

Reference Projects

TheSycon commands expertise in several areas surrounding the development of device drivers and firmware. Below, we give a selection of the projects that have benefited from our expertise. Each item listed below refers to development work that TheSycon successfully completed either under contract to a client company or as product development. In many cases we worked together with partner companies responsible for hardware design.

USB Drivers

Universal USB Device Driver for Windows

- › Design and implementation of a generic WDM device driver for USB 1.1, USB 2.0 and USB 3.0 devices
- › Programming interface for use by C/C++, C# .net or Java applications
- › For Windows XP, Vista, 7, 8 and 8.1 (32 and 64 bit):
<http://www.thesycon.de/usbio>
- › For Windows CE 5, CE 6, WEC7 and Windows Mobile: <http://www.thesycon.de/usbioce>

USB CDC/ACM Class Driver for Windows

- › CDC/ACM (communication device class, subclass abstract control model) device driver
- › Virtual COM port emulation
- › For Windows XP, Vista, 7, 8 and 8.1 (32 and 64 bit):
<http://www.thesycon.de/cdcacm>
- › For Windows CE 5, CE 6, WEC7 and Windows Mobile: <http://www.thesycon.de/cdcacmce>

USB CDC/ECM Class Driver for Windows

- › CDC/ECM (communication device class, subclass Ethernet control model) device driver
- › NDIS Ethernet adapter emulation
- › For Windows XP, Vista, 7 and 8 (32 and 64 bit):
<http://www.thesycon.de/cdcecm>
- › For Windows CE 5, CE 6, WEC 7 and Windows Mobile: <http://www.thesycon.de/cdcecmce>

USB CDC/NCM Class Driver for Windows

- › CDC/NCM (communication device class, subclass network control model) device driver
- › NDIS Ethernet adapter emulation
- › For Windows XP, Vista, 7 and 8 (32 and 64 bit):
<http://www.thesycon.de/cdcncm>
- › For Windows CE 5, CE 6, WEC 7 and Windows Mobile: <http://www.thesycon.de/cdcncmce>

USB CDC/NCM Class Driver for Mac OS X

- › CDC/NCM (communication device class, subclass network control model) device driver
- › For Mac OS X 10.6 and later

Device Driver for USB Camera Devices

- › Device driver and API for a family of USB cameras

USB Audio Class 2.0 Driver for Windows

- › Audio class 2.0 compliant high-speed isochronous audio streaming
- › Windows WDM audio interface, DirectX
- › ASIO 2.2 interface
- › For Windows XP, Vista, 7, 8 and 8.1 (32 and 64 bit):
see also the Professional Audio section below.

USB Audio Class 2.0 Driver for Mac OS X

- › Audio class 2.0 compliant high-speed isochronous audio streaming
- › Apple Core Audio interface
- › For Mac OS 10.6 and later, see also the Professional Audio section below.

USB Driver Suite for 2G and 3G GSM Phones

- › CDC/ACM and WMC, OBEX drivers with virtual COM port interface
- › USB multi-interface (composite) driver
- › RNDIS driver for Ethernet emulation
- › Support for GSM, GPRS, EDGE, UMTS, HSDPA/HSUPA
- › For Windows XP, Windows Vista, Windows 7, Windows 8

Windows Driver for USB Smart Card Reader

- › WDM-compliant Windows device driver for smart card reader device with high-speed USB interface
- › Driver-integrated T0/T1 protocol implementation, compliant to ISO/IEC 7816-3, ISO/IEC 7816-4, ISO/IEC 14443-3, ISO/IEC 14443-4 (Contactless integrated circuit(s) cards, Proximity cards)
- › Interoperability Specification for ICCs and Personal Computer Systems
- › Specification of the SIM - ME interface (GSM 11.11)

Power Line Modem with USB Interface

- › Windows device driver for a USB-based power line modem

High-Speed USB Data Capture

- › Device drivers and firmware for various USB-based high-speed data capture applications, e.g. for measuring devices and medical devices

Device Driver for USB-based Touch Screen

- › WDM-compliant Windows kernel-mode device driver for touch screen with USB interface

Selective USB Device Filtering

- › WDM-compliant Windows filter driver that blocks non-authorized USB devices
- › Flexible and configurable filtering based on VID, PID, serial number etc.

