1 Getting Started with Android Programming

WHAT YOU WILL LEARN IN THIS CHAPTER

- What is Android?
- Android versions and its feature set
- The Android architecture
- The various Android devices on the market
- The Android Market application store
- How to obtain the tools and SDK for developing Android applications
- How to develop your first Android application

Welcome to the world of Android! When I was writing my first book on Android (which was just less than a year ago), I stated that Android was ranked second in the U.S. smartphone market, second to Research In Motion's (RIM) BlackBerry, and overtaking Apple's iPhone. Shortly after the book went to press, comScore (a global leader in measuring the digital world and the preferred source of digital marketing intelligence) reported that Android has overtaken BlackBerry as the most popular smartphone platform in the U.S.

A few months later, Google released Android 3.0, code named *Honeycomb*. With Android 3.0, Google's focus in the new Software Development Kit was the introduction of several new features

designed for widescreen devices, specifically tablets. If you are writing apps for Android smartphones, Android 3.0 is not really useful, as the new features are not supported on smartphones. At the same time that Android 3.0 was released, Google began working on the next version of Android, which can be
used on both smartphones and tablets. In October 2011, Google released Android 4.0, code named *Ice Cream Sandwich*, and that is the focus of this book.

In this chapter you will learn what Android is, and what makes it so compelling to both developers and device manufacturers alike. You will also get started with developing your first Android application, and learn how to obtain all the necessary tools and set them up so that you can test your application on an Android 4.0 emulator. By the end of this chapter, you will be equipped with the basic knowledge you need to explore more sophisticated techniques and tricks for developing your next killer Android application.

WHAT IS ANDROID?

Android is a mobile operating system that is based on a modified version of Linux. It was originally developed by a startup of the same name, Android, Inc. In 2005, as part of its strategy to enter the mobile space, Google purchased Android and took over its development work (as well as its development team).

Google wanted Android to be open and free; hence, most of the Android code was released under the open source Apache License, which means that anyone who wants to use Android can do so by downloading the full Android source code. Moreover, vendors (typically hardware manufacturers) can add their own proprietary extensions to Android and customize Android to differentiate their products from others. This simple development model makes Android very attractive and has thus piqued the interest of many vendors. This has been especially true for companies affected by the phenomenon of Apple's iPhone, a hugely successful product that revolutionized the smartphone industry. Such companies include Motorola and Sony Ericsson, which for many years have been developing their own mobile operating systems. When the iPhone was launched, many of these manufacturers had to scramble to find new ways of revitalizing their products. These manufacturers see Android as a solution — they will continue to design their own hardware and use Android as the operating system that powers it.

The main advantage of adopting Android is that it offers a unified approach to application development. Developers need only develop for Android, and their applications should be able to run on numerous different devices, as long as the devices are powered using Android. In the world of smartphones, applications are the most important part of the success chain. Device manufacturers therefore see Android as their best hope to challenge the onslaught of the iPhone, which already commands a large base of applications.

Android Versions

Android has gone through quite a number of updates since its first release. Table 1-1 shows the various versions of Android and their codenames.

TABLE 1-1: A Brief History of Android Versions

ANDROID VERSION	RELEASE DATE	CODENAME
1.1	9 February 2009	
1.5	30 April 2009	Cupcake
1.6	15 September 2009	Donut
2.0/2.1	26 October 2009	Eclair
2.2	20 May 2010	Froyo
2.3	6 December 2010	Gingerbread
3.0/3.1/3.2	22 February 2011	Honeycomb
4.0	19 October 2011	Ice Cream Sandwich

In February 2011, Google released Android 3.0, a tablet-only release supporting widescreen devices. The key changes in Android 3.0 are as follows.

- New user interface optimized for tablets
- 3D desktop with new widgets
- Refined multi-tasking
- New web browser features, such as tabbed browsing, form auto-fill, bookmark synchronization, and private browsing
- Support for multi-core processors

Applications written for versions of Android prior to 3.0 are compatible with Android 3.0 devices, and they run without modifications. Android 3.0 tablet applications that make use of the newer features available in 3.0, however, will not be able to run on older devices. To ensure that an Android tablet application can run on all versions of devices, you must programmatically ensure that you only make use of features that are supported in specific versions of Android.

In October 2011, Google released Android 4.0, a version that brought all the features introduced in Android 3.0 to smartphones, along with some new features such as facial recognition unlock, data usage monitoring and control, Near Field Communication (NFC), and more.

Features of Android

Because Android is open source and freely available to manufacturers for customization, there are no fixed hardware or software configurations. However, Android itself supports the following features:

- **Storage** — Uses SQLite, a lightweight relational database, for data storage. Chapter 6 discusses data storage in more detail.
- **Connectivity** — Supports GSM/EDGE, IDEN, CDMA, EV-DO, UMTS, Bluetooth (includes A2DP and AVRCP), Wi-Fi, LTE, and WiMAX. Chapter 8 discusses networking in more detail.

- **Messaging** — Supports both SMS and MMS. Chapter 8 discusses messaging in more detail.
- **Web browser** — Based on the open source WebKit, together with Chrome's V8 JavaScript engine
- **Media support** — Includes support for the following media: 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, and BMP
- **Hardware support** — Accelerometer Sensor, Camera, Digital Compass, Proximity Sensor, and GPS
- **Multi-touch** — Supports multi-touch screens
- **Multi-tasking** — Supports multi-tasking applications
- **Flash support** — Android 2.3 supports Flash 10.1.
- **Tethering** — Supports sharing of Internet connections as a wired/wireless hotspot

Architecture of Android

In order to understand how Android works, take a look at Figure 1-1, which shows the various layers that make up the Android operating system (OS).

The Android OS is roughly divided into five sections in four main layers:

- **Linux kernel** — This is the kernel on which Android is based. This layer contains all the low-level device drivers for the various hardware components of an Android device.
- **Libraries** — These contain all the code that provides the main features of an Android OS. For example, the SQLite library provides database support so that an application can use it for data storage. The WebKit library provides functionalities for web browsing.
- **Android runtime** — At the same layer as the libraries, the Android runtime provides a set of core libraries that enable developers to write Android apps using the Java programming language. The Android runtime also includes the Dalvik virtual machine, which enables every Android application to run in its own process, with its own instance of the Dalvik virtual machine (Android applications are compiled into Dalvik executables). Dalvik is a specialized virtual machine designed specifically for Android and optimized for battery-powered mobile devices with limited memory and CPU.
- **Application framework** — Exposes the various capabilities of the Android OS to application developers so that they can make use of them in their applications.
- **Applications** — At this top layer, you will find applications that ship with the Android device (such as Phone, Contacts, Browser, etc.), as well as applications that you download and install from the Android Market. Any applications that you write are located at this layer.

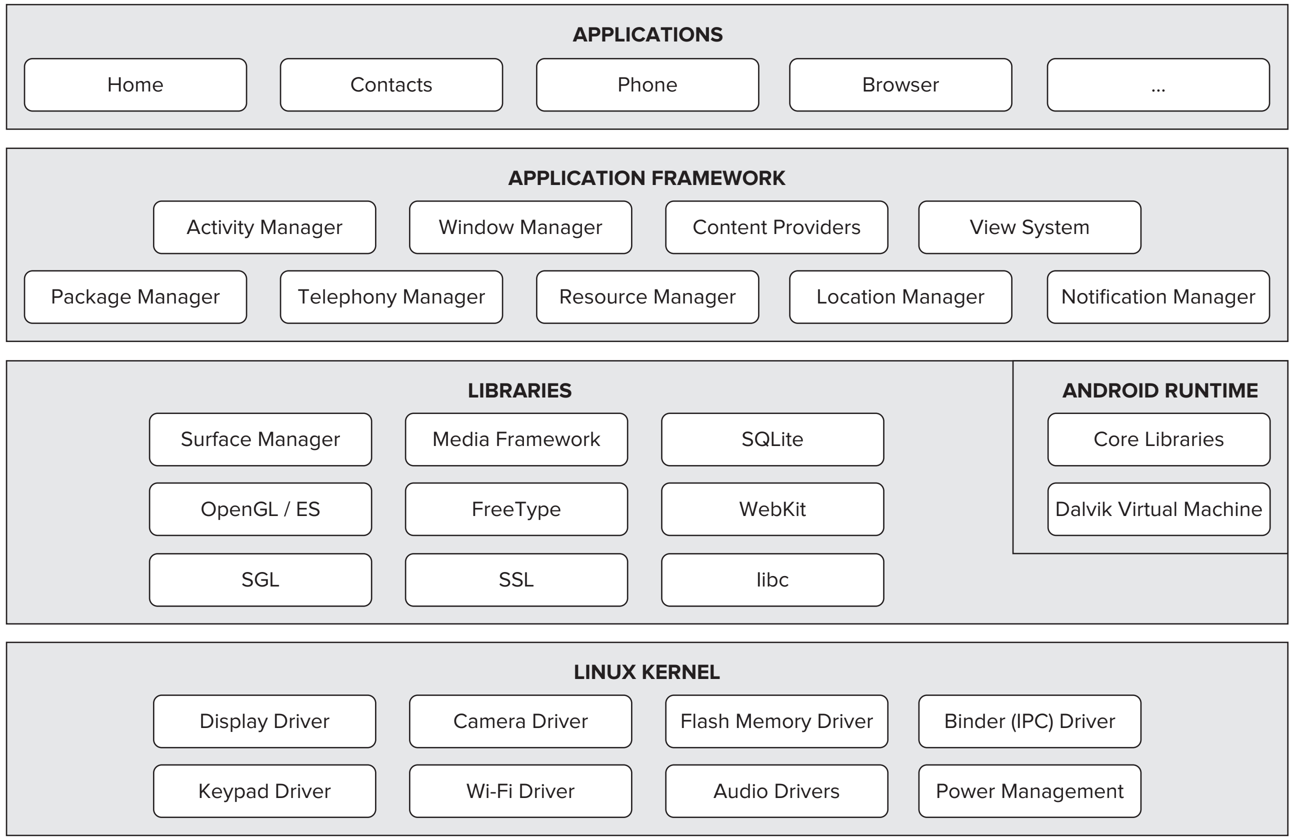

APPLICATIONS
Home
Contacts
Phone
Browser
...
APPLICATION FRAMEWORK
Activity Manager
Window Manager
Content Providers
View System
Package Manager
Telephony Manager
Resource Manager
Location Manager
Notification Manager
LIBRARIES
Surface Manager
Media Framework
SQLite
OpenGL / ES
FreeType
WebKit
SGL
SSL
libc
ANDROID RUNTIME
Core Libraries
Dalvik Virtual Machine
LINUX KERNEL
Display Driver
Camera Driver
Flash Memory Driver
Binder (IPC) Driver
Keypad Driver
Wi-Fi Driver
Audio Drivers
Power Management

FIGURE 1-1

Android Devices in the Market

Android devices come in all shapes and sizes. As of late November 2011, the Android OS powers the following types of devices:

- Smartphones
- Tablets
- E-reader devices
- Netbooks
- MP4 players
- Internet TVs

Chances are good that you own at least one of the preceding devices. Figure 1-2 shows (left to right) the Samsung Galaxy S II, the Motorola Atrix 4G, and the HTC EVO 4G smartphones.

