

Android (operating system)

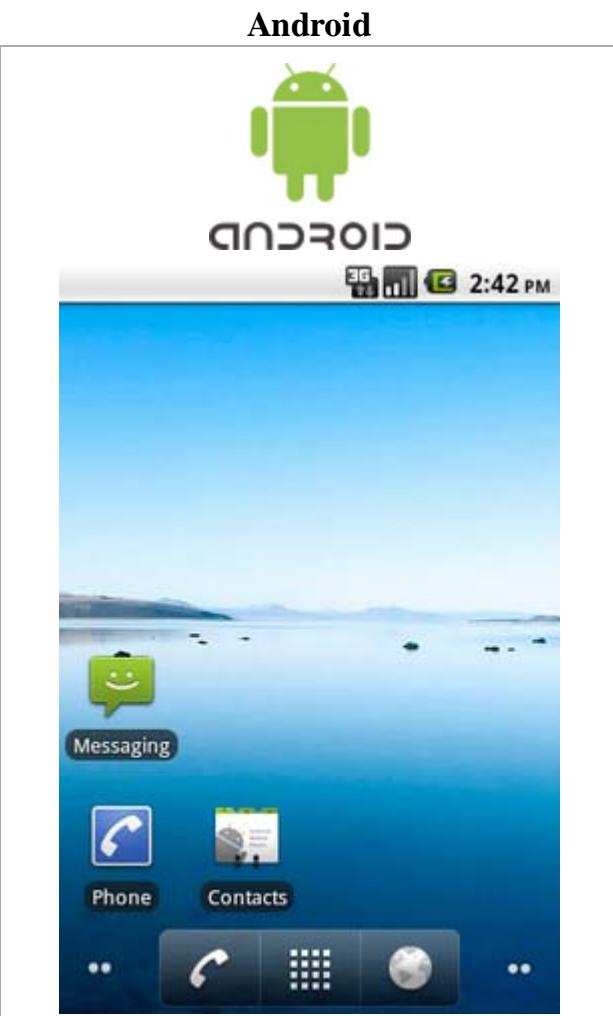
From Wikipedia, the free encyclopedia

Android is a mobile operating system developed by Google and is based upon a modified version of the Linux kernel. It was initially developed by Android Inc. (a firm purchased by Google) and later positioned in the Open Handset Alliance.^[4] According to NPD Group, unit sales for Android OS smartphones ranked first among all smartphone OS handsets sold in the U.S. in the second quarter of 2010, at 33%.^{[5][6]} BlackBerry OS is second at 28%, and iOS is ranked third with 22%.^[7]

Android has a large community of developers writing application programs (*apps*) that extend the functionality of the devices. There are currently over 70,000 apps available for Android with some estimates saying 100,000 have been submitted,^[8] which makes it the second most popular mobile development environment.^[9] Developers write managed code in the Java language, controlling the device via Google-developed Java libraries.^[10]

The unveiling of the Android distribution on 5 November 2007 was announced with the founding of the Open Handset Alliance, a consortium of 78 hardware, software, and telecom companies devoted to advancing open standards for mobile devices.^{[11][12]} Google released most of the Android code under the Apache License, a free software and open source license.^[13]

The Android operating system software stack consists of Java applications running on a Java based object oriented application framework on top of Java core libraries running on a Dalvik virtual machine featuring JIT compilation. Libraries written in C include the surface manager, OpenCore^[14] media framework, SQLite relational database management system, OpenGL ES 2.0 3D graphics API, WebKit layout engine, SGL graphics engine, SSL, and Bionic libc. The Android operating system consists of 12 million lines of code including 3 million lines of XML, 2.8 million lines of C, 2.1 million lines of Java, and 1.75 million lines of C++.^[15]



