NVIDIA DOCA File Scan

Reference Application Guide

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Chapter 1. Introduction

BlueField DPU supports high-speed hardware RegEx acceleration using the RegEx engine. This allows accelerating different security and networking applications which require RegEx processing.

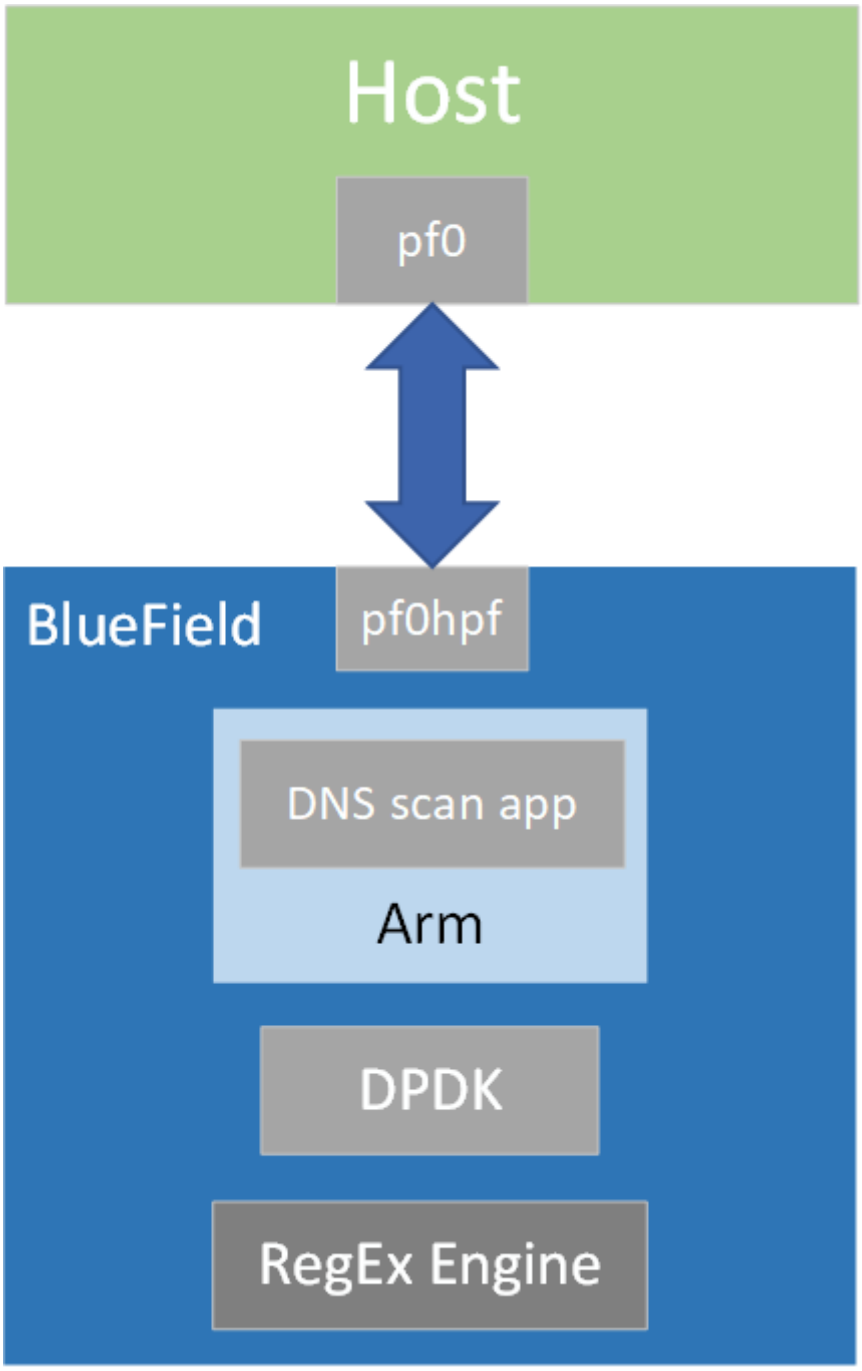
The file scan application uses the hardware RegEx engine to scan a file and returns whether there is a match or not. This application can be a base for many security verifications for sensitive data and personal information.

