**Seminar Report**

**On**

**ANDROID MOBILE OPERATING SYSTEM**



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**Android** is a [software stack](http://en.wikipedia.org/wiki/Solution_stack) for [mobile devices](http://en.wikipedia.org/wiki/Mobile_devices) that includes an [operating system](http://en.wikipedia.org/wiki/Operating_system), [middleware](http://en.wikipedia.org/wiki/Middleware) and key [applications](http://en.wikipedia.org/wiki/Application_software). [Google Inc.](http://en.wikipedia.org/wiki/Google) purchased the initial developer of the software, Android Inc., in 2005. Android's [mobile operating system](http://en.wikipedia.org/wiki/Mobile_operating_system) is based on the [Linux kernel](http://en.wikipedia.org/wiki/Linux_kernel). Google and other members of the [Open Handset Alliance](http://en.wikipedia.org/wiki/Open_Handset_Alliance) collaborated on Android's development and release. The Android Open Source Project (AOSP) is tasked with the maintenance and further development of Android. The Android operating system is the world's best-selling [Smartphone](http://en.wikipedia.org/wiki/Smartphone) platform.

Android has a large community of developers writing [applications](http://en.wikipedia.org/wiki/Application_software) ("*apps*") that extend the functionality of the devices. There are currently over 250,000 apps available for Android. [Android Market](http://en.wikipedia.org/wiki/Android_Market) is the online app store run by Google, though apps can also be downloaded from [third-party sites](http://en.wikipedia.org/wiki/List_of_digital_distribution_platforms_for_mobile_devices#Third-party_platforms). Developers write primarily in the [Java language](http://en.wikipedia.org/wiki/Java_%28programming_language%29), controlling the device via Google-developed Java libraries.

The unveiling of the Android distribution on 5 November 2007 was announced with the founding of the [Open Handset Alliance](http://en.wikipedia.org/wiki/Open_Handset_Alliance), a consortium of 80[hardware](http://en.wikipedia.org/wiki/Computer_hardware), [software](http://en.wikipedia.org/wiki/Computer_software), and [telecom](http://en.wikipedia.org/wiki/Telecommunication) companies devoted to advancing [open standards](http://en.wikipedia.org/wiki/Open_standard) for mobile devices. google released most of the Android code under the [Apache License](http://en.wikipedia.org/wiki/Apache_License), a [free software](http://en.wikipedia.org/wiki/Free_software_license) and [open source license](http://en.wikipedia.org/wiki/Open_source_license).

The Android open-source [software stack](http://en.wikipedia.org/wiki/Software_stack) consists of [Java applications](http://en.wikipedia.org/wiki/Java_%28programming_language%29) running on a Java-based, [object-oriented](http://en.wikipedia.org/wiki/Object-oriented) [application framework](http://en.wikipedia.org/wiki/Application_framework) on top of [Java core libraries](http://en.wikipedia.org/wiki/Java_Class_Library) running on a [Dalvik virtual machine](http://en.wikipedia.org/wiki/Dalvik_%28software%29%22%20%5Co%20%22Dalvik%20%28software%29) featuring [JIT compilation](http://en.wikipedia.org/wiki/Just-in-time_compilation). Libraries written in C include the surface manager, OpenCore[]](http://en.wikipedia.org/wiki/Android_%28operating_system%29%22%20%5Cl%20%22cite_note-20) [media framework](http://en.wikipedia.org/wiki/Multimedia_framework),[SQLite](http://en.wikipedia.org/wiki/SQLite) relational [database management system](http://en.wikipedia.org/wiki/Relational_database_management_system), [OpenGL ES 2.0](http://en.wikipedia.org/wiki/OpenGL_ES) [3D graphics](http://en.wikipedia.org/wiki/3D_computer_graphics) [API](http://en.wikipedia.org/wiki/Application_programming_interface), [WebKit layout engine](http://en.wikipedia.org/wiki/WebKit%22%20%5Co%20%22WebKit), [SGL](http://en.wikipedia.org/wiki/Skia_Graphics_Engine) graphics engine, [SSL](http://en.wikipedia.org/wiki/Transport_Layer_Security), and [Bionic libc](http://en.wikipedia.org/wiki/Bionic_%28software%29). The Android operating system, including the Linux kernel, consists of roughly 12 million [lines of code](http://en.wikipedia.org/wiki/Source_lines_of_code) including 3 million lines of [XML](http://en.wikipedia.org/wiki/Xml), 2.8 million lines of[C](http://en.wikipedia.org/wiki/C_%28programming_language%29), 2.1 million lines of [Java](http://en.wikipedia.org/wiki/Java_%28programming_language%29), and 1.75 million lines of [C++](http://en.wikipedia.org/wiki/C%2B%2B).

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**History**

**Android Inc. founded in 2003**

Android, Inc. was founded in [Palo Alto](http://en.wikipedia.org/wiki/Palo_Alto%2C_California), [California](http://en.wikipedia.org/wiki/California), United States in October, 2003 by [Andy Rubin](http://en.wikipedia.org/wiki/Andy_Rubin) (co-founder of [Danger](http://en.wikipedia.org/wiki/Danger_%28company%29)), [Rich Miner](http://en.wikipedia.org/wiki/Rich_Miner) (co-founder of Wildfire Communications, Inc.), [Nick Sears](http://en.wikipedia.org/w/index.php?title=Nick_Sears&action=edit&redlink=1) (once VP at [T-Mobile](http://en.wikipedia.org/wiki/T-Mobile_USA)), and Chris White (headed design and interface development at [WebTV](http://en.wikipedia.org/wiki/WebTV))  to develop, in Rubin's words "...smarter mobile devices that are more aware of its owner's location and preferences." Despite the obvious past accomplishments of the founders and early employees, Android Inc. operated secretively, admitting only that it was working on software for mobile phones.

**Android Inc. acquired by Google**

[Google](http://en.wikipedia.org/wiki/Google) [acquired](http://en.wikipedia.org/wiki/List_of_Google_acquisitions) Android Inc. in August, 2005, making Android Inc. a wholly owned subsidiary of Google Inc. Key employees of Android Inc., including Andy Rubin, Rich Miner and Chris White, stayed at the company after the acquisition.

Not much was known about Android Inc. at the time of the acquisition, but many assumed that Google was planning to enter the [mobile phone](http://en.wikipedia.org/wiki/Mobile_phone) market with this move.

**Development accelerates**

At Google, the team led by Rubin developed a mobile device platform powered by the [Linux kernel](http://en.wikipedia.org/wiki/Linux_kernel). Google marketed the platform to handset makers and [carriers](http://en.wikipedia.org/wiki/Mobile_network_operator) on the premise of providing a flexible, upgradable system. Google had lined up a series of hardware component and software partners and signaled to carriers that it was open to various degrees of cooperation on their part.

Speculation about Google's intention to enter the mobile communications market continued to build through December 2006. Reports from the [BBC](http://en.wikipedia.org/wiki/BBC) and [*The Wall Street Journal*](http://en.wikipedia.org/wiki/The_Wall_Street_Journal) noted that Google wanted its search and applications on mobile phones and it was working hard to deliver that. Print and online media outlets soon reported rumors that Google was developing a Google-branded[handset](http://en.wikipedia.org/wiki/Handset#Telephony). Some speculated that as Google was defining technical specifications, it was showing prototypes to cell phone manufacturers and network operators.

In September 2007, [*InformationWeek*](http://en.wikipedia.org/wiki/InformationWeek) covered an [Evalueserve](http://en.wikipedia.org/wiki/Evalueserve%22%20%5Co%20%22Evalueserve) study reporting that Google had filed several [patent](http://en.wikipedia.org/wiki/Patent) applications in the area of mobile telephony.

**Open Handset Alliance**

Today's announcement is more ambitious than any single 'Google Phone' that the press has been speculating about over the past few weeks. Our vision is that the powerful platform we're unveiling will power thousands of different phone models."

[Eric Schmidt](http://en.wikipedia.org/wiki/Eric_Schmidt), *former Google Chairman/CEO*

On the November 5, 2007 the [Open Handset Alliance](http://en.wikipedia.org/wiki/Open_Handset_Alliance), a [consortium](http://en.wikipedia.org/wiki/Consortium) of several companies which include [Broadcom Corporation](http://en.wikipedia.org/wiki/Broadcom_Corporation), [Google](http://en.wikipedia.org/wiki/Google), [HTC](http://en.wikipedia.org/wiki/High_Tech_Computer_Corporation), [Intel](http://en.wikipedia.org/wiki/Intel_Corporation), [LG](http://en.wikipedia.org/wiki/LG_Group%22%20%5Co%20%22LG%20Group),[Marvell Technology Group](http://en.wikipedia.org/wiki/Marvell_Technology_Group), [Motorola](http://en.wikipedia.org/wiki/Motorola), [Nvidia](http://en.wikipedia.org/wiki/Nvidia%22%20%5Co%20%22Nvidia), [Qualcomm](http://en.wikipedia.org/wiki/Qualcomm), [Samsung Electronics](http://en.wikipedia.org/wiki/Samsung_Electronics), [Sprint Nextel](http://en.wikipedia.org/wiki/Sprint_Nextel), [T-Mobile](http://en.wikipedia.org/wiki/T-Mobile) and [Texas Instruments](http://en.wikipedia.org/wiki/Texas_Instruments) unveiled itself. The goal of the Open Handset Alliance is to develop [open standards](http://en.wikipedia.org/wiki/Open_standard) for mobile devices. On the same day, the Open Handset Alliance also unveiled their first product, Android, a mobile device [platform](http://en.wikipedia.org/wiki/Platform_%28computing%29) built on the [Linux kernel](http://en.wikipedia.org/wiki/Linux_kernel) version 2.6.