USB Programming Interface for Java

- › Device drivers and JNI libraries for Windows and Linux to create a USB programming interface for Java applications

USB Device Drivers for Linux

- › Kernel-mode drivers for various USB devices
- › Compatible with Linux kernel 2.4 and 2.6 series
- › Various user mode driver libraries

USB Drivers for Apple MacOS-X

- › Various USB device drivers for Mac OS 10.5 and later
- › USB audio drivers with high-speed isochronous streaming

High-Speed USB Interface for Scanner

- › Firmware for Cypress FX-2 microcontroller
- › Windows device driver and API

Embedded USB

Embedded USB Device Firmware Stack

- › Design and implementation of a modular and portable device firmware stack
- › Operating system independent
- › USB 2.0 full and high speed support
- › Various device classes:
CDC/ACM, Mass Storage, CDC/ECM, CDC/NCM, RNDIS, HID, Audio 1.0, Audio 2.0, MIDI 1.0, CCID
- › Supported microcontrollers:
Atmel, NXP, Infineon, ST Microelectronics, Texas Instruments, Xilinx, Renesas, Spansion
- › <http://www.thesycon.de/embusbdevice>

Embedded USB Host Firmware Stack

- › Design and implementation of a modular and portable host firmware stack for OHCI/EHCI
- › Operating system independent
- › Support for external USB hubs
- › Class driver support: Mass Storage, Printer, HID, CDC/ACM
- › Supported microcontrollers: Atmel, NXP, Xilinx, Spansion
- › <http://www.thesycon.de/embusbhost>

Embedded Printer Driver

- › Driver for page and label printers with USB interface
- › Based on embedded USB host stack
- › Printing via PCL3 and ESC/Pos

USB Bootloader for Embedded Systems

- › USB-based bootloader, persistent in FLASH
- › DFU class compliant protocol
- › Windows device driver and API DLL
- › Mac OS X firmware downloader
- › Convenient integration into applications and scripts

USB Device-to-Device Adapter

- › Adds USB device functionality to Linux or Windows system with USB host
- › Emulation of various device classes
- › Endpoint data transfer via private API

USB Firmware and PC API for Sensor Device

- › HID compliant USB interface for sensor chip
- › PC API and demo application for data visualization

USB Firmware for Medical Device

- › RTOS-based firmware framework for battery-powered data recorder
- › Drivers for continuous data sampling
- › USB mass storage device functionality

USB Device with Automatic Driver Installation

- › USB device with integrated CD-COM emulation
- › Automatic driver installation from built-in CD-ROM
- › Driver uninstallation via Windows Control Panel
- › Supports Windows XP to Windows 8 (32 and 64 bit)

USB to Parallel Port Converter Device

- › Design and implementation of an IEEE 1284 parallel port to USB adapter with application-specific protocol implementation in the device
- › Firmware for 32-bit ARM-based MCU
- › Windows device driver, WHQL certification, driver installer, factory test support tools

USB HID Device with Integrated CD-ROM Emulation

- › HID device for Windows installation without administrator privileges
- › Integrated CD-ROM emulation for automatic application launch based on Windows autorun
- › ISO image stored in device-internal FLASH memory
- › ISO image update through HID commands

Firmware for High-end USB Microphone

- › USB Audio 1.0 class compliant firmware
- › PCM audio streaming via I2S
- › HID composite device for private control

IEEE 1394 (FireWire)

IEEE 1394 Bus Driver for Windows

- › Design and implementation of an alternative IEEE1394 bus driver for Windows 2000/XP/Vista/7/8
- › Compatible with Windows in-box bus driver
- › Full IEEE 1394a and IEEE 1394b support
- › OHCI 1.0, 1.1 and 1.1+ compliant
- › Robust design targeting industrial applications
- › <http://www.thesycon.de/t1394bus>

Universal IEEE 1394 Device Driver for Windows

- › Design and implementation of a generic WDM-compliant device driver for IEEE1394 devices
- › Programming interface for use by Win32 applications
- › Supports Windows XP, Windows Vista, Windows 7, Windows 8:
- › <http://www.thesycon.de/vhpd1394>

IP over IEEE 1394 Device Driver for Windows

- › Design and implementation of a driver that implements the IOver1394 standard (RFC 2734).
- › IP packet transport over IEEE 1394a and IEEE 1394b
- › Ethernet adapter emulation

IEEE1394-based Frame Grabber Device

- › Design, Documentation and implementation of the 1394-based communication protocol, including isochronous streaming (similar to IEC 61883)
- › Firmware on Nexperia processor including PCI device driver for 1394 OHCI controller
- › Drivers for various busses: I2C, SPI, JTAG, GPIO
- › Windows device driver and application programming interface (API) library

IEEE 1394 Driver Stack for Windows NT 4

- › Design and implementation of a 1394 OHCI driver stack for Windows NT 4.0

Programming Interface for IEEE 1394 Cameras

- › Design, implementation and documentation of a C++ library that provides a flexible programming interface for various kinds of IEEE 1394-based camera devices

IEEE1394-based Isochronous A/V Streaming

- › IEC 61883-6 compliant audio stream transmission via an IEEE 1394 isochronous channel
- › Audio streaming server that provides IEC 61883-6 compliant streams to client applications
- › IEC 61883-4 compliant transmission of MPEG-2 transport streams via IEEE 1394 isochronous mode

ASIO/WDM Drivers for Professional Audio Devices with IEEE 1394 Interface

- ⇒ See Professional Audio section below.

