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Lauren Darcey
Shane Conder

Fourth Edition

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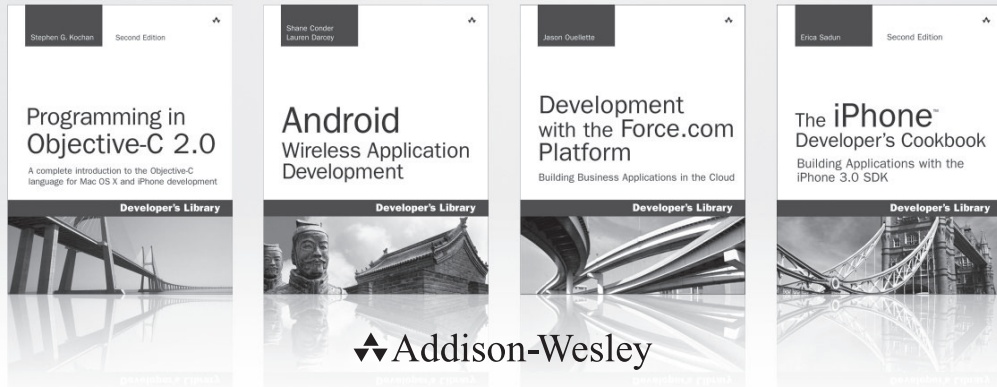
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Introduction to Android™ Application Development

Android Essentials

Fourth Edition

Joseph Annuzzi, Jr.
Lauren Darcey
Shane Conder

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This book is dedicated to Cleopatra (Cleo).

—Joseph Annuzzi, Jr.

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About the Authors

Joseph Annuzzi, Jr., is a freelance software architect, graphic artist, writer, and technical reviewer. He usually can be found mastering the Android platform, implementing cutting-edge HTML5 capabilities, leveraging various cloud technologies, speaking in different programming languages, working with diverse frameworks, integrating with various social APIs, tinkering with peer-to-peer, cryptography, and computer vision algorithms, or creating stunningly realistic 3D renders. He is always on the lookout for disruptive Internet and mobile technologies and has multiple patent applications in process. He graduated from the University of California, Davis, with a BS in managerial economics and a minor in computer science and lives where much of the action is, Silicon Valley.

When he is not working with technology, he has been known to lounge in the sun on the beaches of the Black Sea with international movie stars; he has trekked through the Bavarian forest in winter, has immersed himself in the culture of the Italian Mediterranean, and has narrowly escaped the wrath of an organized crime ring in Eastern Europe after his taxi dropped him off in front of the bank ATM they were liquidating. He also lives an active and healthy lifestyle, designs and performs custom fitness training routines to stay in shape, and adores his loyal beagle, Cleopatra.

Lauren Darcey is responsible for the technical leadership and direction of a small software company specializing in mobile technologies, including Android, iOS, BlackBerry, Palm Pre, BREW, and J2ME, and consulting services. With more than two decades of experience in professional software production, Lauren is a recognized authority in application architecture and the development of commercial-grade mobile applications. Lauren received a BS in computer science from the University of California, Santa Cruz.

She spends her copious free time traveling the world with her geeky mobile-minded husband and is an avid nature photographer. Her work has been published in books and newspapers around the world. In South Africa, she dove with 4-meter-long great white sharks and got stuck between a herd of rampaging hippopotami and an irritated bull elephant. She's been attacked by monkeys in Japan, gotten stuck in a ravine with two hungry lions in Kenya, gotten thirsty in Egypt, narrowly avoided a *coup d'état* in Thailand, geocached her way through the Swiss Alps, drank her way through the beer halls of Germany, slept in the crumbling castles of Europe, and gotten her tongue stuck to an iceberg in Iceland (while being watched by a herd of suspicious wild reindeer).

Shane Conder has extensive development experience and has focused his attention on mobile and embedded development for the past decade. He has designed and developed many commercial applications for Android, iOS, BREW, BlackBerry, J2ME, Palm, and

Windows Mobile—some of which have been installed on millions of phones worldwide. Shane has written extensively about the mobile industry and evaluated mobile development platforms on his tech blogs and is well known within the blogosphere. Shane received a BS in computer science from the University of California.

A self-admitted gadget freak, Shane always has the latest smartphone, tablet, or other mobile device. He can often be found fiddling with the latest technologies, such as cloud services and mobile platforms, and other exciting, state-of-the-art technologies that activate the creative part of his brain. He also enjoys traveling the world with his geeky wife, even if she did make him dive with 4-meter-long great white sharks and almost get eaten by a lion in Kenya. He admits that he has to take at least two phones with him when backpacking—even though there is no coverage—and that he snickered and whipped out his Android phone to take a picture when Laurie got her tongue stuck to that iceberg in Iceland, and that he is catching on that he should be writing his own bio.

Introduction

Android is a popular, free, open-source mobile platform that has taken the wireless world by storm. This book provides guidance for software development teams on designing, developing, testing, debugging, and distributing professional Android applications. If you're a veteran mobile developer, you can find tips and tricks to streamline the development process and take advantage of Android's unique features. If you're new to mobile development, this book provides everything you need to make a smooth transition from traditional software development to mobile development—specifically, its most promising platform: Android.

Who Should Read This Book

This book includes tips for successful mobile development based upon our years in the mobile industry and covers everything you need to know in order to run a successful Android project from concept to completion. We cover how the mobile software process differs from traditional software development, including tricks to save valuable time and pitfalls to avoid. Regardless of the size of your project, this book is for you.

This book was written for several audiences:

- **Software developers who want to learn to develop professional Android applications.** The bulk of this book is targeted at software developers with Java experience who do not necessarily have mobile development experience. More-seasoned developers of mobile applications can learn how to take advantage of Android and how it differs from the other technologies on the mobile development market today.
- **Quality assurance personnel tasked with testing Android applications.** Whether they are black-box or white-box testing, quality assurance engineers can find this book invaluable. We devote several chapters to mobile QA concerns, including topics such as developing solid test plans and defect-tracking systems for mobile applications, how to manage handsets, and how to test applications thoroughly using all the Android tools available.
- **Project managers planning and managing Android development teams.** Managers can use this book to help plan, hire for, and execute Android projects from start to finish. We cover project risk management and how to keep Android projects running smoothly.
- **Other audiences.** This book is useful not only to the software developer, but also to the corporation looking at potential vertical market applications, the entrepreneur thinking about a cool phone application, and the hobbyist looking for some

fun with his or her new phone. Businesses seeking to evaluate Android for their specific needs (including feasibility analysis) can also find the information provided valuable. Anyone with an Android handset and a good idea for a mobile application can put the information in this book to use for fun and profit.

Key Questions Answered in This Book

This book answers the following questions:

1. What is Android? How do the SDK versions differ?
2. How is Android different from other mobile technologies, and how can developers take advantage of these differences?
3. How do developers use the Android SDK and ADT Bundle to develop and debug Android applications on the emulator and handsets?
4. How are Android applications structured?
5. How do developers design robust user interfaces for mobile—specifically, for Android?
6. What capabilities does the Android SDK have and how can developers use them?
7. How does the mobile development process differ from traditional desktop development?
8. What strategies work best for Android development?
9. What do managers, developers, and testers need to look for when planning, developing, and testing a mobile application?
10. How do mobile teams design bulletproof Android applications for publication?
11. How do mobile teams package Android applications for deployment?
12. How do mobile teams make money from Android applications?
13. And, finally, what is new in this edition of the book?

How This Book Is Structured

Introduction to Android Application Development, Fourth Edition focuses on Android essentials, including setting up the development environment, understanding the application lifecycle, user interface design, developing for different types of devices, and the mobile software process from design and development to testing and publication of commercial-grade applications.

The book is divided into six parts. Here is an overview of the various parts:

■ Part I: An Overview of the Android Platform

Part I provides an introduction to Android, explaining how it differs from other mobile platforms. You become familiar with the Android SDK and tools, install the development tools, and write and run your first Android application—on the

emulator and on a handset. This section is of primary interest to developers and testers, especially white-box testers.

- **Part II: Android Application Basics**

Part II introduces the design principles necessary to write Android applications. You learn how Android applications are structured and how to include resources, such as strings, graphics, and user interface components, in your projects. This section is of primary interest to developers.

- **Part III: Android User Interface Design Essentials**

Part III dives deeper into how user interfaces are designed in Android. You learn about the core user interface element in Android: the `View`. You also learn about the most common user interface controls and layouts provided in the Android SDK. This section is of primary interest to developers.

- **Part IV: Android Application Design Essentials**

Part IV covers the features used by most Android applications, including storing persistent application data using preferences and working with files, directories, and content providers. You also learn how to design applications that will run smoothly on many different Android devices. This section is of primary interest to developers.

- **Part V: Publishing and Distributing Android Applications**

Part V covers the software development process for mobile, from start to finish, with tips and tricks for project management, software developers, user experience designers, and quality assurance personnel.

- **Part VI: Appendixes**

Part VI includes several helpful appendixes to help you get up and running with the most important Android tools. This section consists of an overview of the Android development tools, two helpful quick-start guides for the Android development tools—the emulator and DDMS—an appendix of Android IDE tips and tricks, as well as answers to the end-of-chapter quiz questions.

An Overview of Changes in This Edition

When we began writing the first edition of this book, there were no Android devices on the market. Today there are hundreds of devices shipping all over the world—smartphones, tablets, e-book readers, smart watches, and specialty devices such as gaming consoles, Google TV, and Google Glass. Other devices such as Google Chromecast provide screen sharing between Android devices and TVs.

The Android platform has gone through extensive changes since the first edition of this book was published. The Android SDK has many new features, and the development tools have received many much-needed upgrades. Android, as a technology, is now the leader within the mobile marketplace.

In this new edition, we took the opportunity to add a wealth of information about how to plan the Android application experience for users. In addition, we have included valuable and ready-to-use techniques for automating the testing of your Android

applications, to ensure that you deliver high-quality code. We have also updated many chapters and accompanying content for making use of `Fragment`-based implementation approaches. But don't worry, it's still the book readers loved the first, second, and third time around; it's just much bigger, better, and more comprehensive, following many best practices. In addition to adding new content, we've retested and upgraded all existing content (text and sample code) for use with the latest Android SDKs available while still remaining backward compatible. We created quiz questions to help readers ensure they understand each chapter's content, and we added end-of-chapter exercises for readers to perform to dig deeper into all that Android has to offer. The Android development community is diverse, and we aim to support all developers, regardless of which devices they are developing for. This includes developers who need to target nearly all platforms, so coverage in some key areas of older SDKs continues to be included because it's often the most reasonable option for compatibility.

Here are some of the highlights of the additions and enhancements we've made to this edition:

- Coverage of the latest and greatest Android tools and utilities is included.
- The topic of planning the Android application experience now has its own chapter, which includes a discussion of different navigation patterns with a new code sample and presents techniques that you can use to improve the quality of the user experience.
- The chapter on testing has brand-new content to include topics such as unit testing and provides a practical code sample showing how to leverage the automated testing techniques used by the experts for testing their Android applications.
- A new code sample and a discussion of how to add an `ActionBar` to your applications have been included.
- The chapter on dialogs has been completely updated to make use of `DialogFragments`.
- The chapter on Android preferences now includes an additional code sample with a brand-new discussion of how to add preference fragments that display accordingly within single-pane and multipane layouts.
- The publishing chapter has been completely redesigned to discuss using the new Google Play Developer Console for publishing your applications, in addition to outlining new features provided within the console.
- All chapters and appendixes now include quiz questions and exercises for readers to test their knowledge of the subject matter presented.
- All existing chapters have been updated, often with some entirely new sections.
- All sample code and accompanying applications have been updated to work with the latest SDK.

As you can see, we cover many of the hottest and most exciting features that Android has to offer. We didn't take this review lightly; we touched every existing chapter,

updated content, and added new chapters as well. Finally, we included many additions, clarifications, and, yes, even a few fixes based on the feedback from our fantastic (and meticulous) readers. Thank you!

Development Environments Used in This Book

The Android code in this book was written using the following development environments:

- Windows 7
- Android ADT Bundle (the `adt-bundle-windows-x86-20130729.zip` file was used)
- Android SDK Version 4.3, API Level 18 (Jelly Bean)
- Android SDK Tools Revision 22.0.5
- Android SDK Platform Tools 18.0.1
- Android SDK Build Tools 18.0.1
- Android Support Library Revision 18 (where applicable)
- Java SE Development Kit (JDK) 6 Update 45
- Android devices: Nexus 4 (phone), Nexus 7 (small tablet), and Nexus 10 (large tablet)

The Android platform continues to grow aggressively in market share against competing mobile platforms, such as Apple iOS and BlackBerry. New and exciting types of Android devices reach consumers' hands at a furious pace. Developers have embraced Android as a target platform to reach the device users of today and tomorrow.

Android's latest major platform update, Android 4.3—frequently called by its code name, Jelly Bean, or just JB—brings many new features that help differentiate Android from the competition. This book features the latest SDK and tools available, but it does not focus on them to the detriment of popular legacy versions of the platform. The book is meant to be an overall reference to help developers support all popular devices on the market today. As of the writing of this book, approximately 37.9% of users' devices are running a version of Android Jelly Bean, 4.1 or 4.2. Of course, some devices will receive upgrades, and users will purchase new Jelly Bean devices as they become available, but for now, developers need to straddle this gap and support numerous versions of Android to reach the majority of users in the field. In addition, the next version of the Android operating system is likely to be released in the near future.

So what does this mean for this book? It means we provide legacy API support and discuss some of the newer APIs available in later versions of the Android SDK. We discuss strategies for supporting all (or at least most) users in terms of compatibility. And we provide screenshots that highlight different versions of the Android SDK, because each major revision has brought with it a change in the look and feel of the overall platform. That said, we are assuming that you are downloading the latest Android tools, so we provide screenshots and steps that support the latest tools available at the time of writing, not

legacy tools. Those are the boundaries we set when trying to determine what to include and leave out of this book.

Supplementary Materials Available

The source code that accompanies this book is available for download from our book's website: <http://introductiontoandroid.blogspot.com/2013/05/book-code-samples.html>. You'll also find other Android topics discussed at our book website (<http://introductiontoandroid.blogspot.com>).

