Android training with AOSP

Course Duration: 24 Hours **Course code: AND-AOSP**

1. Course Overview

This course equips participants with the skills to develop, customize, and build Android OS using the Android Open Source Project (AOSP). It covers AOSP architecture, system services, HAL, device drivers, custom ROM development, and debugging. Participants will gain hands-on experience building and modifying Android at the system level.

2. What you'll learn?

- Understand Android OS architecture and AOSP components.
- Set up AOSP development environment and build Android from source.
- Customize system UI, services, and frameworks.
- Work with HAL, device drivers, and board support packages (BSPs).
- Debug, optimize, and deploy Android builds.
- Create custom ROMs and integrate hardware features.

3. Target Audience

- Embedded system engineers and mobile OS developers
- Android developers looking to work at OS level
- OEM/ODM engineers customizing Android for devices
- Students and professionals interested in custom ROM development

4. Pre-Requisites

- Strong knowledge of Linux environment
- Familiarity with C/C++, Java, Git, Bash scripting
- Basic Android development experience is recommended

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5. Course content

Module 1: Introduction to AOSP

- Overview of AOSP and Android ecosystem
- Android OS architecture: Kernel, Libraries, Runtime, Framework, Apps
- Branching and version control in AOSP
- Understanding device tree and build targets

Module 2: Setting Up Development Environment

- Hardware and software requirements
- Installing Linux, JDK, Git, Python
- Using repo tool to download AOSP source
- Configuring environment variables

Module 3: Building AOSP

- Build system overview (Soong, Make)
- Emulator vs physical device builds
- Flashing and testing builds
- Common build errors and troubleshooting

Module 4: Android System Architecture Deep Dive

- Application Framework & System Services
- Libraries and Android Runtime (ART/Dalvik)
- Init process and system server
- Package manager and app lifecycle

Module 5: Customizing AOSP Framework

- Modifying system UI and settings
- Adding/removing system apps
- Customizing framework APIs and permissions
- Implementing new features at system level

Module 6: Hardware Abstraction Layer (HAL) and Drivers

- Understanding HAL and HIDL/AIDL
- Writing HAL modules
- Vendor partition and device drivers
- Integrating new hardware features

Module 7: Device Tree and Board Support Package (BSP)

- Structure of device tree
- Creating and customizing BSP
- Bootloader and kernel integration
- Porting Android to new hardware

Module 8: Security and OTA Updates

- Android security model
- SELinux policies
- Signing builds and secure boot
- OTA update mechanisms

Module 9: Debugging and Performance Optimization

- Using adb, logcat, dmesg
- Kernel and system debugging techniques
- Performance profiling tools
- Optimizing AOSP for resource-constrained devices

Module 10: Advanced Custom ROM Development

- Building custom ROMs from AOSP
- Branding, UI, and preloaded apps
- Performance tuning and security considerations
- Integration with Google services

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Module 11: Capstone Project

- End-to-end custom ROM project
- Integrate system-level changes and UI customizations
- Test and deploy on emulator or physical device
- Project presentation and review