On December 9, 2008, 14 new members joined, including [ARM Holdings](http://en.wikipedia.org/wiki/ARM_Holdings), [Atheros Communications](http://en.wikipedia.org/wiki/Atheros_Communications%22%20%5Co%20%22Atheros%20Communications), [Asustek Computer Inc](http://en.wikipedia.org/wiki/Asustek%22%20%5Co%20%22Asustek), [Garmin Ltd](http://en.wikipedia.org/wiki/Garmin), [PacketVideo](http://en.wikipedia.org/wiki/PacketVideo%22%20%5Co%20%22PacketVideo),[Softbank](http://en.wikipedia.org/wiki/Softbank), [Sony Ericsson](http://en.wikipedia.org/wiki/Sony_Ericsson), [Toshiba Corp](http://en.wikipedia.org/wiki/Toshiba), and [Vodafone Group Plc](http://en.wikipedia.org/wiki/Vodafone).

**Licensing**

With the exception of brief update periods, Android has been available under a [free software](http://en.wikipedia.org/wiki/Free_software)/open source license since October, 21 2008. Google published the entire [source code](http://en.wikipedia.org/wiki/Source_code) (including network and telephony stacks) under an [Apache License](http://en.wikipedia.org/wiki/Apache_License). Google also keeps the reviewed issues list publicly open for anyone to see and comment.

Even though the software is open-source, device manufacturers can not use Google's Android trademark unless Google certifies that the device complies with their Compatibility Definition Document (CDD). Devices must also meet this definition to be eligible to license Google's closed-source applications, including Android Market.

In September 2010, [Skyhook Wireless](http://en.wikipedia.org/wiki/Skyhook_Wireless) filed a lawsuit against Google in which they alleged that Google had used the compatibility document to block Skyhook's mobile positioning service (XPS) from Motorola's Android mobile devices. In December 2010 a judge denied Skyhook's motion for preliminary injunction, saying that Google had not closed off the possibility of accepting a revised version of Skyhook's XPS service, and that Motorola had terminated their contract with Skyhook because Skyhook wanted to disable Google's location data collection functions on Motorola's devices, which would have violated Motorola's obligations to Google and its carriers.

**Version history**

# Android version history



The **version history** of the [**Android operating system**](http://en.wikipedia.org/wiki/Android_%28operating_system%29) began with the release of version 1.0 in September 2008. Android is a [mobile operating system](http://en.wikipedia.org/wiki/Mobile_operating_system) developed by [Google](http://en.wikipedia.org/wiki/Google) and the [Open Handset Alliance](http://en.wikipedia.org/wiki/Open_Handset_Alliance). Android has seen a number of [updates](http://en.wikipedia.org/wiki/Patch_%28computing%29) since its original release. These updates to the base [operating system](http://en.wikipedia.org/wiki/Operating_system) typically fix [bugs](http://en.wikipedia.org/wiki/Software_bug) and add new features. Generally each version is developed under a [code name](http://en.wikipedia.org/wiki/Code_name) based on a [dessert item](http://en.wikipedia.org/wiki/Dessert). The code names are in alphabetical order, as seen by Cupcake, Donut, Eclair, Froyo, Gingerbread, Honeycomb, and the future version, Ice Cream Sandwich.

 **Beta**

Released 5 November 2007[Conference Call transcript](http://gizmodo.com/#!318561/live-googles-gphone-open-handset-alliance-conference-call) SDK Released 12 November 2007.

## 1.0





[HTC Dream (G1)](http://en.wikipedia.org/wiki/HTC_Dream)

Released 23 September 2008. The first [Android](http://en.wikipedia.org/wiki/Android_%28operating_system%29) device, the [HTC Dream (G1)](http://en.wikipedia.org/wiki/HTC_Dream), had these Android 1.0 features:

* [Android Market](http://en.wikipedia.org/wiki/Android_Market) application download and updates through the Market app
* [Browser](http://en.wikipedia.org/wiki/Web_browser) to show, zoom and pan full HTML and XHTML web pages - multiple pages show as Windows ("Cards"). [Video](http://www.youtube.com/watch?v=8lZkwaNx8_Y)
* Camera support but no way to change resolution, white balance, compression, etc.
* Email provides access to email servers commonly found on the Internet and supports POP3, IMAP4, and SMTP.
* Folders allow you to group a number of app icons into a single folder icon on the Home screen.
* [Gmail](http://en.wikipedia.org/wiki/Gmail) synchronization with the Gmail app
* [Google Contacts](http://en.wikipedia.org/wiki/Google_Contacts) synchronization with the People app
* [Google Calendar](http://en.wikipedia.org/wiki/Google_Calendar) synchronization with the Calendar app
* [Google Maps](http://en.wikipedia.org/wiki/Google_Maps) with [Latitude](http://en.wikipedia.org/wiki/Google_Latitude) and [Google Street View](http://en.wikipedia.org/wiki/Google_Street_View) to view maps and satellite imagery, as well as find local business and get driving directions using [GPS](http://en.wikipedia.org/wiki/GPS).
* [Google Sync](http://en.wikipedia.org/wiki/Google_Sync) allows management of over-the-air synchronization of [Gmail](http://en.wikipedia.org/wiki/Gmail), [People](http://en.wikipedia.org/wiki/Google_Contacts), and [Calendar](http://en.wikipedia.org/wiki/Google_Calendar)
* [Google Search](http://en.wikipedia.org/wiki/Google_Search) of the internet and phone apps, contacts, calendar, etc.
* [Google Talk](http://en.wikipedia.org/wiki/Google_Talk) instant messaging
* [Instant messaging](http://en.wikipedia.org/wiki/Instant_messaging) and [text messaging](http://en.wikipedia.org/wiki/Text_messaging), IM, and MMS
* [Media Player](http://en.wikipedia.org/wiki/Media_player_%28application_software%29) enables managing, importing, and playing back but lacked video and stereo Bluetooth support
* Notifications appear in the Status bar - drag down to see details, also ringtone, LEDs and vibration options.
* Voice Dialer allows dialing and placing of phone calls without typing a name or number
* Wallpaper allows the user to set the background image or photo behind the Home screen icons and widgets.
* [YouTube](http://en.wikipedia.org/wiki/YouTube) video player
* Other apps include: Alarm Clock, Calculator, Dialer (Phone), Home screen (launcher), Pictures (Gallery), and Settings.
* Other supported features include: WiFi, and Bluetooth.

## 1.1

On 9 February 2009, Android 1.1 update for Android was released for [T-Mobile G1](http://en.wikipedia.org/wiki/T-Mobile_G1) Only. Included in the update were resolved issues, API changes and:

* Maps: Adds details and reviews when a user does a search on Maps and clicks on a business to view its details.
* Dialer: In-call screen timeout default is now longer when using the speakerphone, Show/Hide Dialpad
* Messaging: Saving attachments
* System: Adds support for marquee in layouts.

## 1.5 (Cupcake)





The Android Emulator default home screen (v1.5).

Based on [Linux kernel](http://en.wikipedia.org/wiki/Linux_kernel) 2.6.27. On 30 April 2009, the official 1.5 (Cupcake) update for Android was released. There were several new features and UI updates included in the 1.5 update:

* Virtual keyboard: Support for 3rd party keyboards with text prediction & user dictionary for custom words
* [Widgets](http://en.wikipedia.org/wiki/GUI_widget): Are miniature application views that can be embedded in other applications (such as the Home screen) and receive periodic updates[[15]](http://en.wikipedia.org/wiki/Android_version_history#cite_note-14)
* Camera: Video recording
* Gallery: Video playback (MPEG-4 & 3GP formats)
* Bluetooth: Stereo support added (A2DP and AVRCP profiles), Auto-pairing
* Browser: Copy and paste features added
* Contacts: Shows user picture for Favorites
* Dialer: Specific date/time stamp for events in call log and one-touch access to a contact card from call log event
* System: Animated screen transitions
* Upload videos to YouTube
* Upload photos on Picasa

## 1.6 (Donut)

Based on Linux kernel 2.6.29.On 15 September 2009, the 1.6 (Donut) SDK was released. Included in the update were:

* Search: Voice Search & text entry search enhanced to include bookmarks & history, contacts, the web, and more
* Search: Developers can now include their content in search results
* Text to speech: Features a multi-lingual speech synthesis engine to allow any Android application to "speak" a string of text
* Android Market: Allows easier searching, app screenshots, etc.
* Camera, camcorder, and Gallery: Updated integrated with faster camera access
* Gallery: Now enables users to select multiple photos for deletion
* System: Updated technology support for [CDMA](http://en.wikipedia.org/wiki/IS-95)/[EVDO](http://en.wikipedia.org/wiki/Evolution-Data_Optimized), [802.1x](http://en.wikipedia.org/wiki/IEEE_802.1X), [VPNs](http://en.wikipedia.org/wiki/Virtual_private_network), and a [text-to-speech](http://en.wikipedia.org/wiki/Speech_synthesis) engine
* Display: Support for [WVGA](http://en.wikipedia.org/wiki/Wide_VGA) screen resolutions
* Speed improvements in searching and camera applications
* Expanded Gesture framework and new Gesture Builder development tool
* Google free [turn-by-turn navigation](http://en.wikipedia.org/wiki/Turn-by-turn_navigation)

## 2.0 / 2.1 (Eclair)





[HTC Desire](http://en.wikipedia.org/wiki/HTC_Desire)

Based on Linux kernel 2.6.29 On 26 October 2009, the 2.0 (Eclair) SDK was released. Changes included:

* Sync: Expanded Account sync. Multiple accounts can be added to a device for email and contact synchronization
* Email: Exchange support, Combined inbox to browse email from multiple accounts in one page.
* Bluetooth: 2.1 support
* Contacts: Tap a contact photo and select to call, SMS, or email the person.
* Messaging: Search all saved SMS and MMS messages. Auto delete oldest messages in a conversation when a defined limit is reached.
* Camera: Flash support, Digital zoom, Scene mode, White balance, Color effect, Macro focus
* Virtual keyboard: Improved typing speed, smarter dictionary learns from word usage and includes contact names as suggestions.
* Browser: Refreshed UI, Bookmark thumbnails, Double-tap zoom, Support for HTML5
* Calendar: Agenda view enhanced, Attending status for each invitee, Invite new guests to events.
* System: Optimized hardware speed, Revamped UI
* Display: Support for more screen sizes and resolutions, Better contrast ratio
* Maps: Improved Google Maps 3.1.2
* MotionEvent class enhanced to track multi-touch events
* Live Wallpapers: Home screen background images can be animated to show movement

The **2.0.1** SDK was released on 3 December 2009.

