



NVIDIA DOCA Secure Channel

Application Guide

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Chapter 1. Introduction

DOCA Comm Channel is a secure, network independent communication channel between the host and the NVIDIA® BlueField® DPU.

Comm channel allows the host to control services on the DPU, activate certain offloads, or exchange messages using client-server framework. Communication is based on RDMA queue-pairs (QPs). Each packet that is sent by the QPs consists of two parts: Header and data. The header is a 32-bit structure that holds metadata on the msg to allow the use of a handshake protocol, credit incremental over data packets, and error handling.

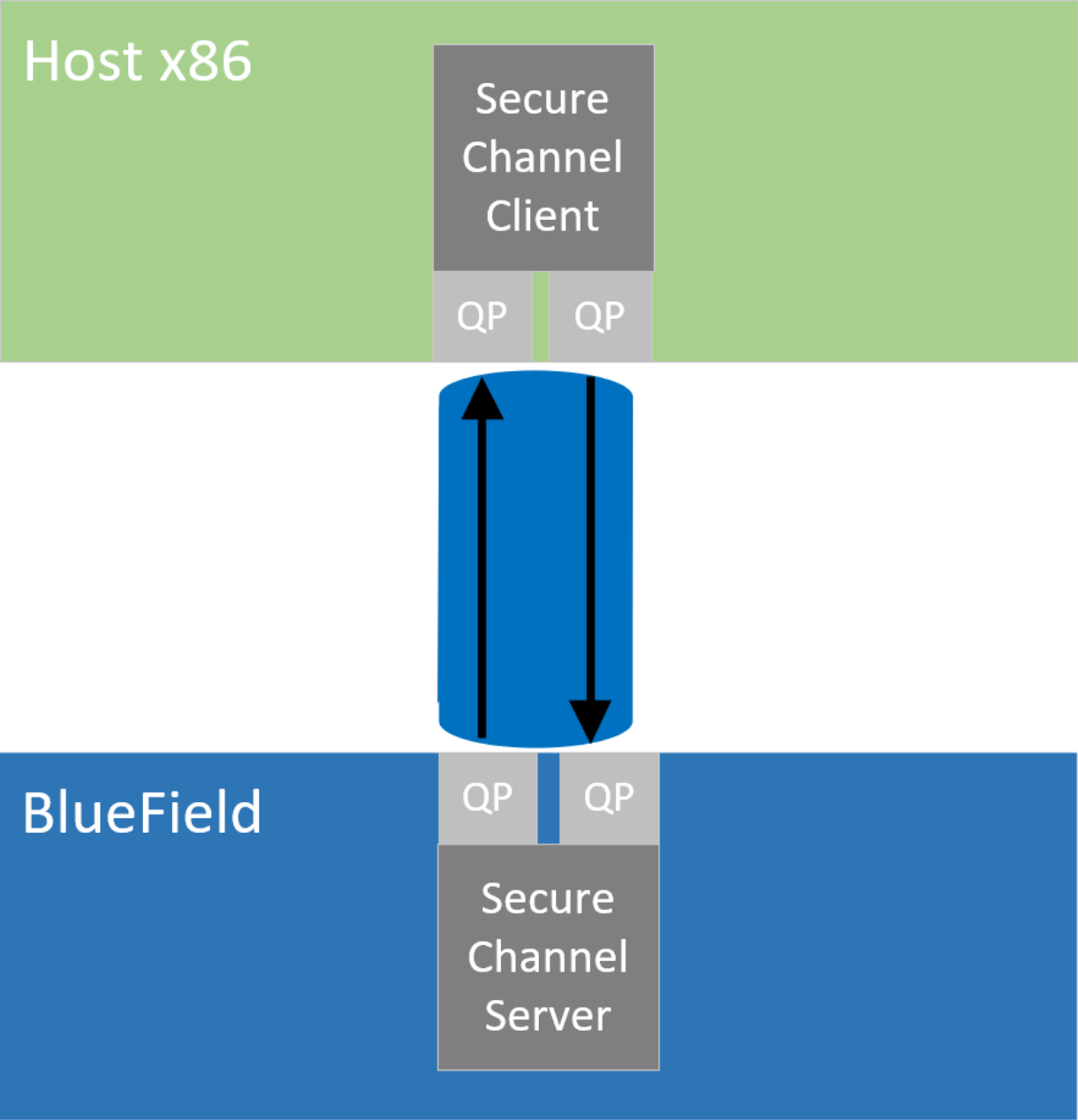
The client (host) side is able to communicate only with one server at a time while the server side is able to communicate with multiple clients.

The API allows communication between any PF/VF/SF on the host to the service on the Arm.

Secure channel allows the user to select the message size and amount to be exchanged between the client and the server to simulate heavy load on the channel.