Where to Find More Information

There is a vibrant, helpful Android developer community on the Web. Here are a number of useful websites for Android developers and followers of the wireless industry:

- Android Developer website: the Android SDK and developer reference site:
<http://d.android.com/index.html> or <http://d.android.com>
- Google Plus: Android Developers Group
<https://plus.google.com/+AndroidDevelopers/posts>
- Stack Overflow: the Android website with great technical information (complete with tags) and an official support forum for developers:
<http://stackoverflow.com/questions/tagged/android>
- Open Handset Alliance: Android manufacturers, operators, and developers:
<http://openhandsalliance.com>
- Google Play: buy and sell Android applications:
<https://play.google.com/store>
- Mobiletuts+: mobile development tutorials, including Android:
<http://mobile.tutsplus.com/category/tutorials/android>
- anddev.org: an Android developer forum:
<http://anddev.org>
- Google Team Android Apps: open-source Android applications:
<http://apps-for-android.googlecode.com>
- Android Tools Project Site: the tools team discusses updates and changes:
<https://sites.google.com/a/android.com/tools/recent>
- FierceDeveloper: a weekly newsletter for wireless developers:
<http://fiercedevloper.com>
- Wireless Developer Network: daily news on the wireless industry:
<http://wirelessdevnet.com>

- XDA-Developers Android Forum: from general development to ROMs:
<http://forum.xda-developers.com/forumdisplay.php?f=564>
- Developer.com: a developer-oriented site with mobile articles:
<http://developer.com>

Conventions Used in This Book

This book uses the following conventions:

- Code and programming terms are set in monospace text.
- Java import statements, exception handling, and error checking are often removed from printed code examples for clarity and to keep the book a reasonable length.

This book also presents information in the following sidebars:



Tip

Tips provide useful information or hints related to the current text.



Note

Notes provide additional information that might be interesting or relevant.



Warning

Warnings provide hints or tips about pitfalls that may be encountered and how to avoid them.

Contacting the Authors

We welcome your comments, questions, and feedback. We invite you to visit our blog at

- <http://introductiontoandroid.blogspot.com>

Or email us at

- introtoandroid4e@gmail.com

Circle us on Google+:

- Joseph Annuzzi, Jr.: <http://goo.gl/FBQeL>
- Lauren Darcey: <http://goo.gl/P3RGo>
- Shane Conder: <http://goo.gl/BpVJh>

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Writing Your First Android Application

You should now have a workable Android development environment set up on your computer. Ideally, you have an Android device as well. Now it's time for you to start writing some Android code. In this chapter, you learn how to install the Android sample applications and to add and create Android projects from within the Android IDE. You also learn how to verify that your Android development environment is set up correctly. You then write and debug your first Android application in the software emulator and on an Android device.



Note

The Android Development Tool Bundles are updated frequently. We have made every attempt to provide the latest steps for the latest tools. However, these steps and the user interfaces described in this chapter may change at any time. Please refer to the Android development website (<http://d.android.com/sdk/index.html>) and our book website (<http://introductiontoandroid.blogspot.com>) for the latest information.

Testing Your Development Environment

The best way to make sure you configured your development environment correctly is to run an existing Android application. You can do this easily by using one of the sample applications provided as part of the Android SDK in the `samples` subdirectory found where your Android SDK is installed.

Within the Android SDK sample applications, you will find a classic game called Snake ([http://en.wikipedia.org/wiki/Snake_\(video_game\)](http://en.wikipedia.org/wiki/Snake_(video_game))). To build and run the Snake application, you must create a new Android project in your Android IDE workspace based on the existing Android sample project, create an appropriate Android Virtual Device (AVD) profile, and configure a launch configuration for that project. After you have everything set up correctly, you can build the application and run it on the Android emulator and on an Android device. By testing your development environment with a sample application, you can rule out project configuration and coding issues and focus on determining

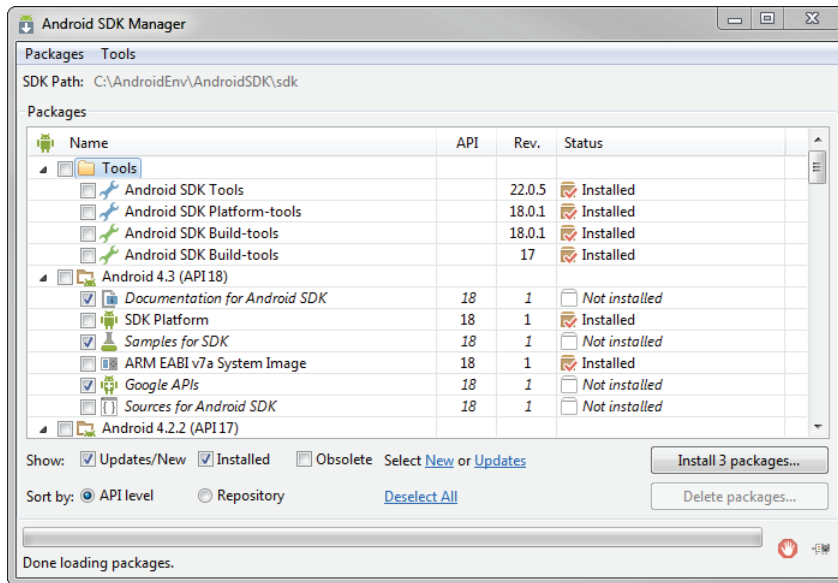


Figure 3.1 The Android SDK Manager.

whether the tools are set up properly for Android development. After this fact has been established, you can move on to writing and compiling your own applications.

Adding the Android Samples Using the SDK Manager

One quick way to learn how to develop Android applications is by reviewing an application that has already been created. There are many Android applications available for this purpose, but first we must download them. Here is how:

1. From within the Android IDE, click the Android SDK Manager icon (📁) to open the Android SDK Manager. You should see a dialog similar to that in Figure 3.1.
2. You now need to install the *Samples for SDK* listed under *Android 4.3 (API 18)*, so go ahead and select this item. You may also want to install a few additional items along with the samples, so select the following for installation (shown in Figure 3.1): *Documentation for Android SDK* and *Google APIs*. Then click *Install Packages*. Make sure that the proper *SDK Tools*, *Platform-tools*, *Build-tools*, *SDK Platform*, and *System Image* are installed as well; if they are not, you should select those for installation now, too.
3. A new dialog appears (see Figure 3.2) asking you to accept the license agreement for the packages that you will be installing. You may accept or reject each license

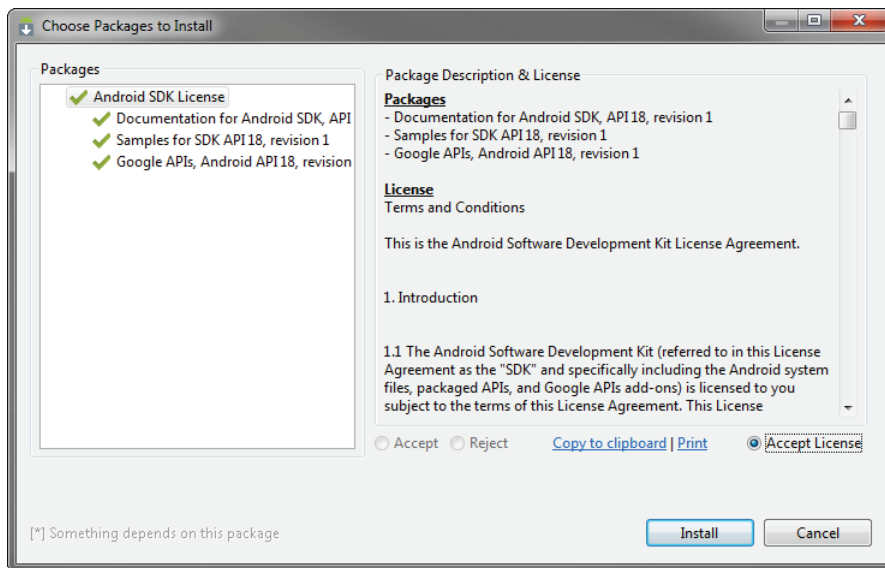


Figure 3.2 Accepting the license agreements.

individually by highlighting a particular package in the left pane and choosing Accept or Reject, or you can accept them all at once by highlighting Android SDK License in the left pane and choosing Accept License. Let's accept all the licenses together by selecting Android SDK License in the left pane, choosing Accept License, and then clicking Install. This will initiate the installation of the selected packages. Wait until the installation is complete.



Tip

To learn more about how to download the Android SDK sample applications for your particular development platform, see <http://d.android.com/tools/samples/index.html>.

Now that the installation is completed, you are ready to begin loading Android sample projects into your workspace.

Adding the Snake Project to Your Android IDE Workspace

To add the Snake project to your Android IDE workspace, follow these steps:

1. Choose File, New, Other...
2. Choose Android, Android Sample Project (see Figure 3.3). Click Next.

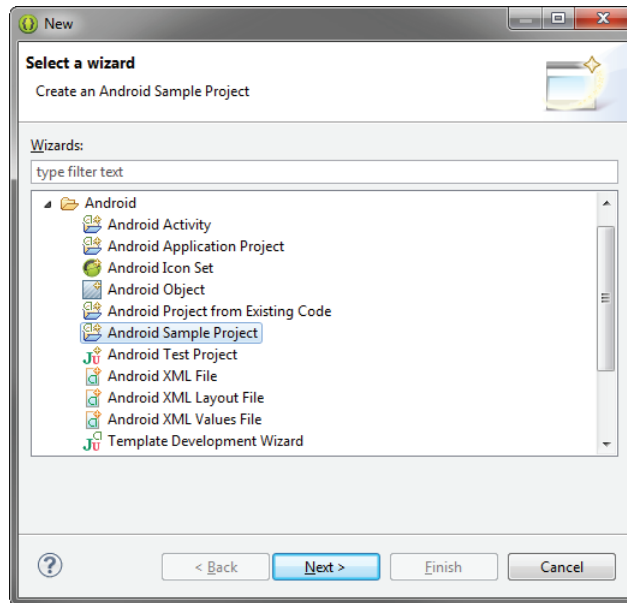


Figure 3.3 Creating a new Android sample project.

3. Choose your build target (see Figure 3.4). In this case, we've picked Android 4.3, API Level 18, from the Android Open Source Project. Click **Next**.
4. Select which sample you want to create (see Figure 3.5). Choose **Snake**.
5. Click **Finish**. You now see the **Snake** project files in your workspace (see Figure 3.6).



Warning

Occasionally the Android IDE shows an error like “Project ‘Snake’ is missing required source folder: gen” when you’re adding an existing project to the workspace. If this happens, navigate to the `/gen` directory and delete the files within. These files are automatically regenerated and the error should disappear. Performing a **Clean** operation followed by a **Build** operation does not always solve this problem.

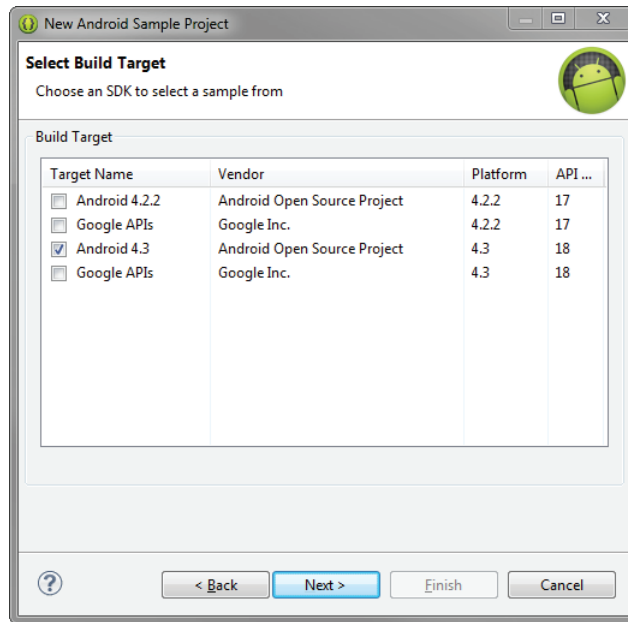


Figure 3.4 Choose an API level for the sample.

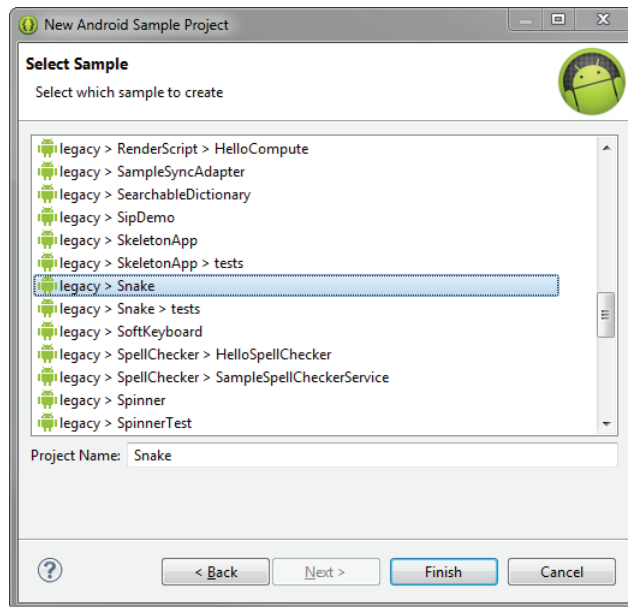


Figure 3.5 Picking the Snake sample project.