The **2.1** SDK was released on 12 January 2010.

## 2.2 (Froyo)





[LG Optimus One](http://en.wikipedia.org/wiki/LG_Optimus_One)

2.2.2 latest release. Based on Linux kernel 2.6.32. On 20 May 2010, the 2.2 (Froyo) SDK was released. Changes included:

* System: Speed, memory, and performance optimizations
* Additional application speed improvements courtesy of [JIT](http://en.wikipedia.org/wiki/Just-in-time_compilation) implementation
* Integration of [Chrome](http://en.wikipedia.org/wiki/Google_Chrome)'s [V8 JavaScript engine](http://en.wikipedia.org/wiki/V8_%28JavaScript_engine%29) into the Browser application
* Improved Microsoft Exchange support (security policies, auto-discovery, GAL look-up, calendar synchronization, remote wipe)
* Improved application launcher with shortcuts to Phone and Browser applications
* USB tethering and Wi-Fi hotspot functionality
* Added an option to disable data access over [mobile network](http://en.wikipedia.org/wiki/Mobile_network)
* Updated Market application with batch and automatic update features
* Quick switching between multiple keyboard languages and their dictionaries
* Voice dialing and contact sharing over Bluetooth
* Support for numeric and alphanumeric passwords
* Support for file upload fields in the Browser application
* Support for installing applications to the expandable memory
* [Adobe Flash](http://en.wikipedia.org/wiki/Adobe_Flash) support
* Support for extra high DPI screens (320 dpi), such as 4" 720p

## 2.3 (Gingerbread)





[Nexus S](http://en.wikipedia.org/wiki/Nexus_S)

2.3.4 latest release. Based on Linux kernel 2.6.35. On 6 December 2010, the 2.3 (Gingerbread) SDK was released.[]](http://en.wikipedia.org/wiki/Android_version_history#cite_note-gingerbread-dev-blog-31) Changes included:

* Support for voice or video chat using [Google Talk](http://en.wikipedia.org/wiki/Google_Talk) [Google Blog/video](http://googlemobile.blogspot.com/2011/04/video-chat-on-your-android-phone.html)
* System: Updated user interface design for simplicity and speed
* Display: Support for extra-large screen sizes and resolutions ([WXGA](http://en.wikipedia.org/wiki/WXGA_%28graphics%29) and higher)
* Internet calling: Native support for [SIP](http://en.wikipedia.org/wiki/Session_Initiation_Protocol) [VoIP](http://en.wikipedia.org/wiki/Voice_over_IP) telephony
* Virtual Keyboard: Faster, more intuitive text input, improved accuracy, better suggested text. Voice input mode
* [Copy/Paste](http://en.wikipedia.org/wiki/Cut%2C_copy%2C_and_paste): Enhanced. Select a word by press-hold, copy, and paste.
* [Near Field Communication](http://en.wikipedia.org/wiki/Near_Field_Communication) lets the user read an NFC tag embedded in a poster, sticker, or advertisement.
* New audio effects such as reverb, equalization, headphone virtualization, and bass boost
* System: Improved [power management](http://en.wikipedia.org/wiki/Power_management) with a more active role in managing apps that are keeping the device awake for too long.
* [Download Manager](http://en.wikipedia.org/wiki/Download_Manager) gives the user easy access to any file downloaded from the browser, email, or another application.
* Camera: Access multiple cameras on the device, including a front-facing camera, if available.
* Media: Support for [WebM](http://en.wikipedia.org/wiki/WebM%22%20%5Co%20%22WebM)/VP8 video playback, and [AAC](http://en.wikipedia.org/wiki/Advanced_Audio_Coding) audio encoding
* System: Enhanced support for native code development
* Audio, graphical, and input enhancements for game developers
* Concurrent [garbage collection](http://en.wikipedia.org/wiki/Garbage_collection_%28computer_science%29) for increased performance
* Native support for more sensors (such as [gyroscopes](http://en.wikipedia.org/wiki/Gyroscope) and [barometers](http://en.wikipedia.org/wiki/Barometer))
* Switched from [YAFFS](http://en.wikipedia.org/wiki/YAFFS) to the [ext4](http://en.wikipedia.org/wiki/Ext4) filesystem

## 3.0 (Honeycomb)





[Motorola Xoom](http://en.wikipedia.org/wiki/Motorola_Xoom) tablet

3.01 latest release. Based on Linux kernel 2.6.36. On 22 February 2011 the 3.0 (Honeycomb) SDK was released for tablets. This is a tablet-only release of Android. The first device featuring this version, the[Motorola Xoom](http://en.wikipedia.org/wiki/Motorola_Xoom) tablet, was released on February 24, 2011.

Changes include:

* Optimized tablet support with a new virtual and “holographic” user interface
* System Bar: Quick access to notifications, status, and soft navigation buttons available at the bottom of the screen.
* Action Bar: Access to contextual options, navigation, widgets, or other types of content at the top of the screen.
* Multitasking: Tap Recent Apps in the System Bar, to see snapshots of the tasks underway and quickly jump from one app to another.
* Redesigned keyboard: To make entering text fast and accurate on larger screen sizes with greater accuracy and efficiency
* [Copy/Paste](http://en.wikipedia.org/wiki/Cut%2C_copy%2C_and_paste): Simplified, more intuitive.
* Browser: Multiple tabs replace browser windows, form auto-fill, and a new “incognito” mode allows anonymous browsing.
* Camera: Quick access to exposure, focus, flash, zoom, front-facing camera, time-lapse, and more.
* Gallery: View albums and other collections in full-screen mode, with easy access to thumbnails for other photos.
* Contacts: New two-pane UI and Fast Scroll to let users easily organize and locate contacts.
* Email: New two-pane UI to make viewing and organizing messages more efficient. The app lets users select one or more messages.
* Support for video chat using [Google Talk](http://en.wikipedia.org/wiki/Google_Talk)
* Hardware acceleration
* Support for multi-core processors

**Features**

Current features and specifications:





The Android Emulator default home screen (v1.5).





