Android Internals

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Outline

- Typical Handset Capabilities
- Android vs Java
- Android architecture
- Building blocks of Android application
- Android project file structure
- App compilation and deployment

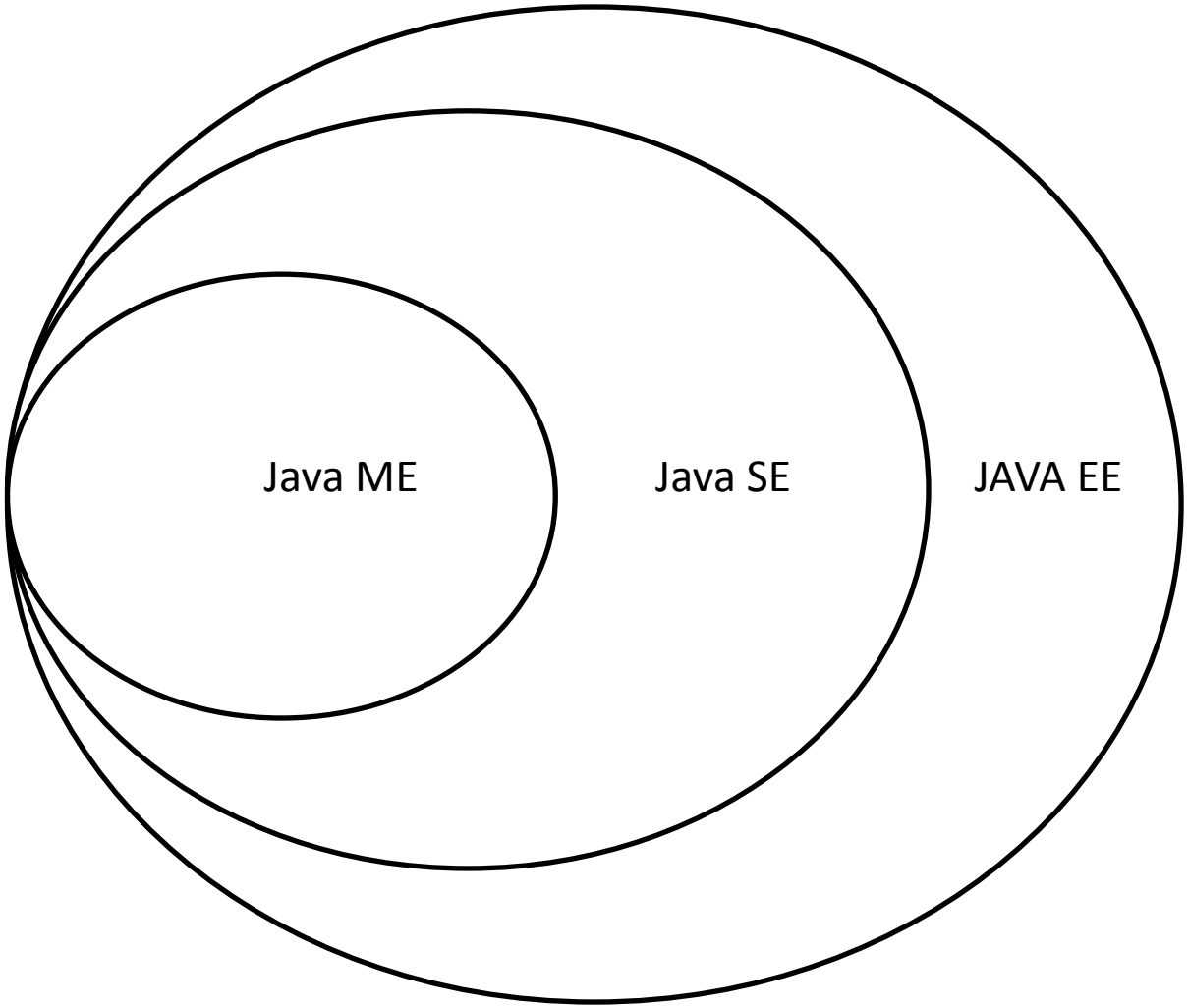
Typical Android-powered Handset

- **Phone Services: GSM (CDMA), SMS**
- **Networking: Wi-Fi, WiMAX, 2G (GPRS, EDGE), 3G (UMTS,**HSPA), 4G(LTE, HSPA+), Bluetooth, NFC
- **Location services: GPS, AGPS, GLONASS, etc...**
- **Multimedia hardware: photo, video camera(s)/microphone**
- **Positioning: accelerometer, compass, gyroscope, barometer, magnetometer**
- **Web Browser: WebKit-based (now Chromium**)
- **Graphics: hardware-accelerated, 2D and 3D**
- **Storage / Encrypted storage**

