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Android Application Development

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Abstract: ***Technology is being used and improved by human beings over a long period of time now and Smartphones is one of them. SmartPhones contain touch screen, built in keyboard, high resolution camera, front side camera for video conferencing, etc. They are used for making and receiving calls, sending and receiving messages, accessing the Internet, digital media, incorporating audio/video recording etc. Different smart phones have different operating systems and mobile applications are developed for each operating system insmart phones, tablet or mobile phones, in order to serve the needs of the user. These apps are either preinstalled or downloadable from online app market that can do almost everything. Apps make a mobile be like a portable computer having multi core processors, gigabytes of memory and a real operating system. Originally mobile apps were made available for only calling, messaging and informational purposes like calendar, weather forecast, e- mail, etc. With improvement in technology and increase in user demands, developers started making apps for other purposes like games, banking, video chats etc. Some appsare also used to present data in the same format as on a computer website and also allow you to download content that you can use when there is no Internet. There are many apps available in market today for different Operating Systems in which Android is having the maximum marketshare these days.***
Keywords: Smartphones, processors,memory, operating system, Internet, Android.

I. INTRODUCTION

The Android operating system is the most installed OS among various mobile platforms across the world. Millions of mobile devices are powered by Android. The company named Open Handset Alliance developed Android for the first time which is based on the modified version of the Linux kernel and other open-source software. Google sponsored the project at initial stages and in the year 2005 it acquired the whole company. In September 2008, the first Android-powered device was launched in themarket. Android dominates the mobile OSindustry because of the number of featuresit provides. It's user-friendly, has huge community support and provides a greater extent of customization. As a result, the market observed a sharp increase in the demand for developing Android mobile applications. At first, the purpose of Android was as a mobile operating system. However, with the advancementof code libraries and its popularity among developers Android became an absoluteset of software for all devices like tablets, wearables, set-top boxes, smart TVs, notebooks, etc.

II. FEATURES

Android is a powerful open-sourceoperating system that provides many features:

A. Android supports different types of wireless connectivity for GSM, CDMA, Wi-Fi, Bluetooth, etc. fortelephonic conversation or data transfer.
B. Using Wi-Fi technology, we can pair with other devices while playing games or use other applications.
C. It contains multiple ApplicationProgramming Interfaces to support location-tracking services such asGPS.
D. We can manage all data storage activities by using the File Manager.
E. It contains a wide range of media supports like AVI, MKV, MPEG4, etc.to play or record audio/video.
F. It also supports different image formatslike JPEG, PNG, GIF, BMP, etc.
G. Android supports multimediahardware control to perform playback or recording using a camera and microphone.
H. It has an integrated open-source Web Kit layout-based web browser to support User Interface like HTML5, CSS3.
I. It supports multi-tasking, which means we can run multiple applications at a time and can switch in between them.
J. It provides support for virtual reality.

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Fig.1: Features of Android

III. ADVANTAGES

Android operating system has many advantages.

A. Android is an open-source operatingsystem and hence possesses a large community for support.
B. The design of the Android Application has guidelines from Google, which becomes easier for developers to produce more instinctive user applications.
C. Fragmentation gives more advantage to Android Applications which means the application can run two activitieson a single screen.
D. Releasing Android application in theGoogle Play Store is easier ascompared to other platforms.

IV. DISADVANTAGES

Every technology has some pros and cons and so does Android.

A. Fragmentation provides a very innate approach for user experience but it has some drawbacks. The development team needs time to adjust with the various screen sizes of mobile smartphones that are available in the market and invoke the particular features in the application.
B. Android devices might vary broadly.So, testing of the application becomes more difficult.
C. As development and testing consumes more time, the cost of the application may increase, depending on the application's complexity and features.

V. ARCHITECTURE

Android operating system is a stack of software components which is roughly divided into five sections and four main layers.