Architecture Diagram

|  |  |
| --- | --- |
| **Handset layouts** | The platform is adaptable to larger, [VGA](http://en.wikipedia.org/wiki/Video_Graphics_Array), [2D graphics](http://en.wikipedia.org/wiki/2D_computer_graphics) library, [3D graphics](http://en.wikipedia.org/wiki/3D_computer_graphics) library based on [OpenGL ES](http://en.wikipedia.org/wiki/OpenGL_ES) 2.0 specifications, and traditional smartphone layouts. |
| **Storage** | [SQLite](http://en.wikipedia.org/wiki/SQLite), a lightweight [relational database](http://en.wikipedia.org/wiki/Relational_database), is used for data storage purposes |
| **Connectivity** | Android supports connectivity technologies including [GSM](http://en.wikipedia.org/wiki/GSM)/[EDGE](http://en.wikipedia.org/wiki/Enhanced_Data_Rates_for_GSM_Evolution), [IDEN](http://en.wikipedia.org/wiki/Integrated_Digital_Enhanced_Network), [CDMA](http://en.wikipedia.org/wiki/Code_division_multiple_access), [EV-DO](http://en.wikipedia.org/wiki/Evolution-Data_Optimized), [UMTS](http://en.wikipedia.org/wiki/Universal_Mobile_Telecommunications_System), [Bluetooth](http://en.wikipedia.org/wiki/Bluetooth), [Wi-Fi](http://en.wikipedia.org/wiki/Wi-Fi) (no connections through[Proxy server](http://en.wikipedia.org/wiki/Proxy_server)[[58]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-57) and no [Ad hoc wireless network](http://en.wikipedia.org/wiki/Ad_hoc_wireless_network)[[59]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-58)), [LTE](http://en.wikipedia.org/wiki/LTE_Advanced), [NFC](http://en.wikipedia.org/wiki/Near_Field_Communication) and [WiMAX](http://en.wikipedia.org/wiki/WiMAX%22%20%5Co%20%22WiMAX). |
| **Messaging** | [SMS](http://en.wikipedia.org/wiki/SMS) and [MMS](http://en.wikipedia.org/wiki/Multimedia_Messaging_Service) are available forms of messaging, including threaded [text messaging](http://en.wikipedia.org/wiki/Text_messaging) and now Android Cloud to Device Messaging Framework ([C2DM](http://en.wikipedia.org/w/index.php?title=C2DM&action=edit&redlink=1)) is also a part of Android Push Messaging service. |
| **Multiple Language Support** | Multiple [Languages](http://en.wikipedia.org/wiki/Language) are available on Android. More than double Languages were added to the platform 2.3 ([Gingerbread](http://en.wikipedia.org/wiki/Gingerbread)). Yet, Android lacks in Font rendering of several languages even after official announcements of added support (e.g [Hindi](http://en.wikipedia.org/wiki/Hindi)). |
| **Web browser** | The web browser available in Android is based on the open-source [WebKit](http://en.wikipedia.org/wiki/WebKit%22%20%5Co%20%22WebKit) layout engine, coupled with [Chrome](http://en.wikipedia.org/wiki/Google_Chrome)'s [V8](http://en.wikipedia.org/wiki/V8_%28JavaScript_engine%29) JavaScript engine. The browser scores a 93/100 on the [Acid3](http://en.wikipedia.org/wiki/Acid3) Test. |
| **Java support** | While most Android applications are written in [Java](http://en.wikipedia.org/wiki/Java_%28programming_language%29), there is no [Java Virtual Machine](http://en.wikipedia.org/wiki/Java_Virtual_Machine) in the platform and Java byte code is not executed. Java classes are compiled into Dalvik executables and run on the [Dalvik virtual machine](http://en.wikipedia.org/wiki/Dalvik_virtual_machine%22%20%5Co%20%22Dalvik%20virtual%20machine). Dalvik is a specialized virtual machine designed specifically for Android and optimized for battery-powered mobile devices with limited memory and CPU. [J2ME](http://en.wikipedia.org/wiki/J2ME) support can be provided via third-party-applications. |
| **Media support** | Android supports the following audio/video/still media formats: [WebM](http://en.wikipedia.org/wiki/WebM%22%20%5Co%20%22WebM), [H.263](http://en.wikipedia.org/wiki/H.263), [H.264](http://en.wikipedia.org/wiki/H.264) (in [3GP](http://en.wikipedia.org/wiki/3GP) or [MP4](http://en.wikipedia.org/wiki/MP4) [container](http://en.wikipedia.org/wiki/Container_format_%28digital%29)), [MPEG-4 SP](http://en.wikipedia.org/wiki/MPEG-4_Part_2), [AMR](http://en.wikipedia.org/wiki/Adaptive_multi-rate_compression), [AMR-WB](http://en.wikipedia.org/wiki/AMR-WB) (in 3GP container), [AAC](http://en.wikipedia.org/wiki/Advanced_Audio_Coding), [HE-AAC](http://en.wikipedia.org/wiki/HE-AAC) (in MP4 or 3GP container), [MP3](http://en.wikipedia.org/wiki/MP3), [MIDI](http://en.wikipedia.org/wiki/Musical_Instrument_Digital_Interface), [Ogg Vorbis](http://en.wikipedia.org/wiki/Vorbis%22%20%5Co%20%22Vorbis), [WAV](http://en.wikipedia.org/wiki/WAV), [JPEG](http://en.wikipedia.org/wiki/JPEG), [PNG](http://en.wikipedia.org/wiki/Portable_Network_Graphics), [GIF](http://en.wikipedia.org/wiki/Graphics_Interchange_Format), [BMP](http://en.wikipedia.org/wiki/BMP_file_format).[[57]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-mediaformats-56) |
| **Streaming media support** | RTP/RTSP streaming ([3GPP PSS](http://en.wikipedia.org/w/index.php?title=3GPP_PSS&action=edit&redlink=1), [ISMA](http://en.wikipedia.org/wiki/ISMA)), HTML progressive download (HTML5 <video> tag). Adobe Flash Streaming (RTMP) and HTTP Dynamic Streaming are supported by the Flash 10.1 plugin.[[60]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-59) Apple HTTP Live Streaming is supported by RealPlayer for Mobile[[61]](http://en.wikipedia.org/wiki/Android_%28operating_system%29%22%20%5Cl%20%22cite_note-60) and planned to be supported by the operating system in Android 3.0 (Honeycomb).[[49]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-honeycomb-highlights-48) Microsoft Smooth Streaming is planned to be supported through the awaited port of Silverlight plugin to Android. |
| **Additional hardware support** | Android can use video/still cameras, [touchscreens](http://en.wikipedia.org/wiki/Touchscreen), [GPS](http://en.wikipedia.org/wiki/Global_Positioning_System), [accelerometers](http://en.wikipedia.org/wiki/Accelerometer), [gyroscopes](http://en.wikipedia.org/wiki/Gyroscope), [magnetometers](http://en.wikipedia.org/wiki/Magnetometer), dedicated gaming controls,[proximity](http://en.wikipedia.org/wiki/Proximity_sensor) and [pressure sensors](http://en.wikipedia.org/wiki/Pressure_sensor), [thermometers](http://en.wikipedia.org/wiki/Thermometer), accelerated 2D [bit blits](http://en.wikipedia.org/wiki/Bit_blit) (with hardware orientation, scaling, pixel format conversion) and accelerated 3D graphics. |
| **Development environment** | Includes a device emulator, tools for [debugging](http://en.wikipedia.org/wiki/Debugging), memory and [performance profiling](http://en.wikipedia.org/wiki/Software_performance_analysis). The [integrated development environment](http://en.wikipedia.org/wiki/Integrated_development_environment) (IDE) is [Eclipse](http://en.wikipedia.org/wiki/Eclipse_%28software%29)(currently 3.4 or greater) using the Android Development Tools (ADT) Plugin. The programming languages are Java and C/C++. |
| **Market** | The [Android Market](http://en.wikipedia.org/wiki/Android_Market) is a catalog of applications that can be downloaded and installed to Android devices over-the-air, without the use of a PC. |
| **Multi-touch** | Android has native support for [multi-touch](http://en.wikipedia.org/wiki/Multi-touch) which was initially made available in handsets such as the [HTC Hero](http://en.wikipedia.org/wiki/HTC_Hero). The feature was originally disabled at the kernel level (possibly to avoid infringing Apple's patents on touch-screen technology at the time).[[62]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-61) Google has since released an update for the [Nexus One](http://en.wikipedia.org/wiki/Nexus_One) and the [Motorola Droid](http://en.wikipedia.org/wiki/Motorola_Droid) which enables multi-touch natively.[[63]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-62) |
| **Bluetooth** | Supports [A2DP](http://en.wikipedia.org/wiki/A2DP), [AVRCP](http://en.wikipedia.org/wiki/AVRCP), sending files ([OPP](http://en.wikipedia.org/wiki/Bluetooth_profile#Object_Push_Profile_.28OPP.29)), accessing the phone book ([PBAP](http://en.wikipedia.org/wiki/Bluetooth_profile#Phone_Book_Access_Profile_.28PBAP.2C_PBA.29)), voice dialing and sending contacts between phones. Keyboard, mouse and joystick ([HID](http://en.wikipedia.org/wiki/Bluetooth_profile#Human_Interface_Device_Profile_.28HID.29)) support is available through manufacturer customizations and third-party applications. Full HID support is planned for Android 3.0 (Honeycomb).[[49]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-honeycomb-highlights-48) |
| **Video calling** | The mainstream Android version does not support video calling, but some handsets have a customized version of the operating system which supports it, either via [UMTS](http://en.wikipedia.org/wiki/UMTS) network (like the [Samsung Galaxy S](http://en.wikipedia.org/wiki/Samsung_Galaxy_S)) or over IP. Video calling through Google Talk is planned for Android 3.0 (Honeycomb). Android 3.3.4 has added Video calling through Google Talk. |
| **Multitasking** | Multitasking of applications is available.[[64]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-63) |
| **Voice based features** | Google search through Voice has been available since initial release.[[65]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-64) Voice actions for calling, texting, navigation, etc. are supported on Android 2.2 onwards.[[66]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-65) |
| **Tethering** | Android supports tethering, which allows a phone to be used as a wireless/wired hotspot. Prior to Android 2.2 this was supported by third-party applications or manufacturer customizations.[[67]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-66) |

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**Hardware running Android**

The main supported platform for Android is the [ARM architecture](http://en.wikipedia.org/wiki/ARM_architecture).

The Android OS can be used as an operating system for cellphones, netbooks and [tablets](http://en.wikipedia.org/wiki/Tablet_personal_computer), including the [Dell Streak](http://en.wikipedia.org/wiki/Dell_Streak), [Samsung Galaxy Tab](http://en.wikipedia.org/wiki/Samsung_Galaxy_Tab), TV and other devices. The first commercially available phone to run the Android operating system was the [HTC Dream](http://en.wikipedia.org/wiki/HTC_Dream), released on 22 October 2008. In early 2010 Google collaborated with [HTC](http://en.wikipedia.org/wiki/HTC) to launch its flagship Android device, the [Nexus One](http://en.wikipedia.org/wiki/Nexus_One). This was followed later in 2010 with the [Samsung](http://en.wikipedia.org/wiki/Samsung)-made [Nexus S](http://en.wikipedia.org/wiki/Nexus_S).

[iOS](http://en.wikipedia.org/wiki/IOS_%28Apple%29) and Android 2.2.1 *Froyo* may be set up to dual boot on a jailbroken [iPhone](http://en.wikipedia.org/wiki/IPhone%22%20%5Co%20%22IPhone) or [iPod Touch](http://en.wikipedia.org/wiki/IPod_Touch) with the help of iBoot and iDroid.

The [smartphone](http://en.wikipedia.org/wiki/Smartphone%22%20%5Co%20%22Smartphone) [IVIO](http://en.wikipedia.org/w/index.php?title=IVIO&action=edit&redlink=1) Icon Pro (DE88) has 2 card slots support CDMA 1xEV-DO along with GSM/GPRS/EDGE networks simultaneously. The operating system is Android 2.2 Froyo and upgradable to Android 2.3 Gingerbread.