File scan logic includes:

- Compiling RegEx rules using Regex compiler
- Loading a compiled set of RegEx rules to the BlueField RegEx engine
- Sending file to the RegEx for scanning
- HW scanning file and returning a list of matches (e.g., matching rule, offset, length)

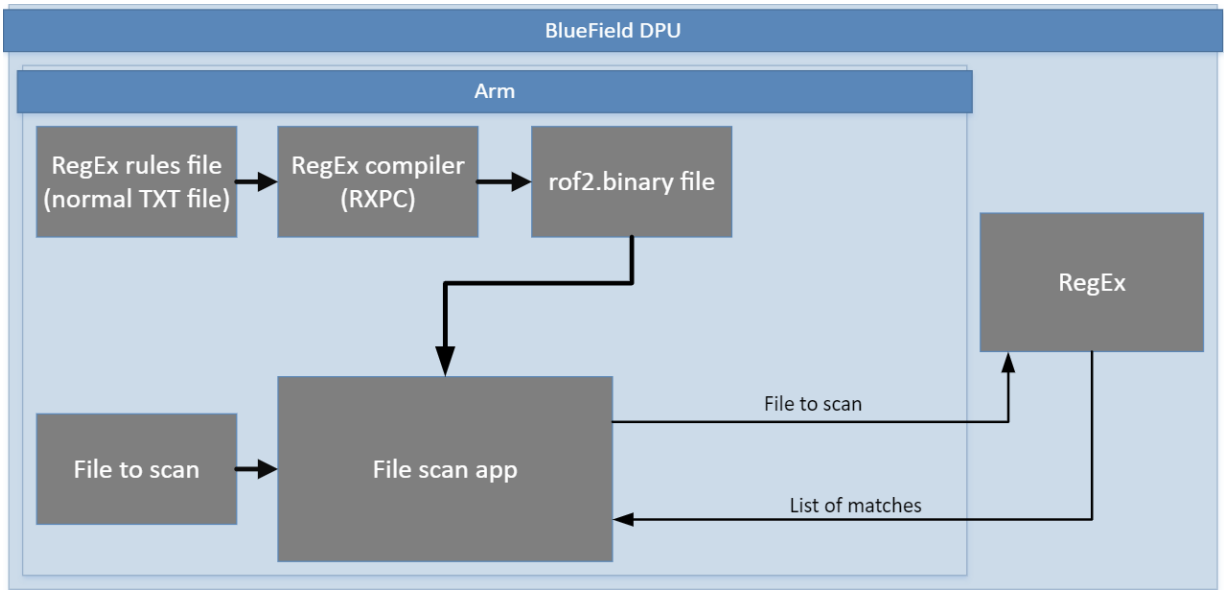
Chapter 2. System Design

File scan utilizes the RegEx engine which is HW accelerator on the BlueField.


Host
pf0
BlueField
pf0hpf
DNS scan app
Arm
DPDK
RegEx Engine

Chapter 3. Application Architecture

The file scan application runs on top of DPDK RegEx API to configure, send, and receive scans to and from the BlueField RegEx engine.



1. RegEx rules file is compiled into a rof2.binary file by the user.
2. The RegEx binary rules file is loaded into the RegEx engine.
3. The file to scan is sent to the RegEx triggering the engine to start matching

> **Note:** The current file scan version supports files up to 16KB in size.

4. The results are sent back to the application.

> **Note:** It is the application's responsibility to check for finished jobs. In this example, you Busy-Wait until the RegEx finishes scanning.

5. The matches are printed on the screen.

Chapter 4. Configuration Flow

1. Parse application argument.
   ```
   arg_parser_init();
   ```
   a). Initialize Arg Parser resources.
   b). Register DOCA general flags.
   ```
   register_file_scan_params();
   ```
   c). Register file scan application flags.
   ```
   arg_parser_start();
   ```
   d). Parsing DPDK flags and calling `rte_eal_init()` function.
   e). Parsing APP flags.
2. Initialize file scan resources.
   ```
   file_scan_init();
   ```
   a). Allocate buffer for the rules and data file.
3. Configure RegEx device.
   ```
   configure_regexdev();
   ```
   a). Configure RegEx engine with the predefined rules file.
   b). Configure RegEx queues.
4. Allocate mbuf pool.
   ```
   allocate_mbuf_pool();
   ```
   a). Allocate mbuf memory pool to hold the file buffer.
5. Load the file into the mbuf pool before enqueuing RegEx scan task.
   ```
   allocate_file_to_mempool();
   ```
6. Enqueue RegEx scan task.
   ```
   regex_enqueue_task();
   ```
   a). Send the file to the RegEx for scanning.
7. Dequeue RegEx scan task.
   ```
   rte_regexdev_dequeue_task();
   ```
   a). Busy-Wait until the file has been scanned.
8. Report results.
   ```
   report_results();
   ```
   a). Print the scan results to the standard output.
9. Destroy the file scan app.
   ```
   file_scan_destroy();
   ```

a). Free allocated buffers.
b). Free memory pool.

