



Mellanox Firmware Tools (MFT) for Linux

User's Manual

Rev 0.60

Mellanox Technologies

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Mellanox Firmware Tools for Linux User's Manual

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Table of Contents

Table of Contents	3
Revision History	5
Chapter 1 Introduction	7
1.1 Supported Operating Systems	8
1.2 Supported Mellanox Devices	9
1.3 MFT Access to Hardware Devices	9
1.4 Software Prerequisites	10
1.4.1 On Linux OS	10
1.5 MFT Installation	10
1.5.1 Install MFT On Linux OS	10
1.5.1.1 Uninstall MFT (Linux)	10
1.6 Reference Documents and Downloads	10
Chapter 2 mlxburn - FW Image Generator & Burner	11
2.1 Overview	11
2.1.1 Access Modes	11
2.1.2 Switch System Mode	11
2.2 mlxburn Synopsys	11
2.2.1 Additional mlxburn Options	13
2.3 Firmware Generation and Burning With mlxburn	13
2.3.1 Firmware Customization	13
2.4 Examples of mlxburn Usage	14
2.4.1 Host Channel Adapter Examples	14
2.4.2 InfiniBand Switch Examples	14
2.5 Exit Return Values	15
Chapter 3 flint - HCA Firmware Burner	17
3.1 Overview	17
3.2 flint Synopsys	17
3.2.1 Switch Descriptions	17
3.2.2 Command Descriptions	18
3.2.2.1 Burning FW	19
3.2.2.2 Querying the FW Image	20
3.2.2.3 Verifying the FW Image	20
3.2.3 Additional Debug / Development Commands	20
3.2.3.1 Reading a Word from Flash	20
3.2.3.2 Writing a dword to Flash	21
3.2.3.3 Writing a dword to Flash Without Sector Erase	21
3.2.3.4 Erasing a Sector	21
Chapter 4 spark, ibspark - Switch Firmware Burners	23
4.1 Overview	23
4.2 spark	23

4.2.1 spark Synopsis	23
4.3 ibspark	25
4.3.1 Description	25
4.3.2 Installation	25
4.3.3 ibspark Synopsis	25
4.3.4 Usage	25
Appendix A PSID Assignment	27
A.1 PSID Field Structure	27
A.2 PSID Assignment and Integration Flow	27
Appendix B Flow Examples - mlxburn	29
B.1 MT47396 In-Band Burning Recommended Flow	29
B.2 Switch System Burning Flow Example	30
Appendix C Debug Utilities	33
C.1 itrace Utility	33
C.2 mstdump Utility	35
C.3 isw Utility	35
C.4 i2c Utility	36

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Revision History

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Table 1 - Revision History Table

Date	Revision	Description
August 2007	0.60	<ul style="list-style-type: none"> Updated tool usage examples to use ConnectX devices Added Appendix C, "Debug Utilities"
June 2007	0.50	<ul style="list-style-type: none"> Added the '-mac' flag to the <i>flint</i> and <i>mlxburn</i> tools to support the ConnectX EN 10GigE adapter Added Section 4.3, "ibspark," on page 25 that describes <i>ibspark</i>, the In-Band firmware burning tool for InfiniScale III switches Modified Chapter 2, "mlxburn - FW Image Generator & Burner" on page 11 to describe <i>mlxburn</i> support for burning switch systems with multiple InfiniScale / InfiniScale III switch devices Added Appendix B, "Flow Examples - mlxburn" to describe burning switches In-Band and via a direct I2C connection
January 2007	0.40	<ul style="list-style-type: none"> Added <i>flint</i> flag: -use_image_ps Removed <i>flint</i> flags: -crc, -bsn
January 2006	0.30	<p>(MFT version 1.0.1)</p> <ul style="list-style-type: none"> Added querying options for VPD for <i>mlxburn</i> Added examples to demonstrate support of MT43132 InfiniScale device by <i>mlxburn</i> and <i>spark</i> Reorganized the "flint - HCA Firmware Burner" (page 17) chapter Added the Appendix "PSID Assignment" on page 27.
October 2005	0.20	<p>Added Windows distribution to MFT (MFT version 0.5.1)</p> <p>Added the following sections:</p> <ul style="list-style-type: none"> Section 1.1, "Supported Operating Systems," on page 8 Section 1.3, "MFT Access to Hardware Devices," on page 9 Section 1.4, "Software Prerequisites," on page 10 Section 1.5, "MFT Installation," on page 10
August 2005	0.10	First release (Linux distribution only) (MFT version 0.5.0)

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1 Introduction

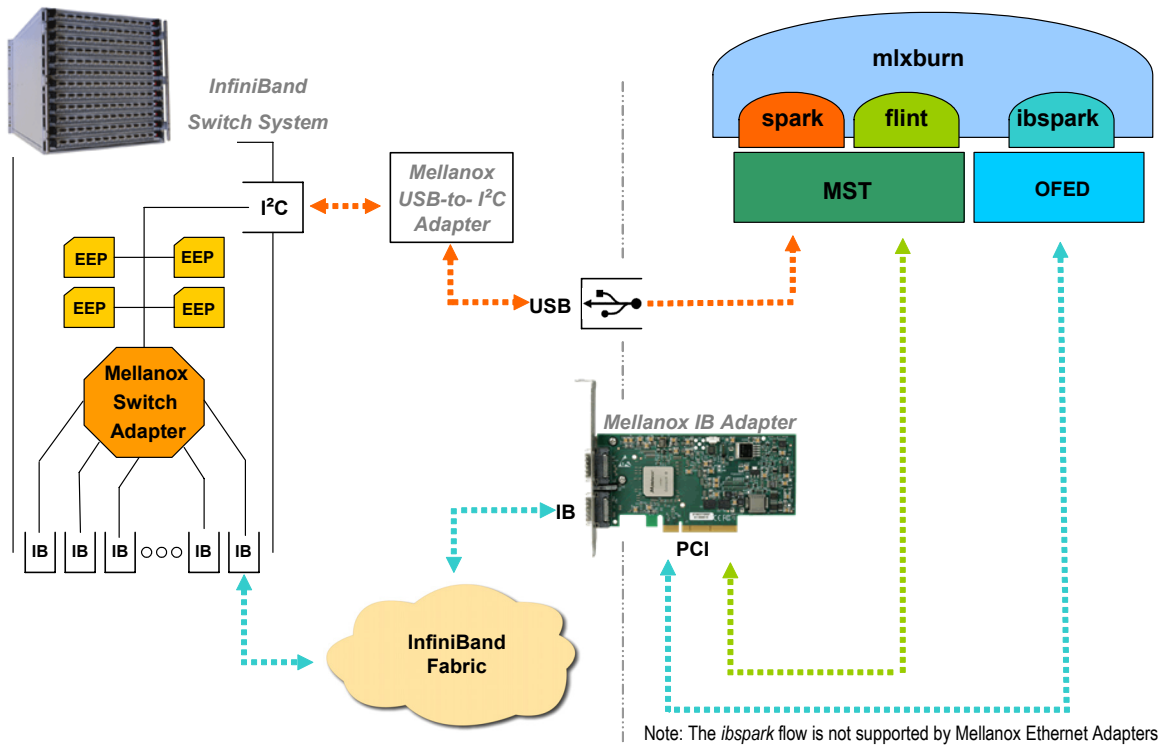
The Mellanox Firmware Tools (MFT) package is a set of firmware management tools for a single InfiniBand node. MFT can be used for:

- Generating a standard or customized Mellanox firmware image
- Querying for firmware information
- Burning a firmware image to a single InfiniBand node

