Running NVIDIA DOCA Reference Applications Over Host

User Guide

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Chapter 1. Introduction

There might several reasons for running application on the host. For example, one might want to utilize a strong and high-resource host machine, or to start DOCA integration on the host before offloading it to the BlueField DPU.

The configuration in this document allows the entire application to run on the host's memory, while utilizing the HW accelerators on the BlueField (e.g., using RegEx the accelerator on BlueField using a daemon running on the DPU).

When virtual functions are enabled on the host, virtual function representors are visible on the Arm side which can be bridged to corresponding physical interface representors (e.g., the uplink representor and the host representor). This allows the application to only scan traffic being forwarded to the VFs as configured by the user and to behave as a simple "bump-on-the-wire" solution. DOCA installed on the host allows accessing the hardware capabilities of the BlueField DPU without comprising features such as the stateful table (SFT) which uses hardware offload and additional hardware steering elements embedded inside the eSwitch.

Chapter 2. Prerequisites

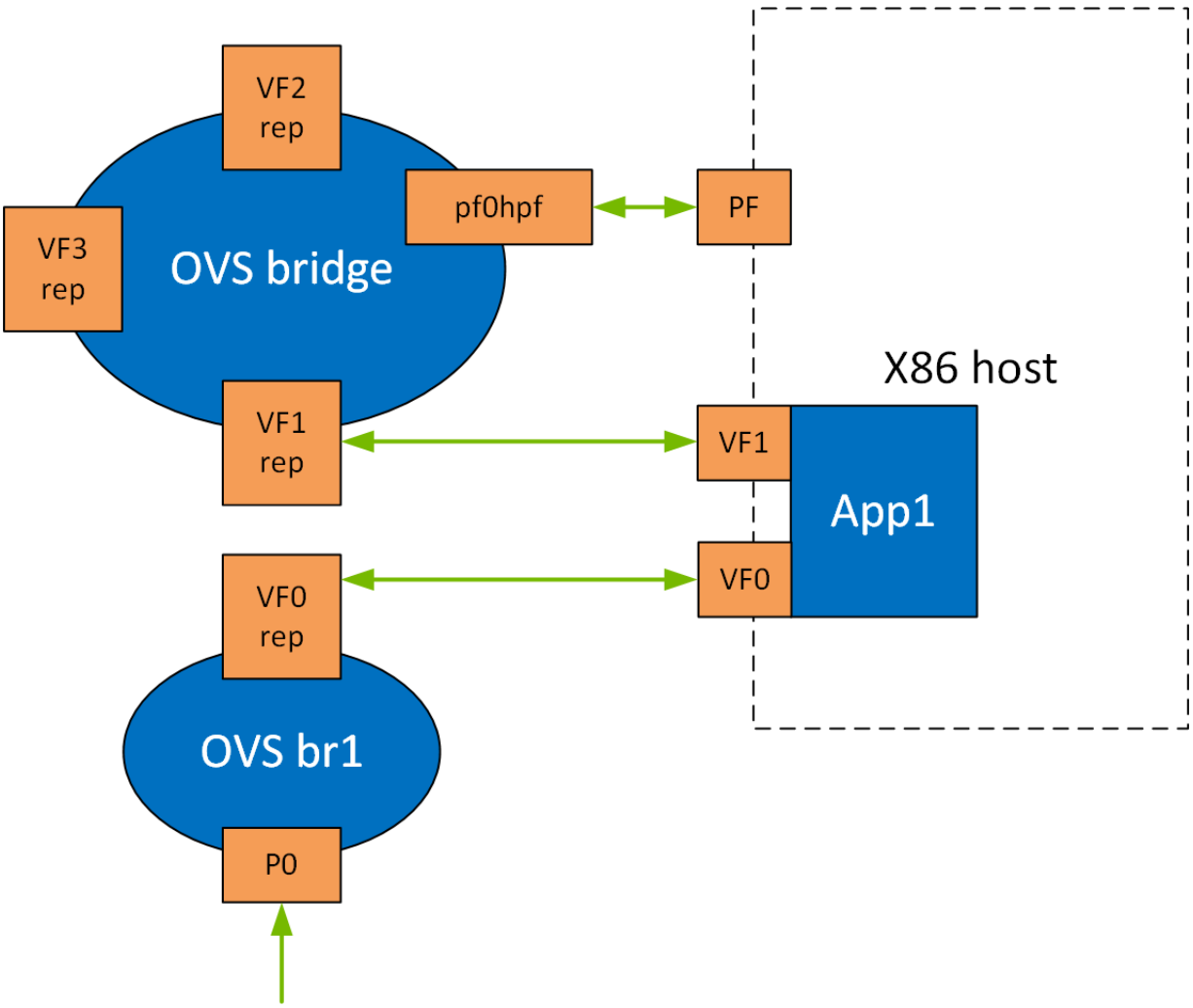
Running applications on the host and using the RegEx accelerator on the BlueField require enabling the RegEx engine.

