Thunderbolt™

Software Development Kit Guide

Version 4.7

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Version History

Version	Date	Comments
4.7	March 21, 2018	Updated document to support Thunderbolt'17 SW4 release (package version 17.4.75.250) - Added "RTD3Capable" property to SdkTbtController class
4.6	July 18, 2017	Updated document to support Thunderbolt'17 SW2 release (package version 17.2.x.250) - Added "LinkSpeed" property to SdkTbtDevice class - "GetTopology" command returns additional info now (controller/device NVM and device CIO link speed)
4.5	April 5, 2017	Updated document to support Thunderbolt'17 SW1 release (package version 17.1.x.250) – Updated with changes following the removal of support for controllers older than L6000 series; added support for native/legacy handling
4.4	February 26, 2017	Updated document to support Thunderbolt'16 SW3 Prime release (package version 16.3.61.275) – Added support for FW update on L7000-based devices
4.3	December 18, 2016	Added the following command lines (for the command line utility only): "I2CRead", "I2CWrite", "GetTIPdInfo". "GetCurrentPdVersion" is deprecated.
4.2	September 27, 2016	Added a command line (for the command line utility only): "GetControllerInfo" for getting controller's information.
4.1	June 21, 2016	Updated document to support Thunderbolt'16 SW2 release (package version 16.2.x.x) – Added documentation for NVM version format change (adding minor revision)
4.0	February 11, 2016	Updated document to support Thunderbolt'16 SW1 release (package version 16.1.45.x) - Added documentation and advice for FW upgrade on multiple-controller end-point devices and details about FW update progress reporting
3.2	November 3, 2015	Updated document to support Thunderbolt'15 SW3 release (package version 15.3.39.x) - SDK and samples updated to support exposure of power delivery (PD) firmware version
3.1	August 18, 2015	Added reference to the Host Controller Force Power sample
3.0	August 9, 2015	Updated document to support Thunderbolt'15 SW2 Prime release (package version 15.2.35.x) - SDK and samples updated to support firmware update on device (for L6000 controller series only) - Modified samples with better error handling
2.1	June 25, 2015	Updated document to support Thunderbolt'15 SW2 release (package version 15.2.32.x) - Modified API to support L6000 controller series - Added command line sample - Added return code documentation

Version	Date	Comments
2.0	June 15, 2014	First version of Thunderbolt™ Software Development Kit for firmware update Aligned with Thunderbolt’14 SW2.5 and L5000 controller series

1 Introduction

This guide describes how to use the Thunderbolt™ Software Development Kit (SDK).

The purpose of this guide is to provide information to OEMs that want to control the firmware update process of Thunderbolt controllers. This guide includes documentation only for the classes and methods that can be used to update the firmware of Thunderbolt controllers.

Note:

The SDK includes two sample projects, FwUpdateTool (GUI) and FwUpdateCmd (CLI), located in the Samples folder (in FW_Update_Tool.zip file). The samples show how to use the methods in this SDK to update the Thunderbolt firmware. The sample projects are written in C# using Microsoft* Visual Studio 2013.

2 Prerequisites

These are the prerequisites to use this SDK:

- The Thunderbolt software that comes with the SDK must be installed on the operating system
- For host controller firmware update, at least one device must be connected to a Thunderbolt port (plugging in a device powers up the Thunderbolt controller and loads the required device driver) or the Thunderbolt host controller should be powered ON through BIOS interface. For device firmware update, the device must be connected to a supporting host controller.

Note:

The SDK includes samples in the ControllerForcePower folder located in the Samples folder (in ControllerForcePower.zip). The samples show how to use the methods to force power the controller, through the Windows* WMI ACPI. The samples were written in VBScript and C# using Microsoft* Visual Studio 2013.

- Supported operating systems:
  - Windows* 10 64-bit
- Supported Thunderbolt controllers:
  - L6000 Series and higher (both for host and for device)

3 Thunderbolt WMI API Reference

The Thunderbolt API enables applications to interface with Thunderbolt software using Windows* Management Instrumentation (WMI) and Managed Object Format (MOF) files.

For more information, see:

- Namespace
- WS-I Compatibility
- Classes
- Methods

Note:

This guide includes documentation only for the classes and methods that can be used to update the firmware of Thunderbolt controller.

