Creating RAID arrays in the EFI shell

Supported configurations

When booting to a GPT RAID partition it is necessary to first create the RAID array. The boot array, in addition to data volumes, can be created using tools in the EFI shell prior to booting from the install media.

- GPT is currently supported by Win7-64 only
- Storage controllers must be configured to use the EFI driver.
- Controllers:
  - Z420/Z620: Intel C602 AHCI and SCU controllers
  - Z820: Intel C602 AHCI and SCU controllers, LSI 2308 controller.

Enabling the EFI Drivers

Use the following procedure to enable the EFI driver pre-OS for the different storage controllers.
Note: These instructions are for v02.07 BIOS. In earlier BIOS versions, the controller settings might be listed separately.

1. Press <F10> to enter the BIOS setup menu.
2. On the Main menu of the BIOS-based configuration utility, navigate to the Advanced menu item using the arrow keys.
3. Navigate to the sub menu item Device Options using the arrow keys and press Enter to access the Device Options menu screen.
4. On the Device Options screen, navigate to the Mass Storage Option ROMS item using the arrow keys.
5. Use the right or left arrow keys to change the selection from Legacy to EFI.
6. Press <F10> twice to go back to the File menu and make sure Save Changes and Exit is highlighted.
7. Press Enter to bring up the Save Changes and Exit confirmation. Make sure Yes is selected and press Enter. The system will reboot.

Creating a bootable UEFI USB key

A BSD licensed x64 UEFI shell can be downloaded from the Intel Tianocore EDK2 project on Sourceforge.net.
https://edk2.svn.sourceforge.net/svnroot/edk2/trunk/edk2/EdkShellBinPkg/FullShell/X64/Shell_Full.efi

1. Create the following path in the root of the USB key:

   \EFI\boot

2. Place the downloaded .efi shell file in the \EFI\boot folder named as:

   bootx64.efi

3. Copy the following files to the root folder of the USB key:

   RCfgSata.efi (For Intel AHCI controller)
   RCfgScu.efi (For Intel SCU controller)
   sas2ircu.efi (For LSI SAS controller)

   These configuration tools are part of the driver package for the Storage Controllers that can be downloaded from hp.com.

Booting to the UEFI Shell

1. Plug the bootable USB key into a USB port on the Workstation.

2. Power on the PC and press <F9> after the first messages appear. A message should appear at the bottom of the screen similar to **Entering Boot Menu…**. (You might not see this message if you have full OROM screens enabled.)

3. After some system messages you will be presented with a Boot Menu where you can use the arrow keys to select your boot device. Use the up and down arrows to select your USB key from the devices under UEFI Boot Sources and press Enter.

4. You should now have a Shell> prompt.

5. Helpful commands:

   a. Help – displays a list of standard shell commands. (Use Page Up and Page Down to view all of the commands.)
   b. `ls` – Displays a list of files and subdirectories in a directory. For example:
      - `ls fs0:` (shows the Directory of: fs0:\ which includes the EFI directory.
      - `ls fs1:` (shows the contents of the root directory where you saved the configuration tools.

Creating RAID arrays on the Intel C602 AHCI and SCU controllers

Use the following procedure to create data RAID arrays or boot RAID arrays prior to OS install.
Note: RAID arrays cannot span different controllers.

1. Using a USB key, boot to the EFI shell.

2. Execute either RCfgSata.efi (AHCI) or RCfgScu.efi (SCU) depending on which controller you are targeting for the RAID array.

3. Creating RAID arrays in EFI mode is a manual command line operation. Below are examples of using the command line configuration utilities to create basic arrays. The process is similar for SCU and AHCI controllers.