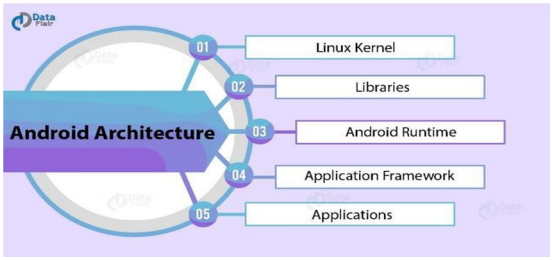


Fig.2: Android Architecture

A. Linux Kernel

Android was created on the open-source Linux kernel. One main reason for choosing this kernel was that it provides proven core features to develop the Android operating system. The features of Linux kernel are:

1) Security: It handles the security between the application and thesystem.
2) Memory Management: It handles the memory management thereby providing the freedom to develop our apps with efficiency.
3) Process Management: It manages the process properly, allocates resources toprocesses whenever they need them.
4) Network Stack: It handles the network communication effectively.
5) Driver Model: It ensures that the application works and hardwaremanufacturers can build their drivers into the Linux build.

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B. Android Libraries

Running on top of the kernel, the Android framework was developed with various features. It consists of various C/C++ core libraries and numerous open-source tools. Some of these are:

1) *The Android Runtime:* It consist of core libraries of Java and ART (the Android Run-Time). Older versions of Android had Dalvik runtime.
2) *Open GL (Graphics Library):* This cross-language, cross-platform API is used to produce 2D and 3D computer graphics.
3) *Web-Kit:* This open-source web browser engine provides all the functionality to display web content and to simplify loading of page.
4) *Media Frameworks:* These libraries allow you to play and record audiosand videos.
5) *Secure Socket Layer (SSL):* These libraries are used for Internet security.

C. Android Runtime

It is the third layer of the Android architecture. It provides for one of the key components which is called Dalvik VirtualMachine. It acts like Java Virtual Machine (JVM) which is designed especially for Android. Android uses its own custom Virtual Machine designed to ensure thatmultiple instances run efficiently on a single device.

The Dalvik Virtual Machine uses the device's underlying Linux kernel to handle low-level functionalities including security, threading and memorymanagement.

D. Application Framework

The Android team has built on a known setof proven libraries, built in thebackground, and all these are exposed through Android interfaces. These interfaces wrap up various libraries and make them useful for the Developer. They don't have to build the functionalities provided by the android. Some of theseinterfaces include:

1) *Activity Manager:* It manages the activity lifecycle and activity stack.
2) *Telephony Manager:* It providesaccess to telephonic services as related subscriber information, such as phonenumbers.
3) *View System:* It builds user interfaceby handling the views and layouts.
4) *Location Manager:* It helps in findingthe device's geographic location.

E. Applications

Android applications are found at the topmost layer. At application layer, we write our applications to be installed. For examples Games, Messages, Contacts,etc.

VI. APPLICATION-COMPONENTS

Application components are building blocks of an Android mobile application. These components are present in the AndroidManifest.xml file that describeseach component of the application and their interaction. There are four main components that are used within an Android application:



Fig.3: Android Application Components

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A. Activities

An activity represents a single screen with a user interface i.e., activity performs actions on the screen. For example, an email application might have one activity that shows a list of new emails, another activity to compose an email, and another activity for reading emails.

B. Services

Service is a component that runs in the background to execute lengthy operations. For example, a service is playing music in the background while the user is on a different application, or it may fetch data over the network without blocking userinteraction with an activity.

C. Broadcast Receivers

Broadcast Receivers handle and respond to broadcast messages from other applications or from the system. For example, the broadcast receiver will intercept the communication between applications where an application can initiate broadcasts to let other applications know that some data has been downloadedto the device and is available for use.

D. Content Providers

A content provider supplies data from one application to other on request. These requests are handled by the methods of the Content Resolver class. The data may be stored in the file system, database or somewhere else.

