



# NVIDIA DOCA Flow

## Sample Guide

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# Chapter 1. Introduction

DOCA Flow is the most fundamental API for building generic execution pipes in HW.

The library provides an API for building a set of pipes, where each pipe consists of match criteria, monitoring, and a set of actions. Pipes can be chained so that after a pipe-defined action is executed, the packet may proceed to another pipe.

For more information about DOCA Flow library, refer to [NVIDIA DOCA Flow Programming Guide](#).

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## Chapter 2. Dependencies

N/A

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## Chapter 3. Prerequisites

The DOCA Flow samples are based on DPDK libraries. Therefore, the user is required to provide DPDK flags, and allocate huge pages.

```
sudo echo 2048 > /sys/kernel/mm/hugepages/hugepages-2048kB/nr_hugepages
```

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# Chapter 4. Samples

## 4.1. Flow Aging

This sample illustrates the use of DOCA Flow's aging functionality. It demonstrates how to build a pipe and add different entries with different aging times and user data.

The sample logic includes:

1. Initializing DOCA Flow with `aging=true` in the `doca_flow_cfg` struct.
2. Starting two DOCA Flow port.
3. On each port:
  - a). Building a pipe with changeable 5-tuple match and forward port action.
  - b). Adding 10 entries with different 5-tuple match, a monitor with different aging time (5-60 seconds), and setting user data in the monitor. The user data will contain the port ID, entry number, and entry pointer.
4. Handling aging every 5 seconds and removing each entry after age-out.
5. Running these commands until all entries age out.

Reference:

► `/opt/mellanox/doca/samples/doca_flow/flow_aging/flow_aging.c`

## 4.2. Flow Control Pipe

This sample shows how to use the DOCA Flow control pipe and decap action.

The sample logic includes:

1. Initializing DOCA Flow.
2. Starting two DOCA Flow ports.
3. On each port:
  - a). Building VXLAN pipe with match on VNI field, decap action, and forwarding the matched packets to the second port.
  - b). Building GRE pipe with match on GRE key field, decap and build `eth` header actions, and forwarding the matched packets to the second port.

c). Building a control pipe with the following entries:

- ▶ If L4 type is UDP and destination port is 4789, forward to VXLAN pipe
- ▶ If tunnel type and L4 type is GRE, forward to GRE pipe

Reference:

- ▶ `/opt/mellanox/doca/samples/doca_flow/flow_control_pipe/flow_control_pipe.c`

## 4.3. Flow Copy to Meta

This sample shows how to use the DOCA Flow copy-to-metadata action to copy the source MAC address and then match on it.

The sample logic includes:

1. Initializing DOCA Flow.
2. Starting two DOCA Flow ports.
3. On each port:
  - a). Building a pipe with changeable match on `meta_data` and forwarding the matched packets to the second port.
  - b). Adding an entry that matches an example source MAC that has been copied to metadata.
  - c). Building a pipe with changeable 5-tuple match, copying source MAC action, and fwd to the first pipe.
  - d). Adding example 5-tuple entry to the pipe.

Reference:

- ▶ `/opt/mellanox/doca/samples/doca_flow/flow_copy_to_meta/flow_copy_to_meta.c`

## 4.4. Flow Drop

This sample illustrates how to build a pipe with 5-tuple match, forward action drop, and forward miss action to hairpin pipe. The sample also demonstrates how to dump pipe information to a file and query entry.

The sample logic includes:

1. Initializing DOCA Flow.
2. Starting two DOCA Flow ports.
3. On each port:
  - a). Building a hairpin pipe with an entry that matches all traffic and forwarding traffic to the second port.

- b). Building a pipe with a changeable 5-tuple match, forwarding action drop and miss forward to the hairpin pipe. This pipe serves as a root pipe.
  - c). Adding example 5-tuple entry to the drop pipe with counter as monitor for query the entry later.
4. Waiting 5 seconds and querying the drop entry (total bytes and total packets).
  5. Dumping the pipe information to a file.

Reference:

- ▶ `/opt/mellanox/doca/samples/doca_flow/flow_drop/flow_drop.c`

## 4.5. Flow gRPC Counter

This sample shows how to use DOCA Flow gRPC library to create a pipe and entry with a counter and to query the entry stats.

The sample logic includes:

1. Creating gRPC environment.
2. Initializing DOCA Flow.
3. Starting two DOCA flow ports.
4. On each port:
  - a). Building a pipe with changeable 5-tuple match.
  - b). Adding example 5-tuple and monitoring with counter flag.
  - c). Waiting 5 seconds and querying the entries (total bytes and total packets).

References:

- ▶ `/opt/mellanox/doca/samples/doca_flow/flow_grpc_counter/flow_grpc_counter.c`

## 4.6. Flow Hairpin

This sample illustrates how to build a pipe with 5-tuple match and to forward packets to the other port.

The sample logic includes:

1. Initializing DOCA Flow.
2. Starting two DOCA Flow ports.
3. On each port:
  - a). Building a pipe with changeable 5-tuple match and forwarding port action.
  - b). Adding example 5-tuple entry to the pipe.

Reference:

- ▶ `/opt/mellanox/doca/samples/doca_flow/flow_hairpin/flow_hairpin.c`



## 4.7. Flow Modify Header

This sample illustrates how to use DOCA Flow actions to decrease TTL by 1 and modify the destination MAC address.

The sample logic includes:

1. Initializing DOCA Flow.
2. Starting two DOCA Flow ports.
3. On each port:
  - a). Building a pipe with action `dec_ttl=true` and changeable `mod_dst_mac`. The pipe matches IPv4 traffic with a changeable destination IP and forwards the matched packets to the second port.
  - b). Adding an entry with an example destination IP and `mod_dst_mac` value.

Reference:

- ▶ `/opt/mellanox/doca/samples/doca_flow/flow_modify_header/flow_modify_header.c`

## 4.8. Flow Monitor Meter

This sample illustrates how to use DOCA Flow monitor meter.

The sample logic includes:

1. Initializing DOCA Flow.
2. Starting two DOCA Flow ports.
3. On each port:
  - a). Building a pipe with monitor meter flag and changeable 5-tuple match. The pipe forwards the matched packets to the second port.
  - b). Adding an entry with an example CIR and CBS values.

Reference:

- ▶ `/opt/mellanox/doca/samples/doca_flow/flow_monitor_meter/flow_monitor_meter.c`

## 4.9. Flow Set Meta

This sample shows how to use the DOCA Flow set metadata action and then match on it.

The sample logic includes:

1. Initializing DOCA Flow.
2. Starting two DOCA Flow ports.

3. On each port:
  - a). Building a pipe with a changeable match on metadata and forwarding the matched packets to the second port.
  - b). Adding an entry that matches an example metadata value.
  - c). Building a pipe with changeable 5-tuple match, changeable metadata action, and fwd to the first pipe.
  - d). Adding entry with an example 5-tuple and metadata value to the pipe.

Reference:

- ▶ `/opt/mellanox/doca/samples/doca_flow/flow_set_meta/flow_set_meta.c`

## 4.10. Flow VXLAN Encap

This sample shows how to use DOCA Flow actions to create a VXLAN tunnel.

The sample logic includes:

1. Initializing DOCA Flow.
2. Starting two DOCA Flow ports.
3. On each port:
  - a). Building a pipe with changeable 5-tuple match, encap action, and forward port action.
  - b). Adding example 5-tuple and encapsulation values entry to the pipe.

Reference:

- ▶ `/opt/mellanox/doca/samples/doca_flow/flow_vxlan_encap/flow_vxlan_encap.c`

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