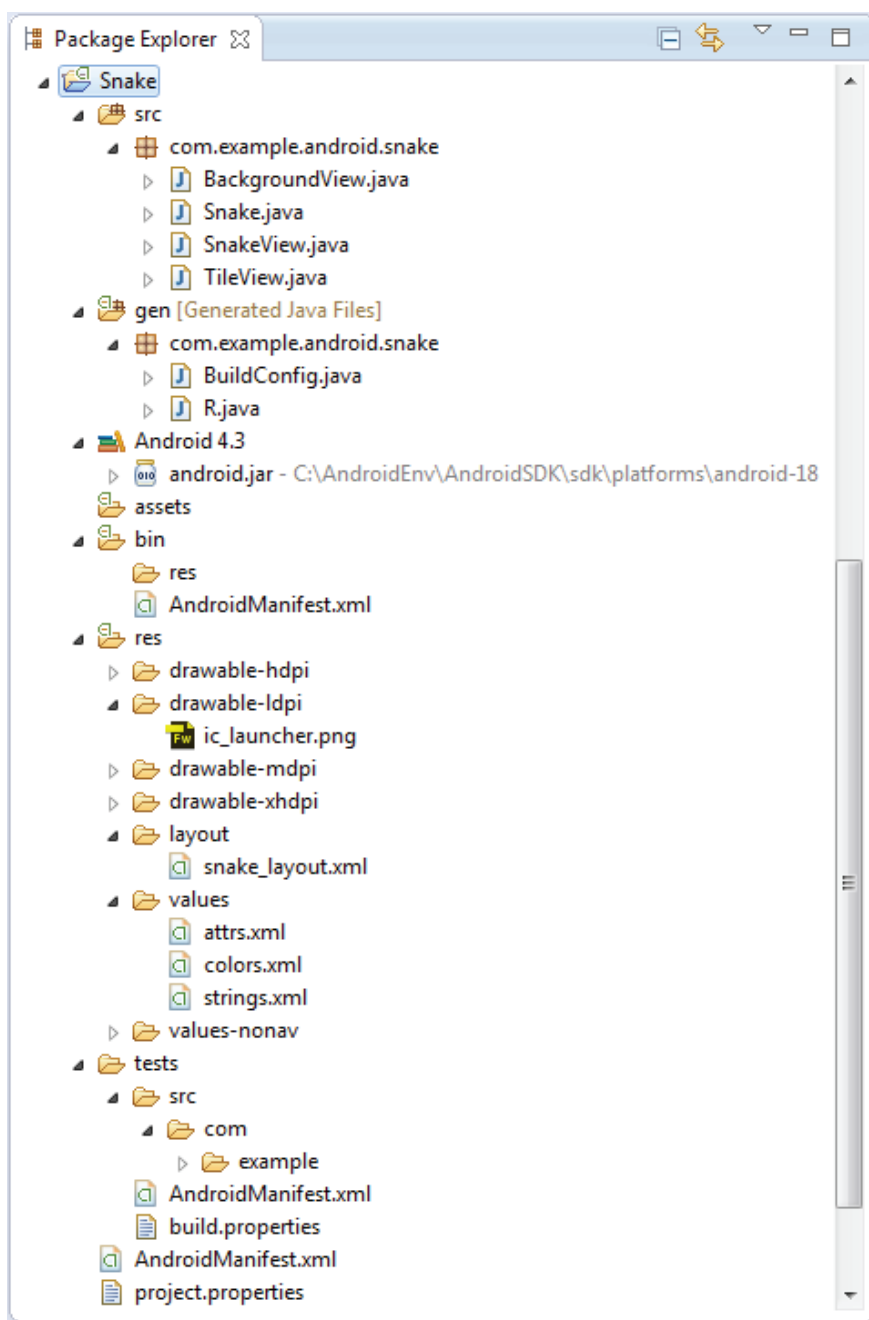


Figure 3.6 The Snake project files.

Creating an AVD for Your Snake Project

The next step is to create an AVD that describes what type of device you want to emulate when running the *Snake* application. This AVD profile describes what type of device you want the emulator to simulate, including which Android platform to support. You do not need to create new AVDs for each application, only for each device you want to emulate. You can specify different screen sizes and orientations, and you can specify whether the emulator has an SD card and, if it does, what capacity the card has.

For the purposes of this example, an AVD for the default installation of Android 4.3 suffices. Here are the steps to create a basic AVD:

1. Launch the Android Virtual Device Manager from within the Android IDE by clicking the little Android device icon on the toolbar (📱). If you cannot find the icon, you can also launch the manager through the Window menu of the Android IDE. You should now see the Android Virtual Device Manager window (see Figure 3.7).
2. Click the **New** button.
3. Choose a name for your AVD. Because we are going to take all the defaults, give this AVD a name of `AndroidVanilla`.

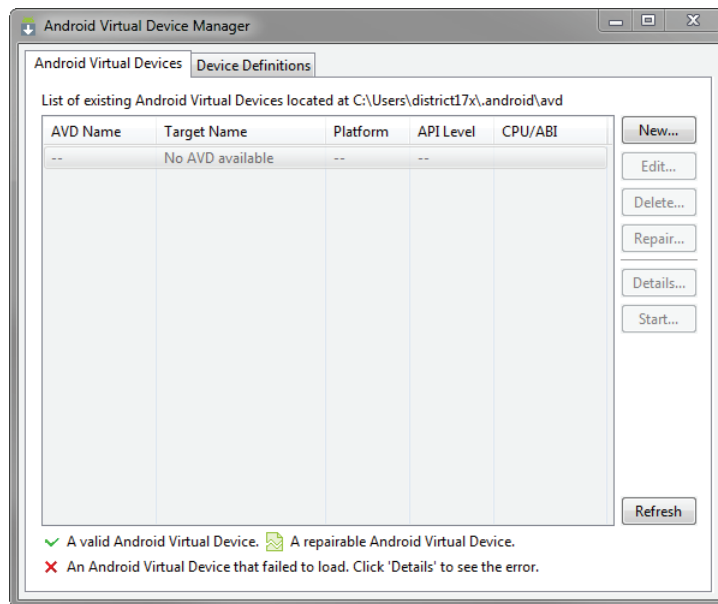


Figure 3.7 Android Virtual Device Manager.

4. Choose a device. This option controls the different resolutions of the emulator. We want to choose a typical device size, so in this case, select `Nexus 4 (4.7", 768 × 1280: xhdpi)`. This option most directly correlates to the popular Nexus 4 Google-branded device. Feel free to choose the most appropriate device to match the Android device on which you plan to run the application.
5. Choose a build target. We want a typical Android 4.3 device, so choose `Google APIs (Google Inc.) - API Level 18` from the drop-down menu. In addition to including the Android APIs, this option will also include the Google APIs and applications, such as the Maps application, as part of the platform image. Although we could choose the standard `Android 4.3 - APIs Level 18` for this project, it is important to be aware of the additional options the Google APIs provide.
6. For the `Memory Options` setting, you may have to try different values for optimal performance depending on the memory configuration of your development machine. The default `RAM` value for this virtual device is 1907 and the `VM Heap` is 64. If your machine is older and does not have a lot of memory, you may need to lower this value significantly to something like 512. The development machine used for this book has 8GB of RAM with a fairly powerful quad-core processor, and the `RAM` value we decided to use is 768 with the `VM Heap` set to 64.
7. Choose an SD card capacity, in either kibibytes or mibibytes. (Not familiar with kibibytes? See this Wikipedia entry: <http://en.wikipedia.org/wiki/Kibibyte>.) This SD card image will take up space on your hard drive and may also take a long time to allocate, so choose something reasonable, such as 1024MiB.
8. Seriously consider enabling the `Snapshot` feature listed under `Emulation Options`. This greatly improves emulator startup performance. See Appendix B, “Quick-Start Guide: The Android Emulator,” for details.
Your project settings will look like Figure 3.8.
9. Click the `OK` button to create the AVD, and then wait for the operation to complete.
10. You should now see the AVD that you just created listed within your Android Virtual Device Manager (see Figure 3.9).

For more information on creating different types of AVDs, check out Appendix B.

Creating a Launch Configuration for Your Snake Project

Next, you must create a launch configuration in the Android IDE to configure under what circumstances the `Snake` application builds and launches. The launch configuration is where you configure the emulator options to use and the entry point for your application.

You can create `Run` configurations and `Debug` configurations separately, each with different options. These configurations are created under the `Run` menu in the Android IDE

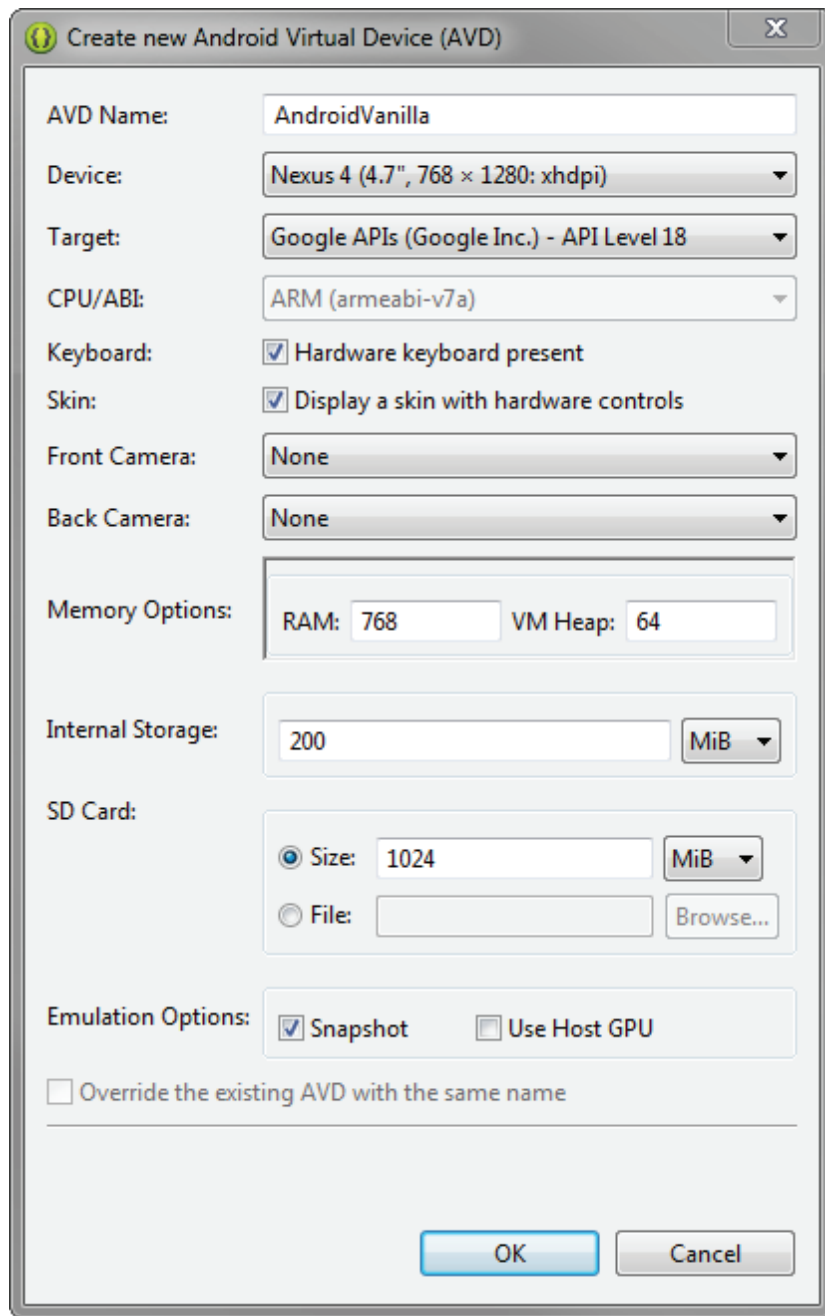


Figure 3.8 Creating a new AVD.

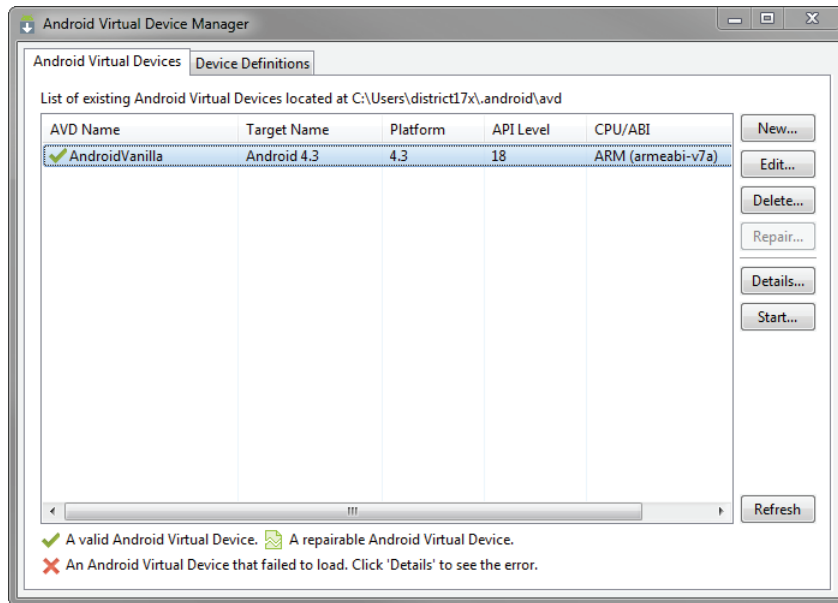


Figure 3.9 The new AVD is now listed.

(Run, Run Configurations... and Run, Debug Configurations...). Follow these steps to create a basic Debug configuration for the Snake application:

1. Choose Run, Debug Configurations...
2. Double-click Android Application to create a new configuration.
3. Name your Debug configuration SnakeDebugConfig.
4. Choose the project by clicking the Browse button and choosing the Snake project (see Figure 3.10).
5. Switch to the Target tab and, from the preferred AVD list, choose the AndroidVanilla AVD created earlier, as shown in Figure 3.11.
6. Choose Apply and then Close.

You can set other emulator and launch options on the Target and Common tabs, but for now we are leaving the defaults as they are.

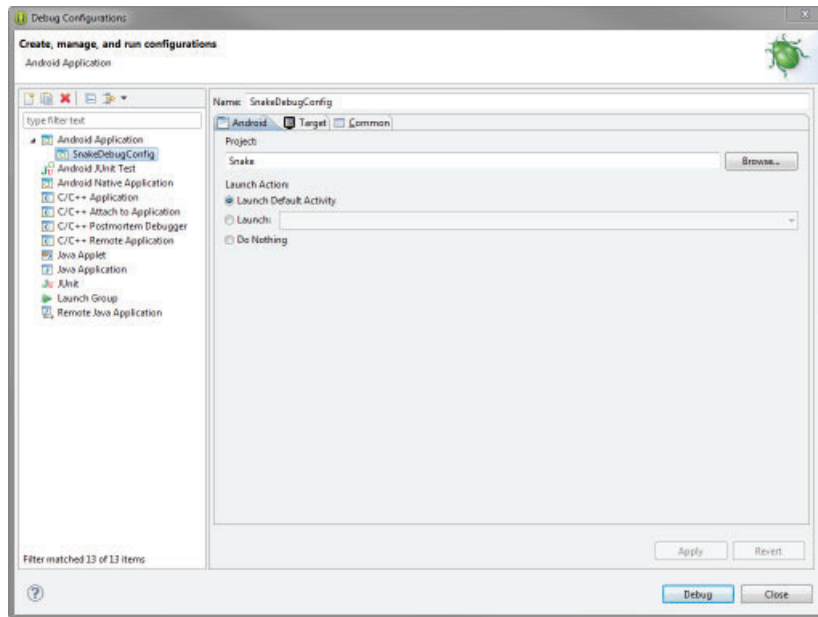


Figure 3.10 Naming the Debug configuration in the Android IDE.

