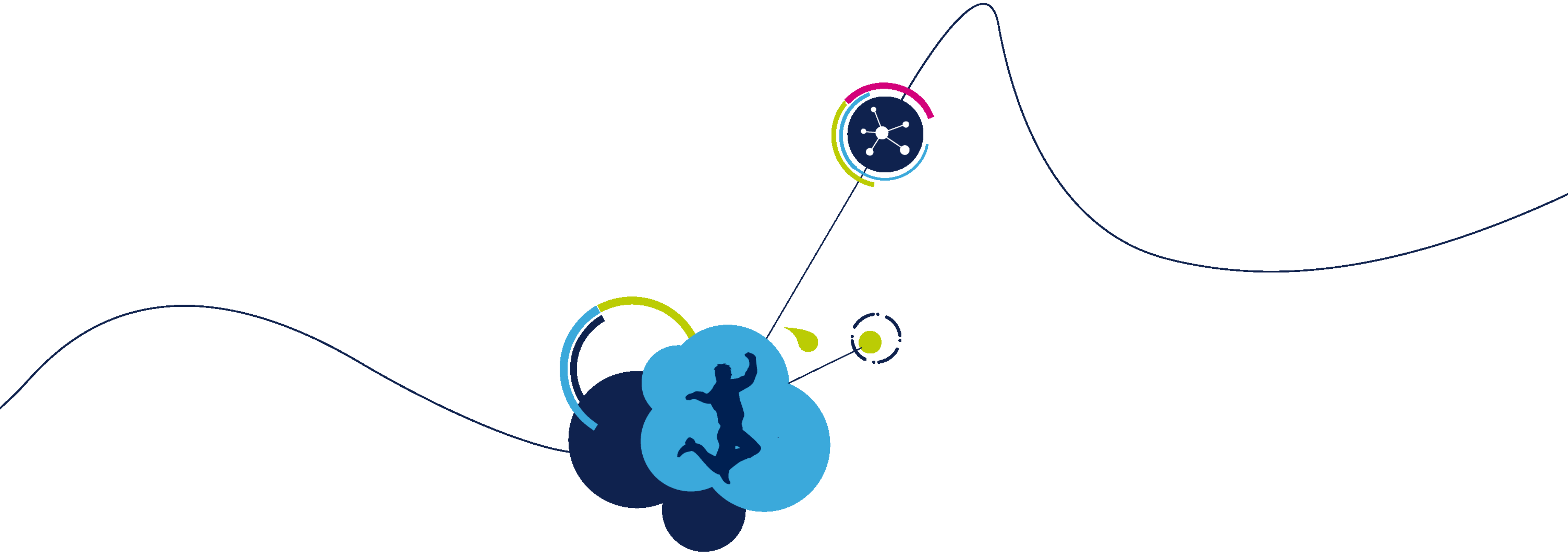


USB debugging

USB debugging – Hardware

- Oscilloscope
  - Check eye diagram with USBET20 PC tool
    - Available at http://www.usb.org/developers/tools/usb20_tools/
  - Useful for checking hardware connection, impedance matching and timing
    - Measuring both at device (packets to STM32) and host side (packets from STM32)
  - Some oscilloscopes have USB decoder
- USB analyzer
  - Able to see all the communication and timings
  - Decoding of the standard USB request and classes
    - Validates some fields in USB descriptors
  - Analyzer is not USB hub – total cable length should be below 5m
- It can’t show why USB host refused to install driver for the USB device
  - E.g. because of invalid or inconsistent descriptors

USB debugging – STM32

- Print debug messages from USB library
  - USBD_DEBUG_LEVEL macro sets the level of verbosity
  - Printf is used for printing messages
    - Can be redirected e.g. to SWO
    - Will be demonstrated in hands-on session
  - Mainly used by the USB host implementation
  - User can add its own debug messages
- Using breakpoints / stepping through code
  - Can cause failure during the enumeration process
  - Useful for detecting if code is executed at all
  - Debugging response on particular USB request

