



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.

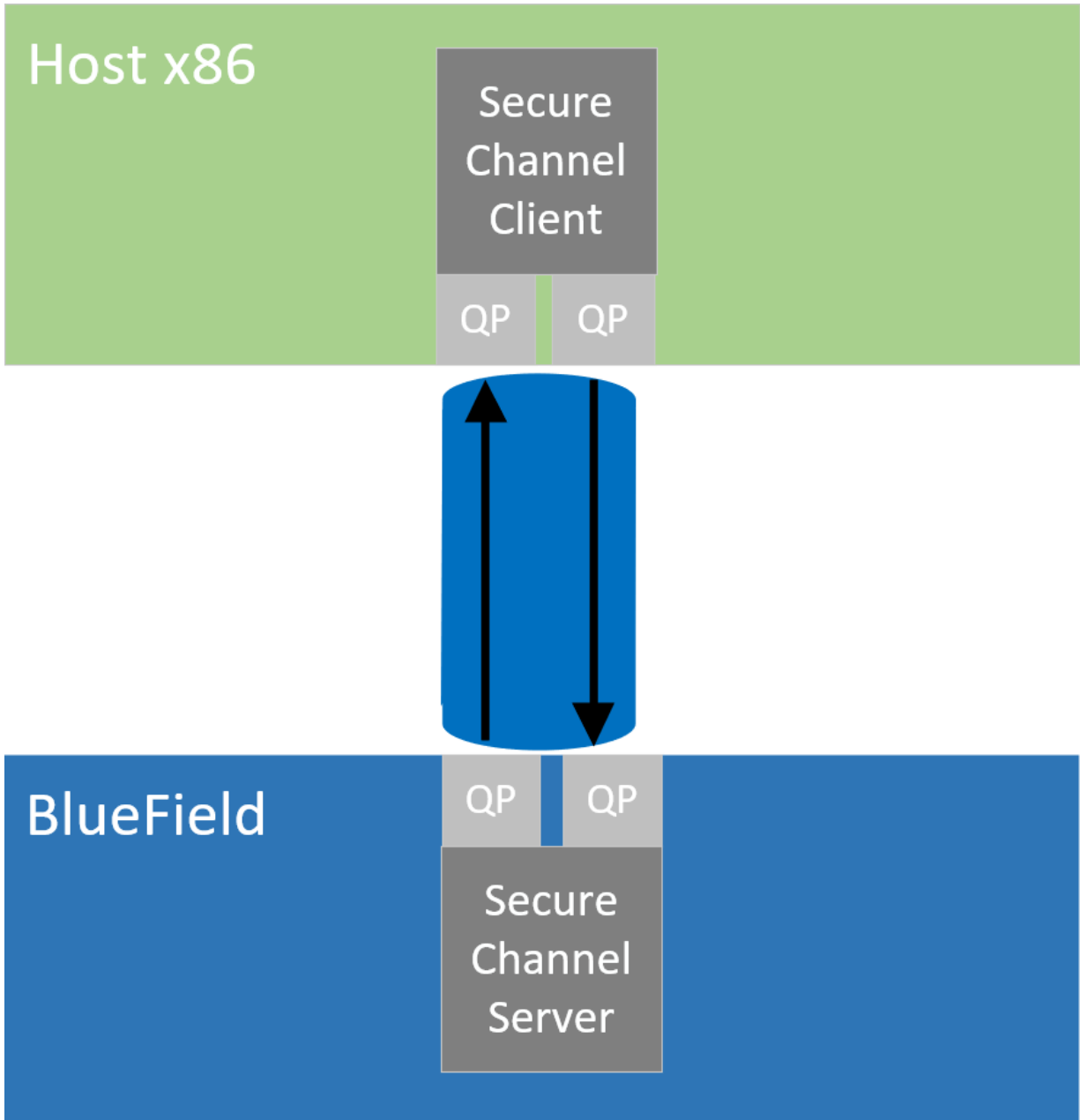
The client (host) side is able to communicate only with one server at a time while the server side is able to communicate with multiple clients.

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

Secure channel on the DPU side implements an "Echo" server. Therefore, all received messages are sent back to the client side.

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. Client executes `connect()` to server and starts connection initialization.
4. Server initiates `rcvfrom()` to indicate it is ready to exchange messages.
5. Client sends first message to server.
6. Server sends the same message it received as a response.

Chapter 4. DOCA Libraries

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

Chapter 5. Configuration Flow

1. Parse application argument.

```
doca_argp_init();
```

- a). Initialize the arg parser resources.
- b). Register DOCA general flags.

```
register_secure_channel_params();
```
- c). Register secure channel application flags.

```
doca_argp_start();
```
- d). Parse application flags.

2. Set queue-pair attributes.

```
configure_ep_qp_attributes();
```

- a). Set maximum message size of 1KB.
- b). Set maximum messages allowed on queue-pair.
- c). Set flag attribute to synchronize mode (block until complete).

3. Create secure channel endpoint.

```
create_secure_channel_ep();
```

- a). Create secure channel endpoint for client/server.

4. Run client/server main logic.

```
secure_channel_client/server();
```

- ▶ For the server side:

- a). Start listening for new connections.
- b). After connection is established, wait until a new message arrives.
- c). Print message received.
- d). Send the same message to client.

- ▶ For the client side:

- a). Connect to server.
- b). Send the message according to the set number of messages (-n flag).
- c). Block until a response from server is received.
- d). Print response.

5. Disconnect from server.

```
doca_comm_channel_ep_disconnect();
```

- a). Disconnect from current session with server.

6. Destroy current endpoint.

```
doca_comm_channel_ep_destroy();
```

- a). Free all end-point resources

Chapter 6. Dependencies

- ▶ DPU firmware version 24.33.0458 or later

Chapter 7. Running Application

1. Refer to the following documents:

- ▶ [NVIDIA DOCA Installation Guide](#) 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.

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 the secure channel application only:

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

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

b). Run the commands in step 2.



Note: `doca_secure_channel` is created under `./build/secure_channel/src/`.

Application usage:

```
Usage: doca_secure_channel [DOCA Flags] [Program Flags]
```

DOCA Flags:

<code>-h, --help</code>	Print a help synopsis
<code>-v, --version</code>	Print program version information
<code>-l, --log-level</code>	Set the log level for the program <CRITICAL=0, DEBUG=4>

Program Flags:

<code>-em, --ep-mode</code>	Set end-point mode {server, client}
<code>-m, --message</code>	Message to send by the client
<code>-n, --num-msgs</code>	Number of messages to send by the client



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 --ep-mode server
```

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

```
/opt/mellanox/doca/applications/secure_channel/bin/doca_secure_channel -em client  
-m runningFromHost -n 1
```



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=0 ▶ ERROR=1 ▶ WARNING=2 ▶ INFO=3 ▶ DEBUG=4 	<code>"log-level": 4</code>
	v	version	Print program version information	N/A
	h	help	Print a help synopsis	N/A
Program Flags	em	ep-mode	Set end-point mode (server or client) <div style="border: 1px solid gray; background-color: #f0f0f0; padding: 5px; margin-top: 10px;">  Note: ep-mode is a mandatory flag. </div>	<code>"ep-mode": "server"</code>
	m	message	Message for client to send to server side. Mandatory flag on client mode.	<code>"message": "Hello from client"</code>
	n	num-msgs	Number of messages to send on client mode. Mandatory flag on client mode.	<code>"num-msgs": 1</code>

Chapter 9. References

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

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