The following is a list of the available tools in MFT, together with a brief description of what each tool performs. See Figure 1 on page 8 for an illustration of the tools' scheme of operation.

mlxburn	This tool provides the following functions: <ul style="list-style-type: none">• Generation of a standard or customized Mellanox firmware image for burning (in binary or .mlx format)• Burning an image to the Flash/EEPROM attached to a Mellanox HCA or switch device• Querying the firmware version loaded on an HCA board• Displaying the VPD (Vital Product Data) of an HCA board
flint	This tool burns a firmware <i>binary</i> image to the Flash(es) attached to an HCA board. It includes query functions to the burnt firmware image and to the binary image file.
spark	This tool burns a firmware <i>binary</i> image to the EEPROM(s) attached to a switch device. It includes query functions to the burnt firmware image and to the binary image file. The tool accesses the EEPROM and/or switch device via an I2C-compatible interface.
ibspark	This tool burns a firmware <i>binary</i> image to the EEPROM(s) attached to a switch device. It includes query functions to the burnt firmware image and to the binary image file. The tool accesses the switch device and the EEPROM via vendor-specific MADs over the InfiniBand fabric (In-Band tool).
Debug utilities	A set of debug utilities (e.g., itrace, mstdump, isw, and i2c)

Figure 1: Mellanox Firmware Tools – A Scheme of Operation



1.1 Supported Operating Systems

Please refer to the release notes of your version for supported platforms and kernels.

1.2 Supported Mellanox Devices

Table 1 - Supported Mellanox Devices

Device Type	Product Name	Supporting Tools
HCA (InfiniBand)	MT23108 InfiniHost	mlxburn, flint
	MT25208 InfiniHost III Ex	
	MT25204 InfiniHost III Lx	
	MT25408 ConnectX IB	
Ethernet Adapter (NIC)	MT25408 ConnectX EN	
Switch	MT47396 InfiniScale III	mlxburn, spark, ibspark
	MT43132 InfiniScale	mlxburn, spark

1.3 MFT Access to Hardware Devices

MFT tools access HCA devices via the PCI-X / PCI Express interface, or via a USB to I2C adapter (Mellanox P/N: MTUSB-1). The tools access switch devices via a USB to I2C adapter, or—only in the case of *ibspark*—via vendor-specific MADs over the InfiniBand fabric (In-Band).

Except for *ibspark*, all MFT tools address the target hardware device using an *mst device name*. On Linux, this name is assigned by running the command 'mst start'.

To list the available mst device names, run 'mst status'.

The format of an mst device name is as follows:

Via PCI: mt<dev-id>_pci<_crX|confX>

where:

X is the index of the HCA on the machine.

_crX devices access the HCA directly (recommended if possible)

confX devices use configuration cycles to access the HCA

Via USB to I2C adapter: For example, mtusb-1

Via the InfiniBand fabric (ibspark only): the switch device is accessed In-Band via the InfiniBand fabric by the device LID.

1.4 Software Prerequisites

1.4.1 On Linux OS

Table 2 - MFT Software Dependencies on Linux

Software Package	Required Version
Perl	5.6 or later
Expat	1.95 or later
zlib	1.1.4 or later
Kernel sources	Machine's kernel version
OFED ¹	1.1 or later

1. OFED is required for the optional installation of *ibspark* only. OFED can be downloaded from <http://www.openfabrics.org>.

1.5 MFT Installation

1.5.1 Install MFT On Linux OS

1. Download the Linux MFT package from the Mellanox Firmware webpage (http://www.mellanox.com/support/firmware_download.php).
2. Untar the downloaded package
3. Run 'install.sh'

Note: To install *ibspark* run 'install --with-ibspark'. Make sure OFED is already installed on your machine.

4. Start the mst driver by entering: mst start

Note: It is possible to customize some parameters of the installation (such as the target installation path). Run 'install.sh --help' for details.

1.5.1.1 Uninstall MFT (Linux)

To uninstall MFT, run 'uninstall_mft.sh' (located under the same directory of the other MFT executables).

1.6 Reference Documents and Downloads

- To download firmware images and their release notes, see <http://www.mellanox.com> under 'Firmware' downloads.
- OFED is an open-source software stack that can be downloaded from the <http://www.openfabrics.org>.
- *ibdiag* tools – run 'man ibdiagnet' for details on a machine with OFED installed.

2 mlxburn - FW Image Generator & Burner

2.1 Overview

mlxburn is a tool for firmware (FW) image generation and/or for burning a firmware image to the Flash/EEPROM attached to a Mellanox device. Both functions or a single function of mlxburn can be activated by means of command line options (see Section 2.2, “mlxburn Synopsys”). It can also query for firmware attributes (e.g., firmware version, GUIDs, etc.) and VPD info of adapter cards and switch systems.

mlxburn allows for customization of standard Mellanox firmware for OEM specific needs (e.g., a specific HCA board type). See Section 2.3.1, “Firmware Customization,” on page 13.

2.1.1 Access Modes

mlxburn can access an InfiniBand adapter (HCA) device via its PCI interface (over the *mst* driver). The target device is specified by an *mst device name* (described in Section 1.3, “MFT Access to Hardware Devices,” on page 9).

mlxburn can access InfiniBand switch devices via the InfiniBand connectivity (In-Band)¹ or via a direct I2C connectivity. If mlxburn accesses the switch In-Band, then the target switch is specified by its LID². If mlxburn accesses the switch via the I2C connectivity, then the target switch is specified by the name of the USB to I2C adapter device³ connected between the mlxburn host machine and the switch.

2.1.2 Switch System Mode

mlxburn can query and update parts of or an entire switch system. This mode of the tool requires familiarity with the target switch system's topology, and it can be applied to the following switch systems: MTPDK24 or MTPDK16 (24- or 16-port *Reindeer*), 96 port MTS9600 (*Gazelle*), MTPDK144 (144-port *Rhino*), and MTPDK288 (288-port *Trex*). See the `-sw_sys` flag in Section 2.2 below.

2.2 mlxburn Synopsys

Note: You must log in as root to run mlxburn.

```
mlxburn [-h | -v] [-V INFORM | WARNING | DEBUG] [-dev <mst-device> | -wimage <fw-image-file>]
          [-dev_type device-type] [-fw <mellanox-fw-file> [-format BINARY|IMAGE] | -image <fw-image-file>]
          [-conf <parameter-set-file>] [-conf_dir <dir>] [-nofs] [-nofs_img] [-exp_rom <exp-rom-file>] [-force]
          [-fwver] [-vpd] [-vpd_rw] [-vpd_prog_rw <rw-fields-file>] [-query] [-inband]
          [-sw_sys gazelle | reindeer | rhino | trex [-pattern <geo-addr>] -list ]
```

where:

```
-h                - display a short help text
-v                - print version info and exit
-V <INFORM|WARNING|DEBUG>- set the verbosity level. Default is WARNING.
-dev <mst-dev | LID> - access the device using the MST device name or the LID (see the -inband flag)
```

1. MT47396 InfiniScale III devices only.
2. The LID is assigned by the Subnet Manager which is part of OFED. See “Reference Documents and Downloads” on page 10.
3. For example, mtsub-1. Run ‘mst status’ to obtain the device name.

