



ANDROID AS OPEN SOURCE AND OPERATING SYSTEM

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ABSTRACT Android Operating System is developed by Google for smart phones and tablets. It is a Open source software. This paper is about Android as open source operating system and why various smart phone manufactures considered it as their main operating system. The android operating system is basically an operating system for mobiles and is rapidly gaining market share ,with dozens of smart phones and tablets either released or set to be released.

KEYWORDS [open source, operating systems, software]

INTRODUCTION

Open Source is a term used to describe something that may be improved upon, shared, and modified by anybody due to its open access to its design. Any computer user cannot access the source code, which is a section of the software that computer programmers can alter to alter how a programme or application functions. Programmers that use open source software can enhance their skills and experience, as well as their programmes by adding new features or resolving any areas that don't always function properly. Because early inventors constructed a large portion of the Internet itself using

ECONOMICS Although not all open source software is free for users, it is highly suggested for individuals who are not in the best financial shape. For the open source software they develop, contribute to, or change, some programmers charge a fee. Some open source programmers don't charge for their services because they wish to share their ideas or try to improve by asking for feedback or reports from the users.

open source, open source benefits both programmers and non-programmers. For a variety of reasons, including control, education, security, stability, and community, most people favour open source software over proprietary software.[1]

SECURITY Because anybody may examine, change, and update or upgrade it, they believe it to be more safe than proprietary software because they might potentially fix bugs without seeking permission from the program's original designers.

STABILITY programmers that depend on open source software for important jobs have the assurance that their tools won't vanish or deteriorate if their original developers cease working on them since programmers make the source code available to the public. Additionally, it has a propensity to adopt and implement open standards.

COMMUNITY A user and developer community always grows up around open source software. Many well-known apps are the focus of user groups, which spark interest in people's willingness to contribute ideas and offer their expertise in order to better the software they adore.

To distribute their source code, however, some programmers may require an open source licence if they intend to sell it.[2]

ABOUT ANDROID Android is a mobile operating system that was created specifically for touch-screen mobile devices like tablets and smart phones. It is based on a

modified version of the Linux kernel and other open source applications. The Open Handset Alliance, a consortium of developers, is creating Android with Google's financial support. It was introduced in 2007, and in September of that same year, its first Android-based product went on sale. The source code for Android, which is part of the Android Open Source Project (AOSP), is available for free and is distributed under the Apache License. The majority of Android devices come pre-installed with additional proprietary software called Google Mobile Service (GMS), which contains essential programmes like Google Chrome, the digital app store Google Play, and the Google Play Music app, comes pre-installed on the majority of Android smart phones. [3]

HISTORY In October 2003, Andy Rubin, Rich Miner, Nick Sears, and Chris White established Android Inc. in Palo Alto, California. An integrated digital camera operating system was the company's first goal, and this served as the basis for their investor presentation in April 2004. The Android project, according to Rubin, "has enormous promise in the development of smarter mobile devices that are more aware of their owner's location and preferences." In April 2013, the company arrived to the conclusion that the cameras market was insufficient for it to realise its goals. Five months later, it switched its efforts and unveiled Android as a smart phone operating system to take on Symbian and Microsoft Windows Phones.

Smartphone based on Android operating system

The HTC Dream, made by the device maker HTC, became the first commercially available smart phone using Android as its operating system on September 23, 2008. Within a year, Android has to contend with the Symbian Foundation and LiMo, two additional open source competitors that are also working on Linux-based mobile operating systems. Numerous upgrades have been made since 2008 to enhance the operating system, add new features, and address bugs. Each variant is named after a sweet food or dessert. Google stated that "Since these gadgets make our lives so sweet, each Android version is named after a dessert" at the 2013 launch of Android Kitkat. officially brand it with numbers in 2019. In order to build new devices and roll out updated Android versions, Google worked with a number of device manufacturers to launch the Nexus device series in 2010. Google introduced Android One in June 2014, allowing manufacturers of low-spec smart phones to simply produce higher-quality phones at a lower cost. The Pixel and Pixel XL smart phones were unveiled by Google in October 2016. They were positioned as the company's first smart phones and came with a limited number of software features, including the Google Assistant, before being made available to more users. When the latest generation of Pixel phones debuted in October 2017, they took the place of the Nexus series. Huawei, along with many other tech companies,