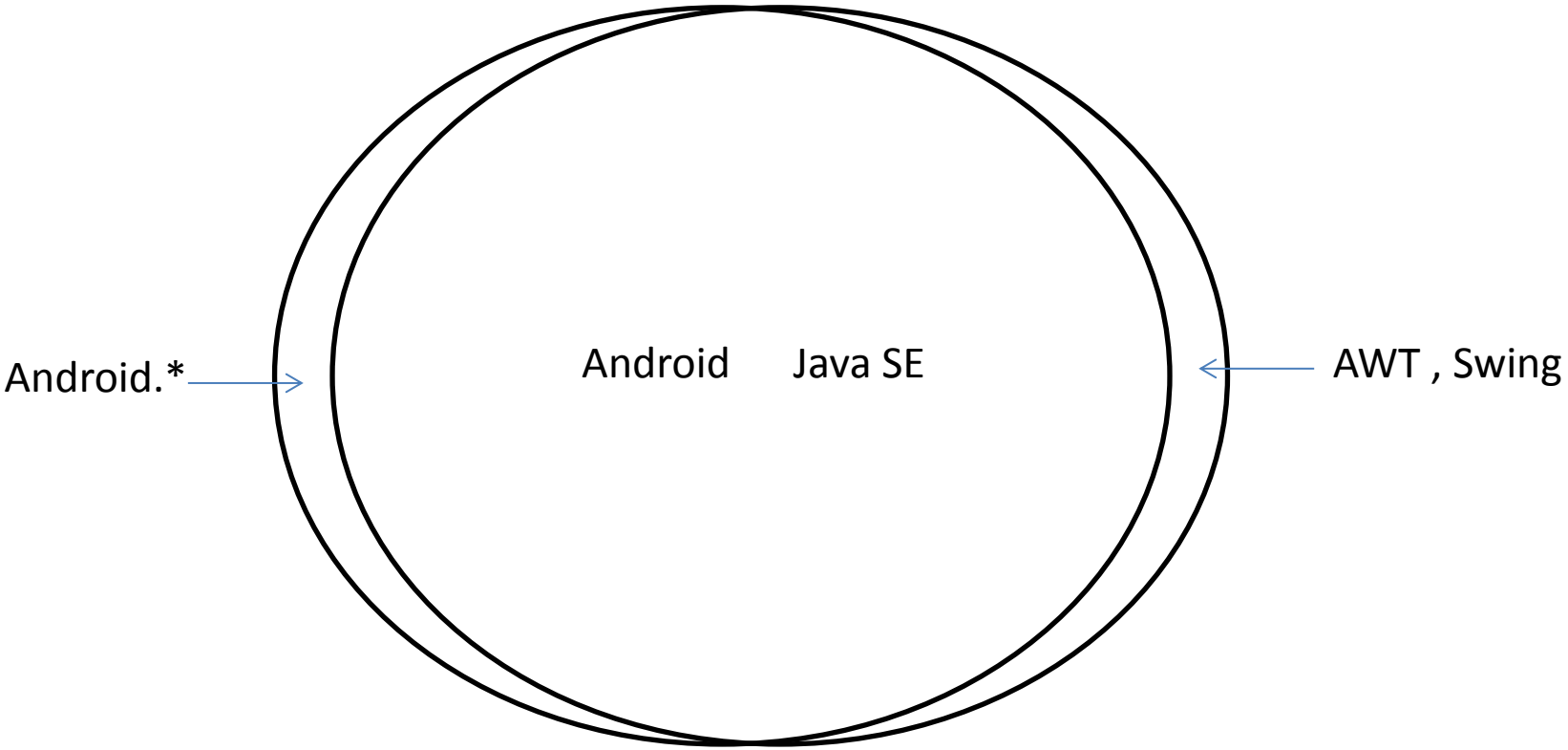
Android vs Java

- Android is a mobile operating system
- Java is a programming language for various platforms
- Android programming is done with Java compatible libraries based on (now deprecated) Apache Harmony project

