



# USB Overview



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# Agenda

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- **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)**





# Topology/Enumeration

- **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**

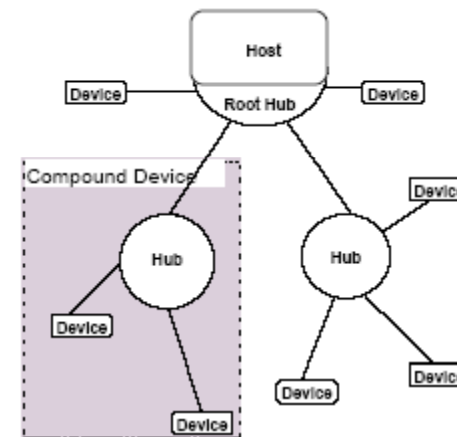


Figure 5-5. USB Physical Bus Topology



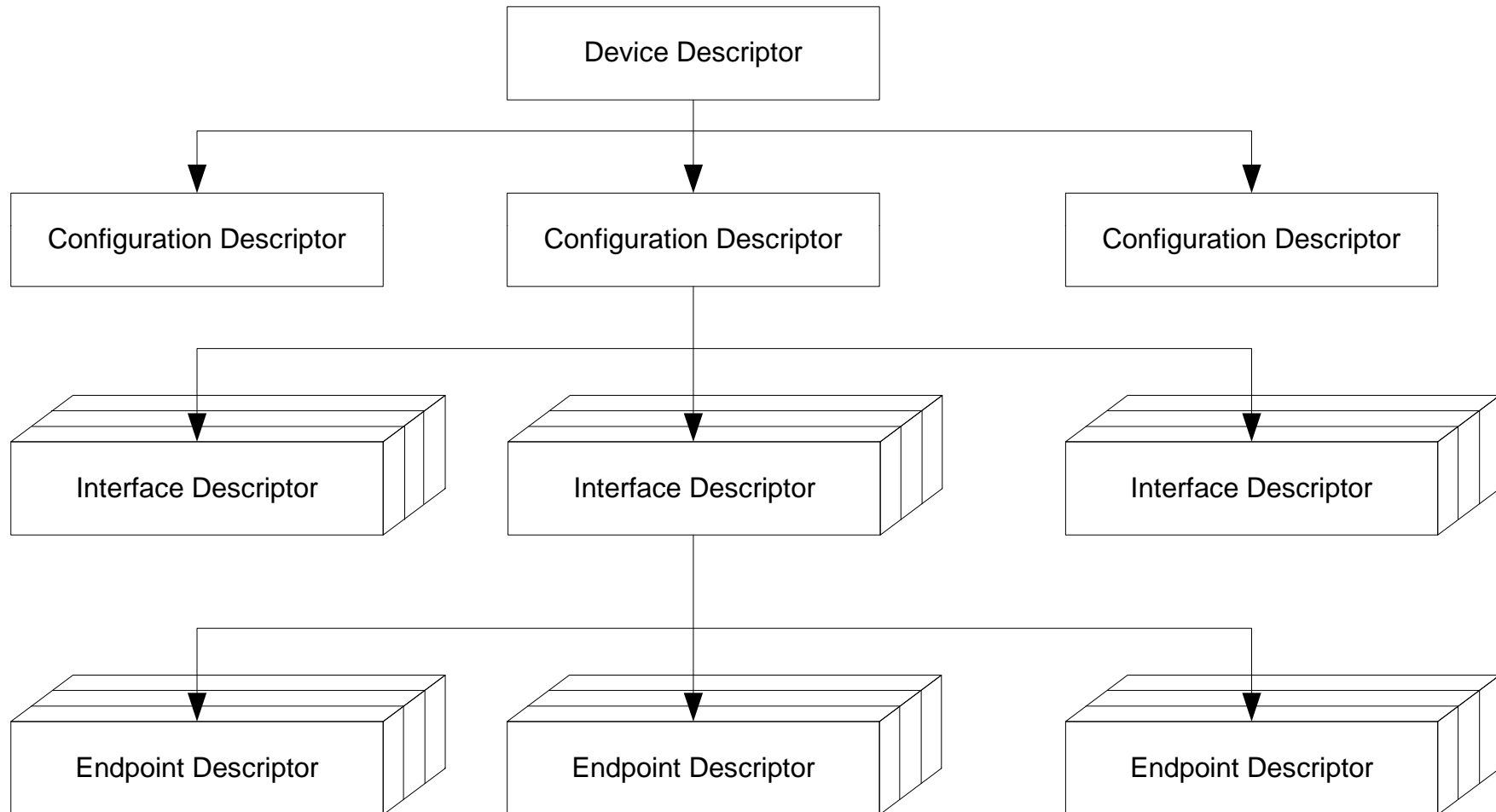
# Standard Requests

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- **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





