



## Table of contents

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- Linux installation guide
  - Delivery
  - Prerequisites
    - Target platform
    - Software
      - Red Hat Enterprise Linux
      - Ubuntu
  - Installation
  - KBDPDK
    - Prerequisites
      - Red Hat Enterprise Linux 8
      - Red Hat Enterprise Linux 9
      - Ubuntu
      - Common
    - NIC Setup
      - Intel NIC
      - NVIDIA NIC
        - Requirements
        - Driver install
        - Enable traffic shaping narrow linear profile
    - KBAPI Clean
  - VCS configuration
    - Interactive Mode
    - Silent Mode
  - Performance considerations
    - Socket
    - BIOS
    - CPU governor
    - Conductor configuration
    - Route
  - Licensing
  - Synchronize multiple NICs

- [Virtual machine support](#)
  - [Configuration](#)
- [PTP](#)
  - [Firewall](#)

# Linux installation guide

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## Delivery

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The package contains all the resources needed to run the IP virtual card.

Once this package is installed, you will be able to run any application linked to the IP Virtual Card solution.

## Prerequisites

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### Target platform

Hardware :

- CPU speed : minimum 2.1GHz
- CPU architecture : 64 bits
- NIC bandwidth : minimum 10Gb/s

OS :

- Ubuntu 20.04 64 bits, Red Hat Enterprise Linux 8 64 bits and Red Hat Enterprise Linux 9 64 bits
- NIC driver must be properly installed and up to date

### Software

To be able to install the IP Virtual Card, you must first install some prerequisites.

#### Red Hat Enterprise Linux

```
sudo dnf -y install gcc-c++ make git python3
```

#### Ubuntu

```
sudo apt-get -y update  
sudo apt-get -y install g++ make git python3
```

## Installation

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The installation is automated by the script `install.py`. This requires python (v3.8 and higher) to be installed on the system.

This script must be launched with root privilege :

```
sudo python3 install.py
```

The script will :

- install some needed packages
- disable NTP
- install and register `ptp4l` as a service
- install the VideoMasterIP libraries
- install and register the VirtualCardService as a service
- install licensing module
- copy the VideoMasterIP API headers on the system.

The script can also be launched with the following arguments :

- The installation mode (those options are mutually exclusive):
  - `--install` : this will install the package with all the needed dependencies. This is the default option.
  - `--clean` : this will remove everything that has been done during installation
  - `--update` : this will update the existing libraries and VirtualCardService executable without reinstalling all the needed dependencies like 'ptp4l' etc.
- Optional argument:
  - `--kbidpdk` : this will install the KBDPDK package to use VCS in DPDK mode. See KBDPDK section for more details.

## KBDPDK

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The first thing to do before installing KBDPDK through the IPVC installer is to check the compatibility with your system. The following script is located in `kbidpdk`

```
sudo python kbcheck_compat.py
```

This script requires Python (v3.8 and higher) to be installed on the system.

### Prerequisites

To be able to use KBDPDK, you must first install some prerequisites.

First, run the commands concerning your OS, then run the common part.

### Red Hat Enterprise Linux 8

```
# Activate codeready-builder repo for RHEL 8
sudo subscription-manager repos --enable codeready-builder-for-rhel-8-x86_64-rpms
# Install package group "Development Tools"

sudo dnf groupinstall -y "Development Tools"
# Install other required packages
sudo dnf install -y numactl-devel meson ninja-build python3-pip python3 pkg-config
```

## Red Hat Enterprise Linux 9

```
# Activate codeready-builder repo for RHEL 9
sudo subscription-manager repos --enable codeready-builder-for-rhel-9-x86_64-rpms
# Install package group "Development Tools"

sudo dnf groupinstall -y "Development Tools"
# Install other required packages
sudo dnf install -y numactl-devel meson ninja-build python3-pip python3 pkg-config
```

## Ubuntu

```
# Install required packages
sudo apt-get install -y build-essential libnuma-dev meson ninja-build \
python3-pip python3 pkg-config
```

## Common

```
# Install pip packages
sudo pip3 install pyelftools distro
```

## NIC Setup

### Intel NIC

No special setup is required for Intel NIC.

