

Overview of Android: Middleware Infrastructure Layers

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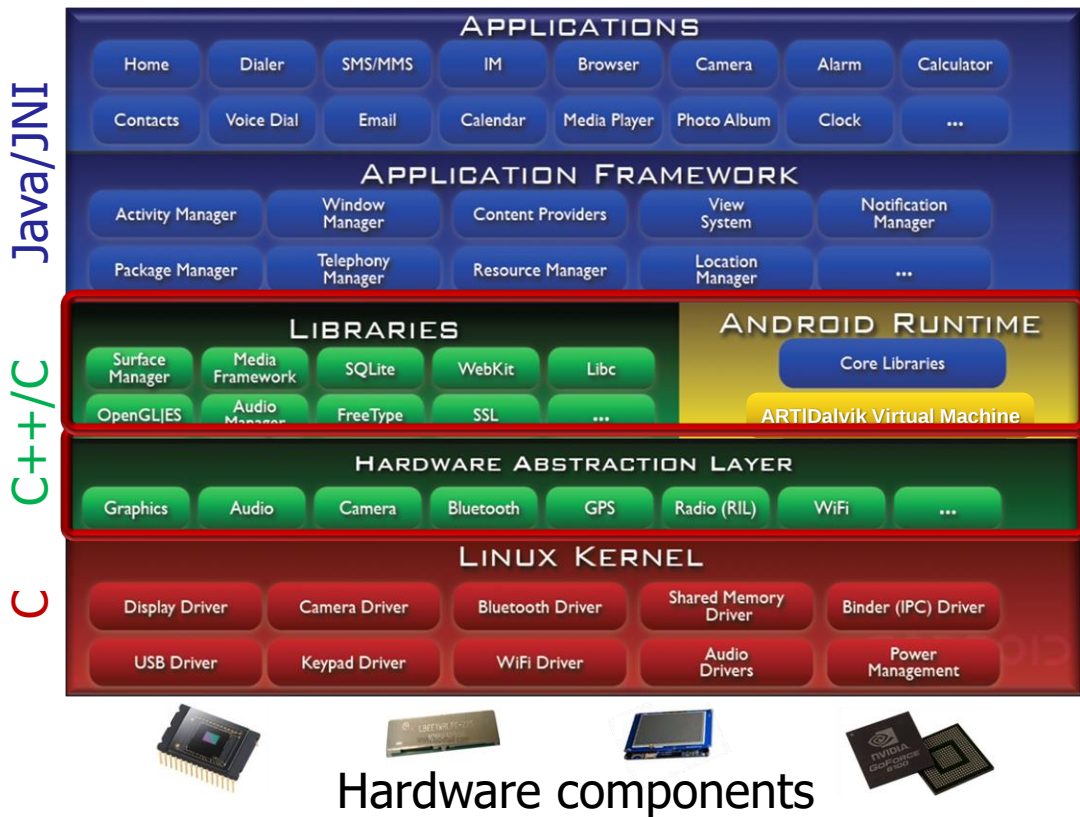
**Institute for Software
Integrated Systems**

**Vanderbilt University
Nashville, Tennessee, USA**



Learning Objectives in this Part of the Lesson

1. Understand key elements in Android's middleware infrastructure
 - e.g., hardware abstraction layer, Android runtime, & native libraries