To run all the reference applications over the host, it is required to install the host DOCA version of DPDK. For more information on host installation, please refer to DOCA Installation Guide.

Note: VFs must be configured as trusted for hardware jump action to work as intended. Run the following command on the Arm device:

```
mlxreg -d /dev/mst/mt41686_pciconf0 --reg_id 0xc007 --reg_len 0x40 --indexes
 "0x0.0:32=0x80000000" --yes --set "0x4.0:32=0x1"
```

To run the application over the host, the following topology is be used.



Configure the OVS on BlueField as follows:

```
    Bridge ovsbr1
        Port ovsbr1
            Interface ovsbr1
                type: internal
        Port pf0hpf
            Interface pf0hpf
        Port pf0vf1
            Interface pf0vf1
    Bridge vf_br
        Port p0
            Interface p0
        Port vf_br
            Interface vf_br
                type: internal
        Port pf0vf0
            Interface pf0vf0
```

Enabling VF over the host bridges the uplink connection (p0) to one end of the VF created (pf0vf0), and the other end (pf0vf1) to the host representors (pf0phf). On the host, the same application is run but 3 PCIe addresses are used:The first one for initiating the RegEx (must be done on interface 0), and the other 2 PCIe address to initialize the virtual function. Now, when traffic is received (e.g., from the uplink), the following flow occurs:

1. Traffic is received over p0.
2. Traffic is forwarded to pf0vf0.
3. Application "listens" to pf0vf0 and pf0vf1 and can, therefore, acquire the traffic from pf0vf0, inspect it, and forward to pf0vf1.
4. Traffic is forwarded from pf0vf1 to pf0hpf.

Chapter 3. Configuration Flow

1. Stop the driver on the host. Run:
   ```
   host$ sudo /etc/init.d/openibd stop
   ```
2. On the Arm, start the driver. Run:
   ```
   dpu$ sudo /etc/init.d/openibd start
   ```
3. On the Arm, enable RegEx. Run:
   ```
   dpu$ echo 1 > /sys/class/net/p0/smart_nic/pf/regex_en
   ```
4. On the Arm, add 200 huge pages. Run:
   ```
   dpu$ current_huge='cat /sys/kernel/mm/hugepages/hugepages-2048kB/nr_hugepages'
   dpu$ echo $((200 + current_huge)) > /sys/kernel/mm/hugepages/hugepages-2048kB/
   nr_hugepages
   ```
5. On the Arm, start mlx RegEx. Run:
   ```
   dpu$ systemctl start mlx-regex
   ```

   Note: If it has not been set before, the previous value of huge pages should be 2048 or higher (depending on the number of cores).
6. Verify that the service is running. Run:
   ```
   dpu$ systemctl status mlx-regex
   ```
7. The host can now run RegEx. Run:
   ```
   host$ sudo /etc/init.d/openibd start
   ```

Note: Running DPDK over the host requires configuring huge pages to be identical to the DPU configuration.

Running the application over the host also initializes all the cores of the device which is usually unnecessary and may even cause unforeseeable issues. It is recommended to limit the number of cores, especially when using an AMD-based system, to 16 cores using the `-c` flag when running DPDK.

The following is a CLI example for running a reference application over the host using VF:

```
./opt/mellanox/doca/example/**/bin/*executable* -a "pci address VF0" -a "pci address
 VF1" -c 0xff -- "application flags"
```

Note: The executable will fail if no correct `LD_LIBRARY_PATH` is set. To set `LD_LIBRARY_PATH`, execute the following.

- For Ubuntu:
  ```
  export LD_LIBRARY_PATH=/opt/mellanox/dpdk/lib/aarch64-linux-gnu/
  ```
- For CentOS:

```
export LD_LIBRARY_PATH=/opt/mellanox/dpdk/lib64
```

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