Quadra™ Installation Guide

V5.5

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2 Scope

NETINT is a supplier of high-performance, low-latency, real-time video processing units (VPUs) for x86 and Arm servers.

This installation guide provides information on setup and configuration of the host in which the NETINT video transcoder device will be installed and operated.

Various environments are supported by Quadra including

- Linux
- Windows
- Android
- MacOS
- Virtual Machines
- Docker containers

Quadra also supports various tools and toolchains like

- Kubernetes
- Windows with Visual Studio
- Windows with MSYS

Aside from this installation document, the **Quadra Quick Start Guide** (**QSG**) is a starting reference for any user trying to quickly setup and configure a NETINT Quadra video transcoder device. This installation document covers all the supported environment installations, whereas the installation steps in the **QSG** document will only explain how to install Quadra into Ubuntu 20.04, or a newer Linux host. The **QSG** is also included in Quadra's release package.

3 Release Package Files Guide

The NETINT Firmware and Software release packages contain many files. This installation guide will primarily use the **Quadra_SW_V*.*.*** folder, which is highlighted below in the table of release package contents:

File	Description
Android_quick_installer	FW/SW guided installation script for Android
clamscan.log	Clam Anti Virus scan log
InstallationGuideQuadra_V*.pdf	NETINT SW installation guide for various systems
IntegrationProgrammingGuideQuadra_V*.pdf	NETINT FW/SW primary user guide that includes the full list of xcoder-params
libxcoder_API_Integration_guideQuadra_V*.pdf	The Libxcoder API Integration Guide
md5sum	MD5 checksum of files
Performance_Test_Report_V*.pdf	Quadra performance test report
Quadra_FW_V*.*.*/	FW release package folder
Quadra_FW_V*.*.*_*_release_notes.txt	FW release notes
Quadra_Quality_Report_V*.*.*.pdf	Visual quality test report
quadra_quick_installer.sh	FW/SW guided installation script for Linux
Quadra_SW_V*.*.*/	SW release package folder
Quadra_SW_V*.*.*_*_release_notes.txt	SW release notes
QuickStartGuideQuadra_V*.pdf	FW/SW Quick start installation and introduction guide
README.md	Information about release package contents
sentinelscan.log	SentinelOne Anti Virus scan log
Test_Coverage_Report_V*.*.*.pdf	Quadra test coverage report

4 Linux Host

The NETINT video transcoder device can operate in various Linux host environments including Ubuntu and CentOS. Various CPU architectures are also supported, including x86 (Intel, AMD) and ARM.

This section covers the NETINT software package installation on a typical Linux host (non-VM, non-container).

4.1 Scripted FW/SW Installation

The **quadra_quick_installer.sh** script is provided to handle automated installation of both FW and SW in its default configuration. The installer script supports Ubuntu, CentOS, and MacOS. It can be found at the top level of the release folder after unzipping the release package.

1. Copy the release package to the host. The filename syntax should be as follows, for example:

   Quadra_V5.4.0.zip

2. From a command line, unzip the release package

   $ unzip Quadra_V5.4.0.zip

3. Enter the release folder and start the upgrade script

   $ bash quadra_quick_installer.sh

4. The upgrade script looks for Quadra FW/SW release packages in the same folder as the script. Confirm the correct release versions are found and press ‘Y’ to install them

   Press [Y/y] to confirm the use of these two release packages.

5. The following menu options are now available

   Choose an option:
   1) Setup Environment variables
   2) Unlock CPU governor
   3) Install OS prerequisite packages
   4) Install NVMe CLI
   5) Install Libxcoder
   6) Install FFmpeg-n4.3.1
   7) Install FFmpeg-n5.1.2
   8) Install FFmpeg-n6.1
   9) Install FFmpeg-n7.1
   10) Install gstreamer-1.22.2
   11) Install gstreamer-1.24.4
   12) Install gstreamer-1.24.9
   13) Install gstreamer-1.26.2
   14) Firmware Update
   15) Quit

6. Type '**1**' and press **Enter** to setup the required environment variables

7. Type '**3**' and press **Enter** to install all the prerequisite software libraries for your OS (Ubuntu/CentOS/MacOS)

8. Type '**4**' and press **Enter** to build and install the **nvme-cli** tool

    a. If the OS version does not support nvme-cli 1.16 you may see this build error message "**Install NVMe CLI failed**"

```
3) Install OS prerequisite packages    6) Install FFmpeg-n4.3.1          9) Install FFmpeg-n7.1          12) Install gstreamer-1.24.9        15) Quit
#? 4
You chose 4 which is Install NVMe CLI
--2025-11-06 19:47:38--  https://github.com/linux-nvme/nvme-cli/archive/v1.16.tar.gz
Resolving github.com (github.com)... 140.82.113.3
Connecting to github.com (github.com)|140.82.113.3|:443... connected.
HTTP request sent, awaiting response... 302 Found
Location: https://codeload.github.com/linux-nvme/nvme-cli/tar.gz/refs/tags/v1.16 [following]
--2025-11-06 19:47:38--  https://codeload.github.com/linux-nvme/nvme-cli/tar.gz/refs/tags/v1.16
Resolving codeload.github.com (codeload.github.com)... 140.82.113.9
Connecting to codeload.github.com (codeload.github.com)|140.82.113.9|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: unspecified [application/x-gzip]
Saving to: 'v1.16.tar.gz'

v1.16.tar.gz                                [ <=>                                                                ] 584.22K  1.72MB/s    in 0.3s

2025-11-06 19:47:39 (1.72 MB/s) - 'v1.16.tar.gz' saved [598246]

NVME_VERSION = 1.16
    CC nvme-print.o
nvme-print.c:4063:6: error: conflicting types for '__nvme_show_id_ctrl' due to enum/integer mismatch; have 'void(struct nvme_id_ctrl *, enum nvme_print_flags,  void (*)(__u8 *, struct json_object *))
' {aka 'void(struct nvme_id_ctrl *, enum nvme_print_flags,  void (*)(unsigned char *, struct json_object *))'} [-Werror=enum-int-mismatch]
 4063 | void __nvme_show_id_ctrl(struct nvme_id_ctrl *ctrl, enum nvme_print_flags flags,
      |      ^~~~~~~~~~~~~~~~~~~
In file included from nvme-print.c:9:
nvme-print.h:14:6: note: previous declaration of '__nvme_show_id_ctrl' with type 'void(struct nvme_id_ctrl *, unsigned int,  void (*)(__u8 *, struct json_object *))' {aka 'void(struct nvme_id_ctrl *,
 unsigned int,  void (*)(unsigned char *, struct json_object *))'}
   14 | void __nvme_show_id_ctrl(struct nvme_id_ctrl *ctrl, unsigned int mode,
      |      ^~~~~~~~~~~~~~~~~~~
cc1: all warnings being treated as errors
make: *** [Makefile:108: nvme-print.o] Error 1
Install NVMe CLI failed
```

To fix the above error and install the latest **nvme-cli** package, **manually** install the tool

```
$  sudo apt install nvme-cli
```

9. Type '**5**' to install the Libxcoder.
    a. If the libxcoder is installed, then a background systemd service that automatically initializes all Quadra VPU devices on system startup can be configured. Choose **Y** at this prompt

    ```
    Would you like to install a systemd service for libxcoder? Press [Y/y] to confirm.
    ```

10. If **FFMpeg** is required, select the menu option matching the **FFMpeg** version and this will download, build and install it. You can select compilation options for the **libav** shared libraries, and add **Gstreamer** or **libavcodec** support.

11. If you also wish to install **Gstreamer** NETINT support through **gst-libav**, choose the required version using option '**10'** to **'13'** and press enter. The pre-requisites are that FFmpeg version >=n4.3.1 is installed with shared libraries and Gstreamer support. Note: Gstreamer support in libavcodec changes some timestamp handling behavior to suit Gstreamer over FFmpeg.
12. Type '**14**' and press enter to go through the guided Firmware update process.
13. Type '**15**' and press enter to exit the script menu

If any individual step fails during the execution of **quadra_quick_installer.sh** it is recommended to check the error messages and take the action necessary to resolve it. If any errors persist then please contact your NETINT support representative.

NOTE: It is vital that the firmware update process (once started), is **NOT interrupted**. Any interruptions during firmware update may cause the device to malfunction. If a cold upgrade fails before completion then a system reboot may resolve the issue. The firmware update process should then be repeated to update the device firmware.

NOTE: Additional information captured during the update process can be found in the **./upgrade_log.txt** file generated by the update script.

NOTE: The behavior of the warm upgrade process is identical to the cold upgrade **except that a system reboot is not required for the warm upgrade**. However if the warm upgrade fails then a system reboot should resolve the issue, and the warm upgrade process can be repeated. However, if warm upgrade repeatedly fails then a cold upgrade and reboot should be used instead.

4.2 Manual SW Installation

4.2.1 Unpacking NETINT SW release

The NETINT SW release package contains the host side driver (libxcoder*), and an FFmpeg patch that adds support for the NETINT hardware codecs, filters and other functionalities.

1. Unzip the NETINT release package file. Replace <version> below with the NETINT release version number (e.g. 5.4):

   ```
   unzip Quadra_V<version>.zip
   ```

2. Acquire the base FFmpeg code. Replace <ff_version> below with the FFmpeg release version (e.g. n4.3.1):

   ```
   git clone -b <ff_version> --depth=1
   https://github.com/FFmpeg/FFmpeg.git FFmpeg
   ```

3. Apply the NETINT patch to the base FFmpeg code. Replace <version> with the NETINT release version number (e.g. n4.3.1). Replace the <ff_version> below with the NETINT release version number (e.g. 4.0.0_RCA):

```
cp Quadra_V<version>/Quadra_SW_V*/FFmpeg-<ff_version>_netint_v<version>.diff FFmpeg/ &&
cd FFmpeg/ && patch -t -p 1 < FFmpeg-n<ff_version>_netint_v<version>.diff &&
cd ..
```

4.2.2 Install Prerequisite 3rd party SW

1. Install the **nvme-cli** utility depending on your distro of Linux:

    a. Ubuntu:

    ```
    sudo apt install nvme-cli pkg-config git gcc
    ```

    b. Centos:

    ```
    sudo yum --enablerepo=extras install -y epel-releas
    sudo yum install nvme-cli pkgconfig git redhat-lsb-
    core make gcc
    ```

    c. Fedora:

    ```
    sudo dnf install nvme-cli pkgconfig git make gcc
    ```

    d. MacOS:

    ```
    xcode-select –install
    curl -O https://pkg-
    config.freedesktop.org/releases/pkg-config-0.28.tar.gz
    && tar -zxvf pkg-config-0.28.tar.gz && rm pkg-config-
    0.28.tar.gz && cd pkg-config-0.28 && export
    CC=/usr/bin/cc 2> /dev/null || setenv CC /usr/bin/cc
    2> /dev/null && ./configure --prefix=/usr/local CC=$CC
    --with-internal-glib && make && sudo make install &&
    cd .. && rm -rf pkg-config-0.28
    ```

2. Install NASM assembly optimizations library:

    ```
    curl -O
    https://www.nasm.us/pub/nasm/releasebuilds/2.14.02/nasm-
    2.14.02.tar.gz &&
    tar -zxf nasm-2.14.02.tar.gz && rm nasm-2.14.02.tar.gz &&
    cd nasm-2.14.02/ && ./configure && make && sudo make
    install && cd .. && rm -rf nasm-2.14.02
    ```

4.2.3 Setup Environment Variables

FFmpeg compilation relies on pkg-config for linking libxcoder to FFmpeg. Certain Linux distros (eg. Centos) may not configure pkg-config's environment variables in a way that works for FFmpeg+libxcoder compilation. Use the below commands to apply Ubuntu's default pkg-config environment variables to your distro if necessary.

```
export PKG_CONFIG_PATH=/usr/local/lib/pkgconfig/ &&
export LD_LIBRARY_PATH=/usr/local/lib/ &&
grep -qxF '/usr/local/lib' /etc/ld.so.conf ||
sudo sh -c 'echo "/usr/local/lib" >> /etc/ld.so.conf'
```

4.2.4 Quadra and Logan Co-existence

There are two product families of NETINT video transcoders, these are Quadra and Logan (also known as T400 series).

Logan and Quadra can now co-exist in the same host. This means all software APIs and symbols are named uniquely, with no clashes. Applications can now be built with either system on the same host. It is possible to link an application against either Logans or Quadra's libraries.

Starting from Quadra release v4.0.0, and Logan release v3.0.0, the NETINT host software packages can be built with options to work specifically with one or both products. This means any Quadra release starting from Quadra v4.0.0 can co-exist with any Logan release from Logan v3.0.0 onwards. FFMpeg versions that are supported by both platforms are 4.2.1 and 6.1.

With co-existence of products, it is important to understand feature compatibility between both Quadra and Logan releases.

4.2.5 Feature Compatibility between Quadra and Logan

As new features are added to Logan and released, they are not automatically included in any ***existing*** Quadra releases. Only when a new Quadra release is published, which includes all the latest Logan files for the new Logan features, will Quadra's release package support the new Logan features. For example, Quadra release v4.0.0 supports all Logan features in Logan release v3.0.0. If the new Logan feature A is then added to the next Logan release v3.1.0, this new Logan feature A will not be available in Quadra v4.0.0. Only when Quadra v4.1.0 is released, and only if it includes Logan v3.1.0 release files will the new Logan feature A be supported in Quadra v4.1.0.

4.2.6 Building Logan and Quadra from the Quadra Release

The following sections explain the required steps for building application software with Logan and Quadra on the same host. The assumption is that all host software packages have been downloaded and NETINT patches have been applied, all from Quadra's release package only.

NOTE : All code required for Logan and Quadra co-existence must be obtained from the **Quadra** release package.

4.2.7 Build and install libxcoder for Quadra

If a Quadra card is installed on the host and the host software is to be built for it, use the commands below to compile the Quadra driver and low-level utilities. Replace <version> with NETINT release version number (e.g. 4.0.0_RCA):

```
cp -r Quadra_SW_V<version>/libxcoder libxcoder &&
cd libxcoder &&
bash build.sh &&
cd ..
```

Note: If installing libxcoder on a system that already has another version installed, make sure to reinitialize the device resource list using the following commands:

```
ni_rsrc_update –D
init_rsrc
```

Alternatively reboot the system after installing all components.

4.2.8 Build and install libxcoder_logan for Logan

If a Logan card is installed on the host, the Logan host software is required. Follow the instructions in the **QuickStartGuideT408_T432_*.pdf** document, unpack the libxcoder_logan folder in the Logan release.

Note : libxcoder_logan code must be from a T4XX release version **>=3.0.0.**

Then compile the Logan driver and low-level utilities below :

```
cp -r release/libxcoder_logan libxcoder_logan &&
cd libxcoder_logan &&
bash build.sh &&
cd ..
```

4.2.9 Build FFmpeg

FFmpeg can be built with Quadra support, Logan support, or both.

Please consult NETINT engineering support for which versions of FFmpeg support which NETINT products, and which version of the NETINT FFmpeg patch should be used for combined Quadra and Logan support.

To build FFmpeg, use the steps below:

1. Go to the FFmpeg directory (directory name depends on the FFmpeg version) with the following command:

   ```
   cd FFmpeg
   ```

2. Ensure folder is clean for compilation with the following command:

   ```
   sudo make clean
   ```

3. The options to build FFmpeg for different NETINT product lines (Quadra, Logan, etc.) are dependent on the options supported by the build_ffmpeg.sh script in the NETINT FFmpeg patch that has been applied to the FFmpeg source.

   a. Check the build_ffmpeg.sh help text to see which options are available with the following command:

      ```
      bash build_ffmpeg.sh -h | grep "build for "
      ```

   b. Build FFmpeg for Quadra with the following command:

      ```
      bash build_ffmpeg.sh --quadra
      ```

   c. Build FFmpeg for Logan with the following command:

      ```
      bash build_ffmpeg.sh --logan
      ```

   d. Build FFmpeg for Quadra and Logan with the following command:

      ```
      bash build_ffmpeg.sh --quadra –logan
      ```

4. Install FFmpeg to the host $PATH with the following command:

   ```
   sudo make install
   ```

4.2.10 Build FFmpeg with LGPL License

By default, when FFmpeg is built using the build_ffmpeg.sh script, it will be configured with the following flags:

--enable-gpl --enable-nonfree

FFmpeg can be built to qualify for the LGPL license. To do this the following flags need to be disabled. To disable the flags, FFmpeg needs to be configured manually i.e. not using the **build_ffmpeg.sh** script. To view the default configuration set by the **build_ffmpeg.sh** script, use the steps below:

1. Go to the FFmpeg directory (directory name depends on the FFmpeg version) with the following command:

   ```
   cd FFmpeg
   ```

2. Clean the folder for compilation with the following command:

   ```
   sudo make clean
   ```

3. Get the configuration:

   ```
   bash build_ffmpeg.sh –dry
   ```

   The response for the above command should look like this :

   ```
   ./configure --pkg-config-flags=--static --enable-gpl --
   enable-nonfree --extra-ldflags=-lm --extra-ldflags=-ldl --
   enable-ni_quadra --disable-ni_logan --disable-
   filter=drawtext_ni_quadra --enable-pic --enable-pthreads --
   extra-libs=-lpthread --enable-encoders --enable-decoders --
   enable-avfilter --enable-muxers --enable-demuxers --enable-
   parsers --disable-debug --disable-ffplay --disable-ffprobe
   --disable-libx264 --disable-libx265 --disable-libaom --
   disable-libvpx --disable-libxml2 --disable-libsrt --
   disable-cuda-nvcc --disable-cuda --disable-cuvid --disable-
   nvdec --disable-nvenc --disable-libvmaf --enable-static --
   disable-shared --extra-cflags=-UNI_DEC_GSTREAMER_SUPPORT --
   extra-cflags=-UNI_MEASURE_LATENCY
   ```

To build FFmpeg to comply with the LGPL license, change the following flags from

--enable-gpl --enable-nonfree

to

--disable-gpl --disable-nonfree

Now the configure command need to be executed:

```
./configure --pkg-config-flags=--static --disable-gpl --
disable-nonfree --extra-ldflags=-lm --extra-ldflags=-ldl --
enable-ni_quadra --disable-ni_logan --disable-
filter=drawtext_ni_quadra --enable-pic --enable-pthreads --
extra-libs=-lpthread --enable-encoders --enable-decoders --
enable-avfilter --enable-muxers --enable-demuxers --enable-
parsers --disable-debug --disable-ffplay --disable-ffprobe
--disable-libx264 --disable-libx265 --disable-libaom --
disable-libvpx --disable-libxml2 --disable-libsrt --
disable-cuda-nvcc --disable-cuda --disable-cuvid --disable-
nvdec --disable-nvenc --disable-libvmaf --enable-static --
disable-shared --extra-cflags=-UNI_DEC_GSTREAMER_SUPPORT --
extra-cflags=-UNI_MEASURE_LATENCY
```

Once FFmpeg is configured it needs to be built and installed on the system using the following steps:

1. Build FFmpeg with the command:

   make

2. Install FFmpeg to the host **$PATH** with the following command:

   sudo make install

Note: The **build_ffmpeg.sh** script with the **--dry** flag can be used with other custom configurations as shown in Section 4.2.9 (Step 3). The **--dry** flag can also be added at the end of the **build_ffmpeg.sh** script to get the configuration, for example

```
bash build_ffmpeg.sh --quadra –logan –dry
```

The above command will print out the FFmpeg configuration with the Quadra and Logan libraries enabled. The above step can be followed with an install of FFmpeg with the LGPL license, with Quadra and Logan features also enabled.

5 Docker Containers

This section details the configuration and usage of the NETINT video transcoder device in a Docker container. This can also be used for other NETINT video transcoder solutions.

5.1 Pre-requisites for the Quadra Environment on Host

The Linux Host must have the following working environment.

1. Quadra libxcoder and FFmpeg source installed and compiled successfully. FFmpeg 4.2.1 is referenced in this document, follow the Quick Start Guide to install libxcoder and FFmpeg.

2. Running 'ffmpeg' dumps similar output to the sample below.

```
$ ffmpeg
ffmpeg version 4.3.1 Copyright (c) 2000-2020 the FFmpeg
developers built with gcc 9 (Ubuntu 9.3.0-17ubuntu1~20.04)
configuration: --pkg-config-flags=--static --enable-gpl --
enable-nonfree --extra-ldflags=-lm --extra-ldflags=-ldl --
enable-libxcoder --enable-ni --enable-pthreads --extra-
libs=-lpthread --enable-encoders --enable-decoders --
enable-avfilter --enable-muxers --enable-demuxers --enable-
parsers --enable-x86asm --disable-debug --disable-ffplay --
enable-ffprobe --enable-libx264 --enable-libx265 --enable-
libaom --disable-libvpx --disable-cuda-nvcc --disable-cuda
--disable-cuvid --disable-nvdec --disable-nvenc --disable-
libvmaf --enable-static --disable-shared --extra-cflags=-
UNIENC_MULTI_THREAD
  libavutil      56. 51.100 / 56. 51.100
  libavcodec     58. 91.100 / 58. 91.100
  libavformat    58. 45.100 / 58. 45.100
  libavdevice    58. 10.100 / 58. 10.100
  libavfilter     7. 85.100 /  7. 85.100
  libswscale      5.  7.100 /  5.  7.100
  libswresample   3.  7.100 /  3.  7.100
  libpostproc    55.  7.100 / 55.  7.100
Hyper fast Audio and Video encoder
usage: ffmpeg [options] [[infile options] -i infile]...
{[outfile options] outfile}...
```

```
Use -h to get full help or, even better, run 'man ffmpeg'
```

3. Executing '**sudo nvme list**' will display all installed Quadra NVMe devices.

```
$ sudo nvme list
Node             SN                   Model
Namespace Usage                      Format           FW
Rev
---------------- -------------------- --------------------
------------------ --------- ------------------------- --
-------------- --------
/dev/nvme0n1     Q1A10BA11FC060-0124  QuadraT1A
1           8.59  TB /   8.59  TB      4 KiB +  0 B   ---
00DEV
/dev/nvme1n1     Q1A10BA11FC060-0142  QuadraT1A-EP1
1           8.59  TB /   8.59  TB      4 KiB +  0 B   ---
00DEV
```

4. Executing '**ni_rsrc_mon**' or '**sudo ni_rsrc_mon**' will produce an output similar to the sample below.

```
$ ni_rsrc_mon
NI resource init'd already ..
************************************************
2 devices retrieved from current pool at start up
Mon Jan 31 13:35:40 2022 up 00:00:00 v---00DEV
Num decoders: 2
BEST INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM DEVICE
NAMESPACE
L    0     0    0          0    0    0         /dev/nvme0
/dev/nvme0n1
     1     0    0          0    0    0         /dev/nvme1
/dev/nvme1n1
Num encoders: 2
BEST INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM DEVICE
NAMESPACE
L    0     0    0          0    0    0         /dev/nvme0
/dev/nvme0n1
```

```
     1     0     0           0     0     0          /dev/nvme1
/dev/nvme1n1
Num scalers: 2
BEST INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM DEVICE
NAMESPACE
L    0     0     0           0     0     0          /dev/nvme0
/dev/nvme0n1
     1     0     0           0     0     0          /dev/nvme1
/dev/nvme1n1
Num ais: 2
BEST INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM DEVICE
NAMESPACE
L    0     0     0           0     0     0          /dev/nvme0
/dev/nvme0n1
     1     0     0           0     0     0          /dev/nvme1
/dev/nvme1n1
************************************************
```

5.2 Create a Docker Image

This section describes how to build a Docker image using a Dockerfile and the NETINT Quadra SW release package.

1. Install the Docker module on your Linux Host. Refer to the links in the previous section 5.1 of this document, **Pre-requisites for the Quadra Environment on Host,** this describes the installation steps based on the OS type of your Linux Host.

2. Install Python Docker package:
   sudo pip install docker

3. Download the Dockerfile from NETINTs public repository on Github:
   https://github.com/NETINT-Technologies/quadra_dockerfile/blob/main/Dockerfile

4. Copy the NETINT release package, for example **Quadra_V5.0.0.zip** to the same folder as the Dockerfile.

5. Generate the Docker image:

   sudo docker build --tag ni_quadra_sw .

   Note, there are two options that can be set with the `--build-arg` command:

   a. `NI_RELEASE_VERSION`
      Version number of NETINT Quadra SW release package (e.g. `--build-arg NI_RELEASE_VERSION=5.0.0`)

   b. `FFMPEG_VERSION`
      Version number of FFmpeg to use (e.g. `--build-arg FFMPEG_VERSION=n5.0`)

6. Confirm the Docker image is created:

```
$ sudo docker images
REPOSITORY    TAG      IMAGE ID       CREATED         SIZE
ni_quadra_sw  latest   fc6cf4086561   5 weeks ago     1.32GB
```

5.2.1 Useful Docker Links

1. https://linuxhint.com/install_configure_docker_ubuntu/
2. https://docs.docker.com/engine/install/centos/
3. https://download.docker.com/linux/centos/8/x86_64/stable/Packages/

5.3 Docker container and Quadra interworking

5.3.1 Scope

This section demonstrates a Quadra transcoding session within the Docker container.

5.3.2 Launch Docker container with Quadra device

Run the following command to start a container using Docker image **ni_quadra_sw**

```
sudo docker run -it --privileged --device /dev/nvme0n1 --device /dev/nvme0
ni_quadra_sw /bin/sh
```

Note – The '**-v**' option can be updated to point to the host folder where FFmpeg and libxcoder are installed. For example: ~/FFmpeg, ~/FFmpegXcoder etc.

You should get a shell prompt to demonstrate a successful container has started.

```
Sh-4.2#
```

Running '**sudo nvme list**' should list all the Quadra devices.

```
sh-4.4# sudo nvme list
Node             SN                   Model                                    Namespace Usage
Format           FW Rev
---------------------- -------------------- ---------------------------------------- --------- -------------------------
-- ---------------- --------
/dev/nvme0n1     Q1A10BA11FC060-0124  QuadraT1A                                1         8.59
TB /   8.59  TB     4 KiB +  0 B   ---00DEV
/dev/nvme1n1     Q1A10BA11FC060-0142  QuadraT1A-EP1                              1
8.59  TB /   8.59  TB     4 KiB +  0 B   ---00DEV
sh-4.4#
```

5.3.3 Transcoding

Run a transcoding operation using FFmpeg. The sample below is for an AVC to HEVC transcode on a **1920x1080p_ParkScene.264** clip.

Note – There are some test clips in the **FFmpegXcoder/libxcoder/test** folder

```
sh-4.4# ffmpeg -y -nostdin -hide_banner -vsync 0 -c:v h264_ni_quadra_dec -dec 0 -i
1920x1080p_ParkScene.264 -vf scale=1920:1080 -xcoder-params
intraQP=27:intraPeriod=120 -c:v h265_ni_quadra_enc -enc 0 -xcoder-params
intraQP=27:intraPeriod=120 1920x1080p_ParkScene-0-0.265
Input #0, h264, from '1920x1080p_ParkScene.264':
  Duration: N/A, bitrate: N/A
    Stream #0:0: Video: h264 (High), yuv420p(progressive), 1920x1080, 24 fps, 24 tbr,
1200k tbn, 48 tbc
Stream mapping:
  Stream #0:0 -> #0:0 (h264 (h264_ni_quadra_dec) -> hevc (h265_ni_quadra_enc))
[h265_ni_quadra_enc @ 0x2705180] Session state: 0 allocate frame fifo.
[h265_ni_quadra_enc @ 0x2705180] pix_fmt is 0, sw_pix_fmt is -1
[h265_ni_quadra_enc @ 0x2705180] sw_pix_fmt assigned to pix_fmt was 0, is now -1
[h265_ni_quadra_enc @ 0x2705180] p_param->hwframes = 0
[h265_ni_quadra_enc @ 0x2705180] dts offset: 7, gop_offset_count: 0
Output #0, hevc, to '1920x1080p_ParkScene-0-0.265':
  Metadata:
    encoder         : Lavf58.29.100
    Stream #0:0: Video: hevc (h265_ni_quadra_enc), yuv420p, 1920x1080, q=2-31, 200
kb/s, 24 fps, 24 tbn, 24 tbc
    Metadata:
      encoder         : Lavc58.54.100 h265_ni_quadra_enc
frame=  240 fps=208 q=-0.0 Lsize=    2572kB time=00:00:09.62 bitrate=2188.7kbits/s
speed=8.34x
video:2572kB audio:0kB subtitle:0kB other streams:0kB global headers:0kB muxing
overhead: 0.000000%
sh-4.4#
```

6 Linux KVM VM

This section details the installation of KVM on a Linux host, and provides details on installing and connecting a NETINT video transcoder device to a Linux Guest or Windows Guest Virtual Machine (VM).

