Android is an open source and Linux-based operating system for mobile devices such as smartphones and tablet computers.

Android is a complete set of software for mobile devices such as tablet computers, notebooks, smartphones, electronic book readers, set-top boxes etc.

It contains a **linux-based Operating System**, **middleware** and **key mobile applications**.

It can be thought of as a mobile operating system. But it is not limited to mobile only. It is currently used in various devices such as mobiles, tablets, televisions etc.

It is developed by Google and later the OHA (Open Handset Alliance). Java language is mainly used to write the android code even though other languages can be used.

The goal of android project is to create a successful real-world product that improves the mobile experience for end users.

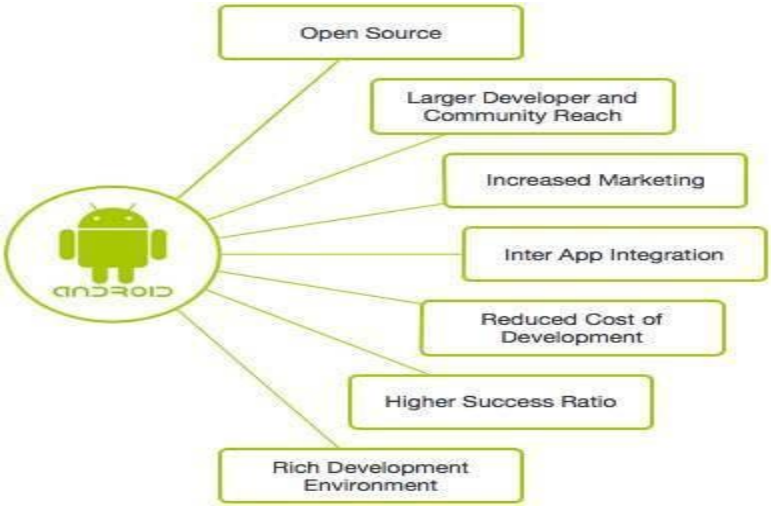
What is Open Handset Alliance (OHA)

It's a consortium of 84 companies such as google, samsung, AKM, synaptics, KDDI, Garmin, Teleca, Ebay, Intel etc.

It was established on 5th November, 2007, led by Google. It is committed to advance open standards, provide services and deploy handsets using the Android Platform.

The first beta version of the Android Software Development Kit (SDK) was released by Google in 2007 where as the first commercial version, Android 1.0, was released in September 2008.

Why Android ?



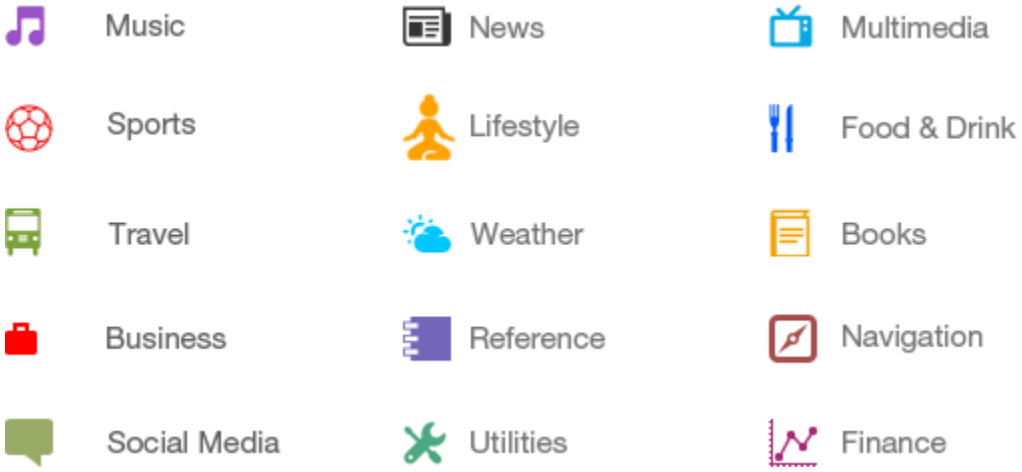
Features of Android

Android is a powerful operating system competing with Apple 4GS and supports great features. Few of them are listed below –

