

Android Introduction

Mobile Computing - Android

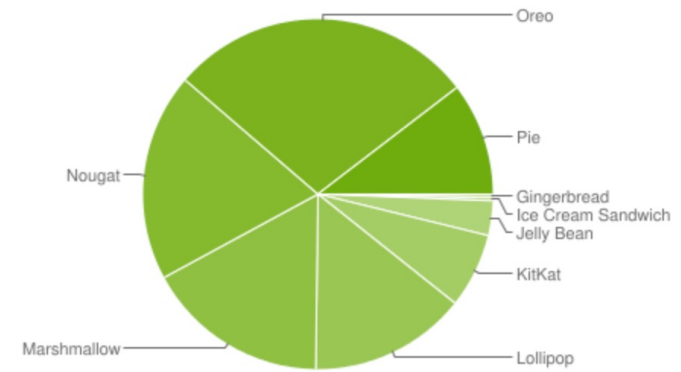
Android Features

- Android is open source (although [not entirely](#))
- Free to develop Android apps
- [Distribution through Google Play](#) requires a 1 time fee of \$25 to register as a developer
- Distribution on your own is free (you *can* distribute apps on your own, with a self-signed .apk)
- Can also distribute through [Amazon App Store](#)
 - Allows you to test drive apps, which is pretty cool ...
- Familiar language (Java) & IDEs (Android Studio, Eclipse), all cross-platform

Android OS Flavors

- Latest: Android 14 (Oct 2023) - [Developer features](#)

Version	Codename	API	Distribution
2.3.3 - 2.3.7	Gingerbread	10	0.3%
4.0.3 - 4.0.4	Ice Cream Sandwich	15	0.3%
4.1.x	Jelly Bean	16	1.2%
4.2.x		17	1.5%
4.3		18	0.5%
4.4	KitKat	19	6.9%
5.0	Lollipop	21	3.0%
5.1		22	11.5%
6.0	Marshmallow	23	16.9%
7.0	Nougat	24	11.4%
7.1		25	7.8%
8.0	Oreo	26	12.9%
8.1	Pie	27	15.4%
9		28	10.4%