**Software development**





Early Android device.

The early feedback on developing applications for the Android platform was mixed. Issues cited include bugs, lack of documentation, inadequate QA infrastructure, and no public issue-tracking system. (Google announced an issue tracker on 18 January 2008.) In December 2007, MergeLab mobile startup founder Adam MacBeth stated, *"Functionality is not there, is poorly documented or just doesn't work... It's clearly not ready for prime time."*[[77]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-Bugs-76) Despite this, Android-targeted applications began to appear the week after the platform was announced. The first publicly available application was the [Snake game](http://en.wikipedia.org/wiki/Snake_%28video_game%29).[[78]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-77)[[79]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-Snake-78) The[Android Dev Phone](http://en.wikipedia.org/wiki/Android_Dev_Phone) is a [SIM](http://en.wikipedia.org/wiki/Subscriber_Identity_Module)-unlocked and hardware-unlocked device that is designed for advanced developers. While developers can use regular consumer devices purchased at retail to test and use their applications, some developers may choose not to use a retail device, preferring an unlocked or no-contract device.

The Android [software development kit](http://en.wikipedia.org/wiki/Software_development_kit) (SDK) includes a comprehensive set of development tools.[[80]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-79) These include a [debugger](http://en.wikipedia.org/wiki/Debugger), [libraries](http://en.wikipedia.org/wiki/Software_library), a handset [emulator](http://en.wikipedia.org/wiki/Emulator)(based on [QEMU](http://en.wikipedia.org/wiki/QEMU)), documentation, sample code, and tutorials. The SDK is downloadable on the [android developer website](http://developer.android.com/sdk/index.html). Currently supported development platforms include computers running [Linux](http://en.wikipedia.org/wiki/Linux_kernel) (any modern desktop [Linux distribution](http://en.wikipedia.org/wiki/List_of_GNU/Linux_distributions)), [Mac OS X](http://en.wikipedia.org/wiki/Mac_OS_X) 10.4.9 or later, [Windows XP](http://en.wikipedia.org/wiki/Windows_XP) or later. The officially supported[integrated development environment](http://en.wikipedia.org/wiki/Integrated_development_environment) (IDE) is [Eclipse](http://en.wikipedia.org/wiki/Eclipse_%28software%29) (currently 3.5 or 3.6) using the Android Development Tools (ADT) Plugin, though developers may use any text editor to edit Java and XML files then use [command line](http://en.wikipedia.org/wiki/Command_line) tools ([Java Development Kit](http://en.wikipedia.org/wiki/Java_Development_Kit) and [Apache Ant](http://en.wikipedia.org/wiki/Apache_Ant) are required) to create, build and debug Android applications as well as control attached Android devices (e.g., triggering a reboot, installing software package(s) remotely).

A preview release of the Android SDK was released on 12 November 2007. On 15 July 2008, the Android Developer Challenge Team accidentally sent an email to all entrants in the Android Developer Challenge announcing that a new release of the SDK was available in a "private" download area. The email was intended for winners of the first round of the Android Developer Challenge. The revelation that Google was supplying new SDK releases to some developers and not others (and keeping this arrangement private) led to widely reported frustration within the Android developer community at the time.[[82]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-81)

On 18 August 2008 the Android 0.9 SDK beta was released. This release provided an updated and extended API, improved development tools and an updated design for the home screen. Detailed instructions for upgrading are available to those already working with an earlier release. On 23 September 2008 the Android 1.0 SDK (Release 1) was released. According to the release notes, it included "mainly bug fixes, although some smaller features were added." It also included several API changes from the 0.9 version. Multiple versions have been released since.

Enhancements to Android's SDK go hand in hand with the overall Android platform development. The SDK also supports older versions of the Android platform in case developers wish to target their applications at older devices. Development tools are downloadable components, so after one has downloaded the latest version and platform, older platforms and tools can also be downloaded for compatibility testing.

Android applications are packaged in [.apk](http://en.wikipedia.org/wiki/APK_%28file_format%29) format and stored under /data/app folder on the Android OS (the folder is accessible to root user only for security reasons). APK package contains .dex files (compiled byte code files called [Dalvik](http://en.wikipedia.org/wiki/Dalvik_Virtual_Machine%22%20%5Co%20%22Dalvik%20Virtual%20Machine) executables), resource files, etc.

**Android Market**

**Android Market** is an online software store developed by [Google](http://en.wikipedia.org/wiki/Google) for [Android](http://en.wikipedia.org/wiki/Android_%28operating_system%29) devices. An application program ("app") called "Market" is preinstalled on most Android devices and allows users to browse and download apps published by third-party developers, hosted on Android Market. Users can also search for and read detailed information about apps from the Android Market website.

**History**

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The current Android Market on an Android phone

The Android Market was announced on 28 August 2008 and was made available to users on 22 October 2008. Priced application support was added for U.S. users and developers in the U.S. and UK in mid-February 2009. UK users gained the ability to purchase priced applications on 13 March 2009.

On 17 March 2009, there were about 2,300 applications available for download from the Android Market, according to [T-Mobile](http://en.wikipedia.org/wiki/T-Mobile) [chief technical officer](http://en.wikipedia.org/wiki/Chief_technical_officer) Cole Brodman.[[4]](http://en.wikipedia.org/wiki/Android_Market#cite_note-3)

By December 2009, there were over 20,000 applications available for download in the Android Market.

By August 2010, there were over 80,000[[6]](http://en.wikipedia.org/wiki/Android_Market#cite_note-5) applications available for download in the Android Market, with over 1 billion application downloads. Recent months (in 2010) have shown an ever increasing growth rate, recently (in May 2010) surpassing 10,000 additional applications per month.

A report in July 2010, a company named Distimo showed that the Android Market features the highest percentage of free apps, with over 57% being free to download, double the amount of [Apple Inc.](http://en.wikipedia.org/wiki/Apple_Inc.)'s [App Store](http://en.wikipedia.org/wiki/App_Store), in which only 28% of apps are free. Other competitors, such as [Nokia](http://en.wikipedia.org/wiki/Nokia)'s [Ovi Store](http://en.wikipedia.org/wiki/Ovi_Store%22%20%5Co%20%22Ovi%20Store) and [Blackberry](http://en.wikipedia.org/wiki/Blackberry%22%20%5Co%20%22Blackberry)'s[App World](http://en.wikipedia.org/wiki/App_World) had 26%, with [Windows Marketplace](http://en.wikipedia.org/wiki/Windows_Marketplace) only having 22%.

In December 2010, it was reported that the Market would shortly receive an update, which will, alongside some minor updates, will add content-filtering to the market, and will reduce the purchase refund window from 24/48 hours to 15 minutes. Google has said that the new update would be available to all devices running Android 1.6 or higher, and arrived on unlocked HTC Desires in the UK on 16th December.

On December 31, 2010 the Android market reached the 200,000 app milestone.

On February 2, 2011 Google presented a new web client providing access to the market via PC. Requested Apps will directly be downloaded and installed on the registered Android device.

At May 1, 2011 Android apps were 294,738 and [Apple apps](http://en.wikipedia.org/wiki/App_Store) were 381,062, but in April 2011 Android had 28,000 new apps, whereas Apple had 11,000 new apps. App store analytics company [Distimo](http://en.wikipedia.org/w/index.php?title=Distimo&action=edit&redlink=1" \o "Distimo (page does not exist)) forecasted Android apps would surpass Apple apps in size before end of July 2011, whereas Germany-based[research2guidance](http://en.wikipedia.org/w/index.php?title=Research2guidance&action=edit&redlink=1) forecasted Android apps to surpass Apple apps in August 2011 at 425,000 apps.

**Priced applications**

Developers of software (apps) receive 70% of the application price, with the remaining 30% distributed among carriers (if authorized to receive a fee for applications purchased through their network) and payment processors.[[15]](http://en.wikipedia.org/wiki/Android_Market#cite_note-14) Revenue earned from the Android Market is paid to developers via [Google Checkout](http://en.wikipedia.org/wiki/Google_Checkout) merchant accounts. T-Mobile, the first carrier with an Android device, recently updated the market to allow Google to directly bill app purchases to a customer's cell phone account that show up as a charge on the bill.

