NVIDIA DOCA File Integrity

Application Guide

MLNX-15-060554 _v2.0.2 | May 2023

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Chapter 1. Introduction

The file integrity application exhibits how to use the DOCA Comm Channel and DOCA SHA libraries to send and receive a file securely.

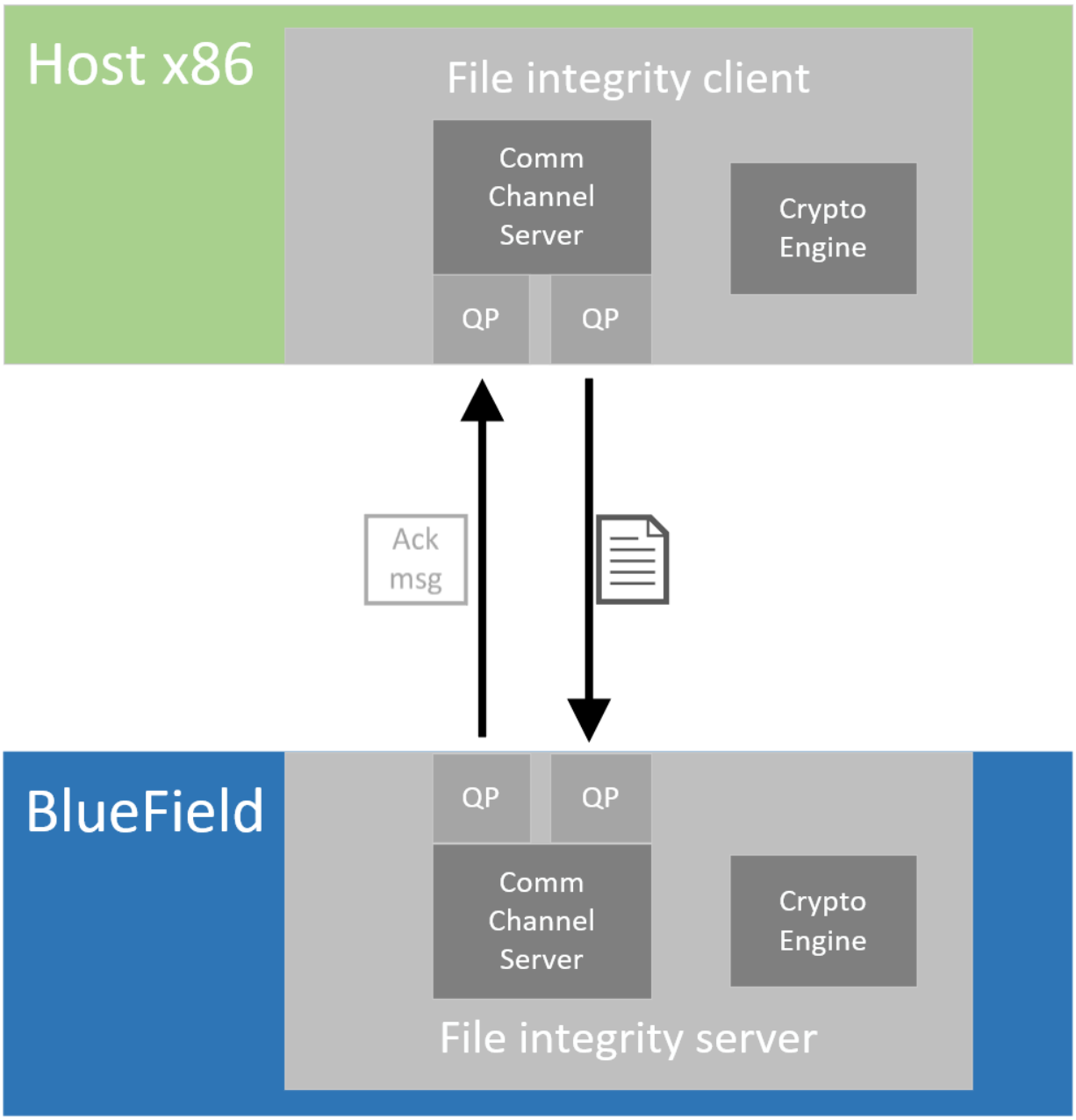
The application's logic includes both a client and a server:

- Client side – the application opens a file, calculates the SHA (secure hash algorithm) digest on it, and sends to the server the digest of the source file alongside the file itself
- Server side – the application calculates the SHA on the received file and compares the received digest to the calculated one to check if the file has been compromised

Note: SHA hardware acceleration is only available on the BlueField-2 DPU. The application is not supported on BlueField-3.