There are two methods for using a Virtual Machine with Quadra. The user can pass the **physical device** to the VM, or they can pass the **virtual device** to the VM.

The use of a virtual device on a host requires **SR-IOV** supporting firmware on the NETINT device. Quadra firmware has supported **SR-IOV** since version 4.1.1, and so any subsequent version of Quadra firmware will also support **SR-IOV**.

6.1 Linux Guest VM with Passthrough Physical Device

6.1.1 Pre-requisite packages

This section was written using Ubuntu 20.04 on the host, and with the VM Guest OS also being Ubuntu 20.04.

First retrieve the Ubuntu 20.04 iso file:

wget https://mirror.it.ubc.ca/ubuntu-releases/20.04/

Then install the packages needed for KVM:

sudo apt -y install bridge-utils cpu-checker libvirt-clients libvirt-daemon qemu qemu-kvm

Use **kvm-ok** to ensure the environment actually supports kvm:

fpga@CLI309:~$ kvm-ok
INFO: /dev/kvm exists
KVM acceleration can be used

Authorize a user to be able to use **KVM** and also the **libvirt**:

sudo usermod -aG kvm $USER
sudo usermod -aG libvirt $USER
sudo systemctl status libvirtd – Check with

fpga@CLI309:~$ sudo systemctl status libvirtd

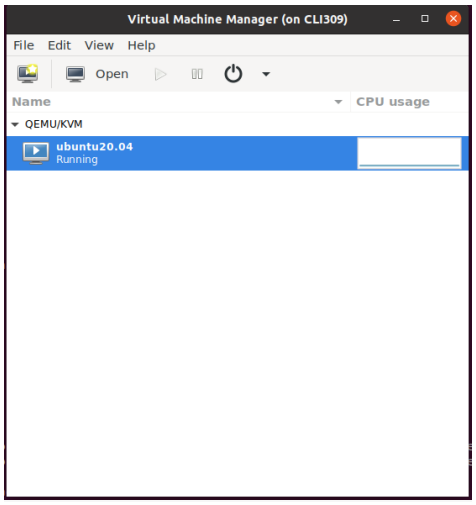
● libvirtd.service - Virtualization daemon
Loaded: loaded (/lib/systemd/system/libvirtd.service; enabled; vendor preset: enabled)
Active: active (running) since Thu 2022-04-14 12:16:25 PDT; 1h 49min ago
TriggeredBy: ● libvirtd.socket
● libvirtd-admin.socket
● libvirtd-ro.socket
Docs: man:libvirtd(8)
https://libvirt.org
Main PID: 1007 (libvirtd)
Tasks: 20 (limit: 32768)
Memory: 51.5M
CGroup: /system.slice/libvirtd.service
├─1007 /usr/sbin/libvirtd
├─1139 /usr/sbin/dnsmasq --conf-file=/var/lib/libvirt/dnsmasq/default.conf --leasefile-ro --dhcp-script=/usr/lib/libvirt/libvirt_leaseshelper
└─1140 /usr/sbin/dnsmasq --conf-file=/var/lib/libvirt/dnsmasq/default.conf --leasefile-ro --dhcp-script=/usr/lib/libvirt/libvirt_leaseshelper

If not enabled then enable with

sudo systemctl enable --now libvirtd

Use the **virt-manager** for the VM Installation:

sudo apt install virt-manager
virt-manager



On the top left of the window click to add a new VM.

Go through the menu, and select local install, choose your ISO, then set the storage, memory and number of cores.

For the network selection, select the host device and use a bridge as the source mode.

Continue through the environment setup for the OS, such as setting timezone, etc.

6.1.2 Enabling IOMMU on Host

Enable the IOMMU feature via the grub configuration.

For an **AMD** system run:

```
sudo nano /etc/default/grub
```

Edit the line that starts with **GRUB_CMDLINE_LINUX_DEFAULT** to match:

```
GRUB_CMDLINE_LINUX_DEFAULT="amd_iommu=on iommu=pt"
```

If you are using an **Intel** system then the line should read:

```
GRUB_CMDLINE_LINUX_DEFAULT="intel_iommu=on"
```

Afterwards run this command

```
sudo update-grub
```

Then reboot the system, when these changes are complete.

Verify if the IOMMU is enabled, by running the following after a reboot:

```
dmesg |grep AMD-Vi
[    1.047041] pci 0000:00:00.2: AMD-Vi: IOMMU performance counters supported
[    1.048758] pci 0000:00:00.2: AMD-Vi: Found IOMMU cap 0x40
[    1.048760] pci 0000:00:00.2: AMD-Vi: Extended features (0x58f77ef22294ade):
[    1.048763] AMD-Vi: Interrupt remapping enabled
[    1.048764] AMD-Vi: Virtual APIC enabled
[    1.048765] AMD-Vi: X2APIC enabled
[    1.048867] AMD-Vi: Lazy IO/TLB flushing enabled
```

6.1.3 Add Quadra to VM

To add Quadra to a KVM, first find the identifier for Quadra's PCIe:

```
lcpci
2c:00.0 SATA controller: Advanced Micro Devices, Inc. [AMD] FCH SATA Controller
[AHCI mode] (rev 51)
2d:00.0 Non-Volatile memory controller: NETINT Technologies Inc. Device 0401
2e:00.0 Non-Essential Instrumentation [1300]: Advanced Micro Devices, Inc. [AMD]
Starship/Matisse PCIe Dummy Function
2f:00.0 Non-Essential Instrumentation [1300]: Advanced Micro Devices, Inc. [AMD]
Starship/Matisse Reserved SPP
2f:00.3 USB controller: Advanced Micro Devices, Inc. [AMD] Matisse USB 3.0 Host
Controller

virsh nodedev-list --cap pci
pci_0000_2a_00_1
pci_0000_2a_00_3
pci_0000_2b_00_0
pci_0000_2c_00_0
pci_0000_2d_00_0
pci_0000_2e_00_0
pci_0000_2f_00_0
pci_0000_2f_00_3
Use 'virsh nodedev-dumpxml pci_0000_2d_00_0' to dump Quadra's PCIe
info for the virtual machine.
fpga@CLI309:~$ virsh nodedev-dumpxml pci_0000_2d_00_0
<device>
 <name>pci_0000_2d_00_0</name>
 <path>/sys/devices/pci0000:00/0000:00:03.1/0000:2d:00.0</path>
 <parent>pci_0000_00_03_1</parent>
 <driver>
  <name>vfio-pci</name>
 </driver>
 <capability type='pci'>
  <class>0x010802</class>
  <domain>0</domain>
  <bus>45</bus>
  <slot>0</slot>
```

```
  <function>0</function>
  <product id='0x0401'/>
  <vendor id='0x1d82'>NETINT Technologies Inc.</vendor>
  <capability type='virt_functions' maxCount='7'/>
  <iommuGroup number='23'>
   <address domain='0x0000' bus='0x2d' slot='0x00' function='0x0'/>
  </iommuGroup>
  <numa node='0'/>
  <pci-express>
   <link validity='cap' port='0' speed='16' width='4'/>
   <link validity='sta' speed='16' width='4'/>
  </pci-express>
 </capability>
</device>
```

Use the information highlighted in red, to add to the virtual machine so the card can be found.

Use **virsh** edit '***yourvmname***' and add the following info.

```
<hostdev mode='subsystem' type='pci' managed='yes'>
 <source>
   <address domain='0x0000' bus='0x2d' slot='0x00' function='0x0'/>
 </source>
</hostdev>
```

Once completed, run '**virsh start *yourvmname***' and install the required packages for Quadra, and build FFmpeg for Quadra.

Verify that the Quadra cards are **detected,** and follow these commands and expected outputs.

```
nvme@logan:~$ sudo nvme list
Node          SN                   Model                                    Namespace Usage
Format        FW Rev
----------------- -------------------- ---------------------------------------- --------- -------------------------- --
---------- --------
/dev/nvme0n1     Q1U02CA13BC056-0009  QuadraT1U-EP1                            1         8.59
TB /   8.59  TB     4 KiB +  0 B   ---52DEV

nvme@logan:~$ ni_rsrc_mon
NI resource not init'd, continue ..
Reading device file: nvme0
Compatible FW API ver: 52
Block name /dev/nvme0n1
1. /dev/nvme0  num_hw: 4
Creating shm_name: SHM_CODERS  lck_name: /dev/shm/NI_LCK_CODERS
0. nvme0
decoder h/w id 0 create
ni_rsrc_fill_device_info type 0 fmt 0
Creating shm_name: shm_d0 , lck_name /dev/shm/NI_lck_d0
ni_rsrc_get_one_device_info written out.
encoder h/w id 1 create
ni_rsrc_fill_device_info type 1 fmt 0
Creating shm_name: shm_e0 , lck_name /dev/shm/NI_lck_e0
ni_rsrc_get_one_device_info written out.
scaler h/w id 2 create
ni_rsrc_fill_device_info type 2 fmt 0
Creating shm_name: shm_s0 , lck_name /dev/shm/NI_lck_s0
ni_rsrc_get_one_device_info written out.
AI h/w id 3 create
ni_rsrc_fill_device_info type 3 fmt 0
Creating shm_name: shm_a0 , lck_name /dev/shm/NI_lck_a0
ni_rsrc_get_one_device_info written out.
************************************************
1 devices retrieved from current pool at start up
Thu Apr 14 17:52:00 2022 up 00:00:00 v---52DEV
```

Num decoders: 1
INDEX LOAD MODEL_LOAD INST MEM SHARE_MEM P2P_MEM DEVICE NAMESPACE
0 0 0 0 0 0 0 /dev/nvme0 /dev/nvme0n1
Num encoders: 1
INDEX LOAD MODEL_LOAD INST MEM SHARE_MEM P2P_MEM DEVICE NAMESPACE
0 0 0 0 0 0 0 /dev/nvme0 /dev/nvme0n1
Num scalers: 1
INDEX LOAD MODEL_LOAD INST MEM SHARE_MEM P2P_MEM DEVICE NAMESPACE
0 0 0 0 0 0 0 /dev/nvme0 /dev/nvme0n1
Num AIs: 1
INDEX LOAD MODEL_LOAD INST MEM SHARE_MEM P2P_MEM DEVICE NAMESPACE
0 0 0 0 0 0 0 /dev/nvme0 /dev/nvme0n1
****

6.2 Linux Guest VM with Passthrough Virtual Device

This section requires SR-IOV enabled firmware (v4.1.1+) is running on all NETINT Quadra devices. Refer to the App Note **APPS525 – Codensity Quadra SR-IOV Configuration and Usage guide** for more details.

6.3 Windows Guest VM with Passthrough Virtual Device

Quadra does not support SR-IOV on Windows.

7 Kubernetes

The Kubernetes orchestration tool allows NETINT video transcoder devices to be managed as nodes. This section details the configuration and usage of NETINT video transcoder device with Kubernetes. The document refers to Quadra video transcoder device but can be used for other NETINT video transcoder solutions as well. This section assumes Docker for Quadra is already setup. Please follow Section 4 if Docker has not yet been setup on your environment.

7.1 Pre-requisites for the Quadra Environment on Host

Ensure on the Linux Host the following pre-requisites

1. Quadra libxcoder and FFmpeg source code installed and compiled successfully. In this document FFmpeg 4.2.1 is used for illustration purposes. Please refer to the **Quick Start Guide** to install other versions of libxcoder and FFmpeg.

2. Running **'ffmpeg'** gives an ouput dump similar to the sample below

```
$ ffmpeg
ffmpeg version 4.3.1 Copyright (c)2000-2020 the FFmpeg developers
  built with gcc 9 (Ubuntu 9.3.0-17ubuntu1~20.04)
  configuration: --pkg-config-flags=--static --enable-gpl --enable-nonfree --extra-
ldflags=-lm --extra-ldflags=-ldl --enable-libxcoder --enable-ni --enable-pthreads --extra-
libs=-lpthread --enable-encoders --enable-decoders --enable-avfilter --enable-muxers --
enable-demuxers --enable-parsers --enable-x86asm --disable-debug --disable-ffplay --
enable-ffprobe --enable-libx264 --enable-libx265 --enable-libaom --disable-libvpx --
disable-cuda-nvcc --disable-cuda --disable-cuvid --disable-nvdec --disable-nvenc --
disable-libvmaf --enable-static --disable-shared --extra-cflags=-
UNIENC_MULTI_THREAD
  libavutil      56. 51.100 / 56. 51.100
  libavcodec     58. 91.100 / 58. 91.100
  libavformat    58. 45.100 / 58. 45.100
  libavdevice    58. 10.100 / 58. 10.100
  libavfilter     7. 85.100 /  7. 85.100
  libswscale      5.  7.100 /  5.  7.100
  libswresample   3.  7.100 /  3.  7.100
  libpostproc    55.  7.100 / 55.  7.100
Hyper fast Audio and Video encoder
usage: ffmpeg [options] [[infile options] -i infile]... {[outfile options] outfile}...
Use -h to get full help or, even better, run 'man ffmpeg'
```

3. Running '**sudo nvme list**' displays all installed Quadra NVMe devices.

```
$ sudo nvme list
Node          SN                   Model                                    Namespace Usage
Format        FW Rev
----------------- -------------------- ---------------------------------------- --------- -------------------------- --
----------
/dev/nvme0n1     Q1A10BA11FC060-0124  QuadraT1A                                1         8.59  TB
/   8.59  TB     4 KiB +  0 B   ---00DEV
/dev/nvme1n1     Q1A10BA11FC060-0142  QuadraT1A-EP1                              1         8.59
TB /   8.59  TB     4 KiB +  0 B   ---00DEV
```

4. Running '**ni_rsrc_mon**' or '**sudo ni_rsrc_mon**' provides an output dump similar to the sample below

```
$ ni_rsrc_mon
NI resource init'd already ..
**************************************************
2 devices retrieved from current pool at start up
Mon Jan 31 13:35:40 2022 up 00:00:00 v---00DEV
Num decoders: 2
BEST INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM DEVICE       NAMESPACE
L   0    0   0       0    0   0       /dev/nvme0    /dev/nvme0n1
    1    0   0       0    0   0       /dev/nvme1    /dev/nvme1n1
Num encoders: 2
BEST INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM DEVICE       NAMESPACE
L   0    0   0       0    0   0       /dev/nvme0    /dev/nvme0n1
    1    0   0       0    0   0       /dev/nvme1    /dev/nvme1n1
Num scalers: 2
BEST INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM DEVICE       NAMESPACE
L   0    0   0       0    0   0       /dev/nvme0    /dev/nvme0n1
    1    0   0       0    0   0       /dev/nvme1    /dev/nvme1n1
Num ais: 2
BEST INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM DEVICE       NAMESPACE
L   0    0   0       0    0   0       /dev/nvme0    /dev/nvme0n1
    1    0   0       0    0   0       /dev/nvme1    /dev/nvme1n1
**************************************************
```

7.2 Kubernetes Package Install

Some additional packages are required for Kubernetes to run on the host. Commands below are for an X86 host with Ubuntu 20.

1. Install the kubectl package for kubernetes

```
sudo apt install apt-transport-https curl
curl https://mirrors.aliyun.com/kubernetes/apt/doc/apt-key.gpg | sudo apt-key add -
sudo apt-add-repository "deb http://apt.kubernetes.io/ kubernetes-xenial main"
sudo apt-get install -y kubelet kubeadm kubectl
```

2. Check that the kubelet service is working on the host.

```
systemctl restart kubelet.service
systemctl status kubelet.service

● kubelet.service - kubelet: The Kubernetes Node Agent
   Loaded: loaded (/lib/systemd/system/kubelet.service; enabled; vendor preset:
enabled)
  Drop-In: /etc/systemd/system/kubelet.service.d
           └─10-kubeadm.conf
   Active: active (running) since Tue 2022-04-12 21:02:02 PDT;  22h ago
```

Note: Kubernetes will not work if swap memory is enabled, make sure to disable.

3. Install minikube, a tool that creates a local cluster for kubernetes

```
curl -LO
https://storage.googleapis.com/minikube/releases/latest/minikube_latest_amd64.de
b

sudo dpkg -i minikube_latest_amd64.deb
```

sudo minikube start --vm-driver=none --image-repository=registry.cn-hangzhou.aliyuncs.com/google_containers --extra-config=kubeadm.pod-network-cidr='10.244.0.0/16'

4. After that, run the following to finish the installation.

   mkdir -p $HOME/.kube
   sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
   sudo chown $(id -u):$(id -g) $HOME/.kube/config

5. Your installation should have succeeded, you can now check available nodes with:

   kubectl get nodes
   kubectl get pods -n kube-system

NAME	READY	STATUS	RESTARTS	AGE
coredns-65c54cc984-g9qdr	1/1	Running	60 (22h ago)	34d
etcd-cli406	1/1	Running	68 (22h ago)	34d
kube-apiserver-cli406	1/1	Running	68 (22h ago)	34d
kube-controller-manager-cli406	1/1	Running	69 (22h ago)	34d
kube-proxy-6p4th	1/1	Running	60 (22h ago)	34d
kube-scheduler-cli406	1/1	Running	61 (22h ago)	34d
storage-provisioner	1/1	Running	110 (22h ago)	34d

7.3 Install Packages for Quadra's Kubernetes Plugin

Quadra has a specialized plugin for Kubernetes so it can be used as a pod. This section will install the required packages for the plugin to work.

6. Install the following packages:

   sudo apt install golang-go
   sudo apt install gccgo-go
   sudo apt-get install apt-transport-https --yes
   echo "deb https://baltocdn.com/helm/stable/debian/ all main" | sudo tee /etc/apt/sources.list.d/helm-stable-debian.list
   sudo apt-get update
   sudo apt-get install helm

7.4 Acquire NETINT Kubernetes plugin

7. Download the plugin compilation files from the NETINT's github public repo: https://github.com/NETINT-Technologies/k8_device_plugin

7.5 Activate NETINT plugin

Activate the plugin:

8. Enter the plugin folder and run the following commands:

   cd netint-device-plugin_release
   make buildImage
   make deploy

9. Check available nodes with the following:

   kubectl get pods -n kube-system

```
NAME                                READY   STATUS    RESTARTS
AGE
coredns-65c54cc984-g9qdr            1/1     Running   60 (22h ago)
34d
etcd-cli406                         1/1     Running   68 (22h ago)
34d
kube-apiserver-cli406               1/1     Running   68 (22h ago)
34d
kube-controller-manager-cli406      1/1     Running   69 (22h ago)
34d
kube-proxy-6p4th                    1/1     Running   60 (22h ago)
34d
kube-scheduler-cli406               1/1     Running   61 (22h ago)
34d
netint-qs7ck                        1/1     Running   33 (22h ago)
20d
storage-provisioner                 1/1     Running   110 (22h ago)
34d
```

You should find the netint-#####, pod running with ready 1/1 and status should be running. When you access this pod, you can install all packages required for quadra within the pod through the quadra_setup script and build FFmpeg for quadra within the pod.

After copying quadra_setup over, run it in the pod, it will install all the packages required. Copy over the FFmpeg folder to the pod and build FFmpeg, you will be able to run commands within the pod now.

Now try running '**sudo nvme list**' and '**ni_rsrc_mon**', and you should see something like this :

[root@netint-qs7ck /]# sudo nvme list

```
Node             SN                   Model
Namespace Usage                       Format           FW Rev
---------------- -------------------- ---------------------------------
------- --------- -------------------------- ---------------- --------
/dev/nvme0n1     Q1A10BA11FC060-0124  QuadraT1A
1           8.59  TB /   8.59  TB      4 KiB +  0 B   ---51DEV
/dev/nvme1n1     Q1A10BA11FC060-0142  QuadraT1A-EP1
1           8.59  TB /   8.59  TB      4 KiB +  0 B   ---51DEV

[root@netint-qs7ck /]# ni_rsrc_mon
NI resource init'd already ..
***********************************************
2 devices retrieved from current pool at start up

Thu Apr 14 02:54:11 2022 up 00:00:00 v---51DEV
Num decoders: 2
INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM P2P_MEM DEVICE
NAMESPACE
0     0    0          0    0    0         0     /dev/nvme0 /dev/nvme0n1
1     0    0          0    0    0         0     /dev/nvme1 /dev/nvme1n1
Num encoders: 2
INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM P2P_MEM DEVICE
NAMESPACE
0     0    0          0    0    0         0     /dev/nvme0 /dev/nvme0n1
1     0    0          0    0    0         0     /dev/nvme1 /dev/nvme1n1
Num scalers: 2
INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM P2P_MEM DEVICE
NAMESPACE
0     0    0          0    0    0         0     /dev/nvme0 /dev/nvme0n1
1     0    0          0    0    0         0     /dev/nvme1 /dev/nvme1n1
Num AIs: 2
INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM P2P_MEM DEVICE
NAMESPACE
      0     0    0          0    0    0       0  /dev/nvme0 /dev/nvme0n1
      1     0    0          0    0    0       0  /dev/nvme1 /dev/nvme1n1
```

8 Windows Host

This section explains how to install and use the NETINT video transcoder device on a Windows host.

8.1 Windows Operating System Support

The following Windows operating system versions are supported:

- Windows 10
- Windows 11
- Windows Server 2012
- Windows Server 2016
- Server 2019

8.2 Installing and running FFmpeg using MSYS2

This section describes the Windows MSYS2 environment setup and usage with NETINT video transcoding device.

8.2.1 Operating Systems

A host server with one of the following operating systems installed is recommended (minor versions can be inconsistent):

- OS: Windows 10 [Version 10.0.19042.1052]
- OS: Windows 11 Enterprise [Version 10.0.26100]
- OS: Windows Server 2012 R2 [Version 6.3.9600]
- OS: Windows Server 2016 [Version 10.0.14393.693]
- OS: Windows Server 2019 [Version 10.0.17763.737]

8.2.2 Setup MSYS2 tools on Windows

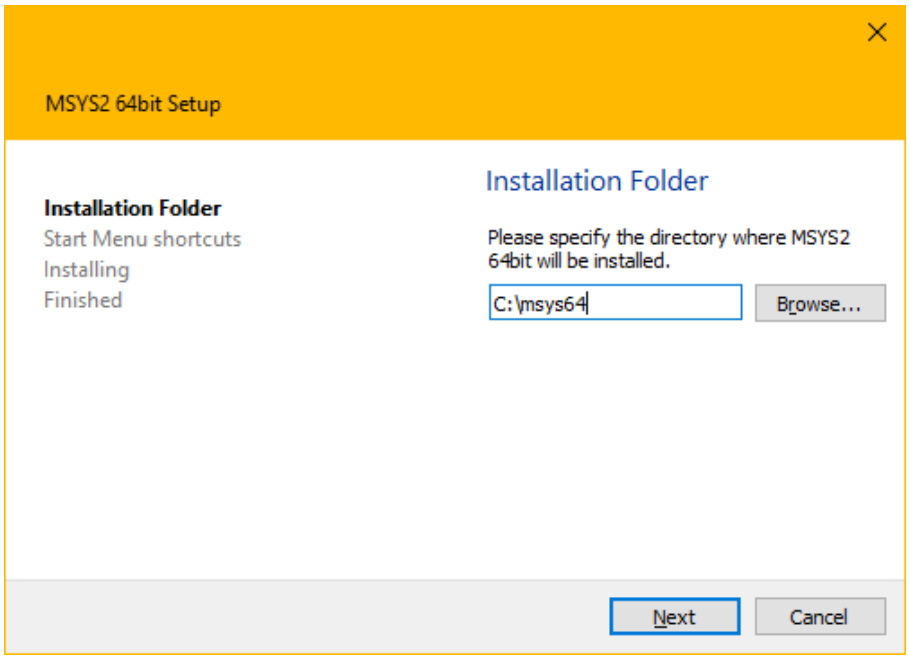
Provide two ways to install the MSYS2 tools package on Windows:

- Online installation
- Offline installation

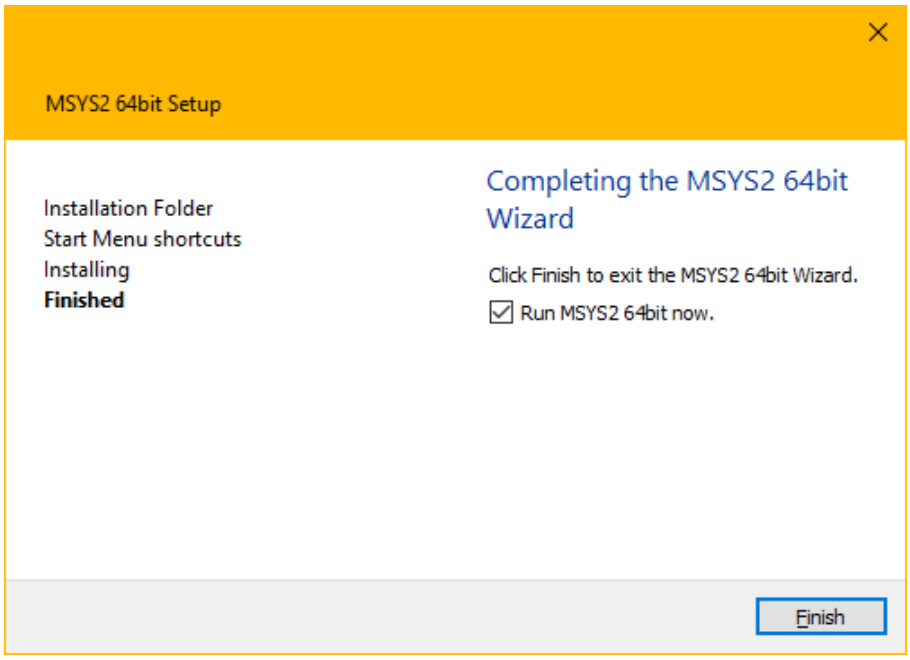
8.2.2.1 Install the MSYS2 - Online

This is a reference to MSYS2. A few additional notes have also been added.

1. Download the latest msys2 installer from https://www.msys2.org/
2. Run the installer. MSYS2 requires 64 bit Windows 7 or newer.
3. Enter your desired Installation Folder (short ASCII-only path on an NTFS volume, no accents, no spaces, no symlinks, no subst or network drives, no FAT).



