Intel® Ethernet NVM Update Tool

Quick Usage Guide for FreeBSD

Ethernet Products Group (EPG)

November 2020

Revision 1.3
333909-004

Revision History

Revision	Date	Comments
1.3	November 19, 2020	Updates include the following: • Updates to include Intel® Ethernet Controller X710-TM4/AT2 as part of the 700 Series. • Minor formatting and pagination.
1.2	October 12, 2020	Updates include the following: • Updates for Intel® Ethernet Controller E810.
1.1	November 19, 2018	Updates include the following: • Updates for NVM version 6.80 for Intel® Ethernet Controller X710/XXV710/XL710. • Updated for NVM version 2.00 for Intel® Ethernet Controller X550. • Added Section 5.1, "Recovery Mode". • Added Section 6.0, "Troubleshooting". • Added Section 7.0, "Create/Edit nvmupdate.cfg for Custom NVM Images".
1.0	February 10, 2016	Initial public release.

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1.0 Introduction

This document demonstrates how to use the Intel® Ethernet NVM Update Tool (NVM Update Tool) to update both the Non-Volatile Memory (NVM) and drivers on Network Adapters based on the following devices:

Series	Devices
Intel® Ethernet 800 Series (800 Series)	• Intel® Ethernet Controller E810-XXVAM2 • Intel® Ethernet Controller E810-CAM1 • Intel® Ethernet Controller E810-CAM2
Intel® Ethernet 700 Series (700 Series)	• Intel® Ethernet Controller X710-AM2 • Intel® Ethernet Controller X710-BM2 • Intel® Ethernet Controller XXV710-AM1 • Intel® Ethernet Controller XXV710-AM2 • Intel® Ethernet Controller XL710-AM1 • Intel® Ethernet Controller XL710-AM2 • Intel® Ethernet Controller XL710-BM1 • Intel® Ethernet Controller XL710-BM2 • Intel® Ethernet Controller X710-AT2 • Intel® Ethernet Controller X710-TM4
Intel® Ethernet 500 Series (500 Series)	• Intel® Ethernet Controller X550-AT • Intel® Ethernet Controller X550-AT2 • Intel® Ethernet Controller X550-BT2

This document is a guide to servicing NVM images, firmware, and drivers of the 800 Series, 700 Series, and 500 Series devices by customers and service technicians in the field.

Note: The information in this document is for experienced system administrators who are familiar with server, network, and data center concepts and technologies.

2.0 Update Both NVM and Driver at the Same Time

Keeping up with software changes, performance enhancements, or security updates requires the most current hardware drivers for supported systems. Previous updates to Intel network adapters were driver specific. With 800 Series, 700 Series, and 500 Series Network Adapters, both the firmware (device NVM image) and network drivers are field-serviceable, allowing the NVM image and network driver to be updated as a matched set. Updating the device image and driver together can increase key features including performance, manageability, media types, physical port counts, virtualization, offloads, remote boot options, VLAN support, teaming, and Receive Side Scaling.

Note: Update to the most current *ice* and *i40e* driver prior to running the NVM Update Tool to ensure the newest features of the NVM image can be installed.

The NVM Update Tool has a built-in integrity check that ensures only Intel-approved firmware updates on 800 Series, 700 Series, and 500 Series devices. Integrity validation of NVM updates is provided by a digital signature. NVM updates are validated prior to invalidating the old NVM configuration, so the old NVM and the configuration are still usable should the update fail.

Note: On 700 Series and 500 Series devices, updating to the most current NVM (with the NVM Update Package) and driver does not update the Option ROM. Intel recommends an Option ROM update after the NVM and driver are updated. Refer to the User Guide for Intel® Ethernet Adapters page for the most current Option ROM update process version.

