



ANDROID OPERATING SYSTEM

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Abstract- Android is a software stack for mobile devices that includes an operating system, middleware and key applications. Android, an open source mobile device platform based on the Linux operating system.

It has application Framework, enhanced graphics, integrated web browser, relational database, media support, LibWebCore web browser, wide variety of connectivity and much more applications. Android relies on Linux version 2.6 for core system services such as security, memory management, process management, network stack, and driver model. Architecture of Android consist of Applications. Linux kernel, libraries, application framework, Android Runtime. All applications are written using the Java programming language. Android mobile phone platform is going to be more secure than Apple's iPhone or any other device in the long run.

Keywords- 3G, Dalvik Virtual Machine, EGPRS, LiMo, Open Handset Alliance, SQLite, WCDMA/HSUPA

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Introduction

Android is a software stack for mobile devices that includes an operating system, middleware and key applications. Android is a software platform and operating system for mobile devices based on the Linux operating system and developed by Google and the Open Handset Alliance. It allows developers to write managed code in a Java-like language that utilizes Google-developed Java libraries, but does not support programs developed in native code. The unveiling of the Android platform on 5 November 2007 was announced with the founding of the Open Handset Alliance, a consortium of 34 hardware, software and telecom companies devoted to advancing open standards for mobile devices. When released in 2008, most of the Android platform will be made available under the Apache free-software and open-source license. Android, an open source mobile device platform based on the Linux operating system.

Features

Application Framework

It is used to write applications for Android. Unlike other embedded mobile environments, Android applications are all equal, for instance, an applications which come with the phone are no different than those that any developer writes. The framework is supported by numerous open source libraries such as openssl, SQLite and libc. It is also supported by the Android core libraries. From the point of security, the framework is based on UNIX file system permissions that assure applications have only those abilities that mobile phone owner gave them at install time.

Integrated Browser

Google made a right choice on choosing WebKit as open source web browser. They added a two pass layout and frame flattening. Two pass layout loads a page without waiting for blocking elements, such as external CSS or external JavaScript and after a

while renders again with all resources downloaded to the device. Frame flattening converts founded frames into single one and loads into the browser. These features increase speed and usability browsing the internet via mobile phone.

Optimized Graphics

As Android has 2D graphics library and 3D graphics based on OpenGL ES 1.0, possibly we will see great applications like Google Earth and spectacular games like Second Life, which come on Linux version. At this moment, the shooting legendary 3D game Doom was presented using Android on the mobile phone.

SQLite

Extremely small (~500kb) relational database management system, which is integrated in Android. It is based on function calls and single file, where all definitions, tables and data are stored. This simple design is more than suitable for a platform such as Android.

Data Storage

SQLite is used for structured data storage.SQLite is a powerful and lightweight relational database engine available to all applications.

Connectivity

Android supports a wide variety of connectivity technologies including GSM, CDMA, Bluetooth, EDGE, 3G and Wi-Fi.

Messaging

SMS, MMS, and XMPP are available forms of messaging including threaded text messaging.

Web Browser

The web browser available in Android is based on the open-source WebKit application framework. It includes LibWebCore which is a modern web browser engine which powers both the Android browser and an embeddable web view.

Media Support

Android will support advanced audio/video/still media formats such as MPEG-4, H.264, MP3, and AAC, AMR, JPEG, PNG, GIF.

Dalvik Virtual Machine

It is extremely low-memory based virtual machine, which was designed especially for Android to run on embedded systems and work well in low power situations. It is also tuned to the CPU attributes. The Dalvik VM creates a special file format (.DEX) that is created through build time post processing. Conversion between Java classes and.DEX format is done by included "dx" tool.

Operation

Android Runtime

Android includes a set of core libraries that provides most of the functionality available in the core libraries of the Java programming language. Every Android application runs in its own process, with its own instance of the Dalvik virtual machine. Dalvik has been written so that a device can run multiple VMs efficiently.