4. When done, tick Run MSYS2 now



5. Update the package database and base packages. If you miss the step 4 and the Msys2 is not started, go to the installation folder “C:\msys64” and run “***msys2.exe***”. Unless your setup file is very recent, it will take two steps. First run ***pacman -Syu*** (*__Note__: Select **Y** at the end):

```
$ pacman -Syu
:: Synchronizing package databases...
 mingw32                 805.0 KiB
 mingw32.sig               438.0   B
 mingw64                 807.9 KiB
 mingw64.sig               438.0   B
 msys                    289.3 KiB
 msys.sig                  438.0   B
:: Starting core system upgrade...
warning: terminate other MSYS2 programs before proceeding
resolving dependencies...
looking for conflicting packages...

Packages (6) bash-5.1.004-1  filesystem-2021.01-1
             mintty-1~3.4.4-1  msys2-runtime-3.1.7-4
             pacman-5.2.2-9  pacman-mirrors-20201208-1

Total Download Size:   11.05 MiB
Total Installed Size:  53.92 MiB
Net Upgrade Size:      -1.24 MiB

:: Proceed with installation? [Y/n]
:: Retrieving packages...
 bash-5.1.004-1-x86_64          2.3 MiB
 filesystem-2021.01-1-any       33.2 KiB
 mintty-1~3.4.4-1-x86_64       767.2 KiB
 msys2-runtime-3.1.7-4-x86_64    2.6 MiB
 pacman-mirrors-20201208-1-any   3.8 KiB
 pacman-5.2.2-9-x86_64          5.4 MiB
```

(6/6) checking keys in keyring 100%
(6/6) checking package integrity 100%
(6/6) loading package files 100%
(6/6) checking for file conflicts 100%
(6/6) checking available disk space 100%
:: Processing package changes...
(1/6) upgrading bash 100%
(2/6) upgrading filesystem 100%
(3/6) upgrading mintty 100%
(4/6) upgrading msys2-runtime 100%
(5/6) upgrading pacman-mirrors 100%
(6/6) upgrading pacman 100%
:: To complete this update all MSYS2 processes including this terminal will be closed. Confirm to proceed [Y/n]

6. Go to the installation folder “C:\msys64” and run “***msys2.exe***”. Update the rest of the base packages with ***pacman -Su*** (*__Note__: Select **Y** at the end):

$ pacman -Su
:: Starting core system upgrade...
there is nothing to do
:: Starting full system upgrade...
resolving dependencies...
looking for conflicting packages...

Packages (20) base-2020.12-1 bsdtar-3.5.0-1
[... more packages listed ...]

Total Download Size: 12.82 MiB
Total Installed Size: 44.25 MiB
Net Upgrade Size: 3.01 MiB

:: Proceed with installation? [Y/n]
[... downloading and installation continues ...]

7. Now MSYS2 is ready. You need to install some essential tools to compile libxcoder and ffmpeg. Below are the commands to install the tools, select the default option **Y** if asked to confirm installation :

   $ pacman -S gcc

   $ pacman -S mingw-w64-x86_64-toolchain

   [NOTE: If multiple choices are given for the above, then select the default option **all]**

   $ pacman -S base-devel

   $ pacman -S nasm

   $ pacman -S mingw-w64-x86_64-SDL2

   $ pacman -S git

   $ pacman -S xz

8. To start building using the mingw-w64 GCC, go to the installation folder "C:\msys64" and run "***mingw64.exe***". Now the tool is ready to build ffmpeg for Windows.

Note – Refer Appendix-A to update Windows environment variables PATH to include MSYS2 environment. This will help access MSYS2 linux commands from Windows Command Terminal window as well.

8.2.2.2 Install the MSYS2 – Offline

Skip these steps if you have already run steps in Section 2.1.

1. Get the offline installation package “msys64.zip” from NETINT Support team.
2. Unzip the msys64.zip to the C: folder. The essential tools have already been installed in this package.
3. To start building using the mingw-w64 GCC, go to the installation folder “C:\msys64” and run “***mingw64.exe***”.

Note 1 – This offline zip package comes with home folder C:\msys64\home\Administrator.

Note 2 – This offline zip package comes with a ffmpeg tar file base_ffmpeg_n4.2.1.tar.gz. If following the offline Section 2.2, you will untar this file in the steps for Section 3.2. File can be found in C:\msys64\home\Administrator folder.

8.2.3 Compile Libxcoder and FFmpeg

8.2.3.1 Overview

In order to use NETINT Quadra encoding and decoding features using FFmpeg, the user needs the following minimum steps:

1. Clone an FFmpeg Repository
2. Get a Quadra Release Package with libxcoder and patch files
3. Patch the FFmpeg installation
4. Compile libxcoder
5. Compile FFmpeg
6. Locate and run init_rsrc.exe in a command window
7. Run the FFmpeg command in a second command window

Full instructions are given below.

Note that there is a compatibility issue between FFmpeg 4.3.x's doc generator and texinfo v7.2-1 tool in the latest MSYS2. Use command "**`pacman -Q texinfo`**" to check the version of textinfo tool. To solve this, please downgrade the version of the textinfo tool with the following command.

$ pacman -U https://repo.msys2.org/msys/x86_64/texinfo-7.1-1-x86_64.pkg.tar.zst

8.2.3.2 Download the FFmpeg Repository

Start an MSYS2 Mingw64 terminal. There are two methods for installing FFmpeg. The first is to clone the repository from GitHub, and the second is to download and install a tarball from the FFmpeg website.

Sourcing FFmpeg from GitHub

To clone the FFmpeg repository from GitHub, you need to specify the correct FFmpeg version. Once example is FFmpeg version 4.3.1. Using the Mingw64 command line, run the following

```
cd C:
cd msys64/home/nvme
git clone -b n4.3.1 --depth=1 https://github.com/FFmpeg/FFmpeg.git FFmpeg
```

Note – the example below assumes the username '**nvme**', which means the home folder is C:/msys64/home/nvme. Replace '**nvme**' with the correct username on your PC. Check the correct subfolder name in the folder **C:/msys64/home**

Other valid options for '**git clone -b'** are other versions of FFMpeg for example n4.2.4, n4.3.2, and n4.4

Sourcing FFmpeg from the official FFmpeg Website

Alternatively, to install FFmpeg from the official website follow these steps.

Use the 'Download xz tarball' from the official FFmpeg website

https://ffmpeg.org/download.html#releases

Move the file to the C:/msys64/home/nvme directory, then execute the following steps.

```
cd C:
cd msys64/home/nvme
xz -d ffmpeg-4.3.1.tar.xz
tar -xvf ffmpeg-4.3.1.tar
mv ffmpeg-4.3.1 FFmpeg
```

Note that FFMpeg release 4.3.1 is used in the example above.

Sourcing FFmpeg from the offline pre-packaged ffmpeg tar file

If you followed the offline steps in Section 2.2 then you can also find a downloaded FFmpeg package "base_ffmpeg_n4.2.1.tar.gz" in the offline package folder

C:\msys64\home\Administrator

Run the following command to untar this tar file

```
tar -zxf base_ffmpeg_n4.3.1.tar.gz
```

8.2.3.3 Download Quadra Release Package

Contact the NETINT Support team to obtain the latest Quadra release package. The release package will contain a zip file entitled ‘Quadra_V*.*.*.zip’.

Where, *.*.* is the software release version=, for example 5.0.0 would be the file

Quadra_V5.0.0.zip

8.2.3.4 Apply Patch to FFmpeg Repository

The following instructions need to be followed in sequence to prepare FFmpeg for use with the NETINT Quadra Video Transcoder.

1. Unzip the Codensity Quadra Software Release package to the $HOME folder:

   cd C:
   cd msys64/home/nvme
   unzip Quadra_V5.0.0.zip

2. Copy the *libxcoder/* folder from the uncompressed release package to the parent folder of FFmpeg (i.e. same level as FFmpeg):

   cp -r Quadra_V5.0.0/libxcoder ./

3. Copy the FFmpeg patch file from the release package to the *FFmpeg* folder:
   Note – this example is for patching a FFmpeg 4.3.x release.

   cp Quadra_V5.0.0/Quadra_SW_V5.0.0_RC2/FFmpeg-n4.3.1_netint_v5.0.0_RC2.diff $HOME/FFmpeg

4. Change directories to the *FFmpeg/* folder:

   cd C:
   cd msys64/home/nvme
   cd FFmpeg

5. Apply the patch depending on the FFmpeg <version> (ex. 3.1.1, 3.4.2, 4.1.3, 4.2.1, 4.3.1):

   patch -t -p 1 < FFmpeg-n4.3.1_netint_v5.0.0_RC2.diff

It is critical to apply the correct NETINT patch for the FFmpeg version in use. Check with NETINT Support team for the patch to use. In general, patch file FFmpeg-**n4.2.x**_netint will work with all FFmpeg 4.2 versions, patch file FFmpeg-n4.3.x_netint will work with all FFmpeg 4.3 versions, and so on.

8.2.3.5 Build FFmpeg with NETINT Codec Library

The following instructions need to be done in sequence to build FFmpeg with the NETINT Codec Library.

1 From the *FFmpeg/* folder, go to the *libxcoder/* folder with the following command:

cd C:
cd msys64/home/nvme
cd FFmpeg
cd ../libxcoder

2 Build and install libxcoder with the following commands. Upon a successful compile the files are auto installed to /usr/local/bin folder.

$ bash build.sh -w
$ ls /usr/local/bin
init_rsrc.exe ni_rsrc_list.exe ni_rsrc_mon.exe ni_rsrc_update.exe

3. Update pkg-config path:

export PKG_CONFIG_PATH=/usr/local/lib/pkgconfig:$PKG_CONFIG_PATH

4. Go to the *FFmpeg/* directory with the following command:

cd ../FFmpeg

5. Run the build_FFmpeg.sh script with the following commands. When successfully built, the executables (.EXE) and libraries can be found in the ***/usr/local/bin*** and ***/usr/local/lib*** folders:

make clean
bash build_FFmpeg.sh -w
make install

6. Some related libraries are compiled dynamically, so the following libraries “libiconv-2.dll, libwinpthread-1.dll, SDL2.dll, zlib1.dll” need to be copied from

   C:/msys64/mingw64/bin to C:/msys64/usr/local/bin

   In a MSYS2 or Mingw64 terminal window run the following commands to confirm the folder contents:

   $ ls /usr/local/bin
   SDL2.dll init_rsrc.exe libwinpthread-1.dll ni_rsrc_mon.exe zlib1.dll ffmpeg.exe
   libiconv-2.dll ni_rsrc_list.exe ni_rsrc_update.exe

   $ ls /usr/local/lib/*
   /usr/local/lib/libavcodec.a /usr/local/lib/libpostproc.a
   /usr/local/lib/libavdevice.a /usr/local/lib/libswresample.a
   /usr/local/lib/libavfilter.a /usr/local/lib/libswscale.a
   /usr/local/lib/libavformat.a /usr/local/lib/libxcoder.a
   /usr/local/lib/libavutil.a

   $ ls /usr/local/lib/pkgconfig
   libavcodec.pc libavfilter.pc libavutil.pc libswresample.pc xcoder.pc
   libavdevice.pc libavformat.pc libpostproc.pc libswscale.pc

This completes the installation steps in prep to start using Quadra card on your Windows host.

8.2.3.6 Building FFmpeg with Libxcoder for Quadra and Logan

The Chapter Quadra and Logan Co-existence in this document describes the feature compatibility between Quadra and Logan. Follow the instructions below in sequence to build FFmpeg with the NETINT Codec Library.

1. From the *FFmpeg/* folder, go to the *libxcoder/* folder with the following command:

   cd C:
   cd msys64/home/nvme
   cd FFmpeg
   cd ../libxcoder

2. Build and install libxcoder with the following commands. Upon successful compilation the files are auto-installed into the **/usr/local/bin** folder.

   $ bash build.sh -w
   $ ls /usr/local/bin
   init_rsrc.exe ni_rsrc_list.exe ni_rsrc_mon.exe ni_rsrc_update.exe
   ni_rsrc_namespace.exe test_rsrc_api.exe

3. From the *FFmpeg/* folder, go to the *libxcoder_logan/* folder with the following command:

   cd C:
   cd msys64/home/nvme
   cd FFmpeg
   cd ../libxcoder_logan

4. Build and install libxcoder_logan with the following commands. Upon a successful compile the files are auto installed to /usr/local/bin folder.

   $ bash build.sh -w
   $ ls /usr/local/bin
   init_rsrc_logan.exe ni_logan_rsrc_list.exe ni_logan_rsrc_mon.exe
   ni_logan_rsrc_update.exe test_rsrc_api_logan.exe

5. Update pkg-config path:

   export PKG_CONFIG_PATH=/usr/local/lib/pkgconfig:$PKG_CONFIG_PATH

6. Go to the *FFmpeg/* directory with the following command:

   cd ../FFmpeg

7. Run the build_FFmpeg.sh script with the following commands. When building successfully, the EXEs and libraries can be found in */usr/local/bin* and */usr/local/lib* folders:

   make clean
   bash build_FFmpeg.sh -w –-quadra --logan
   make install

8. Some related libraries are compiled dynamically, so the following libraries “libiconv-2.dll, libwinpthread-1.dll, SDL2.dll, zlib1.dll” need to be copied from C:/msys64/mingw64/bin to C:/msys64/usr/local/bin
   In a MSYS2 or Mingw64 terminal window run the following commands to confirm the folder contents:

   $ ls /usr/local/bin
   SDL2.dll init_rsrc.exe libwinpthread-1.dll ni_rsrc_mon.exe zlib1.dll ffmpeg.exe
   libiconv-2.dll ni_rsrc_list.exe ni_rsrc_update.exe init_rsrc_logan.exe
   ni_logan_rsrc_mon.exe ni_logan_rsrc_list.exe ni_logan_rsrc_update.exe
   test_rsrc_api_logan.exe test_rsrc_api.exe

   $ ls /usr/local/lib/*
   /usr/local/lib/libavcodec.a /usr/local/lib/libpostproc.a
   /usr/local/lib/libavdevice.a /usr/local/lib/libswresample.a
   /usr/local/lib/libavfilter.a /usr/local/lib/libswscale.a
   /usr/local/lib/libavformat.a /usr/local/lib/libxcoder.a
   /usr/local/lib/libavutil.a /usr/local/lib/libxcoder_logan.a
   $ ls /usr/local/lib/pkgconfig
   libavcodec.pc libavfilter.pc libavutil.pc libswresample.pc xcoder.pc
   xcoder_logan.pc
   libavdevice.pc libavformat.pc libpostproc.pc libswscale.pc

This completes the installation steps in prep to start using Quadra and Logan cards on your Windows host.

8.2.4 Run FFmpeg with Quadra Cards

After a successful compilation, we can test with Quadra cards.

1. Check Hardware.
   With administrator privileges, open a Windows command terminal. Check the Quadra card presence with the following command:
   $ wmic diskdrive get Name,SerialNumber,Model,Size

```
C:\>wmic diskdrive get Name,SerialNumber,Model,Size
Model                   Name                SerialNumber                        Size
QuadraT1A-EP1           \\.\PHYSICALDRIVE1  Q1A10BA11FC060-0048 _00000001.  4294912204800
WDC  WDS250G2B0A-00SM50 \\.\PHYSICALDRIVE0  212024806551                      250056737280
```

2. Initialize Quadra
   With administrator privileges, open a **Windows command terminal**. Go to C:/msys64/usr/local/bin folder. Initialize the Quadra with the following command (*Note: this process must keep running during transcoding).

   cd C:/msys64/usr/local/bin

   init_rsrc.exe

```
Microsoft Windows [Version 10.0.19042.1466]
(c) Microsoft Corporation. All rights reserved.

C:\Windows\system32>init_rsrc
NETINT resources not initialized, starting initialization ..
Searching for NETINT NVMe devices ...

Total Number of NETINT NVMe Transcoders indentified: 1

decoder h/w id 0 create
Creating shm_name: shm_d0
CreateFileMapping created a new mapFile for shm_d0, handle: 00000000000000e4  ..
encoder h/w id 1 create
Creating shm_name: shm_e0
CreateFileMapping created a new mapFile for shm_e0, handle: 00000000000000e8  ..
scaler h/w id 2 create
Creating shm_name: shm_s0
CreateFileMapping created a new mapFile for shm_s0, handle: 00000000000000ec  ..
ai h/w id 3 create
Creating shm_name: shm_a0
CreateFileMapping created a new mapFile for shm_a0, handle: 00000000000000f0  ..
NETINT Resources Intitialized Successfully
```

3. Run FFmpeg

   With administrator privileges, open a **Windows command terminal**. Change to the *C:/msys64/usr/local/bin* folder. Run the following commands with ffmpeg.exe to perform transcoding.

   The following examples use the clips folder *C:/msys64/home/nvme/libxcoder/test*. Update this path if you wish to run custom clips for decoding or encoding.

   cd C:/msys64/usr/local/bin
   ffmpeg.exe

   - test h264 decoder:

     $ ffmpeg.exe -y -hide_banner -nostdin -vsync 0 -c:v h264_ni_quadra_dec -i C:/msys64/home/nvme/libxcoder/test/1280x720p_Basketball.264 -c:v rawvideo output_5.yuv

   - test h265 decoder:

     $ ffmpeg.exe -y -hide_banner -nostdin -vsync 0 -c:v h265_ni_quadra_dec -i C:/msys64/home/nvme/libxcoder/test/akiyo_352x288p25.265 -c:v rawvideo akiyo_352x288p25.yuv

   - test h264 encoder:

     $ ffmpeg.exe -y -hide_banner -nostdin -f rawvideo -pix_fmt yuv420p -s:v 352x288 -r 25 -i C:/msys64/home/nvme/libxcoder/test/akiyo_352x288p25.yuv -c:v h264_ni_quadra_enc output_7.h264

   - test h265 encoder:

     $ ffmpeg.exe -y -hide_banner -nostdin -f rawvideo -pix_fmt yuv420p -s:v 352x288 -r 25 -i C:/msys64/home/nvme/libxcoder/test/akiyo_352x288p25.yuv -c:v h265_ni_quadra_enc output_8.h265

- test 264->265 transcoder:

  $ ffmpeg.exe -y -hide_banner -nostdin -vsync 0 -c:v h264_ni_quadra_dec -i C:/msys64/home/nvme/libxcoder/test/1280x720p_Basketball.264 -c:v h265_ni_quadra_enc output_9.h265

Note: On Windows, params must be enclosed with double quotation marks. For example:

-xcoder-params “out=hw”

4. Monitoring Load

Open a **Windows command terminal with administrator privileges** and change to directory

C:/msys64/usr/local/bin

Run the following command:

ni_rsrc_mon.exe

```
C:\msys64\home>ni_rsrc_mon
NETINT resources have been initialized already, exiting ..
************************************************
1 devices retrieved from current pool at start up
Searching for NETINT NVMe devices ...

Total Number of NETINT NVMe Transcoders indentified: 1

02/17/22 19:14:28 up 00:00:00 v---20DEV
Num decoders: 1
INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM DEVICE         NAMESPACE
0     0    0          0    0    0         \\.\PHYSICALDRIVE2 \\.\PHYSICALDRIVE2
Num encoders: 1
INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM DEVICE         NAMESPACE
0     0    0          0    0    0         \\.\PHYSICALDRIVE2 \\.\PHYSICALDRIVE2
Num scalers: 1
INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM DEVICE         NAMESPACE
0     0    0          0    0    0         \\.\PHYSICALDRIVE2 \\.\PHYSICALDRIVE2
Num ais: 1
INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM DEVICE         NAMESPACE
0     0    0          0    0    0         \\.\PHYSICALDRIVE2 \\.\PHYSICALDRIVE2
************************************************
```

Reporting columns

INDEX	**Resource identifier used by the resource manager**
LOAD	**Realtime load**
MODEL_LOAD	**Estimated load, based on framerate and resolution**
INST	**Number of job instances**
DEVICE	**Path to NVMe device file handle**
NAMESPACE	**Path to NVMe namespace file handle**

8.2.5 Run FFmpeg with Quadra and Logan Co-existence Cards

After a successful compilation, we can test Quadra and Logan co-existence cards.

1. Check Hardware

   With administrator privileges, open a Windows command terminal. Check the Quadra and Logan card presence with the following command:

   $ wmic diskdrive get Name,SerialNumber,Model,Size

```
C:\Windows\System32\wbem>wmic diskdrive get Name,SerialNumber,Model,Size
Model                  Name                SerialNumber          Size
KINGSTON SA400S37240G  \\.\PHYSICALDRIVE0  50026B7380A743B8      240054796800
QuadraT1A-EP1          \\.\PHYSICALDRIVE2  Q1A10BA11FC060-0131   8589890211840
T408-U2                \\.\PHYSICALDRIVE1  TU05-08-02-C10-0972   536864025600
```

2. Initialize Quadra

   With administrator privileges, open a **Windows command terminal**. Go to C:/msys64/usr/local/bin folder. Initialize the Quadra with the following command (*Note: this process must keep running during transcoding).

   cd C:/msys64/usr/local/bin
   init_rsrc.exe

```
c:\build_mingw>init_rsrc.exe
NETINT resources not initialized, starting initialization ..
Searching for NETINT NVMe devices ...

Total Number of NETINT NVMe Transcoders identified: 1

Found NVME Controller at \\.\PHYSICALDRIVE2
WARNING - Query \\.\PHYSICALDRIVE2 FW version: ---6IDEV is below the minimum support version for this SW version. Some f
eatures may be missing.
decoder h/w id 0 create
ni_rsrc_fill_device_info type 0 fmt 0
Creating shm_name: NI_shm_d0
CreateFileMapping created a new mapFile for NI_shm_d0, handle: 00000000000000ec  ..
encoder h/w id 1 create
ni_rsrc_fill_device_info type 1 fmt 0
Creating shm_name: NI_shm_e0
CreateFileMapping created a new mapFile for NI_shm_e0, handle: 00000000000000f0  ..
scaler h/w id 2 create
ni_rsrc_fill_device_info type 2 fmt 0
Creating shm_name: NI_shm_s0
CreateFileMapping created a new mapFile for NI_shm_s0, handle: 00000000000000f4  ..
AI h/w id 3 create
ni_rsrc_fill_device_info type 3 fmt 0
Creating shm_name: NI_shm_a0
CreateFileMapping created a new mapFile for NI_shm_a0, handle: 00000000000000f8  ..
NETINT Resources Intitialized Successfully
```

3. Initialize Logan

   With administrator privileges, open a **Windows command terminal**. Go to C:/msys64/usr/local/bin folder. Initialize the Quadra with the following command (*Note: this process must keep running during transcoding).

   cd C:/msys64/usr/local/bin
   init_rsrc_logan.exe

```
c:\build_vs2019>init_rsrc_logan.exe
NETINT resources not initialized, starting initialization ..
Searching for NETINT NVMe devices ...

Identity information retrieved from the device at port \\.\PHYSICALDRIVE0
    VID:            0x7423
    SSVID:          0x2062
Device at port \\.\PHYSICALDRIVE0 is not a NETINT NVMe device
Identity information retrieved from the device at port \\.\PHYSICALDRIVE1
    VID:            0x1d82
    SSVID:          0x1d82
    Device Model:   T408-U2
    Firmware Rev:   310X2013
    Serial Number: TU05-08-02-C10-0972
NETINT T408-U2 NVMe video transcoder identified at port \\.\PHYSICALDRIVE1

Identity information retrieved from the device at port \\.\PHYSICALDRIVE2
    VID:            0x0
    SSVID:          0x0
Device at port \\.\PHYSICALDRIVE2 is not a NETINT NVMe device
Total Number of NETINT NVMe Transcoders indentified: 1

decoder h/w id 0 create
Creating shm_name: NI_LOGAN_shm_d0
CreateFileMapping created a new mapFile for NI_LOGAN_shm_d0, handle: 0000000000000108  ..
decoder h/w id 0 update
encoder h/w id 1 create
Creating shm_name: NI_LOGAN_shm_e0
CreateFileMapping created a new mapFile for NI_LOGAN_shm_e0, handle: 0000000000000110  ..
encoder h/w id 1 update
NETINT Logan Resources Intitialized Successfully
```

4. Run FFmpeg

   With administrator privileges, open a **Windows command terminal**. Go to your *C:/msys64/usr/local/bin folder*. Run the FFmpeg commands to do the transcoding just as mentioned in Chapter 8.2.4.

5. Monitoring Load

   With administrator privileges, open a **Windows command terminal**. Go to your *C:/msys64/usr/local/bin* folder. Run the following command:

   ni_rsrc_mon.exe or ni_logan_rsrc_mon.exe

```
c:\build_vs2019>ni_rsrc_mon.exe
NETINT resources have been initialized already, exiting ..
**************************************************
1 devices retrieved from current pool at start up
Searching for NETINT NVMe devices ...

Total Number of NETINT NVMe Transcoders identified: 1

Mon Mar 20 15:04:43 2023 up 00:00:00 v---6HDEV
Num decoders: 1
INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM P2P_MEM DEVICE         NAMESPACE
Found NVME Controller at \\.\PHYSICALDRIVE2
0     0    0          0    0    0         0       \\.\PHYSICALDRIVE2 \\.\PHYSICALDRIVE2
Num encoders: 1
INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM P2P_MEM DEVICE         NAMESPACE
Found NVME Controller at \\.\PHYSICALDRIVE2
0     0    0          0    0    0         0       \\.\PHYSICALDRIVE2 \\.\PHYSICALDRIVE2
Num scalers: 1
INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM P2P_MEM DEVICE         NAMESPACE
Found NVME Controller at \\.\PHYSICALDRIVE2
0     0    0          0    0    0         0       \\.\PHYSICALDRIVE2 \\.\PHYSICALDRIVE2
Num AIs: 1
INDEX LOAD MODEL_LOAD INST MEM  SHARE_MEM P2P_MEM DEVICE         NAMESPACE
Found NVME Controller at \\.\PHYSICALDRIVE2
0     0    0          0    0    0         0       \\.\PHYSICALDRIVE2 \\.\PHYSICALDRIVE2
**************************************************
```

```
c:\build_vs2019>ni_rsrc_mon_logan.exe
NETINT resources have been initialized already, exiting ..
**************************************************
1 devices retrieved from current pool at start up
Searching for NETINT NVMe devices ...

Identity information retrieved from the device at port \\.\PHYSICALDRIVE0
    VID:           0x7423
    SSVID:         0x2062
Device at port \\.\PHYSICALDRIVE0 is not a NETINT NVMe device
Identity information retrieved from the device at port \\.\PHYSICALDRIVE1
    VID:           0x1d82
    SSVID:         0x1d82
    Device Model:  T408-U2
    Firmware Rev:  310X2013
    Serial Number: TU05-08-02-C10-0972
NETINT T408-U2 NVMe video transcoder identified at port \\.\PHYSICALDRIVE1

Identity information retrieved from the device at port \\.\PHYSICALDRIVE2
    VID:           0x0
    SSVID:         0x0
Device at port \\.\PHYSICALDRIVE2 is not a NETINT NVMe device
Total Number of NETINT NVMe Transcoders indentified: 1

Mon Mar 27 10:46:54 2023 up 00:00:00 v320R2013
Num decoders: 1
BEST INDEX LOAD MODEL_LOAD MEM  INST DEVICE         NAMESPACE
L    0     0    0          0    0    \\.\PHYSICALDRIVE1 \\.\PHYSICALDRIVE1
Num encoders: 1
BEST INDEX LOAD MODEL_LOAD MEM  INST DEVICE         NAMESPACE
L    0     0    0          0    0    \\.\PHYSICALDRIVE1 \\.\PHYSICALDRIVE1
**************************************************
```

Reporting columns

INDEX **number used by resource manager to identify the resource**

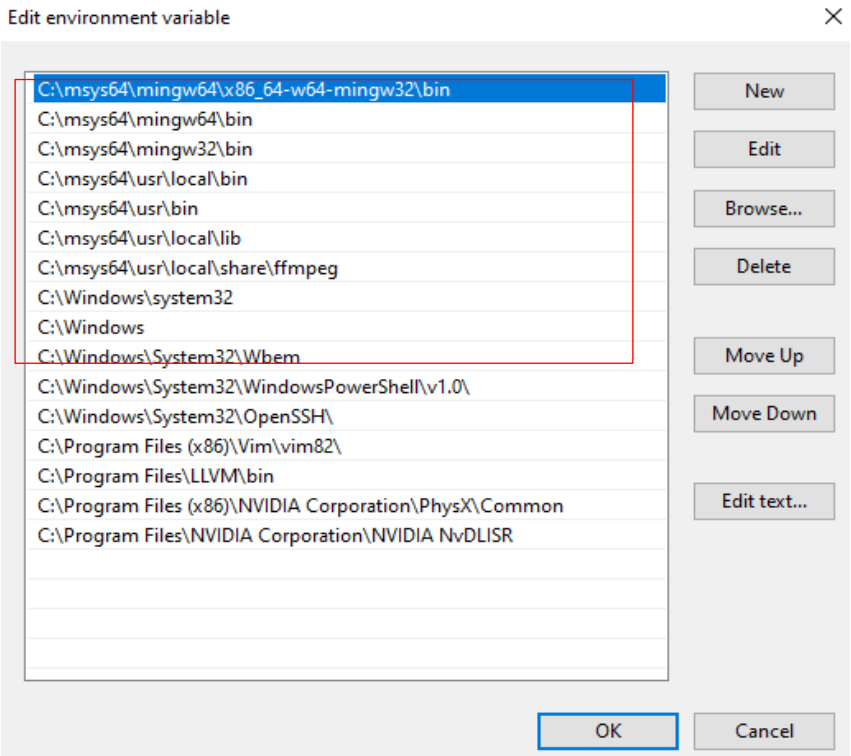
LOAD **realtime load**

MODEL_LOAD	**estimated load based on framerate and resolution**
INST	**number of job instances**
DEVICE	**path to NVMe device file handle**
NAMESPACE	**path to NVMe namespace file handle**

8.2.6 Sourcing MSYS2 environment from Windows Environment Variables

This section is optional. Proceed with the step below to add msys paths to the $PATH on windows.