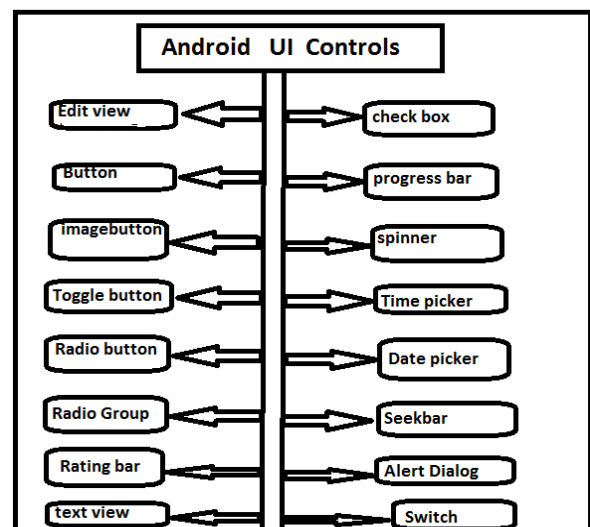
became dependent on access to the Android platform, and as a result, the operating system became involved in the Chinese-American trade war in May 2019. Huawei said in the summer of 2019 that Harmony OS, an alternative Android operating system, will be developed. [4]

METHOLOGY This paper based on qualitative research method, literature studies on Android as open source operating system and why various smart phone manufactures considered it as their main operating system.

FEATURES OF ANDROID

INTERFACE The virtual keyboard and touch actions like swiping, tapping, pinching, and reverse pinching are used in conjunction with the on-screen items' direct interaction in the basic user interface. Full-size physical keyboards and game controllers are also supported through Bluetooth or USB. Some applications make advantage of additional internal hardware, such as accelerometers, gyroscopes, and proximity sensors, to react to additional user actions. For instance, they might change the screen's orientation from portrait to landscape based on how the device is held. The user can drag an app from the list of installed ones to the home screen on the All Apps screen, which displays a list of all installed programmes. Customers can choose between recently used applications on a recent screen.

APPLICATION Android application are written using the Android Software Development Kit (SDK) like Android Studio which including set of development tools which make easy to developer to develop their programs, and, often, the Java and Kotlin programming language. It might be combined with C/C++ programming language, together with a choice of non-default runtimes that allow better C++ support. Due to the open nature of Android, a number of third-party application marketplaces and application also exist for Android.[5]



Android user interface

DEVELOPMENT Android is developed by Google until the latest updates are ready to be released, at some point the source code is made available to the an open source initiative led by Google, Android Open Source Project (AOSP). The AOSP code won't being modify or custom on Android Stock Device like Google Pixel series and Android One devices, but on original equipment manufacturers (OEMs), the source code will be customized to run on their device.

LINUX KERNEL The kernel is based on the Linux kernel's long-term support (LTS) branches. As of 2020, Android uses versions 4.4, 4.9 or 4.14 of the Linux kernel. The actual kernel depends on the individual device. The Android framework is based on the Linux kernel. The Android Runtime (ART), for example, relies on the Linux kernel for underlying functionalities like threading and low-level memory management. Using a Linux kernel helps Android to take advantage of core security features and encourages smart phone makers to build a well-known kernel's hardware drivers.[7]

HARDWARE ABSTRACTION LAYER (HAL) The Hardware abstraction layer (HAL) provides standard interfaces that expose the capabilities of device hardware to the Java API framework at the higher level. The HAL consists of several library modules, each of which implements an interface for a specific form of hardware device, such as the camera or the blue tooth module. The Android code loads the library module for that hardware part when a Platform API allows a request for application hardware to connect.

ANDROID RUNTIME For devices running Android version 5.0 (API level 21) or higher, each app runs its own Android Runtime (ART) instance, in its own process. ART is written to operate several virtual machines on low-memory devices by running DEX scripts, a Byte code format explicitly built for Android that is optimized for reduced memory footprint. Develop tool chains such as Jack, which can operate on the Android platform, compile Java sources into DEX byte code. Android also provides a collection of core runtime libraries to include most of the Java programming language's functionality, including some Java 8 language features used by the Java API application.

NATIVE C/C++ LIBRARIES Many core components and services of the Android system, such as ART and HAL, are built from native code, which require native libraries written in C and C++. The Android platform provides Java framework APIs to expose the functionality of some of these native libraries to apps. You may, for example, use OpenGL ES via the Java OpenGL API in the Android platform to add support for drawing and manipulating 2D and 3D graphics in your device.

JAVA API FRAMEWORK The entire Android OS feature set is accessible to you via Java language-written APIs. Such APIs are the building blocks for Android apps by simplifying the reuse of essential, modular framework components and services. Developers have full access to the same framework APIs that apps use for the Android system.

CONCLUSION Android is a much more diverse operating system than iOS and Windows Phone Mobile. Android has grown rapidly over the past 4 years becoming the most used smart phone operating system in the world. It's because Android doesn't release 1 phone from 1 company with 1 new OS every year, but countless phones from numerous companies, adding their own twist, throughout the year, developing gradually day-by-day. Android's ability to customize is unparalleled compared to Apple's and Microsoft's software allowing the user to change and customize nearly every aspect of Android which most iPhone and Windows Phone users wouldn't dream possible. It is not that Android is better or worse than one OS, but is unique and incomparable to other mobile operating systems. Some manufactures also will get hit with a lot of loss without Android as their operating system. [6]

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