Version 2.9

for Android 2.2

Android™ Programming Tutorials

Mark L. Murphy

CommonsWare

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by Mark L. Murphy

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Printing History:
Jul 2010: Version 2.9 ISBN: 978-0-9816780-3-0

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Also, bear in mind that eventually this edition of this title will be released under a Creative Commons license – more on this in the preface.

Remember that the CommonsWare Web site has errata and resources (e.g., source code) for each of our titles. Just visit the Web page for the book you are interested in and follow the links..

You can search through the PDF using most PDF readers (e.g., Adobe Reader). If you wish to search all of the CommonsWare books at once, and your operating system does not support that directly, you can always combine the PDFs into one, using tools like PDF Split-And-Merge or the Linux command `pdftk *.pdf cat output combined.pdf`.

Some notes for first-generation Kindle users:

- You may wish to drop your font size to level 2 for easier reading

- Source code listings are incorporated as graphics so as to retain the monospace font, though this means the source code listings do not honor changes in Kindle font size

Preface

Welcome to the Book!

If you come to this book after having read its companion volumes, *The Busy Coder's Guide to Android Development* and *The Busy Coder's Guide to Advanced Android Development*, thanks for sticking with the series! CommonsWare aims to have the most comprehensive set of Android development resources (outside of the Open Handset Alliance itself), and we appreciate your interest.

If you come to this book having learned about Android from other sources, thanks for joining the CommonsWare community!

Prerequisites

This book is a collection of tutorials, walking you through developing Android applications, from the simplest "Hello, world!" to applications using many advanced Android APIs.

Since this book only supplies tutorials, **you will want something beyond it as a reference guide**. That could be simply the Android SDK documentation, available with your SDK installation or online. It could be the other books in the CommonsWare Android series. Or, it could be another Android book – a list of currently-available Android books can be found on the Android Programming knol. What you do not want to do is attempt to learn all of Android solely from these tutorials, as they will demonstrate the breadth of the Android API but not its depth.

Also, the tutorials themselves have varying depth. Early on, there is more "hand-holding" to explain every bit of what needs to be done (e.g., classes to import). As the tutorials progress, some of the simpler Java bookkeeping steps are left out of the instructions – such as exhaustive lists of import statements – so the tutorials can focus on the Android aspects of the code.

You can find out when new releases of this book are available via:

- The cw-android Google Group, which is also a great place to ask questions about the book and its examples
- The commonsguy Twitter feed
- The CommonsBlog
- The Warescription newsletter, which you can subscribe to off of your Warescription page

Using the Tutorials

Each tutorial has a main set of step-by-step instructions, plus an "Extra Credit" section. The step-by-step instructions are intended to guide you through creating or extending Android applications, including all code you need to enter and all commands you need to run. The "Extra Credit" sections, on the other hand, provide some suggested areas for experimentation beyond the base tutorial, without step-by-step instructions.

If you wish to start somewhere in the middle of the book, or if you only wish to do the "Extra Credit" work, or if you just want to examine the results without doing the tutorials directly yourself, you can download the results of each tutorial's step-by-step instructions from the book's github repository. You can either clone the repository, or click the Download Source button in the upper-right to get the source as a ZIP file. The source code is organized by tutorial number, so you can readily find the project(s) associated with a particular tutorial from the book.

The tutorials do not assume you are using Eclipse, let alone any other specific editor or debugger. The instructions included in the tutorials will speak in general terms when it comes to tools outside of those supplied by the Android SDK itself.

The code for the tutorials has been tested most recently on Android 2.2. It should work on older versions as well, on the whole.

The tutorials include instructions for both Linux and Windows XP. OS X developers should be able to follow the Linux instructions in general, making slight alterations as needed for your platform. Windows Vista users should be able to follow the Windows XP instructions in general, tweaking the steps to deal with Vista's directory structure and revised Start menu.

If you wish to use the source code from the CommonsWare Web site, bear in mind a few things:

1. The projects are set up to be built by Ant, not by Eclipse. If you wish to use the code with Eclipse, you will need to create a suitable Android Eclipse project and import the code and other assets.
2. You should delete build.xml, then run `android update project -p ...` (where ... is the path to a project of interest) on those projects you wish to use, so the build files are updated for your Android SDK version.

Also, please note that the tutorials are set up to work well on HVGA and larger screen sizes. Using them on QVGA or similar sizes is not recommended.

Warescription

This book will be published both in print and in digital form. The digital versions of all CommonsWare titles are available via an annual subscription – the Warescription.

The Warescription entitles you, for the duration of your subscription, to digital forms of *all* CommonsWare titles, not just the one you are reading.

Presently, CommonsWare offers PDF and Kindle; other digital formats will be added based on interest and the openness of the format.

Each subscriber gets personalized editions of all editions of each title: both those mirroring printed editions and in-between updates that are only available in digital form. That way, your digital books are never out of date for long, and you can take advantage of new material as it is made available instead of having to wait for a whole new print edition. For example, when new releases of the Android SDK are made available, this book will be quickly updated to be accurate with changes in the APIs.

From time to time, subscribers will also receive access to subscriber-only online material, including not-yet-published new titles.

Also, if you own a print copy of a CommonsWare book, and it is in good clean condition with no marks or stickers, you can exchange that copy for a free four-month Warescription.

If you are interested in a Warescription, visit the Warescription section of the CommonsWare Web site.

What's New

For those of you who have a Warescription, or otherwise have been keeping up with this book, here is what is new in this version:

- The Patchy examples were tweaked to use identi.ca instead of Twitter, due to the latter's change in authentication schemes
- The tutorials were tested on Android 2.2

About the "Further Reading" Sections

Each tutorial has, at the end, a section named "Further Reading". Here, we list places to go learn more about the theory behind the techniques illustrated in the preceding tutorial. Bear in mind, however, that the Internet is fluid, so links may not necessarily work. And, of course, there is no good way to link to other books. Hence, the "Further Reading" section describes where you can find material, but actually getting there may require a few additional clicks on your part. We apologize for the inconvenience.

Errata and Book Bug Bounty

Books updated as frequently as CommonsWare's inevitably have bugs. Flaws. Errors. Even the occasional gaffe, just to keep things interesting. You will find a list of the known bugs on the errata page on the CommonsWare Web site.

But, there are probably even more problems. If you find one, please let us know!

Be the first to report a unique concrete problem in the current digital edition, and we'll give you a coupon for a six-month Warescription as a bounty for helping us deliver a better product. You can use that coupon to get a new Warescription, renew an existing Warescription, or give the coupon to a friend, colleague, or some random person you meet on the subway.

By "concrete" problem, we mean things like:

- Typographical errors
- Sample applications that do not work as advertised, in the environment described in the book
- Factual errors that cannot be open to interpretation

By "unique", we mean ones not yet reported. Each book has an errata page on the CommonsWare Web site; most known problems will be listed there. One coupon is given per email containing valid bug reports.

NOTE: Books with version numbers lower than 0.9 are ineligible for the bounty program, as they are in various stages of completion. We appreciate bug reports, though, if you choose to share them with us.

We appreciate hearing about "softer" issues as well, such as:

- Places where you think we are in error, but where we feel our interpretation is reasonable
- Places where you think we could add sample applications, or expand upon the existing material
- Samples that do not work due to "shifting sands" of the underlying environment (e.g., changed APIs with new releases of an SDK)

However, those "softer" issues do not qualify for the formal bounty program.

Questions about the bug bounty, or problems you wish to report for bounty consideration, should be sent to CommonsWare.

Source Code License

The source code samples shown in this book are available for download from the book's GitHub repository. All of the Android projects are licensed under the Apache 2.0 License, in case you have the desire to reuse any of it.

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Each CommonsWare book edition will be available for use under the Creative Commons Attribution-Noncommercial-Share Alike 3.0 license as of the fourth anniversary of its publication date, or when 4,000 copies of the edition have been sold, whichever comes first. That means that, once four years have elapsed (perhaps sooner!), you can use this prose for non-commercial purposes. That is our Four-to-Free Guarantee to our readers and the broader community. For the purposes of this guarantee, new Warescriptions and renewals will be counted as sales of this edition, starting from the time the edition is published.

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Lifecycle of a CommonsWare Book

CommonsWare books generally go through a series of stages.

First are the pre-release editions. These will have version numbers below 0.9 (e.g., 0.2). These editions are incomplete, often times having but a few chapters to go along with outlines and notes. However, we make them available to those on the Warescription so they can get early access to the material.

Release candidates are editions with version numbers ending in ".9" (0.9, 1.9, etc.). These editions should be complete. Once again, they are made available to those on the Warescription so they get early access to the material and can file bug reports (and receive bounties in return!).

Major editions are those with version numbers ending in ".0" (1.0, 2.0, etc.). These will be first published digitally for the Warescription members, but will shortly thereafter be available in print from booksellers worldwide.

Versions between a major edition and the next release candidate (e.g., 1.1, 1.2) will contain bug fixes plus new material. Each of these editions should also be complete, in that you will not see any "TBD" (to be done) markers or the like. However, these editions may have bugs, and so bug reports are eligible for the bounty program, as with release candidates and major releases.

A book usually will progress fairly rapidly through the pre-release editions to the first release candidate and Version 1.0 – often times, only a few months. Depending on the book's scope, it may go through another cycle of significant improvement (versions 1.1 through 2.0), though this may take several months to a year or more. Eventually, though, the book will go into more of a "maintenance mode", only getting updates to fix bugs and deal with major ecosystem events – for example, a new release of the Android SDK will necessitate an update to all Android books.

Roster of Tutorials

Here is what you can expect in going through the tutorials in this book:

1. We start off with a simple throwaway project, just to make sure you have the development tools all set up properly.
2. We then begin creating `LunchList`, an application to track restaurants where you might wish to go for lunch. In this tutorial, we set up a simple form to collect basic information about a restaurant, such as a name and address.
3. We expand the form to add radio buttons for the type of restaurant (e.g., takeout).
4. Instead of tracking just a single restaurant, we add support for a list of restaurants – but each restaurant shows up in the list only showing its name.
5. We extend the list to show the name and address of each restaurant, plus an icon for the restaurant type.
6. To give us more room, we split the UI into two tabs, one for the list of restaurants, and one for the detail form for a restaurant.
7. We experiment with an option menu (the kind that appears when you press the MENU button on a phone) and display a pop-up message.
8. We learn how to start a background thread and coordinate communications between the background thread and the main ("UI") thread.
9. We learn how to find out when the activity is going off-screen, stopping and restarting our background thread as needed.
10. We create a separate UI description for what the tabs should look like when the phone is held in a landscape orientation.