Beautiful UI
Android OS basic screen provides a beautiful and intuitive user interface.
Connectivity
GSM/EDGE, IDEN, CDMA, EV-DO, UMTS, Bluetooth, Wi-Fi, LTE, NFC and WiMAX.
Storage
SQLite, a lightweight relational database, is used for data storage purposes.
Media support
H.263, H.264, MPEG-4 SP, AMR, AMR-WB, AAC, HE-AAC, AAC 5.1, MP3, MIDI, Ogg Vorbis, WAV, JPEG, PNG, GIF, and BMP.
Messaging
SMS and MMS
Web browser
Based on the open-source WebKit layout engine, coupled with Chrome's V8 JavaScript engine supporting HTML5 and CSS3.
Multi-touch
Android has native support for multi-touch which was initially made available in handsets such as the HTC Hero.
Multi-tasking
User can jump from one task to another and same time various application can run simultaneously.
Resizable widgets
Widgets are resizable, so users can expand them to show more content or shrink them to save space.
Multi-Language
Supports single direction and bi-directional text.
GCM
Google Cloud Messaging (GCM) is a service that lets developers send short message data to their users on Android devices, without needing a proprietary sync solution.
Wi-Fi Direct
A technology that lets apps discover and pair directly, over a high-bandwidth peer-to-peer connection.
Android Beam
A popular NFC-based technology that lets users instantly share, just by touching two NFC-enabled phones together.

Categories of Android applications

There are many android applications in the market. The top categories are:



History of Android

Android Version 1 Series

Android 1.0 (API 1) and 1.1 (API 2)

Android 1.0 (API 1) was launched on the **23rd Of September 2008**. It was incorporated into the **HTC Dream smartphone** (aka T-mobile G1 in the US). It thus became the first-ever Android device. The features it offered included Google Maps, YouTube, an HTML browser, Gmail, camera, Bluetooth, Wi-Fi, and many more. The unique feature at that time was the presence of an Android Market (now Play Store) from where the users could download and update Android applications additional to what was already pre-installed. A few months later, in February 2009, Google released the Android 1.1 (API 2) update for HTC Dream. This time the aim was to make it more robust and user-friendly. There were four major updates in this version:

- Saving of attachments in messages
- Availability of details and reviews for businesses on Google Maps
- Longer in-call screen timeout by default while the speakerphone was in use along with the ability to toggle the dial-pad.
- Support was added for a marquee in the system layouts.

Android 1.5 (API 3) aka Cupcake

This version came up in **late April 2009** and was the first to have Google's dessert-themed naming scheme and be incorporated in the Samsung Galaxy phone series. It was introduced with a lot of functionalities that we take for granted today. These updates included new features and enhancements to the ones already present in the above versions, for example, some major updates included auto-rotation, third-party keyboard support, support for widgets, video recording, enabling copy-paste for browser, facility to upload videos on YouTube, check phone usage history, etc.

Android 1.6 (API 4) aka Donut

Just after a couple of months in **September 2009**, Donut was released. One of its most significant features was the inclusion of CDMA-based networks that made it possible for carriers across the globe to support it. Earlier only GSM technologies were in use. Other critical improvements such as support for devices having different screen sizes, quick search boxes and bookmarks on web

browsers, fuller integration of Gallery, Camera, and Camcorder with faster camera access, expansion of the Gesture framework, text-to-speech, etc. were too introduced in this update.

Android Version 2 Series

Android 2.0 (API 5), 2.0.1 (API 6), and 2.1 (API 7) aka Eclair

Almost after a year of the Version 1 release, Version 2.0 was launched in **October 2009**. Key highlights of this update included the introduction of navigation in Google Maps with voice guidance, support for adding multiple accounts in one device, display of live wallpapers, a lock screen with drag and drop unlocking functionality, additions to camera services such as Flash and digital zoom, the inclusion of smarter dictionary for virtual keyboards that learned through word usages, support for further more screen sizes, enhanced ability to track multi-touch events, better Calendar agenda, support for HTML 5 view and so on and so forth. Within three months of 2.0's release, 2.0.1 and 2.1 were released in Dec 2009 and Jan 2010, respectively. These releases majorly dealt with minor amendments to the API and other bug fixes.

Android 2.2 (API 8) aka Froyo

Froyo is actually a combination of the words, "frozen Yogurt". This version was launched in **May 2010**. Some of its most significant features included Wi-Fi mobile hotspot support, push notifications through Android Cloud to Device Messaging, enhancement of device security through PIN/ Password protection, Adobe Flash support, USB tethering functionality, update in Android Market application with the automatic update of apps features, support for Bluetooth enabled car, etc. The other versions 2.2.1, 2.2.2, and 2.2.3 were all in total about bug fixes and other security updates all released in 2011. The latest of them, i.e. 2.2.3 was published in **Nov 2011**.