3.1 Namespace

The WMI classes and methods are registered in this namespace:

Root\Intel\Thunderbolt

3.2 WS-I Compatibility

The Thunderbolt MOF file is not fully compliant with the Web Service Interoperability (WS-I) requirements as defined by the WS-I Organization. While the class definitions were not modified, implementation specific qualifiers (such as "Local" and "Dynamic") were appended to some of the class and method declarations.

3.3 Classes

This section describes the Thunderbolt API classes that contain the firmware related methods.

Both classes support the same methods as is described in a later section. This section describes the class properties of each class.

3.3.1 SdkTbtController

This class contains methods that you can use to control the firmware update process of a specific Thunderbolt host controller. When host controller is in safe mode, only UpdateFirmware method is available.

Fields

Type	Name	Value or Description
String	ControllerId	The ID of the host controller
UInt32	Generation	The generation of the host controller
UInt32	DeviceId	The ID of the host device
Boolean	IsInSafeMode	TRUE if the host controller is in safe mode
UInt8	NVMVersion	The NVM version of the current firmware (only major number; deprecated)
String	FullNVMVersion	The NVM version of the current firmware (in major.minor format)
String	PDVersion	The power delivery firmware version (deprecated)
UInt32	SecurityLevel	The host security level
Boolean	SupportsExternalGpu	TRUE if the host controller supports external GPU
Boolean	OsNativePciEnumeration	TRUE if the host controller is using OS native PCI Enumeration (Native Express mode) * Currently supported only on JHL6540/6340 controllers running FW NVM rev 21 and above
Boolean	RTD3Capable	TRUE if the host controller supports D3 power state

Methods

- UpdateFirmware
- GetCurrentNvmVersion – Deprecated
- GetCurrentFullNvmVersion
- I2CRead
- I2CWrite

- GetCurrentPDVersion – Deprecated
- ReadFirmware

3.3.2 SdkTbtDevice

This class contains methods that you can use to control the firmware update process of a specific Thunderbolt device controller.

Note: Even though the Thundebrolt SW may show a single device when a device has multiple controllers, each of the device's controllers will be shown separately in the FW update tool. This is so that the user may update each controller separately with correct individual images.

Fields

Type	Name	Value or Description
String	UUID	The UUID of the device controller
String	ControllerId	The ID of the host controller the device is connected to
UInt32	PortNum	0-based index of the port in the host controller the device is connected to
UInt32	PositionInChain	1-based index of the device position in the port the device is connected to
String	VendorName	Device vendor name
String	ModelName	Device model name
UInt32	VendorId	Device vendor ID (Note: the actual value is bounded to be UInt16)
UInt32	ModelId	Device model ID (Note: the actual value is bounded to be UInt16)
UInt8	ControllerNumber	Controller enumeration out of total number of controllers in the device
UInt8	NumberOfControllers	Total number of controllers in the device
Boolean	Updatable	True if the device is updatable
UInt32	LinkSpeed	Device CIO link speed in Gbps

Methods

- UpdateFirmware
- GetCurrentNvmVersion – Deprecated
- GetCurrentFullNvmVersion
- I2CRead

- I2CWrite
- GetCurrentPDVersion – Deprecated
- ReadFirmware

3.4 Methods

This section describes the methods available in the SDK for both SdkTbtController and SdkTbtDevice classes.

3.4.1 UpdateFirmware

This method starts the update process of the Thunderbolt firmware. For a host controller that is in safe mode, this is the only available method.

Syntax

```
uint32 UpdateFirmware(uint32 bufferSize, uint8 buffer[])
```

Parameters

Name	Type	Value or Description
bufferSize	Input	The firmware binary image size
buffer	Input	The firmware binary image

Return Values

- See return codes table

3.4.2 GetCurrentNvmVersion - Deprecated

Note: This method is deprecated and exists only for backward compatibility. Use GetCurrentFullNvmVersion method instead.

This method returns the Non-Volatile Memory (NVM) revision number of the Thunderbolt firmware. This method isn't available for host controllers in safe mode.

Syntax

```
uint32 GetCurrentNvmVersion(uint32 nvmVersion)
```

Parameters

Name	Type	Value or Description
nvmVersion	Output	The current NVM version of the firmware (major number only)

Return Values

- See return codes table

3.4.3 GetCurrentFullNvmVersion

This method returns the Non-Volatile Memory (NVM) revision number of the Thunderbolt firmware. This method isn't available for host controllers in safe mode.

