Introduction to Android
Outline

• What is Android?
• Features
  • Android Architecture
  • Linux kernel
  • Native Libraries
  • Android Runtime
  • Application Framework
  • Applications

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What is Android

• Android is a software stack for mobile devices that includes an operating system, middleware and key applications.

• Android is a Java-based operating system that runs on the Linux 2.6 kernel.

• The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language.
Features

• **Application framework** enabling reuse and replacement of components

• **Dalvik virtual machine** optimized for mobile devices

• **Integrated browser** based on the open source WebKit engine

• **Optimized graphics** powered by a custom 2D graphics library; 3D graphics based on the OpenGL ES 1.0 specification (hardware acceleration optional)

• **SQLite** for structured data storage
Features (con’t)

- **Media support** for common audio, video, and still image formats (MPEG4, H.264, MP3, AAC, AMR, JPG, PNG, GIF)
- **GSM Telephony** (hardware dependent)
- **Bluetooth, EDGE, 3G, and WiFi** (hardware dependent)
- **Camera, GPS, compass, and accelerometer** (hardware dependent)
- **Rich development environment** including a device emulator, tools for debugging, memory and performance profiling, and a plugin for the Eclipse IDE
Android Architecture
Linux Kernel
Linux Kernel

- Android is built on the Linux kernel, but Android is not Linux
- Provide core system services such as process, memory, power management, network stack, driver model and security
- Does not include the full set of standard Linux utilities
- The Android kernel source is available today
  - http://git.android.com
Libraries

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Native Libraries

- Bionic Libc
- Function Libraries
- Native Servers
- Hardware Abstraction Libraries
Bionic Libc

- C/C++ library
- Custom libc implementation, optimized for embedded use.
- Not compatible with Gnu Libc (glibc)
- Pros (compare with glibc)
  - Small size and fast code paths
  - Very fast and small custom pthread implementation

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Function Libraries

• WebKit
  – Based on open source WebKit browser
  – Full CSS, Javascript, DOM, AJAX support

• Media Framework
  – Based on PacketVideo OpenCORE platform
  – Supports standard video, audio, still-frame formats

• SQLite
  – Light-weight transactional data store
  – Back end for most platform data storage

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Hardware Abstraction Libraries

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Hardware Abstraction Libraries

• User space C/C++ library layer
• Defines the interface that Android requires hardware “drivers” to implement
• Separates the Android platform logic from the hardware interface

• Why do we need a user-space HAL?
  – Not all components have standardized kernel driver interfaces
  – Kernel drivers are GPL which exposes any proprietary IP
  – Android has specific requirements for hardware drivers
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Android Runtime

- Application Developed language: Java
- Dalvik Virtual Machine
  - Instruction set: Dalvik Executable
- Java Standard Library
  - Compile java code to Dalvik Executable (dex format)
Dalvik Virtual Machine

• Android custom implementation virtual machine
  – Provides application portability and runtime consistency
  – Runs optimized file format (.dex) and Dalvik bytecode
  – Java .class / .jar files converted to .dex at build time

• Designed for embedded environment
  – Supports multiple virtual machine processes per device
  – Highly CPU-optimized bytecode interpreter
  – Efficiently Using runtime memory

• Core Libraries
  – Core APIs for Java language provide a powerful, yet simple and familiar development platform
Application Framework

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Application Framework

- Activity manager
  - Manage the life cycle of applications
- Content Provider
  - Share data between applications
- Resource Manager
  - Manager non-code resource
- Notification Manager
  - Display custom alerts in the status bar
- Views System
  - A rich and extensible set, which can construct UI
Application Framework

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Applications

• Use the powerful and flexible application framework to develop your application
• Written by JAVA programming language