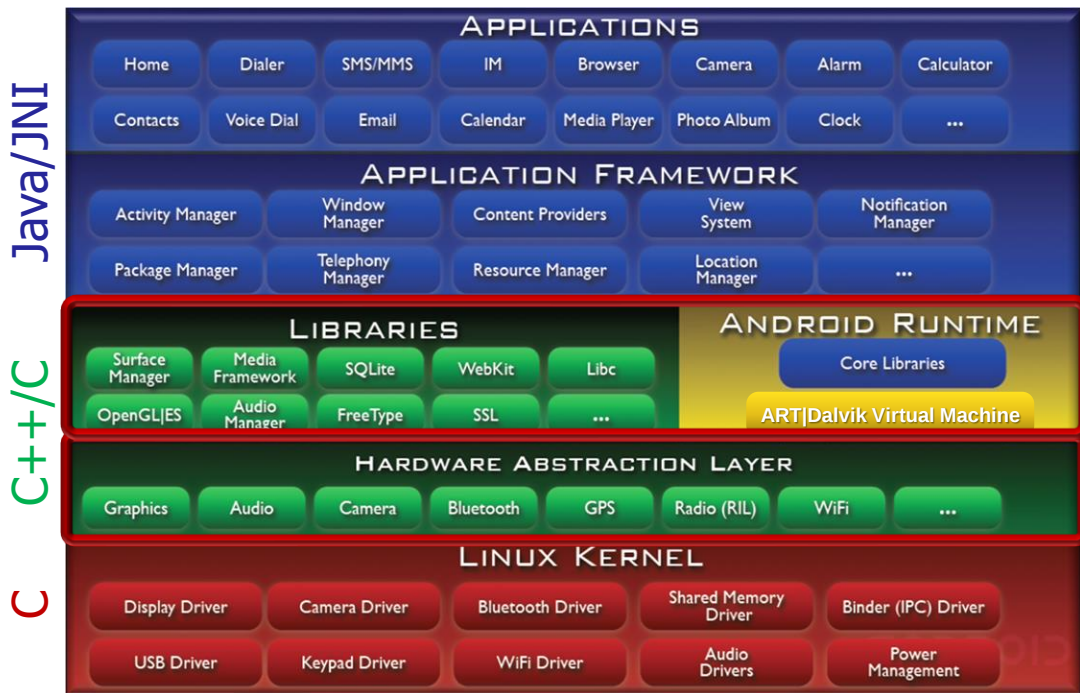


Middleware infrastructure resides atop the OS & below the apps et al

Overview of Android's Middleware Infrastructure

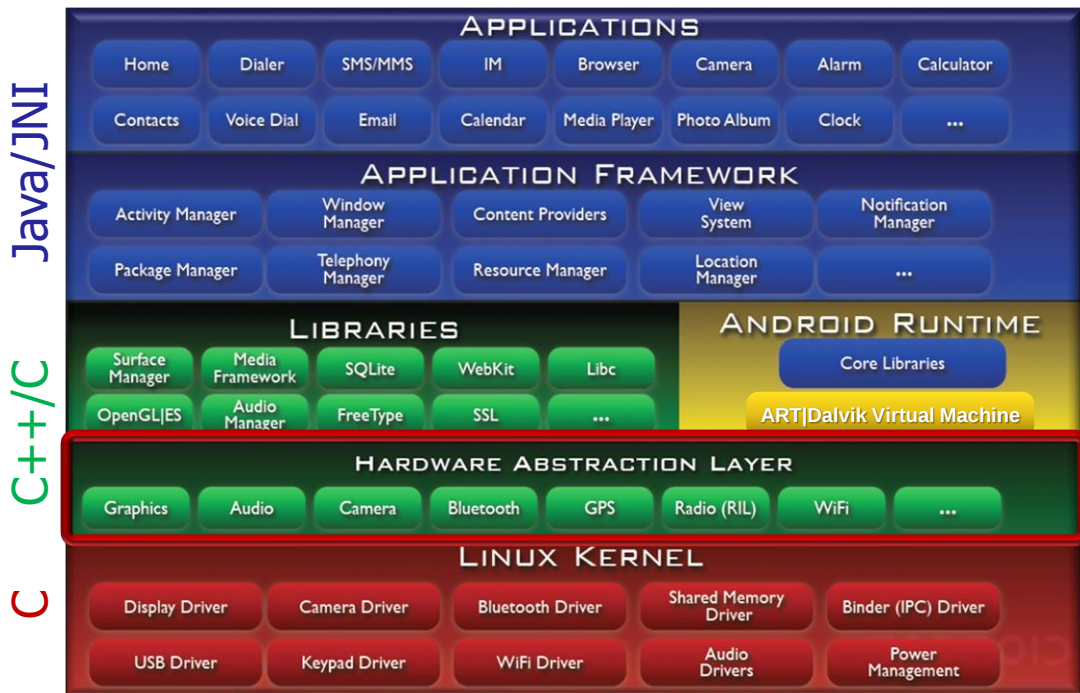
Overview of Android's Middleware Infrastructure

- Android's *middleware infrastructure* provides reusable capabilities that extend hardware-centric OS kernel & protocol mechanisms



Overview of Android's Middleware Infrastructure

- Android's *middleware infrastructure* provides reusable capabilities that extend hardware-centric OS kernel & protocol mechanisms
- Hardware abstraction layer



See [source.android.com/devices/#Hardware Abstraction Layer](http://source.android.com/devices/#Hardware%20Abstraction%20Layer)

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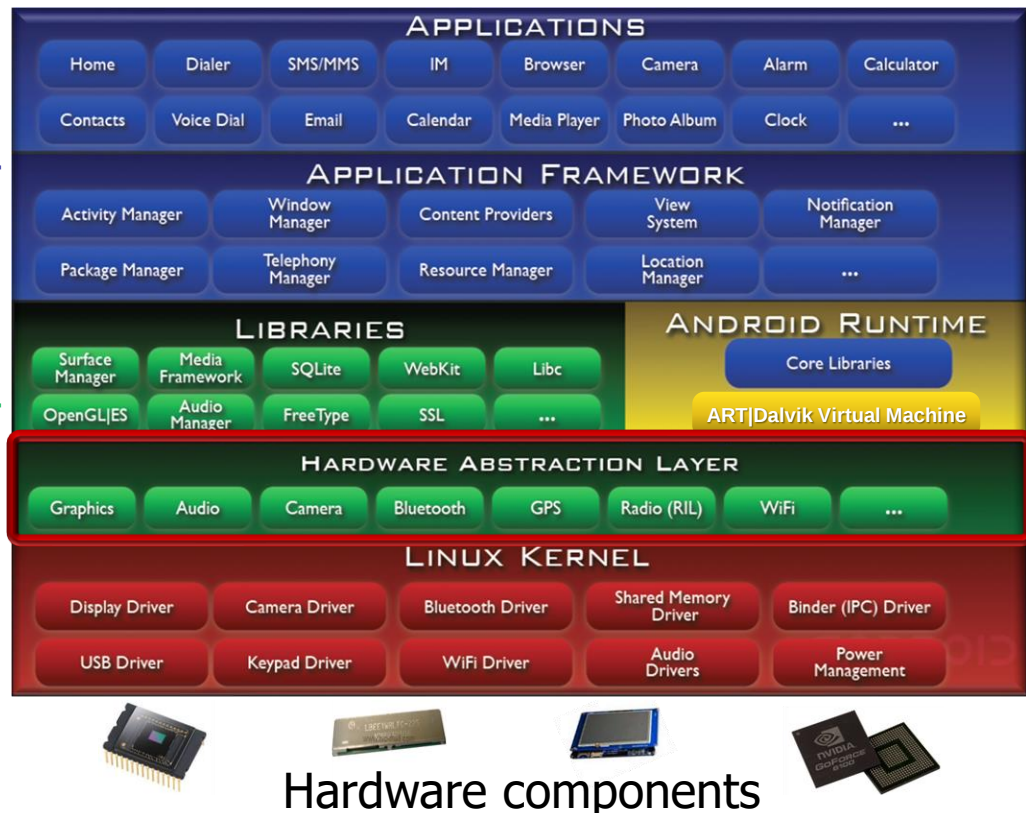
- Android's *middleware infrastructure* provides reusable capabilities that extend hardware-centric OS kernel & protocol mechanisms
- Hardware abstraction layer
 - Shields Android stack from low-level hardware details