Syntax

```
uint32 GetCurrentFullNvmVersion(String nvmVersion)
```

Parameters

Name	Type	Value or Description
nvmVersion	Output	The current NVM version of the firmware (in major.minor format)

Return Values

- See return codes table

3.4.4 GetCurrentPDVersion - Deprecated

Note: This method is deprecated and exists only for backward compatibility. Use I2CRead method instead.

This method returns N/A.

Syntax

```
uint32 GetCurrentPDVersion(String pdVersion)
```

Parameters

Name	Type	Value or Description
pdVersion	Output	The current PD firmware version

Return Values

- See return codes table

3.4.5 I2CRead

This method reads a block of data from I2C registers. Will return the minimum between the wanted length and the actual length of the register that is read. This method isn't available for host controllers in safe mode.

Syntax

```
uint32 I2CRead(uint32 port, uint32 offset, uint32 length, uint8 data[])
```

Parameters

Name	Type	Value or Description
port	Input	Port number to access
offset	Input	Offset in I2C registers
length	Input	Length of requested data (in bytes), currently limited to 64
data	Output	Buffer that will be filled with the requested data from I2C registers

Return Values

- See return codes table

3.4.6 I2CWrite

This method writes a block of data to I2C register. Wouldn't return an error when trying to write to a read only register or to a register that is shorter than the data. This method isn't available for host controllers in safe mode.

Syntax

```
uint32 I2CWrite(uint32 port, uint32 offset, uint8 data[])
```

Parameters

Name	Type	Value or Description
port	Input	Port number to access
offset	Input	Offset in I2C registers.
data	Input	Buffer that is the requested data to write to I2C register.

Return Values

- See return codes table

3.4.7 ReadFirmware

This method reads a block of data from the Thunderbolt firmware. This method isn't available for host controllers in safe mode.

Syntax

```
uint32 ReadFirmware(uint32 offset, uint32 length, uint8 data[])
```

Parameters

Name	Type	Value or Description
offset	Input	Offset of the first byte to read. For current version: Must be DWORD-aligned.
length	Input	Length in bytes of the requested data. For current version: field is ignored, length will always be 4 (one DWORD).
data	Output	Buffer that will be filled with the requested data from firmware. For current version: buffer must be one DWORD.

Return Values

- See return codes table

3.4.8 Return Codes

The return codes of the SDK API are as follows:

Value	Source	Description
0x00	General	Success
0x01	Firmware	Authentication failed
0x02	Firmware	Access to restricted area
0x03	Firmware	General error
0x04	Firmware	Authentication in progress
0x05	Firmware	No key for the specified UID
0x06	Firmware	Authentication key failed
0x07	Firmware	Authentication bonded UUID failed
0x08	Firmware	Unused
0x09	Firmware	Host controller in safe mode
0x100	Service	Firmware response timed out
0x101	Service	Invalid image size
0x102	Service	Internal error
0x103	Service	Power cycle failed
0x104	Service	Operation isn't available when the host controller is in safe-mode
0x105	Service	Platform or controller is not supported
0x106	Service	Invalid argument
0x107	Service	Device is not supported

Value	Source	Description
0x108	Service	Host controller is not supported
0x109	Service	SDK is in use (when trying to run more than one SDK command concurrently)
0x10A	Service	Deprecated method
0x10B	Service	I2C access is not supported
0x10C	Service	Length to access I2C is not supported
0x10D	Service	Unknown (device) hardware

3.4.9 Remarks

After updating the firmware of a host controller or device controller, it can take up to 10 seconds for all devices to be reconnected. A script that tries to update the firmware of more than one device in a row must wait between the commands and then query the device list again to make sure the devices have been reconnected.

3.5 Event classes

3.5.1 SdkFwUpdateProgress

In addition to the classes that expose the SDK functionality, there is an event class that is used for reporting the progress of FW update process.

Fields

Type	Name	Value or Description
UInt32	Progress	The progress in percents (0-100)

4 Thunderbolt FW Update Sample Code

This SDK includes some code to show how to implement the firmware update flow using the Thunderbolt API. The sample code is composed of an API wrapper and two sample applications (GUI based and CLI based) that use this API to perform firmware update. It can be used as reference when building other firmware update applications. The API wrapper and samples are written in C# using Visual Studio 2013 with .Net 4.5.

