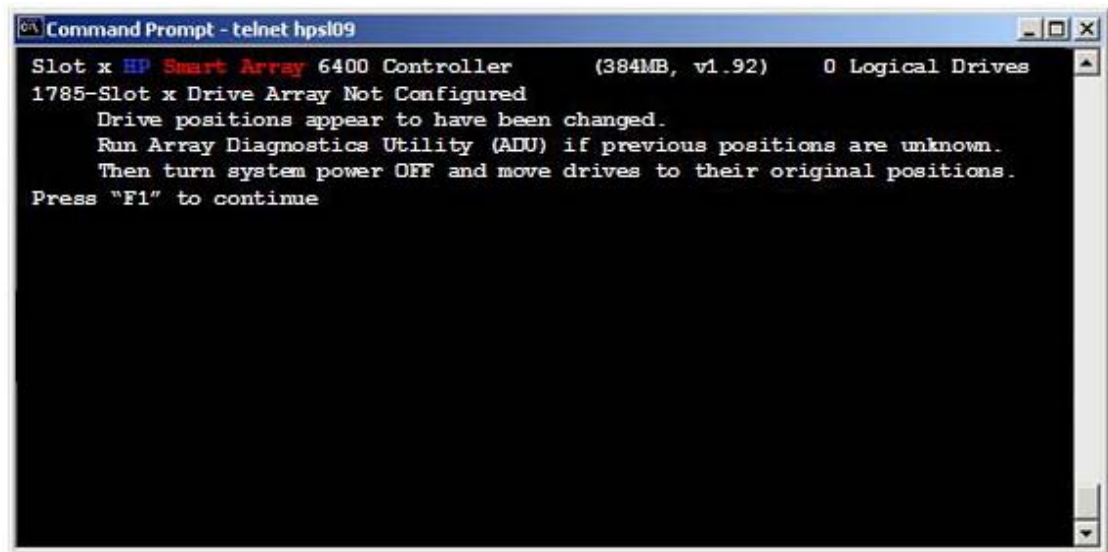
3. During boot-up, the message will indicate that the drives are not responding (Figure 12). Press **F2** to fail the missing drive and continue with one drive in recovery mode.

4. Insert the drive to be overwritten into the open drive bay, and the array rebuild should start automatically. If the rebuild does not start automatically, run the Array Configuration Utility to initiate the rebuild.

CAUTION
It is critical that the drives to be overwritten are hot inserted; they must not be installed while the server is off.

NOTE
The drive-online LED will blink during the rebuild process. When it stops blinking and turns solid green, the rebuild is complete. On a 36-GB Ultra 320 drive, depending on the number of IOPS the server is submitting to the controller, it takes about 6 minutes to rebuild a mirrored array when the controller's rebuild priority is set to high.

5. After the rebuild is complete, proceed with the OS boot.

For more information

For additional information, refer to the resources listed below.

Resource description	Web address
Business Support Center for HP Array Configuration Utility	http://h20000.www2.hp.com/bizsupport/TechSupport/Home.jsp?lang=en&cc=us&prodTypeId=18964&prodSeriesId=468780
HP Array Configuration Utility User Guide	http://h20000.www2.hp.com/bc/docs/support/SupportManual/c00294139/c00294139.pdf
Configuring Arrays on HP Smart Array Controllers Reference Guide	http://h20000.www2.hp.com/bc/docs/support/SupportManual/c00729544/c00729544.pdf

Call to action

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