11. We finally add database support, so your restaurant data persists from run to run of the application.
12. We eliminate the tabs and split the UI into two separate screens ("activities"), one for the list of restaurants, and one for the detail form to add or edit a restaurant.
13. We establish a shared preference – and an activity to configure it – to allow the user to specify the sort order of the restaurants in the list.
14. We re-establish the landscape version of our UI (lost when we eliminated the tabs in Tutorial 12) and experiment with how to handle the orientation changing during execution of our application.
15. We put `LunchList` on hold and start up a brand new project, `Patchy`, for accessing identi.ca.
16. We integrate the JTwitter JAR – an open source Java API for Twitter and things supporting the Twitter API – into our application.
17. We add a partial implementation of a service to the application, one that will periodically poll identi.ca for timeline updates.
18. We fully integrate the service from Tutorial 17 into the application, showing the timeline updates in a list in the main activity.
19. We split the service out into a separate project, accessed as a "remote service" using inter-process communication (IPC).
20. We add logic to the service to watch for posts from specific people – our "BFFs" – and display an icon in the status bar when we see such a post.
21. We add a menu choice to allow the user to inject their current location (latitude and longitude) into the status update they are editing.
22. We watch for locations embedded in posts – akin to those created in Tutorial 21 – and, if the user clicks on a post in the timeline with such a location, we display that location on a map.
23. We add a "helpcast" video to our application, to demonstrate video playback integration.

24. We supplement the "helpcast" with a more traditional help page, in HTML format, show in an embedded WebKit browser.
25. We extend the help page to pull our identi.ca screen name in for customization, by building a bridge between the Javascript in the Web page and the Android Java environment.
26. We give the user a menu option to hide and show the widgets associated with updating the identi.ca status, then arrange to animate hiding and showing those widgets.
27. We replace the callback system used previously in our application with one that uses broadcast `Intent` objects.
28. We integrate our application into the contacts engine, so posts from people who also our in our contacts database are highlighted.
29. Back in `Patchy`, we start monitoring for when Android says the battery level changes, so when it gets low enough, we scale back the frequency of our polls for timeline updates.
30. We have `Patchy`'s service monitor for timeline updates via a scheduled "alarm" rather than via a background thread sleeping for a certain amount of time.
31. We tie `LunchList`'s restaurant database into the Android search framework, so you can find a restaurant by name.
32. We create another project, one that will allow us to pick a contact out of the contact database, then find out what activities can be launched that know how to do something with that contact.
33. We create a simple app widget (i.e., interactive element for the home screen) for `LunchList`, one that displays the name of a randomly-selected restaurant.
34. We extend the app widget to allow the user to click a button to choose a different restaurant and click the name of the restaurant to pull up the `LunchList` detail form for that restaurant.
35. We test the `LunchList` application using the Test Monkey, simulating random input into the UI.
36. We allow users to provide phone numbers for restaurants, then add in phone-dialing capability to `LunchList`.

37. We (pretend to) allow users to take pictures of restaurants using the device's built-in camera.
38. We wrap up by allowing users to randomly select a restaurant by shaking their phone while running the `LunchList` application.
39. We allow users to send the name and address of a restaurant to others via SMS.
40. We fix up the SMS code to support both Android 1.x and Android 2.x.

PART I – Introductory Tutorials

TUTORIAL 1

Your First Android App

This tutorial will help you get your very first Android application up and running, using just the files generated by Android's development tools.

Step-By-Step Instructions

Here is how you can create this application:

Step #1: Choose a Place For Your Applications

You will need a spot on your development machine to store all of the projects that you will create via the tutorials in this book.

Linux

If you are running Linux, open up a terminal window (e.g., Applications > Accessories > Terminal in Ubuntu) and execute the following commands:

```
cd ~
mkdir AndroidTutorials
cd AndroidTutorials
```

This will create an `AndroidTutorials` directory in your home directory and move you into it.

Windows XP

If you are running Windows XP, create an `AndroidTutorials` directory somewhere, inside which you can put your tutorial projects. Note that the Android 2.1 SDK seems to have some problems with directories with spaces in them, so you may wish to take that into account when choosing a spot for your `AndroidTutorials` directory.

Step #2: Check Your Java Environment

You need to have Sun's Java SE version 1.5 or 1.6 in order to compile Android applications.

Linux

Using the terminal, execute the following command:

```
javac -version
```

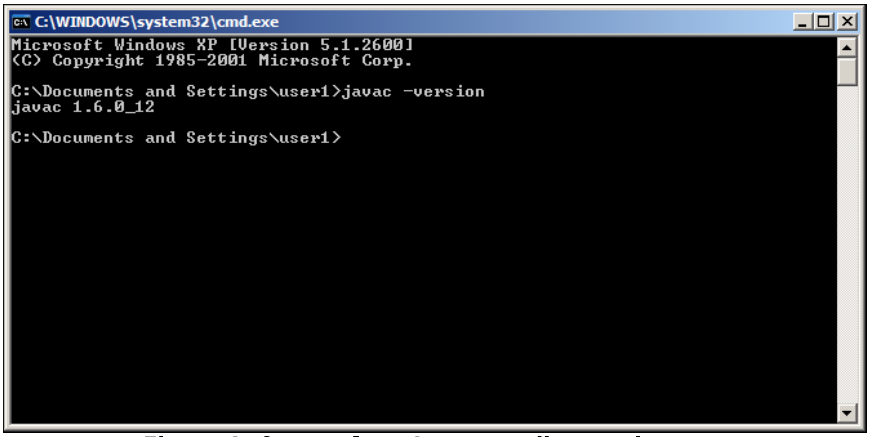
If the output includes a line akin to `javac 1.6.0_10`, your Java version should be fine. If you do not believe you have the proper Java version, you should install the correct one, either through your Linux distribution or through Sun's Java site.

Windows XP

Open a Command Prompt by clicking on the **Start** menu, choosing **Run...**, entering `cmd` in the **Open:** field, and clicking **OK**. Then, execute the following command:

```
javac -version
```

You should see output akin to:



```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\user1>javac -version
javac 1.6.0_12

C:\Documents and Settings\user1>
```

Figure 1. Output from Java compiler version test

If you do not, you will need to install the Java SE SDK from Sun's Java site. You should also be sure to add the directory for the Java commands to your `PATH` by:

1. Finding where the Java commands are (e.g., `C:\Program Files\Java\jdk1.6.0_12\bin`).
2. Go to your Control Panel (**Start** > **Settings** > **Control Panel**).
3. Double-click on the **System** applet.
4. Click the **Advanced** tab.
5. Click the **Environment Variables** button.
6. If there is a `PATH` value in the **User variables** area at the top, add your path to the end by double-clicking the existing one, scrolling to the end, typing a semicolon (;) and the path from step #1 above. If there is no such `PATH` value, click the **New** button, fill in `PATH` as the **Variable name** and the path from step #1 above as the **Variable value**.

Step #3: Download and Install the Android SDK

The Android SDK is available from http://developer.android.com – just follow the download link and choose the ZIP file appropriate for your platform, and follow your platform's installation instructions on that site.

When you download the actual SDK components for different Android API levels, be sure to install the "Google Inc.:Google APIs:7" package (Android 2.1 with Google APIs).

NOTE: While Android 2.2 is available at the time of this writing, there are bugs in the current emulator environment that will cause you problems with two of the tutorials. Moreover, nothing in these tutorials is specific to Android 2.2. You are welcome to download and install the Android 2.2 (API level 8) components as well, for your own experiments, but we recommend you use Android 2.1 for the tutorials.

Optional for All Platforms

Per the Android documentation: "Optionally, you can add the path to the SDK tools directory to your path. The `tools/` directory is located in the SDK directory.

- On Linux, edit your `~/.bash_profile` or `~/.bashrc` file. Look for a line that sets the `PATH` environment variable and add the full path to the `tools/` directory to it. If you don't see a line setting the path, you can add one: `export PATH = ${PATH}:<your_sdk_dir>/tools`. Then, close and reopen the terminal window.
- On a Mac, look in your home directory for `.bash_profile` and proceed as for Linux. You can create the `.bash_profile`, if you haven't already set one up on your machine.
- On Windows, right click on My Computer, and select Properties. Under the Advanced tab, hit the Environment Variables button, and in the dialog that comes up, double-click on Path under System Variables. Add the full path to the `tools/` directory to the path."

Eclipse

You are welcome to use Eclipse for developing your Android projects. This book does not assume Eclipse, and the author does not use Eclipse on a regular basis.

For instructions on setting up Eclipse with Android, visit the Android developer documentation. You might also consider just skipping this tutorial in favor of doing the standard Android Hello, World tutorial, then moving on to Tutorial 2.

Step #4: Generate the Application Files

Next, we need to create a project.

Eclipse

Use the new-project wizard to create an empty Android project named `FirstApp`, as described in the Android developer documentation. This will create an application skeleton for you, complete with everything you need to build your first Android application: Java source code, build instructions, etc.

Outside of Eclipse

Inside your terminal (e.g., Command Prompt for Windows), move back into the `AndroidTutorials` directory you created in step #1. Then, run the following command:

```
android create project --target "Google Inc.:Google APIs:7" --path ./FirstApp
--activity FirstApp --package apt.tutorial
```

This will create an application skeleton for you, complete with everything you need to build your first Android application: Java source code, build instructions, etc.

Step #5: Examine and Modify the Layout File

Using Eclipse or your favorite text editor, look at `FirstApp/res/layout/main.xml`. It should look a bit like this:

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
 android:orientation="vertical"
 android:layout_width="fill_parent"
 android:layout_height="fill_parent"
 >
<TextView
 android:layout_width="fill_parent"
 android:layout_height="wrap_content"
 android:text="Hello World, FirstApp"
 />
</LinearLayout>
```

You will see an XML element for a `LinearLayout` wrapping an XML element for a `TextView`. Inside the `TextView`, you will see an attribute named `android:text` with a value of `Hello World, FirstApp`. Change that value to `Hello`, plus your name (e.g., `Hello, Mark`). Save your changes to this file.

Step #6: Examine the Activity Java Source

Next, take a look at `FirstApp/src/apt/tutorial/FirstApp.java`. It should look like this:

```
package apt.tutorial;

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

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

Notice how the activity class does not have a constructor, only an `onCreate()` method. Also notice that the `onCreate()` method calls `setContentView(R.layout.main)`, which is how Android knows to load the layout you saw in step #5 and display it on the screen.

You do not need to make any changes to this file for this tutorial.

Step #7: Install Ant

To build applications outside of Eclipse, you will need the Apache Ant build tool. This can be downloaded from the Ant Web site, and instructions for installing it can be found at the Ant online manual.

If you are using Eclipse, you can skip this step.