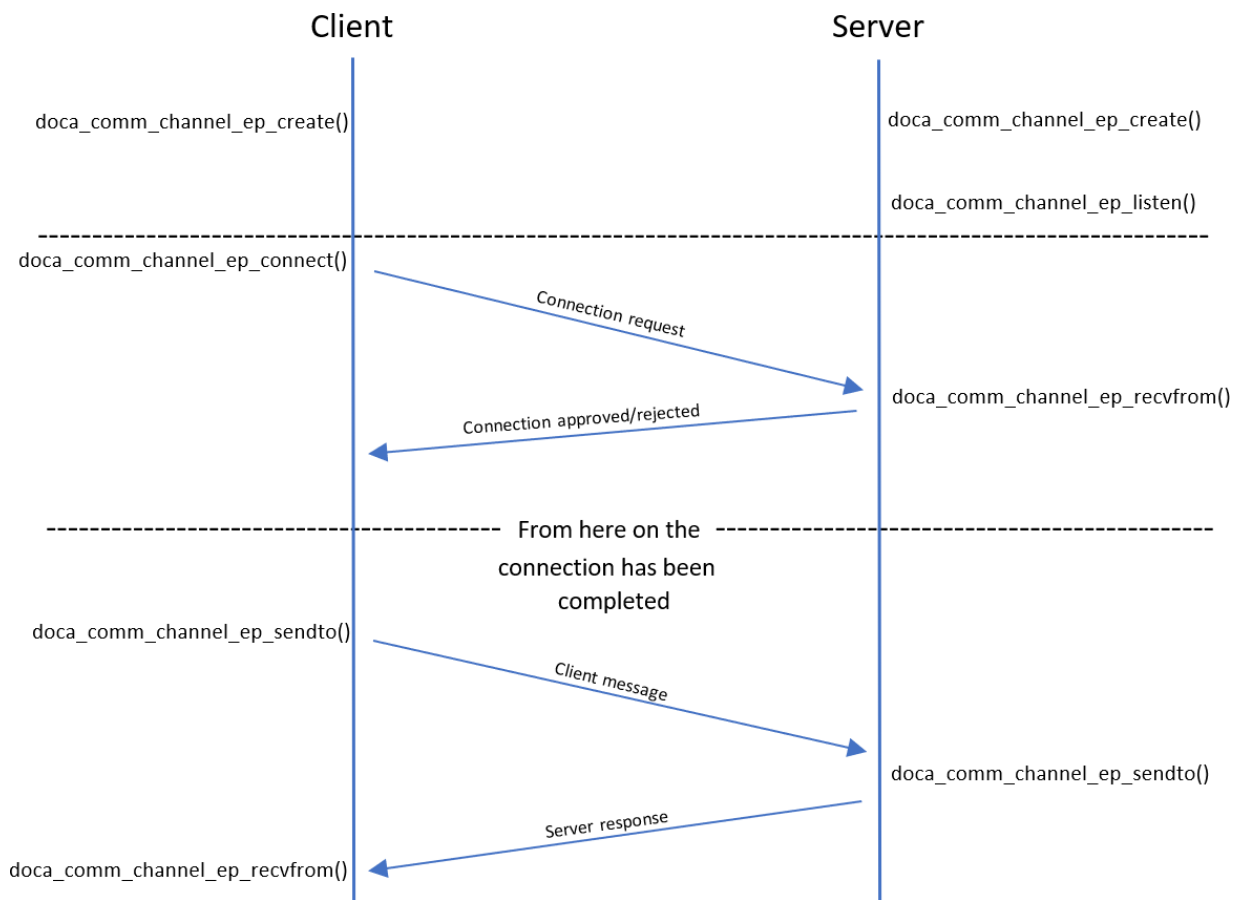
Chapter 2. System Design

A secure channel application runs on client mode (host) and server mode (DPU). Once a channel is open, messages can flow from both sides. Each endpoint holds 2 RDMA QPs, one for send operations and one for receive operations.



Chapter 3. Application Architecture

The secure channel application runs on top of the DOCA Comm Channel API. Full connection flow between the client and the server is illustrated in the following:



1. Both sides initiate `create()`.
2. Server listens and waits for new connections.
3. Server initiates `recvfrom()` to indicate it is ready to exchange messages.
4. Client executes `connect()` to server and starts connection initialization.
5. Client sends first message to server.
6. Server sends a response.

Chapter 4. DOCA Libraries

This application leverages the [DOCA Comm Channel library](#).

Chapter 5. Configuration Flow

1. Parse application argument.

- a). Initialize the arg parser resources and register DOCA general parameters.

```
doxa_argp_init();
```

- b). Register application parameters.

```
register_secure_channel_params();
```

- c). Parse application flags.

```
doxa_argp_start();
```

2. Run main logic.

```
sc_start();
```

- a). Initiate synchronization mechanism between send and receive threads.
- b). Initiate Comm Channel endpoint.
- c). Server side starts listening for new connections and client side connects to server.
- d). Initiate signal masking and epoll instance.
- e). Start send and receive threads. Both threads share the same Comm Channel so each one must "lock" the channel before any send/receive operation.
- f). Send thread prints total number of messages successfully sent.
- g). Once Ctrl+C is entered in the shell, receive thread prints the total number of messages successfully received.
- h). Close and destroy resources.