USB debugging – Windows

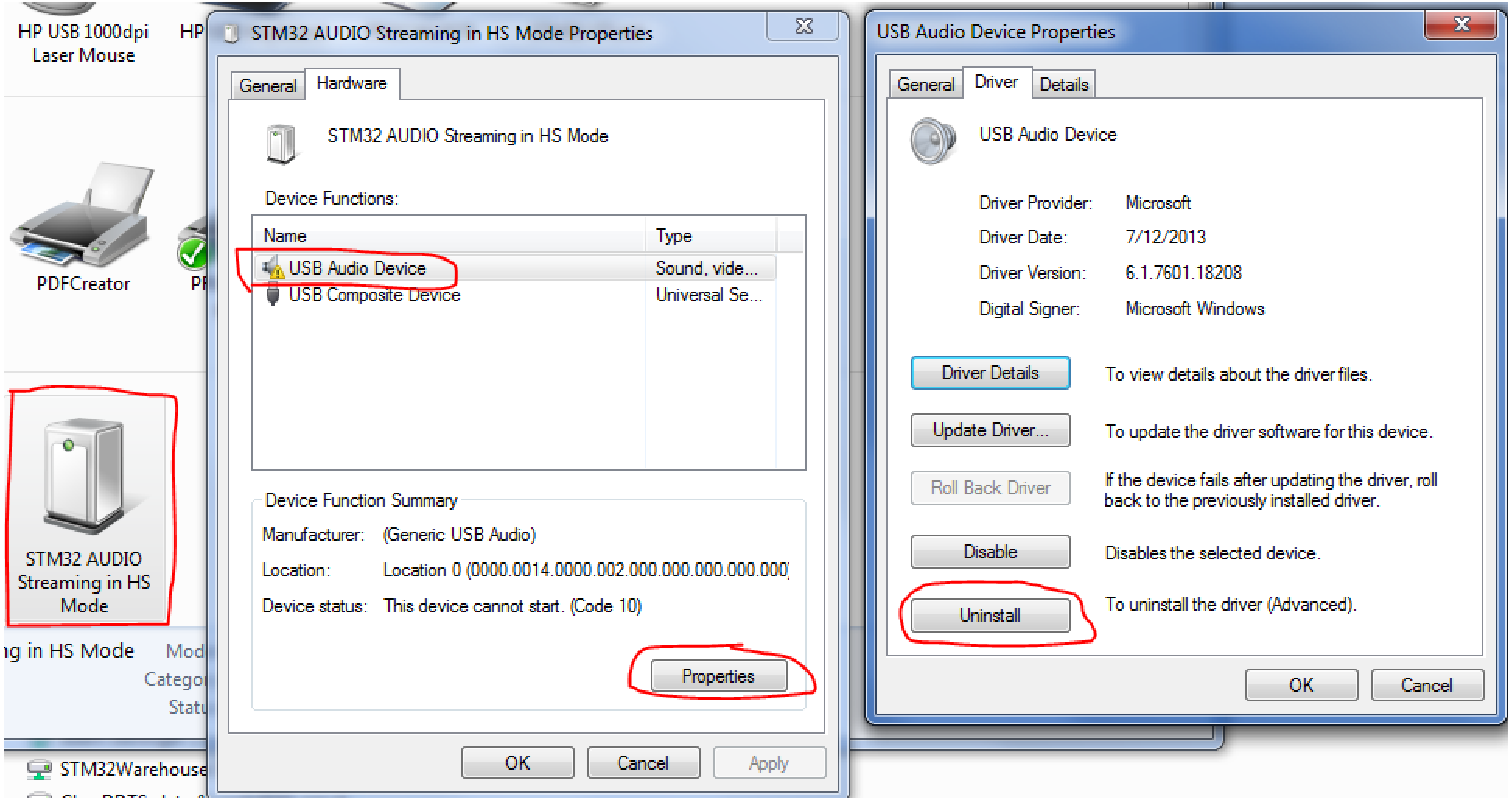
- Need to uninstall device driver after changing device descriptors
  - For the same VID/PID pair

- Microsoft Message Analyzer
  - Tool for tracking various events and protocols
  - USB3.0 requires Windows 8 and newer
  - Error reports
  - Shows only successful transmissions – requests from drivers
  - Doesn’t show low-level data

- Wireshark
  - Requires special driver and administrator rights
  - Similar to Message Analyzer
    - Doesn’t show low-level data

Windows uninstall driver

- Start > Control Panel > Device and Printers



STM32 AUDIO Streaming in HS Mode Properties

STM32 AUDIO Streaming in HS Mode

Device Functions:

Name	Type
USB Audio Device	Sound, vide...
USB Composite Device	Universal Se...

