



NVIDIA DOCA

Installation Guide for Linux

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Chapter 1. Introduction

There are two ways to install the NVIDIA BlueField DPU software:

- ▶ Using the [SDK Manager](#) which provides a GUI/CLI for full DPU software installation
- ▶ [Manual installation](#) with a step-by-step procedure

1.1. Supported Platforms

Model Number	Description
MBF2H322A-AEEOT	NVIDIA® BlueField®-2 P-Series DPU 25GbE Dual-Port SFP56, PCIe Gen4 x8, Crypto Enabled, 8GB on-board DDR, 1GbE OOB management, Tall Bracket, HHHH
MBF2H322A-AENOT	NVIDIA BlueField-2 P-Series DPU 25GbE Dual-Port SFP56, PCIe Gen4 x8, Crypto Disabled, 8GB on-board DDR, 1GbE OOB management, Tall Bracket, HHHH
MBF2H332A-AEEOT	NVIDIA BlueField-2 P-Series DPU 25GbE Dual-Port SFP56, PCIe Gen3/4 x8, Crypto Enabled, 16GB on-board DDR, 1GbE OOB management, Tall Bracket, HHHH
MBF2H332A-AENOT	NVIDIA BlueField-2 P-Series DPU 25GbE Dual-Port SFP56, PCIe Gen3/4 x8, Crypto Disabled, 16GB on-board DDR, 1GbE OOB management, Tall Bracket, HHHH
MBF2H516A-CEEOT	NVIDIA BlueField-2 P-Series DPU 100GbE Dual-Port QSFP56, PCIe Gen4 x16, Crypto Enabled, 16GB on-board DDR, 1GbE OOB management, Tall Bracket, FHHL
MBF2H516A-CENOT	NVIDIA BlueField-2 P-Series DPU 100GbE Dual-Port QSFP56, PCIe Gen4 x16, Crypto Disabled, 16GB on-board DDR, 1GbE OOB management, Tall Bracket, FHHL
MBF2H516A-EEEOT	NVIDIA BlueField-2 P-Series DPU 100GbE/EDR/HDR100 VPI Dual-Port QSFP56, PCIe Gen4 x16, Crypto Enabled, 16GB on-board DDR, 1GbE OOB management, Tall Bracket, FHHL
MBF2H516A-EENOT	NVIDIA BlueField-2 P-Series DPU 100GbE/EDR VPI Dual-Port QSFP56; PCIe Gen4 x16; Crypto Disabled; 16GB on-board DDR; 1GbE OOB management; FHHL
MBF2H516B-CENOT	NVIDIA BlueField-2 P-Series BF2500 DPU Controller, 100GbE Dual-Port QSFP56, PCIe Gen4 x16, Crypto Disabled, 16GB on-board DDR, 1GbE OOB Management, Tall Bracket, FHHL