### NVIDIA NIC

#### Requirements

- Network card :
  - ConnectX-5 :
    - Firmware: **16.21.1000** and above.
  - ConnectX-6 :
    - Firmware: **20.27.0090** and above.
  - ConnectX-6 Lx
    - Firmware: **20.27.0090** and above.
  - ConnectX-6 Dx
    - Firmware: **20.27.0090** and above.
  - BlueField-2
    - Firmware: **18.25.1010** and above.

- Minimal kernel version :
  - v4.14

#### Driver install

1. Download the latest version of MLNX\_OFED for your linux distribution :  
[https://network.nvidia.com/products/infiniband-drivers/linux/mlnx\\_ofed/](https://network.nvidia.com/products/infiniband-drivers/linux/mlnx_ofed/)
2. Extract it on the target machine
3. Install the required libraries by installing Mellanox OFED/EN:

```
sudo ./mlnxofedinstall --upstream-libs --dpmk
```

4. Verify firmware version

```
ibv_devinfo
```

5. Restart driver

```
sudo /etc/init.d/openibd restart  
#OR  
sudo service openibd restart
```

#### Enable traffic shaping narrow linear profile

Requirement:

- Hardware : ConnectX-6 Dx and higher
- OFED Version: 5.1-2 and higher
- Firmware Version : 22.28.2006 and higher
- IP Virtual Card License : Plus

Procedure:

1. Download the latest MFT (Mellanox Firmware Tools) tool package :  
<https://network.nvidia.com/products/adaptersoftware/firmware-tools/>
2. Extract it on the target machine
3. Install MFT tools

```
#In mft tool extracted folder  
sudo ./install.sh
```

4. Get the pci address of your nics

```
lspci | grep Mellanox  
01:00.0 Ethernet controller: Mellanox Technologies MT28841  
01:00.1 Ethernet controller: Mellanox Technologies MT28841
```

5. For each NIC, enable firmware functionality

```
sudo mlxconfig -d [PCI_ADDR] s REAL_TIME_CLOCK_ENABLE=1  
  
sudo mlxconfig -d [PCI_ADDR] s ACCURATE_TX_SCHEDULER=1  
#For example for nic 01:00.0  
sudo mlxconfig -d 01:00.0 s REAL_TIME_CLOCK_ENABLE=1  
sudo mlxconfig -d 01:00.0 s ACCURATE_TX_SCHEDULER=1
```

6. Restart your machine

## KBAPI Clean

This script cleans the kbapi configuration on your system:

```
sudo python3 kbconfig_cleanup.py
```

## VCS configuration

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The VCS configuration is done through the `ipvc_configure.py` script. This script requires Python (v3.8 and higher) to be installed on the system.

The script works in 2 different modes : interactive and silent.

### Interactive Mode

In interactive mode, the script will ask you to enter the configuration parameters one by one. After entering all the parameters, the script will ask you if you want to save the configuration in a file. Then it will ask you if you want to apply the configuration to the system. By default, the configuration file is saved in the current directory and is named `ipvc_config.cfg`.

```
sudo python3 ipvc_configure.py
```

### Silent Mode

In silent mode, the script will use the configuration file passed as an argument. Using the following command, the script will apply the configuration to the system:

```
sudo python3 ipvc_configure.py --config [CONFIG_FILE]
```

## Performance considerations

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### Socket

Redis package installs a script that is launched at each startup and that improves the socket performance.

You can find that script here : `/opt/deltacast/videomasterip/vcs/network_sysctl.sh`

Explanations :

```
sysctl -w net.core.rmem_max=33554432
```

This sets the max OS receive buffer size for all types of connections.

```
sysctl -w net.core.wmem_max=33554432
```

This sets the max OS send buffer size for all types of connections.

```
sysctl -w net.core.rmem_default=65536
```

This sets the default OS receive buffer size for all types of connections.

```
sysctl -w net.core.wmem_default=65536
```

This sets the default OS send buffer size for all types of connections.

```
sysctl -w net.ipv4.route.flush=1
```

This will ensure that immediately subsequent connections use these values.