Android 2.2

Company / developer	Google Inc., Open Handset Alliance
Programmed in	C (core), ^[1] C++ (some third party libraries), Java (UI)
Working state	Current
Source model	Free and open source software
Initial release	21 October 2008
Latest stable release	2.2.1 (Froyo) / 23 September 2010 ^[2]
Supported platforms	ARM, MIPS, Power Architecture, x86

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Kernel type	Monolithic (modified Linux kernel)
Default user interface	Graphical
License	Apache 2.0 and GPLv2 ^[3]
Official website	android.com (http://www.android.com/)

History

Acquisition by Google

In July 2005, Google acquired Android, Inc., a small startup company based in Palo Alto, California, USA.^[16] Android's co-founders who went to work at Google included Andy Rubin (co-founder of Danger),^[17] Rich Miner (co-founder of Wildfire Communications, Inc.),^[18] Nick Sears (once VP at T-Mobile),^[19] and Chris White (headed design and interface development at WebTV).^[20] At the time, little was known about the

functions of Android, Inc. other than that they made software for mobile phones.^[16] This began rumors that Google was planning to enter the mobile phone market.

At Google, the team led by Rubin developed a mobile device platform powered by the Linux kernel which they marketed to handset makers and carriers on the premise of providing a flexible, upgradable system. It was reported that Google had already 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.^{[21][22][23]} More speculation that Google would be entering the mobile-phone market came in December 2006.^[24] Reports from the BBC and *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.^[25] More speculation followed reporting that as Google was defining technical specifications, it was showing prototypes to cell phone manufacturers and network operators.

In September 2007, *InformationWeek* covered an Evalueserve study reporting that Google had filed several patent applications in the area of mobile telephony.^{[26][27]}

Open Handset Alliance

Main article: Open Handset Alliance

On the 5th of November 2007, the Open Handset Alliance, a consortium of several companies which include Texas Instruments, Broadcom Corporation, Google, HTC, Intel, LG, Marvell Technology Group, Motorola, Nvidia, Qualcomm, Samsung Electronics, Sprint Nextel and T-Mobile was unveiled with the goal to develop open standards for mobile devices.^[4] Along with the formation of the Open Handset Alliance, the OHA also unveiled their first product, Android, a mobile device platform built on the Linux kernel version 2.6.^[4]

"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, *Google Chairman/CEO*^[4]

On 9 December 2008, it was announced that 14 new members would be joining the Android project, including PacketVideo, ARM Holdings, Atheros Communications, Asustek Computer Inc, Garmin Ltd, Softbank, Sony Ericsson, Toshiba Corp, and Vodafone Group Plc.^{[28][29]}

Licensing

With the exception of brief update periods, Android has been available as open source since 21 October 2008. Google published the entire source code (including network and telephony stacks)^[30] under an Apache License.^[31]

With the Apache License, vendors can add proprietary extensions without submitting those back to the open source community.

Update history

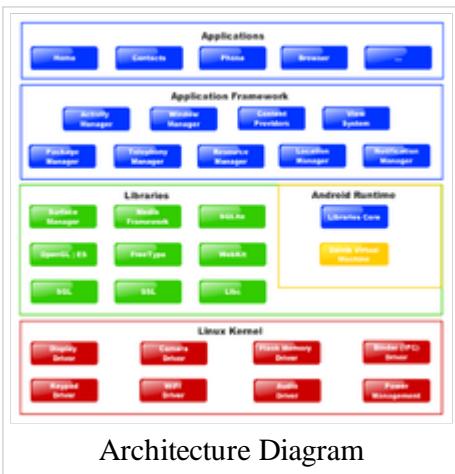
Android has seen a number of updates since its original release. These updates to the base operating system typically fix bugs and add new features. And generally, each update to the Android operating system is developed under a code name based on a dessert item.

