D8 - USB Linux Drivers

Writing USB-2.0 and USB-3.0 host and gadget drivers on Linux

Objectives

- Learn to write Linux drivers for USB-2.0 and USB-3.0
  - Explore the Linux USB host-driver stack
  - Learn the structure of USB device drivers
  - Discover USB gagdet drivers (2.0 and 3.0)
  - Understand the support for OTG-2.0 and OTG-3.0.
- Understand the specifics of the Linux kernel in the management of devices and drivers.
- Learn to configure the Linux kernel for optimal hotplug management.
  - Understand how hotplug events are generated and how to use them in drivers.
  - Install and use external hotplug daemons: udev, libusb, etc ...
- Discover Linux kernel changes up to the latest versions (up to 3.6.39 and 3.x).
- Master the techniques of kernel debugging.

Labs are conducted using the System Workbench for Linux - Basic EditionIDE, for which all trainees will get a free license, so that they can continue to work, after the training, in a convenient and efficient environment.

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Course environment

- A PC workstation and a target board per two trainees group.
- Printed course material.

Prerequisite

- Good practice of C programming on Linux
- Good knowledge of Linux kernel and driver programming (see our D3 - Linux Driverscourse and D7 - Power Management in Linux Drivers courses)

Target Audience

- Any embedded systems engineer or technician with the above prerequisites.

Course Outline

First day

Reminders on kernel programming

- Reminders on kernel module development
- Kernel objects
  Exercise: Writing a kernel module creating and using kernel objects and sets
- The sysfs file system
  Exercise: Interacting with a kernel module through a kernel object and the sysfs file sytem

Hotplug

- Hotplug in the kernel
- uevents
  Exercise: Writing a kernel module sending hotplug events to a user mode program.
- Hotplug at user level
- Udev
- Hal and Dbus
  Exercise: Cross-compiling, configuring and using Udev.

Second Day

Devices and Drivers

- The Device/Driver model in Linux
- Device class and types
- Bus drivers
- Bus types
- Generic devices and drivers
- System devices and drivers
- Platform devices and drivers
  Exercise: Writing a platform device driver showing how device matching work

USB Drivers

- The USB bus
- USB devices
- USB descriptors
- USB endpoints
- USB requests
- User view of the USB bus and devices
- USB device drivers
- Hotplug
- Communicating with devices through URBs
  Exercise: Writing a basic usb device driver using URBs
  Exercise: Writing an usb device driver using synchronous request management

Third Day

The libUSB user-mode USB driver framework

- The libUSB libraries.
- libUSB 0.1.12.
- libUSB 1.0
  Exercise: Building libUSB
  Exercise: Writing a user-mode USB driver using libUSB

USB gadget drivers

- Basic USB gadgets.
- Composite USB gaddget drivers.
  Exercise: Writing a gadget driver and the corresponding host driver on the Linux workstation.
- The USB On-The-Go (OTG) specification.
- OTG support in Linux