Example 1 – To display a list of available commands for the configuration utility use:

```
Shell> rcfgsata
```

Or

```
Shell> rcfgsata /?
```

Example 2 – To display a list of available commands for RCfgScu.efi:

```
Shell> rcfgscu
```

Results in:

```
Intel(R) UEFI RAID Utility for SCU - v3.6.0.1006

RCfgScu.efi [/?] [/Y] [/Q] [/C:vol_name] [/SS:strip_size] [/L:raid_level]
[/S:vol_size] [/DS:disk_id] [/D:vol_name] [/X] [/I] [/P] [/U] [/ST] [/SP] [/V]

/?  Displays Help Screen.  Other options ignored.
/Y  Suppress any user input. Used with options /C, /D, & /X.
/Q  Quiet mode / No output. Should not be used with status commands.

    COMMANDS - Only one at a time.
/C  Create a volume with the specified name.
    /S, /DS, /SS, & /L can be specified along with /C.
/SS Specify strip size in KB.  Only valid with /C.
/L  Specify RAID Level (0, 1, 10, or 5).  Only valid with /C.
/S  Specify volume size in GB or percentage if a '%' is appended.
    Percentage must be between 1-100.  Only valid with /C.
/DS Selects the disks to be used in the creation of volume.
    List should be delimited by spaces.
/D  Delete Volume with specified name.
/X  Remove all metadata from all disks. Use with /DS to delete
    metadata from selected disks.
/I  Display All Drive/Volume/Array Information.  /P can be specified.
/P  Pause display between sections. Only valid with /I or /ST.
/U  Do not delete the partition table. Only valid with /C on RAID 1
    volumes.
/ST Display Volume/RAID/Disk Status.
/SP Marks the selected drive(s) as spare(s). Use with /DS
/V  Display version information

Shell>
```

Example 3 – To display a list of drives on the targeted controller use:

```
Shell> rcfgscu /I
```

Results in:

```
--CONTROLLER INFORMATION--

Controller Name:  SCU

Physical Disks Controlled by RAID on this controller:
```

```
Disk 1 / 2
 Drive: WDC WD2500AAKX-603CA0
 SerialNo:WD-WCAYU8520661
 TotalBlks:0x000000001D1C5970
 DeviceId:0x0 (Non-RAID Disk)
 CfgStatus:(0) Ok
 CheckBox:0x0
 State:(0x450)    Array:0xFFFFFFFF
    DETECTED_DISK
    PASSTHRU_DISK
    DISK_SMART_EVENT_SUPPORTED
Disk 2 / 2
 Drive: WDC WD2500AAKX-603CA0
 SerialNo:WD-WCAYU8002779
 TotalBlks:0x000000001D1C5970
 DeviceId:0x1 (Non-RAID Disk)
 CfgStatus:(0) Ok
 CheckBox:0x0
 State:(0x450)    Array:0xFFFFFFFF
    DETECTED_DISK
    PASSTHRU_DISK
    DISK_SMART_EVENT_SUPPORTED
----------------------------
 Total Physical Disks on SCU controller: 2
 Total Missing Disks on SCU controller: 0

RAID Volumes
----------------------------
 Total Volumes = 0

RAID Arrays
----------------------------
 Total Arrays = 0

Shell>
```

Note the “DeviceId:” for each drive that you want to include in the array. These are HEX values.

Example 4 – To create a RAID 1 array on the SCU use:

```
Shell> rcfgscu /C MyRAID1 /L 1 /DS 0x0 0x1
```

Where:

- The name of the array is “MyRAID1”
- The RAID Level chosen is “1” for Mirrored
- The disks selected are “0x0” and “0x1” which came from the “DeviceId:” lines from the “rcfgscu /I” command of **Example 3** above.

This is a minimal command resulting in defaults being used for most parameters.

You should use this command unless you are an expert and wish to specify additional configuration parameters.

Results in:

```
Creating Volume...
```

```
Volume Name: "MyRAID1"
RAID Level:  1
Size:        226548 MB
Strip Size:  64KB
Ports Selected: Disk(ID:0x0) Disk(ID:0x1)
WARNING: All data on the selected disks will be lost.
Are you sure you want to create this volume?(y/n)
```

(User presses y then sees)

```
Creating Volume....Successfully created volume

You MUST restart your system for your changes to take effect.
Any drives you have created or changed must be formatted
AFTER you restart.

Shell>
```

Creating RAID arrays on the embedded LSI 2308 controller

Use the following procedure to create data RAID arrays or boot RAID arrays prior to OS install.