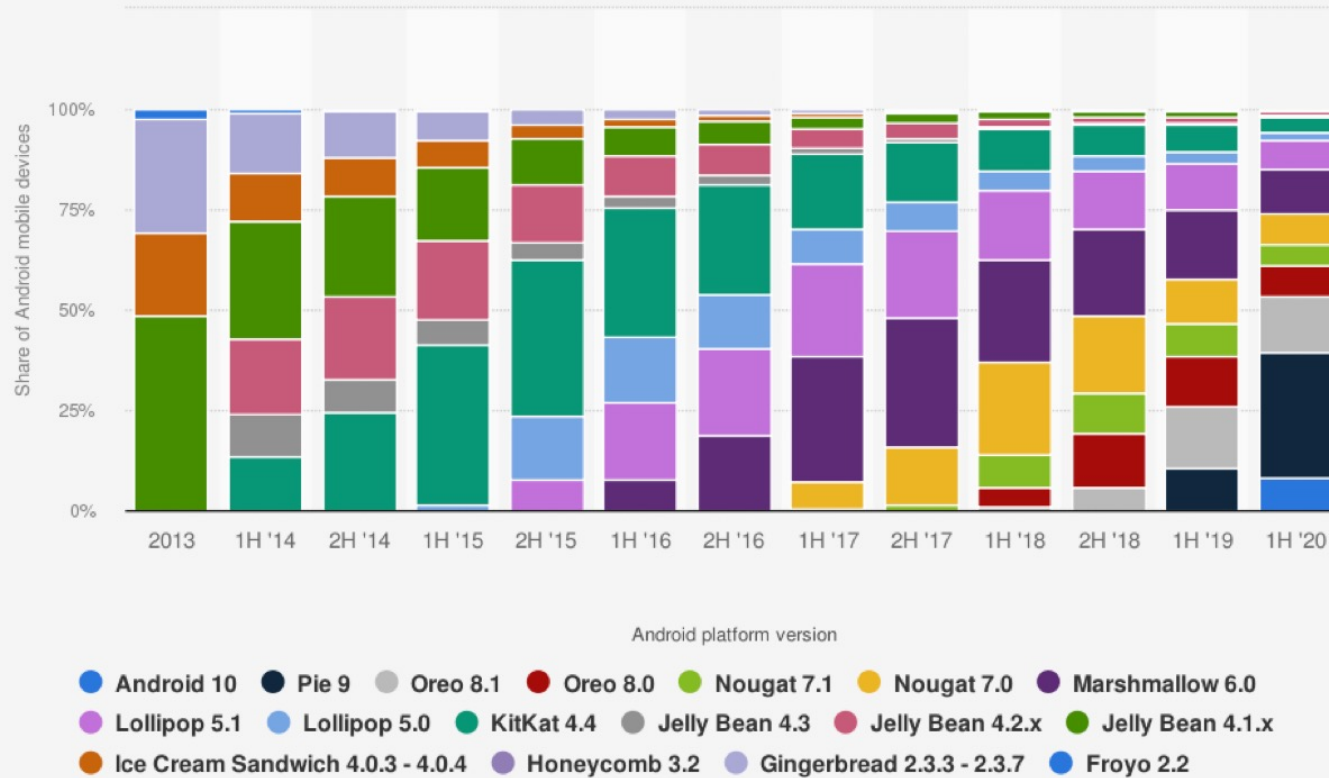


Data collected during a 7-day period ending on May 7, 2019.
Any versions with less than 0.1% distribution are not shown.

[Use distribution dashboard](#)

Market Share over Time

Android operating system share worldwide by OS version from 2013 to 2020*

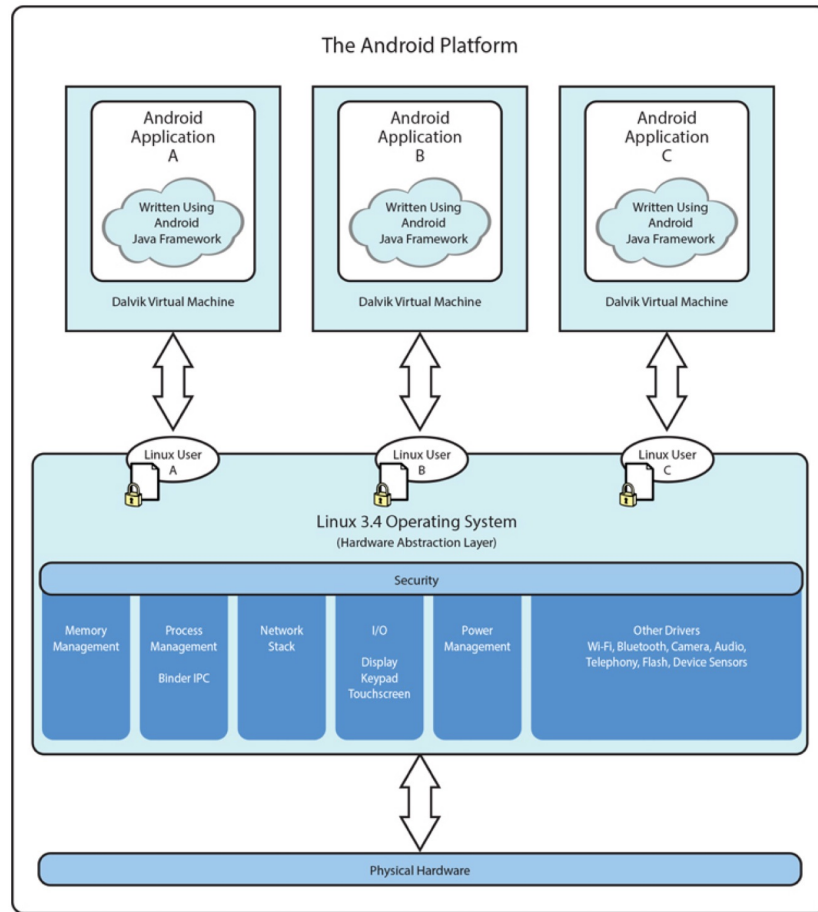


Sources
Android; Website (xda-developers.com)
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Additional Information:
Worldwide; Android; 2013 to 2020