- wrimage <fw-image-file> - write the generated binary image to the provided file name
- fw <mellanox-fw-file> - specify the Mellanox firmware file to use (file extension is .mlx)
- format <BINARY|IMAGE> - specify which image format to use. Can be used only with the -wrimage flag. Default is BINARY.
- image <fw-image-file> - use the given firmware image to burn (file extension is .bin or .img)
- conf <parameter-set-file> - firmware configuration file (.ini). Needed for image generation (not using the -dev flag) or if auto-detection of configuration fails.
- conf_dir <dir> - instruct the burn operation to look for auto-detected configuration files under the specified directory rather than under the firmware file directory.
- nofs - when specified, the burn process will not be failsafe. A non-failsafe burn is required (on the rare occasion) when a new firmware version has modifications in the Invariant Sector
- nofs_img - when specified, the generated image will not be failsafe. If burning is also specified, it will not be failsafe either.
- exp_rom <exp_rom_file> - integrate the given expansion rom file into the firmware image. The given file may be in .img or .bin (raw binary) format. Note that the exp_rom_en (expansion ROM enable FW) parameter must be set in the configuration file.
- force - run mlxburn in non-interactive mode
- fwver - return the loaded firmware version on the Mellanox device
- vpd ¹ - display the Read Only section of the PCI VPD (Vital Product Data) of the given device
- vpd_rw ¹ - display the Read Only and Read/Write sections of the PCI VPD of the given device
- vpd_prog_rw ¹ <rw-fields-file> - program the VPD-W tag (the writable section of the VPD) with the data given in the rw-fields-file. File lines format is "FIELD = VALUE". White spaces before and after VALUE are trimmed. A field name should have 2 letters exactly (for example: "YA" , "V1"). The field name "RW" is reserved and should not be used.
- query - query adapter or switch devices for firmware information
- inband - Use the In-Band access method (query/burn). This is applicable only when burning an InfiniScale III (MT47396) switch device. When using this flag, the argument of the -dev flag should be the LID of the target InfiniScale III device. See Section B.1, "MT47396 In-Band Burning Recommended Flow," on page 29 for a flow example.

Note: The '-inband' flag is supported only if the MFT package is installed with the '--with-ibspark' flag.

- sw_sys <switch_type> [-pattern <geo-add> | -list]
 - Specify a switch system type: *gazelle* (96 ports), *reindeer* (24 or 16 ports), *rhino* (144 ports), or *trex* (288 ports).
 - Use the -pattern flag to specify the system's target device(s) using the geographical name(s); for example, S111 (Device 1 on Spine 1), L1211 (Device 1 on Leaf 12), L* (all switch Leafs) — run 'isw -h' for further details on patterns.
 - The -list flag lists all the InfiniBand devices of the switch system using their geographical names. The -list flag inhibits all other mlxburn functions.

1. The VPD query may not be enabled on certain board types.

`-dev_type <Mellanox-Device-ID>` **mlxburn** must know the Mellanox device ID in order to work properly. This option should be used if auto-detection of the device type (taken from the firmware file) fails. The following is the list of supported device IDs:

23108 - For MT23108 InfiniHost based HCA cards (Cougar family)

25208 - For MT25208 InfiniHost III Ex in InfiniHost-mode (with local attached memory) HCA cards (Lion Cub family)

25218 - For MT25208 InfiniHost III Ex in MemFree-mode HCA cards (Lion Mini family)

25204 - For MT25204 InfiniHost III Lx HCA cards (Tiger/Cheetah families)

25408 - For MT25408 ConnectX IB Dual 10Gb/s InfiniBand Port Adapter Cards

25418 - For MT25408 ConnectX IB Dual 20Gb/s InfiniBand Port Adapter Cards

25448 - For MT25408 ConnectX EN (NIC) cards

43132 - For MT43132 InfiniScale based switch systems

47396 - For MT47396 InfiniScale III based switch systems

2.2.1 Additional **mlxburn** Options

The following is a list of additional options. Please see Chapter 3, “flint - HCA Firmware Burner,” on page 17 for the HCA options, and Chapter 4, “spark, ibspark - Switch Firmware Burners,” on page 23 for the switch options.

For HCA¹: `[-byte_mode] [-use_image_ps] [-skip_is] [-mac(s)] [-guid(s)] [-sysguid] [-vsd]`

For switches²: `[-guid] [-sysguid] [-ndesc] [-bsn] [-pe_i2c] [-se_i2c] [-is3_i2c]`

2.3 Firmware Generation and Burning With **mlxburn**

The **mlxburn** firmware update flow is composed of two separate stages: image generation and image burning. In the image generation stage, a given Mellanox firmware release (in .mlx format for HCAs and in .BIN format for switches) is processed together with a board-specific configuration (.ini) file to generate a ‘burnable’ firmware image. This image is burnt to the Flash/EEPROM attached to a Mellanox device in the second stage. The burning process retains device specific data such as GUIDs, MACs, VSD, and BSN. Also, the burn process is failsafe by default.

mlxburn runs both stages by default, but it may perform only one by means of command options. If the ‘-wrimage’ is specified (see Section 2.2, “**mlxburn** Synopsys”), only image generation is performed. Specifying the ‘-image’ option skips the image generation stage and loads the provided image (generated in a previous run of **mlxburn** using the ‘-wrimage’ option).

Note: When generating an image file for a Mellanox switch device, the produced image file name must end with a .img extension.

2.3.1 Firmware Customization

A Mellanox firmware image can be customized (usually) to fit a specific board type. The customization is done by using a FW parameter-set file in the image generation stage. This file has a .ini format. Each parameter-set file has a unique parameter-set ID (PSID), which is kept in the device Flash/EEPROM and allows retaining device configuration during future FW updates.

1. The arguments of the `-guids` and `-macs` flags must be provided within quotation marks; for example, `mlxburn -macs "0002c900001 0002c900002"`
2. The `-guid` flags is supported by all Mellanox Technologies’ switch devices. All other flags are supported by the MT47396 InfiniScale III devices only.

During a device FW update, **mlxburn** reads the PSID from the device and uses the corresponding .ini file when generating the FW image. **mlxburn** searches for the files in the same directory of the FW release. When **mlxburn** is used to generate an image file, or when no corresponding parameter-set file is found, the user should explicitly specify which parameter-set file to use.

To produce an image file the user needs to provide the option ‘-wrimage <target file>’. To actually burn the image to the Flash/EEPROM attached to a Mellanox HCA or switch device, the user needs to specify the option ‘-dev </dev/mst/dev-file>’.

If run in burning mode, **mlxburn** auto-detects the firmware parameter-set with which the device was previously burnt. It locates and uses this parameter-set file to generate the appropriate image for the device (by merging the FW release with the specific parameter-set required).

To inhibit image generation, the ‘-image <pre-generated-image-file>’ should be used. It instructs **mlxburn** to use the given file for burning the device.