Java/JNI

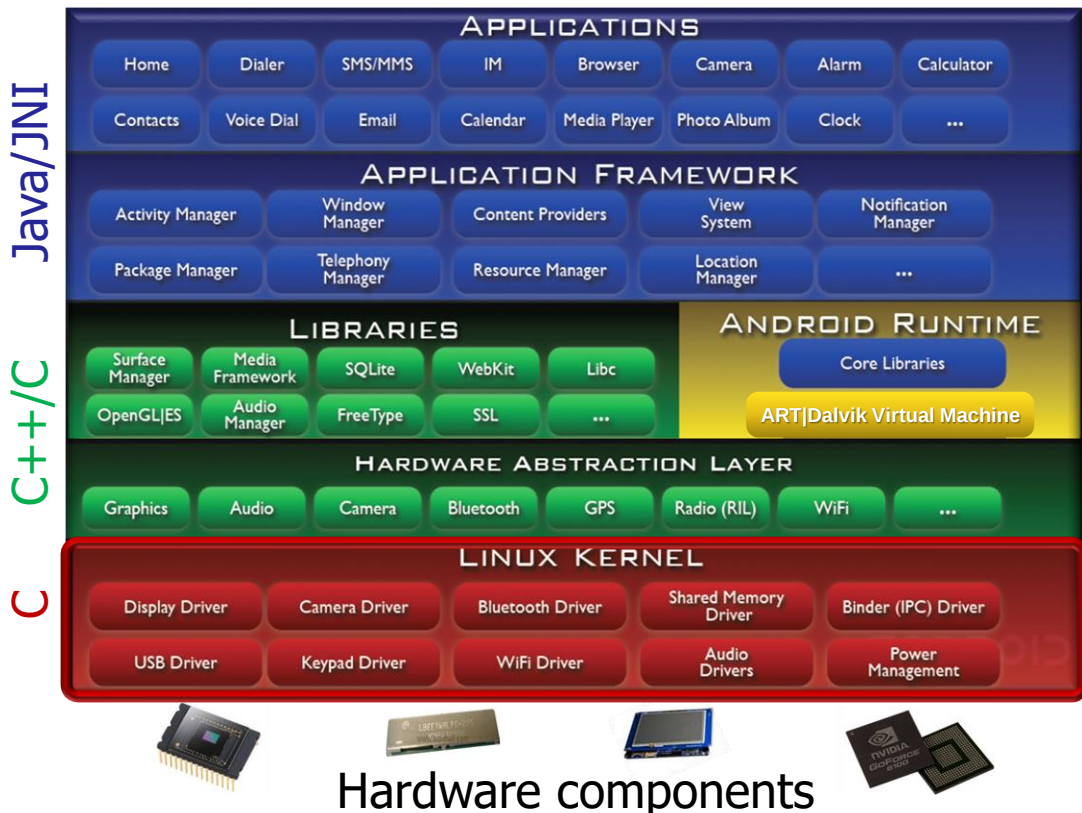
C++/C

C



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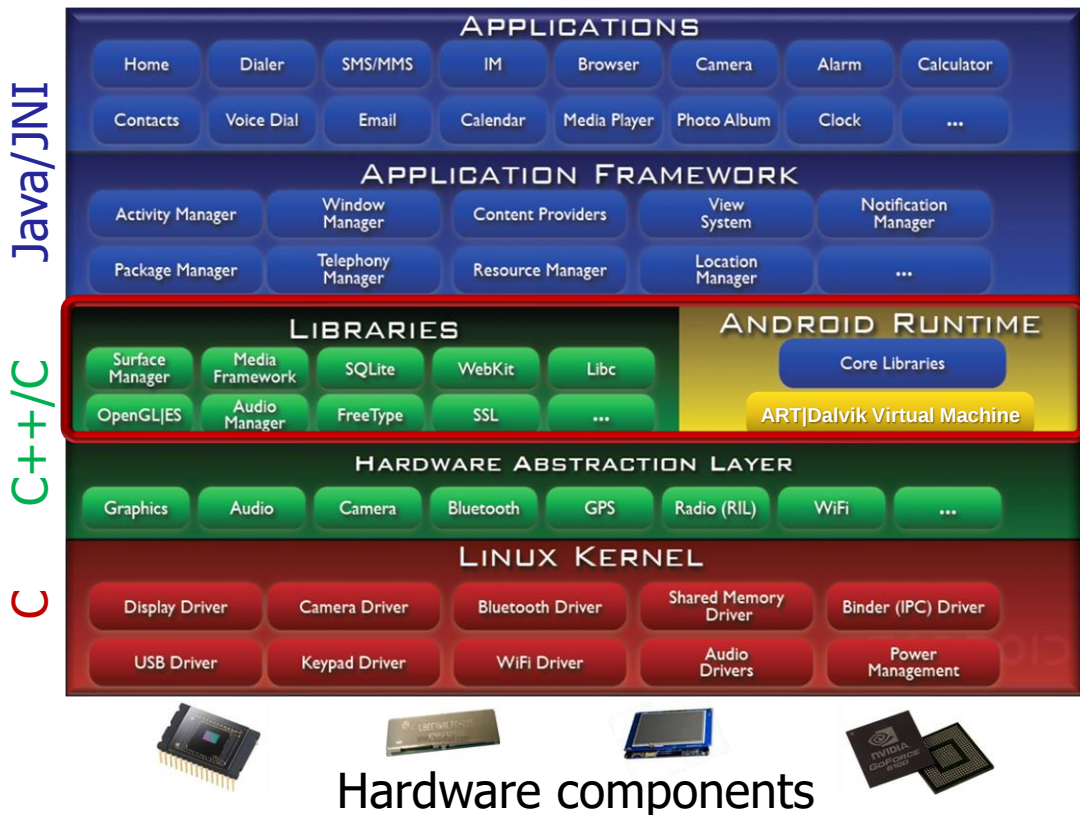
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 - Shields Android stack from low-level hardware details
 - Shields OEMs from GNU Public License "virality"