Linux users: You may be able to install Ant through your Linux distribution's package management system (e.g., Synaptic in Ubuntu). However, that version of Ant may be set up to use the GNU `gcj` Java environment rather than Sun's, which may cause you problems. Make sure that however you set up Ant, it uses the Sun JDK you installed in step #2.

Step #8: Compile the Application

Next, we should compile the application. Eclipse users usually wind up with "Build Automatically" turned on for their projects, so as long as you do not have any warnings or errors in the source code, you are already OK.

For developers not using Eclipse, in your terminal, change into the `FirstApp` directory, then run the following command:

```
ant debug
```

This will compile the application. It should emit a list of steps involved in the installation process, which look like this:

```
Buildfile: build.xml
 [setup] Android SDK Tools Revision 6
 [setup] Project Target: Google APIs
 [setup] Vendor: Google Inc.
 [setup] Platform Version: 2.0.1
 [setup] API level: 6
 [setup] WARNING: No minSdkVersion value set. Application will install on all
Android versions.
 [setup] Importing rules file: platforms/android-
2.0.1/templates/android_rules.xml

-compile-tested-if-test:
```

```
-dirs:
 [echo] Creating output directories if needed...

-resource-src:
 [echo] Generating R.java / Manifest.java from the resources...

-aidl:
 [echo] Compiling aidl files into Java classes...

compile:
 [javac] Compiling 1 source file to
/home/mmurphy/stuff/CommonsWare/books/AndTutorials/samples/01-
FirstApp/FirstApp/bin/classes

-dex:
 [echo] Converting compiled files and external libraries into
/home/mmurphy/stuff/CommonsWare/books/AndTutorials/samples/01-
FirstApp/FirstApp/bin/classes.dex...
 [echo]

-package-resources:
 [echo] Packaging resources
 [aaptexec] Creating full resource package...

-package-debug-sign:
[apkbuilder] Creating FirstApp-debug-unaligned.apk and signing it with a debug
key...
[apkbuilder] Using keystore: /home/mmurphy/.android/debug.keystore

debug:
 [echo] Running zip align on final apk...
 [echo] Debug Package:
/home/mmurphy/stuff/CommonsWare/books/AndTutorials/samples/01-
FirstApp/FirstApp/bin/FirstApp-debug.apk

BUILD SUCCESSFUL
Total time: 4 seconds
```

Note the `BUILD SUCCESSFUL` at the bottom – that is how you know the application compiled successfully.

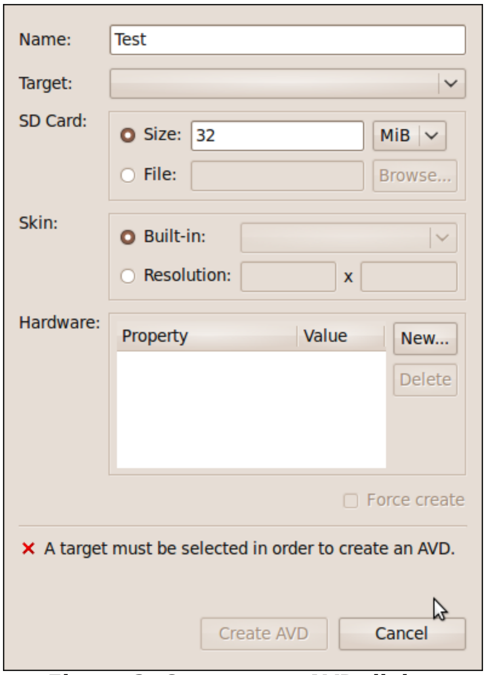
Step #9: Configure and Start Your Emulator

Android developers typically use the Android emulator to test and debug their applications. This is a copy of the Android firmware set up to run in a virtual machine on your development workstation. Note that running the emulator for the first time will take longer than subsequent runs, and you can usually just keep the emulator up and running – you do not need to stop and restart it after every rebuild of your application. In particular, you need to create an Android Virtual Device (AVD) that describes the specific Android environment you wish to emulate – Android API level, SD card size, screen size, etc.

Eclipse users can create an AVD following the instructions in the Android developer documentation.

The easiest way to work with the Android emulator, outside of Eclipse, is to use the AVD Manager. You can open this by running `android` in a terminal window. You might consider adding a shortcut to this command to your desktop, as you will use it often, and it ties up the terminal window when in use.

You will see a window containing an empty list of Android virtual devices. Click the New... button to add a new virtual device:



Name: Test

Target:

SD Card: [✓ Size:] 32 MiB

File:

Skin: [✓ Built-in:]

Resolution: x

Hardware:

Property	Value

Force create

A target must be selected in order to create an AVD.

Figure 2. Create new AVD dialog

Enter a name (e.g., 2_1_HVGA), then choose "Google APIs (Google Inc.) - API Level 7" as the target. Give yourself a 32MB SD card by filling in 32 in the Size field. Choose the "Default (HVGA)" screen size, then click Create AVD. This will add your new AVD to the main window.

At this point, select your AVD in the list and click Start... Accept all of the defaults and click Launch. The first time you start up an emulator for a new AVD, it will take a fair amount of time.

Your emulator should look something like this:

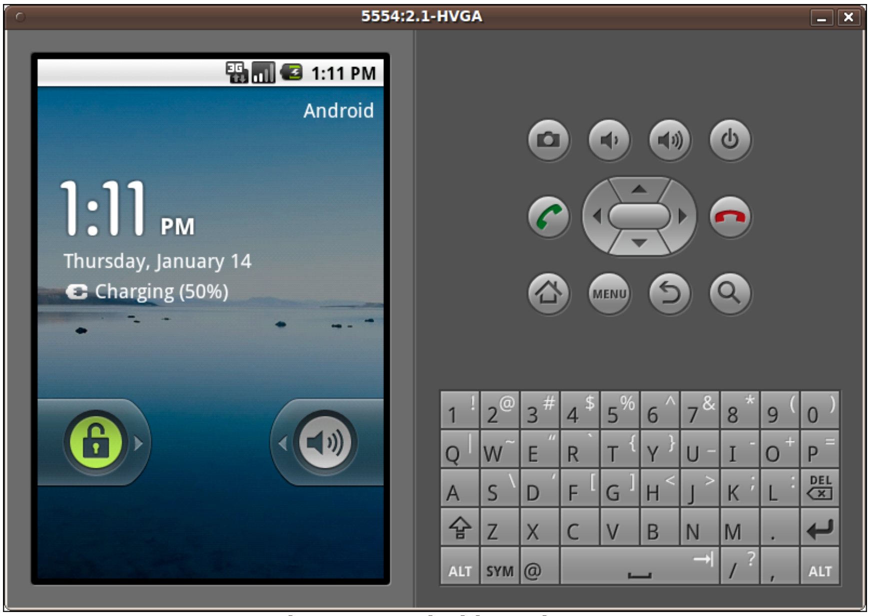


Figure 3. Android emulator

Step #10: Install the Application in Your Emulator

Next, we need to put the application into the emulator.

Eclipse

You can simply run your application and have it automatically start up your AVD in the emulator, install your app, and run it, as is described in the Android developer documentation.

Outside of Eclipse

Back in your terminal window, run the following command:

```
ant install
```

Step #11: Run the Application in Your Emulator

Click the [MENU] button in the emulator window to bring up the Android home screen:

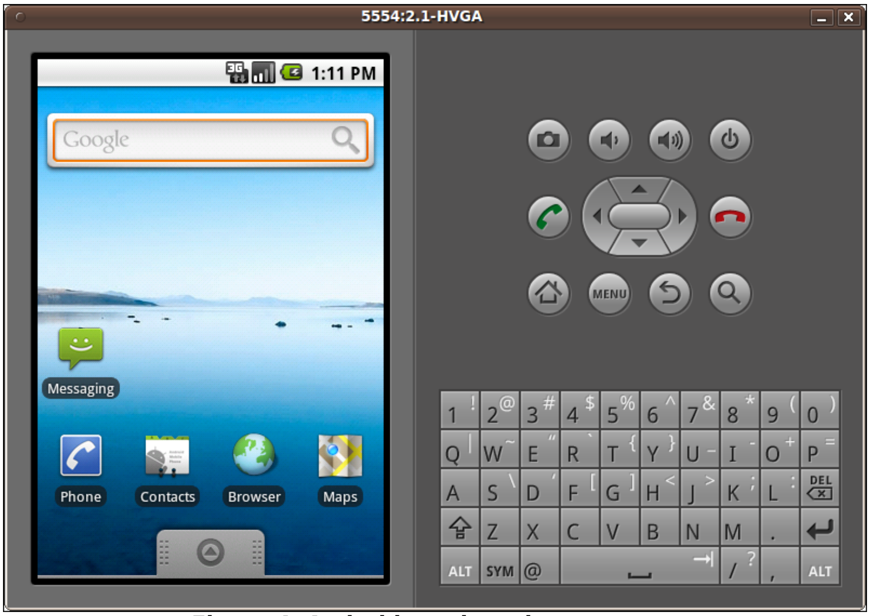


Figure 4. Android emulator home screen

Then, click on the grey button at the bottom of the emulator screen, just above the [MENU] button, to open up the application launcher:

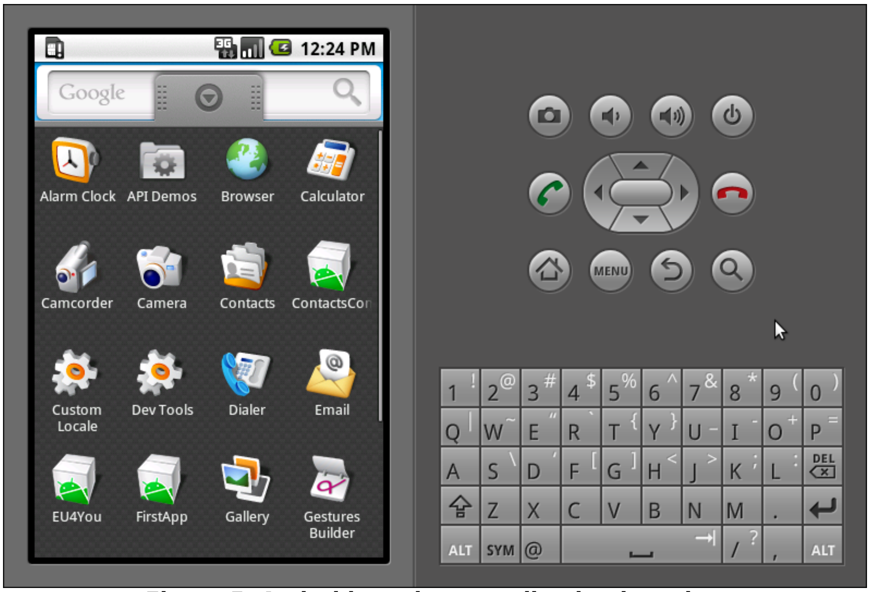
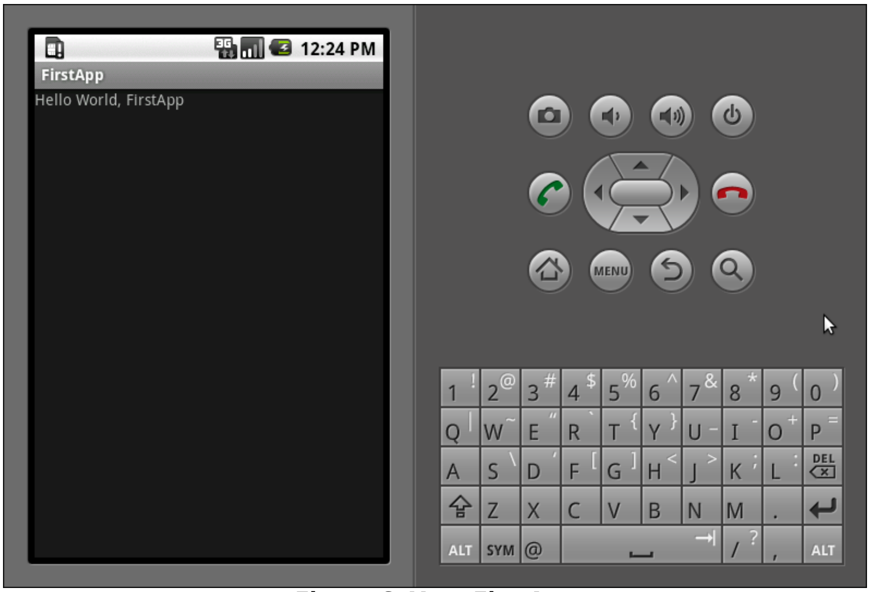


Figure 5. Android emulator application launcher

Notice there is an icon for your `FirstApp` application. Click on it to open it and see your first activity in action:



Hello World, FirstApp

Figure 6. Your FirstApp

To leave the application and return to the launcher, press the "BACK button", located to the right of the [MENU] button, and looks like an arrow pointing to the left.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Instead of using the console tools as documented above, try using Eclipse. You will need to download Eclipse, install the Android plug-in, and use it to create your first project.
- If you have an Android device, try installing the app on the device and running it there. The easiest way to do this is to shut down your emulator, plug in your device, and run `ant install` again. You may need to install drivers (Windows) or adjust some USB settings (Linux) to get the device recognized by the Android build system.
- Play around with the values for `android:layout_width` and `android:layout_height`. You might also add `android:background = "#FFFF0000"` to the `FirstApp/res/layout/main.xml` file, to give the

screen a red background, so you can see where the widget ends and the rest of the screen begins.

Further Reading

The best place to learn the basics of setting up a project, at least for Eclipse, can be found in the Android developer documentation. You may also wish to look at the first three chapters of The Busy Coder's Guide to Android Development ("The Big Picture", "Projects and Targets", and "Creating a Skeleton Application").

TUTORIAL 2

A Simple Form

This tutorial is the first of several that will build up a "lunch list" application, where you can track various likely places to go to lunch. While this application may seem silly, it will give you a chance to exercise many features of the Android platform. Besides, perhaps you may even find the application to be useful someday.

Step-By-Step Instructions

Here is how you can create this application:

Step #1: Generate the Application Skeleton

First, we need to create a new project.

Eclipse

Use the new-project wizard to create an empty Android project named `LunchList`, as described in the Android developer documentation. This will create an application skeleton for you, complete with everything you need to build your first Android application: Java source code, build instructions, etc.

Outside of Eclipse

Inside your terminal (e.g., Command Prompt for Windows), move back into the `AndroidTutorials` directory you created in step #1 of the first tutorial. Then, run the following command:

```
android create project --target "Google Inc.:Google APIs:6" --path ./LunchList
--activity LunchList --package apt.tutorial
```

This will create an application skeleton for you, complete with everything you need to start building the `LunchList` application.

Step #2: Modify the Layout

Using your text editor, open the `LunchList/res/layout/main.xml` file. Initially, that file will look like this:

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
 android:orientation="vertical"
 android:layout_width="fill_parent"
 android:layout_height="fill_parent"
 >
<TextView
 android:layout_width="fill_parent"
 android:layout_height="wrap_content"
 android:text="Hello World, LunchList"
 />
</LinearLayout>
```

Change that layout to look like this:

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:orientation="vertical"
  android:layout_width="fill_parent"
  android:layout_height="fill_parent"
  >
  <LinearLayout
    android:orientation="horizontal"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    >
    <TextView
      android:layout_width="wrap_content"
      android:layout_height="wrap_content"
      android:text="Name:"
      />
    <EditText android:id="@+id/name"
      android:layout_width="fill_parent"
      android:layout_height="wrap_content"
      />
  </LinearLayout>
  <LinearLayout
    android:orientation="horizontal"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    >
    <TextView
      android:layout_width="wrap_content"
      android:layout_height="wrap_content"
      android:text="Address:"
      />
    <EditText android:id="@+id/addr"
      android:layout_width="fill_parent"
      android:layout_height="wrap_content"
      />
  </LinearLayout>
  <Button android:id="@+id/save"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:text="Save"
  />
</LinearLayout>
```

This gives us a three-row form: one row with a labeled field for the restaurant name, one with a labeled field for the restaurant address, and a big Save button.

Step #3: Compile and Install the Application

Compile and install the application in the emulator by running the following commands in your terminal:

```
ant install
```

Or, from Eclipse, just run the project.

Step #4: Run the Application in the Emulator

In your emulator, in the application launcher, you will see an icon for your `LunchList` application. Click it to bring up your form:

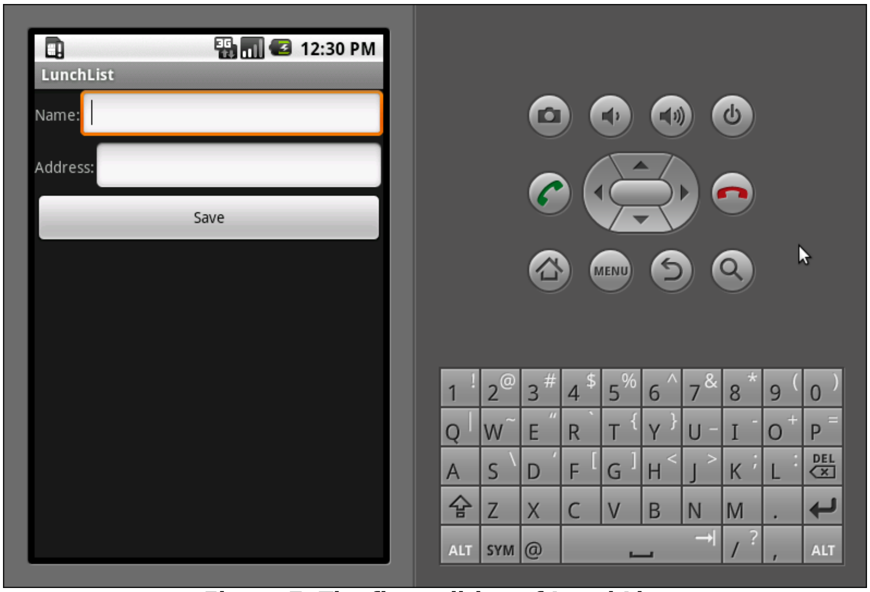


Figure 7. The first edition of LunchList

Use the directional pad (D-pad) below the [MENU] button to navigate between the fields and button. Enter some text in the fields and click the button, to see how those widgets behave. Then, click the BACK button to return to the application launcher.

Step #5: Create a Model Class

Now, we want to add a class to the project that will hold onto individual restaurants that will appear in the `LunchList`. Right now, we can only really work with one restaurant, but that will change in a future tutorial.

So, using your text editor, create a new file named `LunchList/src/apt/tutorial/Restaurant.java` with the following contents:

```
package apt.tutorial;

public class Restaurant {
  private String name="";
  private String address="";

  public String getName() {
    return(name);
  }

  public void setName(String name) {
    this.name=name;
  }

  public String getAddress() {
    return(address);
  }

  public void setAddress(String address) {
    this.address=address;
  }
}
```

This is simply a rudimentary model, with private data members for the name and address, and getters and setters for each of those.

Of course, don't forget to save your changes!

Step #6: Save the Form to the Model

Finally, we want to hook up the Save button, such that when it is pressed, we update a restaurant object based on the two `EditText` fields. To do this, open up the `LunchList/src/apt/tutorial/LunchList.java` file and replace the generated `Activity` implementation with the one shown below:

```
package apt.tutorial;

import android.app.Activity;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;

public class LunchList extends Activity {
  Restaurant r=new Restaurant();

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);

    Button save=(Button)findViewById(R.id.save);

    save.setOnClickListener(onSave);
  }

  private View.OnClickListener onSave=new View.OnClickListener() {
    public void onClick(View v) {
      EditText name=(EditText)findViewById(R.id.name);
      EditText address=(EditText)findViewById(R.id.addr);

      r.setName(name.getText().toString());
      r.setAddress(address.getText().toString());
    }
  };
}
```

Here, we:

- Create a single local restaurant instance when the activity is instantiated
- Get our `Button` from the `Activity` via `findViewById()`, then connect it to a listener to be notified when the button is clicked
- In the listener, we get our two `EditText` widgets via `findViewById()`, then retrieve their contents and put them in the restaurant

This code sample shows the use of an anonymous inner class implementation of a `View.OnClickListener`, named `onSave`. This technique is used in many places throughout this book, as it is a convenient way to organize bits of custom code that go into these various listener objects.

Then, run the `ant install` command to compile and update the emulator. Run the application to make sure it seems like it runs without errors, though at this point we are not really using the data saved in the restaurant object just yet.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Instead of using the console tools as documented above, try using Eclipse. You will need to download Eclipse, install the Android plug-in, and use it to create your first project.
- Try replacing the icon for your application. To do this, you will need to find a suitable 48x48 pixel image, create a `drawable/` directory inside your `res/` directory in the project, and adjust the `AndroidManifest.xml` file to contain an `android:icon = "@drawable/my_icon"` attribute in the application element, where `my_icon` is replaced by the base name of your image file.
- Try playing with the fonts for use in both the `TextView` and `EditText` widgets. The Android SDK documentation will show a number of XML attributes you can manipulate to change the color, make the text boldface, etc.

Further Reading

You can learn more about XML layouts in the "Using XML-Based Layouts" chapter of The Busy Coder's Guide to Android Development. Similarly, you can learn more about simple widgets, like fields and buttons, in the "Employing Basic Widgets" chapter of the same book, where you will also find "Working with Containers" for container classes like `LinearLayout`.