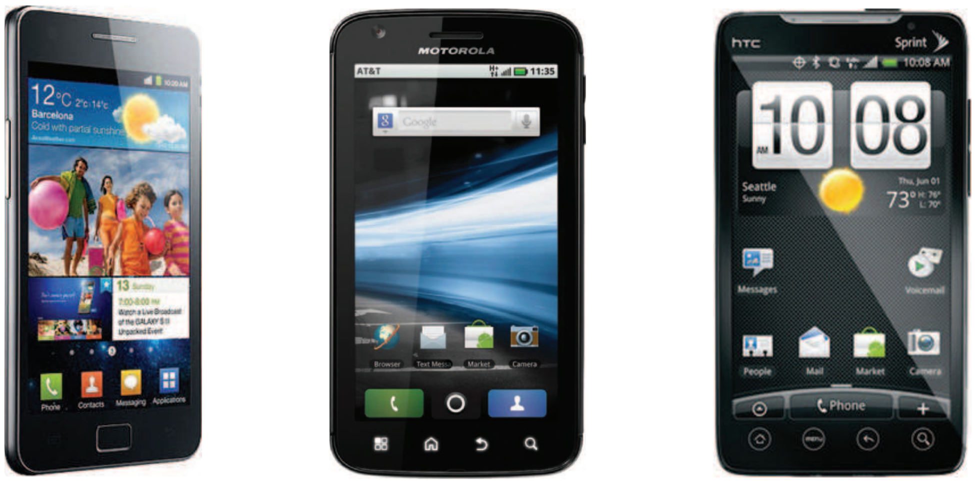


FIGURE 1-2

Another popular category of devices that manufacturers are rushing out is the *tablet*. Tablets typically come in two sizes: seven inches and ten inches, measured diagonally. Figure 1-3 shows the Samsung Galaxy Tab 10.1 (left) and the Asus Eee Pad Transformer TF101 (right), both 10.1-inch tablets. Both the Samsung Galaxy 10.1 and the Asus Eee Pad Transfer TF101 run on Android 3.

FIGURE 1-3

Besides smartphones and tablets, Android is also beginning to appear in dedicated devices, such as e-book readers. Figure 1-4 shows the Barnes and Noble's NOOK Color (left) and Amazon's Kindle Fire (right), both of which are color e-Book readers running the Android OS.

FIGURE 1-4

In addition to these popular mobile devices, Android is also slowly finding its way into your living room. People of Lava, a Swedish company, has developed an Android-based TV, called the Scandinavia Android TV (see Figure 1-5).

Google has also ventured into a proprietary smart TV platform based on Android and codeveloped with companies such as Intel, Sony, and Logitech. Figure 1-6 shows Sony's Google TV.

FIGURE 1-5

FIGURE 1-6

At the time of writing, the Samsung Galaxy Nexus (see Figure 1-7) is the only device running on Android 4.0. However, Google has promised that existing devices (such as the Nexus S) will be able to upgrade to Android 4.0. By the time you are reading this, there should be a plethora of devices running Android 4.0.

FIGURE 1-7

The Android Market

As mentioned earlier, one of the main factors determining the success of a smartphone platform is the applications that support it. It is clear from the success of the iPhone that applications play a very vital role in determining whether a new platform swims or sinks. In addition, making these applications accessible to the general user is extremely important.

As such, in August 2008, Google announced Android Market, an online application store for Android devices, and made it available to users in October 2008. Using the Market application that is preinstalled on their Android device, users can simply download third-party applications directly onto their devices. Both paid and free applications are supported on the Android Market, though paid applications are available only to users in certain countries due to legal issues.

Similarly, in some countries, users can buy paid applications from the Android Market, but developers cannot sell in that country. As an example, at the time of writing, users in India can buy apps from the Android Market, but developers in India cannot sell apps on the Android Market. The reverse may also be true; for example, users in South Korea cannot buy apps, but developers in South Korea can sell apps on the Android Market.

NOTE *Chapter 12 discusses more about the Android Market and how you can sell your own applications in it.*

The Android Developer Community

With Android in its fourth version, there is a large developer community all over the world. It is now much easier to get solutions to problems, and find like-minded developers to share app ideas and exchange experiences.

Here are some developer communities/sites that you can turn to for help if you run into problems while working with Android:

- **Stack Overflow** (`www.stackoverflow.com`) — Stack Overflow is a collaboratively edited question and answer site for developers. If you have a question about Android, chances are someone at Stack Overflow is probably already discussing the same question and someone else had already provided the answer. Best of all, other developers can vote for the best answer so that you can know which are the answers that are trustworthy.
- **Google Android Training** (`http://developer.android.com/training/index.html`) — Google has launched the Android Training site that contains a number of useful classes grouped by topics. At the time of writing, the classes mostly contain useful code snippets that are very useful to Android developers once they have started with the basics. Once you have learned the basics in this book, I strongly suggest you take a look at the classes.
- **Android Discuss** (`http://groups.google.com/group/android-discuss`) — Android Discuss is a discussion group hosted by Google using the Google Groups service. Here, you will be able to discuss the various aspects of Android programming. This group is monitored closely by the Android team at Google, and so this is good place to clarify your doubts and learn new tips and tricks.

OBTAINING THE REQUIRED TOOLS

Now that you know what Android is and what its feature set contains, you are probably anxious to get your hands dirty and start writing some applications! Before you write your first app, however, you need to download the required tools and SDKs.

For Android development, you can use a Mac, a Windows PC, or a Linux machine. All the tools needed are free and can be downloaded from the Web. Most of the examples provided in this book should work fine with the Android emulator, with the exception of a few examples that require access to the hardware. For this book, I am using a Windows 7 computer to demonstrate all the code samples. If you are using a Mac or Linux computer, the screenshots should look similar; some minor differences may be present, but you should be able to follow along without problems.

Let the fun begin!

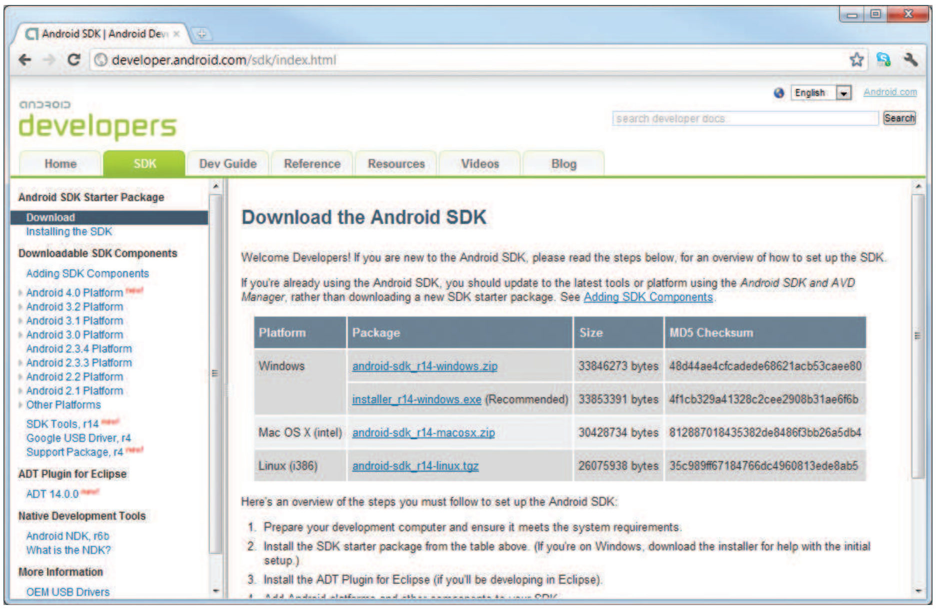
JAVA JDK

The Android SDK makes use of the Java SE Development Kit (JDK). If your computer does not have the JDK installed, you should start by downloading it from `www.oracle.com/technetwork/java/javase/downloads/index.html` and installing it prior to moving to the next section.

Android SDK

The first and most important piece of software you need to download is, of course, the Android SDK. The Android SDK contains a debugger, libraries, an emulator, documentation, sample code, and tutorials.

You can download the Android SDK from `http://developer.android.com/sdk/index.html` (see Figure 1-8).



Download the Android SDK

Welcome Developers! If you are new to the Android SDK, please read the steps below, for an overview of how to set up the SDK.

If you're already using the Android SDK, you should update to the latest tools or platform using the *Android SDK and AVD Manager*, rather than downloading a new SDK starter package. See Adding SDK Components.

Platform	Package	Size	MD5 Checksum
Windows	android-sdk_r14-windows.zip	33846273 bytes	48d44ae4cfcadede68621acb53caee80
	installer_r14-windows.exe (Recommended)	33853391 bytes	4f1cb329a41328c2cee2908b31ae6f6b
Mac OS X (intel)	android-sdk_r14-macosx.zip	30428734 bytes	812887018435382de8486f3bb26a5db4
Linux (i386)	android-sdk_r14-linux.tgz	26075938 bytes	35c989ff67184766dc4960813ede8ab5

Here's an overview of the steps you must follow to set up the Android SDK:

1. Prepare your development computer and ensure it meets the system requirements.
2. Install the SDK starter package from the table above. (If you're on Windows, download the installer for help with the initial setup.)
3. Install the ADT Plugin for Eclipse (if you'll be developing in Eclipse).

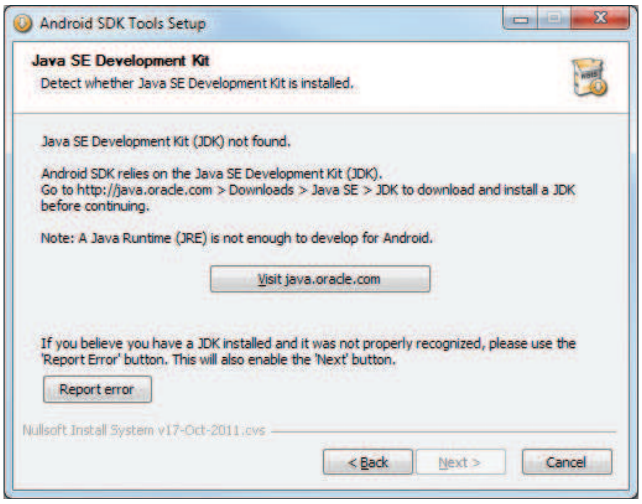
FIGURE 1-8

The Android SDK is packaged in a zip file. You can download it and unzip its content (the `android-sdk-windows` folder) into a folder, say `C:\Android 4.0\`. For Windows user, Google recommends that you download the `installer_r15-windows.exe` file instead and use it to set up the tools for you automatically. The following steps walk you through the installation process using this approach.

Installing the Android SDK Tools

When you have downloaded the `installer_r15-windows.exe` file, double-click it to start the installation of the Android tools. In the welcome screen of the Setup Wizard, click Next to continue.