Android 2.3 (API 9) aka Gingerbread

Gingerbread, released even before the later versions of Froyo, brought drastic changes to the look and feel of smartphones. The first phone to adopt this version was Nexus S, co-developed by Google and Samsung. In this version, the user interface design was updated to bring in more simplicity and speed. Support for extra-large screen sizes and resolutions was integrated. Support for NFC function, improved keyboard, enhanced support for multi-touch events, multiple cameras on the device including a front-facing camera, Enhanced copy/paste functionality were some other noteworthy features. Version 2.3.1 and 2.3.2 were released in **Dec 2010 and Jan 2011** respectively. They majorly carried improvements and bug fixes for the Nexus S.

Android Version 2.3.3 and further in the series Gingerbread (API 10).

Version 2.3.3 brought along some API improvements and bug fixes in Feb 2011. Further 2.3.4 in April the same year introduced support for voice and video chat using Google Talk. In this version, the default encryption for SSL was also changed from AES256-SHA to RC4-MD5. 2.3.5 and 2.3.6 were released dominantly with various kinds of bug fixes and improvements in July 2011 and Sept 2011 respectively. 2.3.7 got the Google wallet support for the Nexus S 4G in Sept 2011.

Android Version 3 Series

Android 3.0 (API 11) Honeycomb

In **Feb 2011**, Android 3.0 Honeycomb was released to be installed on tablets and phones with larger screens only and had functions that could not be managed on phones with smaller screens. The most important function brought by this version was to eliminate the need for the physical button and rather the introduction of virtual buttons for performing the start, back, and menu functions. This version was first launched along with the Motorola Xoom Tablet. Other refined UI advancements were made by adding a System Bar which resolved quicker access to notifications and status at the bottom. The inclusion of an Action Bar gave access to contextual options, navigation, widgets, and other types of content at the top of the screen. This version also **enabled switching between tasks/applications easier.** Another significant feature included the ability to encrypt all the user data.

Android 3.1 (API 12) Honeycomb

This version released in **May 2011** presented many other UI refinements. Its foremost feature was support for **joysticks, gamepads, external keyboards, and pointing devices**. It also had better connectivity for USB accessories.

Android 3.2 series Honeycomb (API 13)

Version 3.2 released in **July 2011**, mainly improved the hardware support and increased the ability of various applications to access files on the SD card. Some displays support functions were also upgraded in this update to control the variation of display appearances on different Android devices more precisely.

3.2.1 in **Sept 2011** brought in various bug fixes and minor security, Wi-Fi, and stability improvements. Some other updates were too made to Google Books, Adobe Flash, and Android Market.

On Aug 30, 2011, 3.2.2 and 3.2.3 were released, and in **Jan 2012**, 3.2.5 was published. All of them were majorly about bug fixes and other minor improvements for the Motorola Xoom and Motorola Xoom 4G.

In **Dec 2011**, the 3.2.4 version introduced the Pay As you Go feature for 3G and 4G tablets. And the last version of this series, 3.2.6, published in Feb 2012 fixed the data connectivity issues faced when disabling the Airplane mode on the US 4G Motorola Xoom.

Android Version 4 Series

Android 4.0 (API 14) Icecream Sandwich

Android 4.0 was released in **October 2011**. It was a combination of a lot of features of the Honeycomb Version and the Gingerbread. For the first time ever, the **Face Unlock feature for smartphones was introduced with 4.0**. Other prominent features included the possibility to monitor the use of mobile data and Wi-Fi, sliding gestures to reject notifications, tabs of a browser or even tasks, integration of screenshot capture using the Power and Volume button, real-time speech to text dictation, using certain apps without necessarily unlocking, pre-fed text responses to calls, and many more. Another important feature that greatly enhanced the accessibility of devices for the visually challenged people was a new explore-by-touch mode through which users could navigate through the screen with the help of audible feedback. This eliminated the need to actually view the device's screen. A lot of advanced camera capabilities were added in this version, including the Panorama mode. Live effects during the recording of videos were also introduced. The new technology of **Wi-Fi peer-to-peer (P2P)** that lets the users connect directly to nearby peer devices over Wi-Fi, without the need for internet or

tethering was also introduced with this version. Android 4.0.1 and 4.0.2 introduced in **October and November 2011 brought minor bug fixes to certain devices.**

Android 4.0.3 and 4.0.4 Ice Cream Sandwich (API 15)

4.0.3, released in **December 2011** brought various bug fixes, optimizations, and enhancements to certain functionalities including databases, Bluetooth, graphics, camera, Calendar provider. 4.0.4, released in **March 2012**, too brought minor improvements such as better camera performance and smoother screen rotation.

