

Linux embedded and Yocto Project training (3 days - combo training with Toradex board)



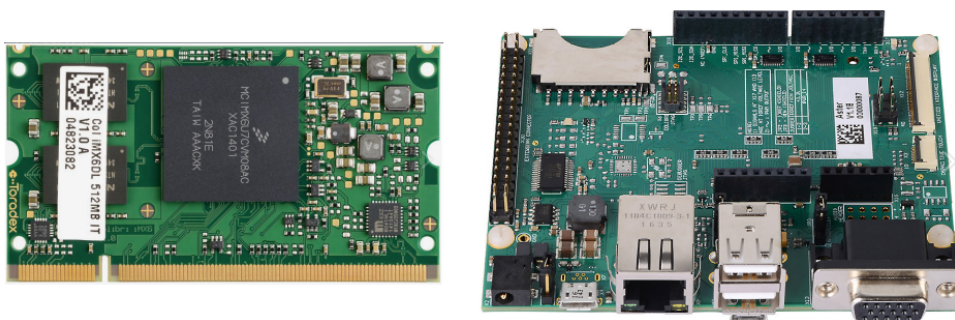
Title	Linux embedded and Yocto Project training with Toradex board
Overview	<ul style="list-style-type: none"> Understanding the Linux filesystem Setup TFTP and NFS services Understanding bootloaders u-boot bootloader Understanding the Linux kernel Configuring and building the Linux kernel Linux Device Tree OpenEmbedded and Yocto Project overview Using it to build a root filesystem and run it on your target Writing and extending recipes Creating layers Practical labs with ARM-based board
Duration	THREE day - 24 hours (8 hours per day). 50% of lectures, 50% of practical labs (approx.)
Trainer	Marco Cavallini m.cavallini (AT) koansoftware.com
Language	Oral lectures: English or Italian Materials: English.
Audience	<ul style="list-style-type: none"> People that need to learn how to use a Linux system People using and managing an embedded Linux system People that need to learn how to configure and build a whole Linux system using Yocto Project People developing Linux kernel and user-space applications People creating Yocto Project recipes and layers
Prerequisites	<p>Knowledge of Linux commands as covered in our embedded Linux training (http://koansoftware.com/en/content/linux-embedded-course)</p> <p>Knowledge and practice of Unix or GNU/Linux commands People lacking experience on this topic should not attend this course.</p>

Required equipment	<p>For public sessions Everything is supplied by KOAN in public sessions except the PC. Participants must have their own PC laptop computer with:</p> <ul style="list-style-type: none"> • PC computers with at least 2GB of RAM, and 40GB of free disk space. • VirtualBox 5 installed. • We will work with Lubuntu Desktop 14.04 (64 bit) We don't support other distributions, because we can't test all possible package versions. • Connection to the Internet (direct or through the company proxy). • PC computers with valuable data must be backed up before being used in our sessions. Some people have already made mistakes during our sessions and damaged work data. <p>For on-site sessions please add the following</p> <ul style="list-style-type: none"> • Video projector • Connection to the Internet (direct or through the company proxy).
Materials	<p>Print and electronic copies of presentations and labs. Electronic copy of lab files.</p>

Hardware

The hardware platform used for the practical labs of this training session is the **Toradex Colibri iMX6DL** board and the **Toradex Aster** carrier board, which features:

- A CPU NXP®/Freescale i.MX 6DualLite
- 512 MB of RAM
- 4 GB of on-board eMMC storage (8 Bit)
- USB host and device
- up to 39 pins headers, to access UARTs, SPI buses, I2C buses
- headers compatible with Arduino Uno and Raspberry Pi (RPi) maker board



Note:

Content and order of this agenda may slightly vary between sessions and will be determined by the participants and the specific needs of the class.

Day 1 - Morning

Lecture - Setup and Introduction

- Virtual machine setup
- Introduction to embedded linux
- Advantages of using linux
- Systems running linux
- Typical embedded hardware
- System architecture

Lecture - Linux commands and filesystem

- Linux commands
- Linux filesystem
- Virtual filesystems
- Understanding the development process

Lab - Using linux

Using the Virtual Machine

- Using the Unix command line
- using the vi text editor
- Discovering procs and sysfs
- Using TFTP and NFS connect the board to development PC

Day 1 - Afternoon

Lecture - Configuring, compiling and booting the Linux kernel

- Busybox
- Bootloaders
- u-boot
- Autotools concepts
- Booting the kernel using TFTP and NFS

Lab - Kernel configuration, cross-compiling and booting on NFS

Using the Virtual Machine

- Configuring TFTP server on the host machine
- Configuring NFS server on the host machine
- Flash a Linux image on a SDCard
- Booting the target board using TFTP and NFS

Day 2 - Morning

Lecture - Linux kernel

- Linux kernel sources structure
- Details about the API provided to kernel drivers
- Cross compiler toolchains
- Cross-compiling the kernel for the target
- Device Tree

Lecture - Linux kernel details

- Linux kernel introduction
- Linux versioning
- Generating patches with diff
- Understanding the kernel development process

Lab - Using linux

Using the Virtual Machine

- Extracting a generic linux kernel
- Applying patches to the kernel with patch
- Configuring the kernel

Day 2 - Afternoon

Lecture - Configuring, compiling and booting the Linux kernel

- Linux kernel configuration
- Kernel booting parameters
- Native and cross-compilation generated files
- CPU pin muxing
- Device Tree
- The init process

Lab - Kernel configuration, cross-compiling and booting on NFS

Using the Virtual Machine

- Cross compile a customized kernel
- Run a modified Linux image on your target board
- Play around with Embedded Linux on your board

Day 3 - Morning

Lecture - Yocto Project introduction

- Yocto Project overview
- How to setup the Yocto Project build system
- Organization of the project source tree
- Building a root filesystem image using the Yocto Project

Lecture - OpenEmbedded and Yocto Project

- General concepts of a build system
- Origin of Yocto Project
- Yocto Project recipes
- Yocto Project meta layers
- Configuring the build system
- Customizing the package selection

Lab - Running Yocto on the host

Using the Virtual Machine

- Setup the Poky reference build system
- Building a system image
- Creating a meta layer with Yocto Project
- Creating an example recipe with Yocto Project

Day 3 - Afternoon

Lecture - Yocto Project

- Writing a minimal recipe
- Adding dependencies
- Development workflow with *bitbake*
- Meta layers customization

Lab - Running linux on the target

Using the ARM board

- Create a custom recipe for a new package *nInvaders*
- Flash a new Linux image on a SDCard
- Writing a recipe for *nInvaders*
- Adding *nInvaders* to the final image
- Play around with generated image on your board