Model Number	Description
MBF2H516B-EENOT	NVIDIA BlueField-2 P-Series BF2500 DPU Controller, 100GbE/EDR/HDR100 VPI Dual-Port QSFP56, PCIe Gen4 x16, Crypto Disabled, 16GB on-board DDR, 1GbE OOB management, Tall Bracket, FHHL
MBF2M322A-AEEOT	NVIDIA BlueField-2 E-Series DPU 25GbE Dual-Port SFP56, PCIe Gen3/4 x8, Crypto, 8GB on-board DDR, 1GbE OOB management, Tall Bracket, HHHH
MBF2M322A-AENOT	NVIDIA BlueField-2 E-Series DPU 25GbE Dual-Port SFP56, PCIe Gen3/4 x8, Crypto Disabled, 8GB on-board DDR, 1GbE OOB management, Tall Bracket, HHHH
MBF2M332A-AEEOT	NVIDIA BlueField-2 E-Series DPU 25GbE Dual-Port SFP56, PCIe Gen4 x8, Crypto, 16GB on-board DDR, 1GbE OOB management, Tall Bracket, HHHH
MBF2M332A-AENOT	NVIDIA BlueField-2 E-Series DPU 25GbE Dual-Port SFP56, PCIe Gen4 x8, Crypto Disabled, 16GB on-board DDR, 1GbE OOB management, Tall Bracket, HHHH
MBF2M516A-CEEOT	NVIDIA BlueField-2 E-Series DPU 100GbE Dual-Port QSFP56; PCIe Gen4 x16; Crypto Enabled; 16GB on-board DDR; 1GbE OOB management; FHHL
MBF2M516A-CENOT	NVIDIA BlueField-2 E-Series DPU 100GbE Dual-Port QSFP56, PCIe Gen4 x16, Crypto Disabled, 16GB on-board DDR, 1GbE OOB management, Tall Bracket, FHHL
MBF2M516A-EEEEOT	NVIDIA BlueField-2 E-Series DPU 100GbE/EDR/HDR100 VPI Dual-Port QSFP56, PCIe Gen4 x16, Crypto Enabled, 16GB on-board DDR, 1GbE OOB management, Tall Bracket, FHHL
MBF2M516A-EENOT	NVIDIA BlueField-2 E-Series DPU 100GbE/EDR/HDR100 VPI Dual-Port QSFP56; PCIe Gen4 x16; Crypto Disabled; 16GB on-board DDR; 1GbE OOB management; FHHL
900-21004-0030-000	NVIDIA BlueField-2 A30X, P1004 SKU 205, Generic, GA100, 24GB HBM2e, PCIe Passive Dual Slot 230W Gen 4.0, DPU Crypto ON W/ Bkt, 1 Dongle, Black, HF, VCPD
900-21004-0010-000	NVIDIA BlueField-2 A100X, P1004 SKU 230, Generic, GA100, 80GB HBM2e, PCIe Passive Dual Slot 300W Gen 4.0, DPU Crypto ON W/ Bkt, 1 Dongle, Black, HF, VCPD

1.2. Hardware Prerequisites

This quick start guide assumes that an NVIDIA® BlueField® DPU has been installed in a server according to the instructions detailed in your [DPU's hardware user guide](#).

1.3. DOCA Packages

Device	Component	Version	Description
Host	DOCA SDK	1.5.0	Software development kit package for developing host software

Device	Component	Version	Description
Target BlueField-2 DPU (Arm)	DOCA Runtime	1.5.0	Runtime libraries required to run DOCA-based software applications on host
	DOCA Tools	1.5.0	Tools for developers and administrators on host
	Arm emulated (QEMU) development container	3.9.3	Linux-based BlueField Arm emulated container for developers
	BlueField Software	3.9.3	BlueField image and firmware
	DOCA SDK	1.5.0	Software development kit packages for developing Arm software
	DOCA Runtime	1.5.0	Runtime libraries required to run DOCA-based software applications on Arm
	DOCA Tools	1.5.0	Tools for developers and administrators for Arm target

1.4. Supported Operating System

The operating system supported on the BlueField DPU is Ubuntu 20.04.

The following operating systems are supported on the host machine:

- ▶ Ubuntu 18.04/20.04/22.04
- ▶ CentOS/RHEL 7.6/8.0/8.2
- ▶ Rocky 8.6
- ▶ Debian 10.8

1.5. Supported Kernel Versions



Note: Only the following generic kernel versions are supported for DOCA local repo package for host installation (whether by SDKM or manually).

Host Operation System	Kernel Support	Arch Support
CentOS 7.6	4.14.0-115.el7a.aarch64	aarch64

Host Operation System	Kernel Support	Arch Support
	3.10.0-957.el7.x86_64	x86
CentOS 8.0	4.18.0-80.el8.x86_64	
CentOS 8.2	4.18.0-193.el8.x86_64	
RHEL 7.6	3.10.0-957.el7.x86_64	
RHEL 8.0	4.18.0-80.el8.x86_64	
RHEL 8.2	4.18.0-193.el8.x86_64	
Rocky 8.6	4.18.0-372.9.1.el8.x86_64	
Ubuntu 18.04	4.15.0-20-generic	
Ubuntu 20.04	5.4.0-26-generic	
Ubuntu 22.04	5.15.0-52-generic	
Debian 10.8	4.19.0-14-amd64	

Chapter 2. SDK Manager

[NVIDIA SDK Manager](#) supports DOCA installation, including software packages on the host and the BlueField-2 target.