1. Using a USB key, boot to the EFI shell.
2. Execute sas2ircu.efi.
3. Creating RAID arrays is in EFI mode is a manual command line operation. Following are examples of using the command line configuration utilities to create basic arrays.

Example 1 – To display a list of available commands for sas2ircu.efi:

```
Shell> sas2ircu
```

Results in:

```
LSI Corporation SAS2 IR Configuration Utility.
Version 14.00.00.00 (2012.07.04)
Copyright (c) 2009-2012 LSI Corporation. All rights reserved.

SAS2IRCU: Disconnecting the EFI Driver.
SAS2IRCU: No command specified.
  sas2ircu <controller #> <command> <parameters> ...
    where <controller #> is:
      Number between 0 and 255
    where <command> is:
      DISPLAY    - display controller, volume and physical device info
      LIST       - Lists all available LSI adapters
                   (does not need ctlr #>
      CREATE     - create an IR volume
      DELETE     - Delete entire RAID configuration on the selected
                   controller
      DELETEVOLUME  - Delete a specific RAID Volume on the selected
                      controller
      HOTSPARE   - make drive a hot spare
      STATUS     - display current volume status info
```

```
      CONSTCHK    - Start Consistency Check operation on the specified IR
                    Volume
      ACTIVATE    - Activate an Inactive IR volume
      LOCATE      - Locate a disk drive on an enclosure
      LOGIR       - Upload or Clear IR Log data
      BOOTIR      - Select an IR Boot Volume as primary boot device
      BOOTENCL    - Select an Enclosure/Bay as primary boot device
      HELP        - Display help information
    where <parameters> are:
      Command specific values; enter "sas2ircu <controller #> <command>"
      to get command specific help

SAS2IRCU: Reconnecting the EFI Driver. Please wait...

Shell>
```

Example 2 – LIST the adapters to get the adapter number that will be used in other commands:

```
Shell> sas2ircu list
```

Results in:

```
LSI Corporation SAS2 IR Configuration Utility.
Version 14.00.00.00 (2012.07.04)
Copyright (c) 2009-2012 LSI Corporation. All rights reserved.

SAS2IRCU: Disconnecting the EFI Driver.

          Adapter      Vendor  Device                       SubSys  SubSys
 Index     Type          ID      ID    Pci Address          Ven ID  Dev ID
 -----  ------------  ------  ------  -----------------    ------  ------
   0     SAS2308_1     1000h    86h   00h:02h:00h:00h      103Ch   158Bh
SAS2IRCU: Utility Completed Successfully.

SAS2IRCU: Reconnecting the EFI Driver. Please wait...

Shell>
```

Example 3 – DISPLAY physical device information that will be used to create the arrays:

```
Shell> sas2ircu 0 display
```

```
Where the controller # “0” is the Index resulting from the LIST command.
```

