CalDigit xHCI MAC OS Design Guide

10/06/2010 Revision 1.1

Who	Date/Revision	Change Log
Jeff	09/20/2010, v1.0	First Initial
Leslie	10/06/2010, v1.1	Rewrite the document

xHCI

Objective

CalDigit has a series of plans to support SuperSpeed devices under MAC OSX. MAC OS (10.6.X) does not currently support xHCI under IOUSBFamily yet. To enable xHCI support in Mac OSX, CalDigit has delicately aimed at designing the xHCI driver and has taken the following steps:

1. Join USB-IF. Download the USB 3.0 specification document and purchase the xHCI PDK.

2. Obtain xHCI specification document from Intel.

3. Download IOUSBFamily from Apple Open Source web site
   http://www.opensource.apple.com/.

4. Download xnu from Apple Open Source web site
   http://www.opensource.apple.com/.

5. Install Xcode included in Mac OS DVD.

6. Add a new target CalDigitUSBxHCI in IOUSBFamily.xcodeproj.

7. Modify codes in some of IOUSBFamily files to support xHCI.

8. Implement all necessary virtual APIs of IOUSBControllerV3 according to xHCI document.

9. Build CalDigitUSBxHCI.kext and IOUSBFamily.kext.

10. Pack CalDigitUSBxHCI.kext and IOUSBFamily.kext by PackageMaker.

Hardware and software requirements:

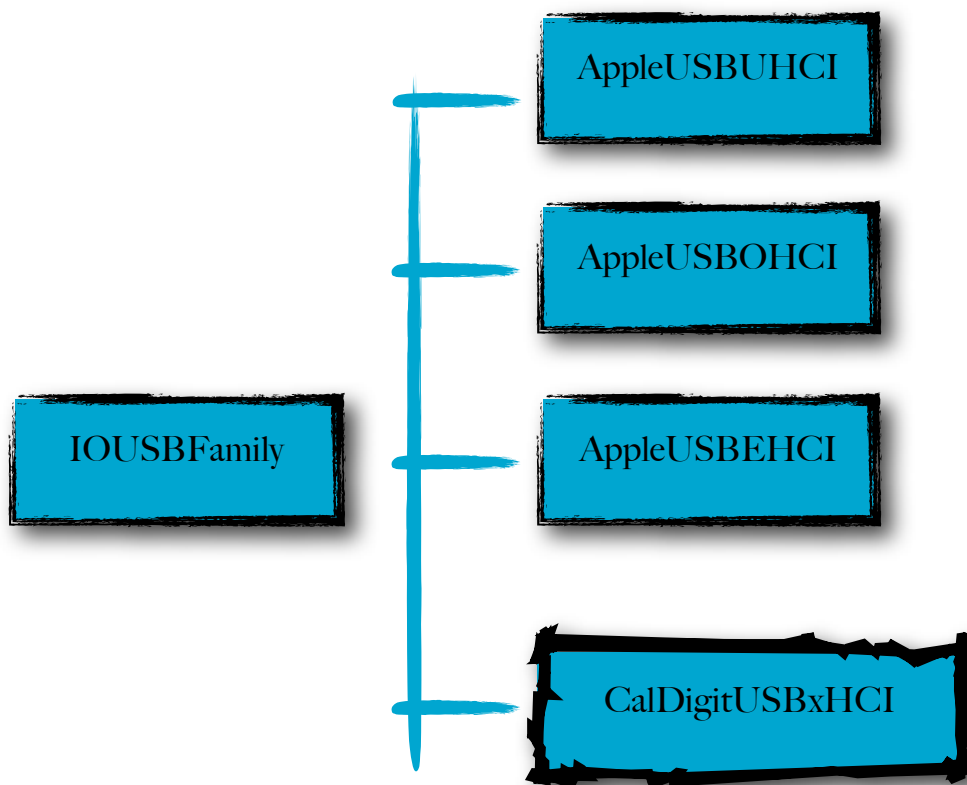To develop xHCI driver under MAC OSX, we have to prepare below software and hardware:

- Software

1. xHCI specification v0.96 document.

2. USB3.0 specification v1.0 document.

3. MAC OSX.

4. Xcode.

5. IOUSBFamily.

6. xnu.

7. PackageMaker.

- Hardware

1. PDK (NEC xHCI 0.96 and Fresco xHCI 0.95).

2. CalDigit AV Drive USB3 devices and cables.

3. Mac Pro.

4. Mac Book Pro.

Procedures

The following procedures are to build CalDigitUSBxHCI.kext and IOUSBFamily.kext in Xcode.

1. Download IOUSBFamily and xnu from Apple Open Source site.

2. Review IOUSBFamily, xHCI and USB3.0 specification and add all possible entry points which are necessary to support xHCI.

3. Add a new target CalDigitUSBxHCI in IOUSBFamily.xcodeproj.

4. Create a class CalDigitUSBxHCI for targeting CalDigitUSBxHCI. This class inherits from IOUSBControllerV3.

5. Implement all necessary virtual APIs of IOUSBControllerV3 based on xHCI specification.

6. Rebuild IOUSBFamily.kext .

7. Build CalDigitUSBxHCI.kext.

8. Test and verify Superspeed device control, bulk, interrupt and isochronous transfers.

HCI of IOUSBFamily

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                                    │   AppleUSBUHCI   │
                                    └──────────────────┘

                                    ┌──────────────────┐
                                    │   AppleUSBOHCI   │
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   ┌──────────────────┐             ┌──────────────────┐
   │    IOUSBFamily   │             │   AppleUSBEHCI   │
   └──────────────────┘             └──────────────────┘

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                                    │  CalDigitUSBxHCI │
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Currently, IOUSBFamily supports three kinds of HCIs - they are Universal Host Controller Interface (UHCI), Open Host Controller Interface (OHCI) and Enhanced Host Controller Interface (EHCI). To recognize USB 3.0 devices such as CalDigit AV Drive, CalDigit must extend IOUSBFamily to support Extensible Host Controller Interface (xHCI).

According to Apple IOKit, all HCI classes must inherit the IOUSBController and then implement all the UIM functions. The current IOUSBController, IOUSBControllerV2 and IOUSBControllerV3 classes are only designed for UHCI, OHCI and EHCI. CalDigit has to modify these three classes and implement all the necessary functions in order to make xHCI utilize CalDigitUSBxHCI driver.