- ▶ To use the SDK Manager GUI, please refer to [NVIDIA SDK Manager GUI installation guide for DOCA](#) for detailed instructions.
- ▶ To use the SDK Manager CLI, please refer to [NVIDIA SDK Manager CLI installation guide for DOCA](#) for detailed instructions.



Note: SDK manager installation requires internet connection through out-of-band (OOB) port.

Chapter 3. Manual BlueField Image Installation

This guide provides the minimal first-step instructions for setting up DOCA on a standard system.

3.1. Installation Files

Device	Component	Arch and OS	Link
Host	These files contain the following components suitable for their respective OS version. <ul style="list-style-type: none"> ▶ DOCA SDK v1.5.0 ▶ DOCA Runtime v1.5.0 ▶ DOCA Tools v1.5.0 	CentOS/RHEL 7.6 on x86	doca-host-repo-rhel76-1.5.0-0.2.2.1.5.0055.1.el7.5.8.1.0.1
		CentOS/RHEL 8.0 on x86	doca-host-repo-rhel80-1.5.0-0.2.2.1.5.0055.1.el8.5.8.1.0.1
		CentOS/RHEL 8.2 on x86	doca-host-repo-rhel82-1.5.0-0.2.2.1.5.0055.1.el8.5.8.1.0.1
		Rocky/RHEL 8.6 on x86	doca-host-repo-rhel86-1.5.0-0.2.2.1.5.0055.1.el8.5.8.1.0.1
		Ubuntu 18.04 on x86	doca-host-repo-ubuntu1804_1.5.0-0.2.2.1.5.0055.1.5.8.1.0.1
		Ubuntu 20.04 on x86	doca-host-repo-ubuntu2004_1.5.0-0.2.2.1.5.0055.1.5.8.1.0.1
		Ubuntu 22.04 on x86	doca-host-repo-ubuntu2204_1.5.0-0.2.2.1.5.0055.1.5.8.1.0.1
	Debian 10.8 on x86	doca-host-repo-debian108_1.5.0-0.2.2.1.5.0055.1.5.8.1.0.1	
Arm Emulated Development Container	Arm container v3.9.3 on aarch64	doca_devel_ubuntu_20.04-inbox-5.5.tar	
Target BlueField-2 DPU (Arm)	BlueField Software v3.9.3	Ubuntu 20.04 on aarch64	doca_1.5.0_bsp_3.9.3_ubuntu_20.04-11.si
	DOCA SDK v1.5.0		doca-dpu-repo-ubuntu2004-local_1.5.0055-1.5.8.1.0.1.1.bf.3.9.3.12383
	DOCA Runtime v1.5.0		
	DOCA Tools v1.5.0		

3.2. Installing Software on Host

1. Installation of MFT and RShim for managing and flashing the BlueField DPU.

For Ubuntu/Debian

- a). Download the DOCA Tools package from [Installation Files](#) section for the host.

- b). Unpack the deb repo. Run:

```
host# sudo dpkg -i doca-host-repo-ubuntu<version>_amd64.deb
```

- c). Perform apt update. Run:

```
host# sudo apt-get update
```

- d). Run `apt install` for DOCA Tools.

- ▶ For DPU:

```
host# sudo apt install doca-tools
```

- ▶ For ConnectX on Ubuntu 20.04:

```
host# sudo apt install doca-cx-tools
```

For CentOS/RHEL 7.x

- a). Download the DOCA Tools package from [Installation Files](#) section for the x86 host.

- b). Unpack the RPM repo. Run:

```
host# sudo rpm -Uvh doca-host-repo-rhel<version>.x86_64.rpm
```

- c). Enable new yum repos. Run:

```
host# sudo yum makecache
```

- d). Run `yum install` to install DOCA Tools.

- ▶ For DPU:

```
host# sudo yum install doca-tools
```

- ▶ For ConnectX:

```
host# sudo yum install doca-cx-tools
```

For CentOS/RHEL 8.x or Rocky 8.6

- a). Download the DOCA Tools package from [Installation Files](#) section for the x86 host.