3.0 Obtaining New Images

The Intel Download Center is Intel's repository for the latest software and drivers for Intel products. The NVM Update Packages for Windows, Linux, ESX, FreeBSD, and EFI/EFI2 are located at:

Network Adapter Series	Link
Intel® Ethernet Network Adapter E810 Series	https://downloadcenter.intel.com/download/29736
Intel® Ethernet Network Adapter 700 Series	https://downloadcenter.intel.com/download/24769
Intel® Ethernet Network Adapter X550 Series	https://downloadcenter.intel.com/download/28336

Use the Software/NVM matrix tables in following documents to ensure firmware image and driver compatibility. These documents are continuously maintained and always up-to-date:

Document	Link
Intel® Ethernet Controller E810 Feature Support Matrix	Doc ID: 630155
Intel® Ethernet Controller X710-TM4/AT2 and V710-AT2 Feature Support Matrix	Doc ID: 619407
Intel® Ethernet Controller X710/XXV710/XL710 Feature Support Matrix	Doc ID: 332191
Intel® Ethernet Controller X550 Feature Support Matrix	Doc ID: 335253

4.0 Verifying Driver, Image Version, and Package Inventory

The FreeBSD version of the NVM Update Tool requires a network driver on the system prior to the NVM update. It is recommended that the most current driver be installed on the system. FreeBSD network drivers can be downloaded from the Intel Download Center.

The first thing to check on the system receiving the update is the most current network driver and NVM image. This can be done with several system commands such as **dmesg**, **sysctl**, or **ifconfig**. For the purposes of this paper, the **sysctl** interface is used to examine network adapter "ixl" (in the case of Intel® Ethernet 700 Series Network Adapters) and "ice" (in the case of Intel® Ethernet 800 Series Network Adapters) parameters.

```
sysctl dev.ixl.0 (device name)
```

or:

```
sysctl dev.ice.0 (device name)
```

Output of `sysctl dev.ixl.0` shows the running version of the NVM image, the ETrackID, and network driver of the 700 Series Network Adapter, as follows:

```
root@fmsnet30:/usr/home/admin # sysctl dev.ixl.0 (output truncated)
dev.ixl.0.fw_version: nvm 4.53 etid 8000 1f54 oem 0.0.0
dev.ixl.0.current_speed: 10G
dev.ixl.0.advertise_speed: 0
dev.ixl.0.fc: 0
dev.ixl.0.%parent: pci1
dev.ixl.0.%pnpinfo: vendor=0x8086 device=0x1572 subvendor=0x8086
dev.ixl.0.%location: slot=0 function=0
dev.ixl.0.%driver: ixl
dev.ixl.0.%desc: Intel(R) Ethernet Connection XL710 Driver, Version - 1.4.26
```

Output of `sysctl dev.ice.0` shows the running version of the NVM image, the ETrackID, and network driver of 800 Series Network Adapter, as follows:

```
root@: # sysctl dev.ice.0 (output truncated)
dev.ice.0.fw_version: fw 4.1.1 api 1.5 nvm 1.40 etid 8000 3ab8 netlist 1.40.2000-
3.13.0.2813dbee oem 1.2735.0
dev.ice.0.%desc: Intel(R) Ethernet Network Adapter E810-C-Q2 - 0.26.16
```

The last 4 hex characters in the firmware version denote the ETrackID.

In preparation for the firmware update, update the network driver to the most current version and identify the path to the NVM Update Tool on the target system.

5.0 Running the NVM Update Tool

The NVM Update Tool runs from a Command-Line Interface (CLI). There are optional CLI attributes for specific tasks and are recommended for advanced users only. As CLI syntax, the NVM Update Tool can be scripted to run across large environments. An example of the update syntax is as follows:

```
nvmupdate64e - command syntax
nvmupdate64e -l fileoutput.txt - command with optional attribute
```

Note: For assistance with optional CLI attributes, contact your Intel Representative.

After extracting the tar file, navigate to the location of the NVM Update Tool executable to change the *nvmupdate64e* executable file permissions, as follows:

```
root@fmsnet30:/usr/home/admin # chmod 755 nvmupdate64e
```

Run the tool like any UNIX executable. An example of the UNIX version of the NVM Update Tool update and its output is shown in Figure 1.