Device Function Summary

Manufacturer: (Generic USB Audio)

Location: Location 0 (0000.0014.0000.002.000.000.000.000.000)

Device status: This device cannot start. (Code 10)

USB Audio Device Properties

USB Audio Device

Driver Provider: Microsoft

Driver Date: 7/12/2013

Driver Version: 6.1.7601.18208

Digital Signer: Microsoft Windows

Driver Details — To view details about the driver files.

Update Driver... — To update the driver software for this device.

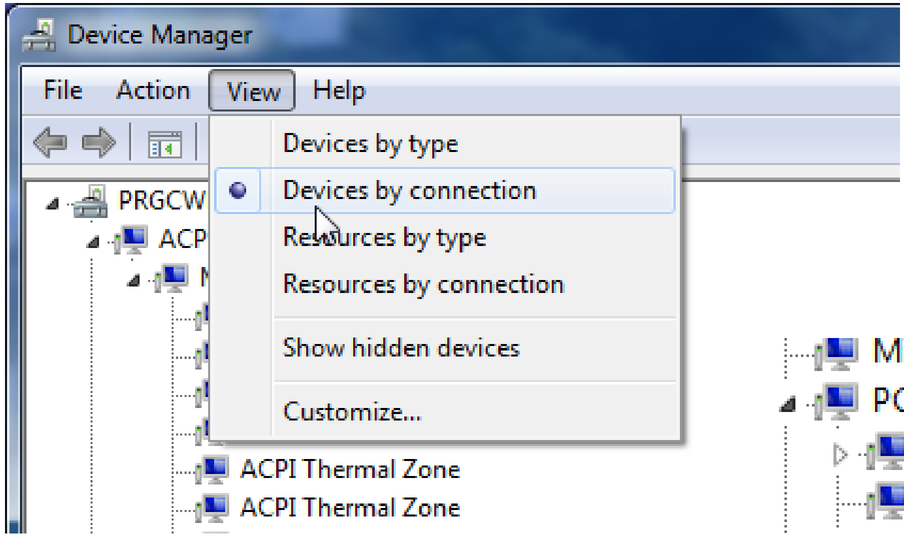
Roll Back Driver — If the device fails after updating the driver, roll back to the previously installed driver.

