Android Introduction

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The Universe of Android Programming

- Development Tools
- Android Architecture
- Software Engineering

Platform Architecture

- **Linux kernel**
  - Use key security features of linux
  - Hardware drivers for well-known kernel

- **Android Runtime**
  - Similar to Java virtual machine
Android Runtime

- ART and DEX files optimized for low-memory devices
- Ahead-of-time (AOT) and just-in-time (JIT) compilation
- Optimized garbage collection
Android Framework

<table>
<thead>
<tr>
<th>Hardware API</th>
<th>App Components</th>
<th>Resources</th>
</tr>
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<tr>
<td>Sensor Manager</td>
<td>Activities</td>
<td>Strings</td>
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<tr>
<td>Location Manager</td>
<td>Services</td>
<td>Media</td>
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<td>Bluetooth Manager</td>
<td>Intents</td>
<td>Layout</td>
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Android Key Terms

- **Activity**
  - Logical unit of a user activity (like window in a computer program)
  - Usually full-screen

- **View**
  - Hierarchical UI element
  - Combined in layouts and extended to Widgets with more functionality

- **Service**
  - Background activity without UI, e.g., music player or FTP server
Android Key Terms

- «Intent»
  - Asynchronous message to bind components
  - Starts or switches between «Activities»
  - Intent Filters are used to only act on specific Intents

- «BroadcastReceiver»
  - Listens for global events (Intents)
    - e.g., «headphones were plugged» sent by the system
  - Can be used to pass system events for further processing
  - Can inform the user about system events
Activity Lifecycle

- **Multi-Tasking**
  - OS keeps apps alive as long as possible
  - On memory shortage, processes are killed according to their priority

- **Essential states of an activity**
  - Running (resumed)
  - Paused
  - Stopped
  - Finished/killed
Development Tools

- **SDK Tools**
  - Development and debug tools, emulator, etc.

- **SDK Platforms**
  - APIs for target platforms

- **Build Tools**

- **Support libraries**
  - Libraries to support backward compatibility
Android Versions

- Very dynamic environment
  - Hard to keep up with changes
  - Compatibility issues
- Since Android 4.0 stable release rhythm (~ yearly)

<table>
<thead>
<tr>
<th>Code name</th>
<th>Version number</th>
<th>Initial release date</th>
<th>API level</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>1.0</td>
<td>23 September 2008</td>
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<td></td>
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<td>Cupcake</td>
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<td>27 April 2009</td>
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<td>Donut</td>
<td>1.6</td>
<td>15 September 2009</td>
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<tr>
<td>Eclair</td>
<td>2.0 – 2.1</td>
<td>26 October 2009</td>
<td>5–7</td>
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<tr>
<td>Froyo</td>
<td>2.2 – 2.2.3</td>
<td>20 May 2010</td>
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<td>Gingerbread</td>
<td>2.3 – 2.3.7</td>
<td>6 December 2010</td>
<td>9–10</td>
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<td>Honeycomb</td>
<td>3.0 – 3.2.6</td>
<td>22 February 2011</td>
<td>11–13</td>
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<tr>
<td>Ice Cream Sandwich</td>
<td>4.0 – 4.0.4</td>
<td>18 October 2011</td>
<td>14–15</td>
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<td>Jelly Bean</td>
<td>4.1 – 4.3.1</td>
<td>9 July 2012</td>
<td>16–18</td>
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<td>KitKat</td>
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<td>5.0 – 5.1.1</td>
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<td>Marshmallow</td>
<td>6.0 – 6.0.1</td>
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<td>Nougat</td>
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Now: Android Live Hacking