- b). Unpack the RPM repo. Run:

```
host# sudo rpm -Uvh doca-host-repo-rhel<version>.x86_64.rpm
```

- c). Enable new dnf repos. Run:

```
host# sudo dnf makecache
```

- d). Run `dnf install` to install DOCA Tools.

- ▶ For DPU:

```
host# sudo dnf install doca-tools
```

- ▶ For ConnectX:

```
host# sudo dnf install doca-cx-tools
```



Note: Skip the following step to proceed without the DOCA local repo package for host.

2. Alternatively, to continue with the DOCA local repo package for host installation:

Installing DOCA Local Repo Package on Ubuntu/Debian Host

a). Download the DOCA SDK and DOCA Runtime packages from [Installation Files](#) section for the host.

b). Unpack the deb repo. Run:

```
host# sudo dpkg -i doca-host-repo-ubuntu<version>_amd64.deb
```

c). Perform apt update. Run:

```
host# sudo apt-get update
```

d). Run `apt install` for DOCA runtime, tools, and SDK.

▶ For DPU:

```
host# sudo apt install -y doca-runtime doca-sdk
```

▶ For ConnectX on Ubuntu 20.04:

```
host# sudo apt install -y doca-cx-runtime doca-cx-sdk
```

e). Extra package:

```
host# sudo dnf install -y doca-extra
```

doca-extra, located under `/opt/mellanox/doca/tools/`, contains:

▶ `doca-info` – displays details of all installed dependencies in DOCA

▶ `doca-kernel-support` – running it adds support on existing kernel to support DOCA

Installing DOCA Local Repo Package on CentOS Host

a). Download the DOCA SDK and DOCA Runtime packages from [Installation Files](#) section for the x86 host.

b). Install the following software dependencies. Run:

```
host# sudo yum install -y epel-release
```

c). For CentOS 8.2 only, also run:

```
host# yum config-manager --set-enabled PowerTools
```

d). Unpack the RPM repo. Run:

```
host# sudo rpm -Uvh doca-host-repo-rhel<version>_x86_64.rpm
```

e). Enable new yum repos. Run:

```
host# sudo yum makecache
```

f). Run `yum install` for DOCA runtime, tools, and SDK.

```
host# sudo yum install -y doca-runtime doca-sdk
```

g). Extra package:

```
host# sudo dnf install -y doca-extra
```

doca-extra, located under `/opt/mellanox/doca/tools/`, contains:

▶ `doca-info` – displays details of all installed dependencies in DOCA

▶ `doca-kernel-support` – running it adds support on existing kernel to support DOCA

Installing DOCA Local Repo Package on Rocky 8.6 Host

a). Install the following software dependencies. Run:

```
host# sudo dnf install -y yum-utils
host# sudo yum-config-manager --enable PowerTools
```

b). Download the DOCA SDK, DOCA Runtime, and DOCA Tools package.

c). Unpack the RMP repo. Run:

```
host# rpm -Uvh <repo_file>.rpm
```

d). Clean cache. Run:

```
host# sudo dnf clean dbcache
```

e). Run `dnf install` for DOCA SDK, DOCA runtime, DOCA tools.

```
host# sudo dnf install -y doca-runtime doca-sdk doca-tools
```

f). Extra package:

```
host# sudo dnf install -y doca-extra
```

`doca-extra`, located under `/opt/mellanox/doca/tools/`, contains:

- ▶ `doca-info` – displays details of all installed dependencies in DOCA
- ▶ `doca-kernel-support` – running it adds support on existing kernel to support DOCA

Installing DOCA Local Repo Package on RHEL Host



Note: For RHEL 7.6, only perform step d. from the following procedure.

a). Open a RedHat account.