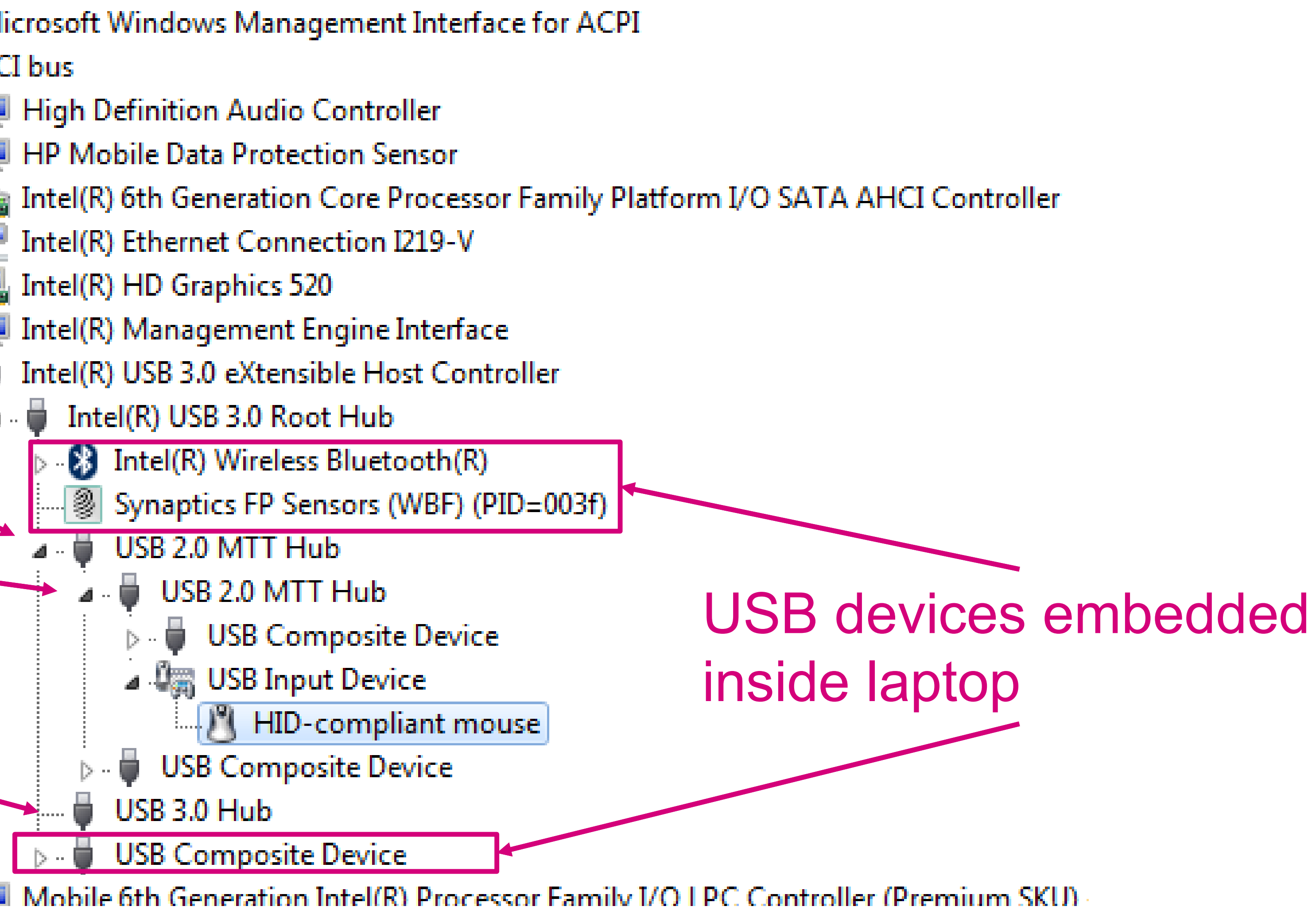
Disable — Disables the selected device.

Uninstall — To uninstall the driver (Advanced).

Show USB hierarchy

- Start > Control Panel > Device Manager





- Microsoft Windows Management Interface for ACPI
- PCI bus
  - High Definition Audio Controller
  - HP Mobile Data Protection Sensor
  - Intel(R) 6th Generation Core Processor Family Platform I/O SATA AHCI Controller
  - Intel(R) Ethernet Connection I219-V
  - Intel(R) HD Graphics 520
  - Intel(R) Management Engine Interface
  - Intel(R) USB 3.0 eXtensible Host Controller
    - Intel(R) USB 3.0 Root Hub
      - Intel(R) Wireless Bluetooth(R)
      - Synaptics FP Sensors (WBF) (PID=003f)
      - USB 2.0 MTT Hub
        - USB 2.0 MTT Hub
          - USB Composite Device
          - USB Input Device
            - HID-compliant mouse
        - USB Composite Device
      - USB 3.0 Hub
      - USB Composite Device
  - Mobile 6th Generation Intel(R) Processor Family I/O LPC Controller (Premium SKU)