E. Additional Components

1) *Intents:* It is an inter-application message passing framework for communication between main Androidcomponents. It is also used for transferringdata between different Activities and tostart a new service and display a list of contacts in List View. For example – the camera application sends an intent to the android operating system when the usershares a picture.
2) *Widgets:* They are variations of Broadcast Receivers and essential aspects of home-screen customization. They are helpful in displaying data and allowing users to perform actions on them. There arevarious types of widgets:

a) *Information widget:* These widgetsdisplay important information and trackhow the information changes over time. Example – Clock widgets and weather and time widgets.
b) *Collection Widget:* They are a collection of information of the same type. It is used for browsing information and opening any one of the elements toview information. Example – music widgets where we can skip, pause and play music outside the music application.
c) *Control Widget:* These widgets displayfunctionalities where the user can trigger an activity from home screenwithout opening the application. Example – pausing and playing the video outside the application.
d) *Hybrid Widget:* This widget combinesfeatures of all the other three widgets. Example – music player widget is acontrol widget but it also informs the user about which track is being currently played. This means, it is a combination of control and informationwidget, thus it is termed as hybrid widget.

3) *Views:* It is responsible for drawing andevent handling. They are rectangular elements on the screen and some of them are EditText, ImageView Button,CheckBox and ImageButton.
4) *Notifications:* It is used to alert users when the application is not visible or is inactive. This alert flashes on the screen. Example – Notification of the new incoming messages is popped or flashes onthe screen.
5) *Fragments:* It is a portion of the total user interface. Users can combine morethan one fragment in a single activity and then they can be reused in multipleactivities. They contain Views and ViewGroups insidethem.
6) *Layout XML Files:* Layout XML File is the structure for the user interface in theapplication. XML files provide differenttypes of layouts for the different type of screens and it also specifies which GUIcomponent an activity or fragment holds.
7) *Resources:* They are used for defining Images, texts, string values. Everything is defined in the resource files and they can be referenced from within the source code.

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VII. FUTURE SCOPE

Smartphone production and usage has increased in the past few years. India stands second in the world, in the number of active smartphones. Today, out of the 6 billion smartphones used in the world, nearly 1 billion of them are being used in India. This is approximately 70% of our current population. Every month we witness an increase of around 6 million subscribers. This is a lot. With the increase in the number and making of smartphones, there comes a demand for better applications. And in turn, a huge scope of android application development. Now, this puts a light on why companies are going wild with their innovations – increase in the need and use of Mobile Applications.

Android is an open-source operating system with Linux based kernel designed mainly for smart phones and tablets. And is being maintained as an open-source project by Google. This open-source code and licensing allows the developers and manufacturers to modify the software according to their needs. Android platform has brought about cutting-edge technologies in application development. Owing to the popularity of Android, application development industries are considering Android Applicatio Development as one of the best business opportunities. The need to hire knowledgeable developers is intense.

One of the main reasons for this is that software as a service (SaaS) is very cost effective. Android, offers dynamic app development at a lower cost. Talking about the scope of Android Application Development, we can take these three primary notions into consideration:

1) *Revenue:* The need for inventive App Developers is increasing in the current scenario. Mobile application development can also be done as a part time job, where you can create your own applications and submit it to the Google Play Store which can be then downloaded. Google Ad Sense can be displayed in your application which also provides monetary gains.
2) *Ease of Use:* Learning Android Programming is fairly easy and developing application is cost effective. Any software developer who can think innovatively will be able to put Android into extraordinary use.
3) *Support:* The most important attraction of Android is that it is backed by Google.