The Dalvik VM executes files in the Dalvik Executable (.dex) for-

mat which is optimized for minimal memory footprint. The VM is register-based, and runs classes compiled by a Java language compiler that have been transformed into the.dex format by the included "dx" tool.The Dalvik VM relies on the Linux kernel for underlying functionality such as threading and low-level memory management.

Linux Kernel

Android relies on Linux version 2.6 for core system services such as security, memory management, process management, network stack, and driver model. The kernel also acts as an abstraction layer between the hardware and the rest of the software stack.

It helps to manage security, memory management, process management, network stack and other important issues. Therefore, the user should bring Linux in his mobile device as the main operating system and install all the drivers required in order to run it.

Developers have full access to the same framework APIs used by the core applications. The application architecture is designed to simplify the reuse of components; any application can publish its capabilities and any other application may then make use of those capabilities (subject to security constraints enforced by the framework). This same mechanism allows components to be replaced by the user.Underlying all applications is a set of services and systems.

Architecture

The following diagram shows the major components of the Android operating system. Each section is described in more detail below.

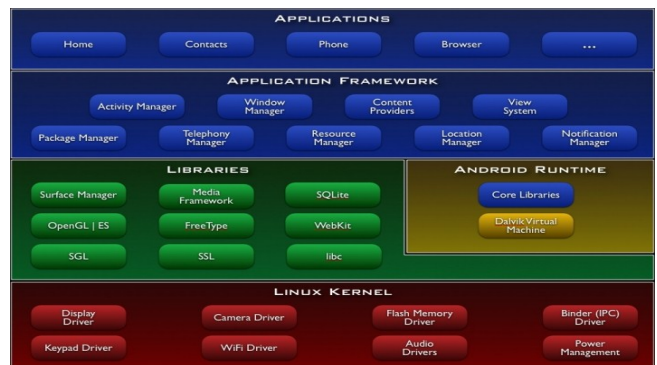
Linux Kernel

Android Architecture is based on Linux 2.6 kernel. It helps to manage security, memory management, process management, network stack and other important issues. Therefore, the user should bring Linux in his mobile device as the main operating system and install all the drivers required in order to run it. Android provides the support for the Qualcomm MSM7K chipset family. For instance, the current kernel tree supports Qualcomm MSM 7200A chipsets, but in the second half of 2008 we should see mobile devices with stable version Qualcomm MSM 7200, which includes major features

Fig. 2.1- Architecture of Android

WCDMA/HSUPA and EGPRS network support

- Bluetooth 1.2 and Wi-Fi support.



- Digital audio support for mp3 and other formats.

- Support for Linux and other third-party operating systems.
- Java hardware acceleration and support for Java applications.
- Qcamera up to 6.0 megapixels.
- gpsOne - solution for GPS
- and lots of other.

Libraries

In the next level there are a set of native libraries written in C/C++, which are responsible for stable performance of various components. For example, Surface Manager is responsible for composing different drawing surfaces on the mobile screen. It manages the access for different processes to compose 2D and 3D graphic layers. OpenGL ES and SGL make a core of graphic libraries and are used accordingly for 3D and 2D hardware acceleration. Moreover, it is possible to use 2D and 3D graphics in accordingly for 3D and 2D hardware acceleration. Moreover, it is possible to use 2D and 3D graphics in the same application in Android. The media framework was provided by PacketVideo, one of the members of OHA. It gives libraries for a playback and recording support for all the major media and static image files. FreeType libraries are used to render all the bitmap and vector fonts. For data storage, Android uses SQLite. As mentioned before, it is extra light rational management system, which locates a single file for all operations related to database. WebKit, the same browser used by Apples' Safari, was modified by Android in order to fit better in a small size screens.

Android Runtime

At the same level there is Android Runtime, where the main component Dalvik Virtual Machine is located. It was designed specifically for Android running in limited environment, where the limited battery, CPU, memory and data storage are the main issues. Android gives an integrated tool "dx", which converts generated byte code from .jar to .dex file, after this byte code becomes much more efficient to run on the small processors.

