



endace
accelerated

InfiniBand Filter loader Software Guide

EDM04-22



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Introduction

The InfiniBand filter loader enables you to load filter rule sets into the TCAM component of InfiniBand based DAG cards. This enables you to filter, classify and steer packets based on user defined criteria.

The InfiniBand filter loader enables InfiniBand packets to be filtered based on:

- Opcode
- InfiniBand Protocol and Service level
- Source and destination ID
- Source and destination Queue Pair number (SQP,DQP)

The InfiniBand filter loader is included in the latest general Endace release and includes:

- Xilinx images for the InfiniBand based DAG cards with classifier and TCAM enabled.
- `dagfilter_loader` application to text parse and load filters into the card.
- `dagconfig` tool for configuring the card and enables the classifier to filter and for hot swapping.

The InfiniBand based DAG cards enable you to filter packets based on filter rules sets. These filter rule sets can be hot swapped as required.

Each filter rule set defines how packets are colorized or dropped. Packets are captured in either ERF or PCAP format depending on the application used to capture the data.

Conventions Used in this Document

- Command-line examples suitable for entering at command prompts are displayed in `mono-space courier font`.
- Results generated by example command-lines are also displayed in `mono-space courier font`.
- Information relating to functions not implemented in this version of this product are underlined

Requirements

The requirements for using the InfiniBand filter loader are:

- An InfiniBand based DAG card.
- DAG software (3.2.1 or greater).
Customers with a current support contract can download this from the secure Endace website: <https://www.endace.com/support>.
Refer to *EDM04-01 DAG Software Installation Guide* for details on how to install and compile the DAG software.

Data capture

The following applications can capture data from DAG cards:

- DAG API (for example, `dagconvert`, `dagsnap` etc)
- Libpcap (0.9.7 or higher). You can download a copy from the following location: <http://www.tcpdump.org>, or <https://www.Endace.com/resources/tools/>

Configuration overview

The following is an overview of the steps required to configure the InfiniBand based DAG card and TCAM. Further details are given in the following sections.

1. Load the appropriate InfiniBand image into a InfiniBand based DAG card and configure the card.
2. Write the required filter rule sets.
3. Load the filter rule sets into the InfiniBand based DAG card's TCAM.
4. Set which filter rule set (database) to use.
5. Set what happens to packets that miss the filter rule set.

Configuring a DAG card

To load and configure a InfiniBand based DAG card, complete the following steps:

1. Load the DAG card with the appropriate InfiniBand image. For example:

```
dagrom -ryp -f dag84ipci_erf.bit
```

Output:

```
user:      dag84ipci_erf_pci_v2_7 5vlx110tff1738 2008/03/03 16:53:05 (active)
factory:   dag84ipci_erf_pci_v2_12 5vlx110tff1738 2008/06/24 20:03:27
Card Serial: 4567
```

2. Configure DAG card for an initial configuration, using the following command:

```
dagconfig -d0 default slen=2048
```

Example output

```
Card Information:
Firmware: dag84ipci_erf_pci_v2_7 5vlx110tff1738 2008/03/03 16:53:05 (user)
Card Serial: 4567
```

```
GPP0:
varlen slen=2048 align64
Port A: drop_count = 0
```

```
GPP1:
varlen slen=2048 align64
Port B: drop_count = 0
```

```
PCI Burst Manager:
unknown
buffer_size=32 rx_streams=1 tx_streams=0 nodrop nooverlap
```

```
Memory Streams:
mem=32:0
```

The InfiniBand based DAG card is now ready to accept filter rule sets.

InfiniBand filter loader

The InfiniBand filter loader uses two command-line applications to program the filtering and classification capabilities of InfiniBand based DAG cards.

- `dagconfig`
- `dagfilter_loader`

Libpcap or the native DAG API application deals with capturing packets.

Filter rule sets can be manually written in the Endace filter format of InfiniBand protocol. They can also be used for debugging or engineering purposes. The filter rule set can be used in TCAM raw format using a different tool (not covered by this document), which also gives direct access to the TCAM.

dagfilter_loader options

The following table explains the `dagfilter_loader` command line options.

Short Option	Long Option	Explanation
	<code>--db x</code>	Allows you to define which Database (0-7) to use. Each database may hold a filter rule set.
<code>-d</code>	<code>--device</code>	DAG device to use. Default is d0.
<code>-f</code>	<code>--rules</code>	Name of the file containing the filter rule set to load.
<code>-h,</code> <code>-?</code>	<code>--usage,</code> <code>--help</code>	Displays the MAN pages for this application.
<code>-i</code>	<code>--init</code>	Use to initialize the databases in the TCAM. All filter rule sets are cleared. This must to be done after power up or after switching firmware images.
<code>-V</code>	<code>--version</code>	Display the version information.
<code>-v</code>	<code>--verbose</code> <code><level></code>	Sets the verbosity level, from 0 (basic) to 3 (full).