Chapter 5. Running Application on BlueField

1. Refer to the DOCA Installation Guide for details on how to install#BlueField#related software.
2. The application binary is located under `/opt/mellanox/doca/examples/file_scan/bin/doca_file_scan`.
3. To rebuild the application:

   a). Run:
   ```
   cd /opt/mellanox/doca/examples/file_scan/src
   meson /tmp/build
   ninja -C /tmp/build
   ```
   `doca_file_scan` is created under `/tmp/build`.

   b). The build process depends on the `PKG_CONFIG_PATH` environment variable to locate the DPDK libraries. If the variable has been accidently corrupted, and the build fails, run the following:

   - For Ubuntu:
     ```
     export PKG_CONFIG_PATH=$PKG_CONFIG_PATH:/opt/mellanox/dpdk/lib/aarch64-linux-gnu/pkgconfig
     ```
   - For CentOS:
     ```
     export PKG_CONFIG_PATH=$PKG_CONFIG_PATH:/opt/mellanox/dpdk/lib64/pkgconfig
     ```
4. In order to run the application, the RegEx compiled rule files must be supplied to the app. These files usually end with `*.rof2.binary`. To compile the example rules file, run:
   ```
   cd /opt/mellanox/doca/examples/file_scan/bin/
   rxpc -f regex_rules.txt -p 0.01 -o /tmp/regex_rules
   ```
   The results of the `rxpc` are written to `/tmp/` directory, each file with the prefix `regex_rules`.

   Note: For more information, refer to NVIDIA RXP Compiler.
5. Pre-run setup.

   a). The file scan example is based on DPDK libraries. Therefore, the user is required to provide DPDK flags, and allocate huge pages. Run:
   ```
   echo 2048 > /sys/kernel/mm/hugepages/hugepages-2048kB/nr_hugepages
   ```
   b). Make sure the regex engine is active:
   ```
   systemctl status mlx-regex
   ```

If the status is inactive (`Active: failed`), run:

```
systemctl start mlx-regex
```

6. To run the application:

```
Usage: doca_file_scan [DPDK Flags] -- [DOCA Flags] [Program Flags]

DOCA Flags:
  -h, --help                Print a help synopsis
  -l, --log-level           Set the log level for the app <CRITICAL=0, DEBUG=4>

Program Flags:
  -r, --rules <path>        Path to precompiled rules file (rof2.binary)
  -d, --data <path>         Path to data file
```

Note: The RegEx accelerator explicitly requires to be initialized on p0.

For example, assuming PCIe address of the DPU is 03:00:

```
cd /opt/mellanox/doca/examples/file_scan/bin/
./doca_file_scan -a 03:00.0,class=regex -- --rules /tmp/regex_rules.rof2.binary
 --data data_to_scan.txt
```

Using a JSON file:

```
doca_file_scan --json [json_file]
```

For example:

```
/opt/mellanox/doca/examples/file_scan/bin/doca_file_scan --json /root/
file_scan_params.json
```

For additional information on available flags for DPDK, use `-h` before the `--` separator:

```
/opt/mellanox/doca/examples/file_scan/bin/doca_file_scan -h
```

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

```
/opt/mellanox/doca/examples/file_scan/bin/doca_file_scan -- -h
```

The file scan app prints the results to the standard output.

Chapter 6. Arg Parser DOCA Flags

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

Flag Type	Short Flag	Long Flag/JSON Key	Description	JSON Content
DPDK Flags	a	devices	Add a PCIe device into the list of devices to probe.	`"devices": [ {"device": "regex", "id": "03: 00.0"} ]`
General Flags	l	log-level	Sets the log level for the application: ▶ CRITICAL=0 ▶ ERROR=1 ▶ WARNING=2 ▶ INFO=3 ▶ DEBUG=4	`"log-level": 4`
	h	help	Print a help synopsis	N/A
Program Flags	r	rules	Path to precompiled rules file (rof2.binary)	`"rules": "/tmp/ regex_rules.rof2.binary"`
	d	data	Path to data file	`"data": "/tmp/ data_to_scan.txt"`

Chapter 7. Running Application on Host

Host execution examples:

```
cd /opt/mellanox/doca/examples/file_scan/bin/
./doca_file_scan -a 21:00.0,class=regex -- --rules /tmp/regex_rules.rof2.binary --
data data_to_scan.txt
```

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

Chapter 8. References

- /opt/mellanox/doca/examples/file_scan/src/file_scan.c
- /opt/mellanox/doca/examples/file_scan/src/regex_rules.txt
- /opt/mellanox/doca/examples/file_scan/src/data_to_scan.txt

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