Note: A typical update takes several minutes to complete.

```
root@:~/E810/FreeBSDx64 # ./nvmupdate64e

Intel(R) Ethernet NVM Update Tool
NVMUpdate version 1.35.42.5
Copyright (C) 2013 - 2020 Intel Corporation.


WARNING: To avoid damage to your device, do not stop the update or reboot or power off the system during this update.
Inventory in progress. Please wait [***|......]


Num Description                          Ver.(hex)  DevId S:B    Status
=== ================================ =========== ===== ====== ==============
01) Intel(R) Ethernet Network Adapter   1.64(1.40)   1592 00:055 Update
    E810-C-Q2                                                  available

Options: Adapter Index List (comma-separated), [A]ll, e[X]it
Enter selection: a
Would you like to back up the NVM images? [Y]es/[N]o: n
Update in progress. This operation may take several minutes.


Num Description                          Ver.(hex)  DevId S:B    Status
=== ================================ =========== ===== ====== ==============
01) Intel(R) Ethernet Network Adapter   2.21(2.15)   1592 00:055 Update
    E810-C-Q2                                                  successful

Reboot is required to complete the update process.

Tool execution completed with the following status: All operations completed successfully.
Press any key to exit.
```

Figure 1. Example Update and Output

Note: The NVM update may require a two-step process depending on the initial image revision. Use the Software/NVM Compatibility table to verify the latest image versions.

When the flash image write completes, the tool asks for a reboot of the system to complete the update process and load the new firmware. After the reboot, verify the new firmware with **sysctl**, as follows:

```
root@fmsnet30:/usr/home/admin # sysctl dev.ixl.0 (output truncated)
dev.ixl.0.fw_version: nvm 5.02 etid 800020e1 oem 0.0.0
dev.ixl.0.current_speed: 10G
dev.ixl.0.advertise_speed: 0
dev.ixl.0.fc: 0
dev.ixl.0.%parent: pci1
dev.ixl.0.%pnpinfo: vendor=0x8086 device=0x1572 subvendor=0x8086
dev.ixl.0.%location: slot=0 function=0
dev.ixl.0.%driver: ixl
dev.ixl.0.%desc: Intel(R) Ethernet Connection XL710 Driver, Version - 1.4.26
```

```
dmesg ouput of E810 adapter displays the ETrack ID, NVM FW and driver versions.
root@:~ # dmesg (output truncated)
ice0: <Intel® Ethernet Network adapter E810-C-Q2 - 0.26.16>
ice0: fw 5.1.5 api 1.7 nvm 2.15 etid 800049c3 netlist 2.1.2000-3.13.0.550223bf oem
```

Note: When updating from early NVM images, the NVM Update Tool may indicate that a power-cycle of the system is necessary.

Note: The NVM update may be (requires) a two-step process depending on the initial image revision. Use the Software/NVM Compatibility table to verify the latest image versions.

Note: The tool allows for updating one, multiple, or all of the installed adapters. For example, to update NVM firmware for two of three installed adapters, follow the syntax as shown in the example below. Enter selection 02,03 (separated by a commas).

```
Num Description                              Ver. DevId S:B    Status
=== ======================================= ===== ===== ====== =========================
01) Intel(R) Ethernet Converged Network     1.147  1563 00:004 Update not available
    Adatper X550-T2
02) Intel(R) Ethernet Network Adapter        5.81  158B 00:006 Update available
    XXV710-2
03) Intel(R) Ethernet Converged Network      5.05  1583 00:131 Update available
    Adapter XL710-Q2

Options: Adapter Index List (comma-separated), [A]ll, e[X]it
Enter selection:02,03
Would you like to back up the NVM images? [Y]es/[N]o: n
Update in progress. This operation may take several minutes.
[***+......]
Reboot is required to complete the update process.

Tool execution completed with the following status: All operations completed successfully
Press any key to exit.
```

Figure 2. Example for Updating Multiple Adapters

5.1 Recovery Mode

When using the NVM Update Tool, it is possible to get a status of "RECOVERY" or messages about Recovery Mode from the tool and/or Base Driver. If this occurs please refer to the *Recovery Mode for Intel® Ethernet Products Application Note* (Doc ID: 606286).