Note:
Prerequisites to using the application complied from the sample code are the same as the ones mentioned above.

4.1 FwUpdateAPI Project

This project includes wrappers for WMI API described above, some utilities and most of the logic used by both the GUI and CLI samples. Only the main parts are documented here. For more information please refer to the source code and the additional documentation there.

Please note: All the functions throw exceptions in case of an error. Applications are responsible for catching the exception and displaying a reasonable error message to the user, if applied. CLI sample (see below) can be used as a reference for such handling.

4.1.1 SdkTbtBase

This class is a base class for the interfacing with both host controllers and devices.

This, with the derived classes (SdkTbtController and SdkTbtDevice), is the main interface of this API module for applications to use.

The main role of this class is to tie the interface to WMI but it also includes the interface for validating the compatibility of the new firmware image with the current controller.

Four of the functions in this class (almost) mirror the Methods in the WMI class.

4.1.1.1 UpdateFirmware

```
public void UpdateFirmware(UInt32 bufferSize, byte[] buffer)
```

Wrapper for UpdateFirmware WMI method. The parameters are the same, but this function throws an exception on error.

4.1.1.2 GetCurrentNvmVersion - Deprecated

Note: This method is deprecated and exists only for backward compatibility. Use GetCurrentFullNvmVersion method instead.

```
public UInt32 GetCurrentNvmVersion()
```

Wrapper for GetCurrentNvmVersion WMI method. This wrapper returns the current NVM version (major number only) by return value instead of output parameter. Throws an exception on error.

4.1.1.3 GetCurrentFullNvmVersion

```
public string GetCurrentFullNvmVersion()
```

Wrapper for GetCurrentFullNvmVersion WMI method. This wrapper returns the current NVM version (in major.minor format) by return value instead of output parameter. Throws an exception on error.

4.1.1.4 GetCurrentPdVersion - Deprecated

Note: This method is deprecated and exists only for backward compatibility. It is marked as obsolete and considered an error. Use I2CRead instead.

```
public string GetCurrentPdVersion()
```

Wrapper for GetCurrentPDVersion WMI method. This wrapper returns the current PD firmware version by return value instead of output parameter. Throws an exception on error.

4.1.1.5 I2CRead

```
public byte[] I2CRead(UInt32 port, UInt32 offset, UInt32 length)
```

Wrapper for I2CRead WMI method. This wrapper returns the data by return value instead of out parameter. Throws an exception on error.

4.1.1.6 I2CWrite

```
public void I2CWrite(UInt32 port, UInt32 offset, byte[]  data)
```

Wrapper for I2CWrite WMI method. The parameters are the same, but this function throws an exception on error.

4.1.1.7 ReadFirmware

```
public byte[] ReadFirmware(UInt32 offset, UInt32 length)
```

Wrapper for ReadFirmware WMI method.

In contrast to the limitations mentioned in the WMI method documentation above, this wrapper function allows reading blocks of data from any offset and of any length. It may call the WMI method multiple times as needed and then extract the exact requested data.

This wrapper returns the data by return value instead of out parameter. Throws an exception on error.

4.1.1.8 ValidateImage

```
public abstract void ValidateImage(string path)
```

This function validates that a given image (from the binary file in the given path) is valid as it relates to the existing image, existing hardware (controller), and the available area on the chip. This function uses a table of properties, which are compared between new image and existing one, and these match the properties that are described in the NVM release notes. We recommend comparing all these properties before updating the NVM image.

The function is implemented by the derived classes, SdkTbtController and SdkTbtDevice, and, in turn, these implementations use the ImageValidator class hierarchy.

4.1.1.9 UpdateFirmwareFromFile

```
public void UpdateFirmware(string filename)
```

This function is a convenient utility for updating the firmware from a file, given the path to the file as an argument. It uses the UpdateFirmware method and throws an exception on error.

4.1.2 SdkTbtController

This class is a wrapper around SdkTbtController WMI class and exposes the same properties and methods as described above. Please note the differences in the methods interface as described in SdkTbtBase class documentation above.

It also includes the following static function for getting the available class instances.

4.1.2.1 GetControllersFromWmi

```
public static Dictionary<String,SdkTbtController> GetControllersFromWmi()
```

This function enumerates all host controller instances that can be detected. All firmware update operations are performed on these instances.