If your computer does not have Java installed, you will see the error dialog shown in Figure 1-9. However, even if you have Java installed, you may still see this error. If this is the case, click the Report error button and then click Next.


Android SDK Tools Setup

Java SE Development Kit

Detect whether Java SE Development Kit is installed.

Java SE Development Kit (JDK) not found.

Android SDK relies on the Java SE Development Kit (JDK).
Go to http://java.oracle.com > Downloads > Java SE > JDK to download and install a JDK before continuing.

Note: A Java Runtime (JRE) is not enough to develop for Android.

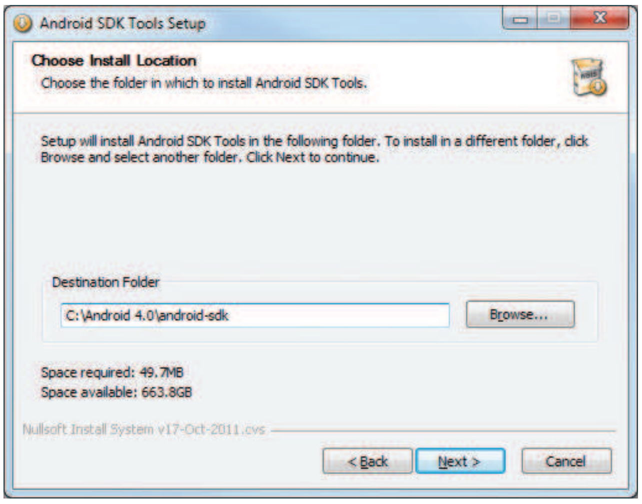
If you believe you have a JDK installed and it was not properly recognized, please use the 'Report Error' button. This will also enable the 'Next' button.

Nullsoft Install System v17-Oct-2011.cvs

FIGURE 1-9

You will be asked to provide a destination folder to install the Android SDK tools. Enter a destination path (see Figure 1-10) and click Next.

When you are asked to choose a Start Menu folder to create the program's shortcut, take the default "Android SDK Tools" and click Install. When the setup is done, check the "Start SDK Manager (to download system images, etc.)" option and click Finish (see Figure 1-11). This will start the SDK Manager.



Choose Install Location

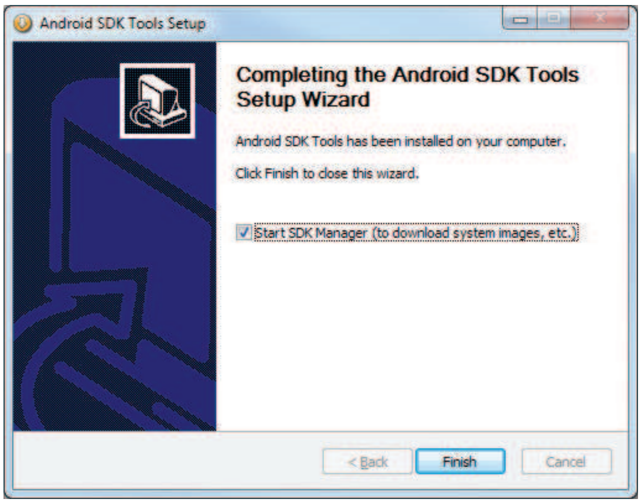
Choose the folder in which to install Android SDK Tools.

Setup will install Android SDK Tools in the following folder. To install in a different folder, click Browse and select another folder. Click Next to continue.

Destination Folder: C:\Android 4.0\android-sdk

Space required: 49.7MB
Space available: 663.8GB

FIGURE 1-10



Completing the Android SDK Tools Setup Wizard

Android SDK Tools has been installed on your computer.

Click Finish to close this wizard.

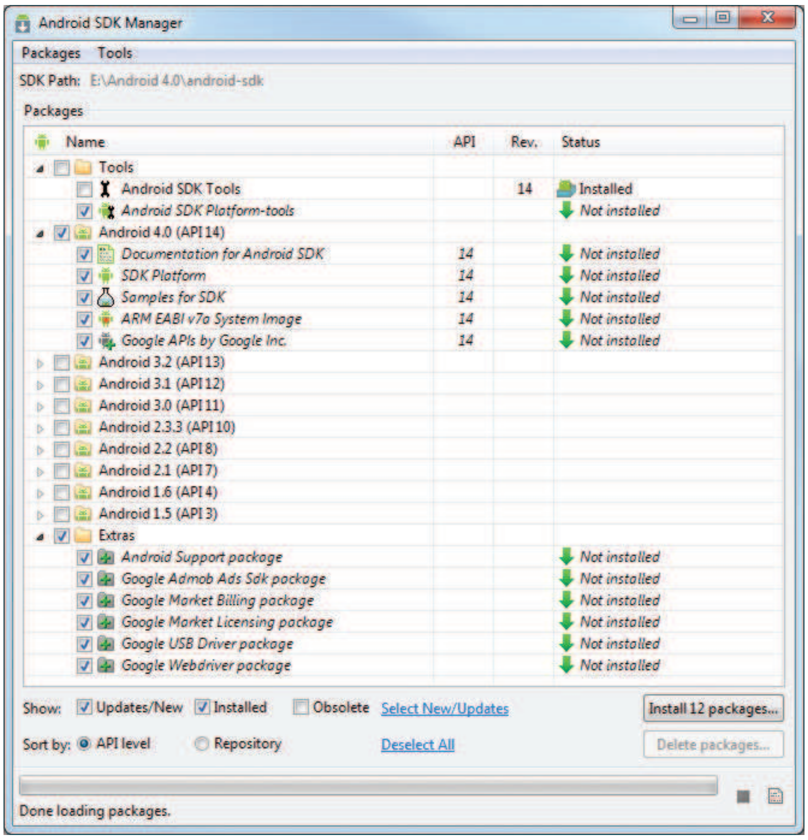
[✓] Start SDK Manager (to download system images, etc.)

FIGURE 1-11

Configuring the Android SDK Manager

The Android SDK Manager manages the various versions of the Android SDK currently installed on your computer. When it is launched, you will see a list of items and whether or not they are currently installed on your computer (see Figure 1-12).

Check the relevant tools, documentation, and platforms you need for your project. Once you have selected the items you want, click the Install button to download them. Because it takes a while to download from Google's server, it is a good idea to download only what you need immediately, and download the rest when you have more time. For now, you may want to check the items shown in the figure.



SDK Path: E:\Android 4.0\android-sdk

Packages

Name	API	Rev.	Status
☐ Tools			
☐ Android SDK Tools		14	Installed
☑ Android SDK Platform-tools			Not installed
☑ Android 4.0 (API 14)			
☑ Documentation for Android SDK	14		Not installed
☑ SDK Platform	14		Not installed
☑ Samples for SDK	14		Not installed
☑ ARM EABI v7a System Image	14		Not installed
☑ Google APIs by Google Inc.	14		Not installed
☐ Android 3.2 (API 13)			
☐ Android 3.1 (API 12)			
☐ Android 3.0 (API 11)			
☐ Android 2.3.3 (API 10)			
☐ Android 2.2 (API 8)			
☐ Android 2.1 (API 7)			
☐ Android 1.6 (API 4)			
☐ Android 1.5 (API 3)			
☑ Extras			
☑ Android Support package			Not installed
☑ Google Admob Ads Sdk package			Not installed
☑ Google Market Billing package			Not installed
☑ Google Market Licensing package			Not installed
☑ Google USB Driver package			Not installed
☑ Google Webdriver package			Not installed

Show: ☑ Updates/New ☑ Installed ☐ Obsolete Select New/Updates

Sort by: [✓ API level] Repository Deselect All

Done loading packages.

FIGURE 1-12

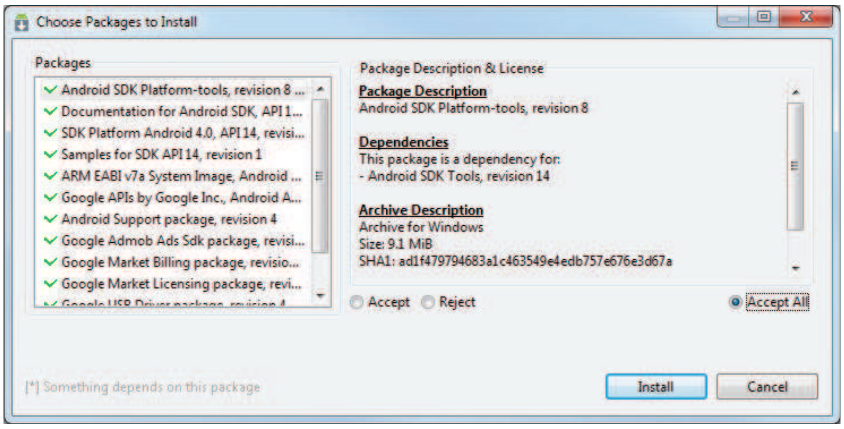
NOTE *For a start, you should at least select the latest Android 4.0 SDK platform and the Extras. At the time of writing, the latest SDK platform is SDK Platform Android 4.0, API 14.*

Each version of the Android OS is identified by an API level number. For example, Android 2.3.3 is level 10 (API 10), while Android 3.0 is level 11 (API 11), and so on. For each level, two platforms are available. For example, level 14 offers the following:

- SDK Platform
- Google APIs by Google Inc.

The key difference between the two is that the Google APIs platform contains additional APIs provided by Google (such as the Google Maps library). Therefore, if the application you are writing requires Google Maps, you need to create an AVD using the Google APIs platform (more on this is provided in Chapter 9, “Location-Based Services.”

You will be asked to choose the packages to install (see Figure 1-13). Check the Accept All option and click Install.



Choose Packages to Install

Packages
- ✓ Android SDK Platform-tools, revision 8 ...
- ✓ Documentation for Android SDK, API 1...
- ✓ SDK Platform Android 4.0, API 14, revisi...
- ✓ Samples for SDK API 14, revision 1
- ✓ ARM EABI v7a System Image, Android ...
- ✓ Google APIs by Google Inc., Android A...
- ✓ Android Support package, revision 4
- ✓ Google Admob Ads Sdk package, revisi...
- ✓ Google Market Billing package, revisio...
- ✓ Google Market Licensing package, revi...
- ✓ Google USB Driver package, revision 4

Package Description & License

Package Description
Android SDK Platform-tools, revision 8

Dependencies
This package is a dependency for:
- Android SDK Tools, revision 14

Archive Description
Archive for Windows
Size: 9.1 MiB
SHA1: ad1f479794683a1c463549e4edb757e676e3d67a

Accept Reject [✓ Accept All]

[*] Something depends on this package

FIGURE 1-13

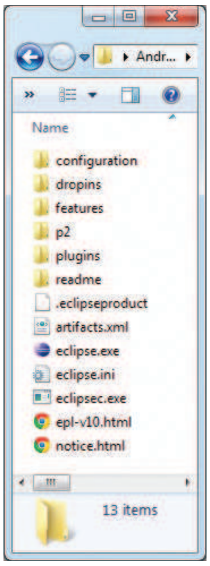
The SDK Manager will proceed to download the packages that you have selected. The installation takes some time, so be patient. When all the packages are installed, you will be asked to restart the ADB (Android Debug Bridge). Click Yes.