6.0 Troubleshooting

- Update to the most current base driver prior to running the NVM Update Tool to ensure the newest features of the NVM image can be installed.
- Refer to the "NVM and Software Compatibility" section in each of the following documents:

Document	Link
Intel® Ethernet Controller E810 Feature Support Matrix	Doc ID: 630155
Intel® Ethernet Controller X710-TM4/AT2 and V710-AT2 Feature Support Matrix	Doc ID: 619407
Intel® Ethernet Controller X710/XXV710/XL710 Feature Support Matrix	Doc ID: 332191
Intel® Ethernet Controller X550 Feature Support Matrix	Doc ID: 335253

  The "Software/NVM Compatibility" tables indicate the set of NVM images and Intel® Ethernet Controller software releases that go together. Intel recommends that you update the NVM and Software driver to compatible versions.

  The "NVM Transition Support" tables indicate the version of NVM from which the NVM Update Tool allows updates.
- In case of a security issue, the security revision might be incremented and then an NVM update to an older NVM with a lower security revision might not be allowed.
- The NVM version for the X550 is NOT shown in when using the `sysctl -I <portname>` command. Only the EEtrack ID is displayed. If you run **nvmupdate** with **-i**, the version is displayed.

6.1 Troubleshooting Using Debug Logs

1. Use the following command to get the log file if there is any error seen.

   ```
   nvmupdate64e -l nvmupdate.log
   ```

   This is a text file that contains history of the NVM Update tool's execution, including the success or failure status for each operation, and what adapters and ORMs were discovered. After running this command, the tool creates the *nvmupdate.log* file under the same folder as *nvmupdate.cfg*. The log file is overwritten each time the NVM Update tool is executed.

2. Use following command to get a little more information on what is in the system by using **nvmupdate** with an inventory mode.

   ```
   nvmupdate64e -i -l inv.log
   ```

   This provides more details about the adapters in the system to help narrow down the debug scope.

3. Use following command(s) to get a superset of debug logs.

   First set following environment variables before **nvmupdate** execution. For debugging purposes, it is necessary to set these flags:

   ```
   export NUL_DEBUGLOG=1
   export QV_DEBUG_LOG=0xFFFFFFFF
   ```

   Now the log generated using the following command is much more detailed.

   ```
   nvmupdate64e -l nvmupdate.lo
   ```

If you continue to have issues, contact Intel support with all these log files.

7.0 Create/Edit *nvmupdate.cfg* for Custom NVM Images

The goal of this section is to assist Intel Ethernet users to create/edit the *nvmudpate.cfg* file for their custom NVM images. For the 800 Series, 700 Series, and 500 Series Network Adapters, this allows the use of NVM Update utility to update custom NVM images that are not included in the NVM Updated packages posted by Intel.

7.1 Sample Configuration File Template

The following is an example of a configuration file with one device block:

```
============================================================
 CURRENT FAMILY: 1.0.0
 CONFIG VERSION: 1.20.0

 ; NIC device
 BEGIN DEVICE
  DEVICENAME: E810_CQDA2_O_SEC_FW
  VENDOR: 8086
  DEVICE: 1592
  SUBVENDOR: 8086
  SUBDEVICE: 0002
  NVM IMAGE: E810_CQDA2_O_SEC_FW_1p4p1p13_NVM_2p0_PLDMoMCTP_80003D96_signed_pldm_fixed.bin
  EEPID: 80003D96
  SKIP NETLIST: FALSE
  IMAGE DOWNGRADE: TRUE
  RESET TYPE: REBOOT
  CURRENT GFID: 0157-1590
  ORIGINAL GFID: 0157-1590
  REVISION: 02
 ; REPLACES: 80003D96
 END DEVICE
============================================================
```

7.2 Device Block in the Configuration File

A device block in configuration file lists out following information:

- **CONFIG VERSION** — Version of syntax for the configuration file.
- **DEVICENAME** — Device name currently in use. For example, Intel X550 Adapter, etc.
- **VENDOR** — PCI vendor ID 8086 identifies Intel as the manufacturer of the device.
- **DEVICE** — Device ID. Device IDs for supported retail Intel Ethernet Adapters can be found in here:

  https://www.intel.com/content/www/us/en/support/articles/000005612/network-and-i-o/ethernet-products.html
- **SUBVENDOR** — Sub-vendor ID in hexadecimal format. This is optional when EEPID is used.
  - On 800 Series NIC entries, this is a mandatory field.
  - On 700 Series and 500 Series devices, this is optional when EEPID is used.
- **SUBDEVICE** — Sub-device ID in hexadecimal format. This is optional when EEPID is used.
  - On 800 Series NIC entries, this is a mandatory field.
  - On 700 Series and 500 Series devices, this is optional when EEPID is used.
- **NVM IMAGE** — NVM Image binary file name with which to update.