TUTORIAL 3

A Fancier Form

In this tutorial, we will switch to using a `TableLayout` for our restaurant data entry form, plus add a set of radio buttons to represent the type of restaurant.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `02-SimpleForm` edition of `LunchList` to use as a starting point.

Step #1: Switch to a TableLayout

First, open `LunchList/res/layout/main.xml` and modify its contents to look like the following:

```
<?xml version="1.0" encoding="utf-8"?>
<TableLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:layout_width="fill_parent"
  android:layout_height="fill_parent"
  android:stretchColumns="1"
  >
  <TableRow>
    <TextView android:text="Name:" />
    <EditText android:id="@+id/name" />
  </TableRow>
  <TableRow>
```

```
    <TextView android:text="Address:" />
    <EditText android:id="@+id/addr" />
  </TableRow>
  <Button android:id="@+id/save"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:text="Save"
  />
</TableLayout>
```

Notice that we replaced the three `LinearLayout` containers with a `TableLayout` and two `TableRow` containers. We also set up the `EditText` column to be stretchable.

Recompile and reinstall the application, then run it in the emulator. You should see something like this:

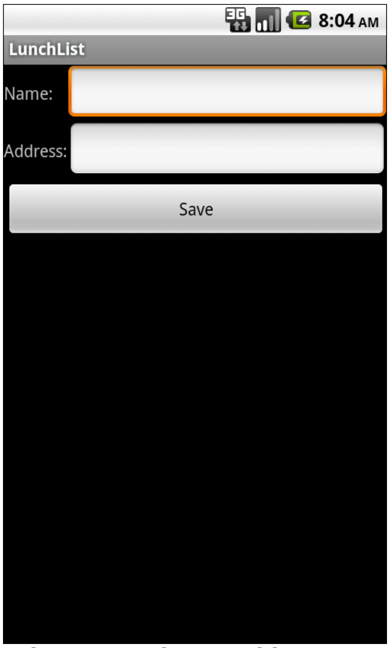
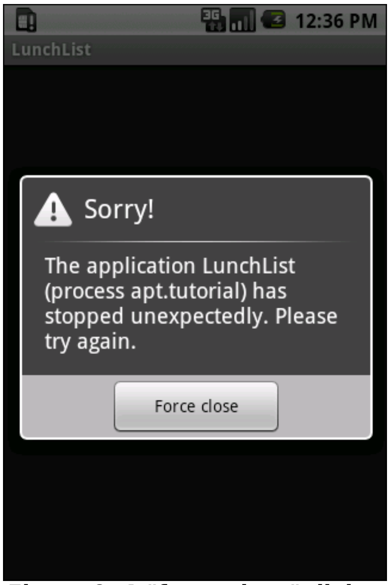


Figure 8. Using a TableLayout

Notice how the two `EditText` fields line up, whereas before, they appeared immediately after each label.

NOTE: At this step, or any other, when you try to run your application, you may get the following screen:



The application LunchList (process apt.tutorial) has stopped unexpectedly. Please try again.

Figure 9. A "force-close" dialog

If you encounter this, first try to do a full rebuild of the project. In Eclipse, this would involve doing **Project** > **Force Clean**. At the command line, use `ant clean` or delete the contents of your `bin/` and `gen/` directories, then `ant install`. If the problem persists after this, then there is a bug in your code somewhere. You can use `adb logcat`, DDMS, or the DDMS perspective in Eclipse to see the Java stack trace associated with this crash, to help you perhaps diagnose what is going on.

Step #2: Add a RadioGroup

Next, we should add some `RadioButton` widgets to indicate the type of restaurant this is: one that offers take-out, one where we can sit down, or one that is only a delivery service.

To do this, modify `LunchList/res/layout/main.xml` once again, this time to look like:

```
<?xml version="1.0" encoding="utf-8"?>
<TableLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:layout_width="fill_parent"
  android:layout_height="fill_parent"
  android:stretchColumns="1"
  >
  <TableRow>
    <TextView android:text="Name:" />
    <EditText android:id="@+id/name" />
  </TableRow>
  <TableRow>
    <TextView android:text="Address:" />
    <EditText android:id="@+id/addr" />
  </TableRow>
  <TableRow>
    <TextView android:text="Type:" />
    <RadioGroup android:id="@+id/types">
      <RadioButton android:id="@+id/take_out"
        android:text="Take-Out"
      />
      <RadioButton android:id="@+id/sit_down"
        android:text="Sit-Down"
      />
      <RadioButton android:id="@+id/delivery"
        android:text="Delivery"
      />
    </RadioGroup>
  </TableRow>
  <Button android:id="@+id/save"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:text="Save"
  />
</TableLayout>
```

Our `RadioGroup` and `RadioButton` widgets go inside the `TableLayout`, so they will line up with the rest of table – you can see this once you recompile, reinstall, and run the application:

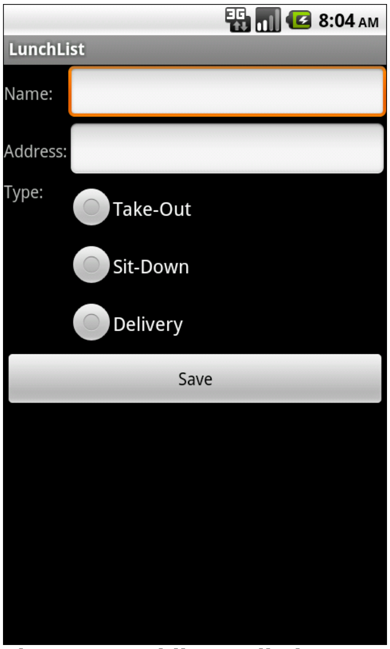


Figure 10. Adding radio buttons

Step #3: Update the Model

Right now, our model class has no place to hold the restaurant type. To change that, modify `LunchList/src/apt/tutorial/Restaurant.java` to add in a new `private String type` data member and a getter/setter pair, like these:

```
public String getType() {
  return(type);
}

public void setType(String type) {
  this.type=type;
}
```

When you are done, your restaurant class should look something like this:

```
package apt.tutorial;

public class Restaurant {
  private String name="";
  private String address="";
  private String type="";

  public String getName() {
    return(name);
  }

  public void setName(String name) {
    this.name=name;
  }

  public String getAddress() {
    return(address);
  }

  public void setAddress(String address) {
    this.address=address;
  }

  public String getType() {
    return(type);
  }

  public void setType(String type) {
    this.type=type;
  }
}
```

Step #4: Save the Type to the Model

Finally, we need to wire our `RadioButton` widgets to the model, such that when the user clicks the Save button, the type is saved as well. To do this, modify the `onSave` listener object to look like this:

```
private View.OnClickListener onSave=new View.OnClickListener() {
  public void onClick(View v) {
    EditText name=(EditText)findViewById(R.id.name);
    EditText address=(EditText)findViewById(R.id.addr);

    r.setName(name.getText().toString());
    r.setAddress(address.getText().toString());

    RadioGroup types=(RadioGroup)findViewById(R.id.types);

    switch (types.getCheckedRadioButtonId()) {
      case R.id.sit_down:
        r.setType("sit_down");
        break;

      case R.id.take_out:
        r.setType("take_out");
        break;

      case R.id.delivery:
        r.setType("delivery");
        break;
    }
  }
};
```

Note that you will also need to import `android.widget.RadioGroup` for this to compile. The full activity will then look like this:

```
package apt.tutorial;

import android.app.Activity;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;
import android.widget.RadioGroup;

public class LunchList extends Activity {
  Restaurant r=new Restaurant();

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);

    Button save=(Button)findViewById(R.id.save);

    save.setOnClickListener(onSave);
  }

  private View.OnClickListener onSave=new View.OnClickListener() {
    public void onClick(View v) {
      EditText name=(EditText)findViewById(R.id.name);
      EditText address=(EditText)findViewById(R.id.addr);

      r.setName(name.getText().toString());
      r.setAddress(address.getText().toString());

      RadioGroup types=(RadioGroup)findViewById(R.id.types);

      switch (types.getCheckedRadioButtonId()) {
        case R.id.sit_down:
          r.setType("sit_down");
          break;

        case R.id.take_out:
          r.setType("take_out");
          break;
        case R.id.delivery:
          r.setType("delivery");
          break;
      }
    }
  };
}
```

Recompile, reinstall, and run the application. Confirm that you can save the restaurant data without errors.

If you are wondering what will happen if there is no selected `RadioButton`, the `RadioGroup` call to `getCheckedRadioButtonId()` will return `-1`, which will not match anything in our `switch` statement, and so the model will not be modified.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- If you have an Android device, try installing the app on the device and running it there. The easiest way to do this is to shut down your emulator, plug in your device, and run `ant reinstall`.
- Set one of the three radio buttons to be selected by default, using `android:checked = "true"`.
- Try creating the `RadioButton` widgets in Java code, instead of in the layout. To do this, you will need to create the `RadioButton` objects themselves, configure them (e.g., supply them with text to display), then add them to the `RadioGroup` via `addView()`.
- Try adding more `RadioButton` widgets than there are room to display on the screen. Note how the screen does not automatically scroll to show them. Then, wrap your entire layout in a `ScrollView` container, and see how the form can now scroll to accommodate all of your widgets.

Further Reading

You can learn more about radio buttons in the "Employing Basic Widgets" chapter of The Busy Coder's Guide to Android Development. Also, you will find material on `TableLayout` in the "Working with Containers" chapter of the same book.

TUTORIAL 4

Adding a List

In this tutorial, we will change our model to be a list of restaurants, rather than just one. Then, we will add a ListView to view the available restaurants. This will be rather incomplete, in that we can only add a new restaurant, not edit or delete an existing one, but we will cover those steps too in a later tutorial.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the 03-FancierForm edition of LunchList to use as a starting point.

Step #1: Hold a List of Restaurants

First, if we are going to have a list of restaurants in the UI, we need a list of restaurants as our model. So, in LunchList, change:

```
Restaurant r=new Restaurant();
```

to:

```
List<Restaurant> model=new ArrayList<Restaurant>();
```

Note that you will need to import `java.util.List` and `java.util.ArrayList` as well.

Step #2: Save Adds to List

Note that the above code will not compile, because our `onSave` `Button` click handler is still set up to reference the old single restaurant model. For the time being, we will have `onSave` simply add a new restaurant.

