

Android Development

References:

- ✓ <https://developer.android.com/guide>
- ✓ <http://idke.ruc.edu.cn/seminars/2010/10.30/Android%20Development%20tutorial.ppy>
- ✓ <http://www.cse.ohio-state.edu/~xuan/courses/5432/AndroidProgramming.ppt>
- ✓ <https://gradle.org/features/>

What's Android?

- Popular mobile device OS
- Developed by Open Handset Alliance, led by Google
 - A group of 71 technology and mobile companies, including Google, Intel, Dell, HTC and China Mobile...
 - Initially called up by Google, and Google is the 'captain'
- An operating system for mobile devices such as *smartphones* and *tablet* computers.
- Android has beaten Apple iOS, being the leading mobile operating system from first quarter of 2011
- Latest Version: Android 9 Pie

What's Android?

- Application framework enabling reuse and replacement of components
- Optimized Java virtual machine: Dalvik
- Optimized Graphics Processing, supporting 2D and 3D graphics
- Integrated open source web browser: WebKit
- SQLite for structured data storage
- Multimedia capability, supporting multiple audio, video, & image formats
- GSM Telephony
- Bluetooth, EDGE, 3G and Wi-Fi support

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Android Architecture



Linux Kernel

- Note that Android based on a Linux kernel not a Linux OS
- Supplies Security, Memory management, Process management, Network stack and Driver model
- Acts as an abstraction layer between the hardware and the rest of the software stack



Libraries

- Run in system background
- C/C++ Language
- 4 types of Libraries
 - Bionic Libc, system C libraries
 - Function Libraries, (multimedia, web browser, SQLite ...)
 - Native Servers
 - Hardware Abstraction Libraries



Android Runtime

- The core of Android platform
- Dalvik Virtual Machine: *Only supports a subset of standard Java Library*
 - Executes files in the Dalvik Executable (.dex) format
 - Java .class / .jar files converted to .dex at build time
- Java core Libraries
 - Provides most of the functionality of the Java programming language.
- Java core libraries rely on the Dalvik VM and the underlying Linux kernel
- Multiple Dalvik VMs may run at the same time
- Every Android application runs in its own process, with its own instance of the Dalvik virtual machine



Application Framework

- Simplify the reuse of components
 - Applications can publish their capabilities and any other application may then make use of those capabilities
- Applications is a set of services and systems, include
 - Views system, content providers, resources manager and so on



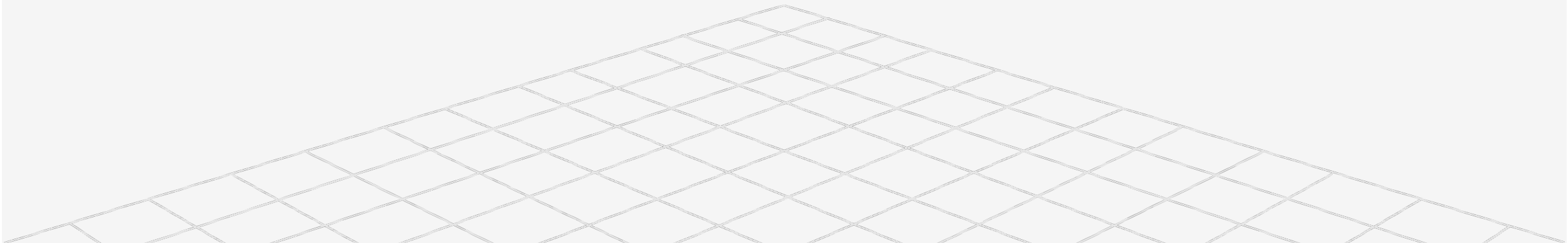
Applications

- A set of core applications shipped with Android platform
 - Email client, SMS program, calendar, maps, browser, contacts ...
- All written in Java
- Our applications are in the same level as these applications



Getting Started

- Install Java Development Kit (JDK) to write Java (and Android) programs. JDK not JRE!
- Android Studio bundle (including Android SDK) for your OS



Android Apps

- Use four main components:

- Activity:

- A “single screen” that’s visible to the user

- Service

- Long-running background “part” of app
 - Not separate process or thread

- **ContentProvider:**

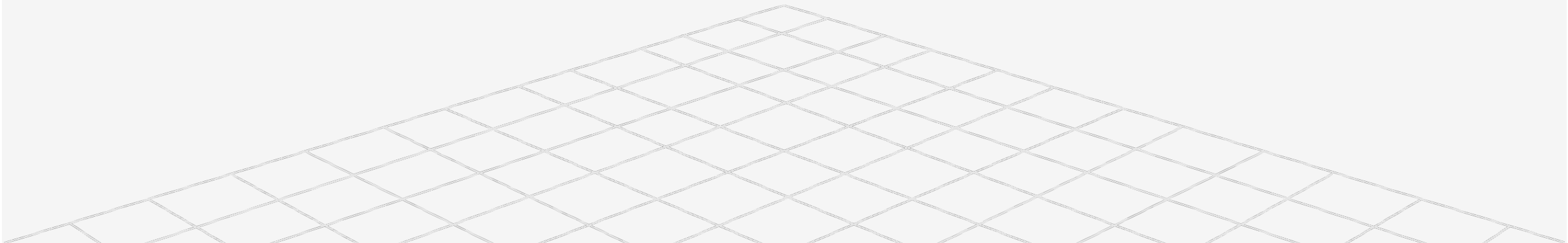
- Manages app data (usually stored in database) and data access for queries