**Availability for users**

Users outside the countries/regions listed below only have access to free applications through Android Market. Paid applications are currently available to Android Market users only in the following countries:

|  |  |  |
| --- | --- | --- |
| **Country↓** | **Users can purchase applications**[[16]](http://en.wikipedia.org/wiki/Android_Market#cite_note-15)**↓** | **Developers can sell applications**[[17]](http://en.wikipedia.org/wiki/Android_Market#cite_note-android1-16)**↓** |
| http://upload.wikimedia.org/wikipedia/commons/thumb/1/1a/Flag_of_Argentina.svg/22px-Flag_of_Argentina.svg.png [Argentina](http://en.wikipedia.org/wiki/Argentina) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/b/b9/Flag_of_Australia.svg/22px-Flag_of_Australia.svg.png [Australia](http://en.wikipedia.org/wiki/Australia) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/4/41/Flag_of_Austria.svg/22px-Flag_of_Austria.svg.png [Austria](http://en.wikipedia.org/wiki/Austria) | Yes (ex | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/c/cb/Flag_of_the_Czech_Republic.svg/22px-Flag_of_the_Czech_Republic.svg.png [Czech Republic](http://en.wikipedia.org/wiki/Czech_Republic) | Yes | No |
| http://upload.wikimedia.org/wikipedia/commons/thumb/c/cf/Flag_of_Canada.svg/22px-Flag_of_Canada.svg.png [Canada](http://en.wikipedia.org/wiki/Canada) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/9/92/Flag_of_Belgium_%28civil%29.svg/22px-Flag_of_Belgium_%28civil%29.svg.png [Belgium](http://en.wikipedia.org/wiki/Belgium) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/0/05/Flag_of_Brazil.svg/22px-Flag_of_Brazil.svg.png [Brazil](http://en.wikipedia.org/wiki/Brazil) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/9/9c/Flag_of_Denmark.svg/22px-Flag_of_Denmark.svg.png [Denmark](http://en.wikipedia.org/wiki/Denmark) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/b/bc/Flag_of_Finland.svg/22px-Flag_of_Finland.svg.png [Finland](http://en.wikipedia.org/wiki/Finland) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/c/c3/Flag_of_France.svg/22px-Flag_of_France.svg.png [France](http://en.wikipedia.org/wiki/France) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/b/ba/Flag_of_Germany.svg/22px-Flag_of_Germany.svg.png [Germany](http://en.wikipedia.org/wiki/Germany) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/5/5b/Flag_of_Hong_Kong.svg/22px-Flag_of_Hong_Kong.svg.png [Hong Kong](http://en.wikipedia.org/wiki/Hong_Kong) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/c/c1/Flag_of_Hungary.svg/22px-Flag_of_Hungary.svg.png [Hungary](http://en.wikipedia.org/wiki/Hungary) | No | No |
| http://upload.wikimedia.org/wikipedia/commons/thumb/4/41/Flag_of_India.svg/22px-Flag_of_India.svg.png [India](http://en.wikipedia.org/wiki/India) | Yes | No |
| http://upload.wikimedia.org/wikipedia/commons/thumb/9/9f/Flag_of_Indonesia.svg/22px-Flag_of_Indonesia.svg.png [Indonesia](http://en.wikipedia.org/wiki/Indonesia) | No | No |
| http://upload.wikimedia.org/wikipedia/commons/thumb/4/45/Flag_of_Ireland.svg/22px-Flag_of_Ireland.svg.png [Ireland](http://en.wikipedia.org/wiki/Republic_of_Ireland) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/d/d4/Flag_of_Israel.svg/22px-Flag_of_Israel.svg.png [Israel](http://en.wikipedia.org/wiki/Israel) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/0/03/Flag_of_Italy.svg/22px-Flag_of_Italy.svg.png [Italy](http://en.wikipedia.org/wiki/Italy) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/9/9e/Flag_of_Japan.svg/22px-Flag_of_Japan.svg.png [Japan](http://en.wikipedia.org/wiki/Japan) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/f/fc/Flag_of_Mexico.svg/22px-Flag_of_Mexico.svg.png [Mexico](http://en.wikipedia.org/wiki/Mexico) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/2/20/Flag_of_the_Netherlands.svg/22px-Flag_of_the_Netherlands.svg.png [Netherlands](http://en.wikipedia.org/wiki/Netherlands) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/3/3e/Flag_of_New_Zealand.svg/22px-Flag_of_New_Zealand.svg.png [New Zealand](http://en.wikipedia.org/wiki/New_Zealand) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/d/d9/Flag_of_Norway.svg/22px-Flag_of_Norway.svg.png [Norway](http://en.wikipedia.org/wiki/Norway) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/3/32/Flag_of_Pakistan.svg/22px-Flag_of_Pakistan.svg.png [Pakistan](http://en.wikipedia.org/wiki/Pakistan) | Yes | No |
| http://upload.wikimedia.org/wikipedia/commons/thumb/1/12/Flag_of_Poland.svg/22px-Flag_of_Poland.svg.png [Poland](http://en.wikipedia.org/wiki/Poland) | Yes | No |
| http://upload.wikimedia.org/wikipedia/commons/thumb/5/5c/Flag_of_Portugal.svg/22px-Flag_of_Portugal.svg.png [Portugal](http://en.wikipedia.org/wiki/Portugal) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/f/f3/Flag_of_Russia.svg/22px-Flag_of_Russia.svg.png [Russia](http://en.wikipedia.org/wiki/Russia) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/4/48/Flag_of_Singapore.svg/22px-Flag_of_Singapore.svg.png [Singapore](http://en.wikipedia.org/wiki/Singapore) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/4/4c/Flag_of_Sweden.svg/22px-Flag_of_Sweden.svg.png [Sweden](http://en.wikipedia.org/wiki/Sweden) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/f/f3/Flag_of_Switzerland.svg/17px-Flag_of_Switzerland.svg.png [Switzerland](http://en.wikipedia.org/wiki/Switzerland) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/7/72/Flag_of_the_Republic_of_China.svg/22px-Flag_of_the_Republic_of_China.svg.png [Taiwan](http://en.wikipedia.org/wiki/Republic_of_China) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/0/09/Flag_of_South_Korea.svg/22px-Flag_of_South_Korea.svg.png [South Korea](http://en.wikipedia.org/wiki/South_Korea) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/9/9a/Flag_of_Spain.svg/22px-Flag_of_Spain.svg.png [Spain](http://en.wikipedia.org/wiki/Spain) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/a/ae/Flag_of_the_United_Kingdom.svg/22px-Flag_of_the_United_Kingdom.svg.png [United Kingdom](http://en.wikipedia.org/wiki/United_Kingdom) | Yes | Yes |
| http://upload.wikimedia.org/wikipedia/commons/thumb/a/a4/Flag_of_the_United_States.svg/22px-Flag_of_the_United_States.svg.png [United States](http://en.wikipedia.org/wiki/United_States) | Yes | Yes |

**Availability for developers**

Early on, only developers in the U.S. and UK were able to publish priced applications. In an email to Android Market developers on 2 April 2009, Google wrote: "... we are hard at work to enable developers in Germany, Austria, Netherlands, France, and Spain to offer priced applications in the coming weeks. Once merchant support for priced apps are live in these countries, we will announce our plans for launching support for developers in additional geographies."

This was partly realized and, for the time being, developers from Austria, France, Germany, Netherlands, Spain, UK and the U.S. can sell priced applications on the Android Market.[[17]](http://en.wikipedia.org/wiki/Android_Market#cite_note-android1-16)

Unlike with the [iPhone](http://en.wikipedia.org/wiki/IPhone%22%20%5Co%20%22IPhone), there is no requirement that Android applications be acquired from Android Market. Android applications may be obtained from any source including a developer's own website or from any of the 3rd party alternatives to Market which exist and can be installed on Android devices alongside Market.

**Banned applications**

On 31 March 2009, Google pulled all [tethering](http://en.wikipedia.org/wiki/Tethering) applications from the Android Market. Google later restored the applications for Android Market users, except those inside the [T-Mobile USA](http://en.wikipedia.org/wiki/T-Mobile_USA) network:

On Monday, several applications that enable tethering were removed from the Android Market catalog because they were in violation of T-Mobile's terms of service in the US. Based on Android's Developer Distribution Agreement (section 7.2), we remove applications from the Android Market catalog that violate the terms of service of a carrier or manufacturer. We inadvertently unpublished the applications for all carriers, and today we have corrected the problem so that all Android Market users outside the T-Mobile US network will now have access to the applications. We have notified the affected developers.

As of 20 May 2010, PDAnet, Easy Tether and Proxoid were all available in the U.S. market for T-mobile users.

On 5 April 2011, Google pulled the [Grooveshark](http://en.wikipedia.org/wiki/Grooveshark%22%20%5Co%20%22Grooveshark) app from the Android Market due to unspecified policy violations. However, the app is still available for direct download via Grooveshark's website, and does not require any special modifications to the Android device to run.

**Implementation details**

The applications themselves are self-contained [Android Package files](http://en.wikipedia.org/wiki/APK_%28file_format%29). The Android Market does not install applications itself, rather it asks the phone's PackageManagerService to install them. The package manager can be seen directly if the user tries to download an [APK](http://en.wikipedia.org/wiki/APK_%28file_format%29) file direct to their phone. Applications can be installed to the phone's internal storage, and can also be installed to the owner's external storage card under certain conditions.

**Application security**





An example of app permissions in the Android Market.

Android devices can run applications written by third-party developers and distributed through the Android Market or one of several other application stores. Once they have signed up, developers can make their applications available immediately, without a lengthy approval process.

When an application is installed, the Android Market displays all required permissions. The user can then decide whether to install the application based on those permissions. The user may decide not to install an application whose permission requirements seem excessive or unnecessary. A game may need to enable vibration, for example, but should not need to read messages or access the phonebook.

Possible app permissions include functionality like:

* Accessing the Internet
* Making phone calls
* Sending SMS messages
* Reading and writing to the installed memory card
* Accessing a user's address book data

Security software companies have been developing applications to help ensure the security of Android devices. SMobile Systems, one such manufacturer, claims that 20% of apps in the Android Market request permissions that could be used for malicious purposes, and 5% of apps can make phone calls without the user's intervention. This is not a claim that th apps are actually malicious, but rather that the potential for malicious activity exists.

In early March 2011, DroidDream, a [trojan](http://en.wikipedia.org/wiki/Trojan_horse_%28computing%29%22%20%5Co%20%22Trojan%20horse%20%28computing%29) [rootkit](http://en.wikipedia.org/wiki/Rootkit%22%20%5Co%20%22Rootkit) exploit, was released to the Android Market in the form of several free applications that were, in many cases, pirated versions of existing priced apps. This exploit allowed hackers to steal information such as IMEI and IMSI numbers, phone model, user ID, and service provider. The exploit also installed a [backdoor](http://en.wikipedia.org/wiki/Backdoor_%28computing%29) that allowed the hackers to download more code to the infected device. These apps were downloaded more than 50,000 times before Google took action and removed them from the Market. The exploit only affected devices running versions of AndroidOS earlier than 2.3 "Gingerbread". In many cases, the only guaranteed method of removing the exploit from an infected device was to reset it to factory state, although community-developed solutions for blocking some aspects of the exploit were also created. Google started remotely removing the malicious apps from infected devices on March 5, and also released its own app, the "Android Market Security Tool March 2011", which automatically removed the exploit. This app was automatically installed to all infected devices, and users with infected devices were notified via e-mail.