Java Platform Variations



Android vs Java



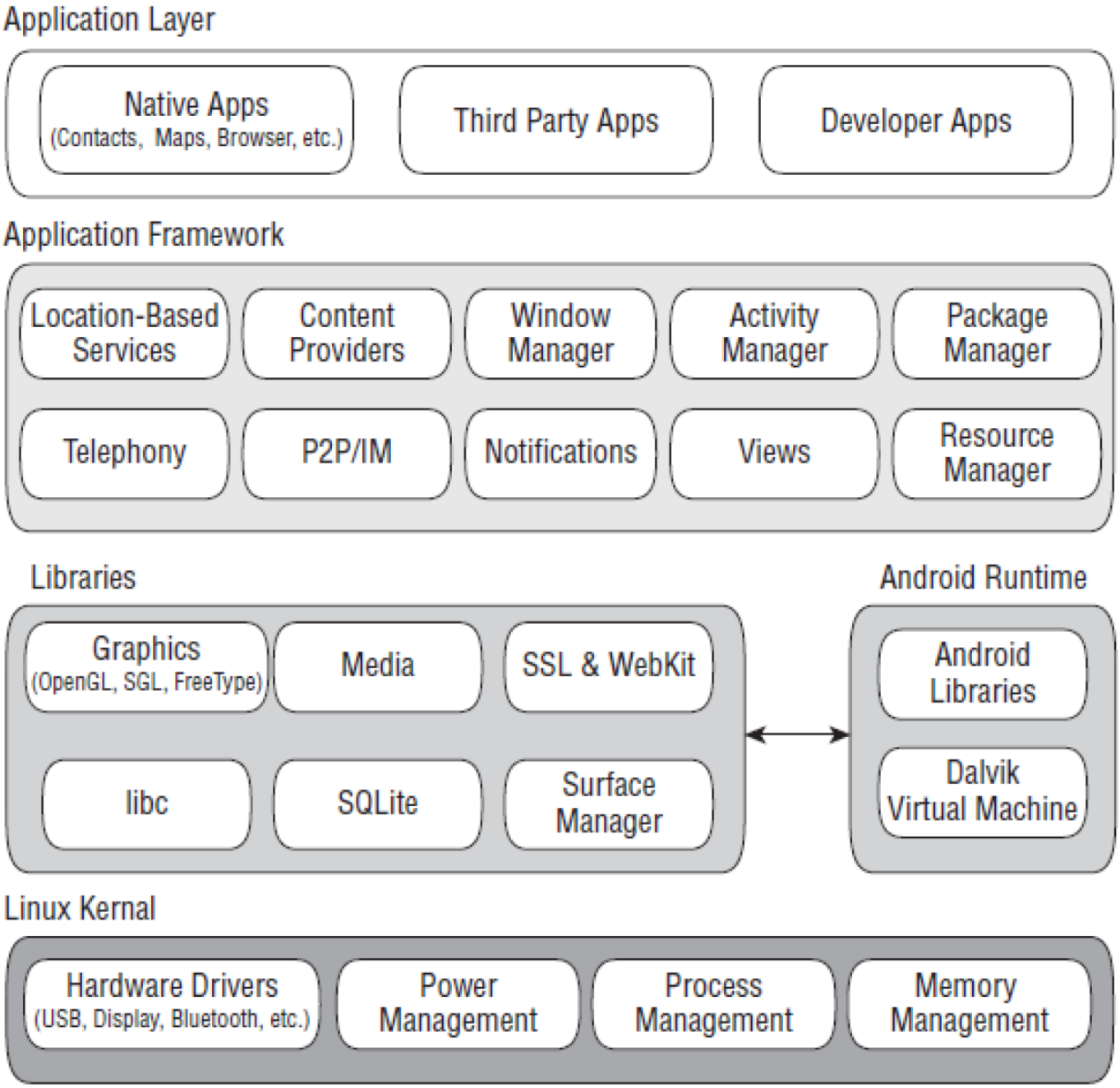


Figure 1-1

Process/Thread Perspective

- Security is managed by the kernel
- Each app runs in its own process
- Each app gets its own unique UID/GID
- Each app runs its own Dalvik VM

- The processes are isolated and crash of one app does not bring down the whole system!

Android.*

- android.util – containers, formatters, parsers
- android.os – message passing, IPC, debugging
- android.graphics – canvas, colour, primitives, ...
- android.text – displaying & parsing text
- android.database – handling cursors for db
- android.content – data access and publishing
- android.view – core user interface
- android.widget – lists, buttons, layouts...

Android.* Cont'd

- com.google.android.maps – map controls
- android.app – activity and service API
- android.provider – standard content provider
- android.telephony – telephony API
- android.webkit – web-based content work
- Also: OpenGL, FreeType, SGL, libc, SQLite, SSL

Android.* Cont'd

- android.location
- android.media
- android.opengl
- android.hardware
- android.bluetooth
- android.net.wifi

Supported Media Formats

- Audio: 3gp, mp4, aac, ts, flac, mid, ogg, mkv, wav
- Images: jpeg, gif, png, bmp, *webp (v4)*
- Video: 3gp, mp4, ts, *webm, mkv*

Basic Building Blocks

- Activities
- Content Providers
- Services
- Intents

Activities

- The building block of the user interface is the activity. You can think of an activity as being the Android analogue for the window or dialog box in a desktop application.

Content Providers

- Content providers provide a level of abstraction for any data stored on the device that is accessible by multiple applications.
- The Android development model encourages you to make your own data available to other applications, as well as your own. Building a content provider lets you do that, while maintaining complete control over how your data is accessed.

Services