Android 4.1 (API 16), 4.2 (API 17), **and 4.3 (API 18) Jelly Bean**

Android 4.1 was the first version of **Jelly bean** and the fastest and smoothest by that time too. This version further enhanced the accessibility and extended assistance to international users by introducing Bi-directional text i.e. left to right or right to left scripts and support for various other international languages. From this version onwards, the notifications could be expanded, display a greater variety of content, present options for multiple actions, etc. User-installable keyboard maps were also introduced. Shortcuts and widgets can automatically be re-arranged or re-sized to allow new items to fit on home screens. **Android Beam, an NFC-based technology** could let users instantly share media, just by touching two NFC-enabled phones together.

Version 4.2 was launched in **Nov 2013**. This was a faster smoother and more responsive version. This was the first version to introduce the feature of one tablet, – many users through which multiple users could use the same device but still have a separate system environment for each user data. Other prominent incorporations included Widget support (display any kind of content on the lock screen, however it was removed again in 2014), Daydream feature which is an interactive screensaver mode that starts when a user's device is docked or charging, presentation functionality that let user represent a window for their app's content on a specific external display, Wi-Fi Display that let users connect to an external display over Wi-Fi on the supported devices and full native support for RTL.

Version 4.3 released in **July 2013** built further on the performance improvements already included in earlier versions of Jelly Bean. It introduced the platform support for **Khronos OpenGL ES 3.0,** which provided games and some other apps with the highest-performance 2D and 3D graphics capabilities on supported devices. This release further extended the multi-user feature for tablets, which made it even easier to manage users and their capabilities on a single device. Another prominent feature of this version would let apps observe the stream of notifications with the user's permission and then display them in any way they choose to. They could also send these notifications to nearby devices connected over Bluetooth.

Android 4.4 (API 19) Kitkat

The launch of Android 4.4 KitKat took place in **2013** and had many distinct features such as the blue accents found in Ice Cream Sandwich and Jelly Bean had turned whiter and many storage applications displayed lighter color schemes. With the 'Ok Google' command, a user could access Google at any time and could work on phones with a **minimum RAM memory of 512MB**. The phone app could automatically prioritize user's contacts based on the numbers most frequently contacted. Google Hangouts was introduced in this version that could keep all the user's SMS and MMS messages together in the same app. Emoji was made also available on Google Keyboard.

Android 4.4W (API 20) KitKat, with wearable extensions.

3 Versions of Android KitKat exclusive to Android Wear devices were released between **June 2014 to October 2014**. These were primarily designed for smartwatches and other wearables

and integrated with **Google Assistant technology** and mobile notifications features into a **smartwatch** form factor.

Android Version 5 Series

Android 5.0 (API 21) Lollipop

Android 5.0 was launched in **Nov 2014 with the Nexus 6 device**. It was the first to feature **Google's 'Material Design' Philosophy** which brought tremendous improvements to the UI Design, for example, the Vector drawables which could be scaled indefinitely without losing their definition were introduced. Other significant features included the replacement of **VM Dalvik** with Android Runtime that improved the app performance and responsiveness considerably as some of the processing power for applications could now be provided before they were opened. Support for Android TV was integrated that provided a complete TV platform for any app's big-screen experience. The navigation bar had been renewed making it more visible, accessible, and configurable. A/V sync was improved noticeably. Quite some new concepts too were implemented in this release such as the '**Document-centric apps**' that enabled users to take advantage of concurrent documents and provided them with instant access to their content/ services, 'Android in the workplace' that allowed apps in the launcher to display a Work badge over their icon which was an indication that a certain app and its data are administered inside of the work profile, and '**dumpsys batterystats**' command that would generate battery usage statistics and help the users understand system-wide power use.

Android 5.1 (API 21) Lollipop

This version of Android was launched in **March 2015**. Some notable features of the release included official support for multiple SIM cards, the Device protection policy that kept the device locked in case of theft/misplacement until the owner signs into their Google account, and the introduction of High-definition voice calls, available between compatible **4G LTE devices**.

Android Version 6.0 Marshmallow (API 23)

Android Marshmallow was launched in **October 2015** and it did bring along remarkable features such as support for **biometric fingerprint unlocking** and USB type C support, the introduction of Doze mode which reduced CPU speed while the display remains turned off to enhance the battery life, a search bar for easy access to applications and option to mark them as favorites, Android Pay, the introduction of the Memory Manager, Contextual search from keywords within apps, the possibility to set the volume for device, media, and alarms all separately, a refurbished vertically scrolling app drawer that could be accessed alphabetically, provisions for target-specific sharing between apps, MIDI support for musical instruments and a lot more. **Google Nexus 6P and Nexus 5X were the first devices to have android Marshmallow preinstalled.**

Android Version 7 Series

Android 7.0 (API 24) Nougat

In **August 2016**, Google released Android 7.0 Nougat. It presented improved multitasking features especially for devices with larger screens, for example, the **split-screen mode** was introduced along with provision for fast switching between applications. Other significant features included the integration of the Daydream virtual-reality platform and enhancement of the '**Doze now**' mode. More characteristics such as rearranging the Quick Setting tiles for faster

access, replying to conversations through notifications themselves, catching up with all the notifications from a specific app together through bundled notifications, limiting device data usage with Data Saver, and the possibility to change the size of the text as well as icons on the display screen were incorporated. Google Now was replaced with Google Assistant. The first phones to come with this version were **Google Pixel, Pixel XL, and LG V20**.