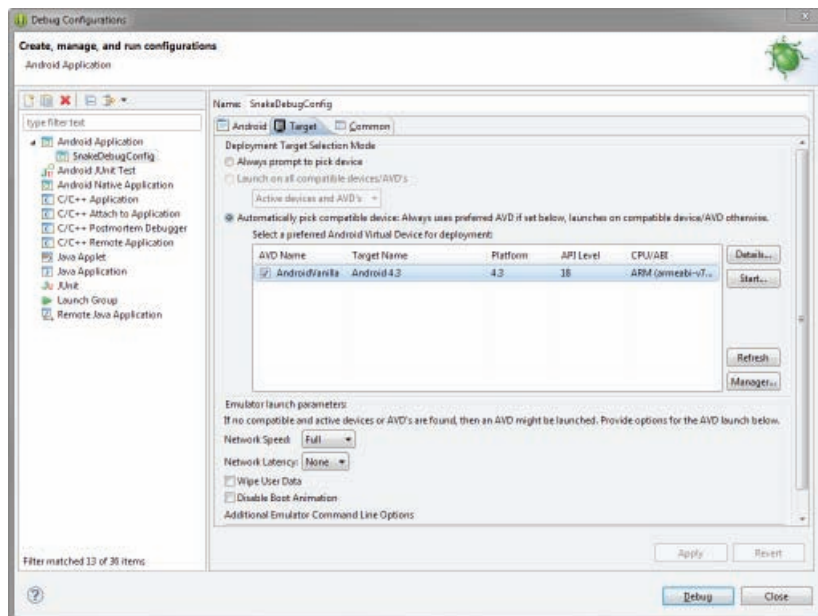



Figure 3.11 Target AVD for the Debug configuration in the Android IDE.

Running the Snake Application in the Android Emulator

Now you can run the Snake application using the following steps:

1. Choose the `Debug As` icon drop-down menu on the toolbar ()
2. Pull the drop-down menu and choose the `SnakeDebugConfig` you created. If you do not see the `SnakeDebugConfig` listed, find it in the `Debug Configurations...` listing and click the `Debug` button. Subsequent launches can be initiated from the little bug drop-down.
3. The Android emulator starts up; this might take a few moments to initialize. Then the application will be installed or reinstalled onto the emulator.



Tip

It can take a long time for the emulator to start up, even on very fast computers. You might want to leave it around while you work and reattach to it as needed. The tools in the Android IDE handle reinstalling the application and relaunching it, so you can more easily keep the emulator loaded all the time. This is another reason to enable the `Snapshot` feature for each AVD. You can also use the `Start` button on the Android Virtual Device Manager to load an emulator before you need it. Launching the AVD this way also gives you some additional options such as screen scaling (see Figure 3.12), which can be used to either fit the AVD on your screen if it's very high resolution or more closely emulate the size it might be on real hardware.

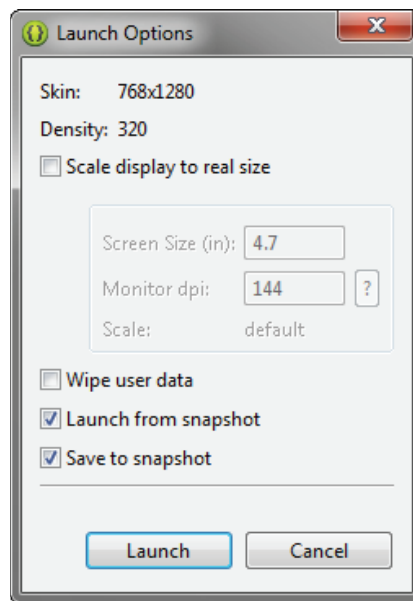


Figure 3.12 Configuring AVD launch options.

4. If necessary, swipe the screen from left to right to unlock the emulator, as shown in Figure 3.13.
5. The Snake application starts and you can play the game, as shown in Figure 3.14.

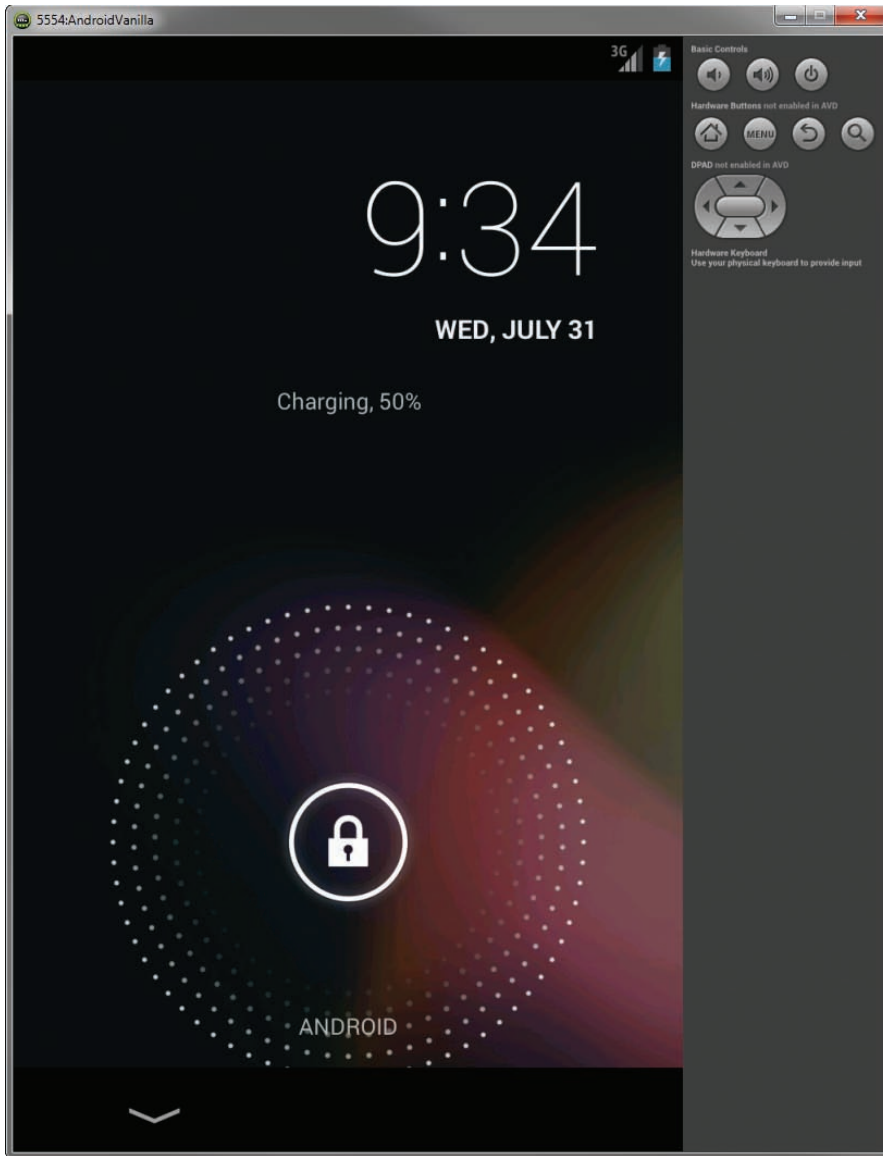


Figure 3.13 The Android emulator launching (locked).

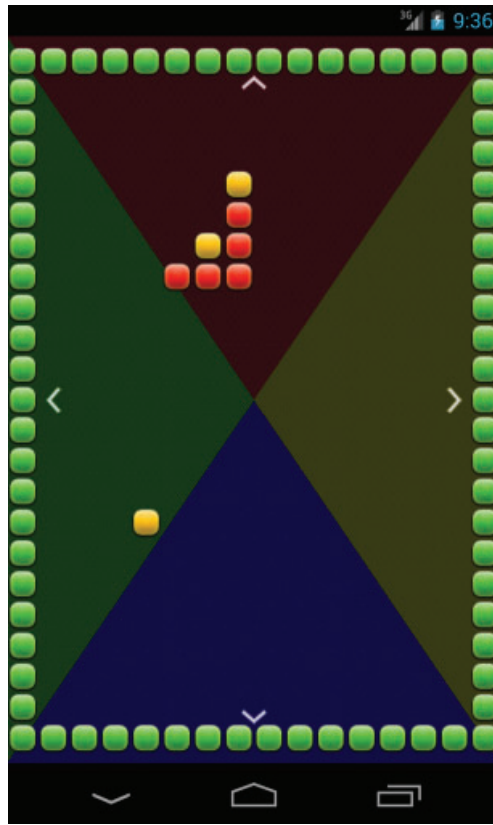


Figure 3.14 The Snake game in the Android emulator.

You can interact with the Snake application through the emulator and play the game. You can also launch the Snake application from the All Apps screen at any time by clicking its application icon. There is no need to shut down and restart the emulator every time you rebuild and reinstall your application for testing. Simply leave the emulator running on your computer in the background while you work in the Android IDE and then redeploy using the Debug configuration again.

Building Your First Android Application

Now it's time to write your first Android application from scratch. To get your feet wet, you will start with a simple "Hello World" application and build upon it to explore some of the features of the Android platform in more detail.

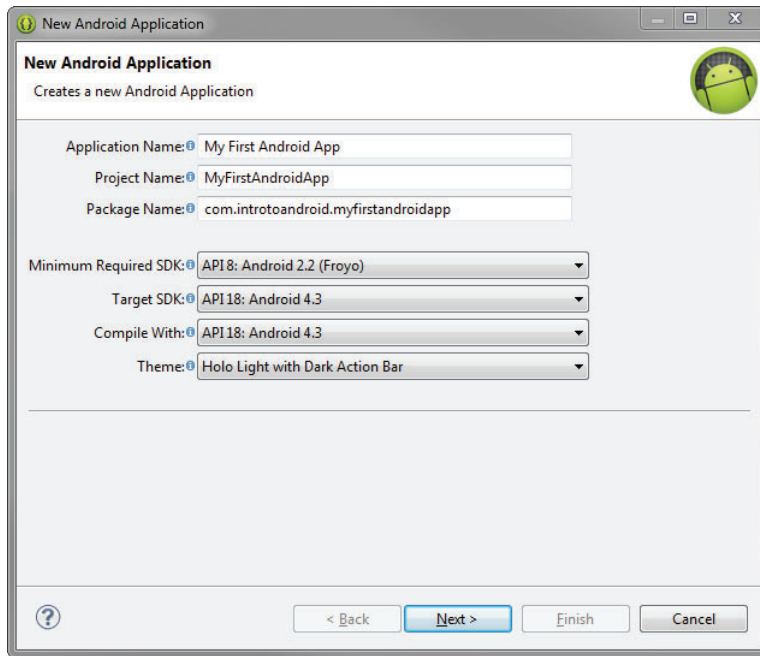


Figure 3.15 Configuring a new Android project.



Tip

The code examples provided in this chapter are taken from the `MyFirstAndroidApp` application. The source code for the `MyFirstAndroidApp` application is provided for download on the book's website.

Creating and Configuring a New Android Project

You can create a new Android application in much the same way that you added the Snake application to your Android IDE workspace.

The first thing you need to do is create a new project in your Android IDE workspace. The Android Application Project creation wizard creates all the required files for an Android application. Follow these steps within the Android IDE to create a new project:

1. Choose File, New, Android Application Project on the Android IDE toolbar.
2. Choose an application name as shown in Figure 3.15. The application name is the “friendly” name of the application and the name shown with the icon on the

application launcher. Name the application `My First Android App`. This will automatically create a project name of `MyFirstAndroidApp`, but you are free to change this to a name of your choosing.

3. We should also change the package name, using reverse domain name notation (http://en.wikipedia.org/wiki/Reverse_domain_name_notation), to `com.introtoandroid.myfirstandroidapp`. The Minimum Required SDK version should be the first SDK API level you plan to target. Because our application will be compatible with just about any Android device, you can set this number low (such as to 4 to represent Android 1.6) or at the target API level to avoid any warnings in the Android IDE. Make sure you set the minimum SDK version to encompass any test devices you have available so you can successfully install the application on them. The default options are just fine for our example. Click **Next**.
4. Keep the rest of the **New Android Application** settings at their defaults, unless you want to change the directory of where the source files will be stored. Click **Next** (see Figure 3.16).

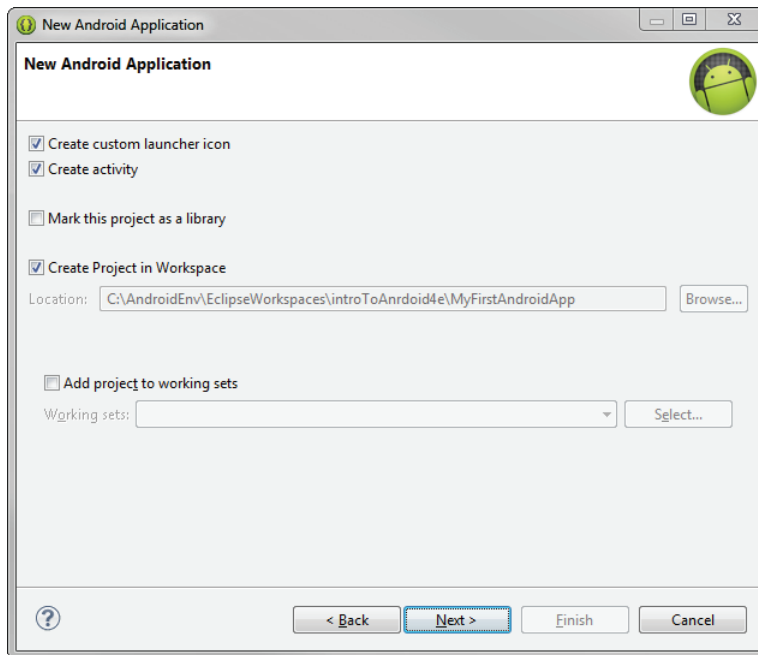


Figure 3.16 Configuring Android project options.