- i. Log into RedHat website via the [developers tab](#).
- ii. [Create a developer user](#).

b). Run:

```
host# subscription-manager register --username=<username> --password=PASSWORD
```

To extract pool ID:

```
host# subscription-manager list --available --all
```

```
...
Subscription Name:   Red Hat Developer Subscription for Individuals
Provides:             Red Hat Developer Tools (for RHEL Server for ARM)
...
                    Red Hat CodeReady Linux Builder for x86_64
...
Pool ID:              <pool-id>
...
```

And use the pool ID for the Subscription Name and Provides that include Red Hat CodeReady Linux Builder for x86_64.

c). Run:

```
host# subscription-manager attach --pool=<pool-id>
host# subscription-manager repos --enable codeready-builder-for-rhel-8-x86_64-rpms
host# sudo yum makecache
```

d). Install the DOCA local repo package for host, enable new yum repos, and install DOCA runtime and SDK. Run:

```
host# rpm -Uvh doca-host-repo-rhel<version>.x86_64.rpm
host# sudo yum makecache
host# sudo yum install -y doca-runtime doca-sdk
```

e). Sign out from your RHEL account. Run:

```
host# subscription-manager remove --all
host# subscription-manager unregister
```

f). Extra package:

```
host# sudo dnf install -y doca-extra
```

doca-extra, located under /opt/mellanox/doca/tools/, contains:

- ▶ doca-info – displays details of all installed dependencies in DOCA
- ▶ doca-kernel-support – running it adds support on existing kernel to support DOCA

3. Initialize MST. Run:

```
host# sudo mst start
```

4. Reset the mlxconfig params to their default values:

```
host# sudo mlxconfig -d /dev/mst/mt41686_pciconf0 -y reset
```

```
Reset configuration for device /dev/mst/mt41686_pciconf0? (y/n) [n] : y
Applying... Done!
-I- Please reboot machine to load new configurations.
```

5. Skip this step if your BlueField DPU is Ethernet only. Please refer to [Supported Platforms](#) to learn your DPU type.

If you have a VPI DPU, the default link type of the ports will be configured to IB. To verify your link type, run:

```
host# sudo mst start
host# sudo mlxconfig -d /dev/mst/mt41686_pciconf0 -e q | grep -i link_type
Configurations:
  Boot          Default          Current          Next
*              LINK_TYPE_P1    IB(1)           ETH(2)
  IB(1)
*              LINK_TYPE_P2    IB(1)           ETH(2)
  IB(1)
```



Note: If your DPU is Ethernet capable only, then the `sudo mlxconfig -d <device>` command will not provide an output.

If the current link type is set to IB, run the following command to change it to Ethernet:

```
host# sudo mlxconfig -d /dev/mst/mt41686_pciconf0 s LINK_TYPE_P1=2
LINK_TYPE_P2=2
```

6. Verify that RShim is active.

```
host# sudo systemctl status rshim
```

This command is expected to display `active (running)`. If RShim service does not launch automatically, run:

```
host# sudo systemctl enable rshim
host# sudo systemctl start rshim
```

7. Assign a dynamic IP to `tmfifo_net0` interface (RShim host interface).



Note: Skip this step if you are [installing the DOCA image on multiple DPUs](#).

```
host# ifconfig tmfifo_net0 192.168.100.1 netmask 255.255.255.252 up
```

3.3. Installing Software on DPU

Users have two options for installing DOCA on the DPU:

- ▶ Upgrading the full DOCA image on the DPU (recommended) - this option overwrites the entire boot partition.
- ▶ Upgrading DOCA local repo package on the DPU – this option upgrades DOCA components without overwriting the boot partition. Use this option to preserve configurations or files on the DPU itself.

3.3.1. Installing Full DOCA Image on DPU

Note: This installation sets up the OVS bridge.

Note: If you are installing DOCA on multiple DPUs, skip to section [Installing Full DOCA Image on Multiple DPUs](#).

Note: This step overwrites the entire boot partition.

3.3.1.1. Option 1 - No Pre-defined Password

Note: To set the password in advance, proceed to [Option 2](#).

BFB installation is executed as follows:

```
host# sudo bfb-install --rshim <rshimN> --bfb <image_path.bfb>
```

Where `rshimN` is `rshim0` if you only have one DPU. You may run the following command to verify:

```
host# ls -la /dev/ | grep rshim
```

3.3.1.2. Option 2 - Set Pre-defined Password

Ubuntu users can provide a unique password that will be applied at the end of the BlueField software image installation. This password needs to be defined in a `bf.cfg` configuration file.