Chapter 6. Dependencies

BlueField-2 firmware version 24.35.1012 or later.

Chapter 7. Running the Application

1. Refer to the following documents:

- ▶ [NVIDIA DOCA Installation Guide for Linux](#) for details on how to install BlueField-related software.
- ▶ [NVIDIA DOCA Troubleshooting Guide](#) for any issue you may encounter with the installation, compilation, or execution of DOCA applications.
- ▶ [NVIDIA DOCA Applications Overview](#) for additional compilation instructions and development tips for the DOCA applications.

2. The URL filtering example binary is located under `/opt/mellanox/doca/applications/secure_channel/bin/doca_secure_channel`. To build all the applications together, run:

```
cd /opt/mellanox/doca/applications/  
meson build  
ninja -C build
```

3. To build only the secure channel application:

a). Edit the following flags in `/opt/mellanox/doca/applications/meson_options.txt`:

- ▶ Set `enable_all_applications` to `false`
- ▶ Set `enable_secure_channel` to `true`

b). Run the commands in step 2.



Note: `doca_secure_channel` will be created under `./build/secure_channel/src/`.

Application usage:

```
Usage: doca_secure_channel [DOCA Flags] [Program Flags]  
DOCA Flags:  
-h, --help                Print a help synopsis  
-v, --version             Print program version information  
-l, --log-level           Set the log level for the program <CRITICAL=20,  
ERROR=30, WARNING=40, INFO=50, DEBUG=60>  
Program Flags:  
-s, --msg-size            Message size to be sent  
-n, --num-msgs           Number of messages to be sent  
-d, --dev-pci            Comm Channel DOCA device PCI address
```

```
-r, --rep-pci          Comm Channel DOCA device representor PCI address
(needed only on DPU)
```



Note: For additional information on the app, use `-h`:

```
/opt/mellanox/doca/applications/secure_channel/bin/doca_secure_channel -h
```

4. CLI example for running the app on BlueField:

```
/opt/mellanox/doca/applications/secure_channel/bin/doca_secure_channel -s 256 -n
10 -d 03:00.0 -r b1:00.0
```

5. CLI example for running the app on the host:

```
/opt/mellanox/doca/applications/secure_channel/bin/doca_secure_channel -s 1024 -n
100 -d b1:00.0
```



Note: Refer to section "Running DOCA Application on Host" in [NVIDIA DOCA Virtual Functions User Guide](#).

6. To run `doca_secure_channel` using a JSON file:



```
doca_secure_channel --json [json_file]
```




For example:

```
cd /opt/mellanox/doca/applications/secure_channel/bin
./doca_secure_channel --json sc_server_params.json
```

Chapter 8. Arg Parser DOCA Flags

Refer to [NVIDIA DOCA Arg Parser User Guide](#) for more information.

Flag Type	Short Flag	Long Flag/JSON Key	Description	JSON Content
General Flags	l	log-level	Sets the log level for the application: <ul style="list-style-type: none"> ▶ CRITICAL=20 ▶ ERROR=30 ▶ WARNING=40 ▶ INFO=50 ▶ DEBUG=60 	<code>"log-level": 60</code>
	v	version	Print program version information	N/A
	h	help	Print a help synopsis	N/A
Program Flags	s	msg-size	Message size in bytes <div style="border: 1px solid gray; background-color: #f0f0f0; padding: 5px; margin-top: 10px;">  Note: This is a mandatory flag. </div>	<code>"msg-size": 128</code>
	n	num-msgs	Number of messages to send on both sides <div style="border: 1px solid gray; background-color: #f0f0f0; padding: 5px; margin-top: 10px;">  Note: This is a </div>	<code>"num-msgs": 256</code>

Flag Type	Short Flag	Long Flag/JSON Key	Description	JSON Content
			 mandatory flag.	
	d	dev-pci	Comm Channel DOCA device PCIe address  Note: This is a mandatory flag.	<code>"dev-pci": 03:00.1</code>
	r	rep-pci	Comm Channel DOCA device representor PCIe address  Note: This is a mandatory flag.	<code>"rep-pci": b1:00.1</code>

Chapter 9. References

- ▶ `/opt/mellanox/doca/applications/secure_channel/src/secure_channel.c`
- ▶ `/opt/mellanox/doca/applications/secure_channel/src/secure_channel_core.c`
- ▶ `/opt/mellanox/doca/applications/secure_channel/src/secure_channel_core.h`

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