USB HUB in docking station

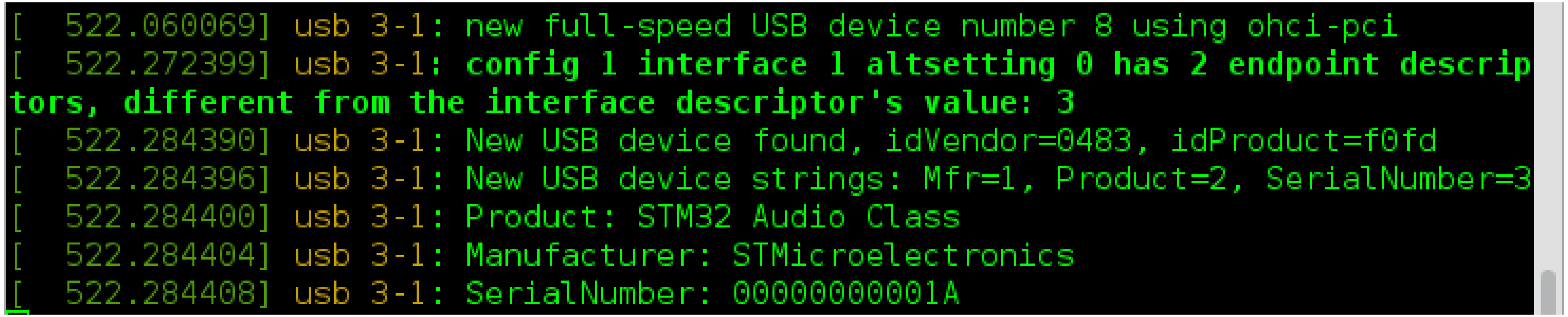
USB HUB inside display

USB HUB on laptop (physical ports)

USB devices embedded inside laptop

USB debugging – Linux

- Command line:
  - “dmesg --color=always -w | grep usb” shows USB log messages in real-time
    - “--color=always” will keep to highlighting



```
[   522.060069] usb 3-1: new full-speed USB device number 8 using ohci-pci
[   522.272399] usb 3-1: config 1 interface 1 altsetting 0 has 2 endpoint descrip
tors, different from the interface descriptor's value: 3
[   522.284390] usb 3-1: New USB device found, idVendor=0483, idProduct=f0fd
[   522.284396] usb 3-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[   522.284400] usb 3-1: Product: STM32 Audio Class
[   522.284404] usb 3-1: Manufacturer: STMicroelectronics
[   522.284408] usb 3-1: SerialNumber: 00000000001A
```

  - “lsusb” shows connected devices
  - “lsusb -s 2:1 -v” shows descriptors for device 1 on bus 2
  - Some commands might require administrator/root access
    - This depends on the configuration
- Wireshark (similar as for Windows)