In Windows 'Control Panel → System → Advanced System Settings → System Properties → Environment Variables… → System Variables → Path → Edit' you can add new environment variables for C:\msys64 as per sample picture below. Use the 'Move Up' button to prioritize the C:\msys64 paths over C:\Windows paths.



This will configure MSYS2 linux type commands from the Windows Command Terminal. Once the above is configured, open a new Windows Command Terminal and test the commands:

which bash
which sh
which ffmpeg.exe
which init_rsrc.exe

8.3 Compiling libxcoder and FFmpeg using Visual Studio 2019

This section describes the Windows VS2019 environment setup, with steps to compile the libxcoder and FFmpeg using VS2019.

8.3.1 Platform and Configuration

8.3.1.1 Configuration of VS2019 project

Debug	Release	DebugDLL	ReleaseDLL
Generates LIB or EXE without optimization	Generates LIB or EXE with optimization	Generates DLL or EXE without optimization	Generates DLL or EXE with optimization

8.3.1.2 Supported Platform and Configuration

Object:	Configuration	Debug		Release		DebugDLL		ReleaseDLL	
	Platform	X86	X64	X86	X64	X86	X64	X86	X64
libxcoder		✓	✓	✓	✓	✓	✓	✓	✓
ffmpeg					✓				✓

8.3.2 Setup VS2019 environment

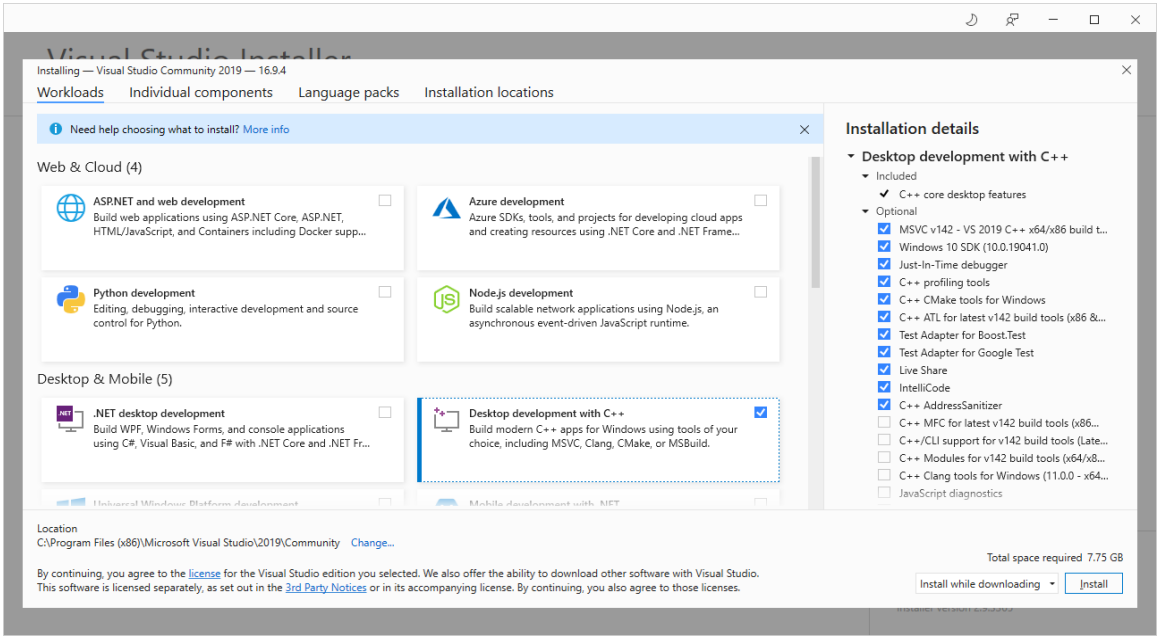
8.3.2.1 Online Setup of VS2019

1. Download the VS2019 installation from

   https://visualstudio.microsoft.com/

2. Install VS2019, selecting the **Desktop development with C++**

3. Install the plug-in **Microsoft Visual Studio Installer Projects** from the **Visual Studio Marketplace**



8.3.2.2 Offline Setup of VS2019

If the target server does not have internet access, then an off-line environment is required. Follow this section for instructions on how to build a compilation environment in an offline environment.

1. Obtain the VS2019 off-line installation package from NETINT. We provide both English and Chinese VS2019 off-line packages. If required request this from your NETINT representative.

2. Unzip the VS2019 package and run the following, select the default options

   vs_setup.exe

3. We can also provide the installer projects plug-in package. Run the package installer

   InstallerProjects.vsix

8.3.3 Compile the Libxcoder and FFmpeg for Quadra/Logan Project

8.3.3.1 Preparation

These two separate solutions can be compiled together using a batch script that calls **devenv.exe** rather than using the VS IDE. However if preferred, the IDE can be used instead by loading and building the VS solution file (**.sln**). Manually copy the intermediate and output files the same way the batch script does.

The compilation of FFmpeg v4.3.1 is shown as an example below.

1. From the release package folder

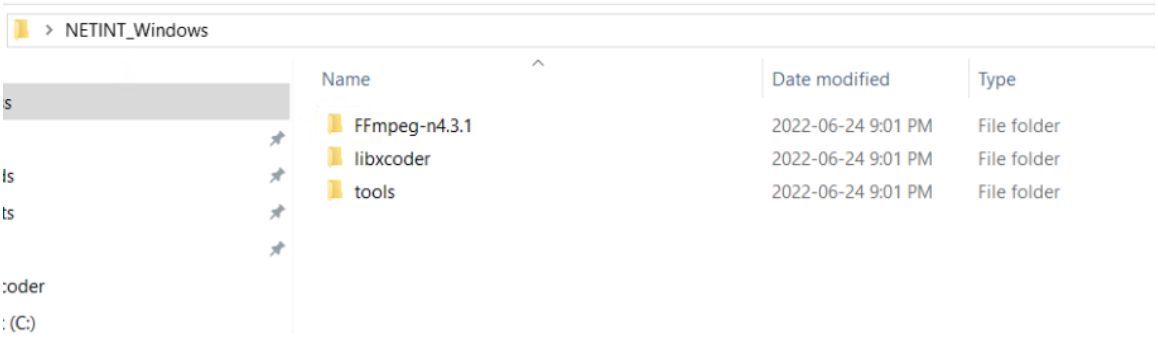
   Quadra_SW_v3.0.0

   Copy the following two folders into a new folder, in this example the folder named **NETINT_Windows** is used

   libxcoder
   tools

2. Clone **FFmpeg-n4.3.1** from git

   git clone -b n4.3.1 --depth=1 https://github.com/FFmpeg/FFmpeg.git FFmpeg-n4.3.1



3. From the following folder

   Quadra_SW_V3.1.1_EN3

   copy the patch file below

   FFmpeg-n4.3.1_netint_v3.1.1_EN3.diff

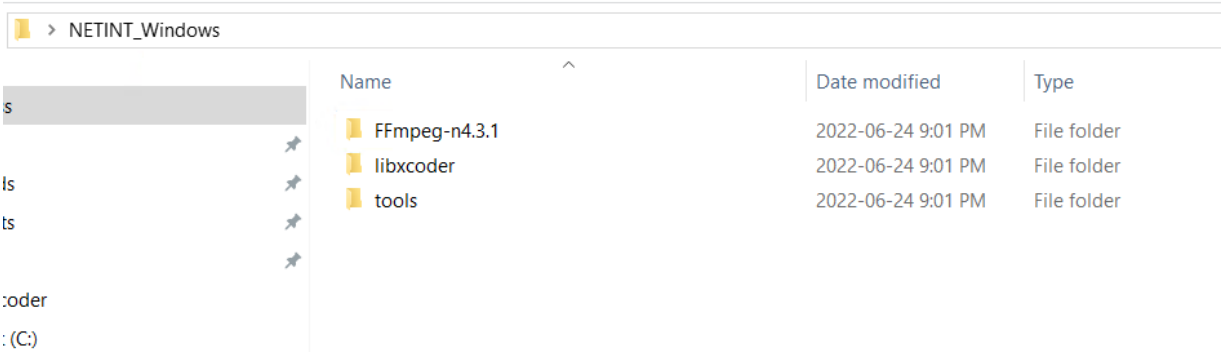
   to the **FFmpeg-n4.3.1** folder created in Step 2 by the git clone command

4. Change directory to

   FFmpeg-n4.3.1

5. Apply the patch with the following command

   patch -p 1 -t -i FFmpeg-n4.3.1_netint_v3.1.1_EN3.diff



8.3.3.2 Compiling Libxcoder and FFmpeg for Quadra or ReleaseDLL

This process is simple with only three steps required

1. Change directory into **tools\MSVS2019\quadra**.

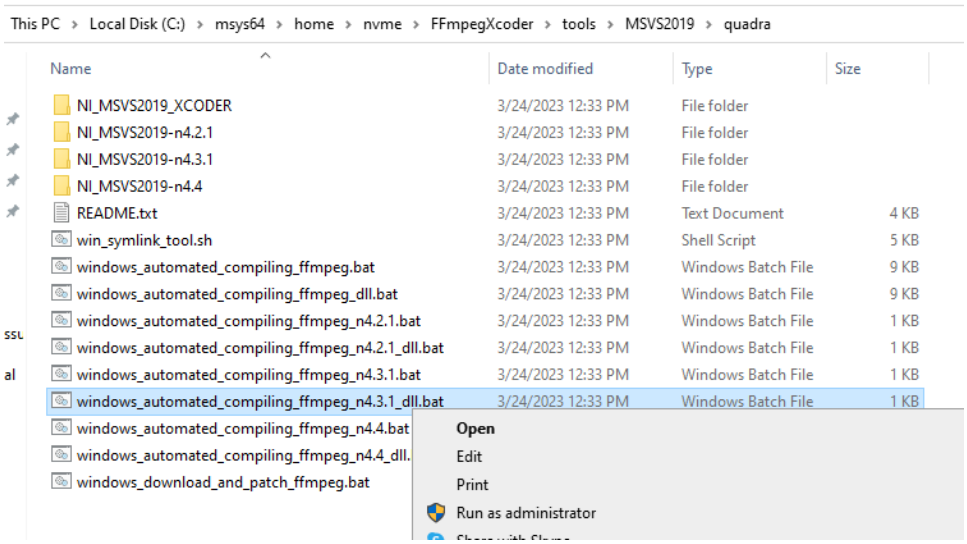
2. Run one of the following batch files **as admin** to build either the libxcoder and FFmpeg Release, or the ReleaseDLL

   windows_automated_compiling_ffmpeg_n4.3.1.bat → for Release build

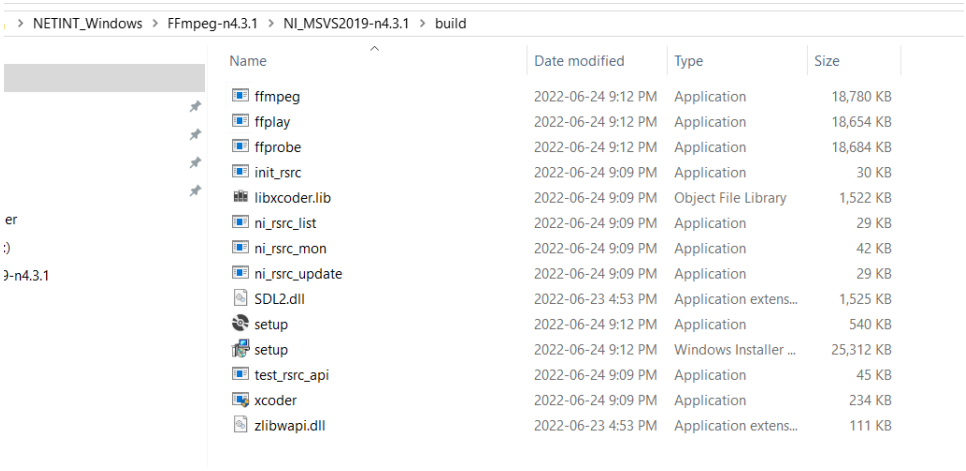
   windows_automated_compiling_ffmpeg_n4.3.1_dll.bat → for ReleaseDLL

3. **Note** – Ensure the following extension is installed on the host before running the batch files

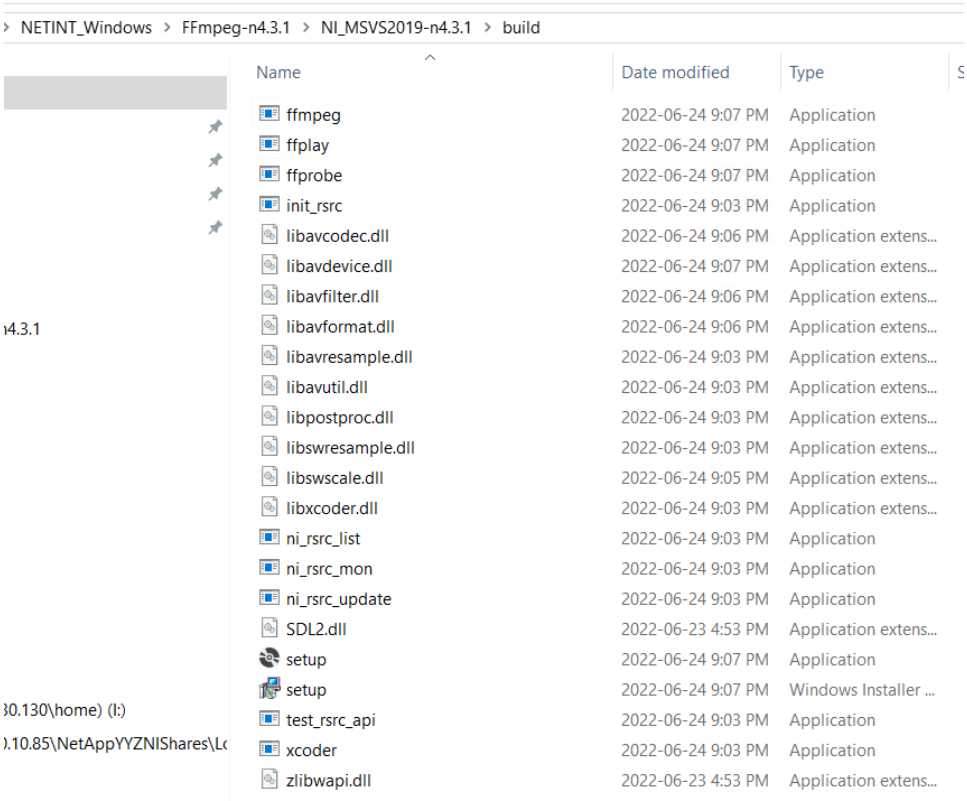
   VS2019 --> Extensions --> Manage Extensions --> Microsoft Visual Studio Installer Projects



4. If the user runs the Release batch files, the output build executable and setup files are found in the build directory.



5. If the user runs the ReleaseDLL batch files, the contents of the build folder will also have additional DLL files, as in the example below.



8.3.3.3 Libxcoder and FFmpeg for Quadra Logan or ReleaseDLL

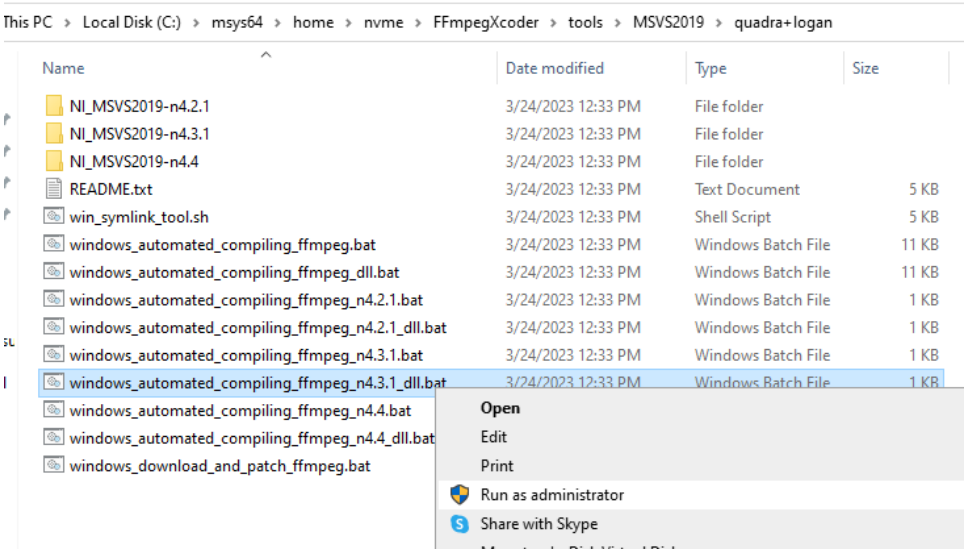
Follow this section to compile the libxcoder and FFmpeg for either a Quadra and Logan release, or a ReleaseDLL

1 Change directory into

tools\MSVS2019\quadra+logan

2 Ensure the following extension is installed **before** running any batch files

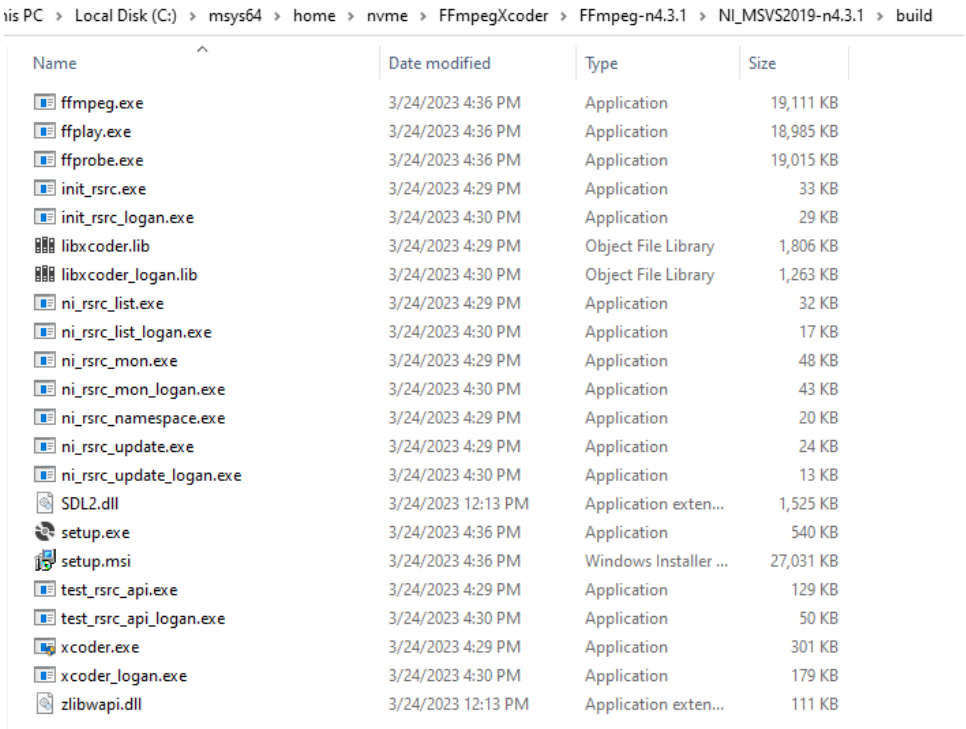
VS2019 --> Extensions --> Manage Extensions --> Microsoft Visual Studio Installer Projects



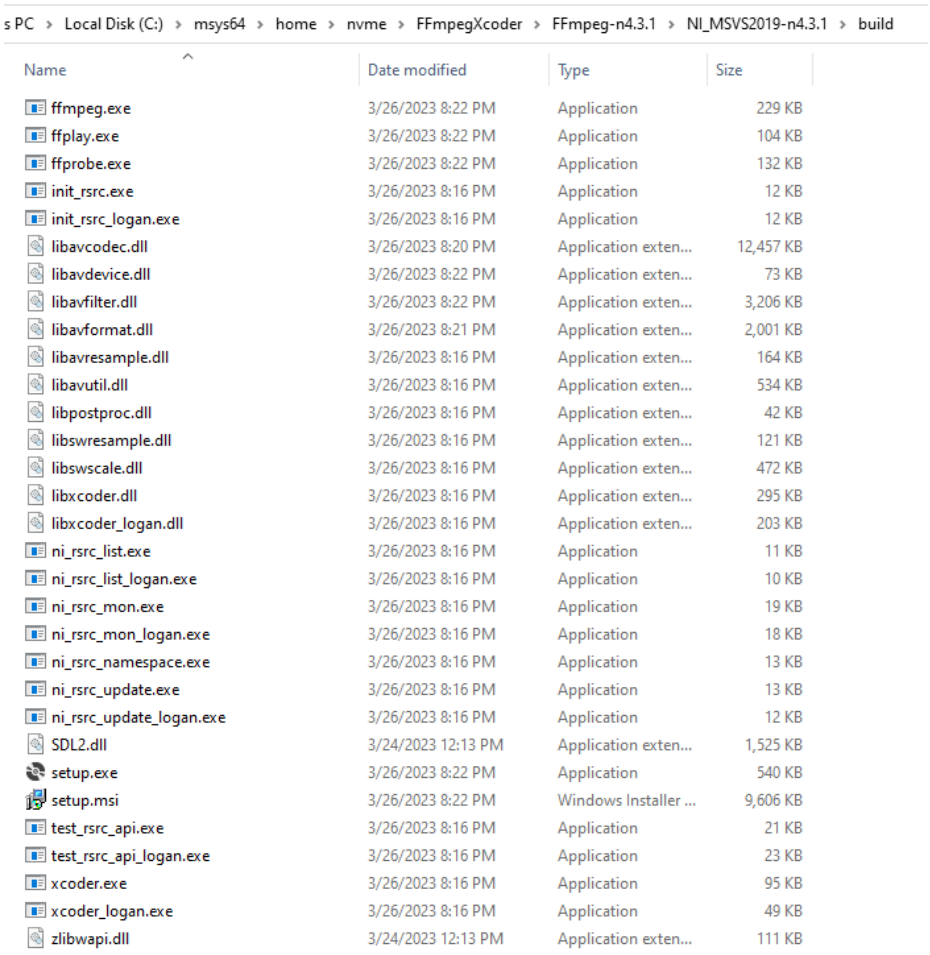
3 Run the following batch files as **admin** to build libxcoder, libxcoder_logan and FFmpeg Release or the ReleaseDLL

windows_automated_compiling_ffmpeg_n4.3.1.bat → Release build
windows_automated_compiling_ffmpeg_n4.3.1_dll.bat → for ReleaseDLL build

4 The output executable and setup files can be found in the **build** directory.



5 If the ReleaseDLL batch files are used then the contents of the **build** folder will also have the additional DLL output files as shown in the example below.



s PC › Local Disk (C:) › msys64 › home › nvme › FFmpegXcoder › FFmpeg-n4.3.1 › NI_MSVS2019-n4.3.1 › build

Name	Date modified	Type	Size
ffmpeg.exe	3/26/2023 8:22 PM	Application	229 KB
ffplay.exe	3/26/2023 8:22 PM	Application	104 KB
ffprobe.exe	3/26/2023 8:22 PM	Application	132 KB
init_rsrc.exe	3/26/2023 8:16 PM	Application	12 KB
init_rsrc_logan.exe	3/26/2023 8:16 PM	Application	12 KB
libavcodec.dll	3/26/2023 8:20 PM	Application exten...	12,457 KB
libavdevice.dll	3/26/2023 8:22 PM	Application exten...	73 KB
libavfilter.dll	3/26/2023 8:22 PM	Application exten...	3,206 KB
libavformat.dll	3/26/2023 8:21 PM	Application exten...	2,001 KB
libavresample.dll	3/26/2023 8:16 PM	Application exten...	164 KB
libavutil.dll	3/26/2023 8:16 PM	Application exten...	534 KB
libpostproc.dll	3/26/2023 8:16 PM	Application exten...	42 KB
libswresample.dll	3/26/2023 8:16 PM	Application exten...	121 KB
libswscale.dll	3/26/2023 8:16 PM	Application exten...	472 KB
libxcoder.dll	3/26/2023 8:16 PM	Application exten...	295 KB
libxcoder_logan.dll	3/26/2023 8:16 PM	Application exten...	203 KB
ni_rsrc_list.exe	3/26/2023 8:16 PM	Application	11 KB
ni_rsrc_list_logan.exe	3/26/2023 8:16 PM	Application	10 KB
ni_rsrc_mon.exe	3/26/2023 8:16 PM	Application	19 KB
ni_rsrc_mon_logan.exe	3/26/2023 8:16 PM	Application	18 KB
ni_rsrc_namespace.exe	3/26/2023 8:16 PM	Application	13 KB
ni_rsrc_update.exe	3/26/2023 8:16 PM	Application	13 KB
ni_rsrc_update_logan.exe	3/26/2023 8:16 PM	Application	12 KB
SDL2.dll	3/24/2023 12:13 PM	Application exten...	1,525 KB
setup.exe	3/26/2023 8:22 PM	Application	540 KB
setup.msi	3/26/2023 8:22 PM	Windows Installer ...	9,606 KB
test_rsrc_api.exe	3/26/2023 8:16 PM	Application	21 KB
test_rsrc_api_logan.exe	3/26/2023 8:16 PM	Application	23 KB
xcoder.exe	3/26/2023 8:16 PM	Application	95 KB
xcoder_logan.exe	3/26/2023 8:16 PM	Application	49 KB
zlibwapi.dll	3/24/2023 12:13 PM	Application exten...	111 KB

8.3.4 Install and Run FFmpeg

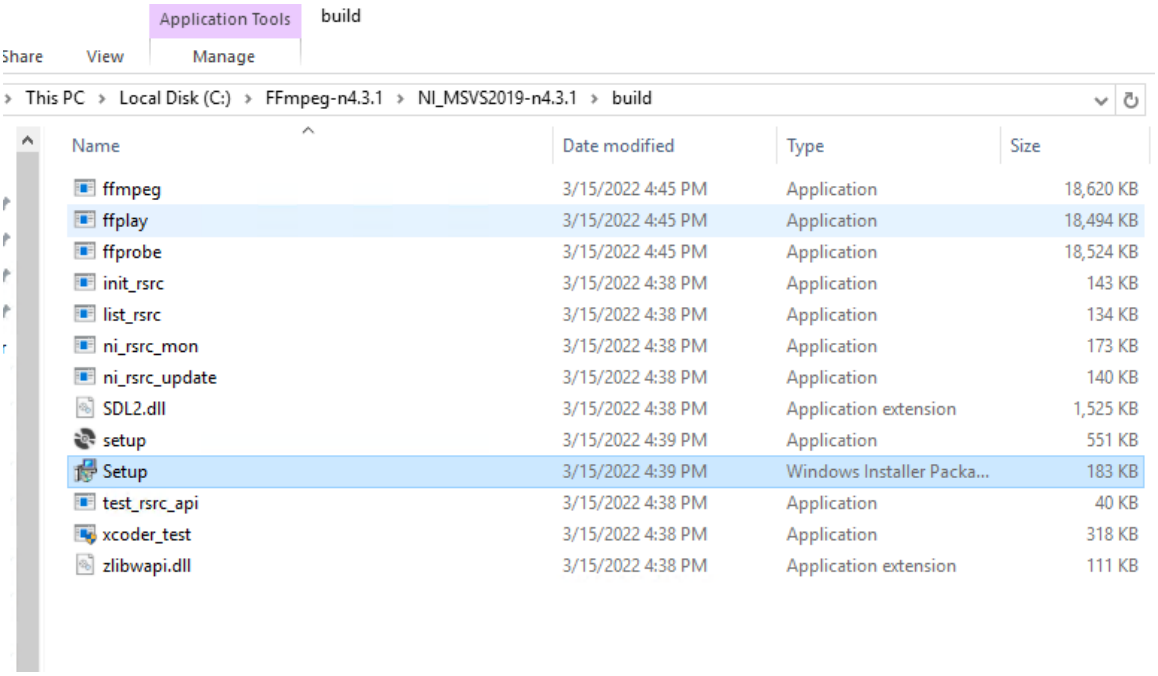
The installation of FFmpeg will NOT modify any environment variable or registry item of a Windows 10 system but does require administrator access.

