Component Firmware Update (CFU)

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Session Agenda

• Problem Statement
• Component Firmware Update
  • Microsoft Devices Team Solution
• How to leverage CFU
  • Demo and Deep Dive
Abbreviations

• CFU – Component Firmware Update
• DMF – Driver Module Framework
• FW – Firmware
• HID – Human Interface Devices industry standard
• I2C – Industry standard bus
• OS – Operating system
• UART – Universal Asynchronous Receiver Transmitter, industry standard
• UMDF – User mode driver framework
• USB – Universal Serial Bus, industry standard
• TLC – HID Top level collection
Problem Statement
Common Hardware Architecture

Component

Component

Component

Component

USB

I2C

I2C

Bluetooth

Custom

UART

Sub Components
Problem Statement

- We ship many Surface Products & Peripherals
- Several internal components
- Modern components have firmware
- Firmware update is a critical business need
- Firmware update must be automatic, non-disruptive, reliable & secure for best customer experience
- Various Connection Buses: USB, Bluetooth, I2C, UART, ...
- Not all components are visible to the OS
- There may be complex dependencies between FW
- Agile time to market
Microsoft Devices Team Solution: Component Firmware Update
What is CFU

• Microsoft Devices Team’s in-house protocol for Firmware Update
• Simple packet-based protocol, mapped to HID standard
  • HID is Ubiquitous, Windows support for I2C, USB, Bluetooth, ...
  • Easily extensible beyond HID
• Seamless via Windows update
• One UMDF 2.0 Driver shared for all components
• Shared code between FW
• Supports devices with multiple components
• Complex firmware dependencies are easy to handle
• Firmware update happens parallel to device operation
• Requires dual-bank for un-interrupted download
• Expects and allows any versioning, integrity, authentication solution
• Allows encrypted firmware
Component Firmware Update Process

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<tr>
<th>Manufacturer</th>
<th>Firmware Update Package</th>
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Windows Update

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<tr>
<th>Component</th>
<th>Firmware Update Package</th>
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Touchpad FW, Sensor FW

Component

Touchpad FW

Sensor FW

SOC

CFU DRIVER

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CFU Architecture – Key Components

- Primary component’s current FW
- Firmware update package (containing firmware files)
- Firmware update driver package
Primary Component’s Current FW

• CFU protocol aware
• Exposes a HID TLC for CFU
• Receives, validates, authenticates, decrypts and ....
• ... accepts new FW image
• Proxy for sub-components

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FW update package contents

- New FW Image(s)
  - Primary component FW - CFU aware
  - Not mandatory for each component
- An Offer for each FW image
- Extension INF

Image
Image [CFU]
Image
Image

EXTN INF
Offer
Offer
Offer
Offer
FW Update Driver Package

- Common for all components
- FW Update Driver
  - DMF Driver
  - UMDF 2.0 Driver
  - HID Client Driver
  - Loads on FW Update HID TLC
  - Sends FW offers and images.
  - Oblivious to firmware image contents.
- INF
  - Hardware ID for all CFU components
CFU Protocol

FIRMWARE UPDATE PACKAGE

Driver

Registry, Driver Store

CFU TLC

HIDCLASS

WinHEC 2018

HBI: Microsoft Confidential
For WinHEC 2018
Shared under NDA
11-05-18
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CFU Protocol – Iteration 4 (Last)

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For WinHEC 2018
Shared under NDA

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How to Leverage CFU
Microsoft Devices Team Open Sources:

• CFU Protocol Specification
  • Open Source – no official support
  • Microsoft Devices solution
    • Not a Windows specification.
    • No CFU Specific HLK requirements.

• CFU Driver Sample
  • DMF; UMDF 2.0; HID Client Driver
  • Working sample

• Firmware Code Sample
  • .c files only
How to Leverage CFU

Demo & Deep Dive
References

- CFU Blog: http://aka.ms/CFU
- Git HUB: https://github.com/Microsoft/CFU
- Contact Information during WinHEC
  - CFU-WinHEC@Microsoft.com
Other recent Open Source Solutions from Microsoft Devices Team

• **Driver Module Framework**
  - Open Source Framework for Windows WDF driver development
  - WinHEC DMF Talk
  - http://aka.ms/DMF

• **Surface Dev Center Manager**
  - Microsoft Devices team tool that leverages REST APIs to interact with Microsoft Hardware Dev Center to release software on Windows Update.
  - Automates operations such as create attestation and WHQL products, submissions, download resulting signed packages, and manage shipping labels
  - https://github.com/Microsoft/SDCM
Thank You & Questions?