## BIOS

According to our observations, C-states, P-states or any energy-saving parameters must be disabled in the BIOS parameter.

This ensures that the computer is running at its peak performances.

Not following the recommendations can lead to unstable or non-compliant streams.

## CPU governor

We strongly recommend to disable `ondemand` CPU scaling daemon to ensure best performances:

```
sudo systemctl disable ondemand
```

To avoid reboot, you can manually change the actual scaling governor:

```
echo performance | sudo tee /sys/devices/system/cpu/cpu*/cpufreq/scaling_governor
```

## Conductor configuration

The CPU core associated to a conductor must not be used by any process.

To avoid kernel interruption on this core, it can be isolated at boot via the option `isolcpus` or with the KBAPI configuration (in case of DPDK mode).

If the hyper-threading is activated, the same guideline must be applied to the associated logical core.

## Route

In order to improve the performances during a TX stream emitting toward a multicast address, it is advised to set a general multicast route associated with the used NIC.

This can be done thanks to the following command :

```
sudo route add -net 224.0.0.0/4 dev xxxx ,
```

where 'xxxx' is the name of the NIC.

Without this route, the packet interval time (PIT) will not be stable and this can cause non-compliance to the ST2110-21 packet pacing standard (overflow in the VRX bucket).

# Licensing

---

The IP Virtual Card solution is secured by a license manager called **dlmcli**.

To identify the platform, dlmcli take several parameters into account. One of those parameters is one of the NIC MAC. To avoid license issue in case of network configuration changes, we recommend to force dlmcli to use a specific NIC MAC that should never be removed or used by IP Virtual Card (mainboard NIC by example). For that, use the following argument while you add the first license:

```
--select-custom-mac #####
```

If a custom mac is not provided with the first license entry, dlmcli will warn you and list all the available NIC mac.

**To add a license in online mode** , use the following command:

```
dlmcli activate #####-#####-#####-#####-#####-#####-#####-##### [--select-custom-mac #####]
```

**To add a license in offline mode** , use the following command:

```
dlmcli activate --offline requestfile.bin #####-#####-#####-#####-#####-#####-#####-##### [--select-custom-mac #####]
```

Provide the processed requestfile.bin to Deltacast. In return, Deltacast will provide you a response file. Then use the following command:

```
dlmcli process responsefile.bin
```

**To update the licensing informations** in VCS, without having to restart it, call the `VMIP_RefreshLicensing()` functions.

You can also compile and run the `sample_refresh_licensing` .

## Synchronize multiple NICs

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When using multiple NICs, if **traffic shaping narrow linear** is enabled, You **MUST** synchronize all the NICs on the interface synchronized with PTP4L.

To synchronize the NICs, a python utility is available in the VCS folder:

This script must be run with admin rights.

The script creates all the necessary phc2sys services.

```
/opt/deltacast/videomasterip/vcs/config_nic_sync.py
USAGE:
# Create and load all the required services

config_nic_sync.py [ptp_domain] [main_interface] [follower_interface] ... [follower_interface]

config_nic_sync.py clean # Clean previous configuration

config_nic_sync.py start # Start all sync services

config_nic_sync.py restart # Restart all sync services

config_nic_sync.py stop # Stop all sync services
```



Example of setup:

```
/opt/deltacast/videomasterip/vcs/config_nic_sync.py 127 eno1 eno2 eno3 eno4
```

## Virtual machine support

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### Configuration

The virtual machine support is only available with network cards configured in PCI passthrough. Socket and DPDK mode are both available in virtual machine.

## PTP

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### Firewall

In order to make PTP work, you have to be sure that the ptp packets are not blocked by any kind of firewall installed on your machine. If it is the case, you must add a firewall rule to allow those packets or PTP will not work.