Eclipse

The next step is to obtain the integrated development environment (IDE) for developing your Android applications. In the case of Android, the recommended IDE is Eclipse, a multi-language software development environment featuring an extensible plug-in system. It can be used to develop various types of applications, using languages such as Java, Ada, C, C++, COBOL, Python, and others.

For Android development, you should download the Eclipse IDE for Java EE Developers (`www.eclipse.org/downloads/`). Six editions are available: Windows (32- and 64-bit), Mac OS X (Cocoa 32- and 64), and Linux (32- and 64-bit). Simply select the relevant one for your operating system. All the examples in this book were tested using the 32-bit version of Eclipse for Windows.

Once the Eclipse IDE is downloaded, unzip its content (the `eclipse` folder) into a folder, say `C:\Android 4.0\`. Figure 1-14 shows the content of the `eclipse` folder.



configuration
dropins
features
p2
plugins
readme
.eclipseproduct
artifacts.xml
eclipse.exe
eclipse.ini
eclipsec.exe
epl-v10.html
notice.html

13 items

FIGURE 1-14

To launch Eclipse, double-click on the `eclipse.exe` file. You are first asked to specify your workspace. In Eclipse, a workspace is a folder where you store all your projects. Take the default suggested (or you can specify your own folder as the workspace) and click OK.

Android Development Tools (ADT)

When Eclipse is launched, select Help ➪ Install New Software (see Figure 1-15) to install the Android Development Tools (ADT) plug-in for Eclipse.

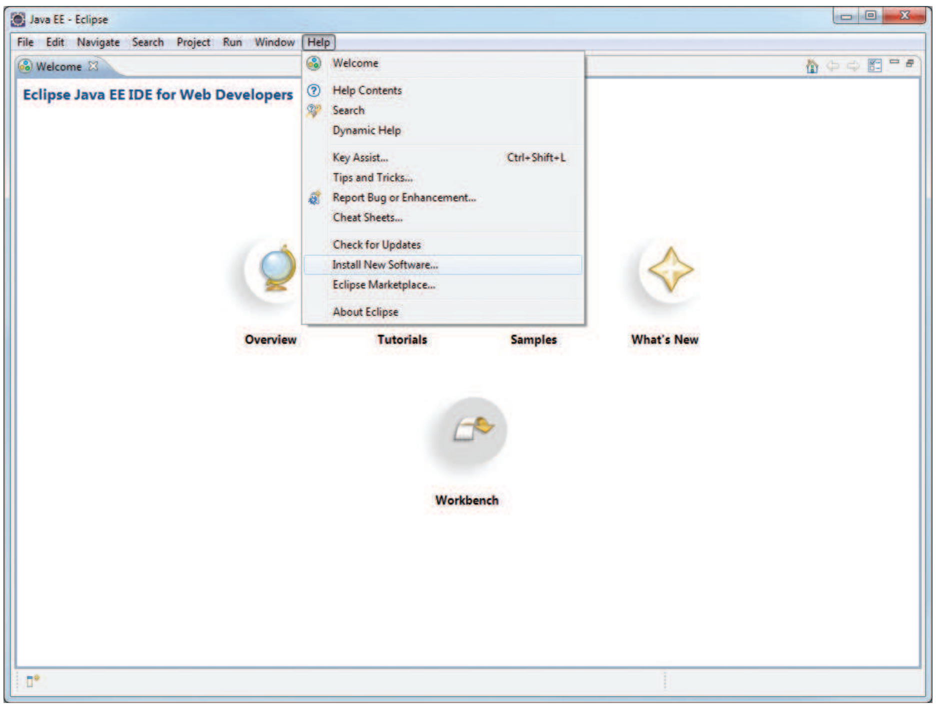
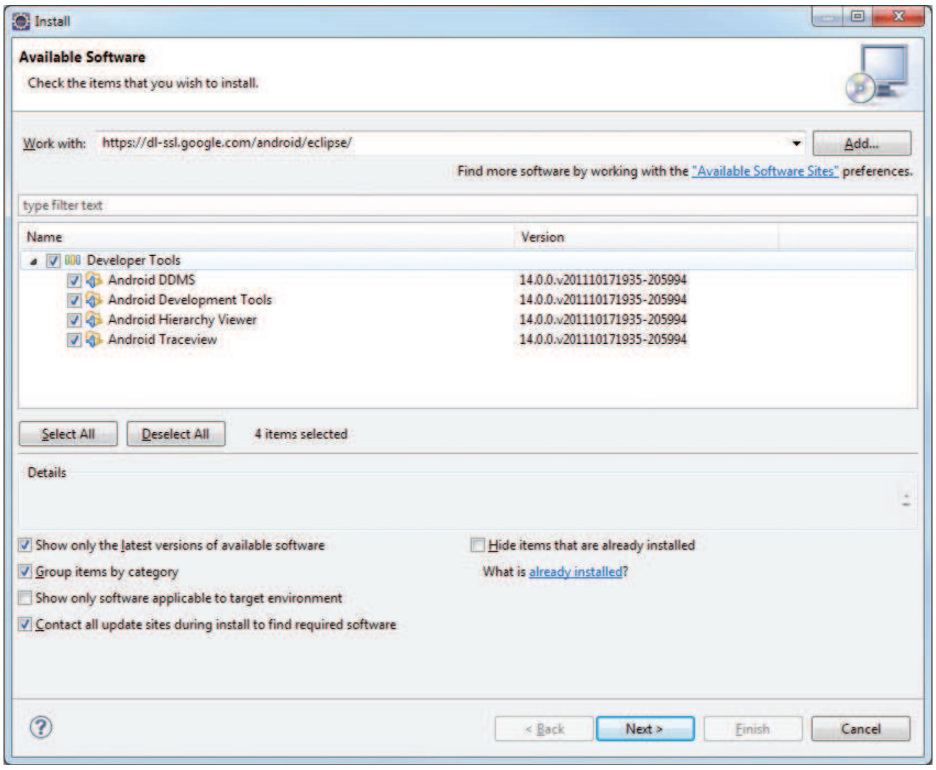


FIGURE 1-15

The ADT is an extension to the Eclipse IDE that supports the creation and debugging of Android applications. Using the ADT, you will be able to do the following in Eclipse:

- Create new Android application projects.
- Access the tools for accessing your Android emulators and devices.
- Compile and debug Android applications.
- Export Android applications into Android Packages (APKs).
- Create digital certificates for code-signing your APK.

In the Install dialog that appears, specify `https://dl-ssl.google.com/android/eclipse/` and press Enter. After a while, you will see the Developer Tools item appear in the middle of the window (see Figure 1-16). Expand it to reveal its content: Android DDMS, Android Development Tools, Android Hierarchy Viewer, and Android Traceview. Check all of them and click Next twice.


Install

Available Software

Check the items that you wish to install.

Work with: https://dl-ssl.google.com/android/eclipse/ [Add...]

Find more software by working with the "Available Software Sites" preferences.

type filter text

Name	Version
✓ Developer Tools	
✓ Android DDMS	14.0.0.v201110171935-205994
✓ Android Development Tools	14.0.0.v201110171935-205994
✓ Android Hierarchy Viewer	14.0.0.v201110171935-205994
✓ Android Traceview	14.0.0.v201110171935-205994

[Select All] [Deselect All] 4 items selected

Details

- [✓] Show only the latest versions of available software
- [✓] Group items by category
- [ ] Show only software applicable to target environment
- [✓] Contact all update sites during install to find required software
- [ ] Hide items that are already installed

What is already installed?

[< Back] [Next >] [Finish] [Cancel]

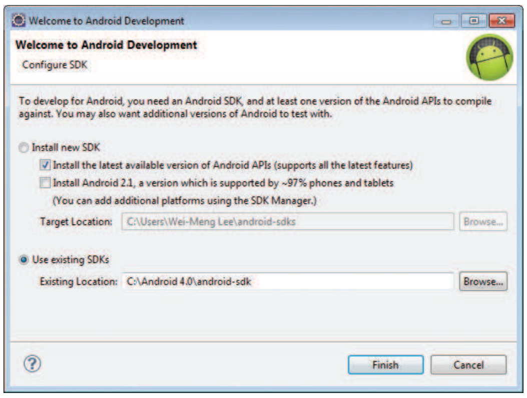
FIGURE 1-16

NOTE *If you have any problems downloading the ADT, check out Google's help at* `http://developer.android.com/sdk/eclipse-adt.html#installing`.

You will be asked to review and accept the licenses. Check the "I accept the terms of the license agreements" option and click Finish. Once the installation is completed, you will be asked to restart Eclipse. Go ahead and restart Eclipse now.

When Eclipse is restarted, you are asked to configure your Android SDK (see Figure 1-17). As the Android SDK has already been downloaded earlier in the previous section, check the "Use existing SDKs" option and specify the directory where you have installed the Android SDK. Click Next.

After this step, you are asked to send your usage statistics to Google. Once you have selected your choice, click Finish.


Welcome to Android Development

Welcome to Android Development

Configure SDK

To develop for Android, you need an Android SDK, and at least one version of the Android APIs to compile against. You may also want additional versions of Android to test with.

- ○ Install new SDK
  - [✓] Install the latest available version of Android APIs (supports all the latest features)
  - [ ] Install Android 2.1, a version which is supported by ~97% phones and tablets
  - (You can add additional platforms using the SDK Manager.)
  - Target Location: C:\Users\Wei-Meng Lee\android-sdks [Browse...]
- ● Use existing SDKs
  - Existing Location: C:\Android 4.0\android-sdk [Browse...]

[Finish] [Cancel]

FIGURE 1-17

> ***NOTE*** *As each new version of the SDK is released, the installation steps tend to differ slightly. If you do not experience the same steps as described here, don't worry — just follow the instructions on screen.*

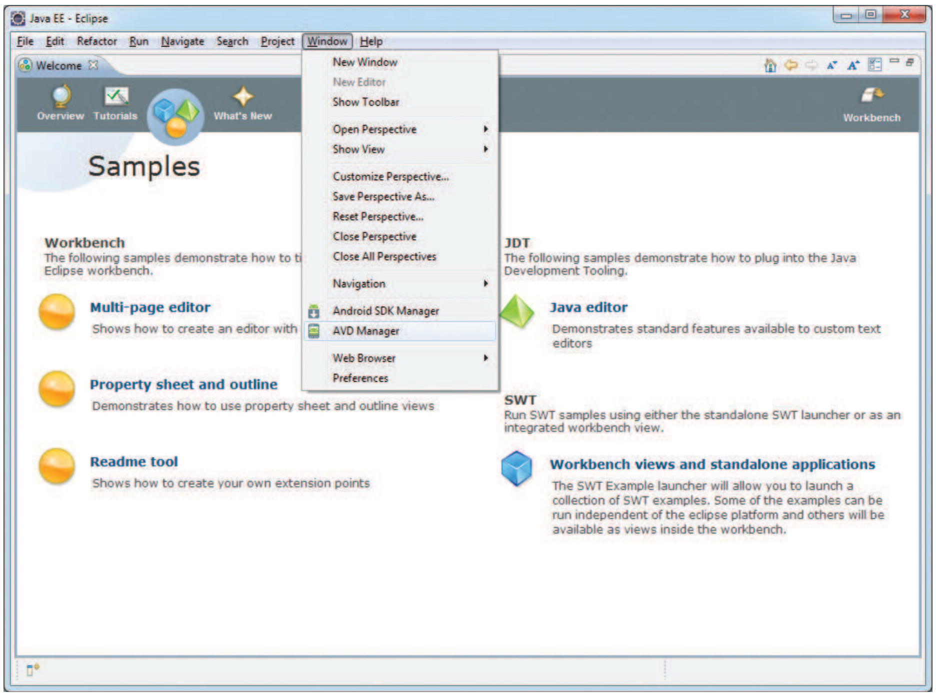
Creating Android Virtual Devices (AVDs)

The next step is to create an Android Virtual Device (AVD) to be used for testing your Android applications. An AVD is an emulator instance that enables you to model an actual device. Each AVD consists of a hardware profile; a mapping to a system image; as well as emulated storage, such as a secure digital (SD) card.