2.4 Examples of mlxburn Usage

2.4.1 Host Channel Adapter Examples

- To update firmware on an MT25408 ConnectX™ IB (HCA) device with the configuration file (.ini) auto-detected, enter:

```
mlxburn -fw ./fw-25408-rel.mlx -dev /dev/mst/mt25418_pci_cr0
```
- To generate a failsafe image file for the same HCA above without burning, enter:

```
mlxburn -fw ./fw-25408-rel.mlx -conf ./MHEH28-XTC_A1.ini -wrimage ./fw-25418.bin
```
- To update firmware on the same HCA above with the configuration file (.ini) explicitly specified, enter:

```
mlxburn -fw ./fw-25408-rel.mlx -dev /dev/mst/mt25418_pci_cr0
      -conf ./MHEH28-XTC_A1.ini
```
- To burn a firmware binary file for an MHGA28-IT (Lion Cub 128MB DDR) HCA card, enter:

```
mlxburn -image ./fw-25208-4_8_200-MHGA28-1T.bin -dev /dev/mst/mt25208_pci_cr0
      -dev_type 25208
```

2.4.2 InfiniBand Switch Examples

- To update firmware on an MT47396 InfiniScale III device, enter:

```
mlxburn -fw IS3FW.BIN -dev /dev/mst/mtusb-1
```

Note: This firmware update cannot be performed before initializing the MST device (mtusb-1) to connect to the I2C-compatible bus of the InfiniScale III and its EEPROM.
- To generate an image for the InfiniScale III switch device, enter:

```
mlxburn -fw IS3FW.BIN -conf ./MTS2400-A00.INI -wrimage IS3FW.img
```

Note: The generated firmware image to be burnt to a switch device must have a ‘.img’ file name extension.
- To update firmware on an MT43132 InfiniScale device in a switch system such as Flextronics’ F-X430066 Stallion 8 4X IB port switch, enter:

```
mlxburn -image Stallion_5_5_0.eeprom -dev /dev/mst/mtusb-1 -dev_type 43132
```

Note: This firmware update cannot be performed before initializing the MST device (mtusb-1) to connect to the I2C-compatible bus of the InfiniScale and its EEPROM.

- To list all detected switch devices (in the format of patterns) that are currently connected to the 144 port Rhino system chassis, enter:
`mlxburn -dev /dev/mst/mtusb-1 -sw_sys rhino -list`
- To perform a full query of a 144 port Rhino switch system, enter:
`mlxburn -dev /dev/mst/mtusb-1 -sw_sys rhino -pattern -query`
- To generate and burn an MT47396 image for device number 3 on Spine number 1 of the 288 port Trex system, enter:
`mlxburn -dev /dev/mst/mtusb-1 -sw_sys trex -pattern S1I3 -fw ./IS3FW.BIN`
- To generate an MT47396 image and perform an In-Band update of the device with LID 0x11, enter:
`mlxburn -dev 0x11 -fw ./IS3FW.BIN -inband`

2.5 Exit Return Values

The following exit values are returned:

- 0 - successful completion
- >0 - an error occurred

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3 flint - HCA Firmware Burner

3.1 Overview

The **flint** (Flash interface) utility performs the following functions:

- Burns a binary firmware image to the Flash attached to an HCA device
- Queries for HCA firmware attributes (version, GUIDs, PSID, etc.)
- Enables executing various operations on the Flash memory from the command line (for debug/production)

3.2 flint Synopsis

flint [switches...] <command> [parameters...]

3.2.1 Switch Descriptions

- d[evice] <device>** - The device to which the Flash is connected.
Affected commands: All
- i[image] <image>** - Binary image file.
Affected commands: burn, verify
- guid <GUID>** - Base value for up to 4 GUIDs which are automatically assigned the following values:
guid -> node GUID
guid+1 -> port1
guid+2 -> port2
guid+3 -> system image GUID.
Affected commands: burn
- guids <GUIDs...>** - 4 GUIDs must be specified here. These GUIDs will be assigned to: node, port1, port2 and system image GUID respectively.
Affected commands: burn
- mac <MAC>¹** - MAC base address value. Each of the two ConnectX EN ports is assigned a MAC address as follows:
MAC is assigned to Port 1
MAC+1 is assigned to Port 2
Affected commands: burn
- macs <MACs...>¹** - 2 MAC addresses must be specified here—one for each ConnectX EN port. The first MAC address is assigned to Port 1 and the second MAC address to Port 2.
Affected commands: burn
- clear_semaphore** - Force the clearing of the Flash semaphore on the device. This flag should come BEFORE the -d[evice] flag in the command line. No command is allowed when this flag is used.

1. The -mac and -macs options are applicable only to Mellanox Technologies Ethernet adapter devices.

- NOTE: Using this flag may result in an unstable behavior and flash image corruption if the device or another flash application is currently using the flash. Handle with care.
- byte_mode - Shift the address when accessing Flash internal registers. May be required for burn/write commands when accessing certain Flash types.
 - h[elp] - Print this message and exit.
 - hh - Print extended command help.
 - nofs - Do not burn image in failsafe mode.
 - skip_is - Allow burning the FW image without updating the invariant sector to ensure fail-safe burning even if the invariant sector of the image is different from the one burnt on the Flash.
Note: Some FW releases may include important changes to the invariant sector that must be included in the FW update process. In these cases, the -skip_is flag should *not* be used. Please refer to the specific FW release notes for details.
 - s[ilent] - Print errors only.
Affected commands: burn
 - y[es] - Non-interactive mode. Assume the answer "yes" to all questions.
Affected commands: all
 - vsd <vendor-specific-data> -A VSD string, composed of up to 208 characters, will be written to the VSD section in the flash. If not specified, the current VSD will be preserved.
 - use_image_ps - Burn vsd as it appears in the given image. (Default: Retain current vsd on Flash.)
Affected commands: burn
 - v - Version information.

3.2.2 Command Descriptions

The **flint** utility commands are:

- b[urn] - Burn flash
- e[rase] - Erase sector
- q[query] - Query for misc. Flash/firmware characteristics
- rw - Read one dword from flash
- v[erify] - Verify entire flash
- ww - Write one dword to flash
- bb - Burn Block - Burns the given image as is. No checks are done.
- wwne - Write one dword to flash without sector erase
- wbne - Write a data block to flash without sector erase
- rb - Read a data block from flash
- ri - Read the fw image on the flash.
- dc - Dump Configuration: print fw configuration file for the given image.

The following sections provide the command line syntax for the following **flint** utility commands, together with examples of usage.

- Burning FW ([page 19](#))

- Querying the FW Image ([page 20](#))
- Verifying the FW Image ([page 20](#))

3.2.2.1 Burning FW

The FLINT utility enables you to burn the Flash from a binary image.

To burn the entire Flash from a raw binary image, use the following command line:

```
flint -d <device> -i <fw-file> [-guid <GUID> | -guids <4 GUIDS> | -mac <MAC> |
-macs <2 MACs>] burn
```

where:

device – Device on which the flash is burned.

fw-file – Binary firmware file.

GUID (optional, for InfiniBand HCAs only) – One or four GUIDs.

If 4 GUIDS are provided (-guids flag), they will be assigned as node, Port 1, Port 2 and system image GUIDs, respectively.

If only one GUID is provided (-guid flag), it will be assigned as node GUID. Its values +1, +2 and +3 will be assigned as Port 1, Port 2 and system image GUID, respectively.

If no -guid/-guids flag is provided, the current GUIDs will be preserved on the device.

Note: A GUID is a 16-digit hexadecimal number. If less than 16 digits are provided, leading zeros will be inserted.

MAC (optional, for Ethernet adapters only) – One or two MACs.

If 2 MACs are provided (-macs flag), they will be assigned to Port 1 and Port 2, respectively.

If only one MAC is provided (-mac flag), it will be assigned to Port 1; MAC+1 will be assigned to Port 2.

If no -mac/-macs flag is provided, the current GUIDs will be preserved on the device.

Note: A MAC is a 12-digit hexadecimal number. If less than 12 digits are provided, leading zeros will be inserted.