To set the password for the "ubuntu" user:

1. Create password hash. Run:

```
host# openssl passwd -1
Password:
Verifying - Password:
$1$3B0RlrfX$TlHry93NFUJzg3Nya00rE1
```

2. Add the password hash in quotes to the `bf.cfg` file:

```
host# sudo vim bf.cfg
ubuntu_PASSWORD='$1$3B0RlrfX$TlHry93NFUJzg3Nya00rE1'
```

When running the installation command, use the `--config` flag to provide the file containing the password:

```
host# sudo bfb-install --rshim <rshimN> --bfb <image_path.bfb> --config bf.cfg
```

Note: If `--config` is not used, then upon first login to the BlueField device, users will be asked to update their password.

The following is an example of Ubuntu installation assuming the "pv" Linux tool has been installed (to view the installation progress).

```
host# sudo bfb-install --rshim rshim0 --bfb DOCA_<version>-aarch64.bfb --config
bf.cfg
Pushing bfb
1.08GiB 0:00:57 [19.5MiB/s] [      <=>      ]
Collecting BlueField booting status. Press Ctrl+C to stop..
INFO[BL2]: start
INFO[BL2]: DDR POST passed
INFO[BL2]: UEFI loaded
INFO[BL31]: start
INFO[BL31]: runtime
INFO[UEFI]: eMMC init
INFO[UEFI]: eMMC probed
INFO[UEFI]: PCIe enum start
INFO[UEFI]: PCIe enum end
INFO[MISC]: Ubuntu installation started
INFO[MISC]: Installation finished
INFO[MISC]: Rebooting...
```

3.3.2. Installing Full DOCA Image on Multiple DPUs

On a host with multiple DPUs, the BFB image can be installed on all of them using the [multi-bfb-install script](#).

```
host# ./bfb-multi-install --bfb <bfb-file> --password <password>
```

This script detects the number of RShim devices and configures them statically.

- ▶ For Ubuntu – the script creates a configuration file `/etc/netplan/20-tmfifo.yaml`
- ▶ For CentOS/RHEL 7.6 – the script creates a configuration file `/etc/sysconfig/network-scripts/ifcfg-br_tmfifo`
- ▶ For CentOS/RHEL 8.0 and 8.2 – the script installs `bridge-utils` package to use the command `brctl`, creates bridge `tm-br` and connects all RShim interfaces to it

After the installation is complete, the configuration of the bridge and each RShim interface can be observed using `ifconfig`. The expected result is to see the IP on the bridge `tm-br` configured to `192.168.100.1` with subnet `255.255.255.0`.



Note: To log into BlueField with `rshim0`, run:

```
ssh ubuntu@192.168.100.2
```

For each RShim after that, add 1 to the fourth octet of the IP address (e.g., `ubuntu@192.168.100.3` for `rshim1`, `ubuntu@192.168.100.4` for `rshim2`, etc).

The script burns a new MAC address to each DPU and configures a new IP, `192.168.100.x`, as described earlier.

3.3.3. Installing DOCA Local Repo Package on DPU



Note: If you have already installed BlueField image, be aware that the DOCA SDK, Runtime, and Tools are already contained in the BFB, and this installation is not mandatory. If you have not

installed the BlueField image and wish to update DOCA Local Repo package, proceed with the following procedure.

Note: Before installing DOCA on the target DPU, make sure the out-of-band interface (mgmt) is connected to the Internet.

1. Download the DOCA SDK, DOCA Runtime, and DOCA Tools package from section [Installation Files](#).

2. Copy deb repo package into BlueField. Run:

```
host# sudo scp -r doca-repo-aarch64-ubuntu2004-local_<version>_arm64.deb
ubuntu@192.168.100.2:/tmp/
```

3. Unpack the deb repo. Run:

```
dpu# sudo dpkg -i doca-repo-aarch64-ubuntu2004-local_<version>_arm64.deb
```

4. Run apt update:

```
dpu# sudo apt-get update
```

5. Check for any DOCA package content upgrade. Run:

```
dpu# sudo apt install doca-runtime
dpu# sudo apt install doca-tools
dpu# sudo apt install doca-sdk
```

3.4. Upgrading Firmware

Note: If multiple DPUs are installed, the following steps must be performed on all of them after [BFB installation](#).

