Introduction to Android

Sean Sullivan
October 27, 2008
What is Android?

“Android is a software stack for mobile devices that includes an operating system, middleware and key applications”

source: Google
Android

- Google
- G1 and the Android Market
- Android platform
- Developer tools
- Android programming
Google’s master plan

- make the cloud more *accessible*
- keep connectivity *pervasive*
- make the client more *powerful*

source: Google I/O keynote, May 2008
Google’s master plan

Richer web apps → More users → More usage → More revenue

open web platform

source: Google I/O keynote, May 2008
Google

“We want the next killer application to be written for cell phones”

(Andy Rubin, Google)

source: businessweek.com
Google buys Android

Google Buys Android for Its Mobile Arsenal

The search giant quietly acquires the startup, netting possibly a key player in its push into wireless, "the next frontier in search.”

In what could be a key move in its nascent wireless strategy, Google (GOOG) has quietly acquired startup Android Inc., BusinessWeek Online has learned. The 22-month-old startup, based in Palo Alto, Calif., brings to Google a wealth of talent, including co-founder Andy Rubin, who previously started mobile-device maker Danger Inc.

Android (www.android.com) has operated under a cloak of secrecy, so little is known about its work. Rubin & Co. have sparingly described the outfit as making software for mobile phones, providing little more detail than that. One source familiar with the company says Android had at one point been working on a software operating system for cell phones.

SEEKING A MOBILE EDGE. In a 2003 interview with BusinessWeek, just two months before incorporating Android, Rubin said there was tremendous potential in developing smarter mobile devices that are more aware of its owner’s location and preferences. “If people are smart, that information starts getting aggregated into consumer products,” said Rubin.

Rubin declined to comment on Android or its sale to Google. A spokesperson for the search giant would not elaborate on the deal, only stating: “We acquired Android because of the talented engineers and great technology. We’re thrilled to have them here.”

August 2005

source: businessweek.com
Open Handset Alliance

November 2007

Industry Leaders Announce Open Platform for Mobile Devices

Group Pledges to Unleash Innovation for Mobile Users Worldwide

MOUNTAIN VIEW, Calif.; BONN, Germany; TAOYUAN, Taiwan; SAN DIEGO, Calif.; SCHAUMBURG, Ill. (November 5, 2007) -- A broad alliance of leading technology and wireless companies today joined forces to announce the development of Android, the first truly open and comprehensive platform for mobile devices. Google Inc., T-Mobile, HTC, Qualcomm, Motorola and others have collaborated on the development of Android through the Open Handset Alliance, a multinational alliance of technology and mobile industry leaders.
Open Handset Alliance

Google

HTC

T-Mobile

NTT docomo

中国移动通信

SAMSUNG

LG

QUALCOMM

Sprint

Intel
Google’s Android Cellphone SDK Released

Posted by CmDrTaco on Monday November 12 2007, @11:23AM
from the can-you-hear-me-now dept.

Achille writes

"The android SDK has been released to the wild. As expected it
features the Linux Kernel, low level libraries such as FreeType,
OpenGL, SQLite, WebKit (as a web browser), a custom Java
Bytecode interpreter that is highly specialized for the CPU. A
common java API is provided. A video has been posted with an
overview of the API."

SM: Several readers have also written to mention the Android
Developer Challenge offering $10 million in prizes for cool mobile
apps.

November 2007
T-Mobile Unveils the T-Mobile G1 — the First Phone Powered by Android

Exclusive T-Mobile Phone Boasts an Intuitive Touch Screen and QWERTY Keyboard, Plus Popular Google Products and Fresh, New Applications

NEW YORK -- Sept. 23, 2008 -- T-Mobile today announced the international launch of the world’s first Android™-powered mobile phone in partnership with Google. Available soon only for T-Mobile customers spanning two continents, the T-Mobile G1 combines full-touch-screen functionality and a QWERTY keyboard with a mobile Web experience that includes the popular Google products that millions have enjoyed on the desktop, including Google Maps Street View™, Gmail™, YouTube™ and others.

“We are proud that T-Mobile is the first operator in the world to launch an Android-powered mobile device,” said Christopher Schläffer, group product and innovation officer of Deutsche Telekom. “Since 2005, Google has been an established partner in T-Mobile’s groundbreaking approach to bringing the open mobile Internet to the mass market. With the T-Mobile G1, we are continuing our strong tradition of being pioneers in the world of the open Internet.”