All we need to do is add a local restaurant `r` variable, populate it, and add it to the list:

```
private View.OnClickListener onSave=new View.OnClickListener() {
  public void onClick(View v) {
    Restaurant r=new Restaurant();
    EditText name=(EditText)findViewById(R.id.name);
    EditText address=(EditText)findViewById(R.id.addr);

    r.setName(name.getText().toString());
    r.setAddress(address.getText().toString());

    RadioGroup types=(RadioGroup)findViewById(R.id.types);

    switch (types.getCheckedRadioButtonId()) {
      case R.id.sit_down:
        r.setType("sit_down");
        break;

      case R.id.take_out:
        r.setType("take_out");
        break;

      case R.id.delivery:
        r.setType("delivery");
        break;
    }
  }
};
```

At this point, you should be able to rebuild and reinstall the application. Test it out to make sure that clicking the button does not cause any unexpected errors.

You will note that we are not adding the actual restaurant to anything – `r` is a local variable and so goes out of scope after `onClick()` returns. We will address this shortcoming later in this exercise.

Step #3: Implement toString()

To simplify the creation of our `ListView`, we need to have our restaurant class respond intelligently to `toString()`. That will be called on each restaurant as it is displayed in our list.

For the purposes of this tutorial, we will simply use the name – later tutorials will make the rows much more interesting and complex.

So, add a `toString()` implementation on restaurant like this:

```
public String toString() {
  return(getName());
}
```

Recompile and ensure your application still builds.

Step #4: Add a ListView Widget

Now comes the challenging part – adding the `ListView` to the layout.

The challenge is in getting the layout right. Right now, while we have only the one screen to work with, we need to somehow squeeze in the list without eliminating space for anything else. In fact, ideally, the list takes up all the available space that is not being used by our current details form.

One way to achieve that is to use a `RelativeLayout` as the over-arching layout for the screen. We anchor the details form to the bottom of the screen, then have the list span the space from the top of the screen to the top of the details form.

To make this change, replace your current `LunchList/res/layout/main.xml` with the following:

```
<?xml version="1.0" encoding="utf-8"?>
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:layout_width="fill_parent"
  android:layout_height="fill_parent"
  >
  <TableLayout android:id="@+id/details"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:layout_alignParentBottom="true"
    android:stretchColumns="1"
    >
    <TableRow>
      <TextView android:text="Name:" />
      <EditText android:id="@+id/name" />
    </TableRow>
    <TableRow>
      <TextView android:text="Address:" />
      <EditText android:id="@+id/addr" />
    </TableRow>
    <TableRow>
      <TextView android:text="Type:" />
      <RadioGroup android:id="@+id/types">
        <RadioButton android:id="@+id/take_out"
          android:text="Take-Out"
        />
        <RadioButton android:id="@+id/sit_down"
          android:text="Sit-Down"
        />
        <RadioButton android:id="@+id/delivery"
          android:text="Delivery"
        />
      </RadioGroup>
    </TableRow>
    <Button android:id="@+id/save"
      android:layout_width="fill_parent"
      android:layout_height="wrap_content"
      android:text="Save"
    />
  </TableLayout>
  <ListView android:id="@+id/restaurants"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:layout_alignParentTop="true"
    android:layout_above="@id/details"
  />
</RelativeLayout>
```

If you recompile and rebuild the application, then run it, you will see our form slid to the bottom, with empty space at the top:

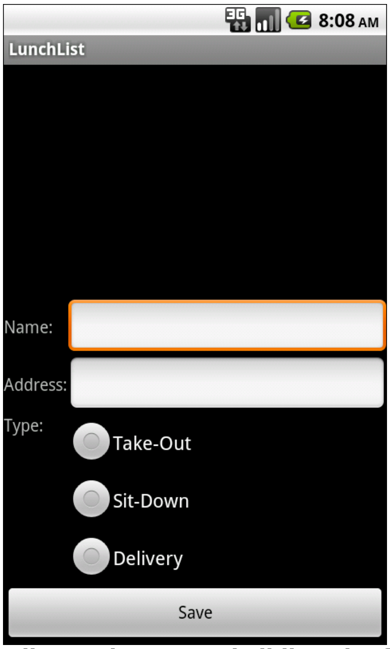


Figure 11. Adding a list to the top and sliding the form to the bottom

Step #5: Build and Attach the Adapter

The `ListView` will remain empty, of course, until we do something to populate it. What we want is for the list to show our running lineup of restaurant objects.

Since we have our `ArrayList<Restaurant>`, we can easily wrap it in an `ArrayAdapter<Restaurant>`. This also means, though, that when we add a restaurant, we need to add it to the `ArrayAdapter` via `add()` – the adapter will, in turn, put it in the `ArrayList`. Otherwise, if we add it straight to the `ArrayList`, the adapter will not know about the added restaurant and therefore will not display it.

Here is the new implementation of the `LunchList` class:

```
package apt.tutorial;

import android.app.Activity;
import android.os.Bundle;
import android.view.View;
import android.widget.ArrayAdapter;
import android.widget.Button;
import android.widget.EditText;
import android.widget.ListView;
import android.widget.RadioGroup;
import java.util.ArrayList;
import java.util.List;

public class LunchList extends Activity {
  List<Restaurant> model=new ArrayList<Restaurant>();
  ArrayAdapter<Restaurant> adapter=null;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);

    Button save=(Button)findViewById(R.id.save);

    save.setOnClickListener(onSave);

    ListView list=(ListView)findViewById(R.id.restaurants);

    adapter=new ArrayAdapter<Restaurant>(this,
                          android.R.layout.simple_list_item_1,
                          model);
    list.setAdapter(adapter);
  }

  private View.OnClickListener onSave=new View.OnClickListener() {
    public void onClick(View v) {
      Restaurant r=new Restaurant();
      EditText name=(EditText)findViewById(R.id.name);
      EditText address=(EditText)findViewById(R.id.addr);

      r.setName(name.getText().toString());
      r.setAddress(address.getText().toString());

      RadioGroup types=(RadioGroup)findViewById(R.id.types);

      switch (types.getCheckedRadioButtonId()) {
        case R.id.sit_down:
          r.setType("sit_down");
          break;

        case R.id.take_out:
          r.setType("take_out");
          break;

        case R.id.delivery:
          r.setType("delivery");
          break;
      }

      adapter.add(r);
    }
  };
}
```

The magic value `android.R.layout.simple_list_item_1` is a stock layout for a list row, just displaying the text of the object in white on a black background with a reasonably large font. In later tutorials, we will change the look of our rows to suit our own designs.

If you then add a few restaurants via the form, it will look something like this:

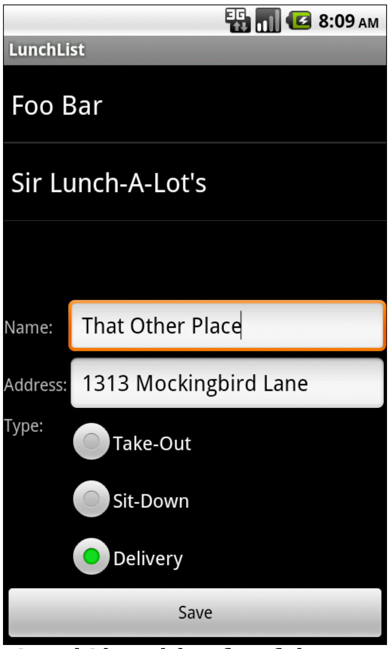


Figure 12. Our LunchList with a few fake restaurants added

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- See what the activity looks like if you use a `Spinner` instead of a `ListView`.
- Make the address field, presently an `EditText` widget, into an `AutoCompleteTextView`, using the other addresses as values to possibly reuse (e.g., for multiple restaurants in one place, such as a food court or mall).

Further Reading

Information on `ListView` and other selection widgets can be found in the "Using Selection Widgets" chapter of The Busy Coder's Guide to Android Development.

TUTORIAL 5

Making Our List Be Fancy

In this tutorial, we will update the layout of our `ListView` rows, so they show both the name and address of the restaurant, plus an icon indicating the type. Along the way, we will need to create our own custom `ListAdapter` to handle our row views and a `RestaurantHolder` to populate a row from a restaurant.

Regarding the notion of adapters and `ListAdapter`, to quote from *The Busy Coder's Guide to Android Development*:

> *In the abstract, adapters provide a common interface to multiple disparate APIs. More specifically, in Android's case, adapters provide a common interface to the data model behind a selection-style widget, such as a listbox...Android's adapters are responsible for providing the roster of data for a selection widget plus converting individual elements of data into specific views to be displayed inside the selection widget.*

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `04-ListView` edition of `LunchList` to use as a starting point.

Step #1: Create a Stub Custom Adapter

First, let us create a stub implementation of a `RestaurantAdapter` that will be where we put our logic for creating our own custom rows. That can look like this, implemented as an inner class of `LunchList`:

```
class RestaurantAdapter extends ArrayAdapter<Restaurant> {
  RestaurantAdapter() {
    super(LunchList.this,
          android.R.layout.simple_list_item_1,
          model);
  }
}
```

We hard-wire in the `android.R.layout.simple_list_item_1` layout for now, and we get our `Activity` and model from `LunchList` itself.

We also need to change our `adapter` data member to be a `RestaurantAdapter`, both where it is declared and where it is instantiated in `onCreate()`. Make these changes, then rebuild and reinstall the application and confirm it works as it did at the end of the previous tutorial.

Step #2: Design Our Row

Next, we want to design a row that incorporates all three of our model elements: name, address, and type. For the type, we will use three icons, one for each specific type (sit down, drive-through, delivery). You can use whatever icons you wish, or you can get the icons used in this tutorial from the tutorial ZIP file that you can download. They need to be named `ball_red.png`, `ball_yellow.png`, and `ball_green.png`, all located in `res/drawable/` in your project.

NOTE: If your project has no `res/drawable/` directory, but does have `res/drawable-ldpi/` and others with similar suffixes, remove all of those and create a `res/drawable/` directory for use in this project.