5. Leave the `Configure Launcher Icon` settings at their defaults. This option screen would allow us to define how our application launcher icon appears, but for this example, we will use the standard icon set included with the Android SDK. Choose `Next` (see Figure 3.17).
6. The `Create Activity` wizard allows us to include a default launch activity by type. We will leave the settings as is and choose `Next` (see Figure 3.18).
7. Choose an `Activity Name`. Call this `Activity` class `MyFirstAndroidApp` `Activity`. The `Layout Name` should automatically change to a name resembling what you just entered. Finally, click the `Finish` button (see Figure 3.19) to create the application.
8. The Android IDE should now display our first application created using the wizard with our layout file open and ready for editing (see Figure 3.20).

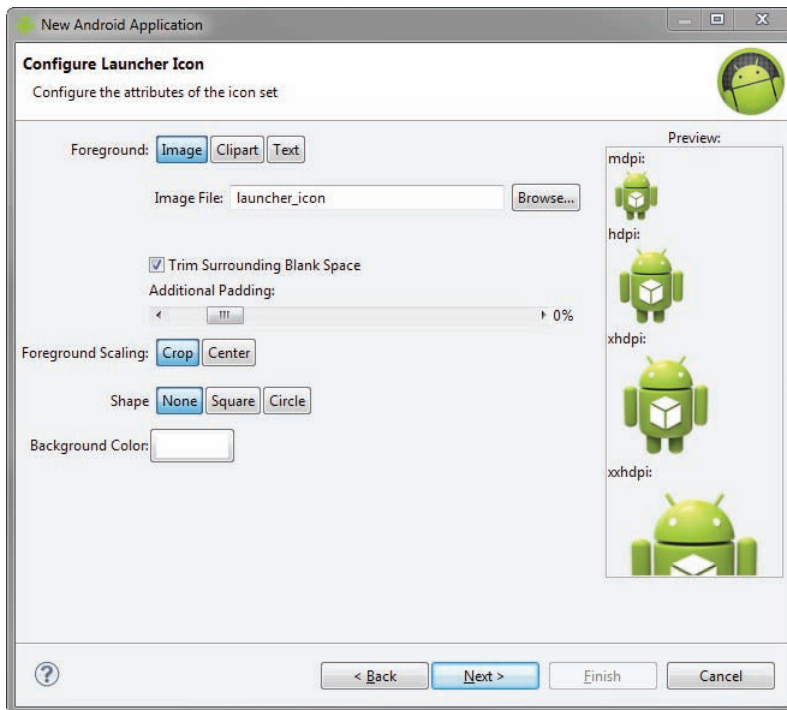


Figure 3.17 Configuring the launcher icon for our Android project.

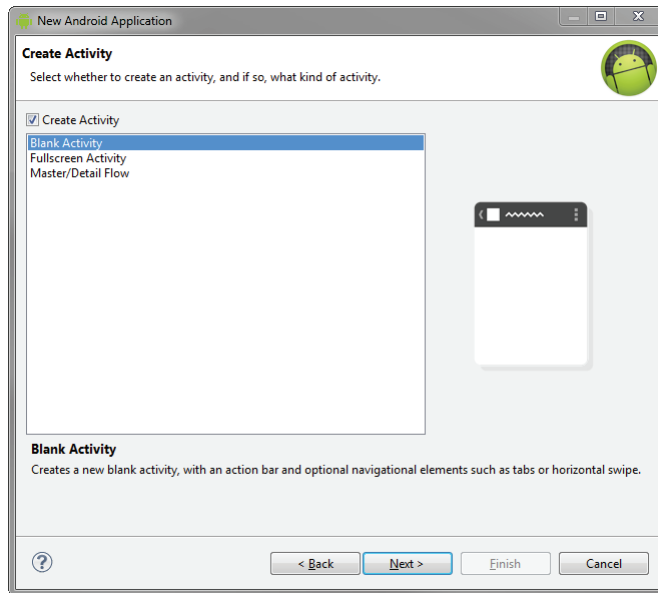


Figure 3.18 Creating an Activity for our Android project.

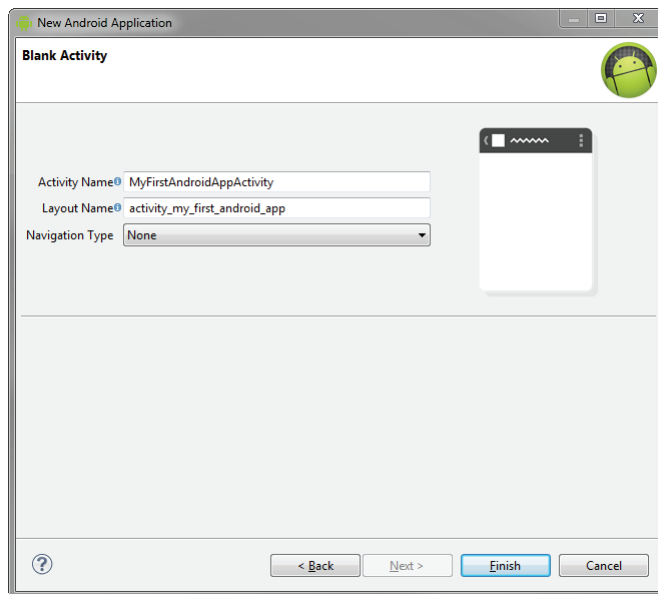


Figure 3.19 Choosing an Activity Name.

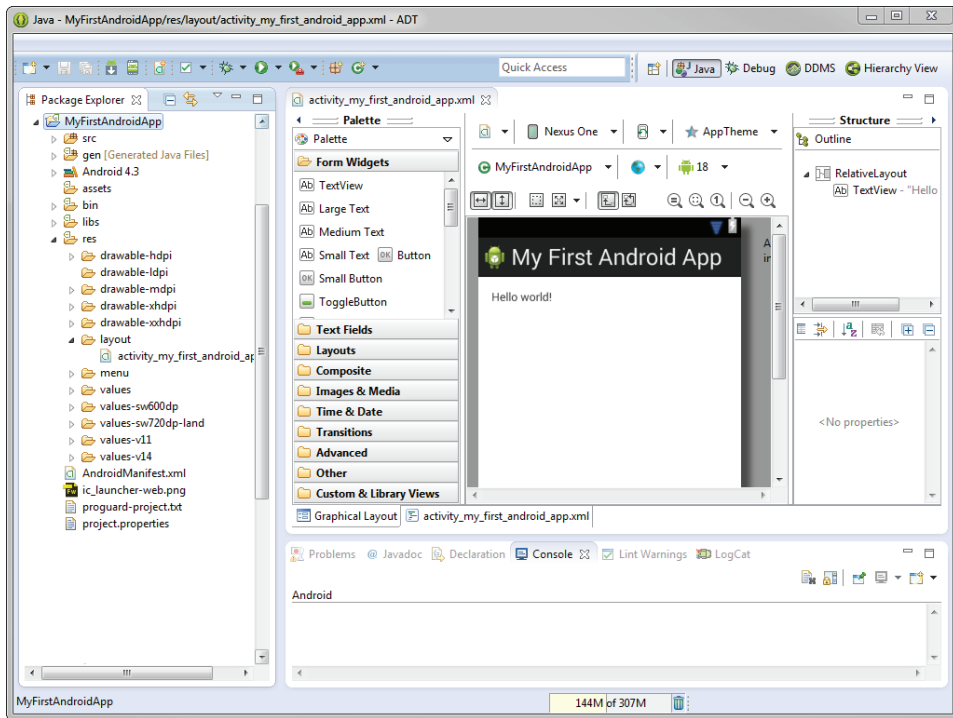


Figure 3.20 Our first application created with the wizard.

Core Files and Directories of the Android Application

Every Android application has a set of core files that are created and used to define the functionality of the application. The following files are created by default with a new Android application:

- **AndroidManifest.xml**—the central configuration file for the application. It defines your application's capabilities and permissions as well as how it runs.
- **ic_launcher-web.png**—This is a high-resolution 32-bit 512 × 512 PNG application icon that is required and used for your application listing in the Google Play store. The size of this icon should not exceed 1024KB.
- **proguard-project.txt**—a generated build file used by the Android IDE and ProGuard. Edit this file to configure your code optimization and obfuscation settings for release builds.
- **project.properties**—a generated build file used by the Android IDE. It defines your application's build target and other build system options, as required. Do not edit this file.

- **/src**—required folder for all source code.
- **/src/com/introtoandroid/myfirstandroidapp/MyFirstAndroidAppActivity.java**—main entry point to this application, named `MyFirstAndroidAppActivity`. This activity has been defined as the default launch activity in the Android manifest file.
- **/gen**—required folder for all autogenerated files.
- **/gen/com/introtoandroid/myfirstandroidapp/BuildConfig.java**—a generated source file used when debugging your applications. Do not edit this file.
- **/gen/com/introtoandroid/myfirstandroidapp/R.java**—a generated resource management source file. Do not edit this file.
- **/assets**—required folder where uncompiled file resources can be included in the project. Application assets are pieces of application data (files, directories) that you do not want managed as application resources.
- **/bin**—folder for creating autogenerated files for producing your application's APK file.
- **/libs**—folder for including any .jar library projects.
- **/libs/android-support-v4.jar**—This support library can be added to your projects to bring newer Android APIs to older devices running older versions of Android.
- **/res**—required folder where all application resources are managed. Application resources include animations, drawable graphics, layout files, datalike strings and numbers, and raw files.
- **/res/drawable-***—Application icon graphics resources are included in several sizes for different device screen resolutions.
- **/res/layout**—required folder that comprises one or more layout resource files, each file managing a different UI or App Widget layout for your application.
- **/res/layout/activity_my_first_android_app.xml**—layout resource file used by `MyFirstAndroidAppActivity` to organize controls on the main application screen.
- **/res/menu**—folder for including XML files for defining Android application menus.
- **/res/menu/my_first_android_app.xml**—menu resource file used by `MyFirstAndroidAppActivity` defining a menu item for Settings.
- **/res/values***—folders for including XML files for defining Android application dimensions, strings, and styles.
- **/res/values/dimens.xml**—dimension resource file used by `MyFirstAndroidAppActivity` defining default screen margins.
- **/res/values/strings.xml**—string resource file used by `MyFirstAndroidAppActivity` defining string variables that may be reused throughout the application.

- **/res/values/styles.xml**—style resource file used by `MyFirstAndroidAppActivity` to define the application theme.
- **/res/values-sw600dp/dimens.xml**—dimension resource file for overriding the `res/values/dimens.xml` for defining dimensions for 7-inch tablets.
- **/res/values-sw720dp-land/dimens.xml**—dimension resource file for overriding the `res/values/dimens.xml` for defining dimensions for 10-inch tablets in landscape mode.
- **/res/values-v11/styles.xml**—style resource file for overriding the `res/values/styles.xml` for devices running Android with an API greater than or equal to 11.
- **/res/values-v14/styles.xml**—style resource file for overriding the `res/values/styles.xml` for devices running Android with an API greater than or equal to 14.

A number of other files are saved on disk as part of the Android IDE project in the workspace. However, the files and resource directories included in the list here are the important project files you will use on a regular basis.

Creating an AVD for Your Project

The next step is to create an AVD that describes what type of device you want to emulate when running the application. For this example, we can use the AVD we created for the Snake application. An AVD describes a device, not an application. Therefore, you can use the same AVD for multiple applications. You can also create similar AVDs with the same configuration but different data (such as different applications installed and different SD card contents).

Creating a Launch Configuration for Your Project

Next, you must create a Run and Debug launch configuration in the Android IDE to configure the circumstances under which the `MyFirstAndroidApp` application builds and launches. The launch configuration is where you configure the emulator options to use and the entry point for your application.

You can create Run configurations and Debug configurations separately, with different options for each. Begin by creating a Run configuration for the application. Follow these steps to create a basic Run configuration for the `MyFirstAndroidApp` application:

1. Choose Run, Run Configurations... (or right-click the project and choose Run As).
2. Double-click Android Application.
3. Name your configuration `MyFirstAndroidAppRunConfig`.
4. Choose the project by clicking the Browse button and choosing the `MyFirstAndroidApp` project.

5. Switch to the Target tab and set the Deployment Target Selection Mode to Always prompt to pick device.
6. Click Apply and then click Close.

**Tip**

If you leave the Deployment Target Selection Mode set to Automatic when you choose Run or Debug in the Android IDE, your application is automatically installed and run on the device if the device is plugged in. Otherwise, the application starts in the emulator with the specified AVD. By choosing Always prompt to pick device, you are always prompted for whether (a) you want your application to be launched in an existing emulator; (b) you want your application to be launched in a new emulator instance and are allowed to specify an AVD; or (c) you want your application to be launched on the device (if it's plugged in). If any emulator is already running, the device is then plugged in, and the mode is set to Automatic, you see this same prompt, too.

Now create a Debug configuration for the application. This process is similar to creating a Run configuration. Follow these steps to create a basic Debug configuration for the `MyFirstAndroidApp` application:

1. Choose Run, Debug Configurations... (or right-click the project and choose Debug As).
2. Double-click Android Application.
3. Name your configuration `MyFirstAndroidAppDebugConfig`.
4. Choose the project by clicking the Browse button and choosing the `MyFirstAndroidApp` project.
5. Switch to the Target tab and set the Deployment Target Selection Mode to Always prompt to pick device.
6. Click Apply and then click Close.

You now have a Debug configuration for your application.

Running Your Android Application in the Emulator

Now you can run the `MyFirstAndroidApp` application using the following steps:

1. Choose the Run As icon drop-down menu on the toolbar (🔍).
2. Pull the drop-down menu and choose the Run configuration you created. (If you do not see it listed, choose the Run Configurations... item and select the appropriate configuration. The Run configuration shows up on this drop-down list the next time you run the configuration.)