See en.wikipedia.org/wiki/Linux_kernel#Licensing_terms

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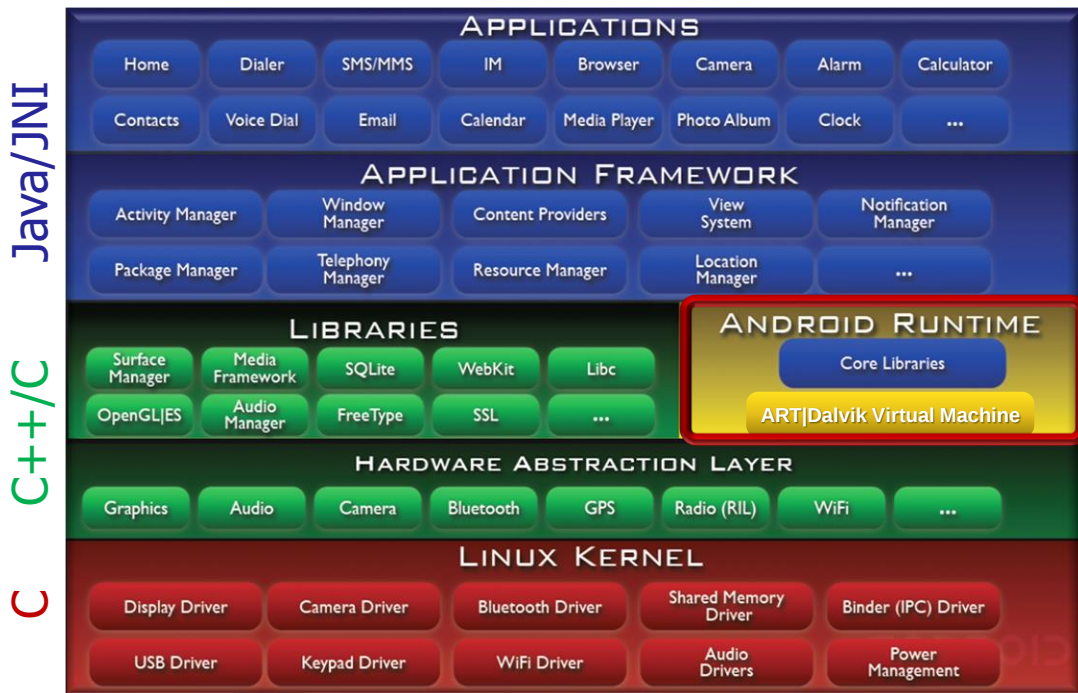
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 - Hardware abstraction layer
 - Runtime & libraries layer



This layer is composed of several middleware elements

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 - Android runtime



This element is composed of two parts

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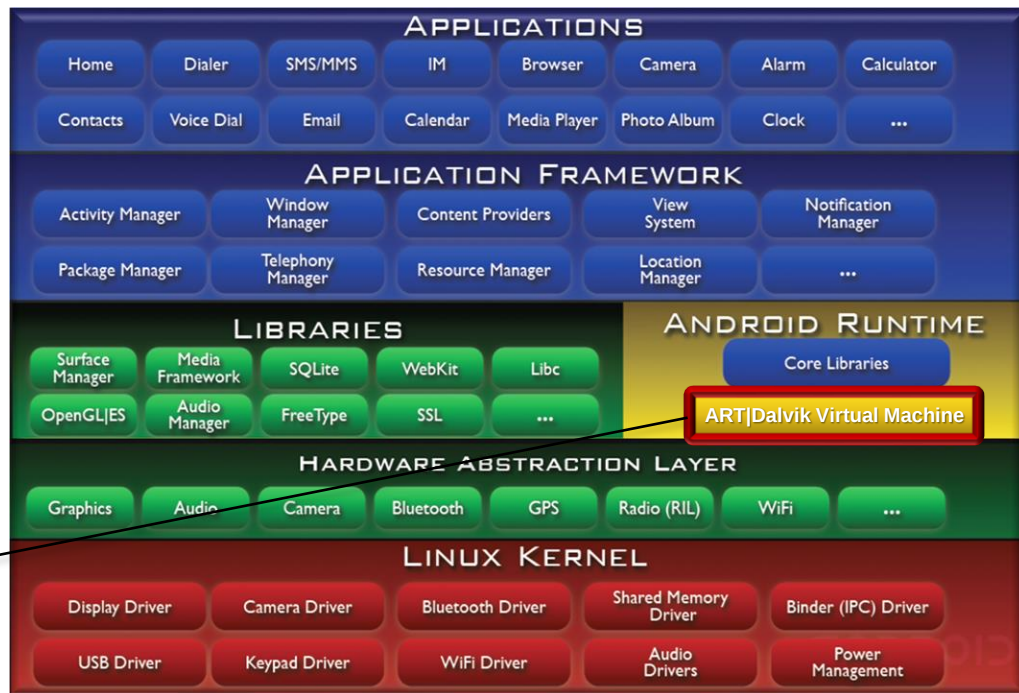
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A managed execution environment that efficiently runs Java-based apps & some Android system services

Java/JNI

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See source.android.com/devices/tech/dalvik

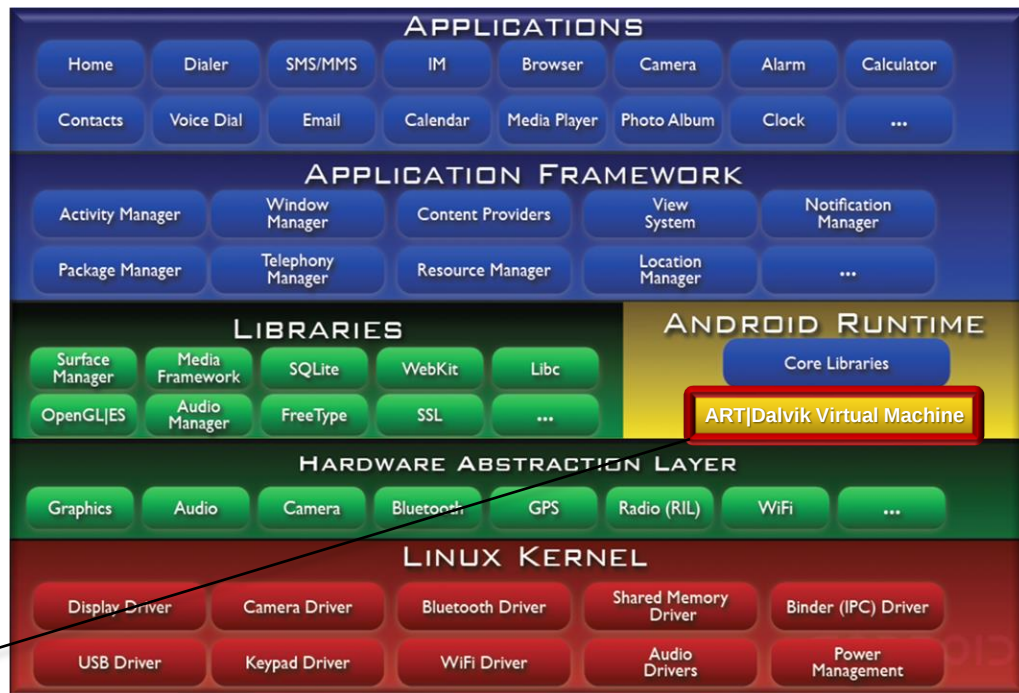
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This managed execution environment is optimized for mobile device constraints