The general layout is to have the icon on the left and the name stacked atop the address to the right:

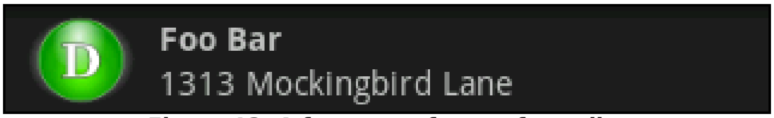


Figure 13. A fancy row for our fancy list

To achieve this look, we use a nested pair of `LinearLayout` containers. Use the following XML as the basis for `LunchList/res/layout/row.xml`:

```
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:layout_width="fill_parent"
  android:layout_height="wrap_content"
  android:orientation="horizontal"
  android:padding="4px"
  >
  <ImageView android:id="@+id/icon"
    android:layout_width="wrap_content"
    android:layout_height="fill_parent"
    android:layout_alignParentTop="true"
    android:layout_alignParentBottom="true"
    android:layout_marginRight="4px"
  />
  <LinearLayout
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:orientation="vertical"
    >
    <TextView android:id="@+id/title"
      android:layout_width="fill_parent"
      android:layout_height="wrap_content"
      android:layout_weight="1"
      android:gravity="center_vertical"
      android:textStyle="bold"
      android:singleLine="true"
      android:ellipsize="end"
    />
    <TextView android:id="@+id/address"
      android:layout_width="fill_parent"
      android:layout_height="wrap_content"
      android:layout_weight="1"
      android:gravity="center_vertical"
      android:singleLine="true"
      android:ellipsize="end"
    />
  </LinearLayout>
</LinearLayout>
```

Some of the unusual attributes applied in this layout include:

- `android:padding`, which arranges for some whitespace to be put outside the actual widget contents but still be considered part of the widget (or container) itself when calculating its size
- `android:textStyle`, where we can indicate that some text is in bold or italics
- `android:singleLine`, which, if `true`, indicates that text should not word-wrap if it extends past one line
- `android:ellipsize`, which indicates where text should be truncated and ellipsized if it is too long for the available space

Step #3: Override getView(): The Simple Way

Next, we need to use this layout ourselves in our `RestaurantAdapter`. To do this, we need to override `getView()` and inflate the layout as needed for rows.

Modify `RestaurantAdapter` to look like the following:

```
class RestaurantAdapter extends ArrayAdapter<Restaurant> {
  RestaurantAdapter() {
    super(LunchList.this,
          android.R.layout.simple_list_item_1,
          model);
  }

  public View getView(int position, View convertView,
                      ViewGroup parent) {
    View row=convertView;

    if (row==null) {
      LayoutInflater inflater=getLayoutInflater();

      row=inflater.inflate(R.layout.row, null);
    }

    Restaurant r=model.get(position);

    ((TextView)row.findViewById(R.id.title)).setText(r.getName());
    ((TextView)row.findViewById(R.id.address)).setText(r.getAddress());

    ImageView icon=(ImageView)row.findViewById(R.id.icon);

    if (r.getType().equals("sit_down")) {
      icon.setImageResource(R.drawable.ball_red);
    }
    else if (r.getType().equals("take_out")) {
      icon.setImageResource(R.drawable.ball_yellow);
    }
    else {
      icon.setImageResource(R.drawable.ball_green);
    }
    
    return(row);
  }
}
```

Notice how we create a row only if needed, recycling existing rows. But, we still pick out each `TextView` and `ImageView` from each row and populate it from the restaurant at the indicated position.

Step #4: Create a RestaurantHolder

To improve performance and encapsulation, we should move the logic that populates a row from a restaurant into a separate class, one that can cache the `TextView` and `ImageView` widgets.

To do this, add the following static inner class to `LunchList`:

```
static class RestaurantHolder {
  private TextView name=null;
  private TextView address=null;
  private ImageView icon=null;
  private View row=null;
  
  RestaurantHolder(View row) {
    this.row=row;
    
    name=(TextView)row.findViewById(R.id.title);
    address=(TextView)row.findViewById(R.id.address);
    icon=(ImageView)row.findViewById(R.id.icon);
  }
  
  void populateFrom(Restaurant r) {
    name.setText(r.getName());
    address.setText(r.getAddress());
    
    if (r.getType().equals("sit_down")) {
      icon.setImageResource(R.drawable.ball_red);
    }
    else if (r.getType().equals("take_out")) {
      icon.setImageResource(R.drawable.ball_yellow);
    }
    else {
      icon.setImageResource(R.drawable.ball_green);
    }
  }
}
```

Step #5: Recycle Rows via RestaurantHolder

To take advantage of the new `RestaurantHolder`, we need to modify `getView()` in `RestaurantAdapter`. Following the holder pattern, we need to create a `RestaurantHolder` when we inflate a new row, cache that wrapper in the row via `setTag()`, then get it back later via `getTag()`.

Change `getView()` to look like the following:

```
class RestaurantAdapter extends ArrayAdapter<Restaurant> {
  RestaurantAdapter() {
    super(LunchList.this, R.layout.row, model);
  }

  public View getView(int position, View convertView,
                      ViewGroup parent) {
    View row=convertView;
    RestaurantHolder holder=null;

    if (row==null) {
      LayoutInflater inflater=getLayoutInflater();

      row=inflater.inflate(R.layout.row, parent, false);
      holder=new RestaurantHolder(row);
      row.setTag(holder);
    }
    else {
      holder=(RestaurantHolder)row.getTag();
    }

    holder.populateFrom(model.get(position));

    return(row);
  }
}
```

This means the whole `LunchList` class looks like:

```
package apt.tutorial;
```

```
import android.app.Activity;
import android.os.Bundle;
import android.view.View;
import android.view.ViewGroup;
import android.view.LayoutInflater;
import android.widget.ArrayAdapter;
import android.widget.Button;
import android.widget.EditText;
import android.widget.ImageView;
import android.widget.ListView;
import android.widget.RadioGroup;
import android.widget.TextView;
import java.util.ArrayList;
import java.util.List;

public class LunchList extends Activity {
  List<Restaurant> model=new ArrayList<Restaurant>();
  RestaurantAdapter adapter=null;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);

    Button save=(Button)findViewById(R.id.save);

    save.setOnClickListener(onSave);

    ListView list=(ListView)findViewById(R.id.restaurants);

    adapter=new RestaurantAdapter();
    list.setAdapter(adapter);
  }

  private View.OnClickListener onSave=new View.OnClickListener() {
    public void onClick(View v) {
      Restaurant r=new Restaurant();
      EditText name=(EditText)findViewById(R.id.name);
      EditText address=(EditText)findViewById(R.id.addr);

      r.setName(name.getText().toString());
      r.setAddress(address.getText().toString());

      RadioGroup types=(RadioGroup)findViewById(R.id.types);

      switch (types.getCheckedRadioButtonId()) {
        case R.id.sit_down:
          r.setType("sit_down");
          break;

        case R.id.take_out:
          r.setType("take_out");
          break;
        case R.id.delivery:
          r.setType("delivery");
          break;
      }

      adapter.add(r);
    }
  };

  class RestaurantAdapter extends ArrayAdapter<Restaurant> {
    RestaurantAdapter() {
      super(LunchList.this, R.layout.row, model);
    }

    public View getView(int position, View convertView,
                        ViewGroup parent) {
      View row=convertView;
      RestaurantHolder holder=null;

      if (row==null) {
        LayoutInflater inflater=getLayoutInflater();

        row=inflater.inflate(R.layout.row, parent, false);
        holder=new RestaurantHolder(row);
        row.setTag(holder);
      }
      else {
        holder=(RestaurantHolder)row.getTag();
      }

      holder.populateFrom(model.get(position));

      return(row);
    }
  }

  static class RestaurantHolder {
    private TextView name=null;
    private TextView address=null;
    private ImageView icon=null;
    private View row=null;

    RestaurantHolder(View row) {
      this.row=row;

      name=(TextView)row.findViewById(R.id.title);
      address=(TextView)row.findViewById(R.id.address);
      icon=(ImageView)row.findViewById(R.id.icon);
    }

    void populateFrom(Restaurant r) {
      name.setText(r.getName());
      address.setText(r.getAddress());
      if (r.getType().equals("sit_down")) {
        icon.setImageResource(R.drawable.ball_red);
      }
      else if (r.getType().equals("take_out")) {
        icon.setImageResource(R.drawable.ball_yellow);
      }
      else {
        icon.setImageResource(R.drawable.ball_green);
      }
    }
  }
}
```

Rebuild and reinstall the application, then try adding several restaurants and confirm that, when the list is scrolled, everything appears as it should – the name, address, and icon all change.

Note that you may experience a problem, where your `EditText` widgets shrink, failing to follow the `android:stretchColumns` rule. This is a bug in Android that will hopefully be repaired one day.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Customize the rows beyond just the icon based on each restaurant, such as applying different colors to the name based upon certain criteria.
- Use three different layouts for the three different restaurant types. To do this, you will need to override `getItemViewType()` and `getViewTypeCount()` in the custom adapter to return the appropriate data.

Further Reading

Using custom `Adapter` classes and creating list rows that are more than mere strings is covered in the "Getting Fancy with Lists" chapter of The Busy Coder's Guide to Android Development.

TUTORIAL 6

Splitting the Tab

In this tutorial, we will move our `ListView` onto one tab and our form onto a separate tab of a `TabView`. Along the way, we will also arrange to update our form based on a `ListView` selections or clicks, even though the Save button will still only add new restaurants to our list.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `05-FancyList` edition of `LunchList` to use as a starting point.

Step #1: Rework the Layout

First, we need to change our layout around, to introduce the tabs and split our UI between a list tab and a details tab. This involves:

- Removing the `RelativeLayout` and the layout attributes leveraging it, as that was how we had the list and form on a single screen
- Add in a `TabHost`, `TabWidget`, and `FrameLayout`, the latter of which is parent to the list and details

To accomplish this, replace your current `LunchList/res/layout/main.xml` with the following:

```
<?xml version="1.0" encoding="utf-8"?>
<TabHost xmlns:android="http://schemas.android.com/apk/res/android"
  android:id="@android:id/tabhost"
  android:layout_width="fill_parent"
  android:layout_height="fill_parent">
  <LinearLayout
    android:orientation="vertical"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent">
    <TabWidget android:id="@android:id/tabs"
      android:layout_width="fill_parent"
      android:layout_height="wrap_content"
    />
    <FrameLayout android:id="@android:id/tabcontent"
      android:layout_width="fill_parent"
      android:layout_height="fill_parent"
    >
      <ListView android:id="@+id/restaurants"
        android:layout_width="fill_parent"
        android:layout_height="fill_parent"
      />
      <TableLayout android:id="@+id/details"
        android:layout_width="fill_parent"
        android:layout_height="wrap_content"
        android:stretchColumns="1"
        android:paddingTop="4px"
        >
        <TableRow>
          <TextView android:text="Name:" />
          <EditText android:id="@+id/name" />
        </TableRow>
        <TableRow>
          <TextView android:text="Address:" />
          <EditText android:id="@+id/addr" />
        </TableRow>
        <TableRow>
          <TextView android:text="Type:" />
          <RadioGroup android:id="@+id/types">
            <RadioButton android:id="@+id/take_out"
              android:text="Take-Out"
            />
            <RadioButton android:id="@+id/sit_down"
              android:text="Sit-Down"
            />
            <RadioButton android:id="@+id/delivery"
              android:text="Delivery"
            />
          </RadioGroup>
        </TableRow>
        <Button android:id="@+id/save"
          android:layout_width="fill_parent"
          android:layout_height="wrap_content"
          android:text="Save"
        />
      </TableLayout>
    </FrameLayout>
  </LinearLayout>
</TabHost>
```