4.1.3 SdkTbtDevice

This class is a wrapper around SdkTbtDevice WMI class and exposes the same properties and methods as described above. Please note the differences in the methods interface as described in

SdkTbtBase class documentation above. Another difference is that it exposes the VendorID and ModelID properties as UInt16.

It also includes the following static function for getting the available class instances.

4.1.3.1 GetDevicesFromWmi

```
public static Dictionary<String,SdkTbtDevice> GetDevicesFromWmi()
```

This function enumerates all device controller instances that can be detected. All firmware update operations are performed on these instances.

4.1.4 TbtException, TbtStatus and Error Handling

The file Exceptions.cs includes the tools this project and the samples use for error reporting.

4.1.4.1 TbtException

All functions in this project use this class for exceptions.

Application shall expect also exceptions that come from WMI (or the COM layer laying underneath WMI), which aren't of TbtException type, in addition to SDK exceptions.

4.1.4.2 TbtStatus

An enum that includes definition for the error codes described above (Return Codes) and additional error codes as follows:

Value	Source	Description
0x200	SDK	General error; used by sample applications for errors that are originated from WMI or COM
0x201	SDK	Internal error; used for notifying about SDK internal coding error
0x202	SDK	No command supplied; used by CLI sample when it runs without any command argument
0x203	SDK	Command not found; used by CLI sample
0x204	SDK	Argument count mismatch; used by CLI sample
0x205	SDK	Invalid host controller ID supplied
0x206	SDK	Invalid device controller UUID supplied
0x207	SDK	No file found in the supplied path for firmware image file
0x208	SDK	Service not found
0x209	SDK	Load host controllers failed
0x20A	SDK	Load devices failed

Value	Source	Description
0x20B	SDK	No host controller found in system
0x20C	SDK	No device found in system
0x20D	SDK	Operation isn't available when the host controller is in safe-mode
0x20E	SDK	Reserved for backward compatibility; not used
0x20F	SDK	This device controller doesn't support device firmware update
0x210	SDK	Reserved for backward compatibility; not used
0x211	SDK	Host/device controller presents an unknown chip
0x212	SDK	The supplied firmware image file is invalid (damaged file)
0x213	SDK	The supplied firmware image file failed validation (incompatible with the host/device controller)
0x214	SDK	The supplied firmware image file is for another hardware generation (incompatible with the host/device controller)
0x215	SDK	The supplied firmware image file is for different port count (incompatible with the host/device controller)
0x216	SDK	The supplied firmware image file can't fit into chip size (incompatible with the host/device controller)
0x217	SDK	Trying to update device controller with a firmware image file intended for host controller
0x218	SDK	Trying to update host controller with a firmware image file intended for device controller
0x219	SDK	Mismatch between the supplied firmware image file and the host/device controller with regarding to PD firmware existence (one has it and one doesn't)
0x21A	SDK	No DROM section found in the supplied firmware image file
0x21B	SDK	Reserved for backward compatibility; not used
0x21C	SDK	The supplied firmware image file is for products of a different vendor than the host/device controller's vendor
0x21D	SDK	The supplied firmware image file is for a different product model than the host/device controller
0x21E	SDK	No matching devices found for the supplied image (used by DeviceFWUTool)
0x21F	SDK	Multiple firmware image files found (used by DeviceFWUTool)
0x220	SDK	The supplied command is not supported on a device
0x221	SDK	Deprectaed method
0x222	SDK	The supplied argument is invalid

Value	Source	Description
0x223	SDK	No DROM section found

4.1.5 Utilities

This class includes some utility functions for application developer’s convenience.

4.1.5.1 GetImageNvmVersion – Deprecated

Note: This method is deprecated and exists only for backward compatibility. Use GetImageFullNvmVersion method instead.

```
public UInt32 GetImageNvmVersion(string path)
```

Gets the NVM version from the new image (from the binary file in the given path). Returns only the major number of the version.

4.1.5.2 GetImageFullNvmVersion

```
public string GetImageFullNvmVersion(string path)
```

Gets the NVM version from the new image (from the binary file in the given path). Returns the version in major.minor format. Used in this sample to display the new image, and allow the user to compare with the existing image version.

4.1.6 FlashProgress

This class is a wrapper around SdkFwUpdateProgress WMI event class and exposes the event with the data described above.