Examples:

1. Update the FW on the device, keeping the current GUIDs and VSD. (Note: This is the common way to use flint.)

```
> flint -d /dev/mst/mt25418_pci_cr0 -i fw-25408-2_1_000-MHGH28-XSC_A1.bin burn
```
2. Update the FW on the device, specifying the GUIDs to burn.

```
> flint -d /dev/mst/mt25418_pci_cr0 -i 25408-2_1_000-MHGH28-XSC_A1.bin
-guid 12345678deadbeef burn
```
3. Update the FW on the device, specifying the MACs to burn.

```
> flint -d /dev/mst/mt25448_pci_cr0 -i fw-25448-6_0_111-MNEH28-XTC_A1.bin
-mac 12345678beef burn
```
4. Burn the image on a blank Flash device. This means that no GUIDs are currently burnt on the device, therefore they must be supplied (with -guid/-guids) by the burning command. Moreover, the burn process cannot be fail-safe when burning a blank Flash, therefore the -nofs flag must be specified.

```
> flint -d /dev/mst/mt25418_pci_cr0 -i 25408-2_1_000-MHGH28-XSC_A1.bin -nofs  
-guid 1234567812345678 burn
```

5. Read FW from the device and save it as an image file.

```
> flint -d /dev/mst/mt25418_pci_cr0 ri Flash_Image_Copy.bin
```

3.2.2.2 Querying the FW Image

To query the FW image on a device, use the following command line:

```
flint -d <device> q
```

To query the FW image in a file, use the following command line:

```
flint -i <image file> q
```

where:

device – Device on which the query is run.

image file – Image file on which the query is run.

Examples:

1. Query the FW on the device.

```
> flint -d /dev/mst/mt25418_pciconf0 query
```

2. Query the FW image file.

```
> flint -i 25408-2_1_000-MHGH28-XSC_A1.bin query
```

3.2.2.3 Verifying the FW Image

To verify the FW image on the Flash, use the following command line:

```
flint -d <device> v
```

To verify the FW image in a file, use the following command line:

```
flint -i <image file> v
```

where:

device is the Flash device to verify, and

image file is the image file to verify

Examples:

```
flint -d /dev/mst/mt25418_pci_cr0 v  
flint -i ./image_file.bin v
```

3.2.3 Additional Debug / Development Commands

3.2.3.1 Reading a Word from Flash

To read one dword from Flash memory, use the following command line:

```
flint -d <device> rw addr
```

where:

device is the device the dword is read from.

addr is the address of the word to read.

Example:

```
flint -d /dev/mst/mt23108_pci_cr0 rw 0x20
```

3.2.3.2 Writing a dword to Flash

To write one dword to Flash memory, use the following command line:

```
flint -d <device> ww addr data
```

where:

device is the device the dword is written to.

addr is the address of the word to write.

data is the value of the word.

Example:

```
flint -d /dev/mst/mt23108_pci_conf01 ww 0x10008 0x5a445a44
```

3.2.3.3 Writing a dword to Flash Without Sector Erase

To write one dword to Flash memory without sector erase, use the following command line:

```
flint -d <device> wwne addr data
```

where:

device – the device the dword is written to.

addr – the address of the word to write.

data – the value of the word.

Example:

```
flint -d /dev/mst/mt23108_pci_cr0 wwne 0x10008 0x5a445a44
```

Note that a result may be dependent on the Flash type. Usually, bitwise and between the specified word and the previous Flash contents will be written to the specified address.

3.2.3.4 Erasing a Sector

To erase a sector that contains a specified address, use the following command line:

```
flint -d <device> e addr
```

where:

device is the device the sector is erased from, and

addr is the address of a word in the sector that you want to erase.

Example:

```
flint -d /dev/mst/mtusb-1 e 0x1000
```

Mellanox Technologies

4 spark, ibspark - Switch Firmware Burners

4.1 Overview

The **spark** tool enables burning a binary firmware image to the EEPROM device attached to an InfiniScale (MT43132) or InfiniScale III (MT47396) switch device via a direct I2C connection. This tool is described in Section 4.2.

The **ibspark** tool enables In-Band burning of a binary firmware image to the EEPROM device attached to an InfiniScale III (MT47396) switch device. This tool is described in Section 4.3.

4.2 spark

4.2.1 spark Synopsis

spark [switches...] <command> [parameters...]

where switches are:

- d[evice] <device> - defines the Mellanox device to which the EEPROM is connected.
Affected commands: All (see the commands below)
- i[image] <image> - Image file is in ".img" format.
Affected commands: burn, verify, query
- guid <GUID> - Uses the given guid as the node guid of the burnt image. By default, the guid is taken from the image on the EEPROM.
Affected commands: burn
- sysguid <GUID> - Use the given guid as the system image guid of the burnt image. By default, this value is taken from the current image on the EEPROM.
Affected commands: burn
- bsn <BSN> - Mellanox Board Serial Number (BSN). The valid BSN format is: MTxxxxx[-]R[xx]ddmmyy-nnn[-cc]. By default, this value is taken from the current image on the EEPROM.
Affected commands: burn
- ndesc <Descr> - Use the given string (max 64 characters) as the node description. By default, this value is taken from the current image on the EEPROM.
Affected commands: burn
- isl - Indicate that the target EEPROM to be burnt is for an InfiniScale (MT43132) device. If this option is not specified, the target EEPROM is for an InfiniScale III (MT47396) device.
Affected commands: burn
- is3_i2c <i2c_addr> - Provides the I2C address of the switch device. If this flag is not specified, then the default address for Mellanox switch devices is: 0x6c.

- pe_i2c <i2c_addr> - Provides the I2C address of the primary EEPROM. By default, this address is read from the Mellanox switch device. Use this flag only if the switch device is not accessible.
- se_i2c <i2c_addr> - Provides the I2C address of the secondary EEPROM. By default, this address is read from the Mellanox switch device. Use this flag only if the switch device is not accessible.
- h[elp] - Prints this help message and exits.
- hh - Prints an extended command help
- nofs - Do *not* burn the firmware image in failsafe mode.
- s[ilent] - Print errors only.
Affected commands: burn
- y[es] - Non-interactive mode. Assume the answer to all questions is "yes".
Affected commands: All
- v - Version information.

The commands of **spark** are:

- b[urn] - Burns the binary image to the EEPROM.
Parameters: None
Examples:
spark -d /dev/mst/mtusb-1 -i image1.img burn
spark -d /dev/mst/mtusb-1 -guid 0x2c9000100d050 -i image1.img b
- q[ue]ry - Queries miscellaneous EEPROM and firmware characteristics
Parameters: None
Example:
spark -d /dev/mst/mtusb-1 query
- v[erify] - Verifies the entire EEPROM
Parameters: None
Example:
spark -d /dev/mst/mtusb-1 v
- bb - Burns the given image as is (Burn Block). No checks are performed on EEPROM or on the given image. Also no fields (e.g., BSN or GUIDs) are read from the EEPROM.
Parameters: None
Example:
spark -d /dev/mst/mtusb-1 -i image1.img bb
- ri - Reads the firmware image on the EEPROM and writes it to a file.
Parameters: filename to write the image to (in .img format)

Example:

```
spark -d /dev/mst/mtusb-1 ri file.img
```

rb

- Reads a block of data from a single eeprom to the given file.

Parameters: <eeprom address> <start offset> <data size> <output file name>

Example:

```
spark -d /dev/mst/mtusb-1 rb 0x56 0x0 0x1000 out.img
```

4.3 ibspark

4.3.1 Description

ibspark is an InfiniScale III (MT47396) In-Band burning tool. Its functionality is similar to that of *spark* except that *ibspark* accesses the InfiniScale III device via the InfiniBand fabric rather than over a direct I2C connection to the firmware EEPROMs bus. EEPROM burning is done by sending InfiniBand management packets (MADs) to the InfiniScale III device.

4.3.2 Installation

ibspark is not installed by default as part of the MFT package. See Section 1.5.1, “Install MFT On Linux OS,” on page 10.