1.1	Released 9 February 2009
1.5 (Cupcake) Based on Linux Kernel 2.6.27	<p>On 30 April 2009, the official 1.5 (Cupcake) update for Android was released.^{[32][33]} There were several new features and UI updates included in the 1.5 update:^[34]</p> <ul style="list-style-type: none"> ■ Ability to record and watch videos through camcorder mode ■ Uploading videos to YouTube and pictures to Picasa directly from the phone ■ A new soft-keyboard with text-prediction ■ Bluetooth A2DP and AVRCP support ■ Ability to automatically connect to a Bluetooth headset within a certain distance ■ New widgets and folders that can populate the Home screens ■ Animated screen transitions
1.6 (Donut) Based on Linux Kernel 2.6.29^[35]	<p>On 15 September 2009, the 1.6 (Donut) SDK was released.^{[36][37]} Included in the update were:^[35]</p> <ul style="list-style-type: none"> ■ An improved Android Market experience ■ An integrated camera, camcorder, and gallery interface ■ Gallery now enables users to select multiple photos for deletion ■ Updated Voice Search, with faster response and deeper integration with native applications, including the ability to dial contacts ■ Updated search experience to allow searching bookmarks, history, contacts, and the web from the home screen ■ Updated technology support for CDMA/EVDO, 802.1x, VPNs, and a text-to-speech engine ■ Support for WVGA screen resolutions ■ Speed improvements in searching and camera applications ■ Gesture framework and GestureBuilder development tool
Features	<p>On 26 October 2009 the 2.0 (Eclair) SDK was released.^[39] Among the changes were:^[40]</p> <p>Current features and specifications:</p> <ul style="list-style-type: none"> ■ Optimized hardware speed ■ Support for more screen sizes and resolutions ■ Revamped UI^[61]^{[62][63]} ■ New Browser UI and HTML5 support ■ New contact lists ■ Better contrast ratio for backgrounds ■ Improved Google Maps 3.1.2 ■ Microsoft Exchange support ■ Built in flash support for Camera ■ Digital Zoom ■ MotionEvent class enhanced to track multi-touch events^[41] ■ Improved virtual keyboard ■ Bluetooth 2.1 ■ Live Wallpapers
2.0/2.1 (Eclair) Based on Linux Kernel 2.6.29^[38]	<p>The 2.0.1 SDK was released on 3 December 2009.^[42]</p> <p>The 2.1 SDK was released on 12 January 2010.^[43]</p>

Handset layouts	The platform is adaptable to larger, VGA, 2D graphics library, 3D graphics library based on OpenGL ES 2.0 specifications, and traditional smartphone layouts.
Storage	SQLite, a lightweight relational database, is used for data storage purposes
Connectivity	Android supports connectivity technologies including GSM/EDGE, IDEN, CDMA, EV-DO, UMTS, Bluetooth, Wi-Fi, and WiMAX.
Messaging	SMS and MMS are available forms of messaging, including threaded text messaging and now Android Cloud to Device Messaging Framework (C2DM) is also a part of Android Push Messaging service.
Web browser	The web browser available in Android is based on the open-source WebKit layout engine, coupled with Chrome's V8 JavaScript engine. The browser scores a 93/100 on the Acid3 Test.
Java support	While Android applications are written in Java, there's no Java Virtual Machine in the platform and Java byte code is not executed. Java classes get recompiled into Dalvik executable and run on Dalvik virtual machine. Dalvik is a specialized virtual machine designed specifically for Android and optimized for battery-powered mobile devices with limited memory and CPU. J2ME support can be provided via third-part-application such as the J2ME MIDP Runner. ^[64]
Media support	Android supports the following audio/video/still media formats: H.263, H.264 (in 3GP or MP4 container), MPEG-4 SP, AMR, AMR-WB (in 3GP container), AAC, HE-AAC (in MP4 or 3GP container), MP3, MIDI, Ogg Vorbis, WAV, JPEG, PNG, GIF, BMP. ^[63]
Streaming media support	RTP/RTSP streaming (3GPP PSS, ISMA), HTML progressive download (HTML5 <video> tag). Adobe Flash Streaming (RTMP) is supported through Adobe Flash Player plugin. Apple HTTP Live Streaming is supported through third party media player (Nextreaming NexPlayer). Microsoft Smooth Streaming is planned to be supported through the awaited port of Silverlight plugin to Android. Adobe Flash HTTP Dynamic Streaming is planned to be supported through an upgrade of the Flash plugin.
Additional hardware support	Android can use video/still cameras, touchscreens, GPS, accelerometers, gyroscopes, magnetometers, proximity and pressure sensors, thermometers, accelerated 2D bit blits (with hardware orientation, scaling, pixel format conversion) and accelerated 3D



