Overview of Android (Part 2):
Middleware Infrastructure Layers

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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
Learning Objectives in this Part of the Lesson

1. Understand key elements in Android’s middleware infrastructure
2. Name all the key app components in Android
Learning Objectives in this Part of the Lesson

1. Understand key elements in Android’s middleware infrastructure
2. Name all the key app components in Android
3. Know what Java threads are in the context of Android
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
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
Overview of Android’s Middleware Infrastructure

- 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
    - Shields OEMs from GNU Public License “virality”

See [en.wikipedia.org/wiki/Linux_kernel#Licensing_terms](en.wikipedia.org/wiki/Linux_kernel#Licensing_terms)
Overview of Android’s Middleware Infrastructure

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

This layer is composed of several middleware elements
Overview of Android’s Middleware Infrastructure

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

This element is composed of two parts
Overview of Android’s Middleware Infrastructure

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

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

See source.android.com/devices/tech/dalvik
Overview of Android’s Middleware Infrastructure

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

*This managed execution environment is optimized for mobile device constraints*

See [sites.google.com/site/io/dalvik-vm-internals](sites.google.com/site/io/dalvik-vm-internals)
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A copy of core Java class libraries & core Android class libraries

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We’ll discuss Java threading shortly
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Android’s core libraries provide key components that we’ll also cover shortly
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Android’s core libraries provide many other UI & persistence components
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We cover Android’s core libraries in the *Android App Development* Specialization.
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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](http://www.dre.vanderbilt.edu/~schmidt/PDF/wrapper-facade.pdf)
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  - Hardware abstraction layer
  - Runtime & libraries layer
    - Android runtime
    - Native C/C++ libraries

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

See [developer.android.com/tools/sdk/ndk](https://developer.android.com/tools/sdk/ndk)