**Known issues**

As of May 2010, a widespread issue has been reported by hundreds of users which inhibits their ability to download applications from the marketplace. Some user issues are related to the migration of UK users from googlemail.com addresses to gmail.com, but the majority are still unresolved, despite a number of suggested fixes. The two most popular questions on Android technical help relate to the issue, with hundreds of unanswered queries.

Hundreds of users across multiple networks have experienced the market place application disappearing after updating to Android 2.2. So far, the only solution Google has offered is to hard reset your phone. However, doing so will delete contacts, text messages and applications from the phone. One other way that can work is to make sure the Google Chat application on the device is signed in to your gmail account - and then the Market Place application should allow downloads (OS 2.2), may be fixed in later versions.[**App Inventor for Android**

On 12 July 2010 Google announced the availability of App Inventor for Android, a Web-based visual development environment for novice programmers, based on MIT's Open Blocks Java library and providing access to Android devices' GPS, accelerometer and orientation data, phone functions, text messaging, speech-to-text conversion, contact data, persistent storage, and Web services, initially including Amazon and Twitter.[[96]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-95) "We could only have done this because Android’s architecture is so open," said the project director, MIT's [Hal Abelson](http://en.wikipedia.org/wiki/Hal_Abelson).[[97]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-96) Under development for over a year,[[98]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-97) the block-editing tool has been taught to non-majors in computer science at Harvard, MIT, Wellesley, and the University of San Francisco, where Professor David Wolber developed an introductory computer science course and tutorial book for non-computer science students based on App Inventor for Android.

**The Simple project**

The goal of Simple is to bring an easy to learn and use language to the Android platform. Simple is a [BASIC](http://en.wikipedia.org/wiki/BASIC) dialect for developing Android applications. It targets professional and non-professional programmers alike in that it allows programmers to quickly write Android applications that utilise the Android runtime components.

Similar to Microsoft Visual Basic 6, Simple programs are form definitions (which contain components) and code (which contains the program logic). The interaction between the components and the program logic happens through events triggered by the components. The program logic consists of event handlers which contain code reacting to the events.

**Android Developer Challenge**

 The Android Developer Challenge was a competition for the most innovative application for Android. Google offered prizes totaling 10 million [US dollars](http://en.wikipedia.org/wiki/US_dollar), distributed between ADC I and ADC II. ADC I accepted submissions from 2 January to 14 April 2008. The 50 most promising entries, announced on 12 May 2008, each received a $25,000 award to funurther development. It ended in early September with the announcement of ten teams that received $275,000 each, and ten teams that received $100,000 each. ADC II was announced on 27 May 2009. The first round of the ADC II closed on 6 October 2009. The first-round winners of ADC II comprising the top 200 applications were announced on 5 November 2009. Voting for the second round also opened on the same day and ended on November 25. Google announced the top winners of ADC II on November 30, with SweetDreams, What the Doodle!? and WaveSecure being nominated the overall winners of the challenge.

**Google applications**

Google has also participated in the Android Market by offering several applications for its services. These applications include [Google Voice](http://en.wikipedia.org/wiki/Google_Voice) for the Google Voice service, Sky Map for watching stars, Finance for their finance service, Maps Editor for their MyMaps service, Places Directory for their Local Search, [Google Goggles](http://en.wikipedia.org/wiki/Google_Goggles) that searches by image, Gesture Search for using finger-written letters and numbers to search the contents of the phone, Google Translate, Google Shopper, Listen for podcasts and My Tracks, a jogging application.

In August 2010, Google launched "Voice Actions for Android," which allows users to search, write messages, and initiate calls by voice.

**Third party applications**

With the growing number of Android handsets, there has also been an increased interest by third party developers to port their applications to the Android operating system.

As of December 2010, the Android Marketplace had over 200,000 applications, with over 1 billion downloads. This is up from 70,000 in July 2010.

Obstacles to development include the fact that Android does not use established Java standards, i.e. [Java SE](http://en.wikipedia.org/wiki/Java_SE) and [ME](http://en.wikipedia.org/wiki/Java_ME). This prevents compatibility among Java applications written for those platforms and those for the Android platform. Android only reuses the Java language syntax, but does not provide the full-class libraries and APIs bundled with Java SE or ME. However, there are multiple tools in the market from companies such as [Myriad Group](http://en.wikipedia.org/wiki/Myriad_Group) and UpOnTek that provide J2ME to Android conversion services.

Developers have reported that it is difficult to maintain applications on multiple versions of Android, owing to compatibility issues between versions 1.5 and 1.6, especially the different resolution ratios in use among various Android phones. Such problems were pointedly brought into focus as they were encountered during the ADC2 contest. Further, the rapid growth in the number of Android-based phone models with differing hardware capabilities also makes it difficult to develop applications that work on all Android-based phones. As of August 2010, 83% of Android phones run the 2.x versions, and 17% still run the 1.5 and 1.6 versions

**Mobile gaming**

Android had a huge showing at the 2011 [Mobile World Congress](http://en.wikipedia.org/wiki/Mobile_World_Congress) in regards to [smartphone](http://en.wikipedia.org/wiki/Smartphone%22%20%5Co%20%22Smartphone) gaming, with many well established game developers showcasing Android games. The trend in mobile gaming on smartphone devices is predicted to shrink the game specialist device market, affecting devices such as the upcoming [Next Generation Portable](http://en.wikipedia.org/wiki/Next_Generation_Portable). Early 2011, PlayStation announced that they would have some [PS games](http://us.playstation.com/corporate/about/press-release/android-based-playstation-portable-devices.html) available on Android powered devices.

**Native code**

Libraries written in [C](http://en.wikipedia.org/wiki/C_%28programming_language%29) and other languages can be compiled to [ARM](http://en.wikipedia.org/wiki/ARM_architecture) [native code](http://en.wikipedia.org/wiki/Native_code) and installed using the Android [Native Development Kit](http://en.wikipedia.org/wiki/Native_Development_Kit). Native classes can be called from Java code running under the Dalvik VM using the System.loadLibrary call, which is part of the standard Android Java classes.

Complete applications can be [compiled](http://en.wikipedia.org/wiki/Compiler) and installed using traditional development tools. The ADB debugger gives a root shell under the Android Emulator which allows native [ARM code](http://en.wikipedia.org/wiki/ARM_architecture) to be uploaded and executed. ARM code can be compiled using [GCC](http://en.wikipedia.org/wiki/GNU_Compiler_Collection) on a standard PC. Running native code is complicated by the fact that Android uses a non-standard C library (libc, known as[Bionic](http://en.wikipedia.org/wiki/Bionic_%28software%29)). The underlying graphics device is available as a [framebuffer](http://en.wikipedia.org/wiki/Framebuffer%22%20%5Co%20%22Framebuffer) at */dev/graphics/fb0*. The graphics library that Android uses to arbitrate and control access to this device is called the [Skia Graphics Library](http://en.wikipedia.org/wiki/Skia_Graphics_Engine%22%20%5Co%20%22Skia%20Graphics%20Engine) (SGL), and it has been released under an open source license.[[129]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-128) Skia has backends for both [win32](http://en.wikipedia.org/wiki/Win32) and [Unix](http://en.wikipedia.org/wiki/Unix), allowing the development of cross-platform applications, and it is the graphics engine underlying the [Google Chrome](http://en.wikipedia.org/wiki/Google_Chrome) web browser.

**Community-based firmware**

There is a community of open-source enthusiasts that build and share Android-based firmware with a number of customizations and additional features, such as [FLAC](http://en.wikipedia.org/wiki/FLAC) lossless audio support and the ability to store downloaded applications on the [microSD](http://en.wikipedia.org/wiki/MicroSD%22%20%5Co%20%22MicroSD) card.[[131]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-130) This usually involves [rooting](http://en.wikipedia.org/wiki/Rooting_%28Android_OS%29) the device. Rooting allows users root access to the operating system, enabling full control of the phone. In order to use custom firmwares the device's bootloader must be unlocked. Rooting alone does not allow the flashing of custom firmware. Modified firmwares allow users of older phones to use applications available only on newer releases.

Those firmware packages are updated frequently, incorporate elements of Android functionality that haven't yet been officially released within a carrier-sanctioned firmware, and tend to have fewer limitations. [CyanogenMod](http://en.wikipedia.org/wiki/CyanogenMod%22%20%5Co%20%22CyanogenMod) and [VillainROM](http://en.wikipedia.org/w/index.php?title=VillainROM&action=edit&redlink=1" \o "VillainROM (page does not exist)) are two examples of such firmware.

On 24 September 2009, Google issued a [cease and desist](http://en.wikipedia.org/wiki/Cease_and_desist) letter to the modder Cyanogen, citing issues with the re-distribution of Google's closed-source applications within the custom firmware. Even though most of Android OS is open source, phones come packaged with closed-source Google applications for functionality such as the application store and GPS navigation. Google has asserted that these applications can only be provided through approved distribution channels by licensed distributors. Cyanogen has complied with Google's wishes and is continuing to distribute this mod without the proprietary software. He has provided a method to back up licensed Google applications during the mod's install process and restore them when it is complete.