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



Architecture Diagram

	graphics.
Development environment	Includes a device emulator, tools for debugging, memory and performance profiling, and a plugin for the Eclipse IDE.
Market	Like many phone-based application stores, the Android Market is a catalog of applications that can be downloaded and installed to target hardware over-the-air, without the use of a PC. Originally only free applications were supported. Paid-for applications have been available on the Android Market in the United States since 19 February 2009. ^[65] The Android Market has been expanding rapidly. As of August 3, 2010, it had over 100,000 Android applications for download. ^[66] There are other markets, such as SlideME and Getjar, but Google's Android Market is the only one whose downloader is installed on every Google Android phone.
Multi-touch	Android has native support for multi-touch which was initially made available in handsets such as the HTC Hero. The feature was originally disabled at the kernel level (possibly to avoid infringing Apple's patents on touch-screen technology). ^[67] Google has since released an update for the Nexus One and the Motorola Droid which enables multi-touch natively. ^[68]
Bluetooth	Support for A2DP and AVRCP were added in version 1.5; ^[34] sending files (OPP) and accessing the phone book (PBAP) were added in version 2.0; ^[40] and voice dialing and sending contacts between phones were added in version 2.2. ^[47]
Videocalling	Only supported handsets with a front facing camera support videocalling (like the Samsung i9000 Galaxy S).
Multitasking	Multitasking of applications is available. ^[69]
Voice based features	Google search through Voice is available as Search Input since initial release. ^[70] Also launched Voice actions supported on Android 2.2 onwards.
Tethering	Android supports tethering, which allows a phone to be used as a wireless/wired hotspot (All 2.2 Froyo phones, unofficial on phones running 1.6 or higher via applications available in the Android Market, e.g. PdaNet). To allow a laptop to share the 3G connection on an Android phone software may need to be installed on both the phone and the laptop ^[71]

Hardware running Android

Main article: List of Android devices

The Android OS can be used to power cellphones, netbooks and tablet PCs, including the Dell Streak, Samsung Galaxy Tab and other devices.^{[72][73]}

The world's first TV running Android, called Scandinavia, has also been launched by the company People of Lava.^[74]

The first commercially available phone to run the Android operating system was the HTC Dream, released on 22 October 2008.^[75]

Software development

The early feedback on developing applications for the Android platform was mixed.^[76] 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.)^[77] 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.*"^[78] Despite this, Android-targeted applications began to appear the week after the platform was announced. The first publicly available application was the Snake game.^{[79][80]} The Android Dev Phone is a SIM-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.

Software development kit

The Android SDK includes a comprehensive set of development tools.^[81] These include a debugger, libraries, a handset emulator (based on QEMU), documentation, sample code, and tutorials. Currently supported development platforms include x86-architecture computers running Linux (any modern desktop Linux distribution), Mac OS X 10.4.8 or later, Windows XP or Vista. Requirements also include Java Development Kit, Apache Ant, and Python 2.2 or later. The officially supported integrated development environment (IDE) is Eclipse (3.2 or later) using the Android Development Tools (ADT) Plugin, though developers may use any text editor to edit Java and XML files then use command line tools to create, build and debug Android applications as well as control attached Android devices (e.g., triggering a reboot, installing software package(s) remotely).^[82]

A preview release of the Android software development kit (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) has led to widely reported frustration within the Android developer community.^[83]



Early Android device.