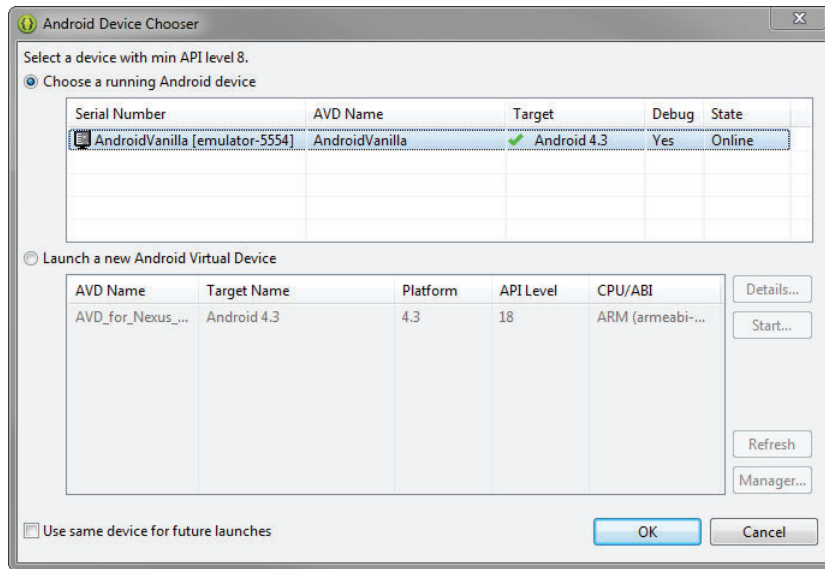


Figure 3.21 Manually choosing a deployment target selection mode.

- Because you chose the `Always` prompt to pick device selection mode, you are now prompted for your emulator instance. Change the selection to `Launch a New Android Virtual Device` and then select the AVD you created. Here, you can choose from an already-running emulator or launch a new instance with an AVD that is compatible with the application settings, as shown in Figure 3.21.
- The Android emulator starts up, which might take a moment.
- Click the `Menu` button or push the slider to the right to unlock the emulator.
- The application starts, as shown in Figure 3.22.
- Click the `Back` button in the emulator to end the application, or click `Home` to suspend it.
- Click the `All Apps` button (see Figure 3.23) found in the `Favorites` tray to browse all installed applications from the `All Apps` screen.
- Your screen should now look something like Figure 3.24. Click the `My First Android App` icon to launch the application again.

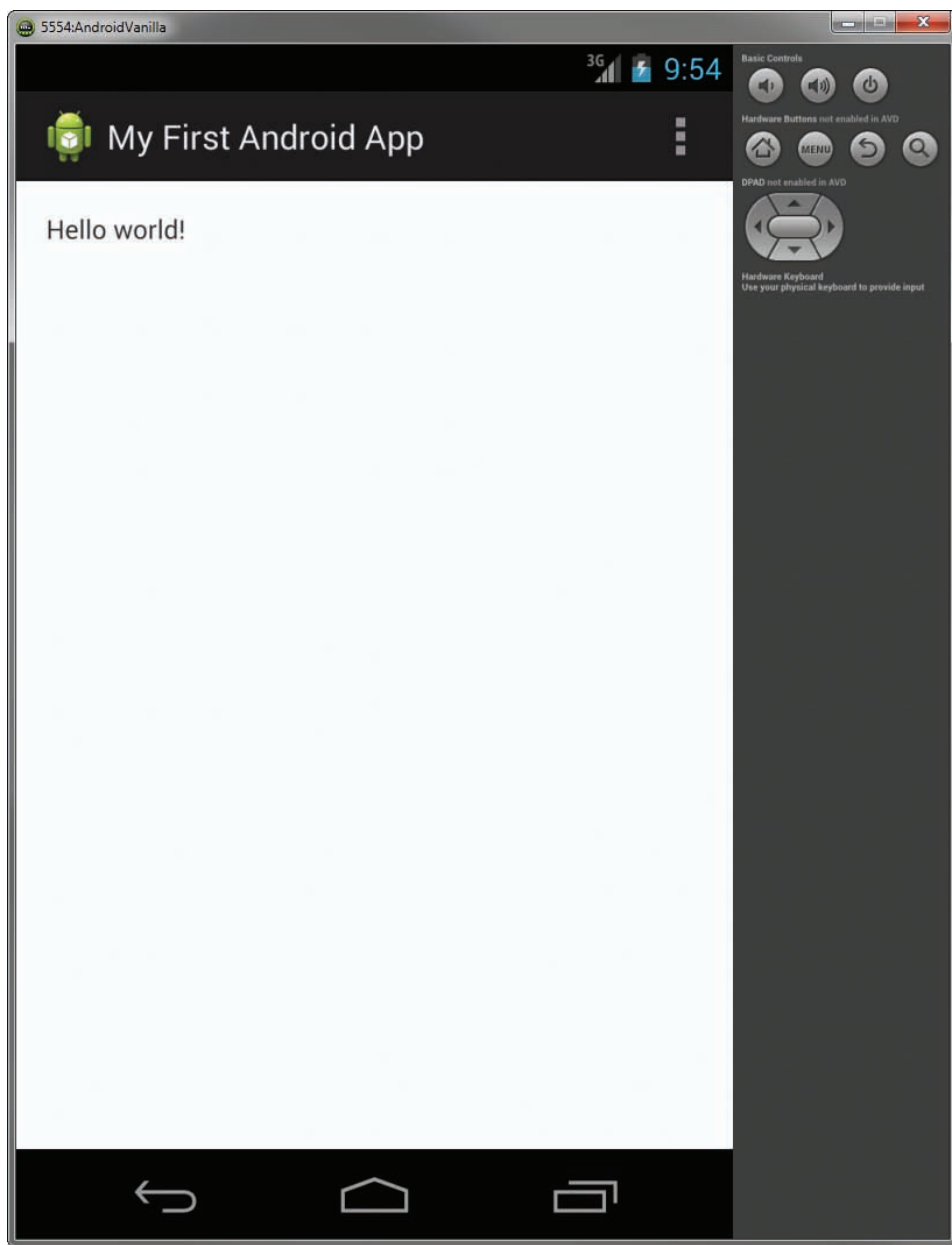


Figure 3.22 My First Android App running in the emulator.

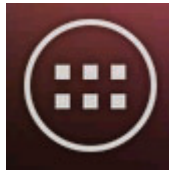


Figure 3.23 The All Apps button.

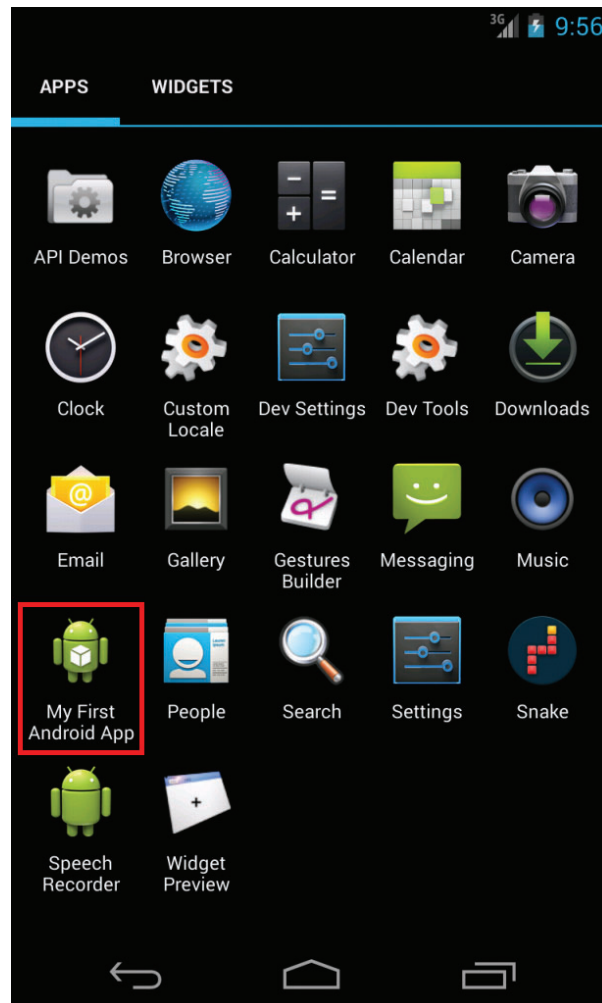


Figure 3.24 The My First Android App icon shown in the All Apps screen.

Debugging Your Android Application in the Emulator

Before going any further, you need to become familiar with debugging in the emulator. To illustrate some useful debugging tools, let's manufacture an error in the `My First Android App`.

In your project, edit the source file called `MyFirstAndroidAppActivity.java`. Create a new method called `forceError()` in your class and make a call to this method in your `Activity` class's `onCreate()` method. The `forceError()` method forces a new unhandled error in your application.

The `forceError()` method should look something like this:

```
public void forceError() {  
    if(true) {  
        throw new Error("Whoops");  
    }  
}
```

It's probably helpful at this point to run the application and watch what happens. Do this using the `Run` configuration first. In the emulator, you see that the application has stopped unexpectedly. You are prompted by a dialog that enables you to force the application to close, as shown in Figure 3.25.

Shut down the application but keep the emulator running. Now it's time to debug. You can debug the `MyFirstAndroidApp` application using the following steps:

1. Choose the `Debug As` icon drop-down menu on the toolbar.
2. Pull the drop-down menu and choose the `Debug` configuration you created. (If you do not see it listed, choose the `Debug Configurations...` item and select the appropriate configuration. The `Debug` configuration shows up on this drop-down list the next time you run the configuration.)
3. Continue as you did with the `Run` configuration and choose the appropriate AVD, and then launch the emulator again, unlocking it if needed.

It takes a moment for the debugger to attach. If this is the first time you've debugged an Android application, you may need to click through some dialogs, such as the one shown in Figure 3.26, the first time your application attaches to the debugger.

In the Android IDE, use the `Debug` perspective to set breakpoints, step through code, and watch the `LogCat` logging information about your application. This time, when the application fails, you can determine the cause using the debugger. You might need to click through several dialogs as you set up to debug within the Android IDE. If you allow the application to continue after throwing the exception, you can examine the results in the `Debug` perspective of the Android IDE. If you examine the `LogCat` logging pane, you see that your application was forced to exit due to an unhandled exception (see Figure 3.27).

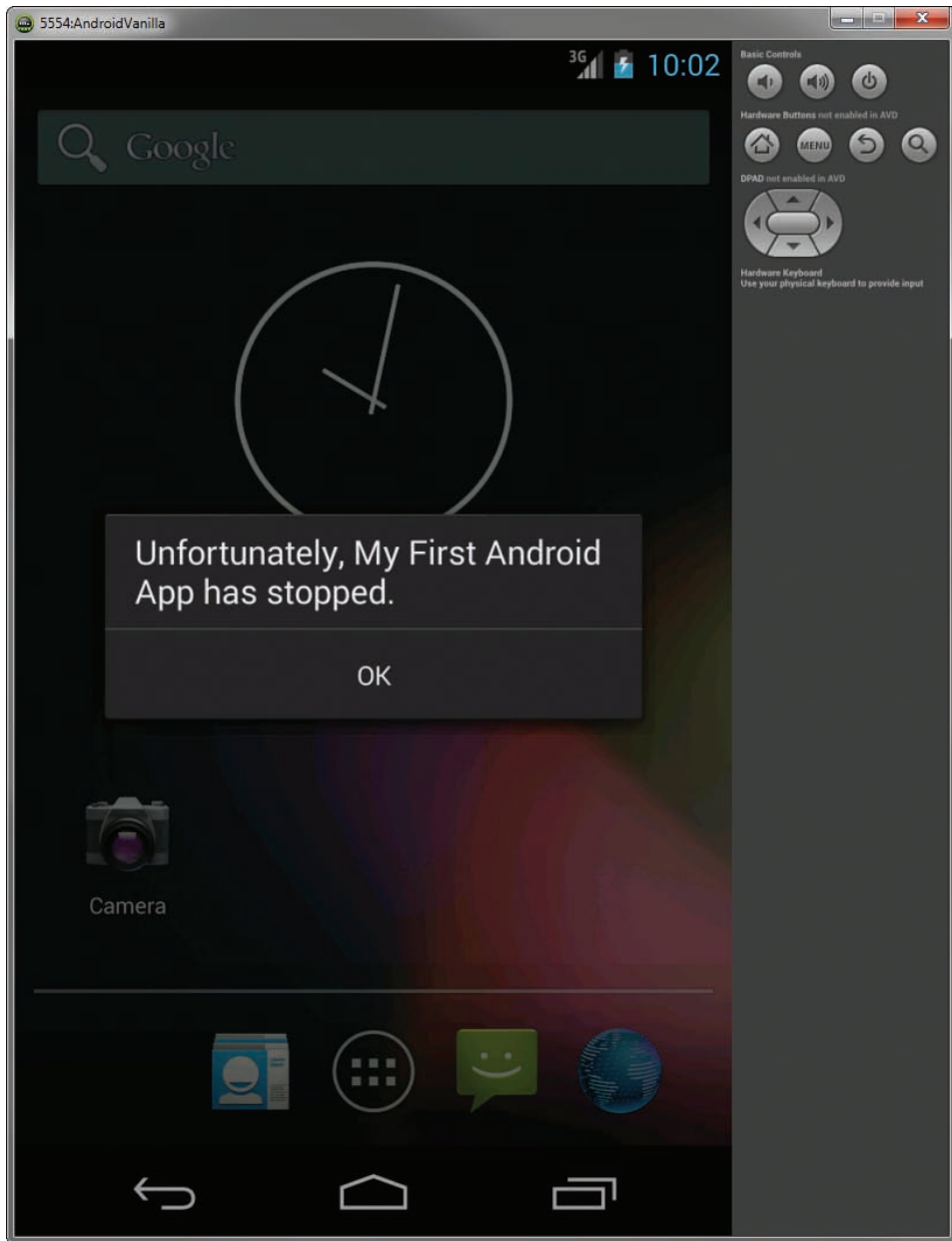


Figure 3.25 My First Android App crashing gracefully.

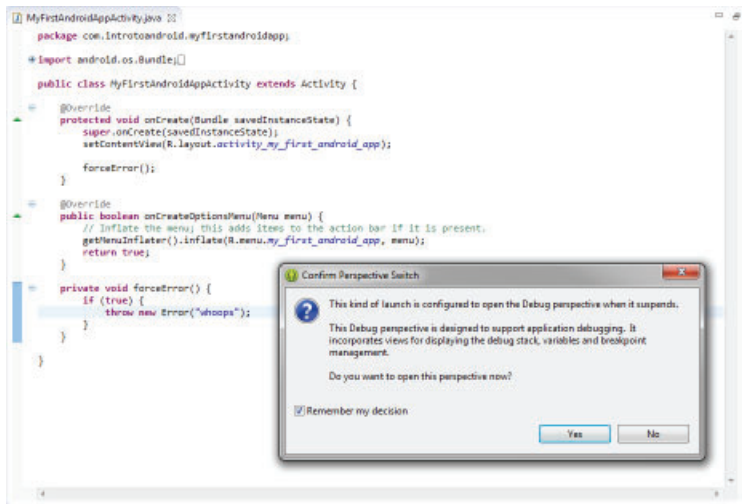


Figure 3.26 Switching to Debug perspective for Android emulator debugging.