**Security**

In March 2011, Google pulled 58 malicious apps from the Android Market, but not before the 58 apps were downloaded to around 260,000 devices. These apps were malicious applications in the Android Market which contained trojans hidden in pirated versions of legitimate apps.[[137]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-136) The malware (called DroidDream) exploited a bug which was present in versions of Android older than 2.2.2.[[138]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-137) Android device manufacturers and carriers work in tandem to distribute Android based updates and had not uniformly issued patches to their customers for the DroidDream exploit, leaving users vulnerable. Google said the exploit allowed the apps to gather device specific information, as well as personal information. The exploit also allowed the apps to download additional code that could be run on the device. Within days, Google remotely wiped the apps from infected users and rolled out an update that would negate the exploits that allowed the apps to view information. They also announced that they would be resolving the issue to ensure that events like this did not occur again. Security firms such as [AVG](http://en.wikipedia.org/wiki/AVG) and [Symantec](http://en.wikipedia.org/wiki/Symantec) have released antivirus software for Android devices.

In August 2010, an SMS Trojan called Trojan-SMS.AndroidOS.FakePlayer.a infected a number of mobile devices, according to security firm [Kaspersky Lab](http://en.wikipedia.org/wiki/Kaspersky_Lab%22%20%5Co%20%22Kaspersky%20Lab). Disguised as a harmless media player application, the trojan, once installed sends out SMS text messages without the users knowledge or consent. According to Denis Maslennikov, Senior Malware Researcher at Kaspersky Lab, there's not an exact number of infected devices available at present, but the outbreak is currently regional. For now, only Russian Android users can actually lose money after installing the Trojan, but anyone can be infected. Android users were advised not to use the Android web browser until Google issues a security patch. The Android Security Team responded and developed a fix on February 5 and patched Open Source Android two days later.

**Marketing**





Android logo

The Android logo was designed with the [Droid font family](http://en.wikipedia.org/wiki/Droid_%28font%29) made by [Ascender Corporation](http://en.wikipedia.org/wiki/Ascender_Corporation).

Android Green is the color of the Android Robot that represents the Android operating system. The print color is [PMS](http://en.wikipedia.org/wiki/Pantone) 376C and the [RGB color](http://en.wikipedia.org/wiki/RGB_color_model) value in hexadecimal is #A4C639, as specified by the Android Brand Guidelines. The custom typeface of Android is called Norad. It is only used in the text logo.

**Market share**

Research company [Canalys](http://en.wikipedia.org/wiki/Canalys%22%20%5Co%20%22Canalys) estimated in Q2 2009 that Android had a 2.8% share of worldwide [smartphone](http://en.wikipedia.org/wiki/Smartphone%22%20%5Co%20%22Smartphone) shipments.[[146]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-Insider_1-145) By Q4 2010 this had grown to 33% of the market, becoming the top-selling smartphone platform. This estimate includes the Tapas and OMS variants of Android.

In February 2010 [ComScore](http://en.wikipedia.org/wiki/ComScore%22%20%5Co%20%22ComScore) said the Android platform had 9.0% of the U.S. smartphone market, as measured by current mobile subscribers. This figure was up from an earlier estimate of 5.2% in November 2009.[[147]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-ComScore_Feb_2010-146) By the end of Q3 2010 Android's U.S. market share had grown to 21.4 percent.

In May 2010, Android's first quarter U.S. sales surpassed that of the rival iPhone platform. According to a report by the NPD group, Android achieved 25% smartphone sales in the US market, up 8% from the December quarter. In the second quarter, Apple's iOS was up by 11%, indicating that Android is taking market share mainly from [RIM](http://en.wikipedia.org/wiki/Research_In_Motion), and still has to compete with heavy consumer demand for new competitor offerings. Furthermore, analysts pointed to advantages that Android has as a multi-channel, multi-carrier OS, which allowed it to duplicate the quick success of Microsoft's Windows Mobile.

In early October 2010, Google added 20 countries to its list of approved submitters. By mid-October, purchasing apps will be available in a total of 32 countries. For a complete list of countries that are allowed to sell apps and those able to buy them see [Android Market](http://en.wikipedia.org/wiki/Android_Market#Availability_for_users).

As of December 2010 Google said over 300,000 Android phones were being activated daily,[[152]](http://en.wikipedia.org/wiki/Android_%28operating_system%29%22%20%5Cl%20%22cite_note-151) up from 100,000 per day in May 2010.

In February 2011, during the 2011 [Mobile World Congress](http://en.wikipedia.org/wiki/Mobile_World_Congress), [Eric Schmidt](http://en.wikipedia.org/wiki/Eric_Schmidt) announced that Android has reached 350,000 activations per day.

**Usage share**





Data collected during two weeks ending on May 2, 2011

Data collected during two weeks ending on May 2, 2011

|  |  |  |
| --- | --- | --- |
| **Platform↓** | [**API**](http://en.wikipedia.org/wiki/Application_programming_interface)**level↓** | **Distribution↓** |
| Android *Honeycomb* 3.0 | 11 | 0.3% |
| Android *Ice Cream* 2.4 | 11 | 0.3% |
| Android *Gingerbread* 2.3.3 | 10 | 3.0% |
| Android *Gingerbread* 2.3 | 9 | 1.0% |
| Android *Froyo* 2.2.x | 8 | 65.9% |
| Android *Eclair* 2.0.*x*/2.1.*x* | 7 | 24.5% |
| Android *Donut* 1.6 | 4 | 3.0% |
| Android *Cupcake* 1.5 | 3 | 2.3% |

**Linux compatibility**

Android's kernel is derived from [Linux](http://en.wikipedia.org/wiki/Linux) but has included architecture changes by Google outside the typical [Linux kernel](http://en.wikipedia.org/wiki/Linux_kernel) development cycle. Android does not have a native [X Window System](http://en.wikipedia.org/wiki/X_Window_System) nor does it support the full set of standard [GNU](http://en.wikipedia.org/wiki/GNU) libraries, and this makes it difficult to port existing GNU/Linux applications or libraries to Android. However, support for the X Window System is possible. Google no longer maintains the code they previously contributed to the [Linux kernel](http://en.wikipedia.org/wiki/Linux_kernel) as part of their Android effort, creating a separate version or [fork](http://en.wikipedia.org/wiki/Fork_%28software_development%29) of Linux This was due to a disagreement about new features Google felt were necessary (some related to security of mobile applications). The code which is no longer maintained was deleted in January 2010 from the Linux [code base](http://en.wikipedia.org/wiki/Codebase).

Google announced in April 2010 that they will hire two employees to work with the Linux kernel community.

However, as of January 2011, points of contention still exist between Google and the Linux kernel team: Google tried to push [upstream](http://en.wikipedia.org/wiki/Upstream_%28software_development%29) some Android-specific power management code in 2009, which is still rejected today.

Furthermore, [Greg Kroah-Hartman](http://en.wikipedia.org/wiki/Greg_Kroah-Hartman), the current Linux kernel maintainer for the -stable branch, said in December 2010 that he was concerned that Google was no longer trying to get their code changes included in mainstream Linux. Some Google Android developers hinted that "the Android team was getting fed up with the process," because they were a small team and had more urgent work to do on Android.

**Claimed infringement of copyrights and patents**

On 12 August 2010, [Oracle](http://en.wikipedia.org/wiki/Oracle_Corporation), owner of Java since it acquired [Sun Microsystems](http://en.wikipedia.org/wiki/Sun_Microsystems) in April 2009, sued Google over claimed infringement of copyrights and patents. The lawsuit claims that, "In developing Android, Google knowingly, directly and repeatedly infringed Oracle's Java-related intellectual property."

Specifically the patent infringement claim references seven patents including United States Patent No. 5,966,702, entitled "Method And Apparatus For Preprocessing And Packaging Class Files," and United States Patent No. 6,910,205, entitled "Interpreting Functions Utilizing A Hybrid Of Virtual And Native Machine Instructions."[[168]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-167) It also references United States Patent No. RE38,104, ("the '104 patent") entitled “Method And Apparatus For Resolving Data References In Generated Code” authored by [James Gosling](http://en.wikipedia.org/wiki/James_Gosling), best known as the father of the [Java programming language](http://en.wikipedia.org/wiki/Java_%28programming_language%29), and currently a Google employee.

In response Google submitted multiple lines of defense, saying that Android did not infringe on Oracle's patents or copyright, that Oracle's patents were invalid, and several other defenses. They said that Android is based on [Apache Harmony](http://en.wikipedia.org/wiki/Apache_Harmony), a [clean room](http://en.wikipedia.org/wiki/Clean_room_design) implementation of the Java class libraries, and an independently developed virtual machine called [Dalvik](http://en.wikipedia.org/wiki/Dalvik_%28software%29%22%20%5Co%20%22Dalvik%20%28software%29).

The [Free Software Foundation](http://en.wikipedia.org/wiki/Free_Software_Foundation) has called this suit a "clear attack against someone's freedom to use, share, modify, and redistribute software."[[174]](http://en.wikipedia.org/wiki/Android_%28operating_system%29#cite_note-ogfsf-173) However, the FSF also criticized Google, saying that Google could have avoided the suit by building Android on top of [IcedTea](http://en.wikipedia.org/wiki/IcedTea%22%20%5Co%20%22IcedTea), whose [GPL license](http://en.wikipedia.org/wiki/GPL_license) provides some protection against patents, instead of implementing it independently under the [Apache License](http://en.wikipedia.org/wiki/Apache_License). The FSF wrote "It's sad to see that Google apparently shunned those protections in order to make proprietary software development easier on Android." and remarked that Google had not taken any clear position or action against software patents.