Professional Audio

ASIO/WDM USB Driver for Windows

- › Device driver for a family of professional audio devices with USB 2.0 high-speed interface
- › Low-latency isochronous streaming and MIDI
- › Supports ASIO 2.0, DirectX/WDM audio, Kernel Streaming (KS) including MIDI and GSIF
- › Supports Windows XP 32 bit and Windows Vista, 7, 8 and 8.1 (32-bit and 64-bit)
- › <http://www.thesycon.de/usbaudio>

USB Audio Driver for Mac OS X

- › Device driver for a family of professional audio devices with USB 2.0 high-speed interface
- › Low-latency isochronous streaming
- › Supports Apple Core Audio
- › Supports Mac OS X 10.6 and later

Audio Device Driver for High-end PCIe Card

- › Windows and Mac driver for PCIe plugin card
- › Multi-channel, low latency

USB 2.0 Interface for Pro-Audio Devices

- › Design and implementation of driver and firmware for a universal USB audio interface with up to 16x16 channels I2S, SPDIF and MIDI
- › Supports ASIO 2.2, WDM Kernel Streaming (KS)
- › Drivers for Windows XP/Vista, XP/Vista x64
- › Drivers for Mac OS X 10.4 and 10.5 Core Audio

Sound Device Emulation on Windows

- › Software-only driver for device emulation
- › PCM audio streaming through private driver API
- › Dynamic creation/deletion of sound devices
- › Supports Windows XP to Windows 8 (32 and 64 bit)

ASIO/WDM IEEE1394 Driver for Windows

- › Device driver for a large set of professional audio devices with FireWire interface
- › Low-latency isochronous streaming according to the following standards: IEC 61883, IEC 61883-6, IEC 60958-1, IEC 60958-3, IEC 61937-5
- › Connection management and AV/C controller according to 1394 TA specifications
- › Supports ASIO 2.0, WDM/DirectX, GSIF
- › Supports multi-device setups and synch management
- › Windows XP, Vista and XP, Vista x64 (64 bit)

ASIO Driver for IEEE1394 Audio Controller

- › Windows ASIO 2.2 driver for 1394 audio device
- › IEC 61883-6 compliant audio streaming
- › Private MIDI and control protocol

FireWire-based PC-to-PC Audio Streaming

- › Windows driver with ASIO 2.0 interface
 - › PC audio streaming network based on standard IEEE 1394 adapters
- Up to 128 channels audio streaming from multiple slave PC systems to one master PC

WLAN-based Audio Streaming

- › Windows Kernel Streaming (KS) driver and service to transfer an audio playback stream over Wireless LAN to an external device
- › Device control via Universal Plug and Play (UPnP)

Application Development

Device Status Monitor for Apple iOS

- › Design and implementation of an App for iOS
- › Displays current device status
- › Communication via WLAN and TCP/IP

Application for Mobile Data Recording

- › GUI application for Windows CE on handheld PC
- › Wireless communication with probe via ANT
- › Data recording, viewing, export
- › Used in mining and field exploration

Device Driver Installation

Windows Device Driver Installation

Thesycon created driver setup wizards for numerous projects. We maintain an internal framework that enables us to create reliable installers very quickly. <http://www.thesycon.de/pnpinstaller>

USB Device Driver Installer for Mobile Phones

- › Complex installer that handles all Windows versions including 64-bit systems and supports a large set of different mobile USB devices and drivers
- › Support for silent (non-interactive) mode
- › Auto-run support and various user interface options
- › External customization

DVB-S and DVB-T

DVB Satellite Receiver PCI Card

- › Windows driver for PCI-based DVB-S receiver card with integrated MPEG-2 transport stream De-multiplexer (Demux) and PID-filters
- › Satellite tuner control
- › DVB SI table parsing and data management
- › DirectShow filter for MPEG2 audio and video stream rendering
- › DVB teletext parsing and rendering
- › Various accompanying Windows applications

Digital Satellite Radio Receiver PCI Card

- › Windows driver for PCI-based radio receiver card
- › Private API and demo application
- › Various tools for supporting mass production

DVB Satellite Receiver with USB Interface

- › Design and documentation of the USB-based streaming and control protocol
- › WDM compliant Windows device driver
- › Device firmware running on a 16 bit microcontroller

Windows Driver for USB DVB Receiver

- › Windows XP/Vista/7 driver for USB-based DVB receiver box
- › MPEG streaming on USB
- › Integration with Windows KS and BDA