- Services are designed to keep running, if needed, independent of any activity. You might use a service for checking for updates to an RSS feed or to play back music even if the controlling activity is no longer operating.

Intents

- Intents are system messages, running around the inside of the device, notifying applications of various events, from hardware state changes, to incoming data, to application events.
- Not only can you respond to intents, but you can create your own to launch other activities or to let you know when specific situations arise.

Basics in the Nutshell

- Activity: basic building block of an application
- Intents: communication mechanism
- Service: background process with no user interface
- Content provider: basic superclass framework for handling and storing data

Android Project Structure

- **AndroidManifest.xml**
- build.xml
- default.properties, local.properties
- assets/
- bin/
- gen/
- libs/
- **src/**
- **res/**
- tests/

AndroidManifest.xml

- AndroidManifest.xml is a foundation of any Android application
- Contains a list of application activities, services
- Describes how particular app fits into the rest of Android system (system menus, etc)
- Requirements to run (sdk version)
- Describes required and provided permissions, libraries, etc.

AndroidManifest.xml

<manifest
xmlns:android="http://schemas.android.com/apk/res/android"
package="ie.ucd.sampleapp">
<usespermission... />
<usessdk… />
<useslibrary… />
<application>...</application>
</manifest>

src/

- Contains source code of your app in
  src/ie/ucd/ex1/SampleApp.java
  …
  src/ie/ucd/ex1/SampleActivity.java

res/

- Res directory holds static resources for your app that are packaged along with your application:
  - drawable/
  - layout/
  - menu/
  - raw/
  - values/
  - xml/

Compile Time!

- .class files – Java bytecode
- .dex – Android executable for Dalvik VM – highly optimised Java bytecode
- Yourapp-debug.apk, yourappunsigned.apk – .dex with resources, ready to debug/deploy

Questions

- Please ask in the Student Forum