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.^[84] On 23 September 2008 the Android 1.0 SDK (Release 1) was released.^[85] 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.

On 9 March 2009, Google released version 1.1 for the Android dev phone. While there are a few aesthetic updates, a few crucial updates include support for "search by voice, priced applications, alarm clock fixes, sending gmail freeze fix, fixes mail notifications and refreshing intervals, and now the maps show business reviews". Another important update is that Dev phones can now access paid applications and developers can now see them on the Android Market.^[86]

In the middle of May 2009, Google released version 1.5 (Cupcake) of the Android OS and SDK. This update included many new features including video recording, support for the stereo Bluetooth profile, a customizable onscreen keyboard system and voice recognition. This release also opened up the AppWidget framework to third party developers allowing anyone to create their own home screen widgets.^[87]

In September 2009 the "Donut" version (1.6) was released which featured better search, battery usage indicator and VPN control applet. New platform technologies included Text to Speech engine (not available on all phones), Gestures & Accessibility framework.^[88]

Android Applications are packaged in .apk format and stored under /data/app folder on the Android OS. The user can run the command adb root to access this folder as only the root has permissions to access this folder.

App Inventor for Android

On July 12, 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.^[89] "We could only have done this because Android's architecture is so open," said the project director, MIT's Hal Abelson.^[90] Under development for over a year,^[91] the block-editing tool has been taught to non-majors in computer science at Harvard, MIT, Wellsley, 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.^{[92][93]}

Android Developer Challenge

Main article: 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, 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 fund further development.^{[94][95]} It ended in early September with the announcement of ten teams that received \$275,000 each, and ten teams that received \$100,000 each.^[96] ADC II was announced on 27 May 2009.^[97] The first round of the ADC II closed on 6 October 2009.^[98] 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.^{[99][100]}

Google applications

Google has also participated in the Android Market by offering several applications for its services. These applications include 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 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 mid August 2010 Google launched "Voice Actions for Android"^[101], an innovative feature to its set of applications. The application listens to users voice commands and does actions like search, writing text message, email or call a friend. It also allows for writing text directly by speaking to the phone. The objective is to reduce the typing hassles on touch phones. Whats more, Google is actively participating in the application building, encouraging developers to build high quality and innovative apps.

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. Notable applications that have been converted to the Android operating system include Shazam, Doodle Jump, and WeatherBug.

The Android operating system has grown significantly, and a lot of the most popular internet sites and services have created native applications. These include MySpace, Facebook, and Twitter.

As of 15 July 2010, the Android Marketplace had over 70,000 applications, with over 1 billion downloads.
[102][103]

Languages (locales)

The locales for Android are:

(from Android 2.2)

- Chinese, People's Republic of China (zh_CN)
- Chinese, Taiwan (zh_TW)
- Czech (cs_CZ)
- Dutch, Netherlands (nl_NL)
- Dutch, Belgium (nl_BE)
- English, United States (en_US)
- English, Britain (en_GB)
- English, Canada (en_CA)
- English, Australia (en_AU)
- English, New Zealand (en_NZ)
- English, Singapore(en_SG)
- French, France (fr_FR)
- French, Belgium (fr_BE)
- French, Canada (fr_CA)

- French, Switzerland (fr_CH)
- German, Germany (de_DE)
- German, Austria (de_AT)
- German, Switzerland (de_CH)
- German, Liechtenstein (de_LI)
- Italian, Italy (it_IT)
- Italian, Switzerland (it_CH)
- Norwegian
- Japanese (ja_JP)
- Korean (ko_KR)
- Polish (pl_PL)
- Russian (ru_RU)
- Spanish (es_ES)^[104]

Native code

Libraries written in C and other languages can be compiled to ARM native code and installed using the Android 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.^{[105][106]}