# Descriptors/Endpoints

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- **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

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

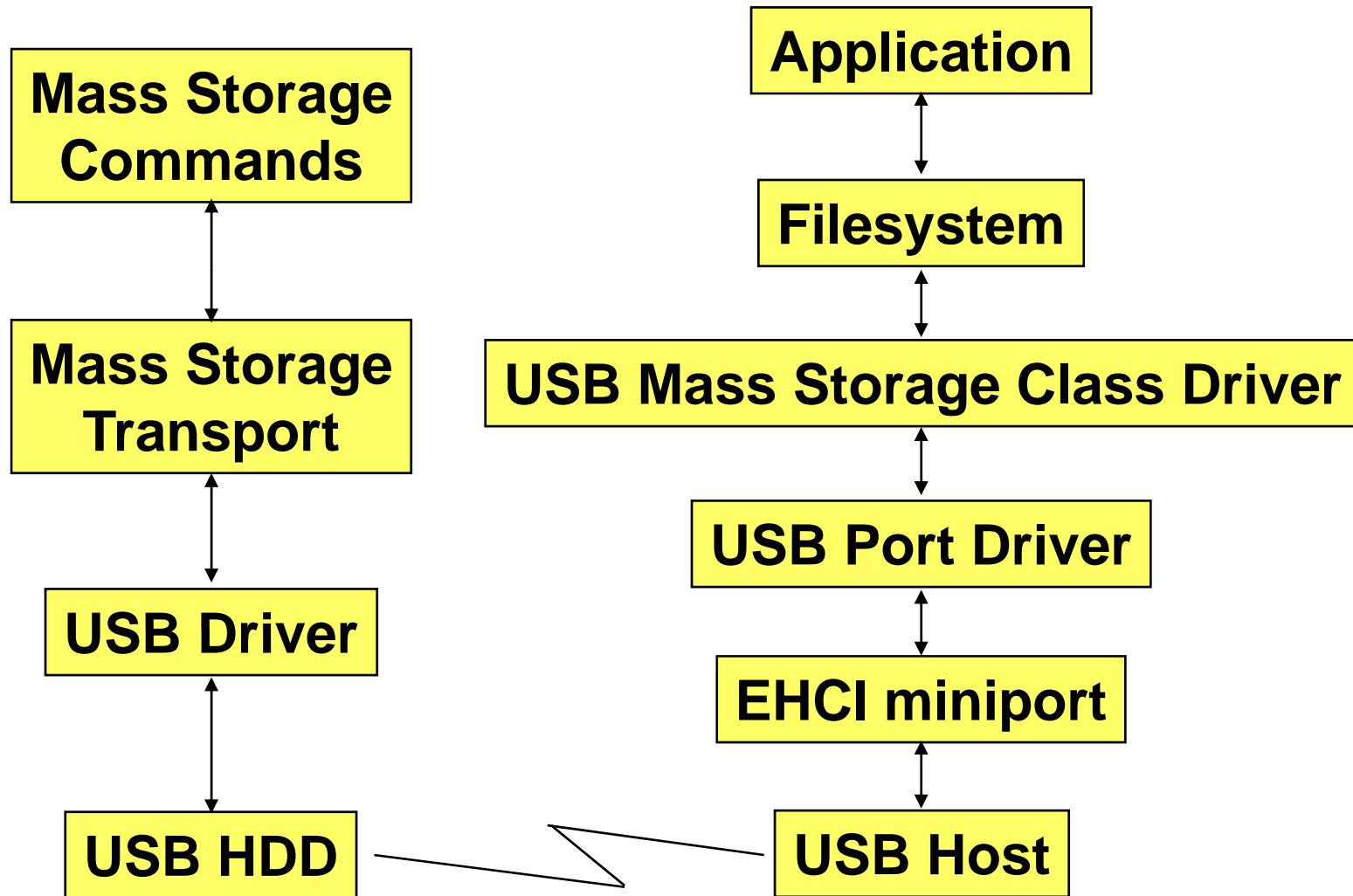


# Mass Storage

- 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





# 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.