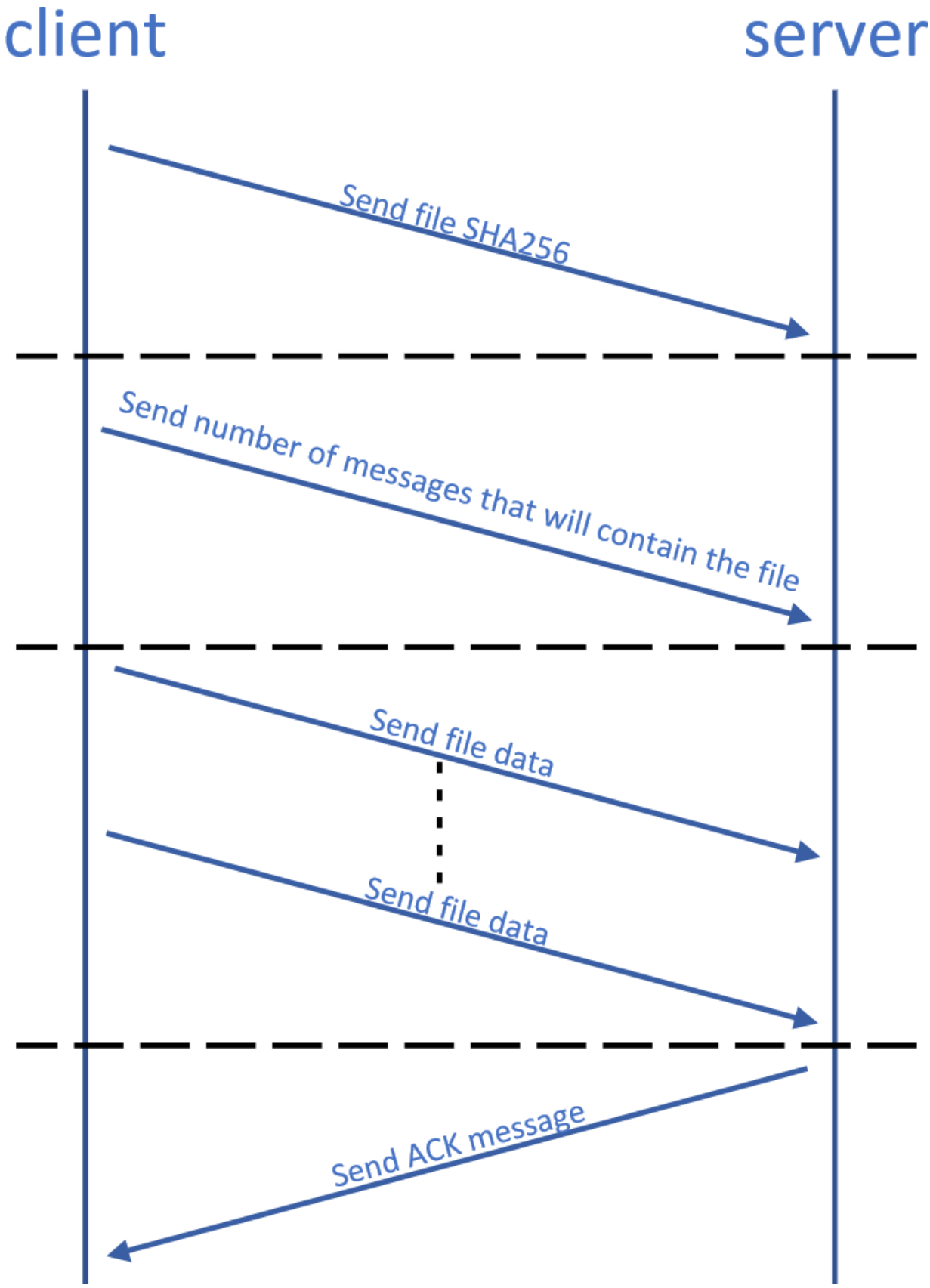
Chapter 2. System Design

The file integrity application runs in both client mode (host) and server mode (DPU).