Cole Brodman, chief technology and innovation officer, T-Mobile USA, said, “The Internet and the mobile phone are both indispensable tools for our hectic lives, but only a fraction of us access the Web on our phones. The T-Mobile G1 is our opportunity in the U.S. to accelerate the mass adoption of the mobile Web, by unleashing Google innovation with a unique software experience that mobilizes the Google services hundreds of millions of consumers rely on every day.”

“Increasingly, connectivity does not just mean a phone call, but rather access to the world’s information,” said Andy Rubin, senior director of mobile platforms for Google. “Today’s news signifies an important first step for the Open Handset Alliance: With Android, we’ve opened the mobile Web not only for millions of users, but also to mobilize the developer community that understands the next most important platform in the world rests in the palm of our hand.”
Retail launch

October 22, 2008

photo credit: Don Park
G1 technical specs

- Qualcomm MSM7201A, 528 MHz
- ROM 256 MB
- RAM 192 MB
- 4.60 in x 2.16 in x 0.62 in
- 158 grams
- Lithium Ion battery, 1150 mAh
G1 technical specs

- 3G (HSDPA)
- touch screen, HVGA 320x480
- QWERTY keyboard
- 3.2 megapixel camera
- microSD expansion slot
- GPS, compass, accelerometer
Third party applications

lifeaware.net

Maverick

Android Locale
Android applications

- multiple applications, running simultaneously
- user may switch between running applications
- background services
- copy and paste
Distributing Android apps

- Android Market
- self-publish on your own web site
- use a 3rd party application store
Android Market
Android Market

• $25 registration fee for developers
• developer receives 70% of each sale
• remaining amount goes to carriers
• Google does not take a percentage
• http://www.android.com/market/
Market got you down?

- self-publish!
- upload APK to your own web server
- use correct MIME type
  application/vnd.android.package-archive
Data Synchronization

• How do I sync my calendar data?
• How do I sync my contacts?
• Does Google offer anything like MobileMe?
Data Synchronization

“the best way to synchronize these various pieces of information is to let the device do it on its own while you're not looking, so you never have to think about it. Once you've logged into your Google account on an Android-powered phone it automatically synchronizes all your contacts and Gmail information so everything is always available”

source: googlemobile.blogspot.com
System Architecture

- Applications
  - Home
  - Contacts
  - Phone
  - Browser
  - ...

- Application Framework
  - Activity Manager
  - Window Manager
  - Content Providers
  - View System
  - Notification Manager
  - Package Manager
  - Telephony Manager
  - Resource Manager
  - Location Manager
  - XMPP Service

- Libraries
  - Surface Manager
  - Media Framework
  - SQLite
  - OpenGL\|ES
  - FreeType
  - WebKit
  - SSL
  - libc
  - SGL

- Android Runtime
  - Core Libraries
  - Dalvik Virtual Machine

- Linux Kernel
  - Display Driver
  - Camera Driver
  - Bluetooth Driver
  - Flash Memory Driver
  - Binder (IPC) Driver
  - USB Driver
  - Keypad Driver
  - WiFi Driver
  - Audio Drivers
  - Power Management
Open source project

- http://source.android.com
- Apache 2.0 and GPL v2
- Git repository
Android applications

- are written in the Java language
- run on the Dalvik virtual machine
Dalvik VM

- not a Java VM
- design constraints: slow CPU, little RAM
- will run on OS without swap space
- http://sites.google.com/site/io/dalvik-vm-internals
## Application API’s

<table>
<thead>
<tr>
<th>J2SE</th>
<th>java.util.*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>java.io.*</td>
</tr>
<tr>
<td></td>
<td>java.lang.*</td>
</tr>
<tr>
<td></td>
<td>etc</td>
</tr>
<tr>
<td>UI</td>
<td>android.widget.*</td>
</tr>
<tr>
<td></td>
<td>android.view.*</td>
</tr>
<tr>
<td></td>
<td>android.graphics.*</td>
</tr>
<tr>
<td>Telephony</td>
<td>android.telephony.IPhone</td>
</tr>
<tr>
<td>SMS</td>
<td>android.telephony.gsm.SmsManager</td>
</tr>
</tbody>
</table>
# Application API’s

<table>
<thead>
<tr>
<th>Feature</th>
<th>Class/Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web</td>
<td>android.webkit.WebView</td>
</tr>
<tr>
<td>Camera</td>
<td>android.hardware.CameraDevice</td>
</tr>
<tr>
<td>Local database</td>
<td>android.database.*</td>
</tr>
<tr>
<td>Maps</td>
<td>com.google.android.maps.MapView</td>
</tr>
<tr>
<td>Location</td>
<td>android.location.LocationManager</td>
</tr>
<tr>
<td>Multimedia</td>
<td>android.media.MediaPlayer</td>
</tr>
<tr>
<td>HTTP</td>
<td>org.apache.http.client.*</td>
</tr>
</tbody>
</table>
Demo