Filter rules

Filter rules are one-line specifications used to describe characteristics of packets considered to be a "match", together with an action to take for matching packets.

The first integer value of the filter rule line is a 16-bit user defined tag that is passed through in the ERF record. This tag is the only compulsory part of the filter rule. Accepted packets are captured to the host. Rejected packets are not captured to the host.

In filter rules, integer numbers can contains the values 0, 1 or x (don't care).

Two actions currently supported are:

Action	Description
Accept a packet.	Accepted packets are passed to the host computer where they can be received using libpcap [2] or the native DAG API and further processed in software.
Reject a packet.	Dropped packets are not sent to the host, saving valuable CPU cycles for analyzing the packets that are of most interest.

Filter rules can be grouped together into filter rule sets. Filter rule sets are loaded into the TCAM in the order they are presented, and the ultimate filter rule should be a catch-all accept or reject filter rule. The InfiniBand filter loader enables InfiniBand packets to be filtered based on:

- Opcode
- InfiniBand Protocol and Service level
- Source and destination ID
- Source and destination Queue Pair number (SQP,DQP)

Syntax

Syntax	Description
\	Next line is part of the same filter rule.
{xxx}	Specifies a bit pattern. x can be replaced with 0,1,x. If replaced with 0 or 1 exact match for that bit (the mask will be set to 1). If x used the mask will be set to 0 (used as a wild card or don't care) for the rule.
//	Comment from the symbol to the end of the line.

Filter rule processing

- Filters are evaluated from the top of the filter rule set to the bottom.
- Missing tokens are assumed to be wildcards.
- The first matching filter is the one selected.
- Associated Ram information behavior if rule matches:
[tag] - an Integer value from 0-65535 . Customer specific.

Filter keywords

The following are valid keywords for inclusion in a rule set. All of these keywords are optional, with the default action taken if the keyword is omitted.

General actions	Description
accept	Sets the filter rule to capture all packets that match the following filter.
Reject	Discards any packets that match the rest of the filter rule. Note: To have a default reject filter in place, you must included one for each interface.
class [stream]	Specifies which stream to steer the packet. For future use. Not implemented at this stage in the card but possible to be used in the rules for compatibility
LRH actions	Description
slid {xxxxxxxxxxxxxxxx}	16 bits. Specifies the classification rule based on Source local identifier
dlid {xxxxxxxxxxxxxxxx}	16 bits. Destination local identifier
sl {XXXX}	4 bits. Service level
LNH {xx}	2 bits Specifies the transport and the following header according to InfiniBand standard. The following codes are supporting to the LNH and intended to be used instead of LNH {xx}. The reason is to give a simplified rules to the customer. <ul style="list-style-type: none"> • IBA_global - is equivalent to LNH {11} • IBA_local - is equivalent to LNH {10} • IP_non_IBA - is equivalent to LNH {01} • RAW_non_IBA - is equivalent to LNH {00}
BTH actions	Description
opcode {xxxxxxx}	8 bits. Specifies the type of packet to match the following rules can be used instead <ul style="list-style-type: none"> • RC - match only RC traffic it is equivalent to opcode {000xxxxx} • UC - match only UC traffic it is equivalent to opcode {001xxxxx} • RD - match only RD traffic it is equivalent to opcode {010xxxxx} • UD - match only UD traffic it is equivalent to opcode {011xxxxx}
DEST-QP {xxxxxxxxxxxxxxxxxxxxxxxx}	24 bits. Specifies destination queue pair . you can use also 'dst-qp'
DETH actions	Description
SRC-QP {xxxxxxxxxxxxxxxxxxxxxxxx}	24 bits specifies source queue pair for packets applicable Note: This rule is traffic dependent and if the traffic do not have DETH header then all 0xFFFFFFFF(11111111111111111111b) will be sent for classification. This behavior is to be specified additionally and can change in the future. In case of usage DETH we recommend specifying the type of traffic as well to make sure that DETH header exists

Notes: Filter rules are evaluated in from the top of the filter rule set to the bottom.
Missing tokens are assumed to be wildcards.
The first matching filter is the one selected.

Keyword defaults

The default values for all valid keywords is shown below.