See sites.google.com/site/io/dalvik-vm-internals

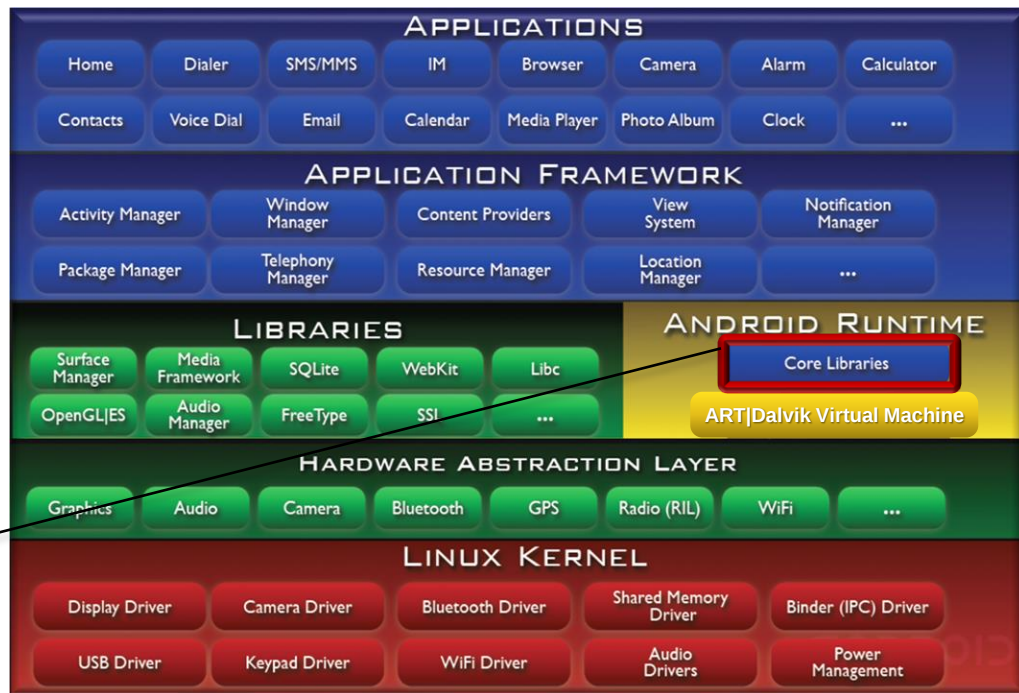
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A copy of core Java class libraries & core Android class libraries

See en.wikipedia.org/wiki/Comparison_of_Java_and_Android_API

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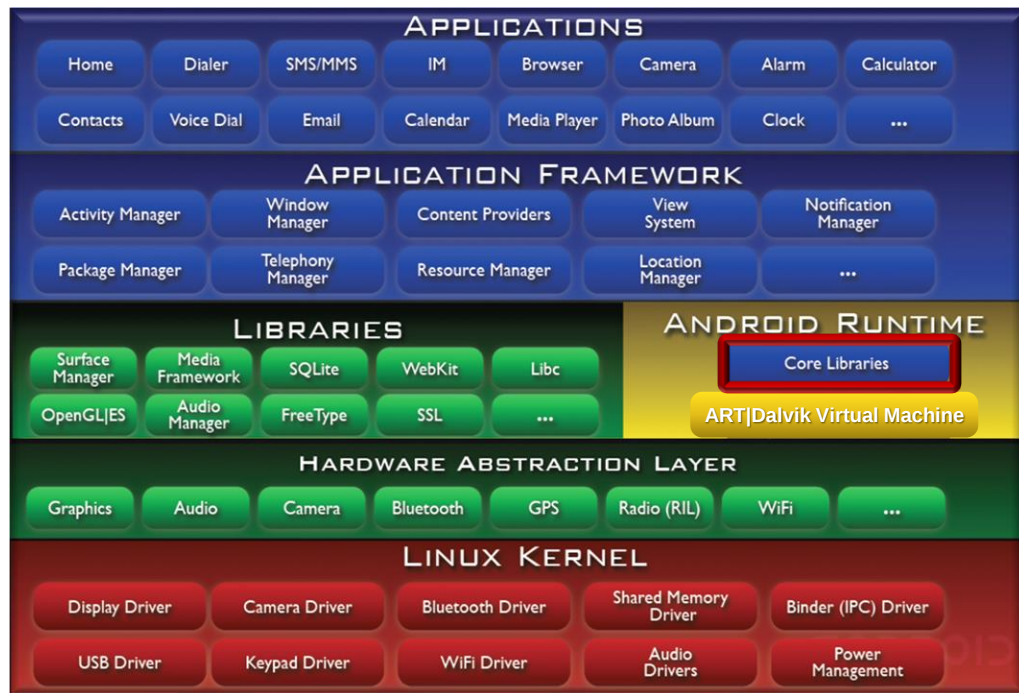
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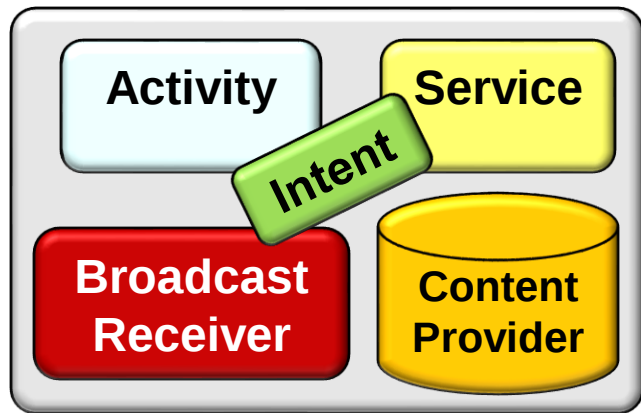
C