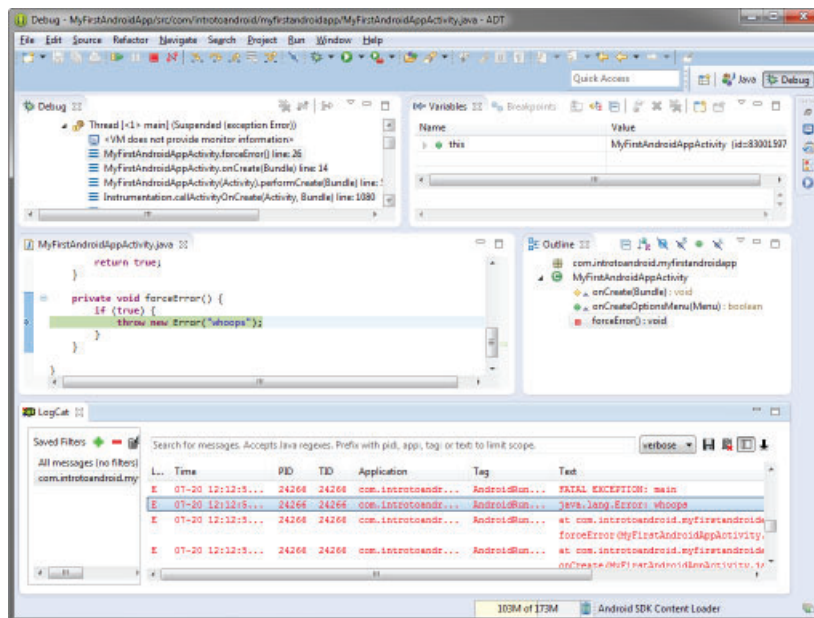


Figure 3.27 Debugging MyFirstAndroidApp in the Android IDE.

Specifically, there's a red `AndroidRuntime` error: `java.lang.Error: whoops`. Back in the emulator, click the `Force Close` button. Now set a breakpoint on the `forceError()` method by right-clicking the left side of the line of code and choosing `Toggle Breakpoint` (or double-clicking).



Tip

In the Android IDE, you can step through code using `Step Into` (F5), `Step Over` (F6), `Step Return` (F7), or `Resume` (F8). On Mac OS X, you might find that the F8 key is mapped globally. If you want to use the keyboard convenience command, you might want to change the keyboard mapping in the Android IDE by choosing `Window, Preferences, General, Keys` and then finding the entry for `Resume` and changing it to something else. Alternatively, you can change the Mac OS X global mapping by going to `System Preferences, Keyboard & Mouse, Keyboard Shortcuts` and then changing the mapping for F8 to something else.

In the emulator, restart your application and step through your code. You see that your application has thrown the exception, and then the exception shows up in the `Variable Browser` pane of the `Debug` perspective. Expanding its contents shows that it is the “Whoops” error.

This is a great time to crash your application repeatedly and get used to the controls. While you're at it, switch over to the `DDMS` perspective. Note that the emulator has a list of processes running on the device, such as `system_process` and `com.android.phone`. If you launch `MyFirstAndroidApp`, you see `com.introtoandroid.myfirstandroidapp` show up as a process on the emulator listing. Force the app to close because it crashes, and note that it disappears from the process list. You can use `DDMS` to kill processes, inspect threads and the heap, and access the phone file system.

Adding Logging Support to Your Android Application

Before you start diving into the various features of the Android SDK, you should familiarize yourself with logging, a valuable resource for debugging and learning Android. Android logging features are in the `Log` class of the `android.util` package. See Table 3.1 for some helpful methods in the `android.util.Log` class.

Table 3.1 Commonly Used Logging Methods

Method	Purpose
<code>Log.e()</code>	Log errors
<code>Log.w()</code>	Log warnings
<code>Log.i()</code>	Log informational messages
<code>Log.d()</code>	Log debug messages
<code>Log.v()</code>	Log verbose messages

To add logging support to `MyFirstAndroidApp`, edit the file `MyFirstAndroidApp.java`. First, you must add the appropriate import statement for the `Log` class:

```
import android.util.Log;
```



Tip

To save time in the Android IDE, you can use the imported classes in your code and add the imports needed by hovering over the imported class name and choosing the `Add Imported Class QuickFix` option.

You can also use the `Organize Imports` command (`Ctrl+Shift+O` in Windows or `Command+Shift+O` on a Mac) to have the Android IDE automatically organize your imports. This removes unused imports and adds new ones for packages used but not imported. If a naming conflict arises, as it often does with the `Log` class, you can choose the package you intended to use.

Next, within the `MyFirstAndroidApp` class, declare a constant string that you use to tag all logging messages from this class. You can use the `LogCat` utility within the Android IDE to filter your logging messages to this `DEBUG_TAG` tag string:

```
private static final String DEBUG_TAG= "MyFirstAppLogging";
```

Now, within the `onCreate()` method, you can log something informational:

```
Log.i(DEBUG_TAG,  
    "In the onCreate() method of the MyFirstAndroidAppActivity Class");
```

While you're here, you must comment out your previous `forceError()` call so that your application doesn't fail. Now you're ready to run `MyFirstAndroidApp`. Save your work and debug it in the emulator. Notice that your logging messages appear in the `LogCat` listing, with the `Tag` field `MyFirstAppLogging` (see Figure 3.28).

Adding Some Media Support to Your Application

Next, let's add some pizzazz to `MyFirstAndroidApp` by having the application play an MP3 music file. Android media player features are found in the `MediaPlayer` class of the `android.media` package.

You can create `MediaPlayer` objects from existing application resources or by specifying a target file using a `URI`. For simplicity, we begin by accessing an MP3 using the `Uri` class from the `android.net` package.

Table 3.2 shows some methods used in the `android.media.MediaPlayer` and `android.net.Uri` classes.

To add MP3 playback support to `MyFirstAndroidApp`, edit the file `MyFirstAndroidApp.java`. First, you must add the appropriate import statements for the `MediaPlayer` class:

```
import android.media.MediaPlayer;  
import android.net.Uri;
```

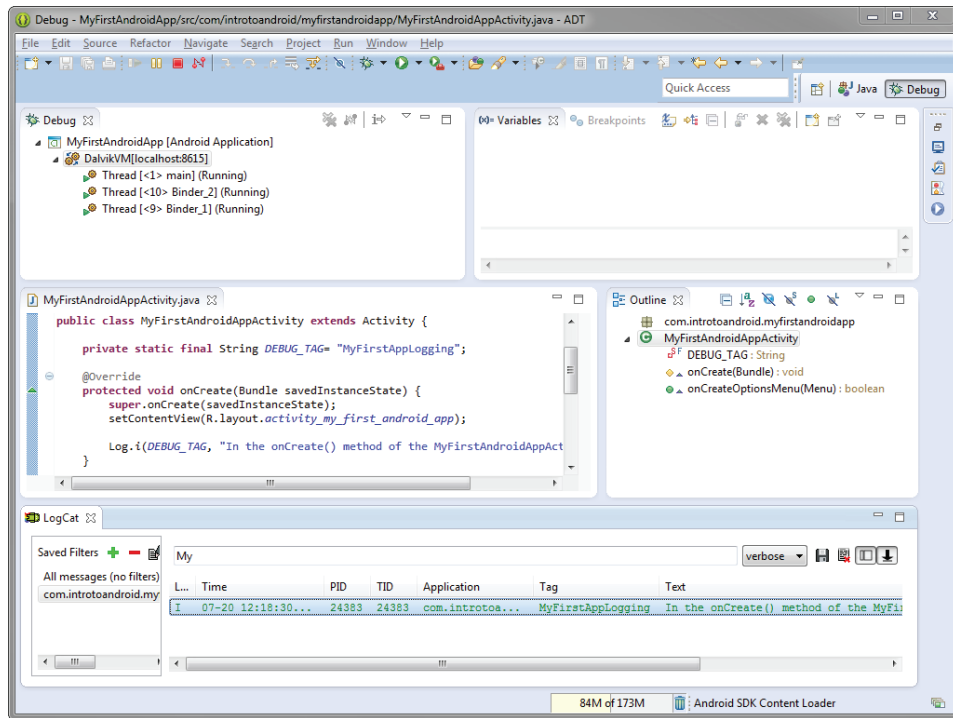


Figure 3.28 A LogCat log for MyFirstAndroidApp.

Table 3.2 Commonly Used **MediaPlayer** and **Uri** Parsing Methods

Method	Purpose
<code>MediaPlayer.create()</code>	Creates a new media player with a given target to play
<code>MediaPlayer.start()</code>	Starts media playback
<code>MediaPlayer.stop()</code>	Stops media playback
<code>MediaPlayer.release()</code>	Releases the media player resources
<code>Uri.parse()</code>	Instantiates a <code>Uri</code> object from an appropriately formatted URI address

Next, within the `MyFirstAndroidApp` class, declare a member variable for your `MediaPlayer` object:

```
private MediaPlayer mp;
```

Now, create a new method called `playMusicFromWeb()` in your class and make a call to this method in your `onCreate()` method. The `playMusicFromWeb()` method creates a

valid `Uri` object, creates a `MediaPlayer` object, and starts the MP3 playing. If the operation should fail for some reason, the method logs a custom error with your logging tag. The `playMusicFromWeb()` method should look something like this:

```
public void playMusicFromWeb() {
    try {
        Uri file = Uri.parse("http://www.perlgurl.org/podcast/archives"
            + "/podcasts/PerlGurlPromo.mp3");
        mp = MediaPlayer.create(this, file);
        mp.start();
    }
    catch (Exception e) {
        Log.e(DEBUG_TAG, "Player failed", e);
    }
}
```

As of Android 4.2.2 (API Level 17), using the `MediaPlayer` class to access media content on the Web requires the `INTERNET` permission to be registered in the application's Android manifest file. Finally, your application requires special permissions to access location-based functionality. You must register this permission in your `AndroidManifest.xml` file. To add permissions to your application, perform the following steps:

1. Double-click the `AndroidManifest.xml` file.
2. Switch to the Permissions tab.
3. Click the Add button and choose `Uses Permission`.
4. In the right pane, select `android.permission.INTERNET` (see Figure 3.29).
5. Save the file.

Later on, you'll learn all about the various `Activity` states and callbacks that could contain portions of the `playMusicFromWeb()` method. For now, know that the `onCreate()` method is called every time the user navigates to the `Activity` (forward or backward) and whenever he or she rotates the screen or causes other device configuration changes. This doesn't cover all cases but will work well enough for this example.

And finally, you want to cleanly exit when the application shuts down. To do this, you need to override the `onStop()` method of your `Activity` class and stop the `MediaPlayer` object and release its resources. The `onStop()` method should look something like this:

```
protected void onStop() {
    if (mp != null) {
        mp.stop();
    }
}
```

```

        mp.release();
    }

    super.onStop();
}

```



Tip

In the Android IDE, you can right-click within the class and choose `Source` (or press `Alt+Shift+S`). Choose the option `Override/Implement Methods` and select the `onStop()` method.

Now, if you run `MyFirstAndroidApp` in the emulator (and you have an Internet connection to grab the data found at the URI location), your application plays the MP3. When you shut down the application, the `MediaPlayer` is stopped and released appropriately.

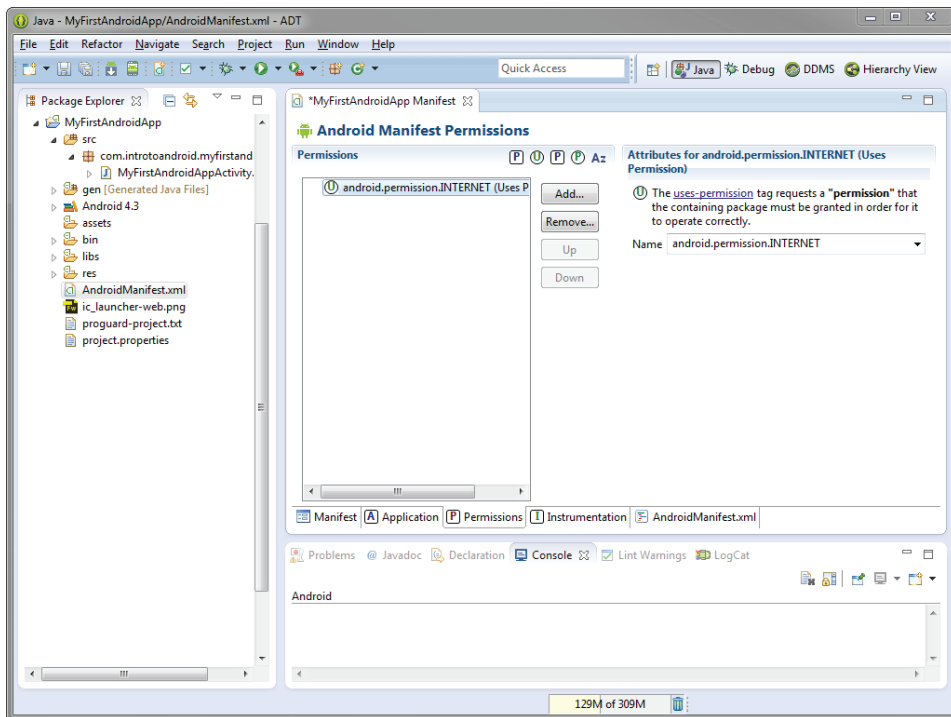


Figure 3.29 Adding the INTERNET permission in the manifest.

Adding Location-Based Services to Your Application

Your application knows how to say “Hello” and play some music, but it doesn’t know where it’s located. Now is a good time to become familiar with some simple location-based calls to get the GPS coordinates. To have some fun with location-based services and map integration, you will use some of the Google applications available on typical Android devices—specifically, the Maps application. You do not need to create another AVD, because you included the Google APIs as part of the target for the AVD you already created.