4.3.3 ibspark Synopsis

The synopsis of *ibspark* is identical to that of *spark* with the following exceptions:

- The InfiniScale (MT43132) flag `-is1` is not supported
- The `-device` flag should be provided a LID and not a device name (see Chapter 2, “*mlxburn* - FW Image Generator & Burner” on page 11)

4.3.4 Usage

The following steps describe how to use *ibspark*:

1. Verify that the local IB ports are in the ACTIVE logical state by running `ibstat` or `ibv_devinfo`. If a port is in the INITIALIZING state, run `opensm` to turn it active. For other logical states, check the physical connections.
2. Run `ibdiagnet` to verify that the InfiniBand fabric is healthy, then find your destination device in the `/tmp/ibdiagnet.lst` file. Its record also contains its LID assigned to it by `opensm`. See Section B.1, “MT47396 In-Band Burning Recommended Flow,” on page 29 for details on obtaining the LID.
3. Provide the `-device` flag of *ibspark* with this LID.
4. See Section 4.2.1 for the full command line synopsis.

Mellanox Technologies

Appendix A - PSID Assignment

In some cases, OEMs or board manufacturers may wish to use a specific FW configuration not supplied by Mellanox. After setting the new FW parameters in an INI file, the user should assign a unique PSID (Parameter Set ID) to this new configuration. The PSID is kept as part of the FW image on the device NVMEM. The firmware burning tools use this field to retain FW settings while updating FW versions.

This appendix explains how to assign a new PSID for a user customized FW, and how to indicate to the burning tools that a new PSID exists.

Note: Please change FW parameters with caution. A faulty setting of FW parameters may result in undefined behavior of the burnt device.

A.1 PSID Field Structure

The PSID field is a 16-ascii (byte) character string. If the assigned PSID length is less than 16 characters, the remaining characters are filled with binary 0s by the burning tool.

Table 1 provides the format of a PSID.

Table 1 - PSID format

Vendor symbol	Board Type Symbol	Board Version Symbol	Parameter Set Number	Reserved
3 characters	3 characters	3 characters	4 characters	3 characters (filled with '\0')

Example: A PSID for Mellanox's MXXL-CF128-T HCA board is MT_0030000001, where:

MT_	Mellanox vendor symbol
003	MXXL-CF128-T board symbol
000	Board version symbol
0001	Parameter Set Number

A.2 PSID Assignment and Integration Flow

To assign and integrate the new PSID to produce the new FW

1. Write the new FW configuration file (in .INI format).
2. Assign it with a PSID in the format described above. Use your own vendor symbol to assure PSID uniqueness. If you do not know your vendor symbol, please contact your local Mellanox FAE.
3. Set the PSID parameter in the new FW configuration file.

Mellanox Technologies

Appendix B - Flow Examples - mlxburn

B.1 MT47396 In-Band Burning Recommended Flow

To update an MT47396 InfiniScale III switch device having a specific GUID (for example, 0x00000006660abcd0), the following are the recommended steps to update the device firmware.

1. Make sure all subnet ports are in the active state. One way to check this is to run *opensm*, the Subnet Manager.

```
[root@mymach]> /etc/init.d/opensmd start
opensm start      [ OK ]
```

2. Make sure the local ports are active by running 'ibv_devinfo'.
3. Obtain the device LID using the GUID. There are two ways to do that:

I. Using the *ibdiagnet* tool:

First, run *ibdiagnet* to sweep the subnet and generate the *ibdiagnet.lst* file. The file lists all the links in the subnet discovered by *opensm*. This is needed to obtain the LID assigned to each device by *opensm*.

```
[root@mymach]> ibdiagnet
Loading IBDIAGNET from: /usr/local/lib/ibdiagnet1.2
Loading IBDM from: /usr/lib64/ibdm1.2
-W- Topology file is not specified.
   Reports regarding cluster links will use direct routes.
-I- Using port 1 as the local port.
-I- Discovering the subnet ... 24 nodes (20 Switches & 4 CA-s) discovered.

-I-----
-I- Bad Guids Info
-I-----
-I- No bad Guids were found

-I-----
-I- Links With Logical State = INIT
-I-----
-I- No bad Links (with logical state = INIT) were found

-I-----
-I- PM Counters Info
-I-----
-I- No illegal PM counters values were found

-I-----
-I- Bad Links Info
-I-----
-I- No bad link were found

-I- Done. Run time was 8 seconds.
```

Next, use the device GUID (0x0000006660abcd0 in this example) to find the LID assigned to it by the Subnet Manager. The format of the `ibdiagnet.lst` file (see `/tmp/ibdiagnet.lst`) requires some manipulation to obtain the LID. The following commands show one way to obtain this LID (0x0011 in this example).

```
[root@mymach]> grep 0000006660abcd0 /tmp/ibdiagnet.lst | cut -d } -f 2 | cut -d
" " -f 2 | sort | uniq > /tmp/left_side.lids
[root@mymach]> grep 0000006660abcd0 /tmp/ibdiagnet.lst | cut -d } -f 4 | cut -d
" " -f 2 | sort | uniq > /tmp/right_side.lids
[root@mymach]> comm -12 /tmp/left_side.lids /tmp/right_side.lids

LID:0011
```

Note: The obtain LID is given as a *hexadecimal* number.

II. Using the `ibnetdiscover` tool:

Run:

```
[root@mymach]# ibnetdiscover | grep 0000006660abcd0 | grep -w Switch
Switch 24 "S-0000006660abcd0" "MT47396 Infiniscale-III Mellanox Technologies"
base port 0 lid 17 lmc 0
```

Note: The resulting LID is given as a *decimal* number.

4. Run `mlxburn` with the LID retrieved in step #3 above to perform the In-Band burning operation.

```
[root@mymach]> mlxburn -inband -dev 0x11 -fw ./IS3FW.BIN
-I- Reading PSID from board
-I- Using auto detected configuration file ./MT34000LE-A00.INI (PSID =
MT_0070000001)
-I- Generating image ...
- Checking primary image - OK

Current FW Version: 1.0.0
New FW Version: 1.0.0

- Burning secondary image - OK
- Verifying secondary image - OK
- Burning primary image - OK
- Verifying primary image - OK
-I- Image burn completed successfully.
```

B.2 Switch System Burning Flow Example

1. Detect and list the switch devices in the switch system. The output format is a device pattern listing.

```
[root@mymach]> mlxburn -dev /dev/mst/mtusb-1 -sw_sys rhino -list
-I- System : MTS14400 Rhino
-I- List of switch devices detected:
-I- L1I1
-I- L2I1
-I- L3I1
-I- L4I1
-I- L5I1
```

```

-I- L6I1
-I- L7I1
-I- L8I1
-I- L11I1
-I- L12I1
-I- S1I1
-I- S1I2
-I- S1I3
-I- S2I1
-I- S2I2
-I- S2I3