We'll discuss Java threading shortly

Overview of Android's Middleware Infrastructure

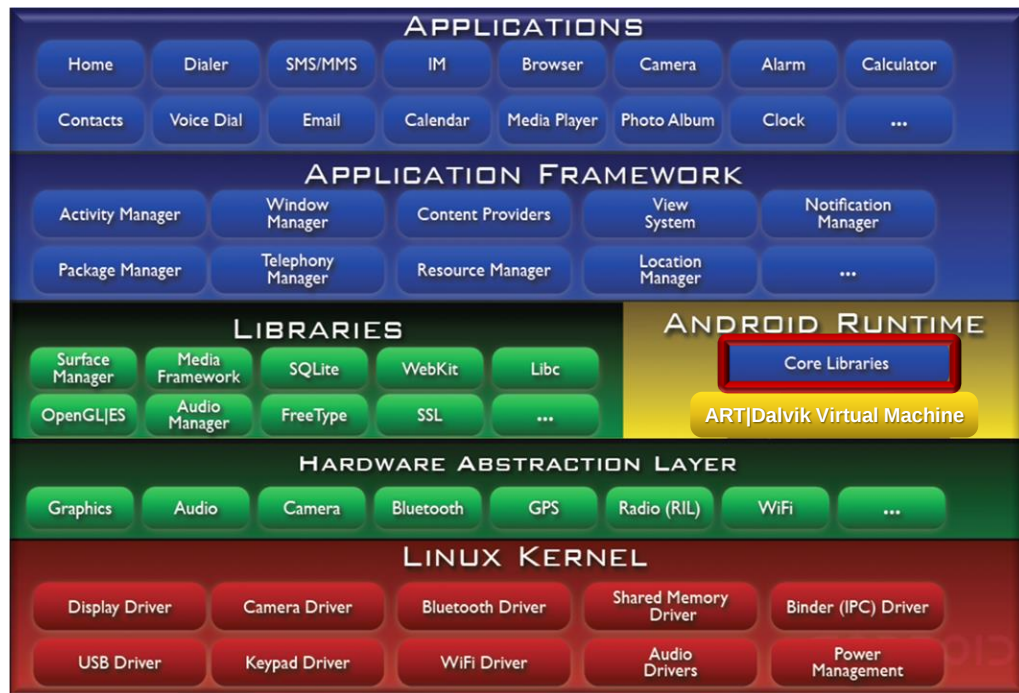
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Android's core libraries provide key components that we'll also cover shortly

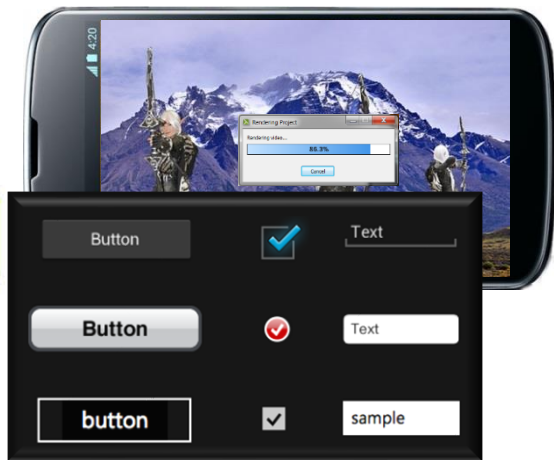
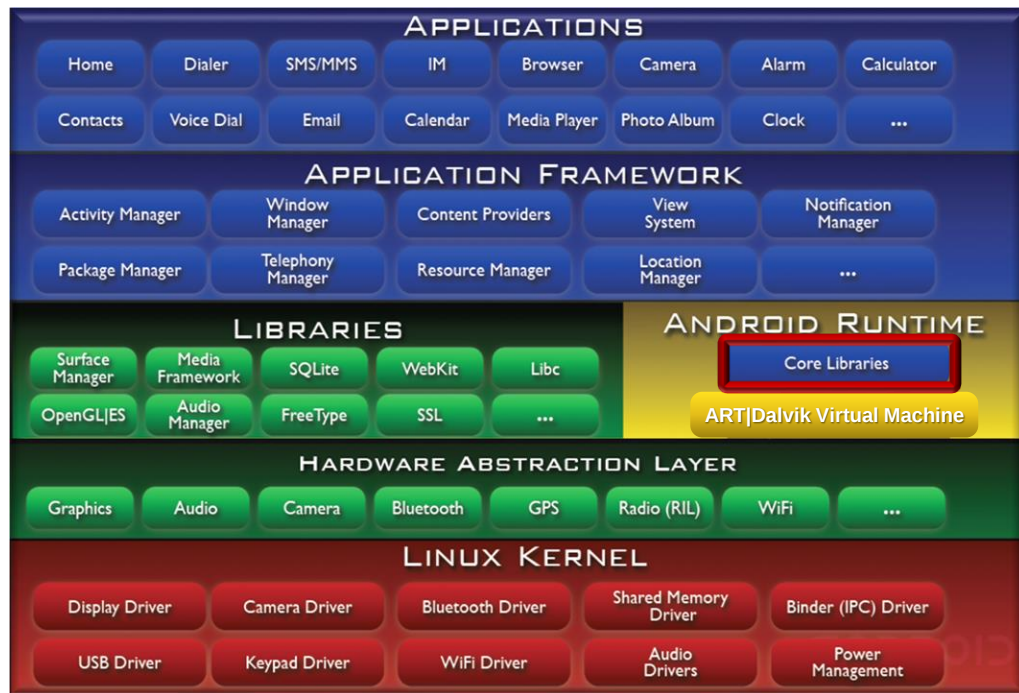
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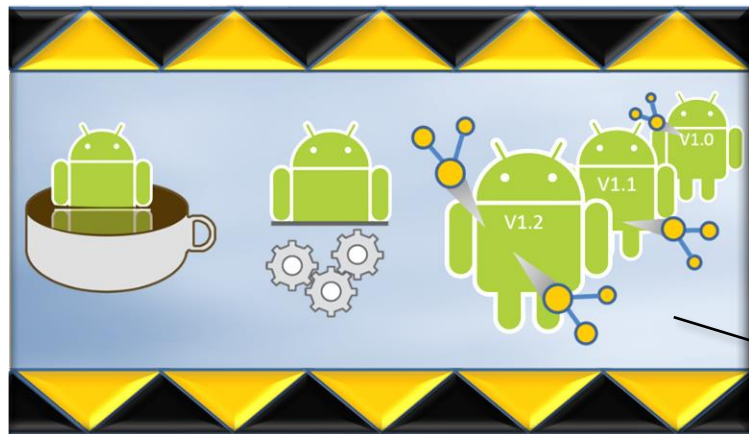
C



