USB Overview

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Agenda

- Host Controllers
- Hardware
- Topology/Enumeration
- Standard Requests
- Descriptors and Endpoints
- Device Classes
- Mass Storage
- USB-IF/Device Working Group
Controllers

- Basic types: UHCI, OHCI, EHCI, UOHCI
  - USB 1.1
    - Low Speed (Keyboards, Mice, Game Controllers) 1.5Mb/s
    - Full Speed (Audio, Communications) 12Mb/s
      - Good for attaching things that transfer at the speed of a parallel port
  - USB 2.0 (High Speed) 480Mb/s
    - Printers, HDD’s, CD/DVD, Video
- USB Device
- USB On-The-Go (OTG)
  - Mainly for devices that act as both Host and Device
Hardware

- Series A – Plugs into a USB port
- Series B – Plugs into a cable
- Mini A and Mini B Variants
- Mini AB (OTG)

**Signaling**
- 1 bi-directional differential connection (3.3v)
- Power (5v) + Ground

- Self-powered hubs (500ma/port)
- Bus-powered hubs (100ma/port)
Maximum of 126 devices/controller
- Root Hub takes 1

Tree Structure

Enumeration is breadth first
- Devices are discovered
- Addresses are assigned

Hot-plug causes re-enumeration
Standard Requests

- Get/Set Configuration
- Get/Set Descriptor
- Get/Set Interface
- Set/Clear Feature
- Set Address, Get Status, Synch Frame

These are the “Chapter 9” tests preformed during certification
Descriptors/Endpoints

Device Descriptor

Configuration Descriptor

Configuration Descriptor

Configuration Descriptor

Interface Descriptor

Interface Descriptor

Interface Descriptor

Endpoint Descriptor

Endpoint Descriptor

Endpoint Descriptor
Descriptors/Endpoints

- Device Descriptor
- Configuration Descriptor
- Interface Descriptor
  - Specifies Class, Subclass, Protocol, and Endpoints
- Endpoint Descriptor
  - Control – One control is always required
  - Bulk – Used for Mass Storage
  - Interrupt – Used in HID
  - Isochronous – Used for video, audio and other classes
Device Classes

- Human Interface Device - Keyboards, Mice, Game controllers, control panels
- HUB
- Mass Storage
- Audio
- Communications – includes telephony and modems
- Imaging
- IrDA
- Monitor
- Video
- Power Class
Mass Storage

- 4 basic specifications
  - Overview
  - CBI Transport
  - BOT Transport
  - Bootability
  - Lockable

- Why Bulk?
  - Can use the full bandwidth of the bus
  - While bandwidth is not guaranteed, can have a very high burst rate

- Transports SCSI protocols including SFF-8070 (SuperFloppy) and SFF-8020 (CD)

- Shortcoming of SCSI is few commands are required
Microsoft USB Stacks

Application

Filesystem

USB Mass Storage Class Driver

USB Port Driver

EHCI miniport

USB Host

USB HDD

USB Driver

Mass Storage Transport

Mass Storage Commands
USB-IF/Device Working Group

- Meets for 1.5 days once every 2 months
- Defines USB class specifications, white papers, and other documents
- Uses a unique revisioning system. This makes revision numbers mean something

**Logo Certification**
- Core, firmware, connectors, and cables must be certified separately
- Device must then be certified as a whole
- Device certification happens in 1 of 2 ways
  - USB plugfest (Free)
  - Licensed certification facility.

**Posted lists of members and certified products**
- All USB components are listed on the USB WEB site. If they are not listed, they are not certified.