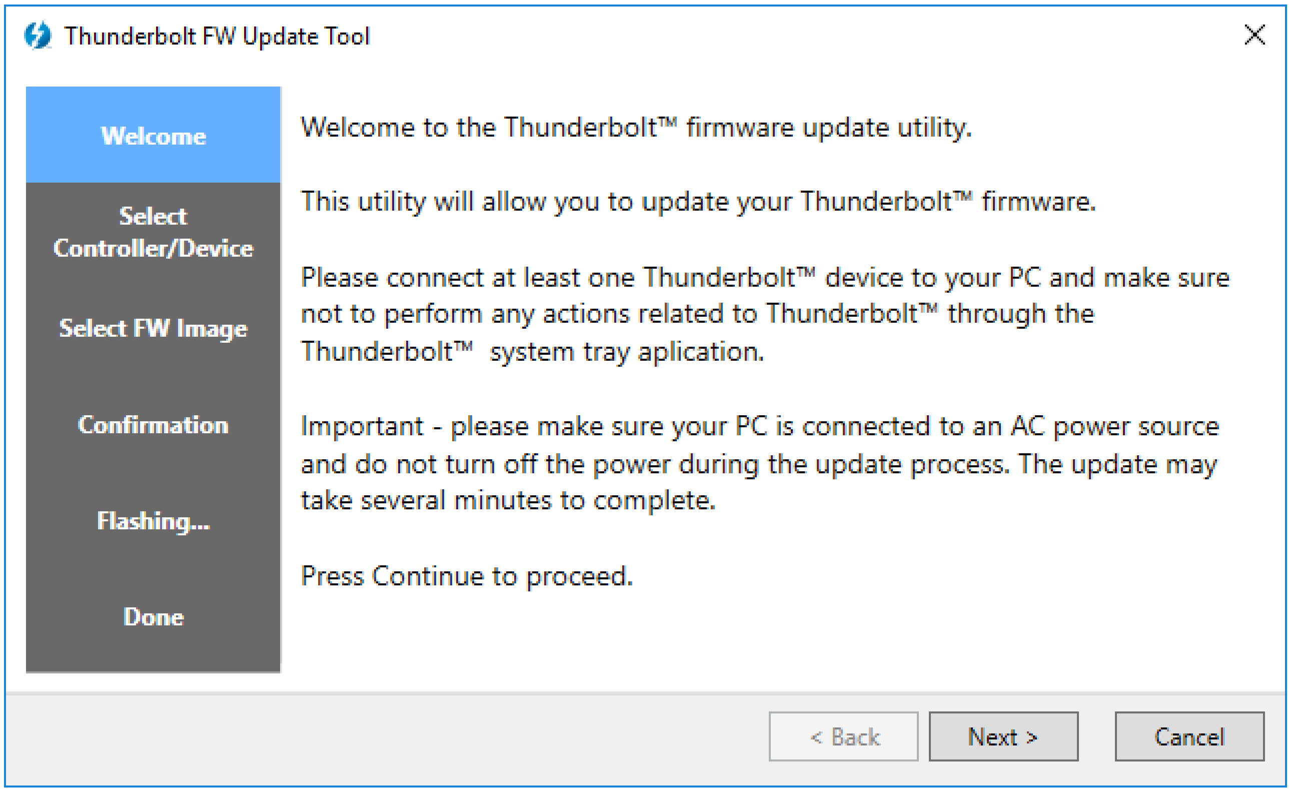
```
public event PropertyChangedEventHandler PropertyChanged
```

This is the event that is raised by this class. User applications should register to this event in order to get progress reports.

```
public UInt32 Progress
```

This is the property to get the information from.

4.2 FwUpdateTool Project



Welcome to the Thunderbolt™ firmware update utility.

This utility will allow you to update your Thunderbolt™ firmware.

Please connect at least one Thunderbolt™ device to your PC and make sure not to perform any actions related to Thunderbolt™ through the Thunderbolt™ system tray aplication.

Important - please make sure your PC is connected to an AC power source and do not turn off the power during the update process. The update may take several minutes to complete.

Press Continue to proceed.