Android's core libraries provide many other UI & persistence components

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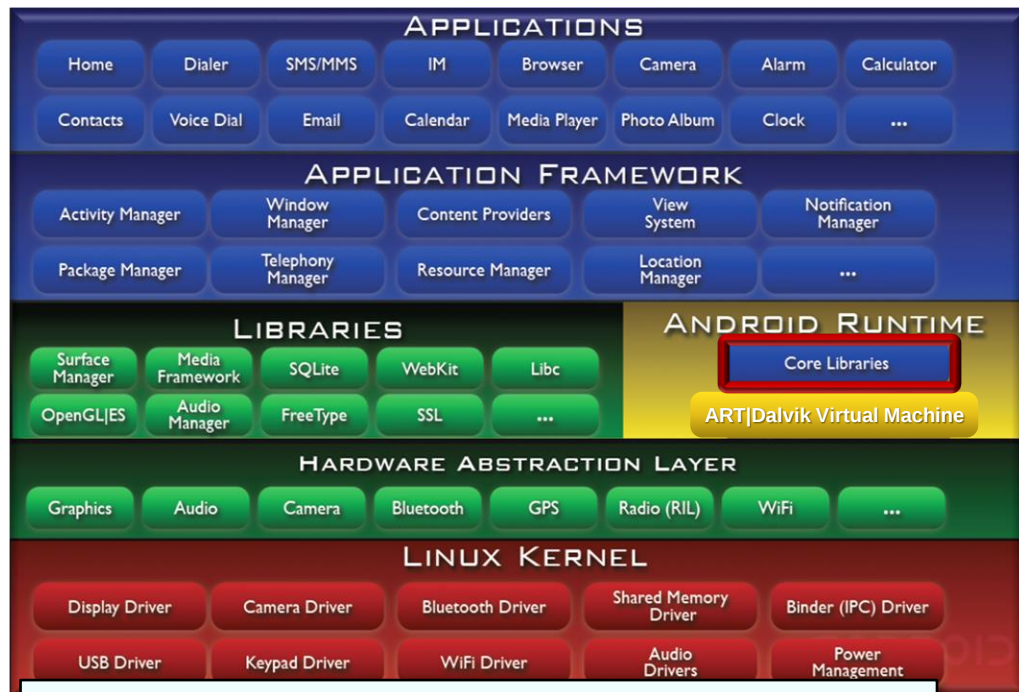
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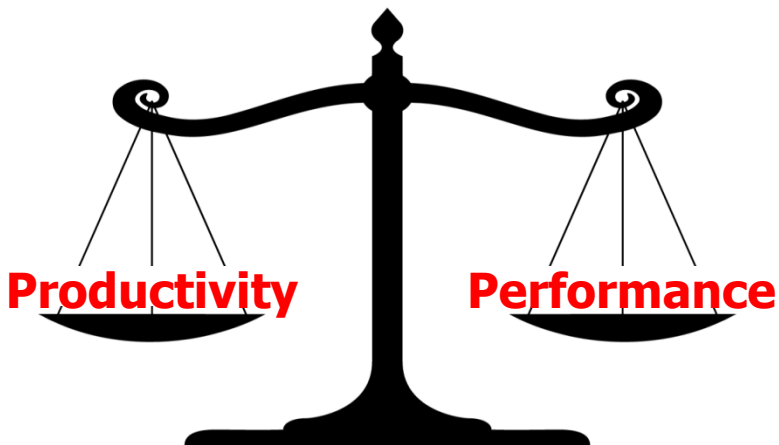


We cover Android's core libraries in the Android App Development Specialization

See www.coursera.org/specializations/android-app-development

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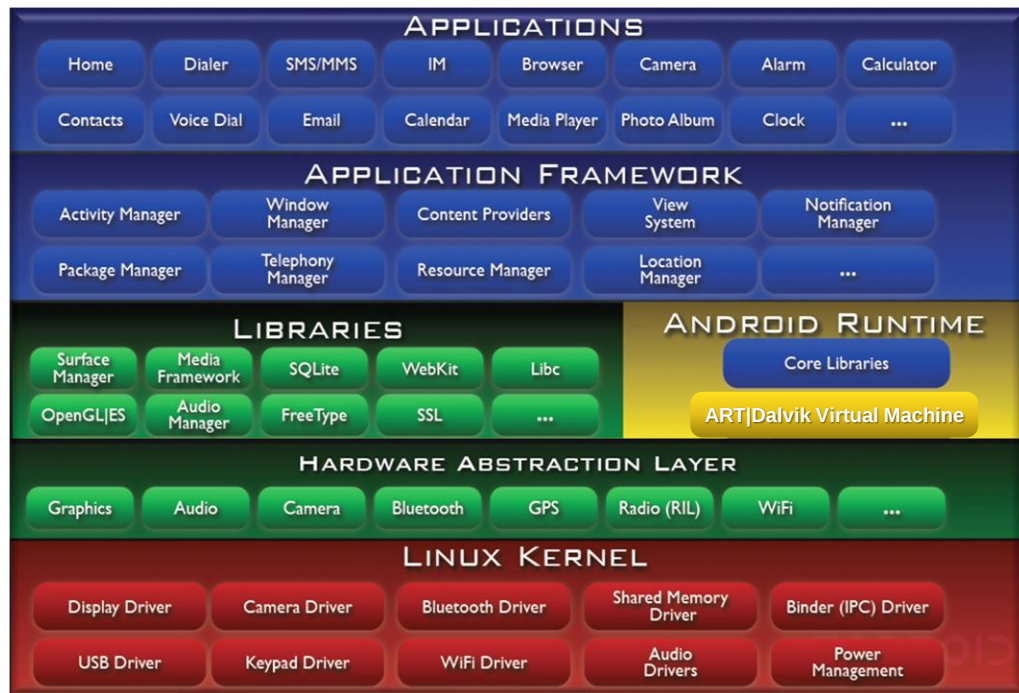
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Android—like Java—balances run-time performance & developer productivity

