

Embedded Android

Android is becoming a popular choice as an embedded operating system, largely because of its great UI and familiar programming interface. Support for Android is available from a wide range of chip, board and module vendors. This course will show you the internal workings of Android, guide you through selecting suitable hardware platforms and teach you how to customize the platform for your own needs.

You will learn how to build Android from source and reflash the system images using fastboot. You will find out how to lock-down the UI to create a single-purpose “kiosk mode” application, and how to access external hardware from Android apps, using JNI. You will learn about the Android security framework and how to reduce the chances of the device becoming compromised. There are modules on how SurfaceFlinger renders graphics for various displays, and on the all-important topic of debugging and profiling the final system.

Roughly half of the course is taken by hands-on lab sessions during which you will apply the theory to create an embedded Android device, based on the popular and readily available BeagleBone Black.

Duration

4 days

Audience

This course is ideal for system architects, engineers and project leaders who want to know how Android works, and how to customize and extend the platform

Prerequisites

Good knowledge of C/C++ and Java

Familiarity with Linux development and command-line tools

About the trainer



Chris Simmonds has a wealth of experience in customizing Android for embedded systems. He has been running training courses and workshops in Android since 2010 and has trained teams at many well-known organisations in the UK, Europe, USA, South America and SE Asia. He is the author of the book “Mastering Embedded Linux Programming”, and is a frequent presenter at open source and embedded conferences, including Embedded Linux Conference and Embedded World. You can see some of his work on the "Inner Penguin" blog at www.2net.co.uk

Enquiries and bookings

Please email training@2net.co.uk or call +44 (0)7788 130719

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Course outline

Introduction to Android

- Android architecture: the big picture
- Getting the source code: the Android Open Source Project (AOSP)
- Building Android from source
- Criteria for selecting hardware

The kernel

- Linux kernel architecture
- Android-specific changes to Linux
- Building Linux from source
- Understanding device trees

Booting Android

- Learning how the bootloader starts Android
- Flashing images using fastboot
- Customizing init boot scripts
- Controlling system behaviour using system properties
- Reducing boot time

The Android framework

- Understanding Android services
- The role of binder and AIDL in defining interfaces to services
- Defining your own service
- Calling native code using JNI
- The Hardware Abstraction Layer (HAL)

Graphics

- How SurfaceFlinger orchestrates image rendering
- Internal and external displays
- Streaming multi-media

Applications

- Application sandboxing
- Dalvik and ART
- How to write a single-use **kiosk-mode** application

Debugging and profiling

- Debugging native code
- Profiling CPU usage using perf
- Profiling memory usage
- Profiling power usage

Security

- User and group IDs
- Android permissions, and how to add your own
- How SELinux adds an extra layer of protection
- Security threats and “rooting”

Interfacing with hardware

- Some different approaches to reaching hardware from apps
- USB host and accessories
- Basic interfacing using GPIO
- Interfacing with serial ports
- Interfacing using i2c and SPI peripherals

Integrating non-Android code

- Problems with integrating non-Android code
- Using a chroot jail
- Using Unix sockets to link into the framework and apps