Keyword	Default
Tag	Tag is the only compulsory part of the rule. It has no default value. Tags need not be unique.
accept/reject	accept
class	"0"
All other keywords	Don't care

Filter rule set example

The following are examples of a filter rule sets:

Example 1

```
1 accept slid {0000 0000 0000 0100}
2 reject dlid {0000 0000 0000 0101}
3 accept IBA-local
4 accept LNH {10}
5 reject LNH {00}
7 accept DEST-QP {0100 00001 0000 1000 0000 0110}
8 accept opcode {0010 0000}
9 reject opcode {0010 0010}
10 accept opcode {0010 0011}
```

Example 2

```
100 accept slid {1110 1110 1110 0000} dlid {---- ---- 0010 0010}
101 accept slid {1110 1110 1110 0001} dlid {---- ---- 0010 0010}
102 accept slid {1110 1110 1110 0010} dlid {---- ---- 0010 0010}
103 accept slid {1110 1110 1110 0011} dlid {---- ---- 0010 0010}
104 accept slid {1110 1110 1110 0100} dlid {---- ---- 0010 0010}
105 accept slid {1110 1110 1110 0101} dlid {---- ---- 0010 0010}
106 accept slid {1110 1110 1110 0110} dlid {---- ---- 0010 0010}
107 accept slid {1110 1110 1110 0111} dlid {---- ---- 0010 0010}
108 accept slid {1110 1110 1110 1000} dlid {---- ---- 0010 0010}
109 accept slid {1110 1110 1110 1001} dlid {---- ---- 0010 0010}
999 reject dest-qp { 1010 1010 1010 1010 1010 1010}
```

Note: The above example may have been wrapped onto several lines for best presentation. In the filter set each rule **must** be on a single line.

dagconfig attributes

The following `dagconfig` attributes are applicable to the InfiniBand DAG cards. Using the `dagconfig -S` and `-G` options you can set and get values of the listed attributes.

Option	Description
<code>sram_miss_value</code>	Use this attribute to set the color of the packets that miss all filter rules.
<code>global_mask_register</code>	Allows you to set which GMR to use.
<code>database_to_use</code>	Allows you to set which filter rule set database (0 - 7) to use.

For more details about `dagconfig`, see your DAG Card User Guide.

Filter Loader operation example

The following are examples of how to load a filter rule set into a TCAM.

- Initializing the filter loader:

```
dagfilter_loader -d0 -i
```

This operation must be done once after power up or after switching firmware images. It initializes the filter rule sets. **Note:** This operation clears all filter rule sets.

- Loading the two filter rule into two databases;

```
dagfilter_loader -d0 --db 0 -f test1.rule
dagfilter_loader -d0 --db 1 -f test2.rule
```

- Switching the active filter rule set:

```
dagconfig -d0 -S database_to_use = 1
```

- Setting the default filter rule in case miss:

The format is specified according to the standard color. **Note:** This can be changed in the future.

```
dagconfig -d0 -S sram_miss_value=xxxx (decimal value)
```

What happens when dagconfig default is run

Whenever the `dagconfig default` command is run, the following actions occur on the InfiniBand based DAG card:

1. The TCAM database is initialized.
 - Eight databases are created (0-7 - one active and the others inactive), each with 16k entries (144 bits).
 - The GMR value is set to `0xFFFFFFFF`
2. The TCAM is flushed, making all entries in the TCAM invalid.
3. Then the following actions occur:
 - The classifier is enabled, allowing access to the TCAM.
 - The classifier is initialized to search from database 0.
 - The value of the `dagconfig` attribute `sram_miss_value` is set to 0. (Pass through all packets. See below for BIT meanings.)
 - the value of the `dagconfig` attribute `global_mask_register` to use the GMR number 0.

(GMR - Global Mask Register)

Bit meanings

TCAM Associated SRAM Data (colour) for InfiniBand used for classification:

Bit	Length	Group	Meaning :
31:20	12	Reserved	Reserved set to 0
19:4	16	User	Tag (user classification(data))
3	1	Reserved	Reserved set to 0
2	1	Steering	Drop Steering Bit. May have Stream Steering bits set too.
1:0	2	Steering	Stream Steering Bits. Binary encoded.

Processing packets

When a packet matches a filter rule, it is deemed to be a **hit** otherwise it is considered a **miss**.

- If a **hit** occurs, the SRAM VALUE (BIT 4 - BIT19) is extracted and put on the packet tag. The packet is then colorized as per the filter rule and passed on for further processing.
- If a **miss** occurs the packet is colorized as per the setting of `sram_miss_value` attribute.
`dagconfig -S sram_miss_value=xxxx` (decimal.)

Hot swapping the filter rule sets

When hot swapping the filter rule sets (`database_to_use`), there is a delay before the new filters rule sets take effect. Changing a filter rule set is made of two parts:

1. Load the filters rule sets to the DAG card. A process which is dependent on the number of filter rule sets loaded. This is automatically completed by the `dagfilter_loader` application.
2. Hot swapping between the filter rule sets is initiated by the user. This process occurs at the beginning of the next packet and is initiated by `dagconfig` by specifying which filter rule set (`database_to_use`) to be swapped to.

Note: Writing to the current (active) filter rule set is permitted. The behavior of the classifier is undetermined for the time the filter rule set is being loaded into the TCAM. This can cause miss classified packets. We recommend always to use another filter rule set and to hot swap to it as soon as the loading is done. The current implementation supports up to 8 filter rule sets.

Version History - 04-22

Version	Date	Reason
1	April 2008	First version. Based on EDM02-02
2	November 2008	Updated document.