Using FFmpeg-n4.3.1 as an example, assume the **build** directory is located at

C:\FFmpeg-n4.3.1\NI_MSVS2019-n4.3.1\build

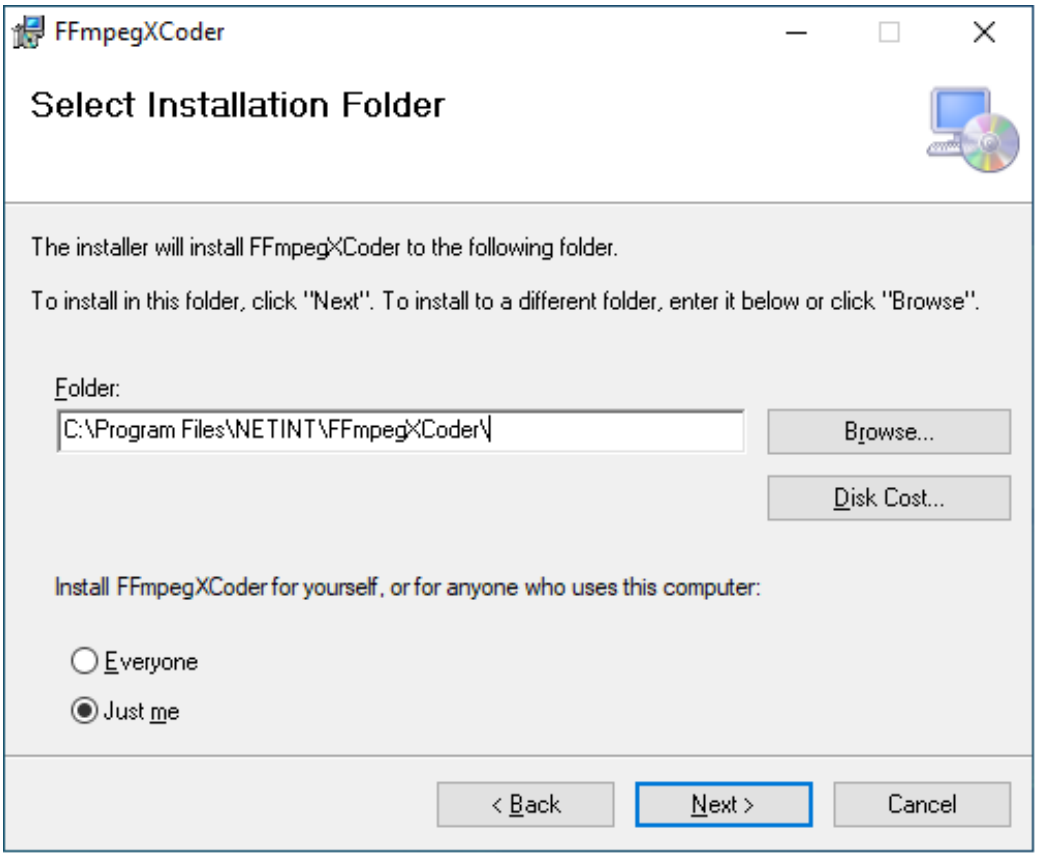
and all output files are located in there.

1. Click the **setup.msi** generated in the build directory

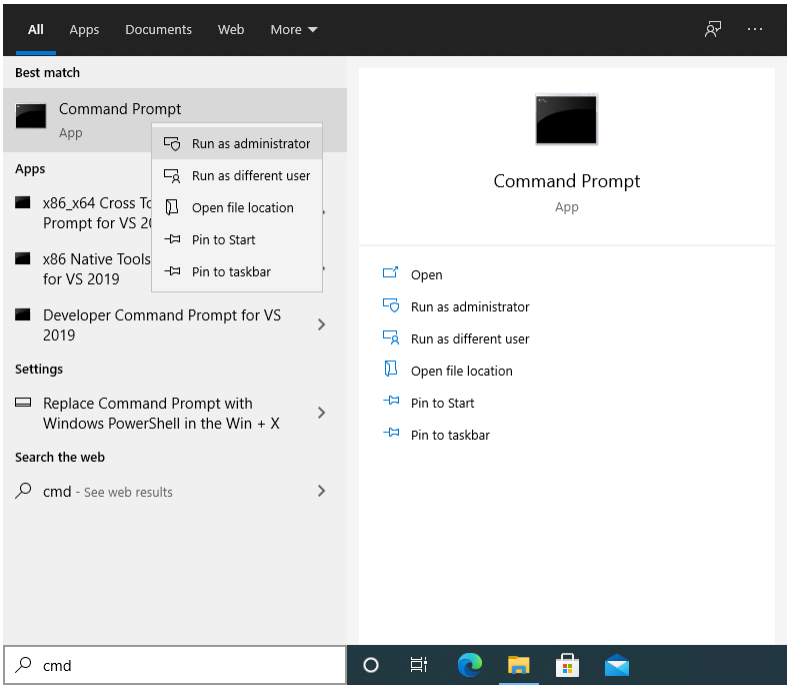


2. Choose your own installation path as administrator, for example

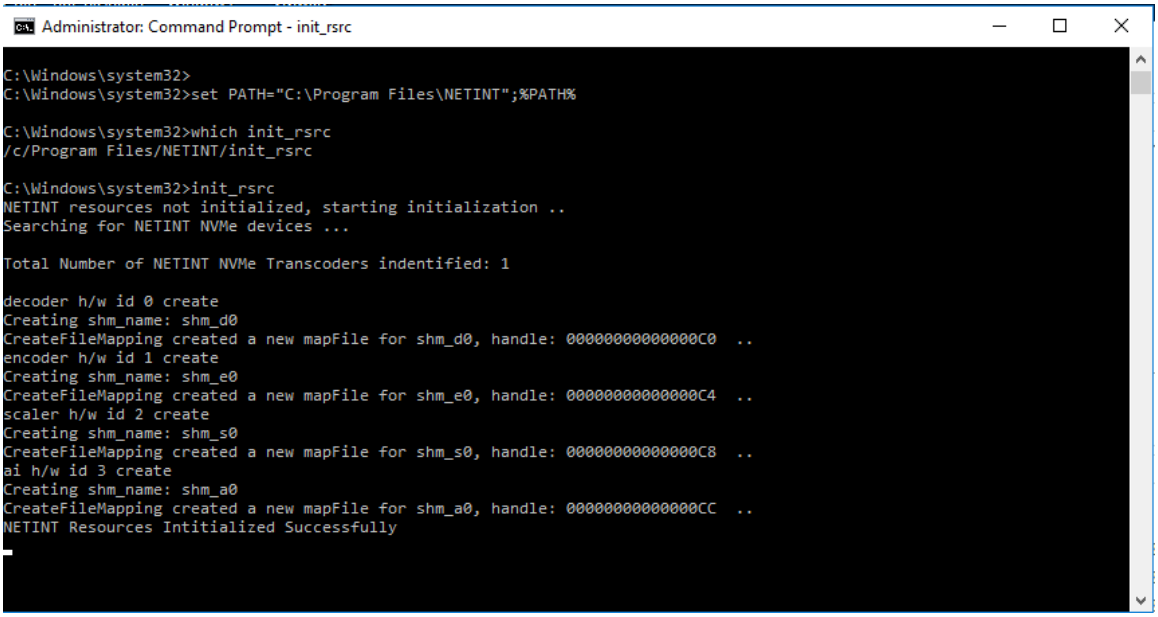
   C:\Program Files\NETINT



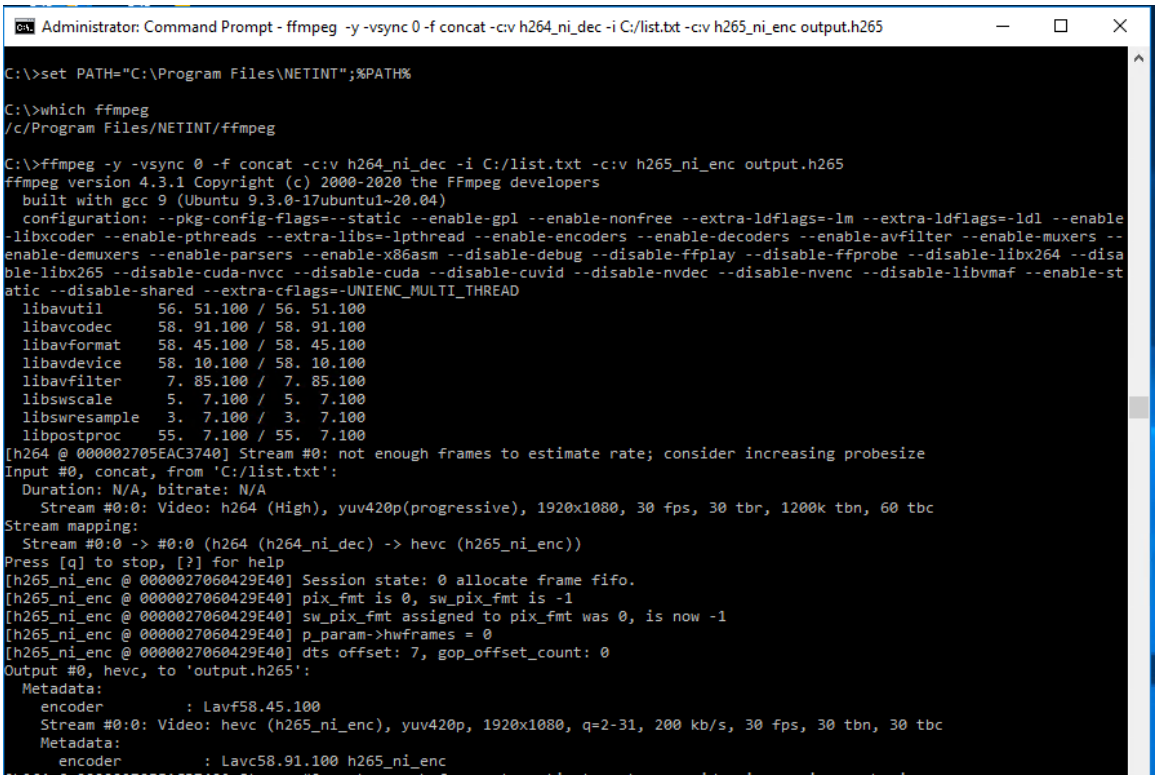
3. Run a command prompt as Administrator



4. Add installation path into %PATH% variable and run init_rsrc command



5. Start another command prompt and run your own ffmpeg command



8.4 Compiling libxcoder and FFmpeg using Visual Studio 2026

This section describes the Windows VS2026 environment setup, with steps to compile the libxcoder and FFmpeg using VS2026.

8.4.1 Platform and Configuration

8.4.1.1 Configuration of VS2026 project

Debug	Release	DebugDLL	ReleaseDLL
Generate LIB or EXE without optimization	Generate LIB or EXE with optimization	Generate DLL or EXE without optimization	Generate DLL or EXE with optimization

8.4.1.2 Supported Platforms and Configuration

Object:	Configuration	Debug		Release		DebugDLL		ReleaseDLL	
	Platform	X86	X64	X86	X64	X86	X64	X86	X64
libxcoder		✓	✓	✓	✓	✓	✓	✓	✓
Ffmpeg					✓				✓

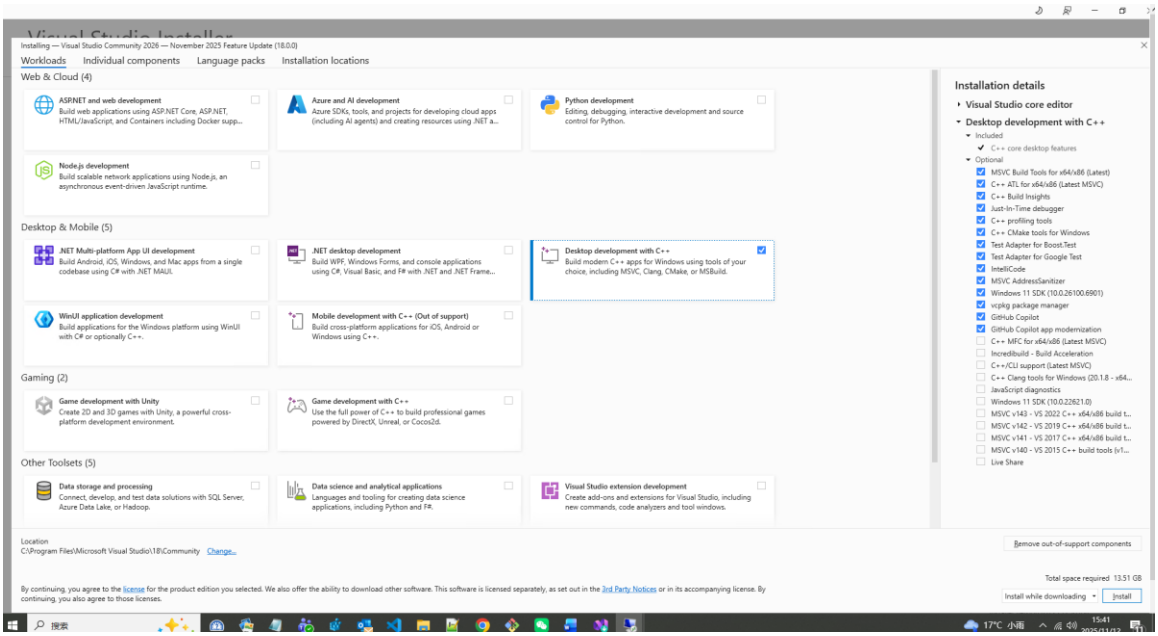
8.4.2 Setup VS2026 environment

8.4.2.1 Online Setup VS2026

1. Download VS2026 from

   https://visualstudio.microsoft.com/

2. Install VS2026, selecting the option **Desktop development with C++**
3. Install the plug-in **Microsoft Visual Studio Installer Projects** from the **Visual Studio Marketplace**



8.4.3 Compiling Libxcoder and FFmpeg for Quadra/Logan

8.4.3.1 Preparation

These two separate solutions can be compiled together using a batch script that calls **devenv.exe** rather than using the VS IDE. However if preferred, the IDE can be used instead by loading and building the VS solution file (**.sln**). Manually copy the intermediate and output files the same way the batch script does.

The compilation of FFmpeg v4.3.1 is shown as an example below.

1. From the release package folder

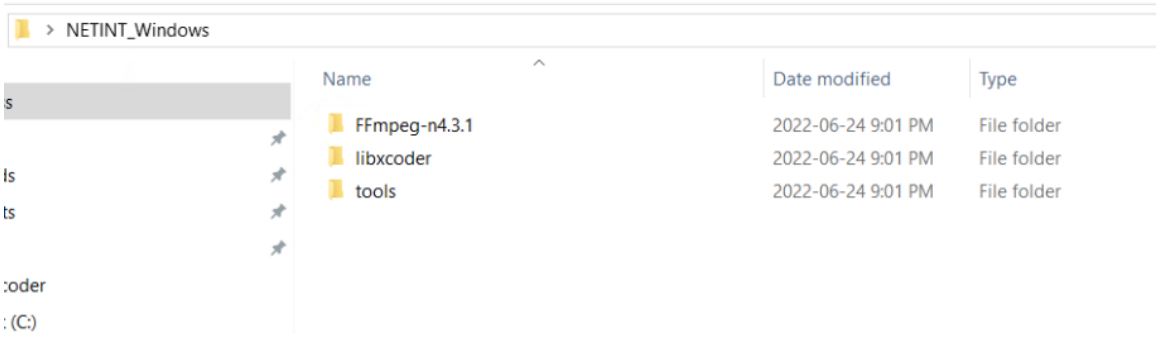
   Quadra_SW_v3.0.0

   Copy the following two folders into a new folder, in this example the folder named **NETINT_Windows** is used

   libxcoder
   tools

2. Clone **FFmpeg-n4.3.1** from git

   git clone -b n4.3.1 --depth=1 https://github.com/FFmpeg/FFmpeg.git FFmpeg-n4.3.1



3. From the following folder

   Quadra_SW_V3.1.1_EN3

   copy the patch file below

   FFmpeg-n4.3.1_netint_v3.1.1_EN3.diff

   to the **FFmpeg-n4.3.1** folder created in Step 2 by the git clone command

4. Change directory to

   FFmpeg-n4.3.1

5. Apply the patch with the following command

   patch -p 1 -t -i FFmpeg-n4.3.1_netint_v3.1.1_EN3.diff

8.4.3.2 Build Libxcoder and FFmpeg for Quadra or ReleaseDLL

This process is simple with only three steps required

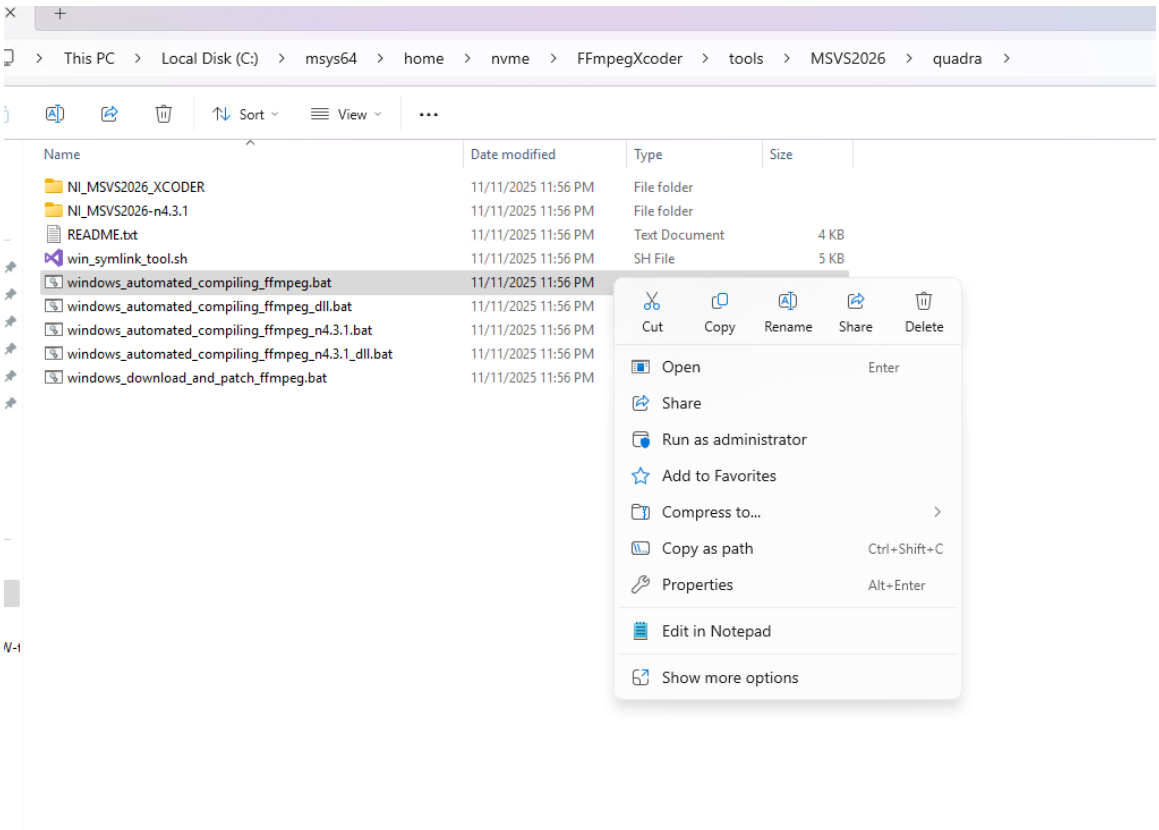
1. Change directory into **tools\MSVS2026\quadra**

2. Run the batch file as an admin to build the libxcoder and FFmpeg Release, or ReleaseDLL

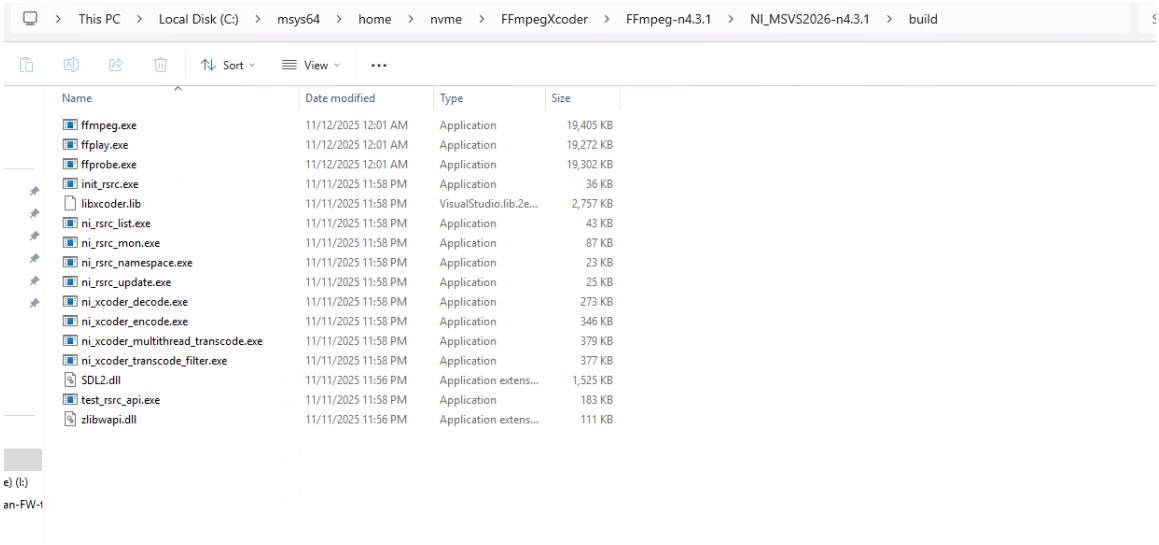
   windows_automated_compiling_ffmpeg_n4.3.1.bat → Release build
   windows_automated_compiling_ffmpeg_n4.3.1_dll.bat → ReleaseDLL build

3. **Note** – Ensure the following extension is installed before running the batch files

   VS2026 --> Extensions --> Manage Extensions --> Microsoft Visual Studio Installer Projects



4. If the user runs the Release batch files, the output build executable and setup files can be found in the build directory.



8.4.4 Install and Run FFmpeg

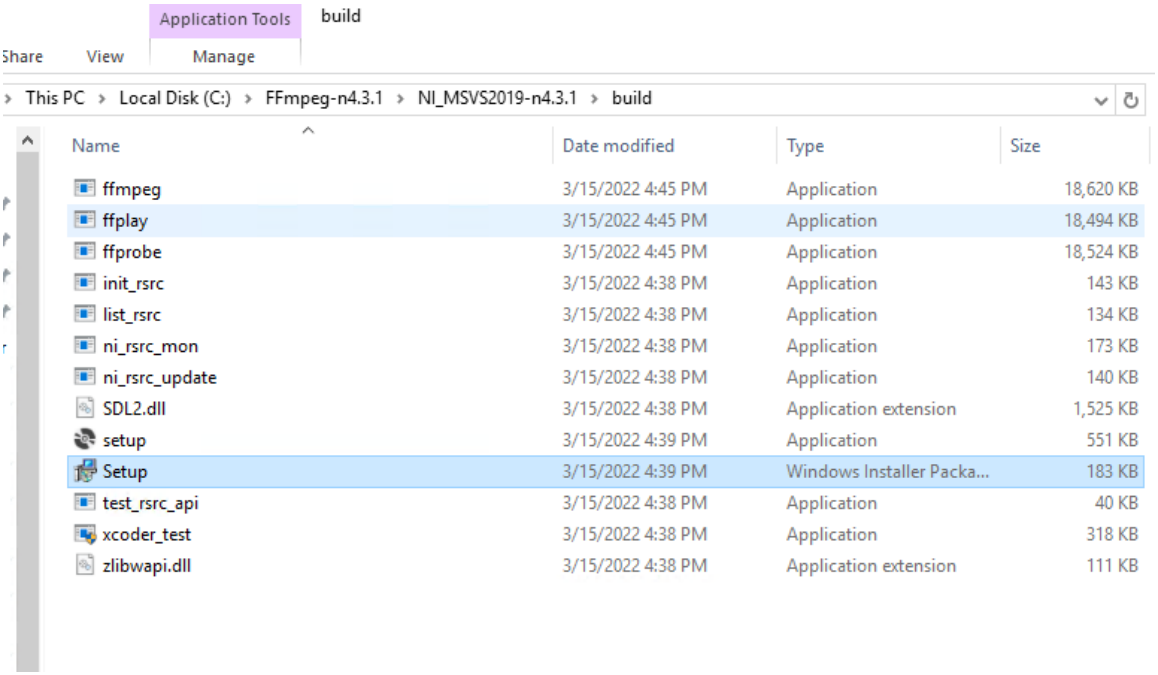
The installation of FFmpeg will NOT modify any environment variable or registry item of a Windows 10 system but does require administrator access.