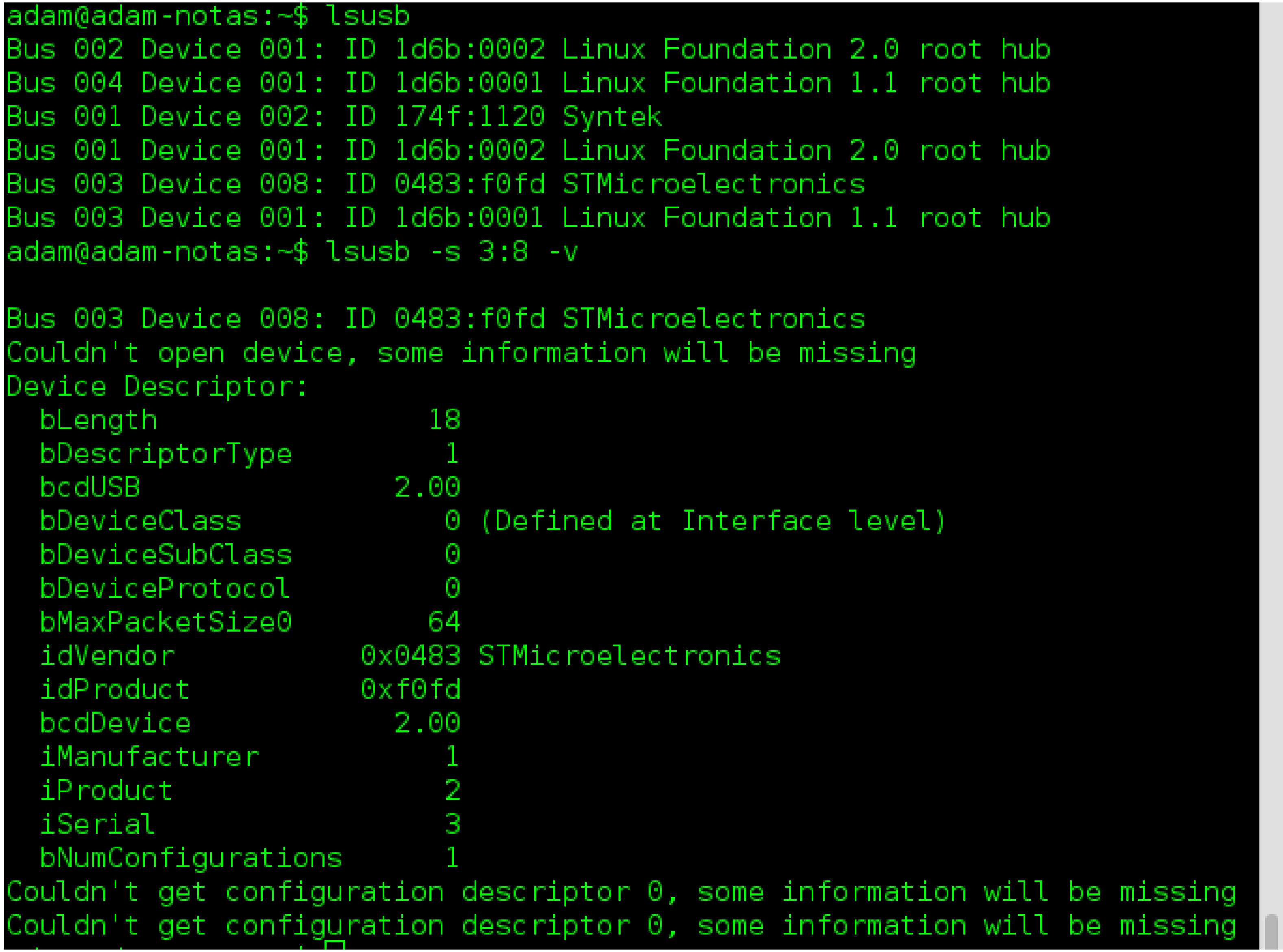
USB debugging – Linux

- “dmesg” sometimes report error codes
  - Codes explanation: https://www.kernel.org/doc/html/v4.12/driver-api/usb/error-codes.html
  - Code lookup in header files: “`grep <error_code> /usr/include/asm-generic/errno*.h`”
    - At least for Debian
  - In worst case, you can look at the source files and see where the error message is printed

USB debugging – Linux

- lsusb example output

- Run with root access will show complete descriptors



```
adam@adam-notas:~$ lsusb
Bus 002 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 004 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
Bus 001 Device 002: ID 174f:1120 Syntek
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 003 Device 008: ID 0483:f0fd STMicroelectronics
Bus 003 Device 001: ID 1d6b:0001 Linux Foundation 1.1 root hub
adam@adam-notas:~$ lsusb -s 3:8 -v

Bus 003 Device 008: ID 0483:f0fd STMicroelectronics
Couldn't open device, some information will be missing
Device Descriptor:
  bLength                18
  bDescriptorType         1
  bcdUSB               2.00
  bDeviceClass            0 (Defined at Interface level)
  bDeviceSubClass         0
  bDeviceProtocol         0
  bMaxPacketSize0        64
  idVendor           0x0483 STMicroelectronics
  idProduct          0xf0fd
  bcdDevice            2.00
  iManufacturer           1
  iProduct                2
  iSerial                 3
  bNumConfigurations      1
Couldn't get configuration descriptor 0, some information will be missing
Couldn't get configuration descriptor 0, some information will be missing
```

STM32 USB common mistakes

- Small heap size
  - Class-specific structures are usually dynamically allocated
- Old driver used (Windows)
  - After changing the device descriptors
  - Windows drivers must be uninstalled
- VBUS sensing activated, but pin not connected
- Using incorrect VID/PID
  - VID/PID already used for different device