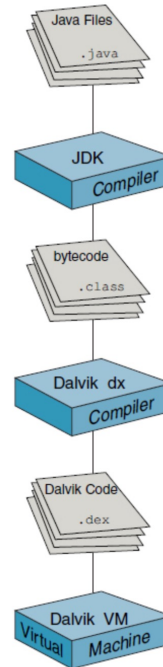
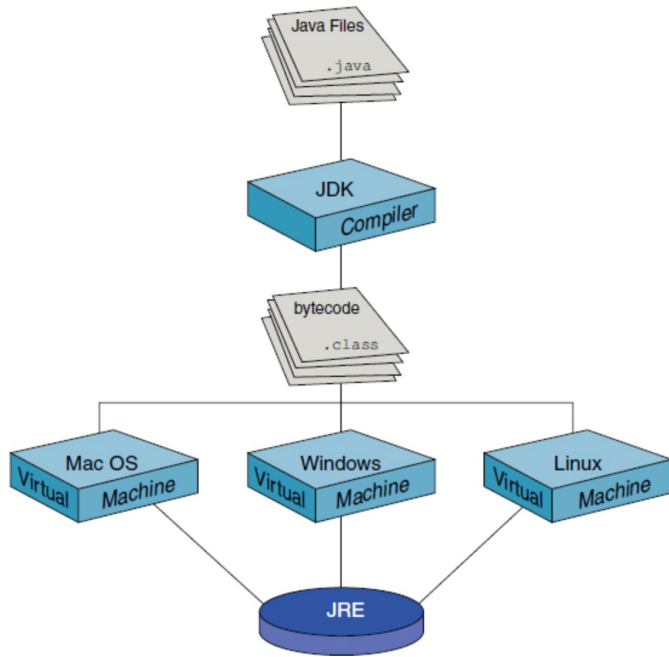
- Last updated 2020
- <https://www.statista.com/statistics/271774/share-of-android-platforms-on-mobile-devices-with-android-os/>

Underlying OS



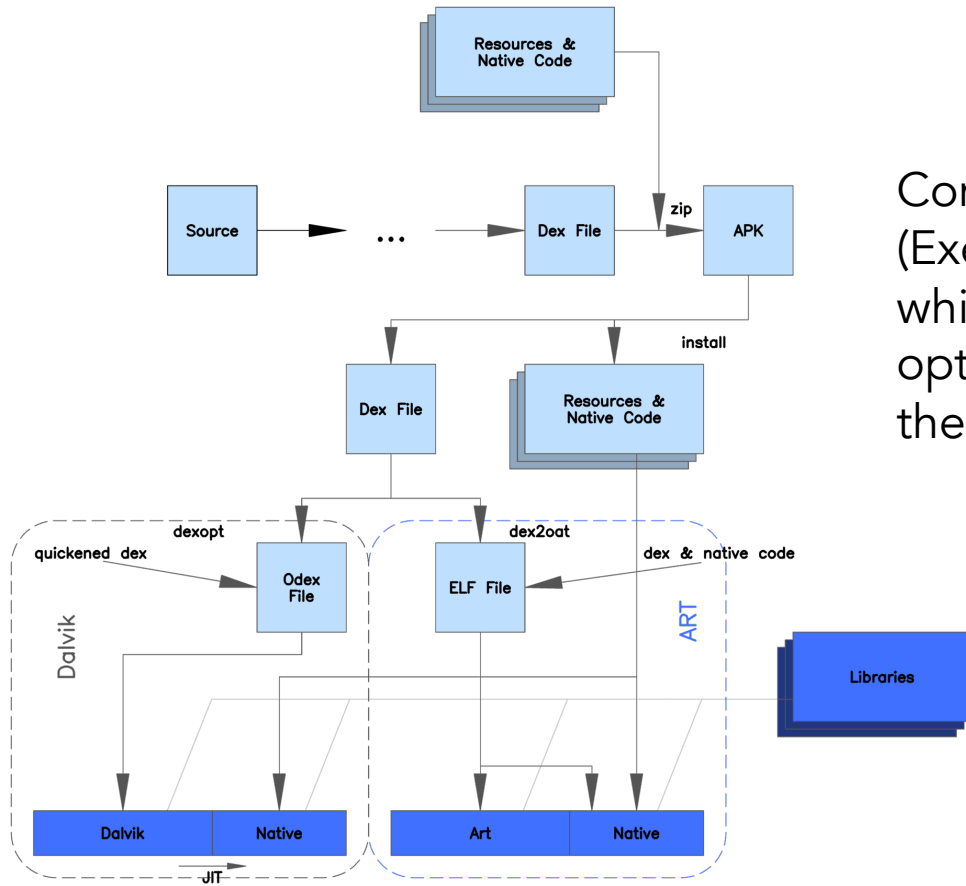
Each app gets its own user id, and each VM runs in a different process by default. This picture is slightly out of date, it's now an ART rather than DVM.