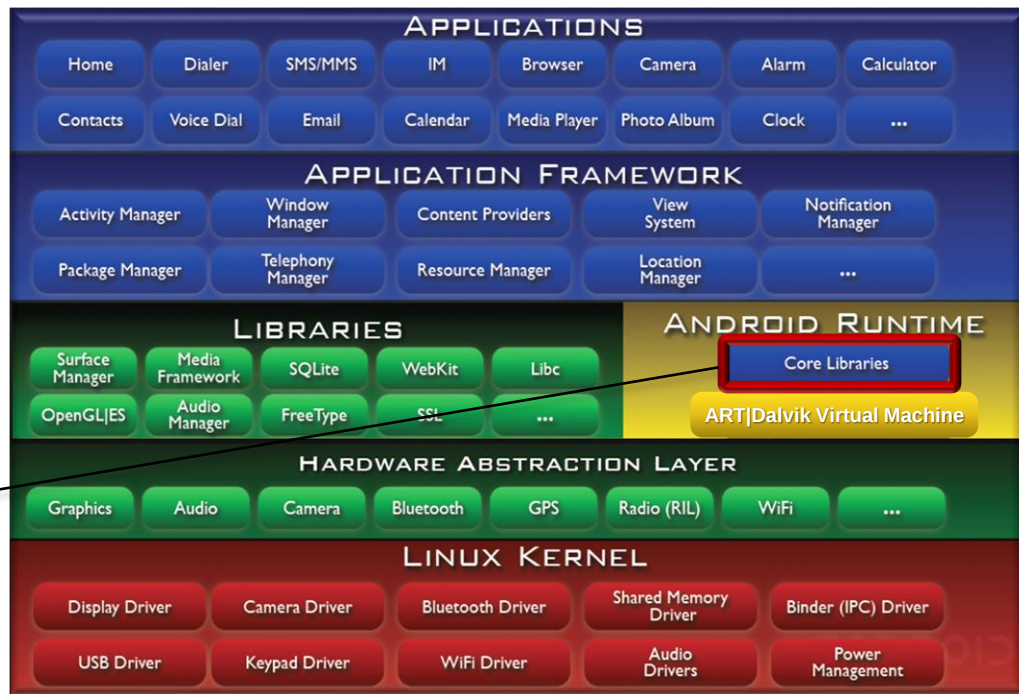
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Android's core libraries are often implemented as wrapper facades

See www.dre.vanderbilt.edu/~schmidt/PDF/wrapper-facade.pdf

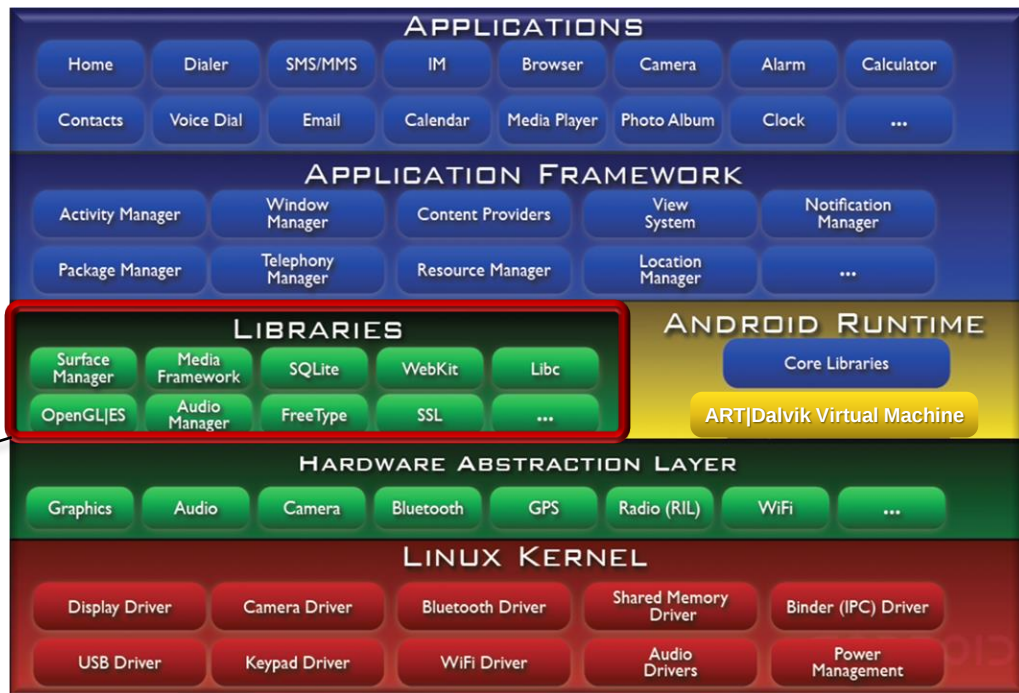
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 - Native C/C++ libraries

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These Java wrapper façade are implemented via native C/C++ code

See developer.android.com/tools/sdk/ndk

End of Overview of Android: Middleware Infrastructure Layers