Complete applications can be compiled and installed using traditional development tools.^[107] The ADB debugger gives a root shell under the Android Emulator which allows native ARM code to be uploaded and executed. ARM code can be compiled using GCC on a standard PC.^[107] Running native code is complicated by the fact that Android uses a non-standard C library (libc, known as Bionic). The underlying graphics device is available as a framebuffer at `/dev/graphics/fb0`.^[108] The graphics library that Android uses to arbitrate and control access to this device is called the Skia Graphics Library (SGL), and it has been released under an open source license.^[109] Skia has backends for both win32 and Unix, allowing the development of cross-platform applications, and it is the graphics engine underlying the Google Chrome web browser.^[110]

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 lossless audio support and the ability to store downloaded applications on the microSD card.^[111] This usually involves rooting the device. Rooting lets users load modified firmwares allowing users of older phones to use applications available only on newer releases.^[112]

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 and VillainROM are two examples of such firmware.

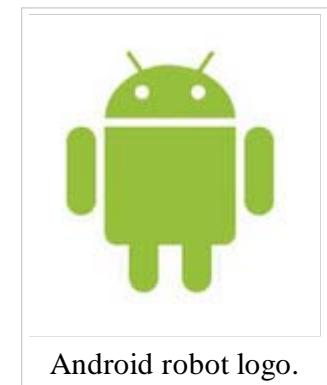
On 24 September 2009, Google issued a cease and desist letter^[113] to the modder Cyanogen, citing issues with the re-distribution of Google's closed-source applications^[114] within the custom firmware. Even though most of Android OS is open source, phones come packaged with closed-source Google applications 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.^[115]

Marketing

Logos

The Android logo was designed with the Droid font family made by Ascender Corporation.^[116]

Android Green is the color of the Android Robot that represents the Android operating system. The print color is PMS 376C and the RGB color value in hexadecimal is #A4C639, as specified by the Android Brand Guidelines.^[117]



Android robot logo.

Typeface

The custom typeface of Android is called Norad, only used in the text logo.^[118]



Market share

Research company Canalys estimates that by Q2 2009, Android had a 2.8% share of the worldwide smartphone market.^[119] By the following quarter (Q3 2009), Android's market share had grown to 3.5%.^[120]

In February 2010 ComScore ranked the Android platform as obtaining a 9.0% of the smartphone platform marketshare. This figure was up from an earlier estimate of 5.2% stated in November 2009.^[121] In July 2010 ComScore revised Android's share for 3 months March/April/May 2010 to 13.0%, an increase of 4 percentage points, 0.2 percentage points behind Microsoft whose share had dropped 1.9%.^[122]

In October 2009, Gartner Inc. predicted that by 2012, Android would become the world's second most popular smartphone platform, behind Nokia's Symbian OS, which is very popular outside the US. Meanwhile, BlackBerry would fall from 2nd to 5th place, iPhone would remain in 3rd place, and Microsoft's Windows Mobile would remain in 4th place.^[123]

Analytics firm Flurry estimates that 250,000 Motorola Droid phones were sold in the United States during the phone's first week in stores.^[124]

In May 2010, Android's first quarter US sales surpassed that of the rival iPhone platform. According to a report by the NPD group, Android achieved 28% smartphone sales in the US market, up 8% from the December quarter. In the second quarter, Apple's iOS was up by 1 %, indicating that Android is taking market share mainly from RIM, and still has to compete with heavy consumer demand for new competitor offerings.^[5] Furthermore, analysts point to advantages that Android has as multi-channel, multi-carrier OS, which has allowed it to duplicate the quick success of Microsoft's Window's Mobile.^[125]

According to an interview with Eric Schmidt in *The Guardian*, Android is getting 160,000 new users per day (end June 2010) up from 100,000 per day in May 2010.^[126]

As of August 4, 2010 Google is now activating 200,000 new phones to the Android platform per day according to Eric Schmidt.^[127]

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.^[128]

Here are the 20 new countries that are now allowed to sell apps:

- Argentina
- Australia
- Belgium
- Brazil
- Canada
- Denmark
- Finland
- Hong Kong
- Ireland
- Israel
- Mexico
- New Zealand
- Norway
- Portugal
- Russia
- Singapore
- South Korea
- Sweden
- Switzerland
- Taiwan

And, here are the 18 new countries that will soon be able to buy them:

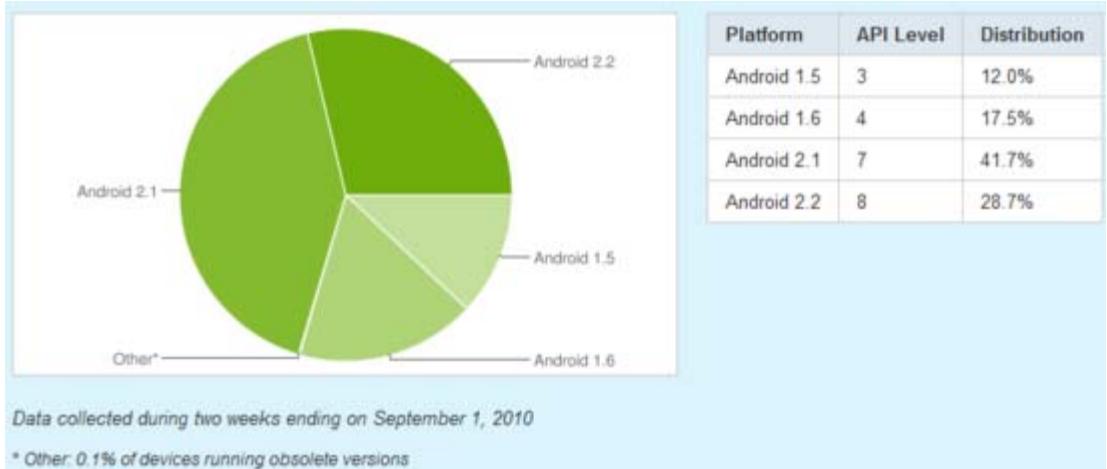
- Argentina
- Belgium
- Brazil
- Czech Republic
- Denmark
- Finland
- Hong Kong
- India
- Ireland
- Israel
- Mexico
- Norway
- Poland
- Portugal
- Russia
- Singapore
- Sweden
- Taiwan

[129]

Android OS usage share

[130]

- Android 2.1 (Eclair) - 40.4%
- Android 2.2 (Froyo) - 33.4%
- Android 1.6 (Donut) - 16.4%
- Android 1.5 (Cupcake) - 9.7%



Restrictions and issues

Google tracks issues and feature requests publicly at Google Code's site.^[131]

Linux compatibility

- Android's kernel was derived from Linux but has been tweaked by Google outside the main Linux kernel tree.^[132] Android does not have a native X Window System nor does it support the full set of standard GNU libraries and this makes it difficult to port existing GNU/Linux applications or libraries to Android.^[133] However, support for the X Window System is possible.^[134]
- Google no longer maintains the code they previously contributed to the Linux kernel as part of their Android effort, effectively branching kernel code in their own tree, separating their code from Linux.^{[135][136][137]} This was due to a disagreement about new features Google felt were necessary. The code which is no longer maintained was deleted in January 2010 from the Linux codebase.^[138] However, Google announced in April 2010 that they will employ staff to work with the Linux kernel community.^[139]

Networking issues

- Support for setting up a network proxy configuration for WiFi connections is not available.^[140]
- Support for setting up a network proxy configuration for APN (i.e. GSM/EDGE) connections is not available.^[141]
- Android doesn't natively support EAP extensions configuration.^[142]
- Android does not support Cisco-compatible IPsec virtual private networks (Layer 2 Tunneling Protocol is supported).^[143]

Issues concerning application development

- Android does not use established Java standards, i.e. Java SE and 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.^[144] However, the Myriad Group claim that their new J2Android tool can convert Java MIDlets into Android applications.^{[145][146][147]}