Configuring the Location of the Emulator

The emulator does not have location sensors, so the first thing you need to do is seed your emulator with some GPS coordinates. You can find the exact steps for how to do this in Appendix B, “Quick-Start Guide: The Android Emulator,” in the section “Configuring the GPS Location of the Emulator.” After you have configured the location of your emulator, the Maps application should display your simulated location, as shown in Figure 3.30. Make sure that the location icon (📍) is showing, which is indicative that the location settings have been enabled on the AVD.



Warning

If you do not see the location icon presented in the status bar, this means that the location is not yet activated and requires configuring within the AVD.

Your emulator now has a simulated location: Yosemite Valley!

Finding the Last Known Location

To add location support to `MyFirstAndroidApp`, edit the file `MyFirstAndroidApp.java`. First, you must add the appropriate import statements:

```
import android.location.Location;
import android.location.LocationManager;
```

Now, create a new method called `getLocation()` in your class and make a call to this method in your `onCreate()` method. The `getLocation()` method gets the last known location on the device and logs it as an informational message. If the operation fails for some reason, the method logs an error.

The `getLocation()` method should look something like this:

```
public void getLocation() {
    try {
        LocationManager locMgr = (LocationManager)
            this.getSystemService(LOCATION_SERVICE);
        Location recentLoc = locMgr.
            getLastKnownLocation(LocationManager.GPS_PROVIDER);
        Log.i(DEBUG_TAG, "loc: " + recentLoc.toString());
    }
```

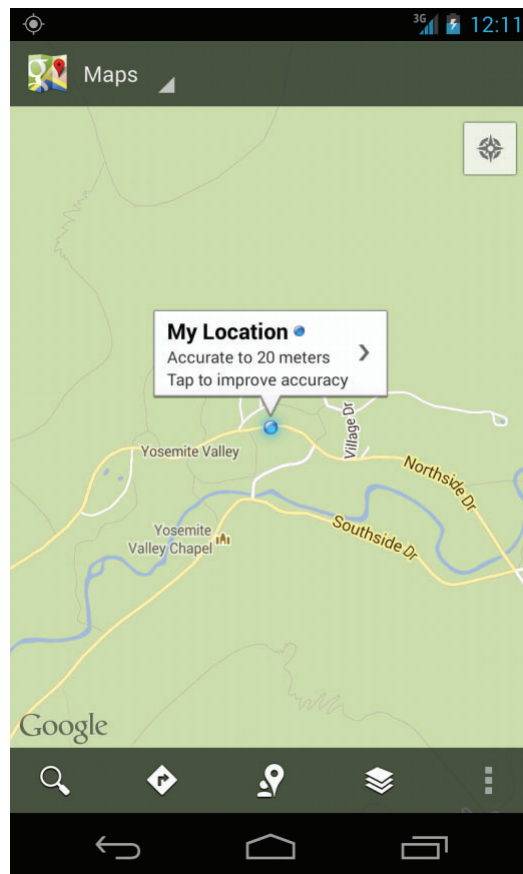


Figure 3.30 Setting the location of the emulator to Yosemite Valley.

```
}  
catch (Exception e) {  
    Log.e(DEBUG_TAG, "Location failed", e);  
}  
}
```

Finally, your application requires special permission to access location-based functionality. You must register this permission in your `AndroidManifest.xml` file. To add location-based service permissions to your application, perform the following steps:

1. Double-click the `AndroidManifest.xml` file.
2. Switch to the `Permissions` tab.

3. Click the Add button and choose Uses Permission.
4. In the right pane, select `android.permission.ACCESS_FINE_LOCATION`.
5. Save the file.

Now, if you run `My First Android App` in the emulator, your application logs the GPS coordinates you provided to the emulator as an informational message, viewable in the LogCat pane of the Android IDE.

Debugging Your Application on Hardware

You have mastered running applications in the emulator. Now let's put the application on real hardware. This section discusses how to install the application on a Nexus 4 device with Android 4.3. To learn how to install on a different device or different Android version, read <http://d.android.com/tools/device.html>.

Connect an Android device to your computer via USB and relaunch the Debug configuration of the application. Because you chose the Always prompt to pick device Deployment Target Selection Mode for the configuration, you should now see a real Android device listed as an option in the Android Device Chooser (see Figure 3.31).

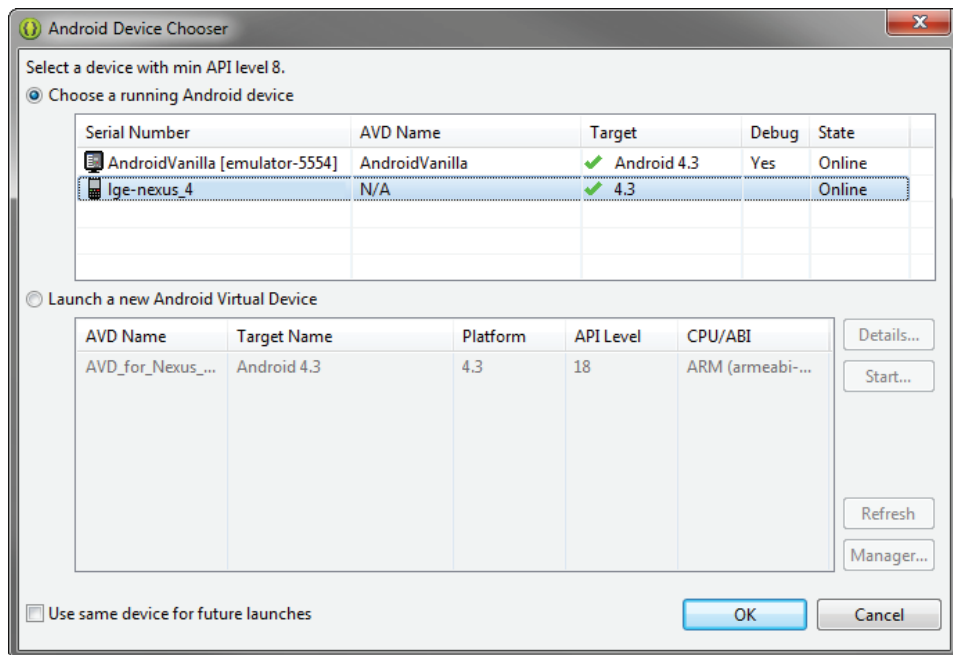


Figure 3.31 Android Device Chooser with USB-connected Android device.

Choose the Android device as your target, and you see that the `My First Android App` application gets loaded onto the Android device and launched, just as before. Provided you have enabled the development debugging options on the device, you can debug the application here as well. To allow USB debugging, go to `Settings, Developer Options`, and under `Debugging`, choose `USB debugging`. A dialog prompt will appear (see Figure 3.32) requesting that USB debugging be allowed. Click `OK` to allow debugging.

Once the USB-connected Android device is recognized, you may be prompted with another dialog asking you to confirm the development computer's RSA key fingerprint. If so, select the option `Always allow from this computer` and click `OK` (see Figure 3.33).

Once enabled, you can tell that the device is actively using a USB debugging connection because a little Android bug-like icon appears in the status bar (🐞). Figure 3.34 shows a screenshot of the application running on a real device (in this case, a smartphone running Android 4.3).

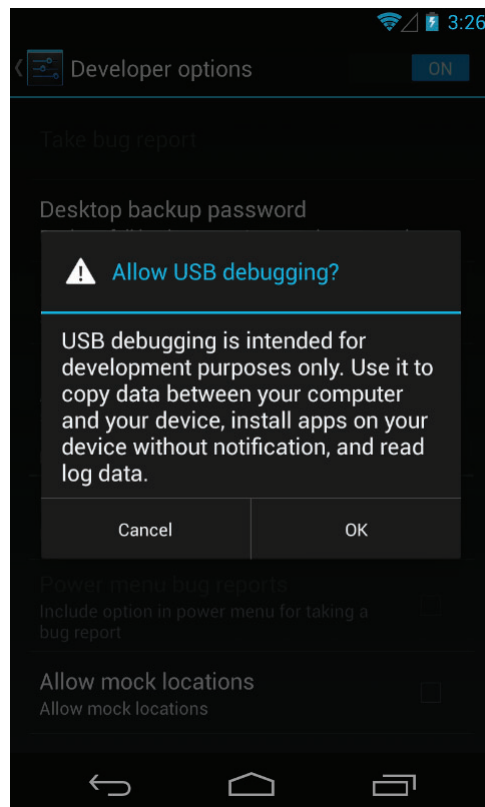


Figure 3.32 Allowing USB debugging.

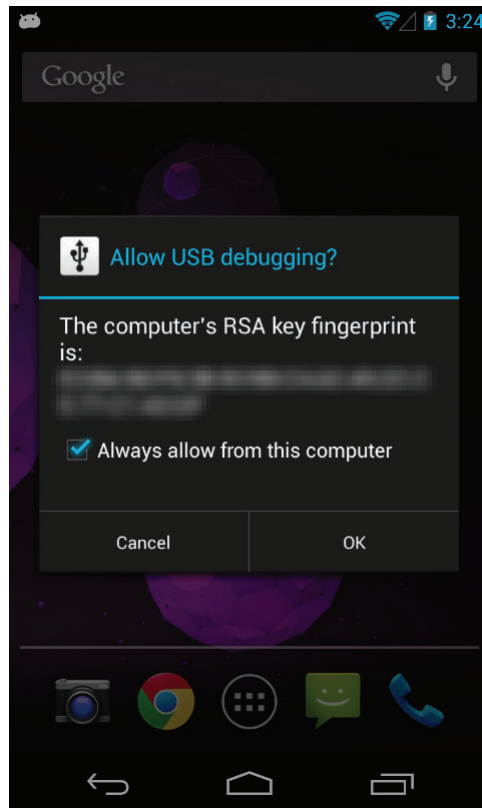


Figure 3.33 Remembering the computer's RSA key fingerprint.

Debugging on the device is much the same as debugging on the emulator, but with a couple of exceptions. You cannot use the emulator controls to do things such as send an SMS or configure the location to the device, but you can perform real actions (true SMS, actual location data) instead.

Summary

This chapter showed you how to add, build, run, and debug Android projects using the Android IDE. You started by installing the sample applications from within the Android IDE. You then began testing your development environment using a sample application from the Android SDK, and then you created a new Android application from scratch using the Android IDE. You also learned how to make some quick modifications to the application, demonstrating some exciting Android features you will learn about in future chapters.

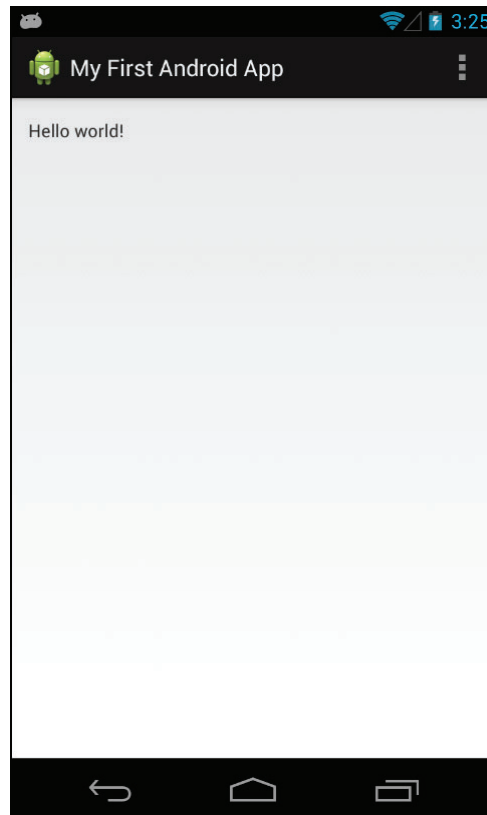


Figure 3.34 My First Android App running on Android device hardware.

In the next few chapters, you will learn about the tools available for use in developing Android applications and then focus on the finer points about defining your Android application using the application manifest file. You will also learn how to organize your application resources, such as images and strings, for use within your application.

Quiz Questions

1. What are the benefits of choosing the Snapshot feature listed under the Emulation Options section of the AVD creation wizard?
2. What do the e, w, i, v, d letters stand for in relation to the `android.util.Log` class, for example, `Log.e()`?
3. What are the Debug breakpoint keyboard shortcuts for Step Into, Step Over, Step Return, and Resume?

4. What is the keyboard shortcut for organizing imports?
5. What is the keyboard shortcut for toggling a breakpoint in the Android IDE?
6. What is the keyboard shortcut for Override/Implement Methods in the Android IDE?

Exercises

1. Create a Nexus 7 AVD using the preconfigured device definitions.
2. Describe the purpose of the Minimum Required SDK, Target SDK, and Compile With options listed in the Android Application Project creation wizard.
3. Found in the Android Application Project creation wizard, describe the difference between a Blank Activity and a Fullscreen Activity.
4. Perform the steps for configuring the Run or Debug configurations of the `MyFirstAndroidApp` to launch the application on all compatible devices/AVDs when running or debugging. Write down each of the steps taken in order.
5. Create a new Android Application Project with a new Launcher Icon. For the Launcher Icon, increase the padding to 50%, change the Foreground Scaling to Center, give it a shape of Circle, and change the icon's background color to blue. Perform any other necessary steps required in order to create the application.
6. There are three Navigation Types available when creating a Blank Activity. Create a new Android Application Project for each Navigation Type available to see what each option provides. Perform any other necessary steps required in order to create the application.

References and More Information

Android SDK Reference regarding the application Activity class:

<http://d.android.com/reference/android/app/Activity.html>

Android SDK Reference regarding the application Log class:

<http://d.android.com/reference/android/util/Log.html>

Android SDK Reference regarding the application MediaPlayer class:

<http://d.android.com/reference/android/media/MediaPlayer.html>

Android SDK Reference regarding the application Uri class:

<http://d.android.com/reference/android/net/Uri.html>

Android SDK Reference regarding the application LocationManager class:

<http://d.android.com/reference/android/location/LocationManager.html>

Android Tools: “Using Hardware Devices”:

<http://d.android.com/tools/device.html>

Android Resources: “Common Tasks and How to Do Them in Android”:

<http://d.android.com/guide/faq/commontasks.html>

Android sample code:

<http://d.android.com/tools/samples/index.html>

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