To upgrade firmware:

1. SSH to your BlueField device via 192.168.100.2 (preconfigured).

Note: If multiple DPUs are installed, the tmfifo IP interface does not have to be 192.168.100.2. The last octate changes and depends on the RShim number.

The default credentials for Ubuntu are as follows:

- ▶ Username: ubuntu
- ▶ Password: ubuntu or a unique password that you set in `bf.cfg`

For example:

```
host# ssh ubuntu@192.168.100.2 Password: <configured-password>
```

2. Upgrade firmware in BlueField DPU. Run:

```
dpu# sudo /opt/mellanox/mlnx-fw-updater/mlnx_fw_updater.pl --force-fw-update
```

Example output:

```
Device #1:
```

```
-----
Device Type:      BlueField-2
[...]
Versions:        Current      Available
FW               <Old_FW>      <New_FW>
```

3. For the firmware upgrade to take effect:

- a). Run the following command on the BlueField DPU and host:

```
dpu# sudo mst start
```

- b). Query the available reset flows:

```
dpu# sudo mlxfwreset -d /dev/mst/mt41686_pciconf0 q
```

Example output:

```
Reset-levels:
```

```
...
```

```
Reset-types (relevant only for reset-levels 3,4):
```

```
...
```

```
Reset-sync (relevant only for reset-level 3):
```

```
0: Tool is the owner -Supported (default)
```

```
1: Driver is the owner -Supported
```

- c). **If reset-sync 1 is not supported or if mlxfwreset failed, perform host power cycle.** Otherwise, trigger reset by running the following:

```
dpu# sudo mlxfwreset -d /dev/mst/mt41686_pciconf0 --sync 1 -y reset
```



Note: The entire DPU will experience reset.

3.5. Post-installation Procedure

1. Restart the driver. Run:

```
host# sudo /etc/init.d/openibd restart
```

```
Unloading HCA driver:
```

```
[ OK ]
```

```
Loading HCA driver and Access Layer:
```

```
[ OK ]
```

2. Configure the physical function (PF) interfaces.

```
host# sudo ifconfig <interface-1> <network-1/mask> up
```

```
host# sudo ifconfig <interface-2> <network-2/mask> up
```

For example:

```
host# sudo ifconfig p2p1 192.168.200.32/24 up
```

```
host# sudo ifconfig p2p2 192.168.201.32/24 up
```

Pings between the source and destination should now be operational.

Chapter 4. Building Your Own BFB Installation Image

Users wishing to build their own customized BlueField OS image can use the BFB build environment. Please refer to [this GitHub webpage](#) for more information.



Note: For a customized BlueField OS image to boot on the UEFI secure-boot-enabled DPU (default DPU secure boot setting), the OS must be either signed with an existing key in the UEFI DB (e.g., the Microsoft key), or UEFI secure boot must be disabled. Please refer to the [Secure Boot](#) section and its subpages of the *NVIDIA BlueField DPU Platform Operating System Documentation* for more details.

Chapter 5. Setting Up Build Environment for Developers

For full instructions about setting up a development environment, refer to the [NVIDIA DOCA Developer Guide](#).

Chapter 6. Installing CUDA on NVIDIA Converged Accelerator

NVIDIA® CUDA® is a parallel computing platform and programming model developed by NVIDIA for general computing GPUs.

This section details the necessary steps to set up CUDA on your environment. This section assumes that a BFB image has already been installed on your environment.

To install CUDA on your converged accelerator:

1. Download and install the latest NVIDIA Data Center GPU driver.
2. Download and install CUDA.



Note: Downloading CUDA includes the latest NVIDIA Data Center GPU driver and CUDA toolkit. For more information about CUDA and driver compatibility please refer to [NVIDIA CUDA Toolkit Release Notes](#).