- **BroadcastReceiver**

- Component that listens for particular Android system “events”, e.g., “found wireless device”, and responds accordingly

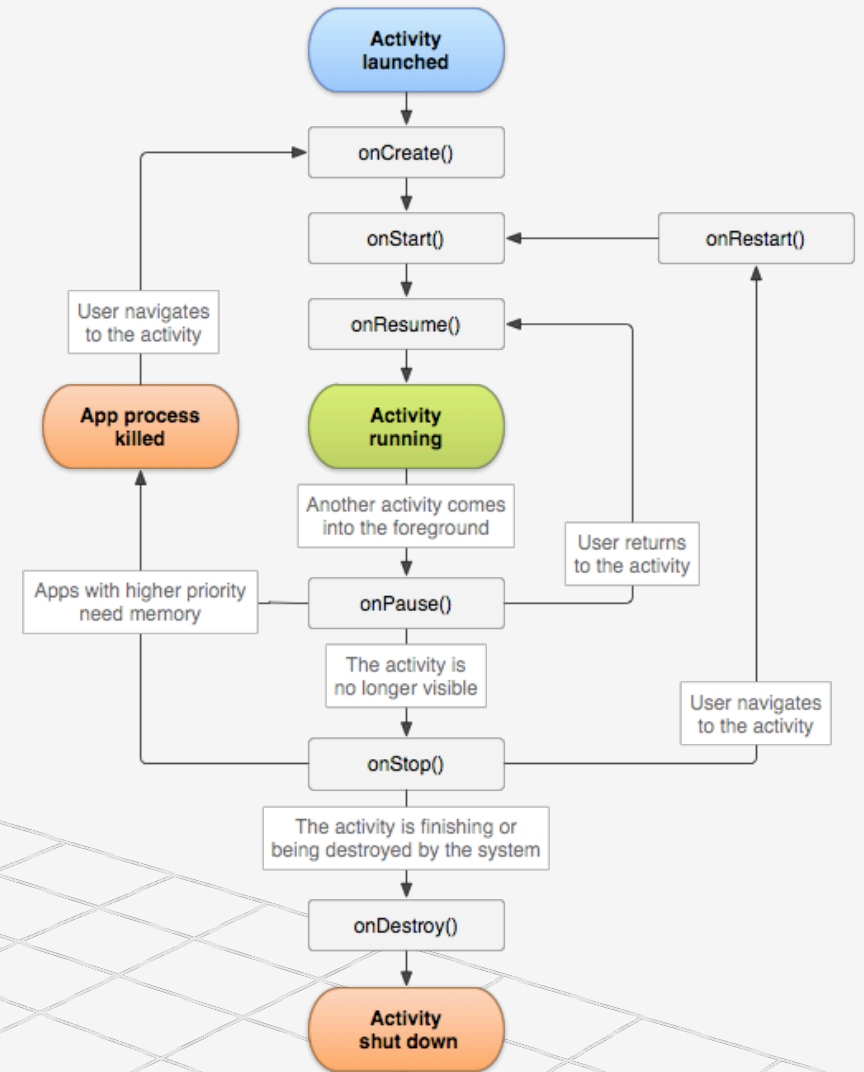
Android Apps – Manifest File

- Every Android app must include an AndroidManifest.xml file:
 - Describes functionality
 - App's Activities, Services, etc.
 - Permissions requested by app
 - Minimum API required
 - Hardware features required, e.g., camera with autofocus
 - External libraries to which app is linked, e.g., Google Maps library



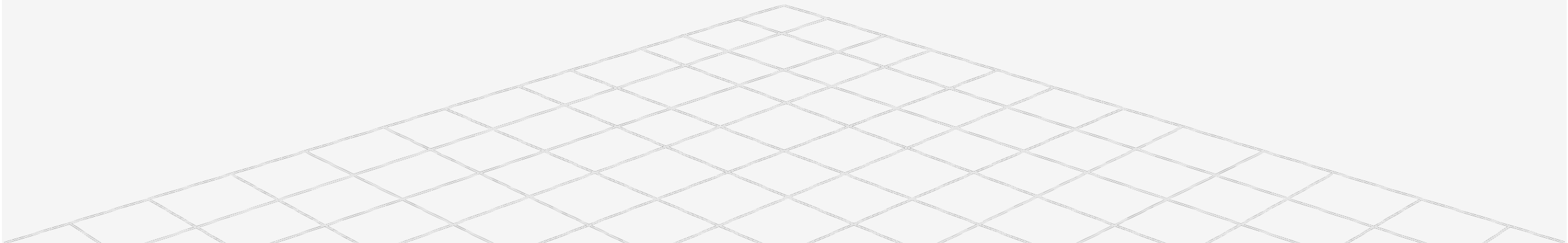
Android Apps – Activity

- Activity: key building block of Android apps
- Extend Activity class, override onCreate(), onPause(), onResume() methods
- Dalvik VM can stop any Activity without warning, so saving state is important!
- Activities need to be “responsive”, otherwise Android shows user “App Not Responsive” warning:
 - Place lengthy operations in Runnable Threads, AsyncTasks



Create a new Android Project

- Open File->New->Android project
 - Project name
 - Build Target
 - Application name
 - Package name
 - Create Activity



What's in the project folder?

- src: source folder
 - Your Java files are under main/java/package/...
 - Manifest is also under main/java/
- res: contains layout-related files and more
 - activity_main.xml
- Gradle related files:
 - An open-source build automation system that builds upon the concepts of Apache Ant and Apache Maven and introduces a Groovy-based domain-specific language (DSL)