Host x86
File integrity client
Comm Channel Server
Crypto Engine
QP
QP
Ack msg
BlueField
QP
QP
Comm Channel Server
Crypto Engine
File integrity server

Chapter 3. Application Architecture

The file integrity application runs on top of the DOCA Comm Channel API to send and receive files from the host and DPU.


client
server
Send file SHA256
Send number of messages that will contain the file
Send file data
Send file data
Send ACK message

1. Connection is established on both sides by the Comm Channel API.
2. Client submits SHA job with the DOCA SHA Library and sends the result to the server.
3. Client sends the number of messages needed to send the content of the file.
4. Client sends data segments in size of up to 4032 bytes.
5. Server submits a partial SHA job on each received segment.
6. Server sends an ACK message to the client when all parts of the file are received successfully.
7. Server compares the received SHA to the calculated SHA.

Chapter 4. DOCA Libraries

This application leverages the following DOCA libraries:

- DOCA SHA Library
- DOCA Comm Channel Library

Chapter 5. Configuration Flow

1. Parse application argument.
   a). Initialize arg parser resources and register DOCA general parameters.
   ```
   doca_argp_init();
   ```
   b). Register file integrity application parameters.
   ```
   register_file_integrity_params();
   ```
   c). Parse the arguments.
   ```
   doca_argp_start();
   ```
      i. Parse app flags.
2. Set queue-pair attributes.
   ```
   set_endpoint_properties();
   ```
   a). Set maximum message size of 4032 bytes.
   b). Set maximum messages allowed on queue pair.
3. Create Comm Channel endpoint.
   ```
   doca_comm_channel_ep_create();
   ```
   a). Create endpoint for client/server.
4. Create SHA context.
   ```
   doca_sha_create();
   ```
   a). Create SHA context for submitting SHA jobs for client/server.
5. Run client/server main logic.
   ```
   file_integrity_client/server();
   ```
6. Clean up the application.
   ```
   file_integrity_cleanup();
   ```
   a). Free all application resources.

Chapter 6. Running 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 regarding the DOCA applications.
2. The file compression binary is located under `/opt/mellanox/doca/applications/file_integrity/bin/doca_file_integrity`. To build all the applications together, run:

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

3. To build only the file integrity application:
   a). Edit the following flags in `/opt/mellanox/doca/applications/meson_options.txt`:
      - Set `enable_all_applications` to `false`
      - Set `enable_file_integrity` to `true`
   b). Run the commands in step 2.

> Note: `doca_file_integrity` is created under `./build/file_integrity/src/`.

Application usage:

```
Usage: doca_file_integrity [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:
  -p, --pci-addr                    DOCA Comm Channel device PCI address
  -r, --rep-pci                     DOCA Comm Channel device representor PCI
 address
  -f, --file                        File to send by the client / File to write by
 the server
```

```
 -t, --timeout                       Application timeout for receiving file
content messages, default is 5 sec
```

> Note: For additional information on the application, use `-h` option:
> `/opt/mellanox/doca/applications/file_integrity/bin/doca_file_integrity -h`

4. CLI example for running the application on BlueField:

```
/opt/mellanox/doca/applications/file_integrity/bin/doca_file_integrity -p 03:00.0
 -r b1:00.0 -f recieved_data.txt
```

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

```
/opt/mellanox/doca/applications/file_integrity/bin/doca_file_integrity -p b1:00.0
 -f file_data.txt
```

> Note: Refer to section "Running DOCA Application on Host" in NVIDIA DOCA Virtual Functions User Guide.

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

```
doca_file_integrity --json [json_file]
```

   For example:

```
cd /opt/mellanox/doca/applications/file_integrity/bin
./doca_file_integrity --json file_integrity_params.json
```

Chapter 7. Arg Parser DOCA Flags

For more information, refer to NVIDIA DOCA Arg Parser Programming Guide.

Flag Type	Short Flag	Long Flag/ JSON Key	Description	JSON Content
General Flags	`l`	`log-level`	Set the log level for the application: ▶ CRITICAL=20 ▶ ERROR=30 ▶ WARNING=40 ▶ INFO=50 ▶ DEBUG=60	`"log-level": 60`
	`v`	`version`	Print program version information	N/A
	`h`	`help`	Print a help synopsis	N/A
Program Flags	`f`	`file`	For client – path to the file to be sent For server – path to write the file into Note: This is	`"file": "/tmp/data.txt"`

Flag Type	Short Flag	Long Flag/ JSON Key	Description	JSON Content
			mandatory flag.	
	p	pci-addr	DOCA Comm Channel device PCIe address Note: This is mandatory flag.	"pci-addr": 03:00.1
	r	rep-pci	DOCA Comm Channel device representor PCIe address Note: This flag is mandatory only on the DPU.	"rep-pci": b1:00.1

Chapter 8. References

- `/opt/mellanox/doca/applications/file_integrity/src`

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