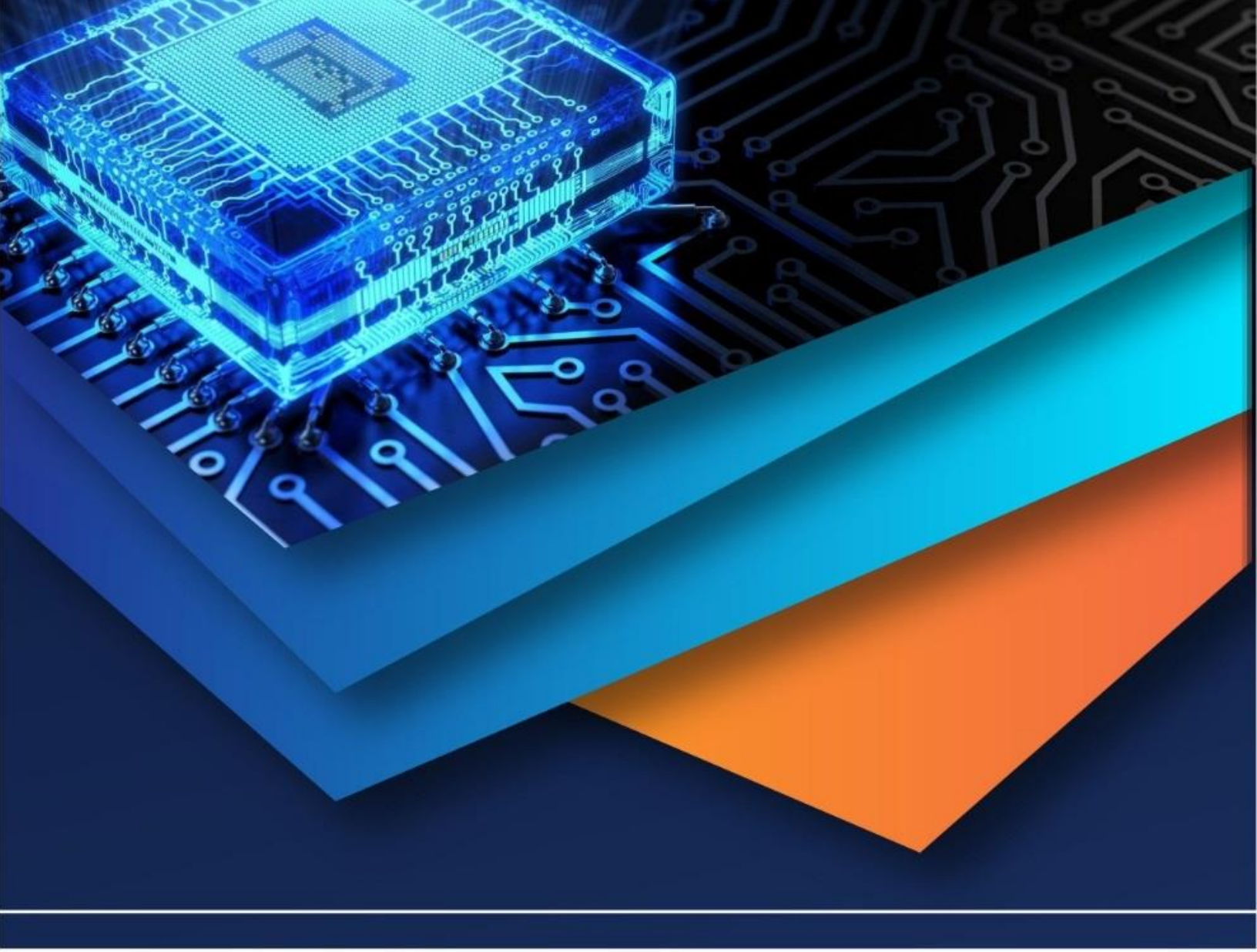
VIII CONCLUSION

In few years' time, Android has effectively become the world's most popular mobile operating system by a number of measures. Despite the popularity of the capable Apple iPhone platform, Android shipments have considerably outpaced Apple's offerings worldwide. While Apple devices continue to demand an ever-increasing price, Android devices scale the global marketplace. Yes, there are pricy Android models sitting next to the latest iPhones, but there are also relatively low-cost Android phones and tablets available. As Android is technologically advancing, it is finding its way into a variety of devices, including televisions, projectors, automobiles, and even recreational vehicles. Android has gone from market entrant to dominant force in its relatively brief existence in the global market.

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