You can create as many AVDs as you want in order to test your applications with several different configurations. This testing is important to confirm the behavior of your application when it is run on different devices with varying capabilities.

> ***NOTE*** *Appendix B discusses some of the capabilities of the Android emulator.*

To create an AVD, select Window ➪ AVD Manager (see Figure 1-18).



Workbench
The following samples demonstrate how to ti
Eclipse workbench.

Multi-page editor
Shows how to create an editor with

Property sheet and outline
Demonstrates how to use property sheet and outline views

Readme tool
Shows how to create your own extension points

JDT
The following samples demonstrate how to plug into the Java Development Tooling.

Java editor
Demonstrates standard features available to custom text editors

SWT
Run SWT samples using either the standalone SWT launcher or as an integrated workbench view.

Workbench views and standalone applications
The SWT Example launcher will allow you to launch a collection of SWT examples. Some of the examples can be run independent of the eclipse platform and others will be available as views inside the workbench.

FIGURE 1-18

In the Android Virtual Device Manager dialog (see Figure 1-19), click the New... button to create a new AVD.

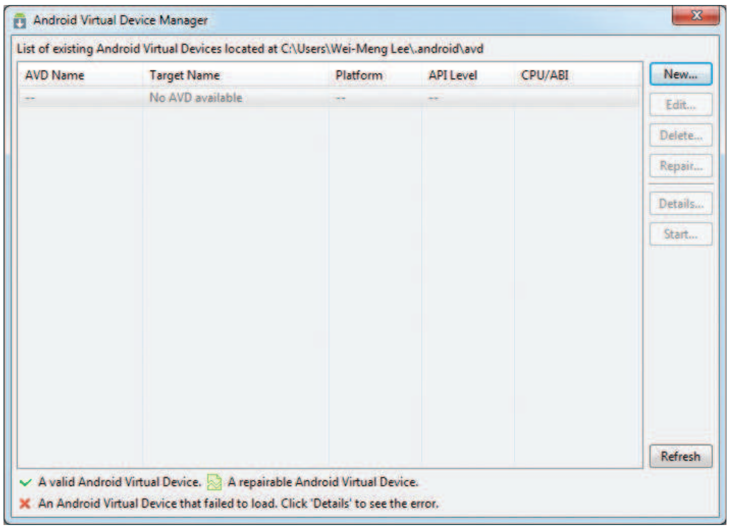
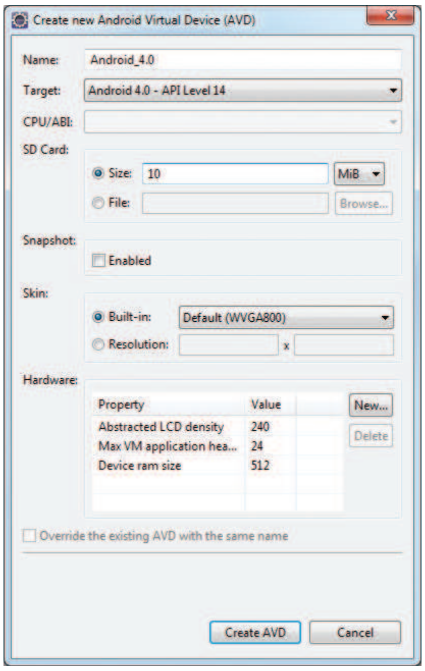

Android Virtual Device Manager
List of existing Android Virtual Devices located at C:\Users\Wei-Meng Lee\.android\avd
AVD Name
Target Name
Platform
API Level
CPU/ABI
--
No AVD available
--
--
New...
Edit...
Delete...
Repair...
Details...
Start...
Refresh
A valid Android Virtual Device.
A repairable Android Virtual Device.
An Android Virtual Device that failed to load. Click 'Details' to see the error.

FIGURE 1-19

In the Create new Android Virtual Device (AVD) dialog, enter the items as shown in Figure 1-20. Click the Create AVD button when you are done.


Create new Android Virtual Device (AVD)
Override the existing AVD with the same name
Create AVD
Cancel
New...
Delete
Browse...

Name: Android_4.0
Target: Android 4.0 - API Level 14
CPU/ABI:
SD Card:
Size: 10 MiB
File:
Snapshot:
Enabled
Skin:
Built-in: Default (WVGA800)
Resolution: x
Hardware:

Property	Value
Abstracted LCD density	240
Max VM application hea...	24
Device ram size	512

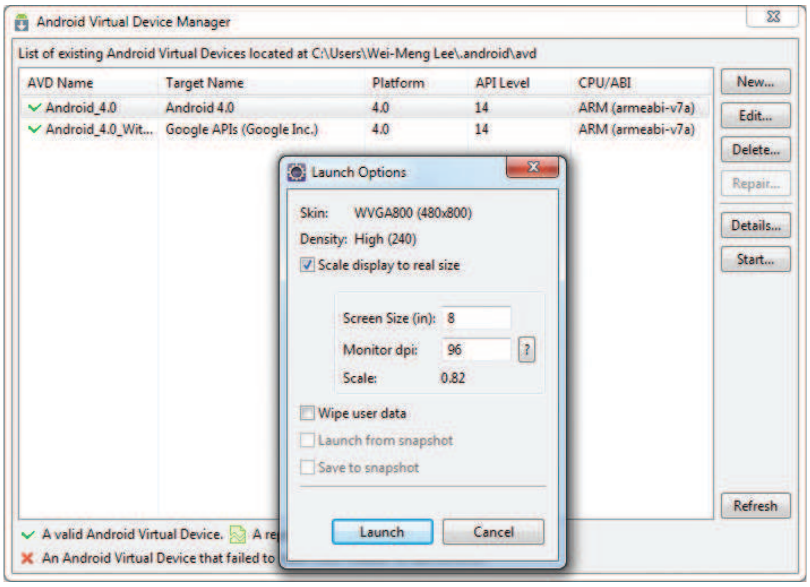
FIGURE 1-20

In this case, you have created an AVD (put simply, an Android emulator) that emulates an Android device running version 4.0 of the OS with a built-in 10-MB SD card. In addition to what you have created, you also have the option to emulate the device with different screen densities and resolutions.

NOTE *Appendix B explains how to emulate the different types of Android devices.*

It is preferable to create a few AVDs with different API levels and hardware configurations so that your application can be tested on different versions of the Android OS.

Once your ADV has been created, it is time to test it. Select the AVD that you want to test and click the Start… button. The Launch Options dialog will appear (see Figure 1-21). If you have a small monitor, it is recommended that you check the "Scale display to real size" option so that you can set the emulator to a smaller size. Click the Launch button to start the emulator.


Android Virtual Device Manager

List of existing Android Virtual Devices located at C:\Users\Wei-Meng Lee\.android\avd

AVD Name	Target Name	Platform	API Level	CPU/ABI
✓ Android_4.0	Android 4.0	4.0	14	ARM (armeabi-v7a)
✓ Android_4.0_Wit...	Google APIs (Google Inc.)	4.0	14	ARM (armeabi-v7a)

Launch Options

Skin: WVGA800 (480x800)
Density: High (240)
[✓] Scale display to real size
Screen Size (in): 8
Monitor dpi: 96
Scale: 0.82
[ ] Wipe user data
[ ] Launch from snapshot
[ ] Save to snapshot

✓ A valid Android Virtual Device.
✗ An Android Virtual Device that failed to

FIGURE 1-21

The Android emulator will start, and after a while it will be ready for use (see Figure 1-22). Go ahead and try out the emulator. It will behave just like a real Android device. After that, in the next section you will learn how to write your first Android application!

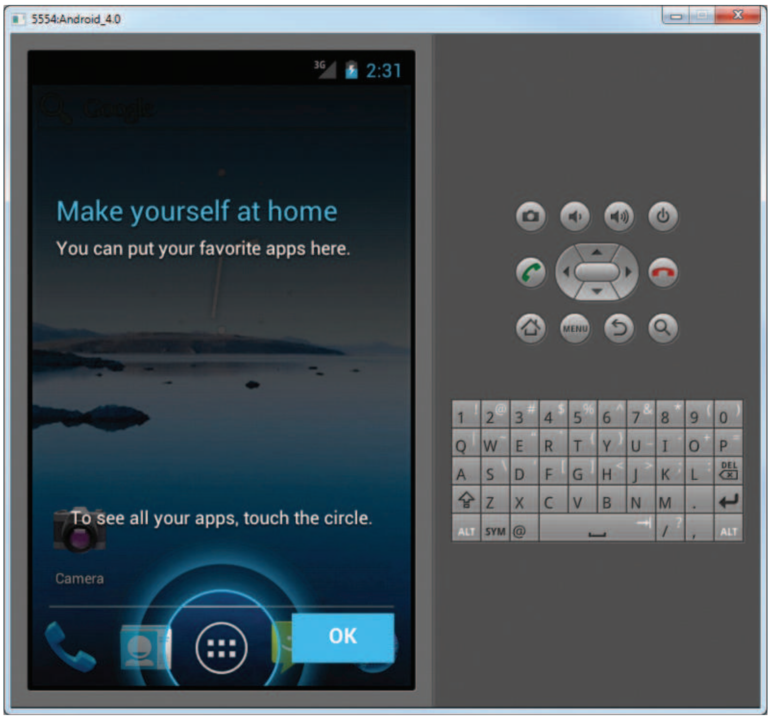

5554:Android_4.0
2:31
Make yourself at home
You can put your favorite apps here.
To see all your apps, touch the circle.
Camera
OK

FIGURE 1-22

CREATING YOUR FIRST ANDROID APPLICATION

With all the tools and the SDK downloaded and installed, it is now time to start your engine. As in all programming books, the first example uses the ubiquitous Hello World application. This will give you a detailed look at the various components that make up an Android project.