- 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,^{[148][149]} especially the different resolution ratios in use among various Android phones.^[150] Such problems were poignantly brought into focus as they were encountered during the ADC2 contest.^[151]
- 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.^{[152][153][154][155]} As of August 2010, 64% of Android phones run the 2.x versions, and 36% still run the 1.5 and 1.6 versions^[156]
- Older versions of Android do not readily support Bluetooth file exchange,^[157] although it may still be achieved with some hacking.^[158] Bluetooth is supported by more recent phones.^[159]
- Android does not support video calls as do other mobile operating systems, such as Apple's iOS, Symbian OS, and Windows Mobile, although third-party applications like Qik allow video calling over Internet on some models, and video broadcasting on others.^[160]

Protocols

- In version 2.2 the rSAP protocol is missing which many vehicles use for handsfree.^[161]

Time zones

Using the native Google Calendar functionality for Android phones, an Android device user runs into the same limitations that exist in the Calendar application. The most noticeable defect is the lack of proper time zone support: it is not possible to set the time zone for start/end times of events.^{[162][163][164]} Because of this issue, some users experience difficulty while traveling with Android devices.^[165]

Claimed infringement of copyrights and patents

See also: Java applet#The 2010 Oracle - Google lawsuit

On the 12th of August 2010, Oracle, owner of Java since it acquired 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."^[166] Oracle has named Boies, Schiller & Flexner as part of its legal team.^[167]

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] 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 best known as the father of the Java programming language.^[169]

According to Gartner analyst Ken Dulaney, Android is based on a clean room reverse-engineered version of Java, called Dalvik, which was developed without using any Sun technology or intellectual property. Oracle says Dalvik is a competitor to Java and infringes several of its patents, which are listed in the complaint, and its Java copyright.^{[166][170]} While officially claiming that "Android is not Java", Google at the same time calls the suit "attack on Java community"^[171], likely making difference between "official Java" and "Java in general".

Unicode

As of the 2.2 release, Android does not have full Unicode support. Developers are reporting rendering issues, support for conjunct consonants, etc.^[172]

See also

- Android (disambiguation)
- Android Market
- BlackBerry OS
- Dalvik virtual machine
- Chromium OS
- Google Chrome OS
- iOS
- LiMo Foundation
- Linux Phone Standards Forum
- List of Android devices
- List of Android OS-related topics
- List of Android Permissions
- List of Open Source Android Applications
- Maemo
- MeeGo
- Nexus One
- Goobuntu
- Samsung's Bada OS
- Mobile World Congress
- Mobilinux
- Moblin project
- OPhone
- Open Mobile Alliance
- Openmoko
- Palm, Inc.'s webOS
- Symbian Foundation
- Windows Mobile
- Windows Phone 7
- Google TV
- Droid (from Motorola)
- Triad Method
- VillainROM

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External links

- Official Android page (<http://www.android.com/>)
 - Android Open Source Project (<http://source.android.com/>)
 - Android Market (<http://www.android.com/market>)
 - Android Developers (<http://developer.android.com/>)
 - Android Developers Blog (<http://android-developers.blogspot.com/>)
 - Android Brand Guidelines (<http://www.android.com/branding/>)
- Google Projects for Android (<http://code.google.com/android>) from Google Code
- Android Wiki (<http://www.androidwiki.com/>)
- Sergey Brin introduces the Android platform (<http://www.youtube.com/watch?v=1FJHYqE0RDg>) at YouTube
- Android: Building a Mobile Platform to Change the Industry (<http://www.stanford.edu/class/ee380/Abstracts/071128.html>) — lecture given by Google Mobile Platforms Manager, Richard Miner at Stanford University (video archive (<http://ee380.stanford.edu/cgi-bin/videologger.php?target=071128-ee380-300.aspx>)).
- Android (operating system) (<http://www.dmoz.org/Computers/Systems/Handhelds/Android/>) at the Open Directory Project

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