Using FFmpeg-n4.3.1 as an example, assume the **build** directory is located at

C:\FFmpeg-n4.3.1\NI_MSVS2026-n4.3.1\build

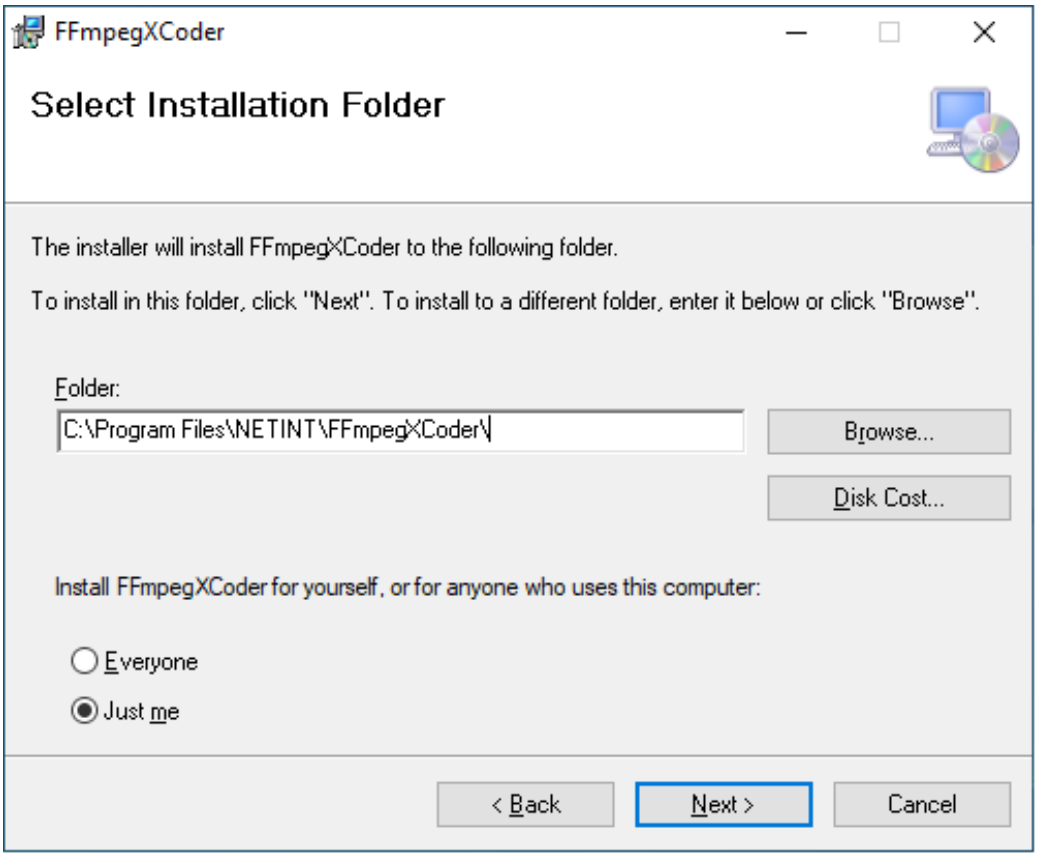
and all the output files are located in there.

1 Click the **setup.msi** generated in the build directory

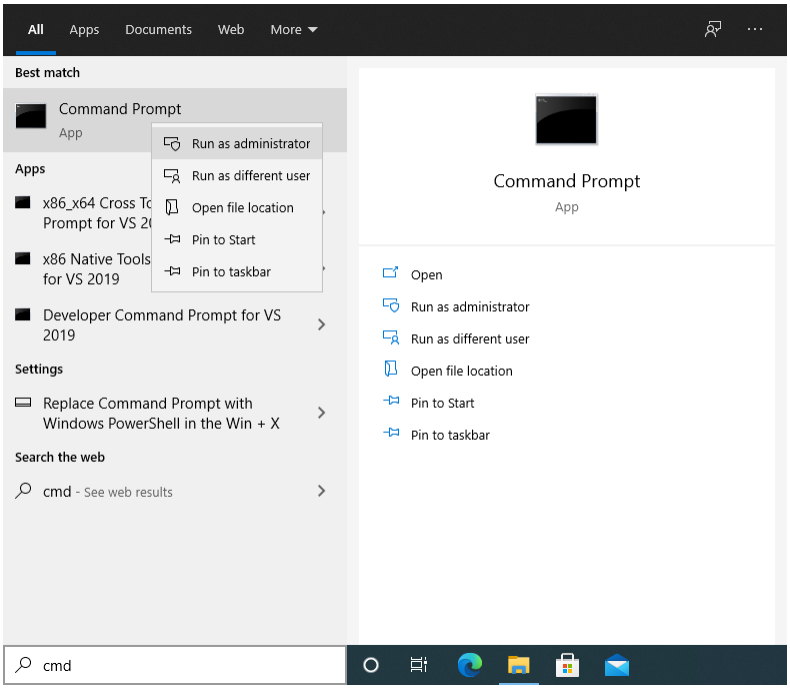


2. Choose your own installation path as administrator, for example

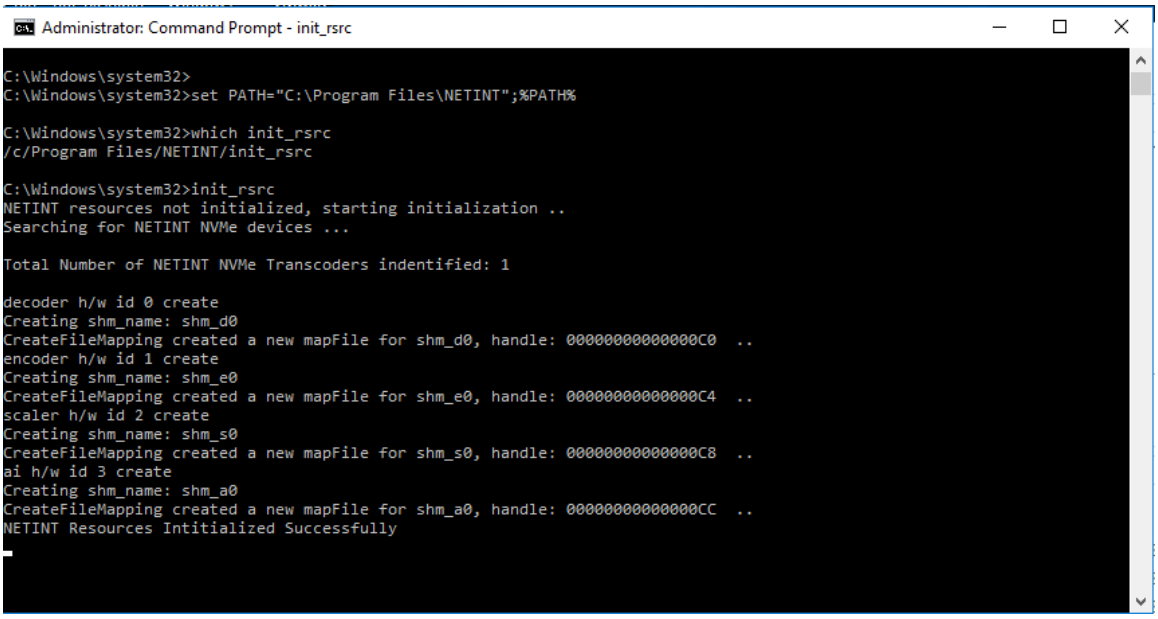
   C:\Program Files\NETINT



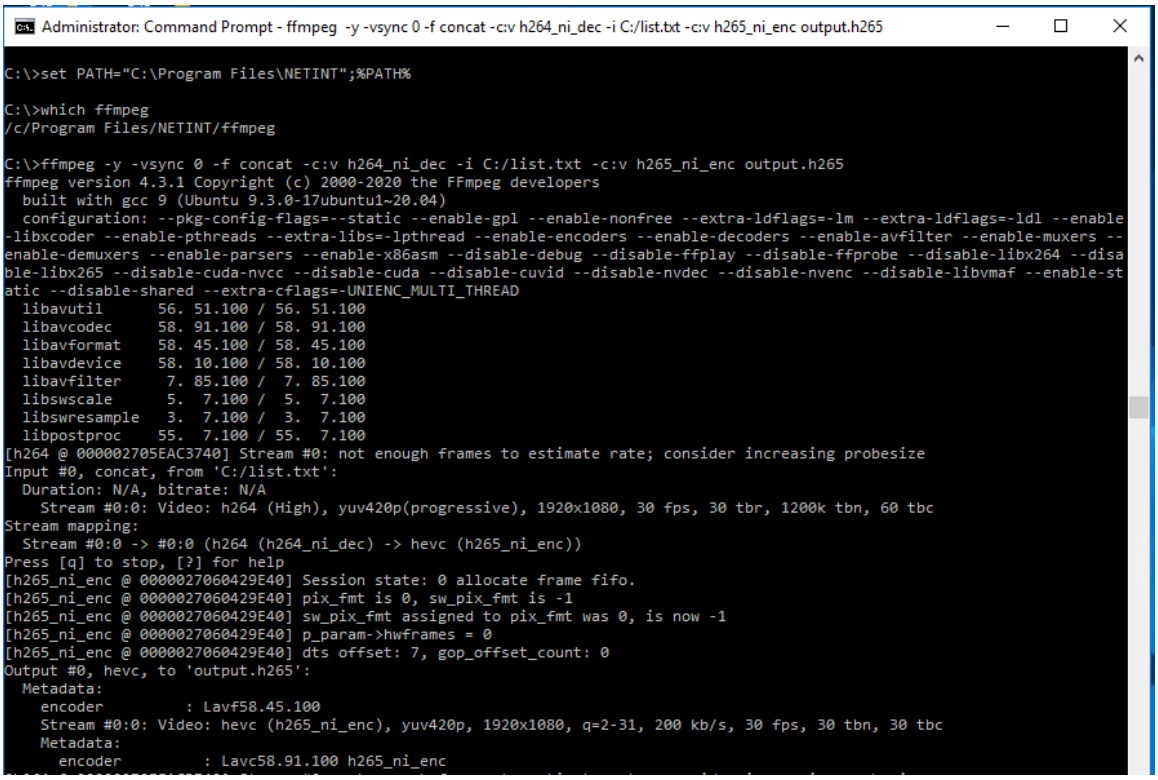
3. Run a command prompt as Administrator



4. Add installation path into %PATH% variable and run init_rsrc command



5. Start another command prompt and run your own ffmpeg command



9 Windows Host Hyper-V VM

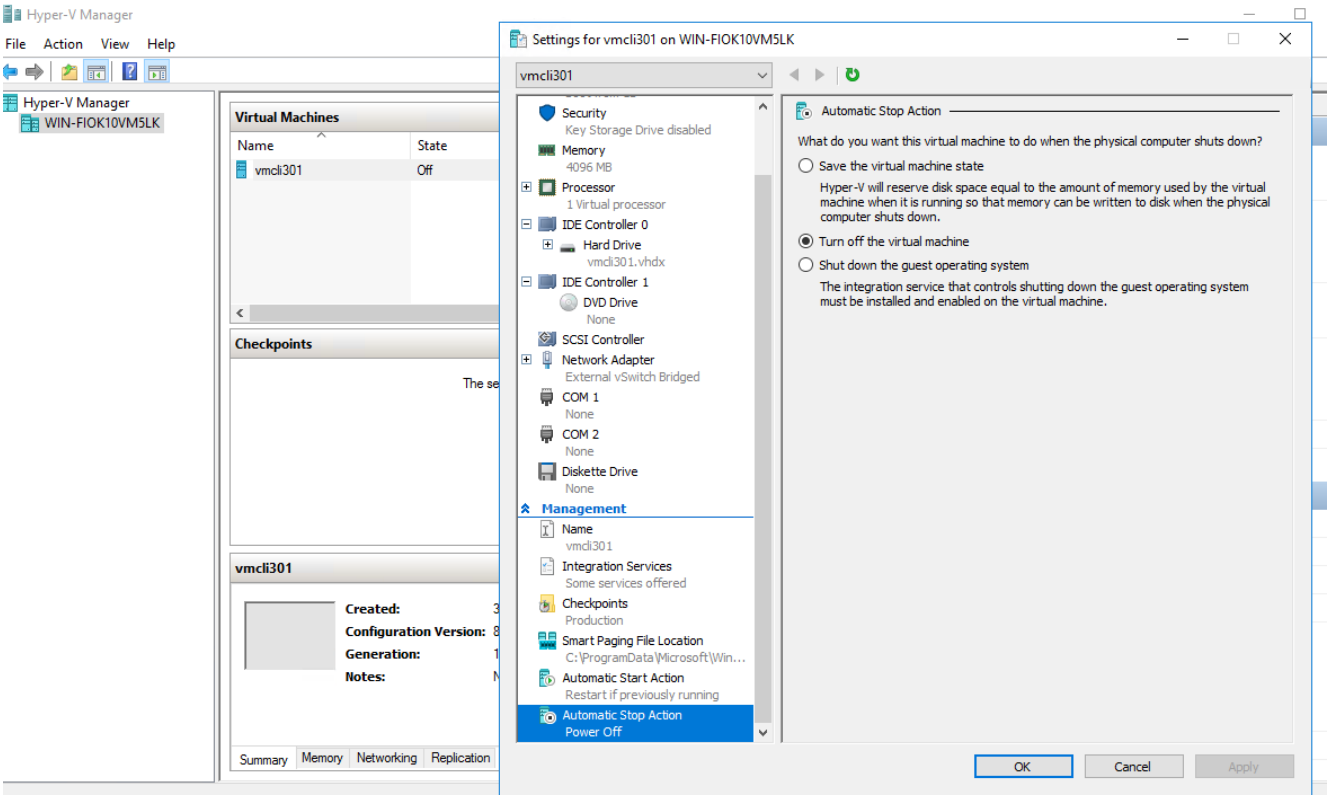
This section describes how to setup NETINT's video transcoder device in a Windows Hyper-V VM.

9.1 Hyper-V Linux Guest VM

Search for **Turn Windows Features On or Off** from the **Start** menu and ensure that **Hyper-V** is **on**. This will install **Hyper-V** on the Windows host. Reboot once the installation is complete.

Note : Installation and configuration of a **Hyper-V** VM is not within the scope of this document.

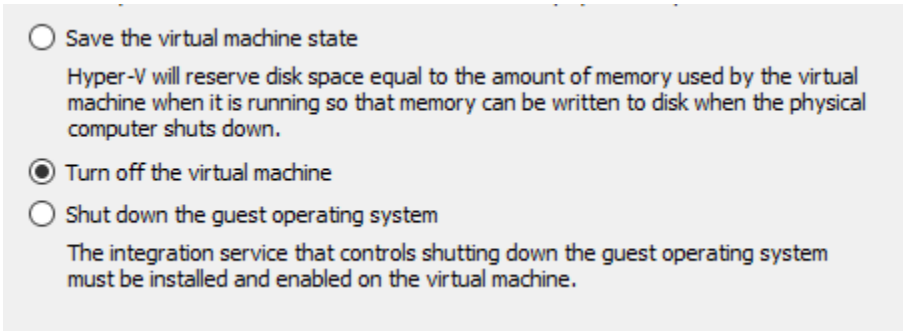
Follow the links in Section 9.1.7 for online material describing how to install **Hyper-V** and a Guest VM of your choice. Ensure the VM can be started and shutdown, and also has a working network connection.



Throughout this section an **Ubuntu 20.04 Desktop Version** VM called **vmcli301** is used.

9.1.1 Additional settings on VM

1. In VM Settings set **Automatic Stop Action** to **Turn off the Virtual Machine**



2. In VM Settings confirm the VM state is **Off**

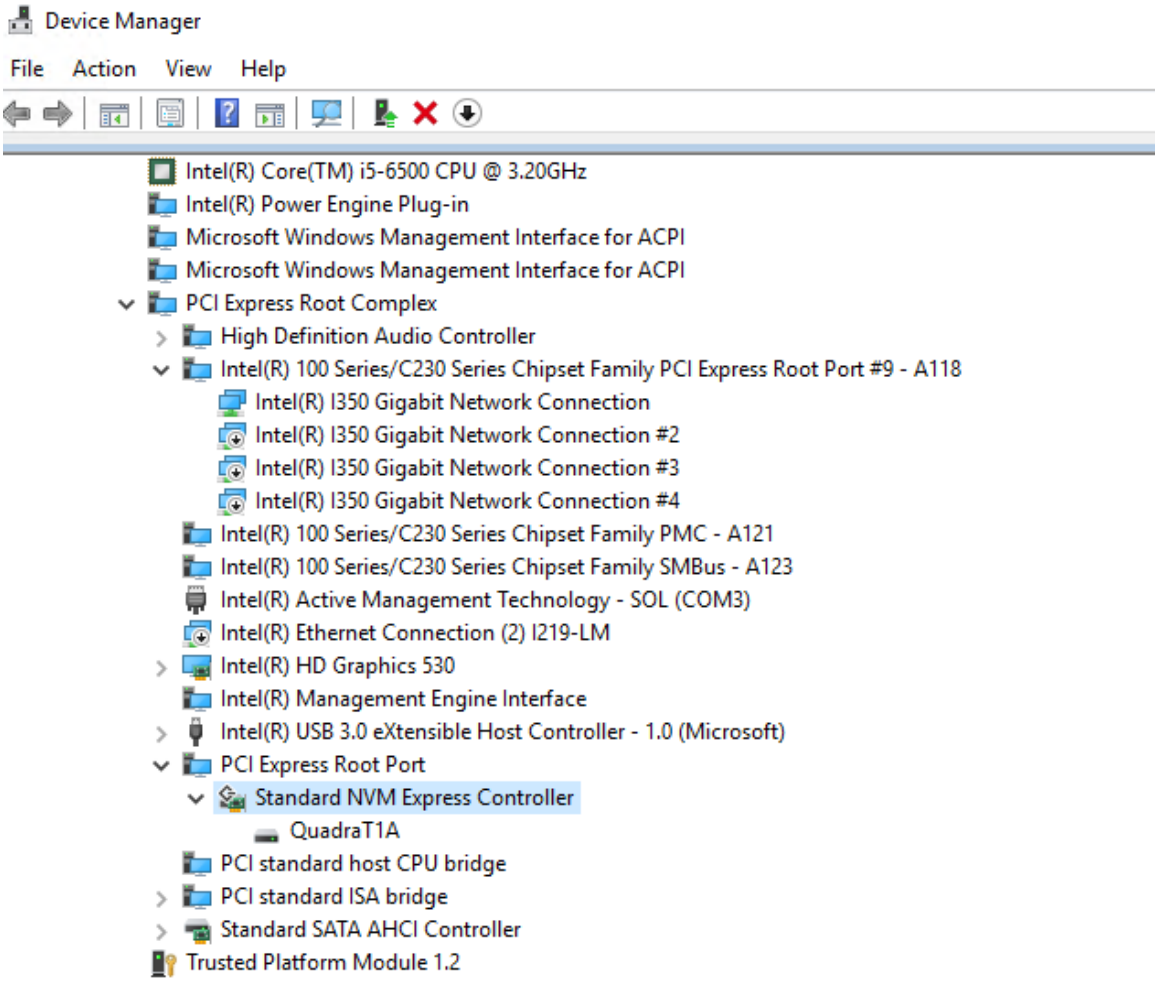
```
PS C:\Windows\system32> Get-VM

Name     State CPUUsage(%) MemoryAssigned(M) Uptime   Status             Version
----     ----- ----------- ----------------- ------   ------             -------
vmcli301 Off   0           0                 00:00:00 Operating normally 8.0
```

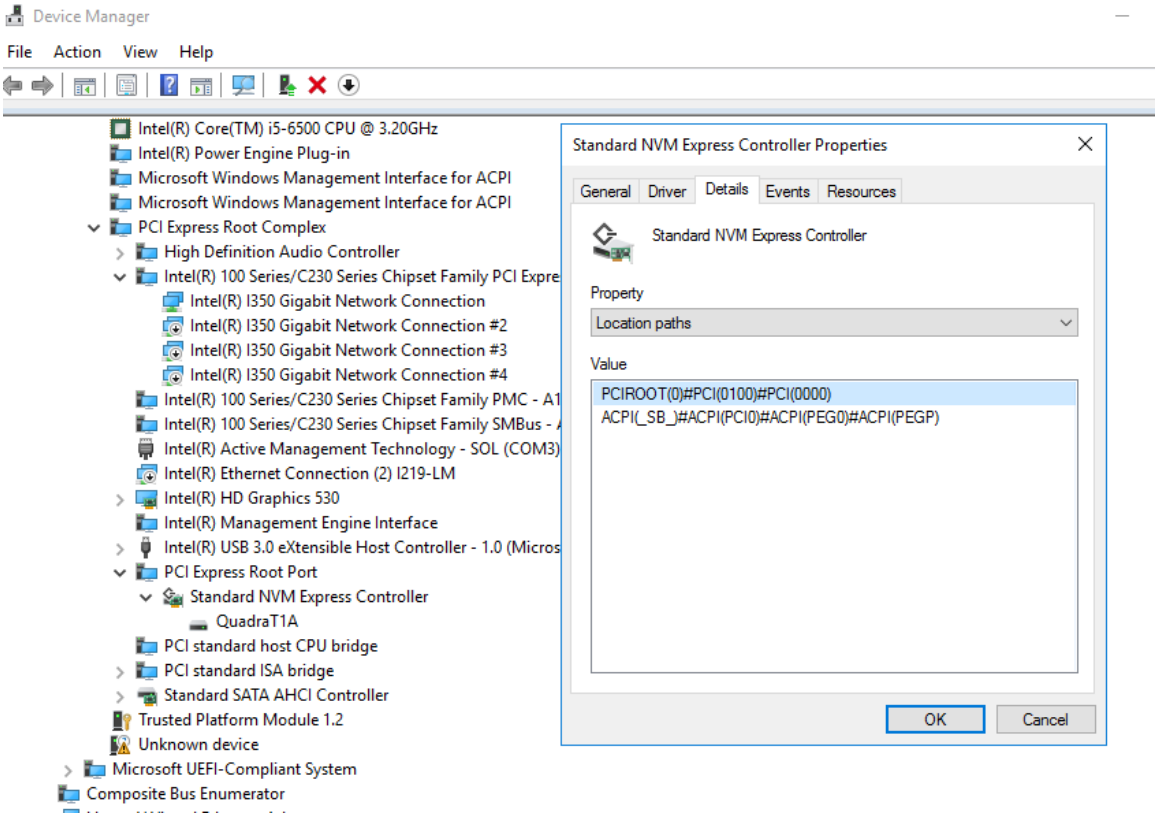
9.1.2 NVMe device Location Path

Each device on the host is assigned a **Location Path** upon host boot up.

To detect the **Location Path** for the **NVMe** device launch the **Device Manager**.

Select **View → Devices by Connection**



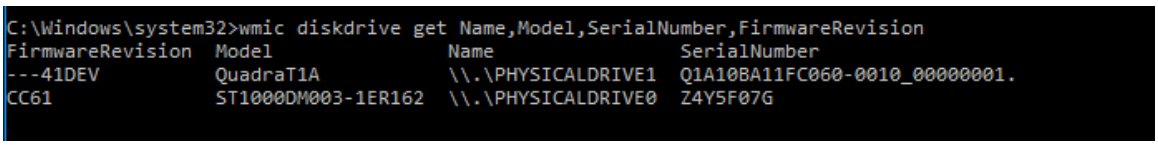


In this case the **Location Path** for the **Standard NVM Express Controller** is `PCIROOT(0)#PCI(0100)#PCI(0000)`.

9.1.3 Disable the NVMe device

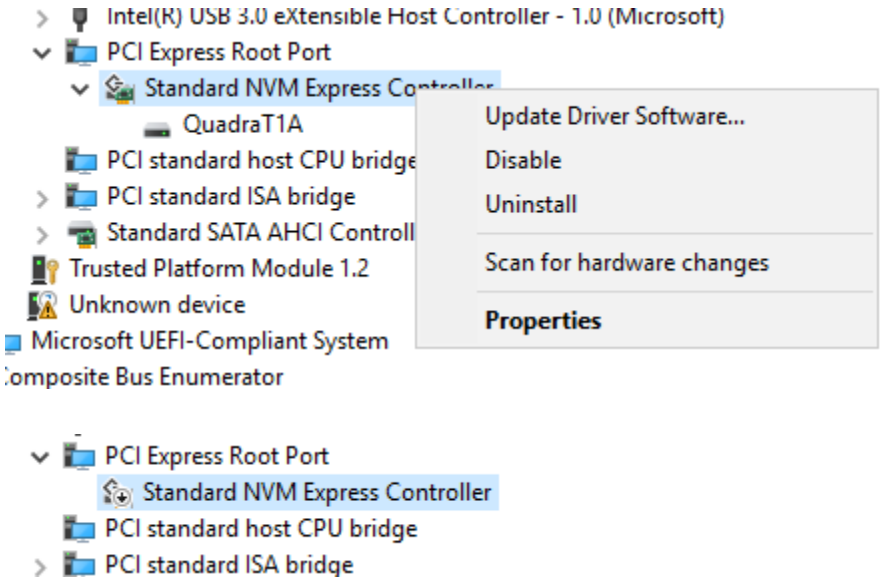
Check the Quadra NVMe device is installed on the Host by running the following command:

```
wmic diskdrive get Name,Model,SerialNumber,FirmwareRevision
```



In the Windows **Device Manager** click **View Devices by connection** and disable the **Standard NVM Express Controller**. It may be found under PCI Express Root Complex --> PCI Express Root Port --> Standard NVM Express Controller.

Right click on **Standard NVM Express Controller** to see the menu selection and select **Disable**



The NVMe device will now not show up in wmic output

```
C:\Windows\system32>wmic diskdrive get Name,Model,SerialNumber,FirmwareRevision
FirmwareRevision  Model              Name               SerialNumber
CC61              ST1000DM003-1ER162  \\.\PHYSICALDRIVE0  Z4Y5F07G
```

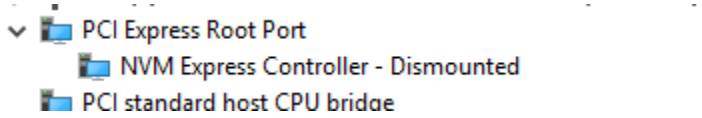
9.1.4 Passthrough physical device to VM

Launch **Windows Powershell** in Administrator mode.

Run the following commands to dismount the NVMe device from the host. Then attach the device to the VM. Ensure to use the **Location Path** for your NVMe device, as collected in above in Section 9.1.2.

```
Dismount-VMHostAssignableDevice -LocationPath
"PCIROOT(0)#PCI(0100)#PCI(0000)"
```

Confirm the Windows Device Manager shows the NVMe device is dismounted.