```

2. Query the entire switch system.

```

[root@mymach]> mlxburn -dev /dev/mst/mtusb-1 -sw_sys rhino -pattern "*" -query
-I- System : MTS14400 Rhino
-I- Location FW Version Node GUID System Image GUID BSN PSID
-I- L1I1 1.0.0 0x000b8cffff00275d 0x000b8cffff002750 NO_BSN MT_0070000002
-I- L2I1 1.0.0 0x000b8cffff002774 0x000b8cffff002750 NO_BSN MT_0070000002
-I- L3I1 1.0.0 0x000b8cffff002770 0x000b8cffff002750 NO_BSN MT_0070000002
-I- L4I1 1.0.0 0x000b8cffff0028a7 0x000b8cffff002750 NO_BSN MT_0070000002
-I- L5I1 1.0.0 0x000b8cffff0025d6 0x000b8cffff002750 NO_BSN MT_0070000002
-I- L6I1 1.0.0 0x000b8cffff002757 0x000b8cffff002750 NO_BSN MT_0070000002
-I- L7I1 1.0.0 0x000b8cffff0028bf 0x000b8cffff002750 NO_BSN MT_0070000002
-I- L8I1 1.0.0 0x000b8cffff0028c1 0x000b8cffff002750 NO_BSN MT_0070000002
-I- L11I1 1.0.0 0x000b8cffff00275c 0x000b8cffff002750 NO_BSN MT_0070000002
-I- L12I1 1.0.0 0x000b8cffff0025e3 0x000b8cffff002750 NO_BSN MT_0070000002
-I- S1I1 1.0.0 0x000b8cffff00277e 0x000b8cffff002750 NO_BSN MT_0080000002
-I- S1I2 1.0.0 0x000b8cffff00277f 0x000b8cffff002750 NO_BSN MT_0080000002
-I- S1I3 1.0.0 0x000b8cffff002780 0x000b8cffff002750 NO_BSN MT_0080000002
-I- S2I1 1.0.0 0x000b8cffff00278d 0x000b8cffff002750 NO_BSN MT_0080000002
-I- S2I2 1.0.0 0x000b8cffff00278e 0x000b8cffff002750 NO_BSN MT_0080000002
-I- S2I3 1.0.0 0x000b8cffff00278f 0x000b8cffff002750 NO_BSN MT_0080000002

```

3. Generate an InfiniScale III image and burn device number 3 on Rhino Spine number 1.

```

[root@mymach]> mlxburn -dev /dev/mst/mtusb-1 -sw_sys rhino -pattern S1I3 -fw ./
IS3FW.BIN
-I- System : MTS14400 Rhino

-I- Burning switch device at S1I3 ...
-I- Reading PSID from board
-I- Using auto detected configuration file ./MT34000SP_DDR-A00.INI (PSID =
MT_0080000002)
-I- Generating image ...
- Checking primary image - OK

Current FW Version: 1.0.0
New FW Version: 1.0.0

- Burning secondary image - OK
- Verifying secondary image - OK
- Burning primary image - OK
- Verifying primary image - OK
-I- Image burn completed successfully.

```

4. Generate and burn an InfiniScale III image for all the devices on Rhino Spine number 1.

```
[root@mymach]> mlxburn -dev /dev/mst/mtusb-1 -sw_sys rhino -pattern "S1I*" -fw ./
IS3FW.BIN
-I- System : MTS14400 Rhino

-I- Burning switch device at S1I1 ...
-I- Reading PSID from board
-I- Using auto detected configuration file ./MT34000SP_DDR-A00.INI (PSID =
MT_0080000002)
-I- Generating image ...
- Checking primary image      - OK

    Current FW Version:  1.0.0
    New FW Version:      1.0.0

- Burning secondary image    - OK
- Verifying secondary image  - OK
- Burning primary image      - OK
- Verifying primary image    - OK
-I- Image burn completed successfully.

-I- Burning switch device at S1I2 ...
-I- Generating image ...
- Checking primary image      - OK

    Current FW Version:  1.0.0
    New FW Version:      1.0.0

- Burning secondary image    - OK
- Verifying secondary image  - OK
- Burning primary image      - OK
- Verifying primary image    - OK
-I- Image burn completed successfully.

-I- Burning switch device at S1I3 ...
-I- Generating image ...
- Checking primary image      - OK

    Current FW Version:  1.0.0
    New FW Version:      1.0.0

- Burning secondary image    - OK
- Verifying secondary image  - OK
- Burning primary image      - OK
- Verifying primary image    - OK
-I- Image burn completed successfully.
```


Appendix C - Debug Utilities

This appendix presents the following set of utilities that can aid driver developers in debug:

- “itrace Utility” on page 33
- “mstdump Utility” on page 35
- “isw Utility” on page 35
- “i2c Utility” on page 36

C.1 itrace Utility

C.1.1 Overview

The itrace utility extracts and prints trace messages generated by the embedded iRISC processors of Mellanox Technologies' InfiniBand or Ethernet adapter devices. These trace messages inform developers of software drivers about internal status, events, critical errors, etc., for each iRISC. Trace messages generated by iRISCs are stored in the trace buffer. The trace buffer is located in host memory for MemFree adapter cards (i.e., without on-board memory), and in adapter memory for adapter cards with on-board memory.

The utility is a command line application controlled by command line parameters. It prints trace messages in text format to the console.

For more details, see the QUERY_DEBUG_MESSAGE command interface description in the device's *Programmer's Reference Manual* available via <https://docs.mellanox.com> (requires a customer login account).

C.1.2 Operation

In order to print the firmware traces, it is required that

- Debug firmware is burnt and loaded to the device
- The driver is up. Specifically, this means that
 - For HCAs with on-board memory: The SYS_ENABLE command has been executed
 - For HCAs without on-board memory (MemFree): The RUN_FW command has been executed
- The desired trace mask is set (see the -m flag below)

The MST driver must be started prior to running itrace tool. **To start itrace:**

- Start the MST driver (mst start or mst restart).
- Enter the following command:

```
itrace [options...] IRISC_NAME
```

where:

IRISC_NAME – is the iRISC for which traces are to be printed. This can be specified once anywhere in the command line as a special option without the leading hyphen. Run ‘itrace -h’ to get a list of iRISC names for each adapter device.

[options] can specify any of the following:

- h, --help** – Displays help about itrace usage.
- m, --mask=TRACE_MASK** – Sets the Trace Mask.

To enable generating trace messages for an iRISC, the `trace_mask` register must be set according to the specifications in the device’s *Programmer’s Reference Manual*. Setting or clearing bits of the `trace_mask` register enables or disables, respectively, the generation of specific types of trace messages. The `TRACE_MASK` parameter must be a hexadecimal or decimal number and its value will be written into the `trace_mask` register. Changing `trace_mask` will not change or remove messages previously stored in the trace buffer, so disabled types of messages can still be displayed by itrace if they were previously generated.

Example:

```
itrace -d /dev/mst/mt25204_pci_cr0 --nomap -m 0xffffffff tpt
```

This generates output regarding the sequence numbers, timestamps, and records of operations, such as the following:

```
IRISC Trace Viewer (Mellanox InfiniHost, V4.4.2, Jul 31 2007 16:56:59)
FW Version: 1.2.922 09/07/2007 20:36:53
```

```
(00000001 c1b59bd1) SCHD: SQP:0x000402 exes_super_scheduler:busy_done
(00000003 c1b59e4e) SCHD: exeqpc_valid2freed(0x0) vec_busy_valid=0x00000010
(00000004 dda895e4) SCHD: SQP:0x000400 exes_super_scheduler:busy_done
(00000005 dda89760) SCHD: writing QpState SQPSTATE_GOOD_IDLE!!!!
(00000006 dda89868) SCHD: exeqpc_valid2freed(0x0) vec_busy_valid=0x00000010
(00000007 dda97ccf) SCHD: SQP:0x000400 exes_super_scheduler:busy_
(00000008 dda97e47) SCHD: writing QpState SQPSTATE_GOOD_IDLE!!!!
(00000009 dda97f4f) SCHD: exeqpc_valid2freed(0x0) vec_busy_valid=0x00000010
(0000000a dda9a8f6) SCHD: SQP:0x000400 exes_super_scheduler:busy
(0000000b dda9aa6e) SCHD: writing QpState SQPSTATE_GOOD_IDLE!!!!
(0000000c dda9ab79) SCHD: exeqpc_valid2freed(0x0) vec_busy_valid=0x00000010
(0000000d ddaaadcl) SCHD: SQP:0x000400 exes_super_scheduler:busy_
(00000029 ddaee521) INFO: IPCdata[00]=0x01abcd0a
(0000002a ddaee60c) INFO: IPCdata[01]=0x00000014
(0000002b ddaee8ce) MAD: exes_mad: QPN=0x000000, nda_nds=0x7c58d014
(0000002c ddaee9f2) SCHD: SQP:0x000000 sqpc_access_db_algorithm: INC
(0000002d ddaef0d5) SCHD: exes_scheduler: try to insert
(0000002e ddaef2d9) SCHD: SQP:0x000000 exes_scheduler chosen
(0000002f ddaef6aa) SCHD: EXES_GO(0x0)
.
.
.
```