TRY IT OUT Creating Your First Android Application

codefile HelloWorld.zip available for download at Wrox.com

1. Using Eclipse, create a new project by selecting File ➪ New ➪ Project . . . (see Figure 1-23).

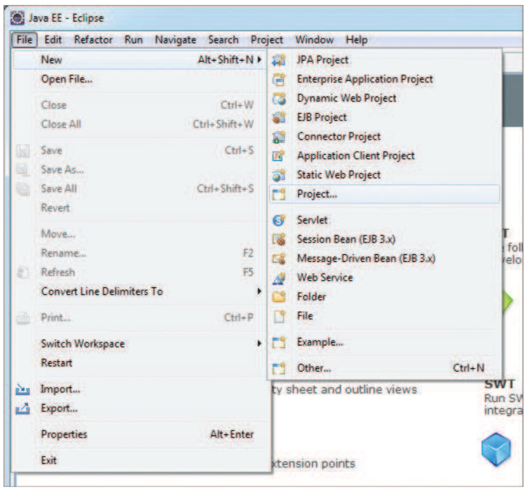


FIGURE 1-23

NOTE *After you have created your first Android application, subsequent Android projects can be created by selecting File ➪ New ➪ Android Project.*

2. Expand the Android folder and select Android Project (see Figure 1-24). Click Next.
3. Name the Android project **HelloWorld**, as shown in Figure 1-25, and then click Next.

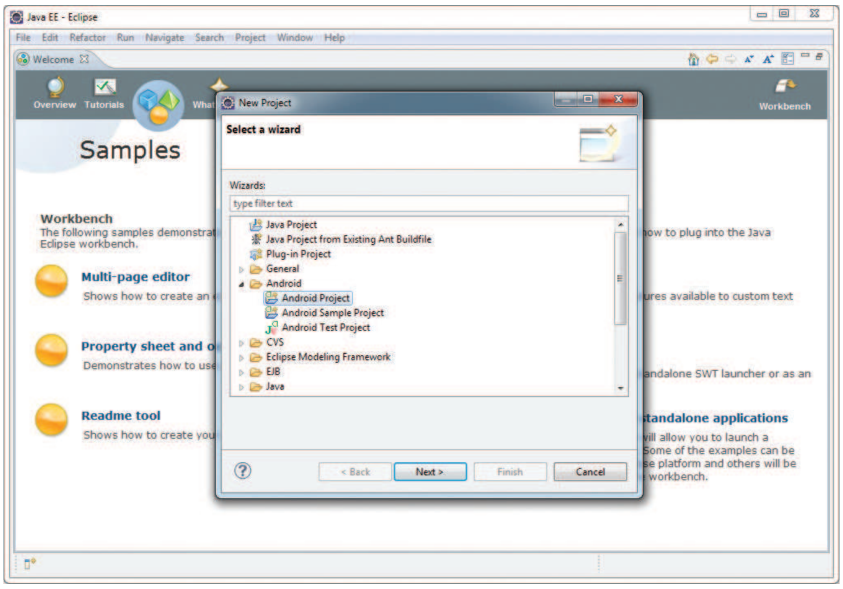
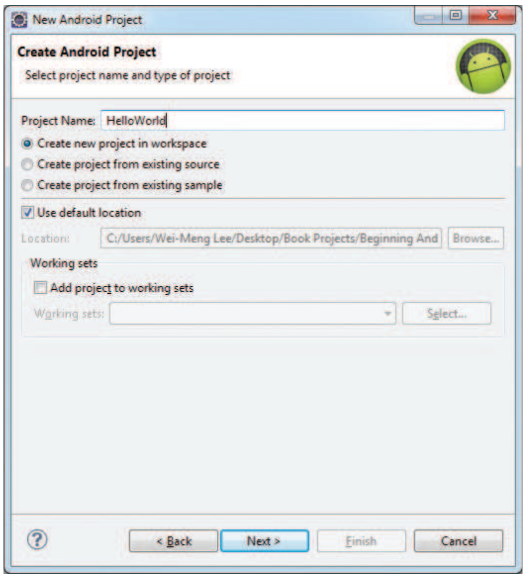


FIGURE 1-24


New Android Project

Create Android Project

Select project name and type of project

Project Name: HelloWorld

(●) Create new project in workspace
( ) Create project from existing source
( ) Create project from existing sample

[✓] Use default location

Location: C:/Users/Wei-Meng Lee/Desktop/Book Projects/Beginning And Browse...

Working sets

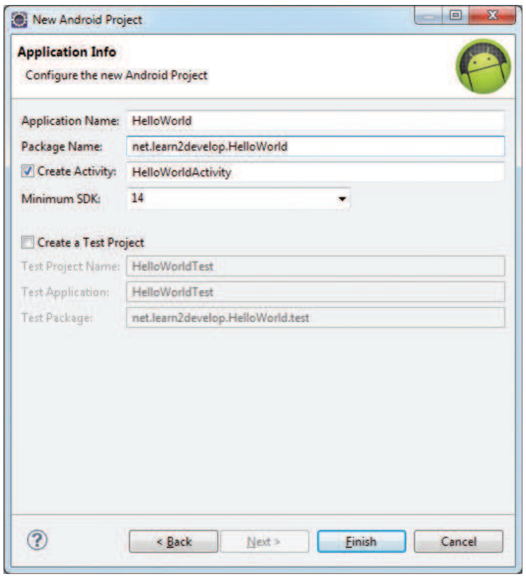
[ ] Add project to working sets

Working sets: Select...

FIGURE 1-25

4. Select the Android 4.0 target and click Next.

5. Fill in the Application Info details as shown in Figure 1-26. Click Finish.


New Android Project

Application Info

Configure the new Android Project

Application Name: HelloWorld

Package Name: net.learn2develop.HelloWorld

[✓] Create Activity: HelloWorldActivity

Minimum SDK: 14

[ ] Create a Test Project

Test Project Name: HelloWorldTest

Test Application: HelloWorldTest

Test Package: net.learn2develop.HelloWorld.test

FIGURE 1-26

NOTE *You need to have at least a period (*`.`*) in the package name. The recommended convention for the package name is to use your domain name in reverse order, followed by the project name. For example, my company's domain name is* `learn2develop.net`*; hence, my package name would be* `net.learn2develop.HelloWorld`*.*

6. The Eclipse IDE should now look like Figure 1-27.

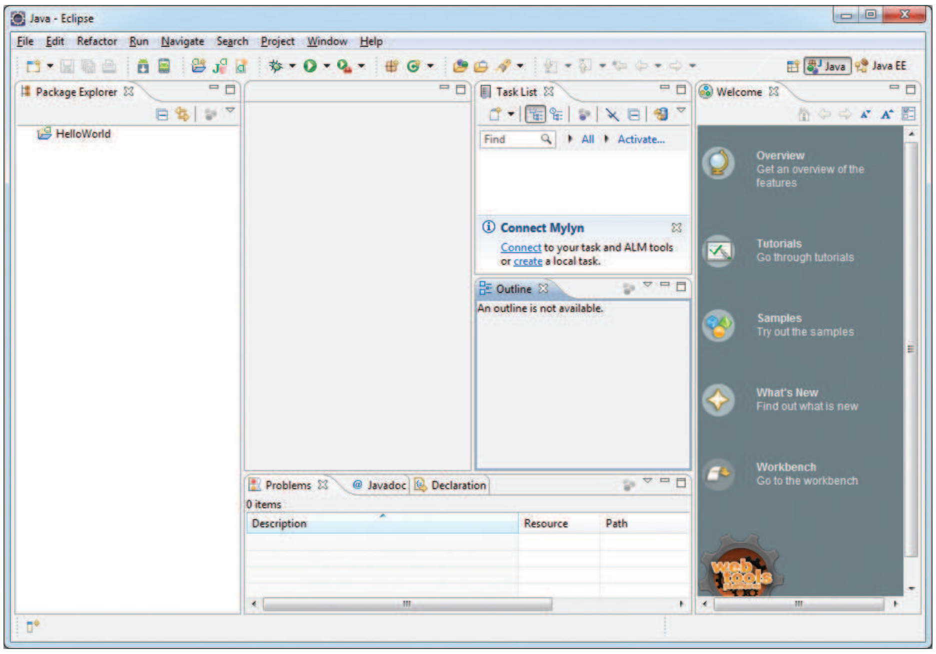


FIGURE 1-27

7. In the Package Explorer (located on the left of the Eclipse IDE), expand the HelloWorld project by clicking on the various arrows displayed to the left of each item in the project (see Figure 1-28). In the `res/layout` folder, double-click the `main.xml` file.

8. The `main.xml` file defines the user interface (UI) of your application. The default view is the Layout view, which lays out the activity graphically. To modify the UI by hand, click the `main.xml` tab located at the bottom (see Figure 1-29).

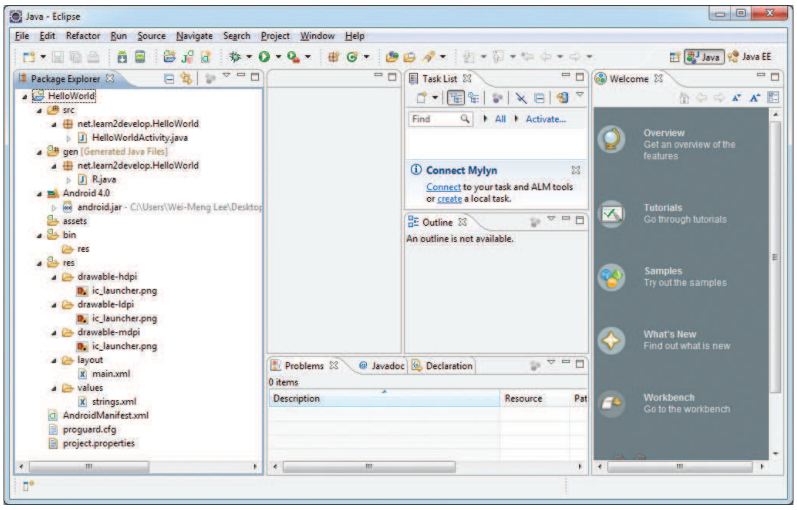
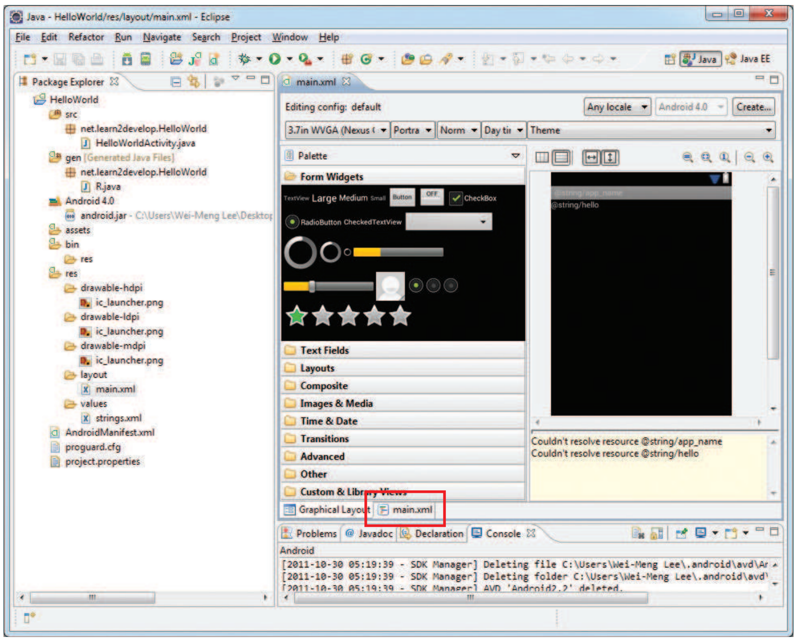