6.1. Configuring Operation Mode

There are two modes that the NVIDIA Converged Accelerator may operate in:

- ▶ Standard mode (default) – the BlueField DPU and the GPU operate separately
- ▶ BlueField-X mode – the GPU is exposed to the DPU and is no longer visible on the host

To verify which mode the system is operating in, run:

```
host# sudo mst start
host# sudo mlxconfig -d /dev/mst/mt41686_pciconf0 q PCI_DOWNSTREAM_PORT_OWNER[4]
```

Standard mode output:

```
Device #1:
[...]
Configurations:
    PCI_DOWNSTREAM_PORT_OWNER[4]
Next Boot
    DEVICE_DEFAULT(0)
```

BlueField-X mode output:

```
Device #1:
[...]
Configurations:
    PCI_DOWNSTREAM_PORT_OWNER[4]
Next Boot
    EMBEDDED_CPU(15)
```

To configure BlueField-X mode, run:

To configure standard mode, run:

Power cycle is required for configuration to take effect. To power cycle the host run:

```
host# ipmitool power cycle
```

6.2. Downloading and Installing CUDA Toolkit and Driver

This section details the necessary steps to set up CUDA on your environment. It assumes that a BFB image has already been installed on your environment.

1. Install CUDA by visiting the [CUDA Toolkit 11.6.2 Downloads](#) webpage.

Note: Select the Linux distribution and version relevant for your environment.

2. Test that the driver installation completed successfully. Run:

```
nvidia-smi
```

```
Tue Apr  5 13:37:59 2022
```

NVIDIA-SMI 510.47.03 Driver Version: 510.47.03 CUDA Version: 11.6									
GPU	Name	Persistence-M	Bus-Id	Disp.A	Volatile	Uncorr.	ECC		
Fan	Temp	Perf	Pwr:Usage/Cap	Memory-Usage	GPU-Util	Compute	M.	MIG M.	
0	NVIDIA BF A10	Off	00000000:06:00.0	Off			0		
0%	43C	P0	N/A / 225W	0MiB / 23028MiB	0%	Default	N/A		

```

Processes:
GPU  GI  CI          PID  Type  Process name          GPU Memory
  ID  ID  ID                               Usage
=====
No running processes found

```

3. Verify that the installation completed successfully.

- a). Download CUDA samples repo. Run:

```
dpu# git clone https://github.com/NVIDIA/cuda-samples.git
```

- b). Build and run vectorAdd CUDA sample. Run:

```
dpu# cd cuda-samples/Samples/0_Introduction/vectorAdd
dpu# make
dpu# ./vectorAdd
```

Note: If the `vectorAdd` sample works as expected, it should output "Test Passed".

Note: If it seems that the GPU is slow or stuck, stop execution and run:

```
dpu# sudo setpci -v -d ::0302 800.L=201 # CPL_VC0 = 32
```

6.3. GPUDirect RDMA

To enable GPUDirect RDMA with a network card on NVIDIA Converged Accelerator, you need an additional kernel module. Run:

```
dpu# sudo modprobe nvidia-peermem
```

6.4. DPDK GPUDEV

To enable CPU map GPU memory feature in DPDK's gpudev library, you need the GDRCopy library and driver to be installed on your system.

1. Install GDRCopy library. Run:

```
dpu# git clone https://github.com/NVIDIA/gdrcopy.git
```

2. Install dependencies.

- ▶ For RHEL:

```
# DKMs can be installed from epel-release. See https://fedoraproject.org/wiki/EPEL.
dpu# $ sudo yum install dkms check check-devel subunit subunit-devel
```

- ▶ For Debian:

```
dpu# $ sudo apt install check libsubunit0 libsubunit-dev
```

3. Build the library and install the driver. Run:

```
dpu# cd gdrcopy
dpu# make
# Launch gdrdrv kernel module on the system
dpu# ./insmod.sh
```

4. Setup GDRCopy path. Run:

```
dpu# export GDRCOPY_PATH_L=/path/to/libgdrapi
```



Note: In general, the path to libgdrapi is `/path/to/gdrcopy/src/`.

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