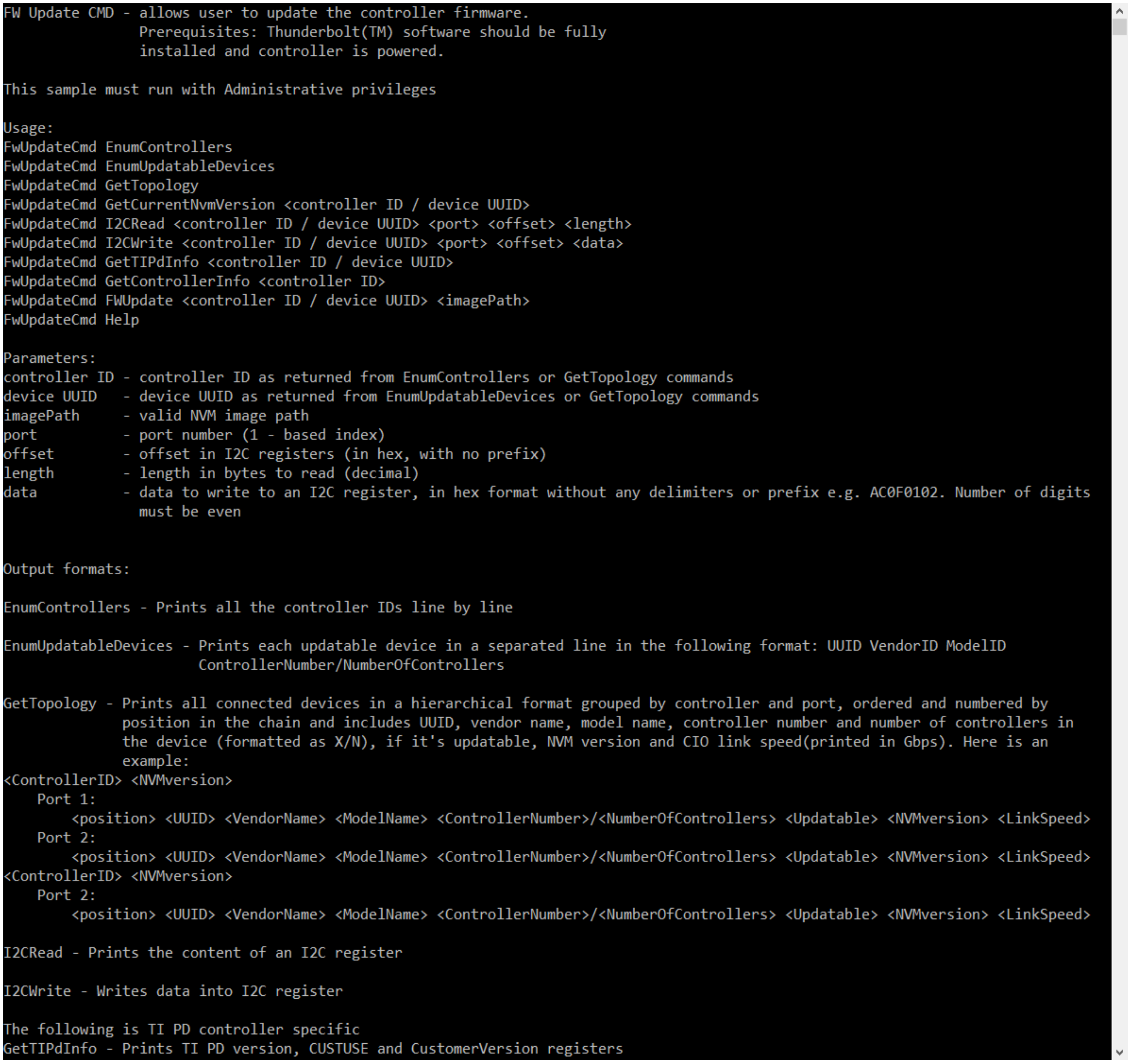
Most of the code in this sample code is UI-related and is not covered by this document.

This sample application is designed for a step by step process to perform the firmware update flow:

1. Select the Thunderbolt host controller or device to be updated
2. Select the new firmware image to be applied
3. Check compatibility between new image and selected Thunderbolt controller configuration
4. Start firmware update process

Note: Device controllers that are part of a multiple-controller device may appear in the list of the controllers followed by their enumeration (e.g. "1/2"). Please take note of the remarks at the end of the document before updating multiple-controller devices.