FIGURE 1-28



Couldn't resolve resource @string/app_name
Couldn't resolve resource @string/hello

```
Android
[2011-10-30 05:19:39 - SDK Manager] Deleting file C:\Users\Wei-Meng Lee\.android\avd\Ar
[2011-10-30 05:19:39 - SDK Manager] Deleting folder C:\Users\Wei-Meng Lee\.android\avd\
[2011-10-30 05:19:39 - SDK Manager] AVD 'Android2.2' deleted.
```

FIGURE 1-29

9. Add the following code in bold to the `main.xml` file:

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/
android"
    android:layout_width="fill_parent"
```

```
        android:layout_height="fill_parent"
        android:orientation="vertical" >

        <TextView
            android:layout_width="fill_parent"
            android:layout_height="wrap_content"
            android:text="@string/hello" />

        <TextView
            android:layout_width="fill_parent"
            android:layout_height="wrap_content"
            android:text="This is my first Android Application!" />

        <Button
            android:layout_width="fill_parent"
            android:layout_height="wrap_content"
            android:text="And this is a clickable button!" />

    </LinearLayout>
```

10. To save the changes made to your project, press Ctrl+S.

11. You are now ready to test your application on the Android emulator. Right-click the project name in Eclipse and select Run As ➪ Android Application (see Figure 1-30).

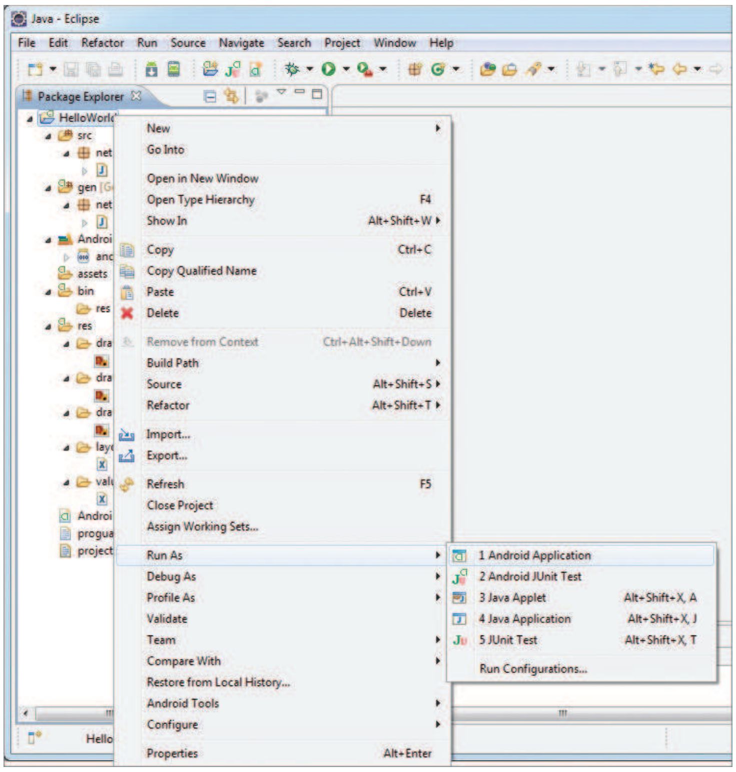
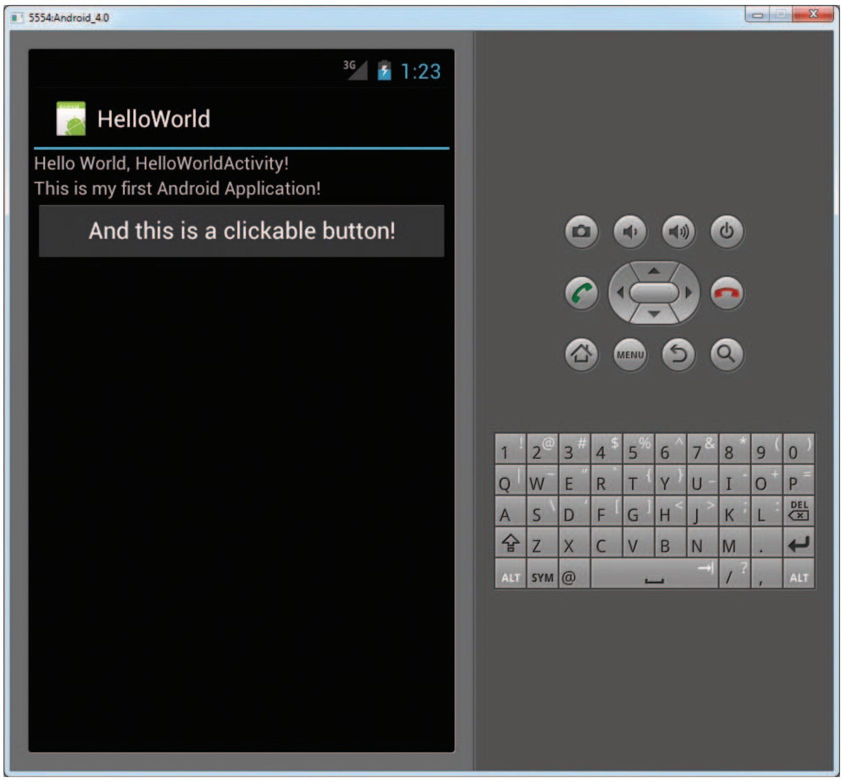


FIGURE 1-30

12. If you have not made any mistakes in the project, you should now be able to see the application installed and running on the Android emulator (see Figure 1-31).



Hello World, HelloWorldActivity!
This is my first Android Application!
And this is a clickable button!

FIGURE 1-31

13. Click the Home button (the house icon in the lower-left corner above the keyboard) so that it now shows the Home screen (see Figure 1-32).

14. Click the application launcher icon to display the list of applications installed on the device. Note that the HelloWorld application is now installed in the application launcher (see Figure 1-33).

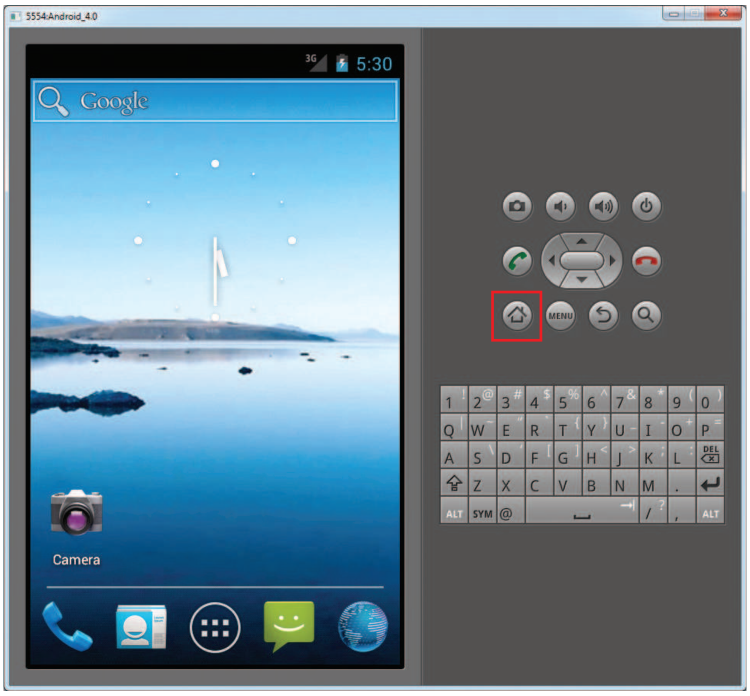


FIGURE 1-32

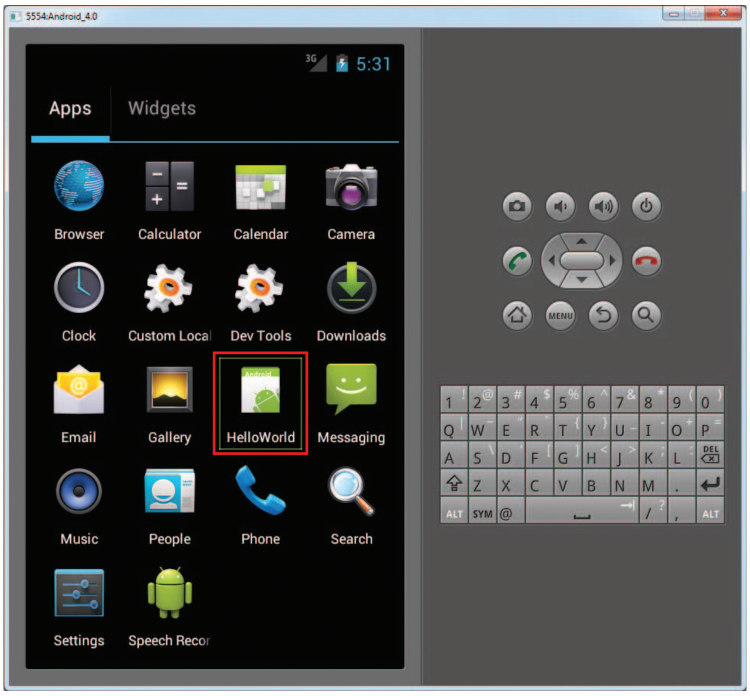
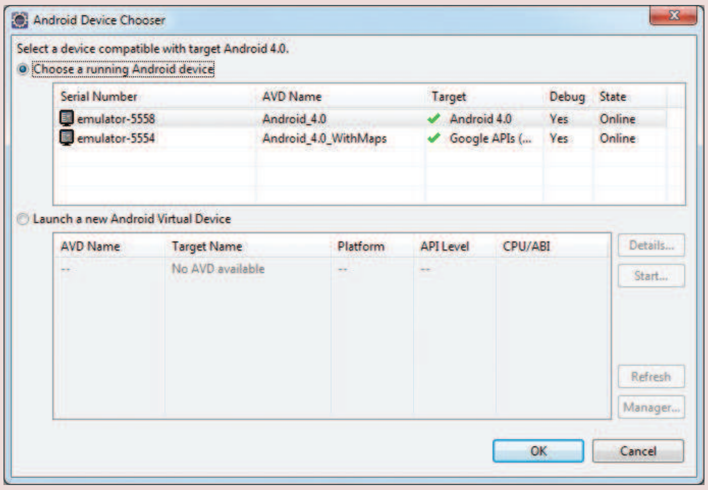


FIGURE 1-33

WHICH AVD WILL BE USED TO TEST YOUR APPLICATION?

Recall that earlier you created a few AVDs using the AVD Manager. So which one will be launched by Eclipse when you run an Android application? Eclipse checks the target that you specified (when you created a new project), comparing it against the list of AVDs that you have created. The first one that matches will be launched to run your application.

If you have more than one suitable AVD running prior to debugging the application, Eclipse will display the Android Device Chooser dialog, which enables you to select the desired emulator/device to debug the application (see Figure 1-34).



Android Device Chooser

Select a device compatible with target Android 4.0.

[✓ Choose a running Android device]

Serial Number	AVD Name	Target	Debug	State
emulator-5558	Android_4.0	✓ Android 4.0	Yes	Online
emulator-5554	Android_4.0_WithMaps	✓ Google APIs (...	Yes	Online

Launch a new Android Virtual Device

AVD Name	Target Name	Platform	API Level	CPU/ABI
--	No AVD available	--	--	

FIGURE 1-34

How It Works

To create an Android project using Eclipse, you need to supply the information shown in Table 1-2.

TABLE 1-2: Project Files Created by Default

PROPERTIES	DESCRIPTION
Project name	The name of the project
Application name	A user-friendly name for your application
Package name	The name of the package. You should use a reverse domain name for this.
Create Activity	The name of the first activity in your application
Min SDK Version	The minimum version of the SDK that your project is targeting

In Android, an *activity* is a window that contains the user interface of your applications. An application can have zero or more activities; in this example, the application contains one activity: `HelloWorldActivity`. This `HelloWorldActivity` is the entry point of the application, which is displayed when the application is started. Chapter 2 discusses activities in more detail.

In this simple example, you modified the `main.xml` file to display the string "This is my first Android Application!" and a button. The `main.xml` file contains the user interface of the activity, which is displayed when `HelloWorldActivity` is loaded.

When you debug the application on the Android emulator, the application is automatically installed on the emulator. And that's it — you have developed your first Android application!

The next section unravels how all the various files in your Android project work together to make your application come alive.

ANATOMY OF AN ANDROID APPLICATION

Now that you have created your first Hello World Android application, it is time to dissect the innards of the Android project and examine all the parts that make everything work.

First, note the various files that make up an Android project in the Package Explorer in Eclipse (see Figure 1-35).

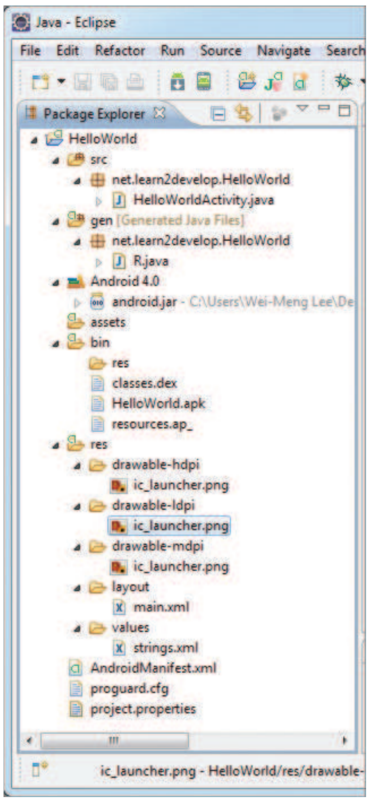


FIGURE 1-35

The various folders and their files are as follows:

- `src` — Contains the `.java` source files for your project. In this example, there is one file, `HelloWorldActivity.java`. The `HelloWorldActivity.java` file is the source file for your activity. You write the code for your application in this file. The Java file is listed under the package name for your project, which in this case is `net.learn2develop.HelloWorld`.
- `gen` — Contains the `R.java` file, a compiler-generated file that references all the resources found in your project. You should not modify this file. All the resources in your project are automatically compiled into this class so that you can refer to them using the class.
- `Android 4.0` library — This item contains one file, `android.jar`, which contains all the class libraries needed for an Android application.
- `assets` — This folder contains all the assets used by your application, such as HTML, text files, databases, etc.
- `bin` — This folder contains the files built by the ADT during the build process. In particular, it generates the `.apk` file (Android Package). An `.apk` file is the application binary of an Android application. It contains everything needed to run an Android application.

- ➤ `res` — This folder contains all the resources used in your application. It also contains a few other subfolders: `drawable-<resolution>`, `layout`, and `values`. Chapter 3 talks more about how you can support devices with different screen resolutions and densities.
- ➤ `AndroidManifest.xml` — This is the manifest file for your Android application. Here you specify the permissions needed by your application, as well as other features (such as intent-filters, receivers, etc.). Chapter 2 discusses the use of the `AndroidManifest.xml` file in more detail.

The `main.xml` file defines the user interface for your activity. Observe the following in bold:

```
<TextView
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:text="@string/hello" />
```

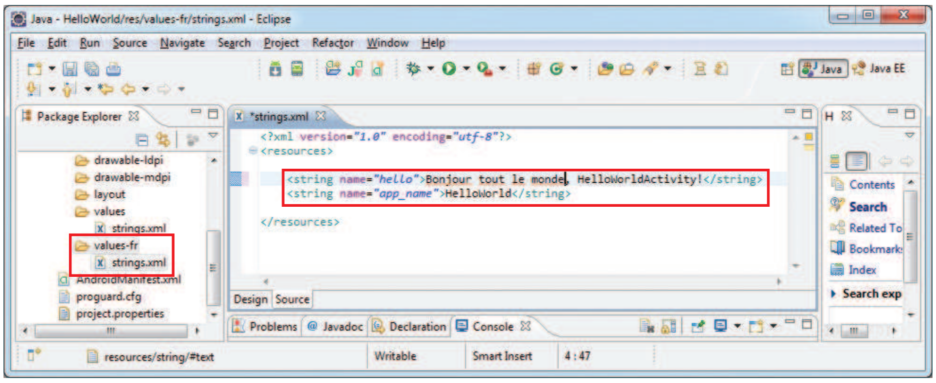
The `@string` in this case refers to the `strings.xml` file located in the `res/values` folder. Hence, `@string/hello` refers to the `hello` string defined in the `strings.xml` file, which is "Hello World, HelloWorldActivity!":

```
<?xml version="1.0" encoding="utf-8"?>
<resources>

    <string name="hello">Hello World, HelloWorldActivity!</string>
    <string name="app_name">HelloWorld</string>

</resources>
```

It is recommended that you store all the string constants in your application in this `strings.xml` file and reference these strings using the `@string` identifier. That way, if you ever need to localize your application to another language, all you need to do is make a copy of the entire `values` folder and modify the values of `strings.xml` to contain the string in the language that you want to display. Figure 1-36 shows that I have another folder named `values-fr` with the `strings.xml` file containing the same `hello` string in French.



```
<?xml version="1.0" encoding="utf-8"?>
<resources>

    <string name="hello">Bonjour tout le monde, HelloWorldActivity!</string>
    <string name="app_name">HelloWorld</string>

</resources>
```

FIGURE 1-36

If the user loads the same application on a phone configured to display French as the default language, your application will automatically display the `hello` string in French.

The next important file in an Android project is the manifest file. Note the content of the `AndroidManifest.xml` file:

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="net.learn2develop.HelloWorld"
    android:versionCode="1"
    android:versionName="1.0" >

    <uses-sdk android:minSdkVersion="14" />

    <application
        android:icon="@drawable/ic_launcher"
        android:label="@string/app_name" >
        <activity
            android:label="@string/app_name"
            android:name=".HelloWorldActivity" >
            <intent-filter >
                <action android:name="android.intent.action.MAIN" />

                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
    </application>

</manifest>
```

The `AndroidManifest.xml` file contains detailed information about the application:

- It defines the package name of the application as `net.learn2develop.HelloWorld`.
- The version code of the application is 1 (set via the `android:versionCode` attribute). This value is used to identify the version number of your application. It can be used to programmatically determine whether an application needs to be upgraded.
- The version name of the application is 1.0 (set via the `android:versionName` attribute). This string value is mainly used for display to the user. You should use the format *<major>.<minor>.<point>* for this value.
- The `android:minSdkVersion` attribute of the `<uses-sdk>` element specifies the minimum version of the OS on which the application will run.
- The application uses the image named `ic_launcher.png` located in the `drawable` folders.
- The name of this application is the string named `app_name` defined in the `strings.xml` file.
- There is one activity in the application represented by the `HelloWorldActivity.java` file. The label displayed for this activity is the same as the application name.

- Within the definition for this activity, there is an element named `<intent-filter>`:
  - The action for the intent filter is named `android.intent.action.MAIN` to indicate that this activity serves as the entry point for the application.
  - The category for the intent-filter is named `android.intent.category.LAUNCHER` to indicate that the application can be launched from the device's launcher icon. Chapter 2 discusses intents in more detail.

As you add more files and folders to your project, Eclipse will automatically generate the content of `R.java`, which currently contains the following:

```
/* AUTO-GENERATED FILE.  DO NOT MODIFY.
 *
 * This class was automatically generated by the
 * aapt tool from the resource data it found.  It
 * should not be modified by hand.
 */

package net.learn2develop.HelloWorld;

public final class R {
    public static final class attr {
    }
    public static final class drawable {
        public static final int ic_launcher=0x7f020000;
    }
    public static final class layout {
        public static final int main=0x7f030000;
    }
    public static final class string {
        public static final int app_name=0x7f040001;
        public static final int hello=0x7f040000;
    }
}
```

You are not supposed to modify the content of the `R.java` file; Eclipse automatically generates the content for you when you modify your project.

NOTE *If you delete* `R.java` *manually, Eclipse will regenerate it for you immediately. Note that in order for Eclipse to generate the* `R.java` *file for you, the project must not contain any errors. If you realize that Eclipse has not regenerated* `R.java` *after you have deleted it, check your project again. The code may contain syntax errors, or your XML files (such as* `AndroidManifest.xml`, `main.xml`, *etc.) may not be well-formed.*

Finally, the code that connects the activity to the UI (`main.xml`) is the `setContentView()` method, which is in the `HelloWorldActivity.java` file:

```
package net.learn2develop.HelloWorld;

import android.app.Activity;
import android.os.Bundle;

public class HelloWorldActivity extends Activity {
    /** Called when the activity is first created. */
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.main);
    }
}
```

Here, `R.layout.main` refers to the `main.xml` file located in the `res/layout` folder. As you add additional XML files to the `res/layout` folder, the filenames will automatically be generated in the `R.java` file. The `onCreate()` method is one of many methods that are fired when an activity is loaded. Chapter 2 discusses the life cycle of an activity in more detail.

SUMMARY

This chapter has provided a brief overview of Android, and highlighted some of its capabilities. If you have followed the sections on downloading the tools and the Android SDK, you should now have a working system — one that is capable of developing more interesting Android applications other than the Hello World application. In the next chapter, you will learn about the concepts of activities and intents, and the very important roles they play in Android.

EXERCISES

1. What is an AVD?

2. What is the difference between the `android:versionCode` and `android:versionName` attributes in the `AndroidManifest.xml` file?

3. What is the use of the `strings.xml` file?

Answers to the exercises can be found in Appendix C.