- **OROM IMAGE** — OROM Image file name.
- **EEPID** — ETrack ID of NVM Image with which to update.
- **REPLACES** — ETrack ID of NVM Image that with which to replace. Multiple ETrack IDs can be entered, separated by spaces.
  - On 800 Series NIC entries, the tool compares 4-part ID, which makes this field optional.
- **RESET TYPE** — Specifies whether reboot/power cycle is required to complete the NVM update process.
- **REVISION** — Revision number in hexadecimal format.
  - On 800 Series NIC devices, this field differentiates between B0 and C0 devices.
  - This is optional on 700 Series and 500 Series devices.
- **CURRENT GFID** — On 800 Series devices, the value consists of Intel IANA and Silicon default Device ID. If this field is not present but **ORIGINAL GFID** is, the tool uses **ORIGINAL GFID** value for both cases. This is important to reduce the time required for update to complete.
- **ORIGINAL GFID** — On 800 Series devices, the value consists of Intel IANA and Silicon default Device ID. If this field is not present but **CURRENT GFID** is, the tool uses **CURRENT GFID** value for both cases. This is important to reduce the time required for update to complete.

7.3 Steps to Create/Edit *nvmupdate.cfg* File to Update Custom NVM Image

7.3.1 On 800 Series Devices

1. Include the custom NVM Image binary file under the same folder as the *nvmupdate.cfg* file and *nvmupdate64e* executable file.
2. Open the *nvmupdate.cfg* file as text file.
3. Copy and paste one of the device blocks (or use the example in Section 7.1) and update following information for custom NVM image update.
   a. Custom NVM Image binary file name in **NVM IMAGE** field.
   b. ETrack ID (in the **EEPID** field) of the custom NVM Image listed in **NVM IMAGE** field. This is the image that the device will be update to.
   c. ETrack ID (in **REPLACES** field) of NVM Image that an update will be allowed from applies only for LOM designs, and is not needed for NIC devices.

      Note: When editing the *nvmupdate.cfg* file, if there is a need to have ETrack ID in the **REPLACES** field, you must ensure that this ETrack ID and the **EEPID** field are the same type of image and are both created for the device that is being updated.

   d. **DEVICE**, **VENDOR**, **SUBDEVICE**, and **SUBVENDOR** must be set correctly to match the device required to update.

   The remaining fields (including **CURRENT FAMILY**, **CONFIG VERSION**, **DEVICENAME**, and **RESET TYPE**) can typically be left as is.
4. Run the *nvmupdate64e* executable file.

Following is an example of Device block in the configuration file. This includes the minimum fields required for an update. The fields listed in red should be updated:

```
=========================================================================
 CURRENT FAMILY: 1.0.0
 CONFIG VERSION: 1.20.0

 ; NIC device
 BEGIN DEVICE
  DEVICENAME: E810_CQDA2_O_SEC_FW
  VENDOR: 8086
  DEVICE: 1592
  SUBVENDOR: 8086
  SUBDEVICE: 0002
  NVM IMAGE: nvmImage.bin [Include the NVM Image File name to be updated with]
  EEPID: 80003FFF [Mention ETrack ID of NVM Image that need to be updated with]
  SKIP NETLIST: FALSE
  IMAGE DOWNGRADE: TRUE
  RESET TYPE: REBOOT
  CURRENT GFID: 0157-1590
  ORIGINAL GFID: 0157-1590
  REVISION: 02
 ; REPLACES: 80003D96 [Optional when 4 part ID is used above, Multiple Etrack IDs
                       can be entered separated with space]
 END DEVICE
=========================================================================
```

7.3.2 On 700 Series and 500 Series Devices

1. Include the custom NVM Image binary file under the same folder as the *nvmupdate.cfg* file and *nvmupdate64e* executable file.
2. Open the *nvmupdate.cfg* file as text file.
3. Copy and paste one of the device blocks (or use the example in Section 7.1) and update following information for custom NVM image update.
   a. Custom NVM Image binary file name in **NVM IMAGE** field.
   b. ETrack ID (in the **EEPID** field) of the custom NVM Image listed in NVM IMAGE field. This is the image that the device will be update to.
   c. ETrack ID (in **REPLACES** field) of NVM Image that an update will be allowed from.