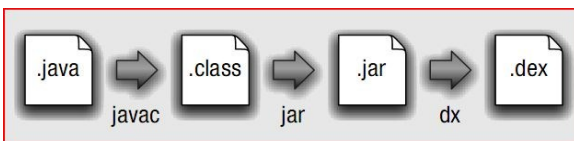


Fig. 2.2- Conversion from .java to .dex file

As the result, it is possible to have multiple instances of Dalvik virtual machine running on the single device at the same time. The Core libraries are written in Java language and contains of the collection classes, the utilities, IO and other tools.

Application Framework

After that, there is Application Framework, written in Java language. It is a toolkit that all applications use, ones which come with mobile device like Contacts or SMS box, or applications written by Google and any Android developer. It has several components.

The Activity Manager manages the life circle of the applications and provides a common navigation back stack for applications,

which are running in different processes. The Package Manager keeps track of the applications, which are installed in the device. The Windows Manager is Java programming language abstraction on the top of lower level services that are provided by the Surface Manager.

The Telephony Manager contains of a set of API necessary for calling applications.

Content Providers was built for Android to share a data with other applications, for instance, the contacts of people in the address book can be used in other applications too. The Resource Manager is used to store localized strings, bitmaps, layout file descriptions and other external partsof the application. The View System generates a set of buttons and lists used in UI. Other components like Notification manager is used to customize display alerts and other functions.

Application Layer

At the top of Android Architecture we have all the applications, which are used by the final user. By installing different applications, the user can turn his mobile phone into the unique, optimized and smart mobile phone. All applications are written using the Java programming language.

Security Issues

Android mobile phone platform is going to be more secure than Apple's iPhone or any other device in the long run. There are several solutions nowadays to protect Google phone from various attacks. One of them is security vendor McAfee, a member of Linux Mobile (LiMo) Foundation. This foundation joins particular companies to develop an open mobile-device software platform. Many of the companies listed in the LiMo Foundation have also become members of the Open Handset Alliance (OHA).

As a result, Linux secure coding practice should successfully be built into the Android development process. However, open platform has its own disadvantages, such as source code vulnerability for black-hat hackers. In parallel with great opportunities for mobile application developers, there is an expectation for exploitation and harm. Stealthy Trojans hidden in animated images, particular viruses passed from friend to friend, used for spying and identity theft, all these threats will be active for a long run.

Another solution for such attacks is SMobile Systems mobile package. SecurityShield -an integrated application that includes anti-virus, anti-spam, firewall and other mobile protection is up and ready to run on the Android operating system. Currently, the main problem is availability for viruses to pose as an application and do things like dial phone numbers, send text messages or multimedia messages or make connections to the Internet during normal device use. It is possible for somebody to use the GPS feature to

track a person's location without their knowledge. Hence SMobile Systems is ready to notify and block these secure alerts. But the truth is that it is not possible to secure your mobile device or personal computer completely, as it connects to the internet. And neither the Android phone nor other devices will prove to be the exception.

Conclusion and Future Scope

Android has been criticized for not being all open-source software despite what was announced by Google. Parts of the SDK are

proprietary and closed source, and some believe this is so that Google can control the platform. Software installed by end-users must be written in Java, and will not have access to lower level device APIs. This provides end-users with less control over their phone's functionality than other free and open source phone platforms, such as OpenMoko.

With all upcoming applications and mobile services Google Android is stepping into the next level of Mobile Internet. Android participates in many of the successful open source projects. That is, architect the solution for participation and the developers will not only come but will play well together. This is notable contrast with Apple and other companies, where such architecture of participation is clearly belated.

The first Android based official devices may well be launched sometime in the early half of 2009. Obviously, that's an age away when it comes to handset design, and Android may well find itself competing against the forthcoming Nokia touch screen phones and maybe even the iPhone 2.

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