- Android 1.0
- GPS
- Yahoo Fire Eagle
- OAuth

http://code.google.com/p/jfireeagle/source/browse/#svn/trunk/jfireeagle-android-app
Getting started

Android - An Open Handset Alliance Project

The Open Handset Alliance, a group of more than 30 technology and mobile companies, is developing Android: the first complete, open, and free mobile platform. To help developers get started developing new applications, we're offering an early look at the Android Software Development Kit.

Open
Android allows you to access core mobile device functionality through standard API calls.

All applications are equal
Android does not differentiate between the phone's basic and third-party applications -- even the dialer or home screen can be replaced.

Breaking down boundaries
Combine information from the web with data on the phone -- such as contacts or geographic location -- to create new user experiences.

Fast & easy development
The SDK contains what you need to build and run Android applications, including a true device emulator and advanced debugging tools.

Getting Started
1. Learn about Android
2. Download the SDK
3. Join the community. Participate in our discussion group through email or the web.

Top 50 apps announced
From more than 1,700 contest entries, those 50 entries will continue into the second and final round of Android Developer Challenge I.

Featured Videos

http://code.google.com-android
Development tools

• Android SDK
• Eclipse plugin
Android SDK

- Android emulator
- command line tools
- documentation
- example applications
Command line tools

- `aapt` - Android asset packaging tool
- `adb` - Android debug bridge
- `aidl` - Android IDL compiler
- `emulator` - Android emulator
Android emulator
Android emulator
Emulator limitations

- No support for placing or receiving actual phone calls
- No support for camera/video capture (input)
- No support for audio input
- No support for determining connected state
- No support for determining battery charge level
- No support for Bluetooth
Eclipse plugin

https://dl-ssl.google.com/android/eclipse/
Android applications

- application package file: *myapp.apk*
- an application is composed of one or more *activities*
Activity

• an activity is usually a single screen in your application

• however, activities can also be faceless

• one activity is designated as the entry point for your application
```java
import android.app.Activity;

public class MyActivity extends Activity {
    public void onCreate(Bundle savedValues) {
        super.onCreate(savedValues);
        setContentView(R.layout.main);
    }
}
```
Application building blocks

- AndroidManifest.xml
- Activities
- Views
- Layouts
- Intents & IntentReceivers
- Services
- Notifications
- ContentProviders
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
package="com.my_domain.app.helloactivity">
  <application android:label="@string/app_name">
    <activity android:name=".HelloActivity">
      <intent-filter>
        <action android:name="android.intent.action.MAIN"/>
        <category android:name="android.intent.category.LAUNCHER"/>
      </intent-filter>
    </activity>
  </application>
</manifest>
Implementing your application UI

- Java code
- XML
Android UI: XML

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:orientation="vertical"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
>
    <TextView
        android:layout_width="fill_parent"
        android:layout_height="wrap_content"
        android:text="Hello World"
    />
</LinearLayout>
```
Android UI: Views

- an object that knows how to draw itself on the screen

- examples:
  - `android.widget.ListView`
  - `android.widget.DatePicker`
  - `android.widget.Button`
  - `android.widget.ImageView`
Intents

- "an Intent is a simple message object that represents an ‘intention’ to do something”
- “an intent is an abstract description of an operation to be performed”
android.content.Intent

- VIEW_ACTION
- EDIT_ACTION
- PICK_ACTION
- WEB_SEARCH_ACTION
- SYNC_ACTION
- ...

Application Context

android.app.ApplicationContext

- startActivity(Intent)
- getSystemService
- createDatabase
- openDatabase
- deleteDatabase
- ...

Additional topics

- Threading
- Security model
- Internationalization
- Power management
- AIDL - Android IDL
- Data synchronization
- WiFi API
- Bluetooth API
What’s Next

• more phones (Motorola, ...)
• multi-touch?
• virtual keyboard
• Bluetooth A2DP
• enterprise features (Exchange support?)
Android resources

• http://code.google.com/android/
• http://android-developers.blogspot.com
• http://code.google.com/p/apps-for-android/
• http://sites.google.com/site/io/
• http://www.openhandsetalliance.com/
• http://source.android.com
The End