Assign MMIO space

```
Set-VM -LowMemoryMappedIoSpace 1Gb -VMName vmcli301
Set-VM -HighMemoryMappedIoSpace 2Gb -VMName vmcli301
```

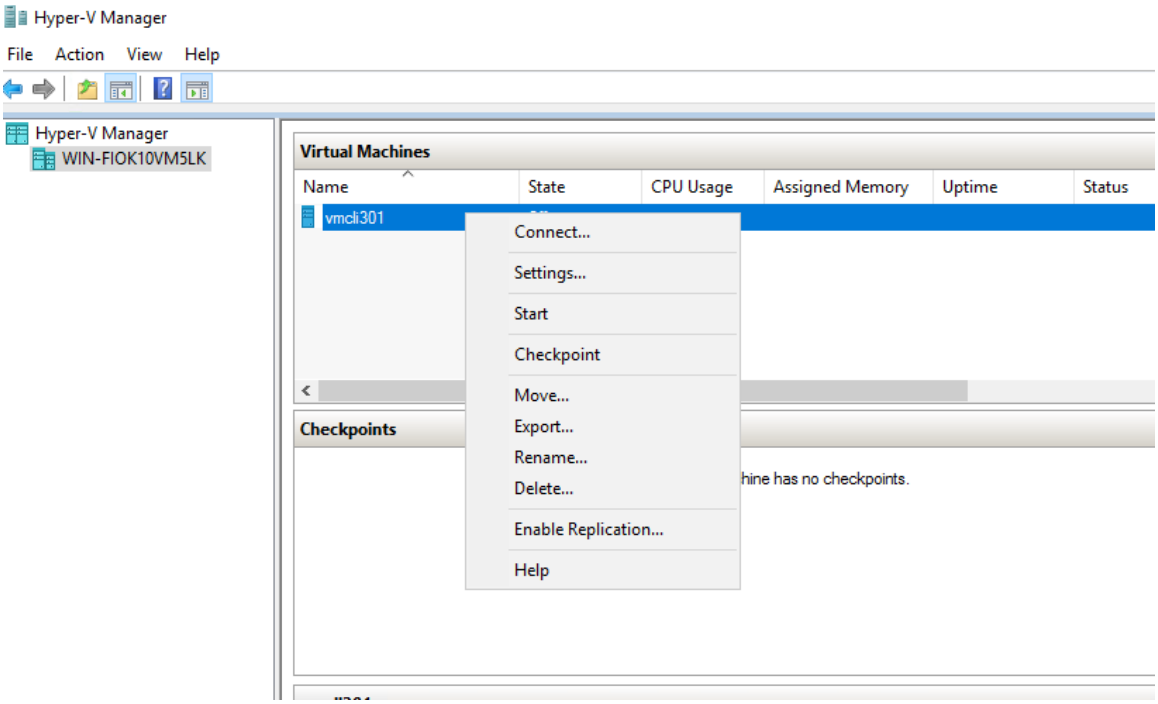
Attach NVMe device to VM

```
Add-VMAssignableDevice -LocationPath
“PCIROOT(0)#PCI(0100)#PCI(0000)” -VMName vmcli301
Get-VMAssignableDevice
```

Example:

```
PS C:\Windows\system32> Get-VMAssignableDevice

cmdlet Get-VMAssignableDevice at command pipeline position 1
Supply values for the following parameters:
VMName[0]: vmcli301
VMName[1]:

InstanceID       :
PCIP\VEN_1D82&DEV_0401&SUBSYS_04011D82&REV_00\4&1F0B2711&0&0008
LocationPath     : PCIROOT(0)#PCI(0100)#PCI(0000)
ResourcePoolName : Primordial
Name             : Virtual PCI Express Port Settings
Id               : Microsoft:132F09C1-A7E3-44CD-B619-
A218F8524B6F\46FF7B1F-9A20-48E9-8679-8D202A8FC245
VMId             : 132f09c1-a7e3-44cd-b619-a218f8524b6f
VMName           : vmcli301
VMSnapshotId     : 00000000-0000-0000-0000-000000000000
VMSnapshotName   :
CimSession       : CimSession: .
ComputerName     : WIN-FIOK10VM5LK
IsDeleted        : False
VMCheckpointId   : 00000000-0000-0000-0000-000000000000
VMCheckpointName :
```

Start the VM by clicking on **Hyper-V Manager → Virtual Machines → vmcli301 → Start**



Run the following command to get status of VM

```
get-VM
```

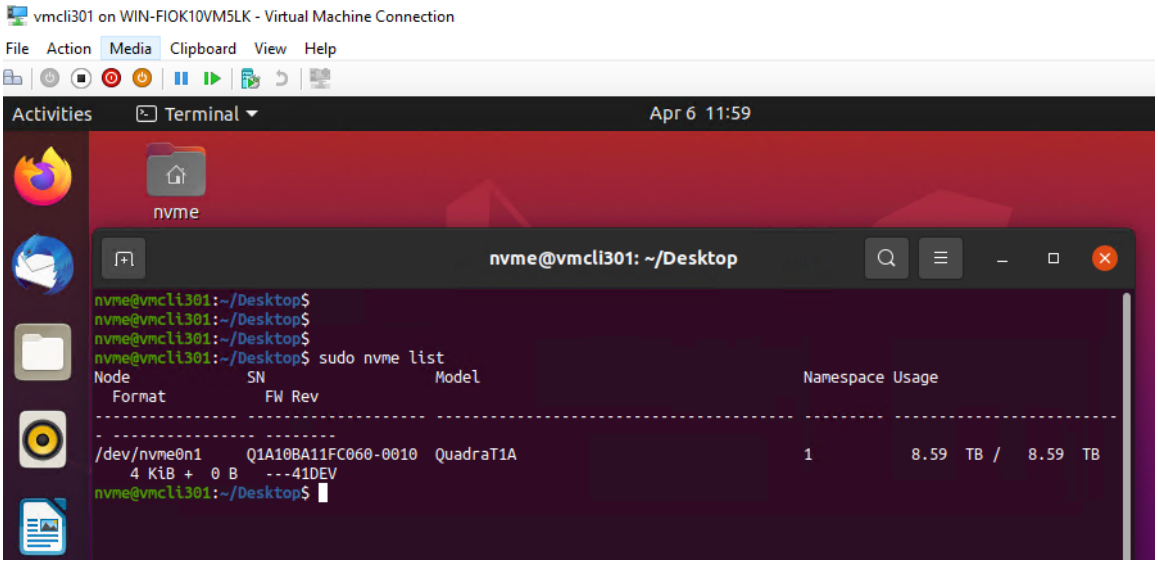
```
PS C:\Windows\system32> Get-VM

Name     State   CPUUsage(%) MemoryAssigned(M) Uptime          Status             Version
----     -----   ----------- ----------------- ------          ------             -------
vmcli301 Running 0           4096              00:32:45.4440000 Operating normally 8.0
```

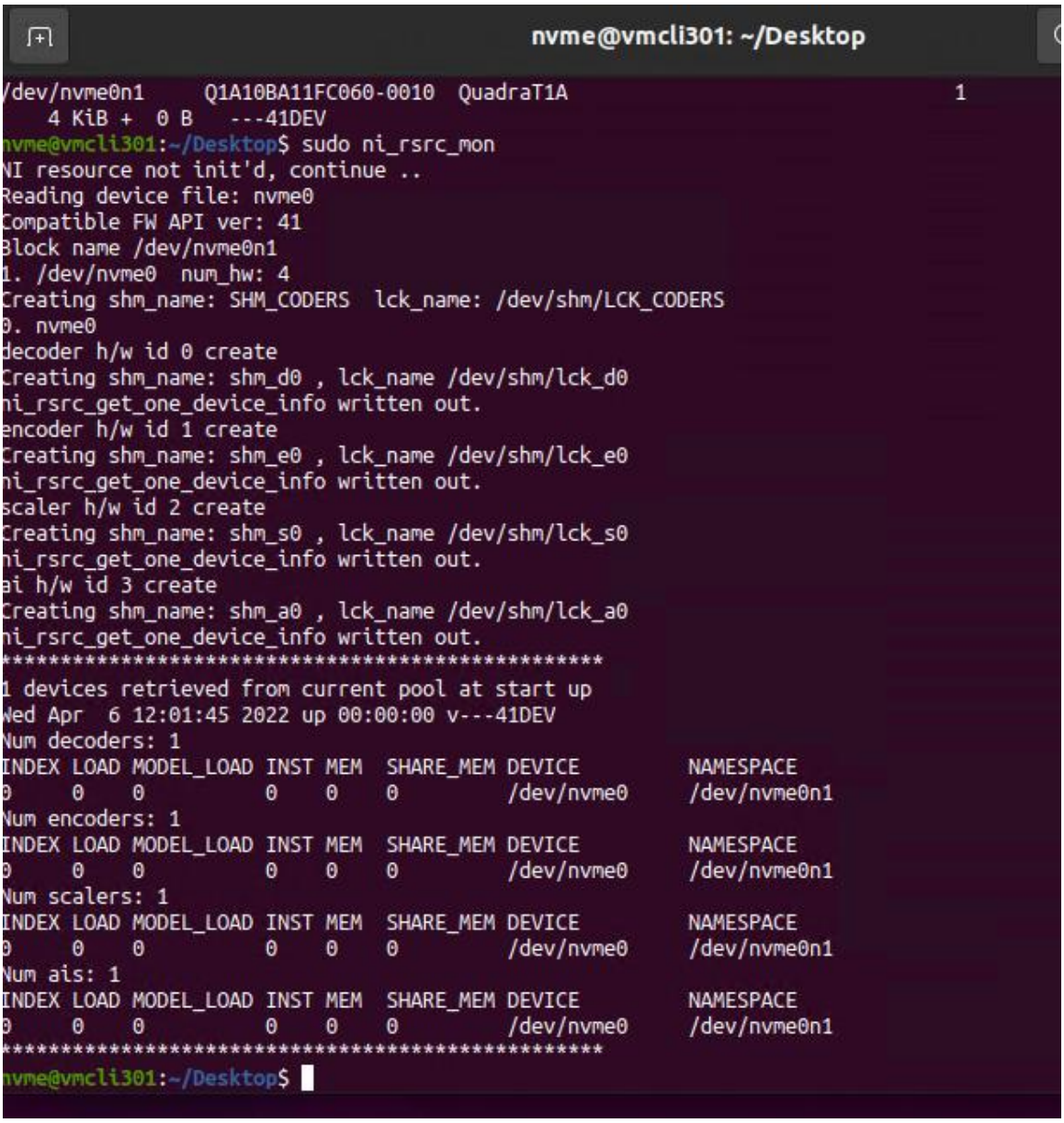
Connect to the VM to launch the VM desktop view.

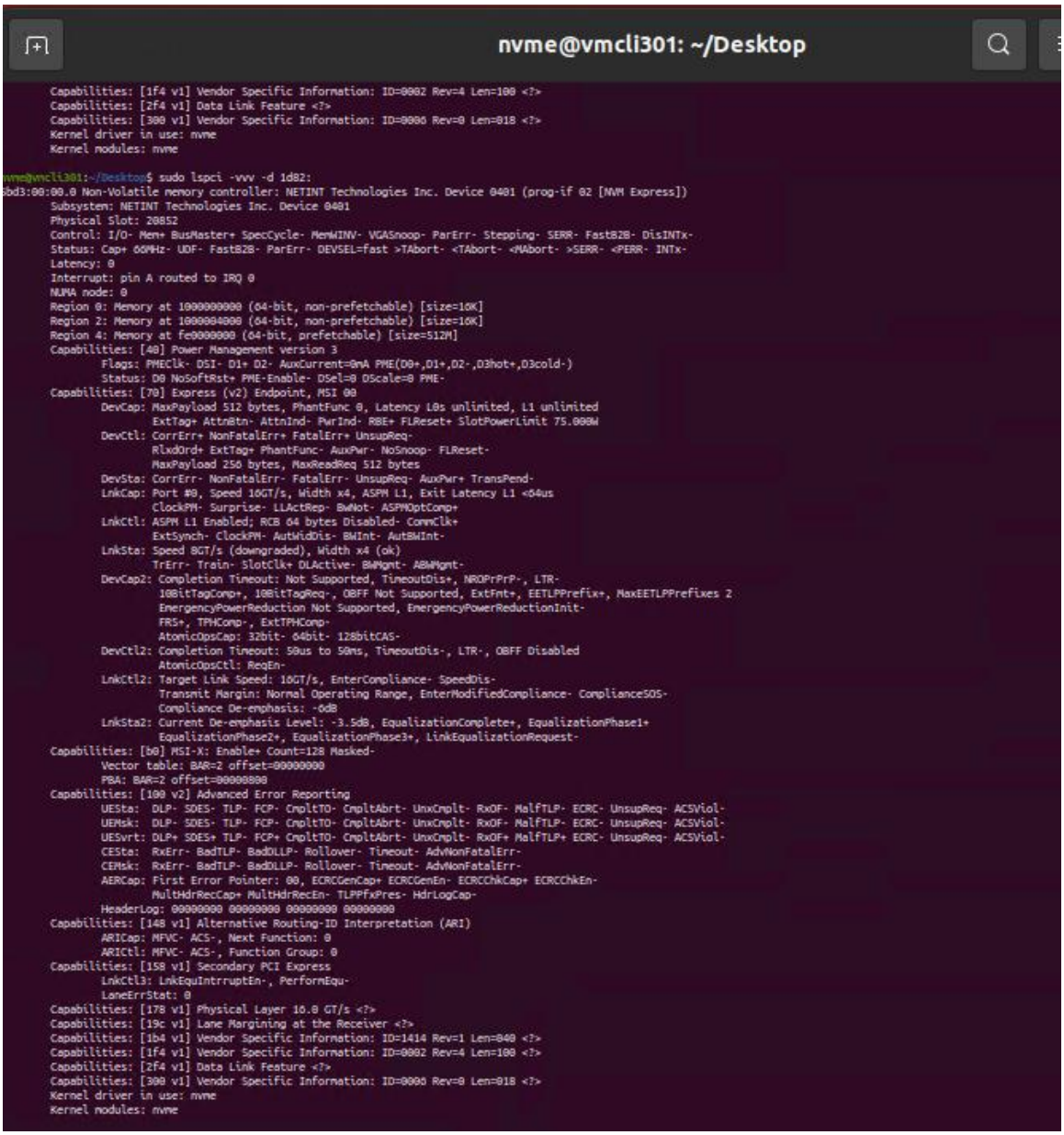
Follow the QuickStartGuideQuadra_V3 or newer, to install the Linux and FFmpeg environment to VM to help see the Quadra device and perform transcoding operations.

Confirm the NVMe device is mounted and accessible to the VM by running the following commands

```
sudo nvme list
sudo ni_rsrc_mon
sudo lspci -vvv -d 1d82:
```




nvme@vmcli301: ~/Desktop
/dev/nvme0n1 Q1A10BA11FC060-0010 QuadraT1A 1
4 KiB + 0 B ---41DEV
nvme@vmcli301:~/Desktop$ sudo ni_rsrc_mon
NI resource not init'd, continue ..
Reading device file: nvme0
Compatible FW API ver: 41
Block name /dev/nvme0n1
1. /dev/nvme0 num_hw: 4
Creating shm_name: SHM_CODERS lck_name: /dev/shm/LCK_CODERS
0. nvme0
decoder h/w id 0 create
Creating shm_name: shm_d0 , lck_name /dev/shm/lck_d0
ni_rsrc_get_one_device_info written out.
encoder h/w id 1 create
Creating shm_name: shm_e0 , lck_name /dev/shm/lck_e0
ni_rsrc_get_one_device_info written out.
scaler h/w id 2 create
Creating shm_name: shm_s0 , lck_name /dev/shm/lck_s0
ni_rsrc_get_one_device_info written out.
ai h/w id 3 create
Creating shm_name: shm_a0 , lck_name /dev/shm/lck_a0
ni_rsrc_get_one_device_info written out.
****
1 devices retrieved from current pool at start up
Wed Apr 6 12:01:45 2022 up 00:00:00 v---41DEV
Num decoders: 1
INDEX LOAD MODEL_LOAD INST MEM SHARE_MEM DEVICE NAMESPACE
0 0 0 0 0 0 /dev/nvme0 /dev/nvme0n1
Num encoders: 1
INDEX LOAD MODEL_LOAD INST MEM SHARE_MEM DEVICE NAMESPACE
0 0 0 0 0 0 /dev/nvme0 /dev/nvme0n1
Num scalers: 1
INDEX LOAD MODEL_LOAD INST MEM SHARE_MEM DEVICE NAMESPACE
0 0 0 0 0 0 /dev/nvme0 /dev/nvme0n1
Num ais: 1
INDEX LOAD MODEL_LOAD INST MEM SHARE_MEM DEVICE NAMESPACE
0 0 0 0 0 0 /dev/nvme0 /dev/nvme0n1
****
nvme@vmcli301:~/Desktop$



The Quadra NVMe device is now ready for use in the **Hyper-V** VM.

9.1.5 Passthrough virtual device to VM

This section requires firmware support for SR-IOV on the NETINT video transcoder device, this was introduced since release 4.1.1.

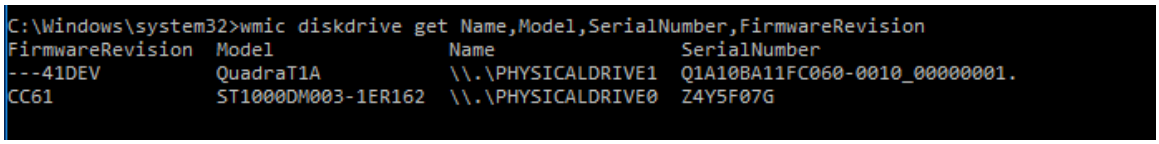
9.1.6 Restoring the NVMe device back to the host

1. Launch Windows Powershell in adminstrator mode. Run the following commands to remove the NVMe device from the hyper-v VM and mounting it back to the host. Replace Location Path and VM name values in the commands to values specific to your host and VM.

```
Remove-VMAssignableDevice -LocationPath
"PCIROOT(0)#PCI(0100)#PCI(0000)" -VMName vmcli301
Mount-VMHostAssignableDevice -LocationPath
"PCIROOT(0)#PCI(0100)#PCI(0000)"
```

2. In Windows ‘Device Manager’ à view à Devices by connection, ensable the ‘Standard NVM Express Controller’. It may be found under ‘PCI Express Root Complex à PCI Express Root Port’ à ‘Standard NVM Express Controller’. Right click on ‘Standard NVM Express Controller’ to see the menu selection and select ‘Enable’.
3. Check the Quadra NVMe device is available on the Host by running the following command.

```
wmic diskdrive get Name,Model,SerialNumber,FirmwareRevision
```



9.1.7 Useful links and References

1. https://docs.microsoft.com/en-us/virtualization/hyper-v-on-windows/quick-start/quick-create-virtual-machine
2. https://ubuntu.com/download/desktop
3. https://docs.microsoft.com/en-us/windows-server/virtualization/hyper-v/deploy/deploying-graphics-devices-using-dda#:~:text=Starting%20with%20Windows%20Server%202016,leverage%20the%20devices%20native%20drivers
4. https://docs.microsoft.com/en-us/windows-server/virtualization/hyper-v/deploy/deploying-graphics-devices-using-dda#:~:text=Starting%20with%20Windows%20Server%202016,leverage%20the%20devices%20native%20drivers
5. https://www.techtarget.com/searchvirtualdesktop/tip/Running-GPU-passthrough-for-a-virtual-desktop-with-Hyper-V
6. https://www.zdnet.com/article/windows-10-tip-find-out-if-your-pc-can-run-hyper-v/

10 Android Emulator

This section details the installation and usage of NETINT video transcoder device on an Android emulator.

10.1 Scripted build of Android Emulator and Netint SW on Linux host

The Android quick installer script can be used to install the Android emulator environment, then compile Netint libxcoder & FFmpeg using the Android NDK to run them in an Android emulator environment.

10.1.1 Prepare Installation Files

The installation scripts is located in the Android_quick_installer folder at the top level of the Netint release package. Or, it can be found in the tools/Android_quick_installer folder of the Netint SW release package folder (eg. Quadra_SW_V*.*.*_RC*/).

1. Move the contents of the Android_quick_installer folder to where you want Android development folders installed. Note, the development folders can be moved after installation too.
2. Move the Quadra_SW_V*.*.*_RC*/ folder to be with the contents of the Android_quick_installer folder.
3. Optionally, move the Quadra_FW_V*.*.*_RC*/ folder to be with the contents of the Android_quick_installer folder if you wish to use the quadra_android_quick_installer.sh to upgrade FW.
4. Make sure that the virtualization option (vt-x, vt-d) is enabled in BIOS before building android emulator environment.

10.1.2 Script usage help

Make sure that all files/folders required for installation are in the same directory:

- quadra_android_quick_installer.sh
- adb_push.sh
- build_all_android.sh
- init_android_rsrc_mon.sh
- run_emulator.sh
- patch/
- Quadra_SW_V*.*.*_RC*/

The following command may be used to see help text for the script:

bash quadra_android_quick_installer.sh -h

```
nvme@cli433:Android_quick_installer$ ./quadra_android_quick_installer.sh -h
This script performs installation of Android emulator environment with Netint
Quadra SW on Ubuntu host. Before use, please go to the BIOS and enable
virtualization options (eg. vt-x, vt-d).

For further installation help see README file

Install environment sequence:
Step 1:  Select usage of '64 bit' or '32 bit' Android.
Step 2:  Select option to 'Setup Environment variables'.
Step 3:  Select option to 'Install prerequisite Linux packages (Ubuntu)'.
Step 4:  Select option to 'Install nvme-cli'.
Step 5:  Select option to 'Download Android NDK-r21d and SDK-r24.4.1'.
Step 6:  Select option to 'Install Libxcoder to Linux host for build test
         (Optional)' if desiring to test libxcoder can install on host directly.
Step 7:  Select option to 'Install FFmpeg-n4.3 to Linux host for build test
         (Optional)' if desiring to test FFmpeg can install on host directly.
Step 8:  Select option to perform 'Firmware Update (Optional)' if desiring to
         upgrade firmware.
Step 9:  Select option to 'Download and build Android'. Download requires 60GB
         disk space, compile requires another 160GB of disk space.
Step 10:  Select option to 'Setup VFIO'. Host needs to be rebooted after this
         step. Continue steps after reboot.
Step 11: Select option to 'Check VFIO' is setup successfully.
Step 12: Select option to 'Build libxcoder and FFmpeg-n4.3 on Android emulator'.
Step 13: If previous step succeeds, the environment has been successfully
         installed. Select option to 'Quit'.
nvme@cli433:Android_quick_installer$
```

10.1.3 Script execution instructions

Start the script with the following command:

bash android_auto_install.sh

Then, follow the guided process. Refer to the steps in the scripts help text pictured above (bash android_auto_install.sh -h).

The main menu of the script is used to run individual steps of the Android environment installation.

```
nvme@cli433:Android_quick_installer$ ./quadra_android_quick_installer.sh
This script performs installation of Android emulator environment with Netint
Quadra SW on Ubuntu host. Before use, please go to the BIOS and enable
virtualization options (eg. vt-x, vt-d).

For further installation help see README file
Please put the Netint FW and SW release package you wish to install in the same
directory as this script.
The latest FW release package found here is:     Quadra_FW_V4.3.0_RC3.tar.gz
The latest FFmpeg release package found here is: Quadra_SW_V4.3.0_RC3.tar.gz
Press [Y/y] to confirm the use of these two release packages. y
Select usage of 64bit or 32bit Android:
1) 64 bit
2) 32 bit
3) Quit
#? 1
Android environment x86_64 (64 bit) selected
Choose an option:
 1) Setup Environment variables
 2) Install prerequisite Linux packages (Ubuntu)
 3) Install nvme-cli
 4) Download Android NDK-r21d and SDK-r24.4.1
 5) Install Libxcoder to Linux host for build test (Optional)
 6) Install FFmpeg-n4.3 to Linux host for build test (Optional)
 7) Firmware Update (Optional)
 8) Download and build Android
 9) Setup VFIO
10) Check VFIO
11) Build libxcoder and FFmpeg-n4.3 on Android emulator
12) Quit
#?
```

Option 1: Setup Environment variables

Set terminal environment variables ($PKG_CONFIG_PATH, $LG_LIBRARY_PATH), sudo $PATH, and ldconfig paths.

Option 2: Install prerequisite Linux packages (Ubuntu)

Use apt-get to install pre-requisite software packages for Ubuntu Linux host: nasm, libssl-dev, m4, libncurses5, zip, git, build-essential, make, cmake, gcc, g++, patch, ncurses-dev, valgrind,pkg-config, python2.7, curl

Option 3: Install NVMe CLI

Install nvme-cli app to aid in NVMe device administration and FW upgrade. Nvme-cli app is not necessary for transcoding.

Option 4: Download Android NDK-r21d and SDK-r24.4.1

Download the necessary Android NDK and SDK packages.

Option 5: Install Libxcoder to Linux host for build test (Optional)

Check prerequisites are installed well on Linux host by building Libxcoder for Linux.

Option 6: Install FFmpeg-n4.3 to Linux host for build test (Optional)

Check installed prerequisites on the Linux host by building FFmpeg-n4.3 for Linux.

Option 7: Firmware Update (Optional)

Update FW for Quadra cards on system. NVMe-cli required.

Option 8: Download and build Android

Download and build AOSP and Android kernel, then attempt to start Android emulator. Note, this step requires about 60GB of downloads and 220GB of free disk space. During this step there will be the option to select either global (Google) or chinese (Tsinghua university) download source.

Option 9: Setup VFIO

Install virt-manager to configure VFIO. When the VFIO installation is complete, a reboot is required to activate it. If installation is successful, the script will notify user to reboot the host for VFIO activation.

Use Option 12: Quit to leave the install script and sudo reboot now to reboot the host.

Option 10: Check VFIO

Check VFIO successfully activated

Option 11: Build libxcoder and FFmpeg on Android emulator

This step uses the following scripts so make sure they are in the same directory as the main script:

- build_all_android.sh
  - unzip android-ndk and android-sdk, copy libxcoder+FFmpeg to android_work/ external folder and build them
- adb_push.sh
  - push the files generated by build_all_android.sh to the Android emulator environment
- init_android_rsrc_mon.sh
  - launch the Android emulator environment and verify that the Quadra device is detected
- run_emulator.sh
  - launch the Android emulator environment in the background

If and error occurs during build of libxcoder and FFmpeg on Android emulator, please check log, debug issue, restart the host, and perform this step again.

Option 12: Quit

Exit script.

At this point, the Android environment is installed. Below are the manual installation steps, if there is a problem with the automatic installation script you can try manual installation.

10.2 Manual build on Linux host with 32 or 64 bit Android Emulator

10.2.1 Install the VFIO on the server

Run the following command to install the vfio

```
sudo apt-get install virt-manager python-spice-client-gtk
```

Reboot and go to the BIOS and enable virtualization option (vt-x, vt-d)

After boot up Modify the sudo vim /etc/default/grub

Add below:

```
GRUB_CMDLINE_LINUX_DEFAULT="intel_iommu=on"
GRUB_CMDLINE_LINUX="intel_iommu=on"
sudo update-grub
```

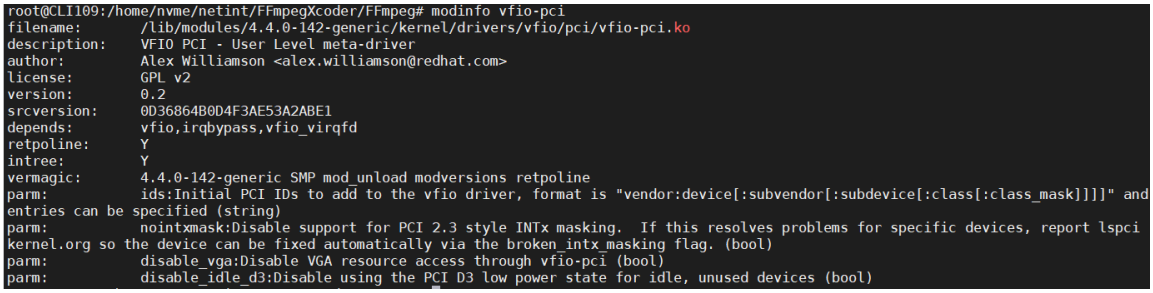
Then reboot again.

10.2.2 Check and insmod the VFIO module on your server

Run the commands below

```
modprobe vfio
modprobe vfio-pci
modinfo vfio-pci
```

If success it will print below info:



10.2.3 VFIO PCI Quadra to KVM

Running “lspci” to identify your Quadra pci address(Ex:0000:01:00.0) and sub-number: (1d82 0401) then run below cmd:

```
echo "0000:01:00.0" > /sys/bus/pci/drivers/nvme/unbind
echo 1d82 0401 > /sys/bus/pci/drivers/vfio-pci/new_id
chown fpga:fpga  /dev/vfio/1
```

Note: replace the “0000:01:00.0” with the actual PCI address that found in the “lspci”, replace fpga:fpga with the current user ID. Change the vfio device number based on the actual number that shows up under /dev/vfio. Different hosts may have different numbers.