Java v. Android Java



Dalvik is a secondary compiler that produces .dex code, designed for android. It can run on a Dalvik VM, which is Just-in-Time (compiles small frequently used fragments of code to native). Alternatively, Android Runtime is Ahead-of-Time. ART compiles an entire app at installation and produces a native app, so it is a) faster, b) less battery-intensive c) garbage collection is improved.

DVM v ART



Compile to ELF
(Executable/Linkable Files)
which is then run. At this point
optimizations can be done on
the ELF with profiling.

Recap

- Android consists of Linux 3.4 & Dalvik VM (and, as of 5.0, Android Runtime)
- Apps are written in Java, compiled to Java bytecode, thence into Dalvik byte code, and eventually get wrapped into an Android package (an .apk file) that runs on a DVM or ART
- A new Linux user is created when each app is installed
- The app doesn't know the user's id
- Each app runs as a separate process
- Each app must ask permission to do various tasks (access the phone, GPS, camera, user location, contact info, &c).
 - The user must grant the app permission at install time

App Components

- You are conditioned to write a main class, with a main() method. In Android, that is not the case. You will instead subclass one of the 4 components listed below, and the OS will instantiate the component in question at the appropriate time.
- **Activities** - an application component with a user interface that can be drawn on a screen
 - An app is a collection of related activities
 - One activity is the main activity (although it lacks main()) -- it invokes other activities as needed
- **Services** - a background process (no UI) that usually runs a long-running operation (e.g., downloading a file)
- **Content Providers** - allow apps to access structured data in a uniform fashion regardless of its underlying organization
- **Broadcast Receivers** - an app component that responds to messages broadcast either by the OS or by other apps
 - e.g., a picture was taken, the battery is low, etc.
- **Intents** - asynchronous messages that tie all the above together

App Components

- We focus on Activities and Intents in this course.
- Each app is made of multiple app components - activities, services, content providers, broadcast receivers. Has aspects of Model-View-Controller. Note, this is inherently parallel. We will have multiple threads running.

Manifest File

- An app tells the OS what its components are by means of the *manifest file* (**AndroidManifest.xml**) that lives in the root directory.
- Components are defined by xml tags and names the implementing classes:
 - <activity>
 - <service>
 - <provider>
 - <receiver>
- AndroidManifest.xml also defines the name of the app, permissions, icons, target SDK level, required libraries.
- In AndroidStudio, some of the information specified in the AndroidManifest is duplicated in various gradle build files.

Frameworks*

- Numerous user interface controls (Buttons, Spinners, Text input)
- Multiple user interface layouts (Tables, Tabs, Lists, Galleries)
- Integration capabilities (Notifications, Widgets)
- Secure networking and Web browsing (SSL, WebKit)
- XML support (DOM, SAX, XML Pull Parser)
- Structured storage and relational databases (App Preferences, Room, JetPack)
- Powerful 2D & 3D graphics (including SGL, OpenGL ES)
- Multimedia frameworks for playing and recording standalone or network streaming (MediaPlayer, JetPlayer, SoundPool, AudioManager)
- Extensive support for many audio and visual media formats (MPEG4, H.264, MP3, AAC, AMR, JPG, and PNG)
- Access to optional hardware such as location-based services (LBS), USB, Wi-Fi, Bluetooth, and hardware sensors

*This is not an exhaustive list, but an indication of what is available. For more: [ref 1](#)

Questions

- 1.Name and describe the 4 components of an Android app.
- 2.Which component has a user interface?
- 3.Which component is used to provide a uniform set of methods to access data from a variety of sources?
- 4.Distinguish between a service and an activity
- 5.Define the term "framework"
- 6.On which OS is Android based?
- 7.What is meant by the Dalvik Virtual Machine?
- 8.True or false: all Android apps run in a single Dalvik VM
- 9.An Android device has 20 apps. How many Linux users does it have?
- 10.What is the manifest file?
- 11.True, false, or maybe: App components can only run if they are declared in the manifest file

References

- Ref 1: Android Developer packages
<https://developer.android.com/reference/packages>