- w, --wait** – Runs itrace in wait mode. itrace will exit only if you press <Ctrl-C>. This is not the default behavior of itrace. Without the -w option, itrace will exit if there have been no new traces in the last 0.5 seconds.
- d, --d=DEVICE** – Specifies the name of the MST device driver for accessing the cr-space. The default value is:/dev/mst/mt23108_pci_cr0.

To run itrace via the I2C interface, use this option to specify the following:

--d=device, where the device is an I2C device (such as mtusb-1)

- nomap** - Sets itrace not to directly access memory (via memory mapping) for reading the trace buffer, but to use the HCA memory access Gateway instead. By default, itrace accesses the memory directly. If the cr-space device specified by the -d parameter is one of the I2C devices, -nomap is switched on.
- no-propel** - Sets itrace not to animate the propeller in wait mode (-w option). By default, animation is enabled.
- v, --version** - Prints the MFT version and exits
- c, --color** - Enables color in trace output
- D, --dump** - Dumps the trace buffer and exits. This option is useful for debugging itrace; it dumps the contents of the trace buffer in row format.

Note: Typing `--help` at the command line displays manual pages describing the syntax of the itrace utility.

C.2 mstdump Utility

The mstdump utility dumps device internal configuration data. The data can be used by for hardware troubleshooting. It can be applied to all Mellanox HCA devices and to the InfiniScale III switch device.

C.2.1 Operation

The MST driver must be started prior to running mstdump tool. **To start mstdump:**

- Start the MST driver (`mst start` or `mst restart`).
- Enter a mstdump command that complies with the following command syntax:

```
mstdump <device file> > <dump file>
```

Example:

```
[root@mymach]# mstdump /dev/mst/mt25408_pci_cr0 > mt25408.dmp
```

This dumps the internal configuration data of the device into the file `mt25408.dmp`.

C.3 isw Utility

The isw utility provides access, via the I2C MST device, to one of the boards/chips on the following switch platforms: MTPDK24 or MTPDK16 (24- or 16-port Reindeer), 96 port MTS9600 (Gazelle), MTPDK144 (144-port Rhino), and MTPDK288 (288-port Trex). This utility is used to connect to a device on a Leaf or Spine board of the switch platform.

C.3.1 Operation

The MST driver must be started prior to running isw tool. **To start isw:**

- Start the MST driver (`mst start` or `mst restart`).
- Run isw with the following command line syntax:

```
isw [OPTIONS]
```

where [OPTIONS] are:

- h- Print this message.
- d DEVICE - I2C access device

- s SYSTEM - Options are trex, rhino, gazelle and reindeer. Needed when system auto-detection fails.
- n - Display the detected system's name
- l [FROM [TO]] - Scan mode. Scan the pointed to I2C bus (if the -p flag is not specified isw will recursively scan the whole system) for all answering I2C slaves in the address range of FROM-TO.
- Default is 0x1-0x7f. In case only the FROM parameter is specified, then the address range is FROM-FROM. The scan report includes all answering I2C slaves in the path to the pointed bus as well.
- p TARGET - Point to the target *InfiniScale III* I2C bus. The TARGET format is [BRD][DEST], where the BRD options are Sm for spine m, and Lm for leaf m; DEST options are in for IS3 bus number n.
- Note: Wildcards may be used, such as S*I*, for all *InfiniScale III* NW busses on all spines or L*I* for all leafs accordingly.
- e - List all the boards that are currently present in the system.

Examples:

```
isw -d /dev/mst/mtusb-1 -p "*" -l 0x6c
- auto detect switch system and list all board GAs which have an answering slave at I2C address 0x6c (InfiniScale III).
```

```
isw -d /dev/mst/mtusb-1 -p S*I* -l 0x6c -n
- auto detect switch system and print its name. List all InfiniScale III GAs which have an answering slave at I2C address 0x6c.
```

On spines only:

```
isw -d /dev/mst/mtusb-1 -s rhino -l -p S3
- list all answering I2C slaves detected on rhino spine 3.
```

```
isw -d /dev/mst/mtusb-1 -s rhino -p S3I2
- point rhino InfiniScale III number 2 on spine 3.
```

```
isw -d /dev/mst/mtusb-1
- run I2C scan of currently pointed to I2C bus.
```

```
isw -d /dev/mst/mtusb-1 -s reindeer -p L1
- point to the reindeer InfiniScale III network bus.
```

C.4 i2c Utility

The i2c utility provides low level access to the I2C bus on any Mellanox switch platform, enabling the user to read or write data.

C.4.1 Operation

The MST driver must be started prior to running i2c tool. **To start i2c:**

- Start the MST driver (mst start or mst restart).

- Run `i2c` with the following command line syntax:

```
i2c [OPTIONS] <device> <cmd> <i2c_addr> <addr> [<data>]
```

where [OPTIONS] can be the following:

- `-h` – Prints this message.
- `-a <addr_width>` – Sets address width (in bytes) to the specified value. May be 0, 1, 2 or 4. Default: 1.
- `-d <data_width>` – Sets data width (in bytes) to the specified value. May be 1, 2 or 4. Default is 1.
- `-x <data_len>` – Presents each byte of data as two hexadecimal digits (such as 013C20343B). Note that this option is mutually exclusive with the "-d" option.

The remaining parameters are:

- `<device>` – Valid MST device.
- `<cmd>` – Command. May be "r[ead]" or "w[rite]".
- `<i2c_addr>` – I2C slave address.
- `<addr>` – Address (of length `addr_width`) inside I2C target device to read/write operation. Note that the `<addr>` value is ignored if `<addr_width>=0`.
- `<data>` – Data (bytes of length `data_width`) to write to target device.

Note: All parameters are interpreted as hexadecimal values.

Examples:

1. Read two bytes from address 0 of target I2C device at address 0x56:

```
> i2c -a 1 -d 2 /dev/mst/mtusb-1 r 0x56 0x00
0000
```

2. Write two bytes to the address above then read them:

```
> i2c -a 1 -d 2 /dev/mst/mtusb-1 w 0x56 0x00 0x1234
> i2c -a 1 -d 2 /dev/mst/mtusb-1 r 0x56 0x00
3412
```

3. Read (as separate) 16 bytes in hexadecimal format starting from address 0 of the target device above:

```
> i2c -a 1 -x 16 /dev/mst/mtusb-1 r 0x56 0x00
12340000000000000000000000000000
```

C.4.2 Exit Return Values

The following exit values are returned:

- 0 - successful completion
- >0 - an error occurred

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