Windows Driver for DVB Descrambling Device

- › Windows XP/Vista/7 driver for USB-based DVB CAM
- › Protocol implementation according to EN 50221 (Common Interface Specification for Conditional Access)
- › Kernel streaming and DirectShow integration

Networking

Windows Driver for W-LAN Network Interface Card (PCI and CardBus)

- › NDIS 5.1 miniport driver for PCI/Cardbus W-LAN adapter with integrated software protocol module
- › Windows 98, ME, 2000 and XP

USB RNDIS Driver

- › USB Remote NDIS device driver for Windows as a replacement for the in-box driver

USB CDC/ECM Class Driver

- › USB CDC/ECM class driver for Windows XP, Windows Vista, Windows 7, Windows 8:
<http://www.thesycon.de/cdcecm>
- › For Windows CE 5, CE 6, WEC7 and Windows Mobile: <http://www.thesycon.de/cdcecmce>

USB CDC/NCM Class Driver

- › USB CDC/ECM class driver for Windows XP, Windows Vista, Windows 7, Windows 8:
<http://www.thesycon.de/cdcncm>
- › For Windows CE 5, CE 6, WEC7 and Windows Mobile: <http://www.thesycon.de/cdcncmce>

Virtual NDIS Network Adapter Driver

- › NDIS 5.0 miniport driver that provides a virtual network adapter with direct access to Ethernet packets via private API

NDIS Multiplexer Intermediate Driver

- › Controls two physical NICs
- › Exposes one virtual NIC

PXE Boot Driver for UEFI BIOS

- › UEFI network driver (UNDI) for USB device

Automatic W-LAN Configuration Wizard

- › Windows tool for automatic configuration of an external WLAN-based device
- › Automatic Windows firewall configuration

ATM Network Adapter Drivers

- › Various device drivers for ATM-155 and ATM-25 network interface controllers

Other

Audio/Video Processing and Streaming

- › Design and implementation of a library of DirectShow modules for real-time processing and transmission of audio and video data streams
- › The functionality includes audio/video capturing, encoding, real-time network transmission, decoding.

Various PCI Drivers

Thesycon has implemented many PCI device drivers for Windows 2000/XP/Vista/7/8, Windows CE/Mobile and Linux. Most devices use PCI bus mastering. Device types include:

- › PCI video capture board (frame grabber)
- › PCI multi-function card with serial and parallel ports
- › DMA-based high-speed measuring data capture
- › Network interface card
- › PCI-based USB device controller PLX NET2282

Serial Multiplexer Driver

- › WDM-compliant device driver for Windows that implements the serial multiplexing protocol defined by the ETSI TS 101 369 (GSM 7.10) standard

Persistent USB Disk Drive Letter Assignment

- › Windows kernel-mode driver that guarantees a fixed and persistent mapping of drive letters to USB disks

Serial Port Emulator (Virtual COM)

- › WDM-compliant bus driver that provides virtual COM port devices
- › Private API to create/destroy virtual ports and to transfer data
- › Can be used to create various virtual COM port solutions, for example: COM over TCP/IP tunneling, COM port emulation on top of arbitrary devices.

Virtual CD-ROM and Disk Driver

- › Windows kernel-mode driver that emulates a CD-ROM or hard disk drive and implements special data processing such as decryption

WHQL Certification of Windows Device Drivers

Thesycon has executed WHQL certification procedures and submissions on behalf of many customers. We have huge experience in running WHQL test benches on Windows XP, Windows Vista, Windows 7 and Windows 8. Thesycon offers WHQL driver certification as a service to customers.

Consulting

USB Problem Analysis

For many customers, Thesycon has analyzed USB-related hardware, firmware or driver problems and provided methods of resolution, or implemented fixes.

USB Protocol Design

Thesycon has designed and optimized the USB-based device communication protocol for numerous applications. Thesycon has huge experience in designing reliable and efficient protocols as required by many industrial-scale solutions.

Driver Problem Analysis and Optimization

Thesycon has helped various customers to solve issues in existing PCI and other device drivers and to improve efficiency of the driver code.

Programming Interface Design

Thesycon has many years experience in application programming interface (API) design and other software interface design tasks. Main design principles are: efficiency, robustness, simplicity and scalability.

EHCI USB Host Controller Verification

Thesycon has supported a major silicon manufacturer in verifying an EHCI host controller design. Thesycon provided various USB test benches and supported the designers in Windows kernel-mode debugging.

FireWire Problem Analysis

Thesycon has supported customers in the analysis and solving of IEEE1394-related hardware, firmware or driver problems. We worked out solution strategies for various application scenarios, e.g. very large topology configurations.

Feasibility and Technology Studies

- › USB 3.0 security aspects
- › USB device based security exploits