4.3 FwUpdateCmd Project



```
FW Update CMD - allows user to update the controller firmware.
                Prerequisites: Thunderbolt(TM) software should be fully
                installed and controller is powered.

This sample must run with Administrative privileges

Usage:
FwUpdateCmd EnumControllers
FwUpdateCmd EnumUpdatableDevices
FwUpdateCmd GetTopology
FwUpdateCmd GetCurrentNvmVersion <controller ID / device UUID>
FwUpdateCmd I2CRead <controller ID / device UUID> <port> <offset> <length>
FwUpdateCmd I2CWrite <controller ID / device UUID> <port> <offset> <data>
FwUpdateCmd GetTIPdInfo <controller ID / device UUID>
FwUpdateCmd GetControllerInfo <controller ID>
FwUpdateCmd FWUpdate <controller ID / device UUID> <imagePath>
FwUpdateCmd Help

Parameters:
controller ID - controller ID as returned from EnumControllers or GetTopology commands
device UUID   - device UUID as returned from EnumUpdatableDevices or GetTopology commands
imagePath     - valid NVM image path
port          - port number (1 - based index)
offset        - offset in I2C registers (in hex, with no prefix)
length        - length in bytes to read (decimal)
data          - data to write to an I2C register, in hex format without any delimiters or prefix e.g. AC0F0102. Number of digits
                must be even


Output formats:

EnumControllers - Prints all the controller IDs line by line

EnumUpdatableDevices - Prints each updatable device in a separated line in the following format: UUID VendorID ModelID
                       ControllerNumber/NumberOfControllers

GetTopology - Prints all connected devices in a hierarchical format grouped by controller and port, ordered and numbered by
              position in the chain and includes UUID, vendor name, model name, controller number and number of controllers in
              the device (formatted as X/N), if it's updatable, NVM version and CIO link speed(printed in Gbps). Here is an
              example:
<ControllerID> <NVMversion>
    Port 1:
        <position> <UUID> <VendorName> <ModelName> <ControllerNumber>/<NumberOfControllers> <Updatable> <NVMversion> <LinkSpeed>
    Port 2:
        <position> <UUID> <VendorName> <ModelName> <ControllerNumber>/<NumberOfControllers> <Updatable> <NVMversion> <LinkSpeed>
<ControllerID> <NVMversion>
    Port 2:
        <position> <UUID> <VendorName> <ModelName> <ControllerNumber>/<NumberOfControllers> <Updatable> <NVMversion> <LinkSpeed>

I2CRead - Prints the content of an I2C register

I2CWrite - Writes data into I2C register

The following is TI PD controller specific
GetTIPdInfo - Prints TI PD version, CUSTUSE and CustomerVersion registers
```

This sample application is command line based and was designed with automation in mind, so output would be easily parsable and reused as parameter of the different implemented commands.

It provides the following commands:

1. EnumControllers – Enumerate Thunderbolt host controllers
2. EnumUpdatableDevices – Enumerate Thunderbolt updatable devices.
3. GetTopology – Show all devices in a tree-like format; only host controllers and ports that have devices connected to them will be shown
4. GetCurrentNvmVersion – Print current NMV version (in major.minor format) for a given Thunderbolt host/device controller
5. I2CRead – Prints I2C register content for a given Thunderbolt host/device controller.
6. I2CWrite – Writes to I2C register content on a given Thunderbolt host/device controller.
7. GetTIPdinfo – Prints TI specific wanted I2C registers.
8. GetControllerInfo – Print information on a given Thunderbolt host controller
9. FWUpdate – Perform firmware update on a given Thunderbolt host/device controller
10. Help – Print help about the available commands and output formats of the various host and device controller listing commands

Since this sample application is based on the same Thunderbolt API wrapper as the GUI based sample, it also performs the same kind of compatibility check between the new image and the selected Thunderbolt controller configuration before applying the new NVM image.

This sample uses application return value (ERRORLEVEL) to notify any error condition as described above. It also prints the error code number, the enum entry name and detailed description if found.

4.3.1 Remarks

- This sample must run with Administrative privileges in order to be able to use the GetCurrentNvmVersion, GetCurrentPDVersion and FWUpdate commands.
- The controller ID format includes command-line special characters (e.g. '&'), so it must be quoted to pass it as an argument.
- The user is advised to update multiple-controller devices starting with the device controller that is farthest from the host, ending with the device controller that is closest to the host.