Results in:

```
LSI Corporation SAS2 IR Configuration Utility.
Version 14.00.00.00 (2012.07.04)
Copyright (c) 2009-2012 LSI Corporation. All rights reserved.

SAS2IRCU: Disconnecting the EFI Driver.
Read configuration has been initiated for controller 0
```

```
------------------------------------------------------------------------
Controller information
------------------------------------------------------------------------
  Controller type                         : SAS2308_1
  BIOS version                            : 7.23.02.00
  Firmware version                        : 12.00.02.00
  Channel description                     : 1 Serial Attached SCSI
  Initiator ID                            : 0
  Maximum physical devices                : 255
  Concurrent commands supported           : 3072
  Slot                                    : 1
  Segment                                 : 0
  Bus                                     : 2
  Device                                  : 0
  Function                                : 0
  RAID Support                            : Yes
------------------------------------------------------------------------
IR Volume information
------------------------------------------------------------------------
------------------------------------------------------------------------
Physical device information
------------------------------------------------------------------------
Initiator at ID #0

Device is a Hard disk
  Enclosure #                             : 1
  Slot #                                  : 0
  SAS Address                             : 4433221-1-0000-0000
  State                                   : Ready (RDY)
  Size (in MB)/(in sectors)               : 715404/1465149167
  Manufacturer                            : ATA
  Model Number                            : WDC WD7500AALX-6
  Firmware Revision                       : 1H18
  Serial No                               : WDWCATR3740757
  GUID                                    : 50014EE2AFBB4C36
  Protocol                                : SATA
  Drive Type                              : SATA_HDD

Device is a Hard disk
  Enclosure #                             : 1
  Slot #                                  : 1
  SAS Address                             : 5000CCA-0-1215-EF49
  State                                   : Ready (RDY)
  Size (in MB)/(in sectors)               : 572325/1172123567
  Manufacturer                            : HITACHI
  Model Number                            : HUC106060CSS600
  Firmware Revision                       : HPH0
  Serial No                               : PPGD1YVB
  GUID                                    : 5000CCA01215EF48
  Protocol                                : SAS
```

```
  Drive Type                              : SAS_HDD

Device is a Hard disk
  Enclosure #                             : 1
  Slot #                                  : 2
  SAS Address                             : 5000CCA-0-12BE-DF1D
  State                                   : Ready (RDY)
  Size (in MB)/(in sectors)               : 572325/1172123567
  Manufacturer                            : HITACHI
  Model Number                            : HUC106060CSS600
  Firmware Revision                       : HPH0
  Serial No                               : PPKBZ4PB
  GUID                                    : 5000CCA012BEDF1C
  Protocol                                : SAS
  Drive Type                              : SAS_HDD
------------------------------------------------------------------------
Enclosure information
------------------------------------------------------------------------
  Enclosure#                              : 1
  Logical ID                              : 50014380:16A6D82B
  Numslots                                : 8
  StartSlot                               : 0
------------------------------------------------------------------------
SAS2IRCU: Command DISPLAY Completed Successfully.
SAS2IRCU: Utility Completed Successfully.

SAS2IRCU: Reconnecting the EFI Driver. Please wait...

Shell>
```

Example 4 – Create a RAID 0 with two drives:

The format of the CREATE command is
sas2ircu <controller #> create <volume type> <size> <Encl:Bay> [Volume Name] [noprompt]
where <controller #> is:
A controller number between 0 and 255.
where <volume type> is:
The type of the volume to create and is either RAID1 (or)
RAID1E (or) RAID0 (or) RAID10.
where <size> is:
The size of the RAID volume in Mbytes or 'MAX' for the maximum size available.
where <Encl:Bay> is:
A list of Encl:Bay pairs identifying the disk drives you
wish to include in the volume being created. If the volume type is
'RAID1', the first drive will be selected as the primary and the
second as the secondary drive.
For a type 'RAID1' volume exactly 2 disks must be specified.
For a type 'RAID1E' volume min of 3 disks must be specified.
For a type 'RAID0' volume min of 2 disks must be specified.
For a type 'RAID10' volume min of 4 disks must be specified.
where [Volume Name] is an optional argument that can be used
to identify a Volume with a user specified Alpha-numeric string
where noprompt is an optional argument that eliminates
warnings and prompts

```
Shell> sas2ircu 0 create RAID0 MAX 1:1 1:2 MyRAID0
```

Results in:

```
LSI Corporation SAS2 IR Configuration Utility.
Version 14.00.00.00 (2012.07.04)
Copyright (c) 2009-2012 LSI Corporation. All rights reserved.

SAS2IRCU: Disconnecting the EFI Driver.
You are about to create an IR volume.

WARNING: Proceeding with this operation may cause data loss or data
         corruption. Are you sure you want to proceed (YES/NO)? YES

WARNING: This is your last chance to abort this operation. Do you wish
         to abort (YES/NO) NO
Please wait, may take up to a minute...
SAS2IRCU: Volume created successfully.
SAS2IRCU: Command CREATE Completed Successfully.
SAS2IRCU: Utility Completed Successfully.

SAS2IRCU: Reconnecting the EFI Driver. Please wait...

Shell>
```