      Note: When editing the *nvmupdate.cfg* file, you must ensure the ETrack ID in the **REPLACES** field and the **EEPID** field are the same type of image and are both created for the device that is being updated. For example, in 700 Series, a device with CFG_ID 2.4 should be updated with an image with CFG_ID 2.4.

   d. **DEVICE**, **VENDOR**, **SUBDEVICE**, and **SUBVENDOR** must be set correctly to match the device required to update. **SUBDEVICE**, and **SUBVENDOR** are optional when **EEPID** is used.

   OROM update can be skipped by including the line `SKIP OROM: TRUE`. Use **bootutil** to update the OROM if necessary. The remaining fields, including **CURRENT FAMILY**, **CONFIG VERSION**, **DEVICENAME**, and **RESET TYPE**, can typically be left as is.
4. Run *nvmupdate64e* executable file.

Following is an example of Device block in the configuration file. This includes the minimum fields required for an update. The fields listed in red should be updated:

```
==========================================================================
 CURRENT FAMILY: 12.1.1
 CONFIG VERSION: 1.7.0

 BEGIN DEVICE
  DEVICENAME: Intel x540 Adapter
  VENDOR: 8086
  DEVICE: 10C9
  NVM IMAGE: nvmImage.bin [Include the NVM Image File name to be updated with]
  SKIP OROM: TRUE
  EEPID: 800007A9 [Mention ETrack ID of NVM Image that need to be updated with]
  REPLACES: 80000692 [Looks for Etrack ID of NVM Image that need to be replaced,
                      Multiple Etrack IDs can be entered separated with space]
  RESET TYPE: POWER
 END DEVICE
==========================================================================
```

8.0 Summary

Updating the NVM and network driver can increase performance, manageability, and reliability of the 800 Series, 700 Series, and 500 Series Network Adapters. The update process has a built-in integrity feature to ensure that only Intel-approved firmware code is able to be updated after manufacturing. This procedure is performed each time an attempt is made to update one of the protected modules.

Intel Customer Support Services offers a broad selection of technical and customer support programs. For more information, contact your local Intel representative. Service and availability may vary by country.

For more information on the 800 Series Network Adapter family, go to the following links:

- Intel® Ethernet 800 Series Network Adapters
- Downloads for Intel® Ethernet Network Adapter E810 Series
- Intel® Ethernet 800 Series Controllers
- Intel® Ethernet Controller E810 Technical Library
- Downloads for Intel® Ethernet Controller 800 Series

For more information on the 700 Series Network Adapter family, go to the following links:

- Intel® Ethernet 700 Series Network Adapters
- Downloads for Intel® Ethernet Network Adapter X710 Series
- Downloads for Intel® Ethernet Network Adapter XXV710 Series
- Downloads for Intel® Ethernet Server Adapter XL710 Series
- Intel® Ethernet 700 Series Controllers
- Intel® Ethernet Controller X710, 10 GbE Technical Library
- Intel® Ethernet Controller XXV710, 25 GbE Technical Library
- Intel® Ethernet Controller XL710, 40 GbE Technical Library
- Intel® Ethernet Controller X710-TM4/AT2 Technical Library
- Downloads for Intel® Ethernet 700 Series Controllers

For more information on the 500 Series Network Adapter family, go to the following links:

- Intel® Ethernet 500 Series Network Adapters
- Downloads for Intel® Ethernet Converged Network Adapter X550 Series
- Intel® Ethernet 500 Series Controllers
- Intel® Ethernet Controller X550 Series Technical Library
- Downloads for Intel® Ethernet 500 Series Controllers

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