Android 7.1, 7.1.1 and 7.1.2 Nougat (API 25)

Android 7.1, released in **October 2016** majorly brought changes and updates to the existing features and the ones introduced in 7.0, however, one fascinating design idea portrayed in 7.1 was the **Circular app icon support**.

In 7.1.1, launched in **December 2016**, a new set of emojis with different skin tones and haircuts to existing ones were added. Moreover, it now became possible to send GIFs directly from the default keyboard.

In **April 2017,** 7.1.2 was published that brought in battery usage alerts.

Android Version 8 Series

Android 8.0 (API 26) Oreo

This version appeared in **Aug 2017** and brought a series of noteworthy changes to the existing ones. It turned out to be a more powerful and faster version as it had a **2x boot speed compared to Nougat** when tested on Pixel devices, according to a claim by Google. This version was smarter as well which was evident through the introduction of functionalities such as **Autofill**, **picture-in-picture mode (for example, the video calling window in WhatsApp while working with some other app)**, and the Notification dots through which user could quickly catch up with newer information. This update brought enhancements to the security aspect too by launching Google Play Protect that ensured the safety of the device and its data against misbehaving apps. Apart from these, attention was also driven towards visual details, e.g. the blob style for emojis was replaced with emojis that were consistent with other platforms, and Quick Settings and Settings were redesigned considerably.

Android 8.1.0 (API 27) Oreo

Android 8.1 released in **December 2017**, introduced a variety of new capabilities for users and developers. The most significant one for users was the development of Go Edition that provided configurations for **Memory optimizations**, Flexible targeting options (New hardware feature constants that let the users target the distribution of their apps to normal or low-RAM devices.), and Google Play Services. For Developers, a whole new bunch of APIs was added including the Neural Networks API, Shared memory API, and WallpaperColors API.

Android Version 9 Pie (API 28)

Android 9 was introduced in **August 2018**. It brought tremendous improvements to the visual aspect and made exceptional use of the power of artificial intelligence. The most noticeable ones included, replacement of traditional navigation buttons with an elongated button in the center that functioned as the new start button, swiping which up provided an overview of recently used applications, a search bar, and five application suggestions. Improvements were brought to the battery life, '**Shush**' was introduced that automatically put the phone in '**Do not Disturb**' mode by placing the phone face down, capabilities for adaptive Brightness and Battery were

embedded, provision to avail details of screentime to grab a better idea of how often and for what purposes the phone device was used was introduced.

Android Version 10 (API 29)

With Android 10 in **Sept 2019**, Google announced a rebranding of the operating system, eliminating the sweets-name based naming scheme that was being used for the earlier versions. With this version, a new logo and a different color scheme were announced. Facilities such as Live Captions for all media, smarter replies to text (automated text and actions suggestions), **'Focus mode'** to block out distractions by selecting certain apps to pause temporarily, replacement of navigation buttons with the use of gestures, availability of the dark mode at the system level, provision for more control over permissions for applications, the introduction of support for foldable smartphones with flexible displays, and capabilities to see device location, set screen time limits and have better parental control over children's content were embedded.

Android Version 11 (API 30)

Android 11 was recently released on the **8th of September 2020**. This version has come up with a tagline '**The OS that gets to what's important**' and it's pretty much justified. Android 11 brings along capabilities to control conversations across multiple messaging apps all in the same spot, it allows the user to digitally select priorities for people they are conversing with and then show the most important conversations at the top and on the lock screen. Another distinguishing feature is the chat bubbles (similar to the Facebook messenger) through which users can pin conversations from various messaging apps so they always appear on their screens. The built-in screen recording feature has been introduced finally that avoids the installation of an extra app to record the screen. Enhancements have been brought to the smart reply features and the voice access functionalities. One more captivating feature is the Device control capability that allows controlling all the connected devices from one place. Google play security has also been updated remarkably. **11 major versions have been launched by Android till date** and with each version, the OS promises to get better. Till the next release let's speculate what newer capabilities could an OS unleash!