Example 5 – Check your newly created array using the DISPLAY command:

```
Shell> sas2ircu 0 display
```

Note that the *IR Volume Information* section will now be populated and the state of the drives used in the array should change from *Ready (RDY)* to *Optimal (OPT).*

Results in:

```
LSI Corporation SAS2 IR Configuration Utility.
Version 14.00.00.00 (2012.07.04)
Copyright (c) 2009-2012 LSI Corporation. All rights reserved.

SAS2IRCU: Disconnecting the EFI Driver.
Read configuration has been initiated for controller 0
------------------------------------------------------------------------
Controller information
------------------------------------------------------------------------
  Controller type                         : SAS2308_1
  BIOS version                            : 7.23.02.00
  Firmware version                        : 12.00.02.00
  Channel description                     : 1 Serial Attached SCSI
  Initiator ID                            : 0
  Maximum physical devices                : 255
  Concurrent commands supported           : 3072
  Slot                                    : 1
  Segment                                 : 0
```

```
  Bus                                     : 2
  Device                                  : 0
  Function                                : 0
  RAID Support                            : Yes
-------------------------------------------------------------------------
IR Volume information
-------------------------------------------------------------------------
IR volume 1
  Volume ID                               : 323
  Volume Name                             : MyRAID0
  Status of volume                        : Okay (OKY)
  Volume wwid                             : 0AB1E3FAE1B36644
  RAID level                              : RAID0
  Size (in MB)                            : 1142500
  Physical hard disks                     :
  PHY[0] Enclosure#/Slot#                 : 4294967297:1
  PHY[1] Enclosure#/Slot#                 : 4294967297:2
-------------------------------------------------------------------------
Physical device information
-------------------------------------------------------------------------
Initiator at ID #0

Device is a Hard disk
  Enclosure #                             : 1
  Slot #                                  : 0
  SAS Address                             : 4433221-1-0000-0000
  State                                   : Ready (RDY)
  Size (in MB)/(in sectors)               : 715404/1465149167
  Manufacturer                            : ATA
  Model Number                            : WDC WD7500AALX-6
  Firmware Revision                       : 1H18
  Serial No                               : WDWCATR3740757
  GUID                                    : 50014EE2AFBB4C36
  Protocol                                : SATA
  Drive Type                              : SATA_HDD

Device is a Hard disk
  Enclosure #                             : 1
  Slot #                                  : 1
  SAS Address                             : 5000CCA-0-1215-EF49
  State                                   : Optimal (OPT)
  Size (in MB)/(in sectors)               : 572325/1172123567
  Manufacturer                            : HITACHI
  Model Number                            : HUC106060CSS600
  Firmware Revision                       : HPH0
  Serial No                               : PPGD1YVB
  GUID                                    : 5000CCA01215EF48
  Protocol                                : SAS
  Drive Type                              : SAS_HDD
```

```
Device is a Hard disk
  Enclosure #                             : 1
  Slot #                                  : 2
  SAS Address                             : 5000CCA-0-12BE-DF1D
  State                                   : Optimal (OPT)
  Size (in MB)/(in sectors)               : 572325/1172123567
  Manufacturer                            : HITACHI
  Model Number                            : HUC106060CSS600
  Firmware Revision                       : HPH0
  Serial No                               : PPKBZ4PB
  GUID                                    : 5000CCA012BEDF1C
  Protocol                                : SAS
  Drive Type                              : SAS_HDD
-------------------------------------------------------------------------
Enclosure information
-------------------------------------------------------------------------
  Enclosure#                              : 1
  Logical ID                              : 50014380:16A6D82B
  Numslots                                : 8
  StartSlot                               : 0
-------------------------------------------------------------------------
SAS2IRCU: Command DISPLAY Completed Successfully.
SAS2IRCU: Utility Completed Successfully.

SAS2IRCU: Reconnecting the EFI Driver. Please wait...

Shell>
```

4. Reboot the system to use the newly created RAID arrays.