Embedded and real-time Linux

Hands-on course of 4 days - 28h
Ref.: LXT - Price 2025: 2 950 (excl. taxes)

HANDS-ON WORK
Every step of the training session is immediately applied as a case study on an embedded ARM board with a touch screen to test graphical developments.

THE PROGRAMME

last updated: 03/2024

1) Open-source cross development tools

- Architecture overview. Overview of an embedded system and of the Linux kernel architecture.
- Cross development tool chain, gcc cross compiler, C libraries, glibc and uClibc, GNU debugger, GNU ELF tools.
- Embedded development tools, QEMU, BUILDROOT, BUSYBOX.

Hands-on work : Installation and practice of Buildroot to build a cross compilation toolchain.

2) The universal Boot loader: uBoot

- uBoot project overview. A walk through the source code. Supported architectures.
- Basic functionalities. The uImage format for booting uBoot Images.
- Practice on a ARM-9 device with uBoot. Configuration, compilation and installation in a qemu sandbox for testing.
- The uBoot configuration options. uBoot commands and environment.
- Integration of new uBoot commands. Development of a standalone program using uBoot as BIOS.

Hands-on work : You will add a new command to uBoot and test uBoot inside QEMU.

3) Linux kernel

- Licenses implications on kernel and kernel modules development.
- Kernel development tools, quilt, GDB, GIT, LTT. Kernel configuration tool Kbuild.
- Kernel configuration and compilation. Module development and compilation.
- The Linux boot process. The schedulers, preemption and scheduling.
- The Linux driver framework and standard drivers.
- VFS Essentials callbacks, implementing a quick and dirty driver with open, read and write callbacks.

Hands-on work : How to modify the kernel tree to add a new driver to the kernel tree. Generate a patch formatted for the LKML. Develop a character driver outside of the kernel tree.

4) Root File system

- Bottom-up approach for the root file system creation.
- Adding users management with busybox.
- Application integration.
- Copying the root file system on a memory technology device.

Hands-on work : Create rootfs from scratch using busybox and test it on a real ARM target. Use buildroot to build new generic applications. Add your own application.

5) Linux and Real-Time

- History and kernel evolution.

- Linux-RT a realtime evolution.
- Nano kernels and interrupt virtualisation.
- Xenomai applications development.
- Real-time Hypervisors.
Hands-on work : Installation of Xenomai, development of a realtime application with Posix and Native Interface. Benchmark comparing Linux standard applications and Xenomai applications under heavy load.

DATES

REMOTE CLASS
2025 : 16 sept., 04 nov.