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Chapter 1. Introduction

L4 Open vSwitch (OVS) firewall is used to perform basic Access Deny List (ACLs) operations. It allows to identify different flows based on L3/L4 headers and execute different actions.

One of the ways to implement OVS L4 firewall is to use the connection tracking module as part of OVS. Connection tracking refers to keeping a record of all currently open connections (stateful inspection).

OVS is an open-source implementation of a virtual switch software layer which resides in a server and supports different switching capabilities. For more information on OVS, please refer to the official documentation for Open vSwitch.
Packet flow steps:
1. Packet is received from physical port on the DPU. If the packet has no match in the eswitch flow table, it is sent to the Arm’s pf0.
2. According to OVS, the packet is directed to its destination. If OVS has no rule for where to send the packet, it is sent to pf0hpf (host representor).
3. pf0hpf is associated with pf0 on the host. The packet is sent from pf0hpf on the Arm to pf0 on the host.
4. The host processes the packet and responds with a packet to the Arm. OVS learns the packet and adds a rule into OVS table. Now ASAP2 adds the same rule to the e-switch.
5. When the next packet from the same flow is sent to the DPU through the physical port, it hits the e-switch flow table and is then passed to its destination.
Chapter 3. Application Architecture

The following diagram illustrates a packet’s flow in different OVS tables.

- Drop all flows with lowest priority
- Allow ARP traffic
- IP traffic is sent to connection tracking module and table1

- Tracked IP traffic from port1 is sent to port2
- Tracked IP traffic from port2 is sent to port1
- All tracked IP traffic is allowed
- Add ACL entry to drop traffic from port1 only
Chapter 4. Configuration Flow

1. Add table0 entry with priority 1 and action drop.
   The lowest priority entry to drop all flows if no other match
2. Add table0 entry with priority 10 for ARP traffic with action normal (=forward).
   All ARP traffic will be forwarded.
3. Add table0 entry with priority 100 for IP traffic with action ct (=connection tracking)
   and forward to OVS table1.
   All IP traffic will be set for connection tracking and sent to OVS table1.
4. Add table1 entry for IP and tracked traffic from port1 with action port2.
   All tracked IP traffic from port1 will be sent to port2.
5. Add table1 entry for IP and tracked traffic from port2 with action port1.
   All tracked IP traffic from port2 will be sent to table1.
   At this point, all IP traffic is tracked by OVS connection tracking module.
6. Add access deny list (ACL) entry to table1 to drop all tracked IP traffic from port1.
   Traffic from port1 should be blocked, while traffic from port2 remains allowed.
Chapter 5. Running Application on BlueField

1. Please refer to the DOCA Installation Guide for details on how to install BlueField related software.

2. To run the application:

   a. Configure the OVS switch, ports, and enable OVS.

      ```bash
      ovs-vsctl del-br ovsbr1
      ovs-vsctl del-br ovsbr2
      ovs-vsctl add-br ovsbr1
      ovs-vsctl add-port ovsbr1 p0;
      ovs-vsctl add-port ovsbr1 pf0hpf;
      ovs-vsctl set Open_vSwitch . other_config:hw-offload=true;
      systemctl restart openvswitch
      systemctl enable openvswitch
      ```

   b. Configure OVS L4 Firewall rules as detailed in section Configuration Flow.

      ```bash
      ovs-ofctl add-flow ovsbr1 table=0,priority=1,action=drop
      ovs-ofctl add-flow ovsbr1 table=0,priority=10,arp,action=normal
      ovs-ofctl add-flow ovsbr1 "table=0,priority=100,ip,ct_state=-trk,actions=ct(table=1)"
      ovs-ofctl add-flow ovsbr1 "table=1,in_port=1,ip,ct_state=+trk,action=ct(commit),2"
      ovs-ofctl add-flow ovsbr1 "table=1,in_port=2,ip,ct_state=+trk,action=ct(commit),1"
      ovs-ofctl add-flow ovsbr1 "table=1,in_port=1,ip,ct_state=+trk,action=drop"
      ```
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