Modify /etc/security/limits.conf to add

```
@fpga    hard    memlock 15928456
@fpga    soft    memlock 15928456
```

Note: some hosts require root access to modify limits.conf

Replace @fpga with your user name and replace 15442440 with your system memory size

Reference: https://www.kernel.org/doc/Documentation/vfio.txt

10.2.4 Start Android Emulator using VFIO PCI Quadra card

On the AOSP(android_work or android_work32) folder.

```
source build/envsetup.sh
lunch aosp_x86_64-eng  (for 32bit: lunch aosp_x86-eng)
emulator -memory 4096 -partition-size 4096 -writable-system -
netdelay none -netspeed full -gpu off -show-kernel -no-window -
qemu -enable-kvm -device vfio-pci,host=0000:01:00.0 -kernel
goldfish/arch/x86/boot/bzImage
```

Note: use your own PCI address, 0000:01:00.0 is just an example. Increase the virtual memory and partition size to 8g, “-memory 8192 -partition-size 8192” if you want to generate clips that are bigger than 1.5GB inside the emulator.

10.2.5 Check the card status when Android Emulator boot up

After the emulator boots up, open another terminal and run:

```
source build/envsetup.sh
```

lunch aosp_x86_64-eng .For 32bit lunch aosp_x86-eng

```
adb shell
ls /dev/
ls /dev/block/
```

If the command prints the /dev/nvme0 and dev/block/nvme0n1, it means the environment is ready.

10.2.6 Copy nidec with Android source

In the Android AOSP build folder copy the nidec folder to aosp/hardware/interfaces/

You can also get nidec from

https://1drv.ms/u/s!As9sncgYSSJhh3-RxB6qeTzfrkT7?e=DCd176

From inside the AOSP (android_work or android_work32) folder

```
source build/envsetup.sh
lunch aosp_x86_64-eng  (for 32bit: lunch aosp_x86-eng)
mmm aosp/hardware/interfaces/nidec/1.0
```

Copy the below generate files to android emulator:

```
adb root
adb remount
adb push aosp/out/target/product/generic_x86_64/system/lib/vndk-
28/android.hardware.nidec\@1.0.so /system/lib/vndk-28/
adb push
aosp/out/target/product/generic_x86_64/system/lib64/vndk-
28/android.hardware.nidec\@1.0.so /system/lib64/vndk-28/
adb push
aosp/out/target/product/generic_x86_64/system/lib64/android.hardw
are.nidec\@1.0.so /system/lib64/
adb push
aosp/out/target/product/generic_x86_64/system/lib/android.hardwar
e.nidec\@1.0.so /system/lib/
adb push
aosp/out/target/product/generic_x86_64/system/lib64/android.hardw
are.nidec\@1.0.so /vendor/lib64/
adb push
aosp/out/target/product/generic_x86_64/vendor/lib64/hw/android.ha
rdware.nidec\@1.0-impl.so /vendor/lib64/hw/
adb push
aosp/out/target/product/generic_x86_64/vendor/lib64/hw/android.ha
rdware.nidec\@1.0-impl.so /vendor/lib64/
adb push
aosp/out/target/product/generic_x86_64/vendor/bin/hw/android.hard
ware.nidec\@1.0-service /vendor/bin/hw/
adb push
aosp/out/target/product/generic_x86_64/vendor/etc/init/android.ha
rdware.nidec\@1.0-service.rc /vendor/etc/init/
```

10.2.7 Build libxcoder on Android source

On the AOSP(android_work or android_work32) folder.

```
source build/envsetup.sh
```

lunch aosp_x86_64-eng (for 32bit: lunch aosp_x86-eng)

```
mmm  ../FFmpegXcoder/libxcoder/source
```

Note: FFmpegXcoder is a reference folder. Folder name will depend on where the software package is extracted (Quadra_SW_v*).

Note: Try below command if the above build command is not working:

```
cp /home/$USER/FFmpegXcoder/libxcoder ./external/ -r
mmm ./external/libxcoder/source
```

Copy the below generate files to android emulator

```
adb root
adb remount
adb push
aosp/out/target/product/generic_x86_64/system/lib64/libxcoder.so
/system/lib64/
adb push aosp/out/target/product/generic_x86_64/system/lib/libxcoder.so
/system/lib/
adb push aosp/out/target/product/generic_x86_64/system/lib/vndk-
28/libxcoder.so /system/lib/vndk-28/
adb push aosp/out/target/product/generic_x86_64/system/lib64/vndk-
28/libxcoder.so /system/lib64/vndk-28/
adb push aosp/out/target/product/generic_x86_64/vendor/bin/ni_rsrc_mon
/system/bin/
```

Note: This should be the relative path to **FFmpegXoder/libxcoder/source**

An error will be reported if the path is absolute.

An example of an absolute path **/home/fpga/FFmpegXcoder/libxcoder/source**

10.2.8 Push security change to environment

You can also get **nidec** from

https://1drv.ms/u/s!As9sncgYSSJhh3-RxB6qeTzfrkT7?e=DCd176

In the AOSP (android_work or android_work32) folder

```
adb root
adb remount
adb push mediacodec.policy /system/etc/seccomp_policy/
adb push manifest.xml vendor/
```

10.2.9 Prepare ffmpeg4.3 environment

Download the following

android-ndk-r21d

from this location

https://developer.android.com/ndk/downloads

Note that you can also download it from

https://1drv.ms/u/s!As9sncgYSSJhh3-RxB6qeTzfrkT7?e=DCd176

Now download this

android-sdk_r24.4.1-linux

from this location

https://dl.google.com/android/android-sdk_r24.4.1-linux.tgz?utm_source=androiddevtools.cn&utm_medium=website

You can also download it from

https://1drv.ms/u/s!As9sncgYSSJhh3-RxB6qeTzfrkT7?e=DCd176

Unpack it in your home directory

```
unzip android-ndk-r21d-linux-x86_64.zip
```

You should now have the **ndk** folder

```
fpga@CLI206:~$ ls -laht |grep ndk

drwxr-xr-x   13 fpga fpga 4.0K Sep 28 19:02 android-ndk-r21d
```

10.2.10 Build FFmpeg 4.3 from the FFmpegXcoder

Build the libxcoder

```
fpga@CLI206:~/FFmpegXcoder$ cd libxcoder
fpga@CLI206:~/FFmpegXcoder/libxcoder$ make clean; bash build.sh
```

Build the FFmpeg 4.3

```
fpga@CLI206:~/FFmpegXcoder$ cd FFmpeg-n4.3
fpga@CLI206:~/FFmpegXcoder/FFmpeg-n4.3$ make clean
fpga@CLI206:~/FFmpegXcoder/FFmpeg-n4.3$ bash build_ffmpeg.sh -a -
-shared
fpga@CLI206:~/FFmpegXcoder/FFmpeg-n4.3$ make install
fpga@CLI206:~/FFmpegXcoder/FFmpeg-n4.3$ sudo ldconfig
```

You should now see the build output lib & bin in the following folders

./android/x86_64/lib

./android/x86_64/bin

Note: If the build fails with an **unaccepted sdk license** in the **build.log**

1. Record the name of the license
2. Go to **android-sdk-linux/tools**
3. Run the command
   ./android list sdk –all
   Now check the license ID you previously recorded
4. Run this command
   ./android update sdk –u -a –t ID1,ID2...

   or this which may take longer
   ./android update sdk –u -a

10.2.11 Push all the libs and bin to android

Note: The **adb** command requires an emulator running in another terminal

Start another terminal, under aosp folder:

```
source build/envsetup.sh
lunch aosp_x86_64-eng    #for 32bit: lunch aosp_x86-eng
adb root
adb remount
```

If you do not have the Android source code, you can directly use our build libs and bin for android x86_64 platform.

Push the aosp build output:

```
adb push
aosp/out/target/product/generic_x86_64/system/bin/ASharedBufferSe
rver   /system/bin/
adb push
aosp/out/target/product/generic_x86_64/system/bin/ni_rsrc_mon
/system/bin/
adb push
aosp/out/target/product/generic_x86_64/system/lib64/libxcoder.so
/system/lib64/
```

Note for 32bit :

```
adb push
aosp/out/target/product/generic_x86/system/bin/ASharedBufferServe
r  /system/bin/
adb push
aosp/out/target/product/generic_x86/system/bin/ni_rsrc_mon
/system/bin/
adb push
aosp/out/target/product/generic_x86/system/lib/libxcoder.so
/system/lib/
```

Push the FFmpeg4.3 **bin** and **lib** build outputs

```
adb push ./FFmpegXcoder/FFmpeg-n4.3/android/x86_64/bin/*
/system/bin/
adb push ./FFmpegXcoder/FFmpeg-n4.3/android/x86_64/lib/*
/system/lib64/
```

Make a soft link in the Android env for libraries

```
source build/envsetup.sh
lunch aosp_x86_64-eng    #for 32bit: lunch aosp_x86-eng
adb root
adb remount
adb shell
cd  /system/lib64        #for 32bit: cd  /system/lib
ln -s libxcoder.so libxcoder.so.250R1F10
reboot the android system
```

Note: 250R1F10 is the version number, change according to your release version

10.2.12 Run the ffmpeg on android platfrom

Only run this once, after the Android system boot up

```
adb shell
./vendor/bin/hw/android.hardware.nidec@1.0-service &
 ni_rsrc_mon
```

Now run the ffmpeg command

```
ffmpeg -y -hide_banner -nostdin -vsync 0 -c:v h264_ni_quadra_dec
-i libxcoder/test/1280x720p_Basketball.264 -c:v rawvideo
output_5.yuv
```

11 Android Docker

For Android 11 and later we use a Docker container rather than the Android emulator. We will now show how to setup the Android Docker environment, and how to use Quadra inside this Android Docker environment.

11.1 Download and start Android docker

ReDroid (**https://github.com/remote-android/redroid-doc**) is an open source project for an Android Docker container solution.

We can make a customized Android Docker image from ReDroid or we can use the prebuilt image by ReDroid. ReDroid provides Docker images for multiple versions of Android.

In this document we will use the Docker image for Android 11 provided by ReDroid.

1. Install the required kernel modules

```
apt install linux-modules-extra-`uname -r`
modprobe binder_linux devices="binder,hwbinder,vndbinder"
modprobe ashmem_linux
```

2. Download Android Docker image

```
docker pull redroid/redroid:11.0.0-latest
```

Note: The Android 11 Docker image provided by ReDroid is used here, but any other Android image could be used, according to the requirements.

3. Start the Android Docker container

```
docker run --name=android11 -itd --rm --privileged -v ~/data:/data
redroid/redroid:11.0.0-latest
```

NOTE: We should use the **--privileged** option when launching as this argument is required to successfully launch the Android Docker container.

4. After the Android Docker container has been launched successfully you can enter into the Android container by executing the following command:

```
docker exec -it android11 /system/bin/sh
```

You will find some NVMe devices:

```
ls /dev/nvme*
ls /dev/block/nvme*
```

11.2 Download and Build AOSP

There are 3 NETINT software package components required for an Android Docker environment. They should be built separately, and they are

1) NETINT customized Android service built based on AOSP

   android.hardware.nidec

2) A dynamic library for using NETINT's decoders/encoders and filters with FFmpeg. The library must be built on AOSP.

   libxcoder

3) To access NETINT decoders/encoders and filters in FFmpeg FFmpeg is built based on the Android NDK. This requires an Android NDK environment.

   FFmpeg

The AOSP environment must be setup first. AOSP is required for building the **android.hardware.nidec** service, and **libxcoder**.

1. Download the repo tool

```
mkdir ~/bin
curl http://commondatastorage.googleapis.com/git-repo-downloads/repo
> ~/bin/repo
chmod a+x ~/bin/repo
export PATH=~/bin:$PATH
```

2. Download AOSP

```
mkdir ~/android_work && cd android_work

repo init -u https://android.googlesource.com/platform/manifest -b
android-11.0.0_r48

repo sync -j16
```

NOTE: android-11.0.0_r48 is being used as an example in this section, choose the specific branch depending on the system's requirements.

3. Build AOSP

```
source build/envsetup.sh

lunch aosp_x86_64-eng

make –j16 //Use -j4 with for CPUs with fewer cores
```

Note: **aosp_x86_64-eng** is also just an example in this section, choose the AOSP based on the system requirements. If the environment is **x86_64** architecture then **aosp_x86_64-eng** is needed. But if the environment is **arm64** then **aosp_arm64-eng** is required. **aosp_x86_64-eng** is used for an example in this section.

11.3 Building the android.hardware.nidec service

android.hardware.nidec is NETINT's customized Android service. **Libxcoder** used this.

1. Change directory to the AOSP folder

```
cd ~/android_work
```

2. Copy the **nidec** folder to the **hardware/interfaces** path under the **AOSP** folder. Get the **nidec** folder from **FFmpegXcode**

```
cp ~/ FFmpegXcoder/AOSP/Android11/nidec  hardware/interfaces/ -r
```

3. Build the nidec service

```
source build/envsetup.sh
lunch aosp_x86_64-eng
mmm ./hardware/interfaces/nidec/1.0/
```

If successful, the following files will be generated in the AOSP out directory

```
out/target/product/generic_x86_64/system/lib64/android.hardware.nidec\@1.0.so
out/target/product/generic_x86_64/vendor/lib64/hw/android.hardware.nidec\@1.0-impl.so
out/target/product/generic_x86_64/vendor/bin/hw/android.hardware.nidec\@1.0-service
out/target/product/generic_x86_64/vendor/etc/init/android.hardware.nidec\@1.0-service.rc
```

Push the generated files to the Android run environment, see section11.7 for more details.

NOTE: In this document we assume FFmpegXcoder is placed under path ~/

11.4 Build libxcoder

libxcoder is required for NETINT's decoders/encoders and filters in FFmpeg. It must be build based on AOSP.

For when Quadra and Logan co-existence is required libxcoder and libxcoder_logan should be built separately.

1. Change directory to the AOSP folder and copy the libxcoder folder to the **external** folder under the AOSP folder.

```
cd ~/android_work
cp ~/FFmpegXcoder/libxcoder external/ -r
```

For Logan copy libxcoder_logan:

```
cp ~/FFmpegXcoder/libxcoder_logan external/ -r
```

2. Build the libxcoder

```
source build/envsetup.sh
lunch aosp_x86_64-eng
mmm ./external/libxcoder/source/
```

For Logan we should build libxcoder_logan:

```
mmm ./external/libxcoder_logan/source/
```

If the build is successful there will be the following generated files in the AOSP out directory

```
out/target/product/generic_x86_64/system/lib64/libxcoder.so
out/target/product/generic_x86_64/vendor/bin/ni_rsrc_mon
```

For Logan there are following generated files under AOSP out directory:

```
out/target/product/generic_x86_64/system/lib64/libxcoder_logan.so
out/target/product/generic_x86_64/vendor/bin/ni_rsrc_mon_logan
```

We need to push the generated files to the Android run environment. Refer to chapter 11.7 for details.

11.5 Build ffmpeg based on NDK

To Support NETINT's decoder, encoder and filter modules build FFmpeg based on the Android NDK.

1. Create a **pkg-config** file for **libxcoder**

libxcoder is referenced by **FFmpeg** which is based on the **pkg-config** mechanism. Generate the **pkg-config** file for **libxcoder** first.

```
cd ~/FFmpegXcoder/libxcoder/ &&  sh build.sh -a
```

The above step is for Quadra only. For Logan (including for when Quadra and Logan co-existence is required) **also** create the **pkg-config** file for **libxcoder_logan**

```
cd ~/FFmpegXcoder/libxcoder_logan/ &&  sh build.sh -a
```

Generate the **pkg-config** file for **libxcoder.** Now copy the AOSP generated libxcoder dynamic library to the specified directory in the libxcoder pkg-config file.

```
cp
~/android_work/out/target/product/generic_x86_64/system/lib64/libxcoder
.so /usr/local/lib/
```

For Logan we should copy libxcoder_logan:

```
cp
~/android_work/out/target/product/generic_x86_64/system/lib64/libxcoder
_logan.so /usr/local/lib/
```

2. Build FFmpeg

```
cd ~/FFmpegXcoder/FFmpeg-n4.3.1 && make clean
sh build_ffmpeg.sh -a -shared --android_arch=x86_64
make install
sudo ldconfig
```

For Quadra and Logan co-existence build FFmpeg with the following command:

```
sh build_ffmpeg.sh --quadra --logan -a -shared --android_arch=x86_64
```

Note: This uses FFmpeg-n4.3.1 as an example but other FFmpeg versions can be used depending on the system requirements.

There are a range of valid **android_arch** parameters [arm,arm64,x86,x86_64(default)], in this example we are using **x86_64**.

If the build is successful a folder named **android** is created under the path

~/FFmpegXcoder/FFmpeg-n4.3.1

There will also be some FFmpeg libraries and bin files generated under the same folder.

Push the generated files to the Android run environment. Please refer to section 11.7 for details.

11.6 Copying the build to the Android container

Before using the NETINT transcoding card inside the Android Docker container, copy the build output **lib/bin** files to the Android Docker container.

1. Push the **android.hardware.nidec** service build

Change the directory to AOSP, then copy these files to the Android Docker container

```
cd ~/android_work

docker cp
out/target/product/generic_x86_64/system/lib64/android.hardware.nidec\@
1.0.so /system/lib64/

docker cp
out/target/product/generic_x86_64/system/lib64/android.hardware.nidec\@
1.0.so / vendor/lib64/

docker cp
out/target/product/generic_x86_64/vendor/lib64/hw/android.hardware.nide
c\@1.0-impl.so /vendor/lib64/

docker cp
out/target/product/generic_x86_64/vendor/bin/hw/android.hardware.nidec\
@1.0-service /vendor/bin/hw/

docker cp
out/target/product/generic_x86_64/vendor/etc/init/android.hardware.nide
c\@1.0-service.rc /vendor/etc/init/
```

2. Push the libxcoder build

Change directory to AOSP, then copy the file to the Android Docker container:

```
cd ~/android_work

docker cp out/target/product/generic_x86_64/system/lib64/libxcoder.so
/system/lib64/

docker cp out/target/product/generic_x86_64/vendor/bin/ni_rsrc_mon
/system/bin/
```

For the Quadra and Logan co-existence case, also copy the following file:

```
cd ~/android_work

docker cp
out/target/product/generic_x86_64/system/lib64/libxcoder_logan.so
/system/lib64/

docker cp
out/target/product/generic_x86_64/vendor/bin/ni_rsrc_mon_logan
/system/bin/
```

3. Copy the FFmpeg build

Change directory to FFmpeg and copy the FFmpeg **libs/bin** to the Android container

```
cd ~/FFmpegXcoder/FFmpeg-n4.3.1

docker cp android/x86_64/lib/* /system/lib64/

docker cp android/x86_64/bin/* /system/bin/
```

11.7 Copy the customized manifest file to Android container

As described in section 11.4, **android.hardware.nidec** is a customized Android service. To start the service, first register it to the Android system using the manifest file.

The file android.hardware.nidec@1.0-service.xml is the manifest file for the customized Android service.

Copy the android.hardware.nidec@1.0-service.xml file to the Android run environment

```
cd ~/FFmpegXcoder/AOSP/Android11/

docker cp android.hardware.nidec@1.0-service.xml
/vendor/etc/vintf/manifest/
```

NOTE: Change the destination path to the manifest file being copied according to the desired running environment.

11.8 Run FFmpeg inside the Android container

After copying the build to the Android container, restart the Android container

```
docker restart android11
```

To use Quadra follow these steps

1. Initialization the device

```
ni_rsrc_mon
```

```
ni_rsrc_mon_logan //this step is need for Quadra and Logan co-existence
```

NOTE: **ni_rsrc_mon** is for Quadra only. For Logan use **ni_rsrc_mon_logan**. For Logan also execute **ni_rsrc_mon_logan**

2. Execute the ffmpeg command

Example Test command for Quadra

```
ffmpeg -c:v h264_ni_quadra_dec -i 1280x720p_Basketball.h264 -c:v h265_ni_quadra_enc test.h265 -y
```

For co-existence of Quadra and Logan, the test command for Logan should be

```
ffmpeg -c:v h264_ni_logan_dec -i 1280x720p_Basketball.264 -c:v h265_ni_logan_enc test.265 -y
```

12 Enable PCIe bifurcation for Quadra T2A

Please note that the host has to support x4 PCIe bifurcation.

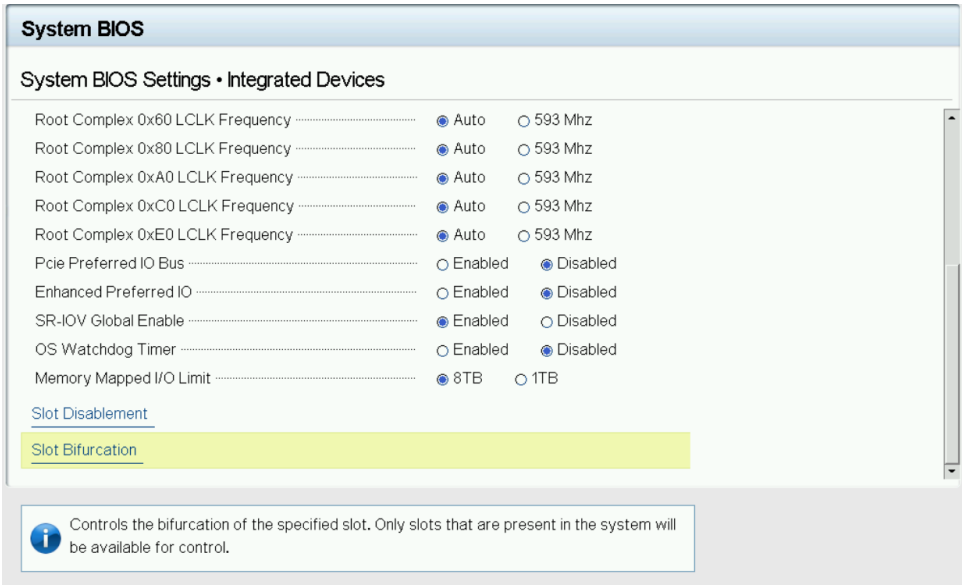
1. Boot into BIOS/CMOS

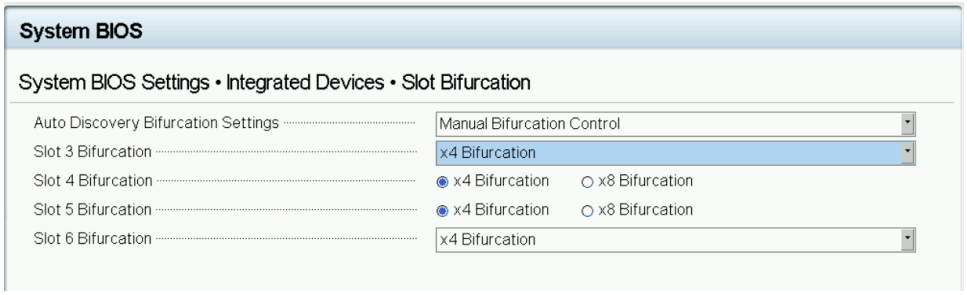
2. Set bifucation to use x4

   Find bifucation setting in BIOS and set it to use x4 or x4x4x4x4.

   Please note that bifucation settings might be named differently with different BIOS

   Example bifurcation setting:





3. Confirm bifurcation is set correctly. You should see two units from the T2 card

```
nvme@nvme-cli444:~$ sudo nvme list
Node             SN                   Model
---------------- -------------------- --------------
/dev/nvme0n1     Q2A224A11DC066-0014B QuadraT2A-EP2
/dev/nvme1n1     Q2A224A11DC066-0014A QuadraT2A-EP2
```

13 Versioning Number Schema

NETINT release package contains multiple components with their own release version numbers and semantic like compatibility numbers.

13.1 Release Version Number

The Netint Quadra *release version numbers* e.g. 4.7.0 consist of 3 single characters

```
Major.Minor.Micro
```

Major milestone releases will increment the 1st /Major character. Periodic releases from the development trunk will increment the 2nd/minor version number. And all other types of releases (e.g. hotfix) will increment the 3rd/micro number.

The *release version number* characters range from 0 to 9, then A through to Z.

A release of greater *release version number* supersedes releases of lesser *release version number* as newer releases are based upon older releases. Users should keep updated to the latest available release version numbers to have access to the latest features and bug fixes.

Upgrading to the latest releases should be low effort due to the fact that Quadra supports backward compatibility of all its APIs. Quadra also supports executing any version of firmware with any versions of software. So upgrades can be performed with the firmware on the device first, then later upgrading to the latest software (if needed).

Users should check the release notes for indications of what has been fixed recently, in order to decide if an upgrade is required.

NETINT release **packages** have a *release version number*, but the FW and SW releases also have their own 3 character FW/SW *release version number*. FW and SW releases in a release package do not always share the same *release version number*. If FW and SW releases in a release package are of different *release version numbers*, the release package's *release version number* will be the larger *release version number* between FW and SW releases.

13.2 Full Version Number

Between the Firmware revision and Software applications there is also an 8 character *full version number* (e.g. 4706r3r4).

The firmware *full version number* can be seen and read from the following commands

```
sudo nvme list
```

or

```
./quadra_fw_info FL_BIN/*.bin
```

The Software *full version number* can be read from any libxcoder applications with the `-v` argument. For example:

```
ni_rsrc_mon -v
```

It is also defined in code of the **`libxcoder/source/ni_defs.h`** file.

The first 3 characters of the *full version number* is the *release version number*.

The 4th to 6th characters are the FW API version number (see below).

The last 2 characters of the *full version number* are for NETINT to track release development.

13.3 FW API Version Number

Within the *full version number* (eg. 4706r3r4) of FW and SW applications the 4th to 6th characters contain the *FW API version number*. This is one semantic major and two minor version numbers that tracks API compatibility between the firmware on the device and the libxcoder version. The major *FW API version number* must match between FW and libxcoder for basic interoperability. The minor *FW API version numbers* should match to access full/new feature set of FW/libxcoder.

NETINT maintains backward compatibility between FW and libxcoder in all releases.

13.4 Libxcoder API Version Number

The *libxcoder API version number* is a semantic major and minor version number pair that tracks libxcoder public API compatibility with linked APIs (eg. libavcodec) and applications (eg. xcoder-util).

It can be read from code in the following file

`libxcoder/source/ni_defs.h`

The *libxcoder API version number* characters is strictly numeric. The individual major and minor portions may have more than one digit.

The major *libxcoder API version number* will be incremented when the API changes are backward incompatible. The minor *libxcoder API version number* will be incremented when new features are added that require updating application code to access.

Regardless of any *libxcoder API version number* changes, it is recommended to recompile all applications linked to libxcoder when updating to a new SW *release version*.

14 Useful documents and references

There are several documents included in each Quadra release package. Please ask NETINT support if you require help finding any of them.

1. **Quick Start Guide Quadra**
   This guide is a quick and easy setup guide for Quadra. It walks through a typical setup for a user who requires FFmpeg only using Linux.

2. **Integration Programming Guide Quadra**
   This is a detailed guide that shows how to integrate Quadra into customer solutions. It covers how to integrate Quadra in your application using various SDKs, for example FFMpeg, GStreamer or our own NETINT proprietary libxcoder API.

3. **Installation Guide Quadra**
   This is the document you are reading right now, and it covers all methods of installation and setup for Quadra. All supported Operating Systems, Architectures, Form Factors, Frameworks, VMs, Containers etc. are covered.

4. **Libxcoder API Guide Quadra**
   This document details the API that is available from libxcoder. This is NETINTs proprietary framework that can use used instead of FFmpeg or GStreamer.

5. **Release Notes**
   Every new release of Quadra includes a set of release notes that describe every bug fix and all the new features that have been added in that release.

6. **Performance and Quality Reports**
   To ensure Quardas strict Performance and Quality requirements are maintained for all releases, reports are published for every release. Customers are then assured that no degradation will be experienced if upgrading to any other release.

7. Please contact NETINT support for a complete list of **Application Notes** for Quadra. These are some examples of Quadra's App Notes are

    - Encoder Quality
    - Low Latency
    - Sequence Change
    - Live Streaming

    - Android
    - Windows 2019/2026/MSYS64
    - MacOS

    - SR-IOV in Linux
    - Docker

    - Libavcodec API
    - GStreamer