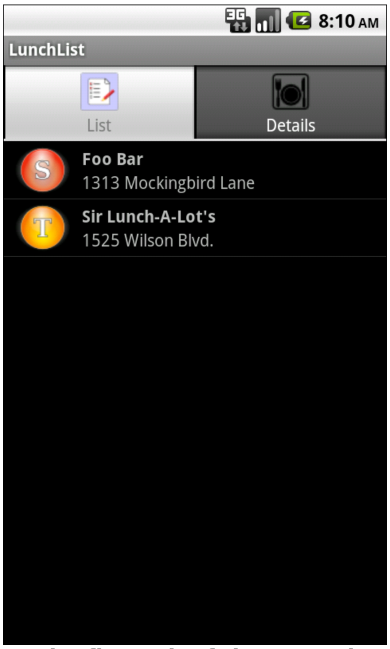
Step #2: Wire In the Tabs

Next, we need to modify the `LunchList` itself, so it is a `TabActivity` (rather than a plain `Activity`) and teaches the `TabHost` how to use our `FrameLayout` contents for the individual tab panes. To do this:

1. Add imports to `LunchList` for `android.app.TabActivity` and `android.widget.TabHost`
2. Make `LunchList` extend `TabActivity`
3. Obtain 32px high icons from some source to use for the list and details tab icons, place them in `LunchList/res/drawable` as `list.png` and `restaurant.png`, respectively
4. Add the following code to the end of your `onCreate()` method:

```
TabHost.TabSpec spec=getTabHost().newTabSpec("tag1");

spec.setContent(R.id.restaurants);
spec.setIndicator("List", getResources()
                           .getDrawable(R.drawable.list));
getTabHost().addTab(spec);

spec=getTabHost().newTabSpec("tag2");
spec.setContent(R.id.details);
spec.setIndicator("Details", getResources()
                              .getDrawable(R.drawable.restaurant));
getTabHost().addTab(spec);

getTabHost().setCurrentTab(0);
```

At this point, you can recompile and reinstall the application and try it out. You should see a two-tab UI like this:



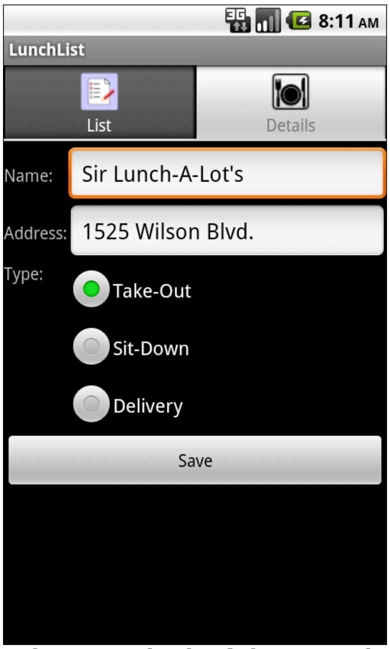
8:10 AM

LunchList

Foo Bar
1313 Mockingbird Lane

Sir Lunch-A-Lot's
1525 Wilson Blvd.

Figure 14. The first tab of the two-tab LunchList



8:11 AM

LunchList

Name: Sir Lunch-A-Lot's

Address: 1525 Wilson Blvd.

Type: [✓ Take-Out] Sit-Down Delivery

Figure 15. The second tab of the two-tab LunchList

Step #3: Get Control On List Events

Next, we need to detect when the user clicks on one of our restaurants in the list, so we can update our detail form with that information.

First, add an import for `android.widget.AdapterView` to `LunchList`. Then, create an `AdapterView.OnItemClickListener` named `onListClick`:

```
private AdapterView.OnItemClickListener onListClick=new
AdapterView.OnItemClickListener() {
  public void onItemClick(AdapterView<?> parent,
                         View view, int position,
                         long id) {
  }
};
```

Finally, call `setOnItemClickListener()` on the `ListView` in the activity's `onCreate()` to connect the `ListView` to the `onListClick` listener object (`list.setOnItemClickListener(onListClick);`)

Step #4: Update Our Restaurant Form On Clicks

Next, now that we have control in a list item click, we need to actually find the associated restaurant and update our details form.

To do this, you need to do two things. First, move the `name`, `address`, and `types` variables into data members and populate them in the activity's `onCreate()` – our current code has them as local variables in the `onSave` listener object's `onClick()` method. So, you should have some data members like:

```
EditText name=null;
EditText address=null;
RadioGroup types=null;
```

And some code after the call to `setContentView()` in `onCreate()` like:

```
name=(EditText)findViewById(R.id.name);
address=(EditText)findViewById(R.id.addr);
types=(RadioGroup)findViewById(R.id.types);
```

Then, add smarts to `onListClick` to update the details form:

```
private AdapterView.OnItemClickListener onListClick=new
AdapterView.OnItemClickListener() {
  public void onItemClick(AdapterView<?> parent,
                          View view, int position,
                          long id) {
    Restaurant r=model.get(position);

    name.setText(r.getName());
    address.setText(r.getAddress());

    if (r.getType().equals("sit_down")) {
      types.check(R.id.sit_down);
    }
    else if (r.getType().equals("take_out")) {
      types.check(R.id.take_out);
    }
    else {
      types.check(R.id.delivery);
    }
  }
};
```

Note how we find the clicked-upon restaurant via the position parameter, which is an index into our `ArrayList` of restaurants.

Step #5: Switch Tabs On Clicks

Finally, we want to switch to the details form when the user clicks a restaurant in the list.

This is just one extra line of code, in the `onItemClick()` method of our `onListClick` listener object:

```
getTabHost().setCurrentTab(1);
```

This just changes the current tab to the one known as index `1`, which is the second tab (tabs start counting at `0`).

At this point, you should be able to recompile and reinstall the application and test out the new functionality.

Here is the complete source code to our `LunchList` activity, after all of the changes made in this tutorial:

```
package apt.tutorial;

import android.app.TabActivity;
import android.os.Bundle;
import android.view.View;
import android.view.ViewGroup;
import android.view.LayoutInflater;
import android.widget.AdapterView;
import android.widget.ArrayAdapter;
import android.widget.Button;
import android.widget.EditText;
import android.widget.ImageView;
import android.widget.ListView;
import android.widget.RadioGroup;
import android.widget.TabHost;
import android.widget.TextView;
import java.util.ArrayList;
import java.util.List;

public class LunchList extends TabActivity {
  List<Restaurant> model=new ArrayList<Restaurant>();
  RestaurantAdapter adapter=null;
  EditText name=null;
  EditText address=null;
  RadioGroup types=null;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);

    name=(EditText)findViewById(R.id.name);
    address=(EditText)findViewById(R.id.addr);
    types=(RadioGroup)findViewById(R.id.types);

    Button save=(Button)findViewById(R.id.save);

    save.setOnClickListener(onSave);

    ListView list=(ListView)findViewById(R.id.restaurants);

    adapter=new RestaurantAdapter();
    list.setAdapter(adapter);

    TabHost.TabSpec spec=getTabHost().newTabSpec("tag1");

    spec.setContent(R.id.restaurants);
    spec.setIndicator("List", getResources()
                                .getDrawable(R.drawable.list));
    getTabHost().addTab(spec);
    spec=getTabHost().newTabSpec("tag2");
    spec.setContent(R.id.details);
    spec.setIndicator("Details", getResources()
                                .getDrawable(R.drawable.restaurant));
    getTabHost().addTab(spec);

    getTabHost().setCurrentTab(0);

    list.setOnItemClickListener(onListClick);
  }

  private View.OnClickListener onSave=new View.OnClickListener() {
    public void onClick(View v) {
      Restaurant r=new Restaurant();
      r.setName(name.getText().toString());
      r.setAddress(address.getText().toString());

      switch (types.getCheckedRadioButtonId()) {
        case R.id.sit_down:
          r.setType("sit_down");
          break;

        case R.id.take_out:
          r.setType("take_out");
          break;

        case R.id.delivery:
          r.setType("delivery");
          break;
      }

      adapter.add(r);
    }
  };

  private AdapterView.OnItemClickListener onListClick=new
AdapterView.OnItemClickListener() {
    public void onItemClick(AdapterView<?> parent,
                           View view, int position,
                           long id) {
      Restaurant r=model.get(position);

      name.setText(r.getName());
      address.setText(r.getAddress());

      if (r.getType().equals("sit_down")) {
        types.check(R.id.sit_down);
      }
      else if (r.getType().equals("take_out")) {
        types.check(R.id.take_out);
      }
      else {
        types.check(R.id.delivery);
      }

      getTabHost().setCurrentTab(1);
    }
  };

  class RestaurantAdapter extends ArrayAdapter<Restaurant> {
    RestaurantAdapter() {
      super(LunchList.this, R.layout.row, model);
    }

    public View getView(int position, View convertView,
                       ViewGroup parent) {
      View row=convertView;
      RestaurantHolder holder=null;

      if (row==null) {
        LayoutInflater inflater=getLayoutInflater();

        row=inflater.inflate(R.layout.row, parent, false);
        holder=new RestaurantHolder(row);
        row.setTag(holder);
      }
      else {
        holder=(RestaurantHolder)row.getTag();
      }

      holder.populateFrom(model.get(position));

      return(row);
    }
  }

  static class RestaurantHolder {
    private TextView name=null;
    private TextView address=null;
    private ImageView icon=null;
    private View row=null;

    RestaurantHolder(View row) {
      this.row=row;

      name=(TextView)row.findViewById(R.id.title);
      address=(TextView)row.findViewById(R.id.address);
      icon=(ImageView)row.findViewById(R.id.icon);
    }

    void populateFrom(Restaurant r) {
      name.setText(r.getName());
      address.setText(r.getAddress());

      if (r.getType().equals("sit_down")) {
        icon.setImageResource(R.drawable.ball_red);
      }
```

```
        else if (r.getType().equals("take_out")) {
          icon.setImageResource(R.drawable.ball_yellow);
        }
        else {
          icon.setImageResource(R.drawable.ball_green);
        }
      }
    }
}
```

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Add a date in the restaurant model to note the last time you visited the restaurant, then use either `DatePicker` or `DatePickerDialog` to allow users to set the date when they create their restaurant objects.
- Try making a version of the activity that uses a `ViewFlipper` and a `Button` to flip from the list to the detail form, rather than using two tabs.

Further Reading

The use of tabs in an Android activity is covered in the "Employing Fancy Widgets" chapter of The Busy Coder's Guide to Android Development.

TUTORIAL 7

Menus and Messages

In this tutorial, we will add a EditText for a note to our details form and restaurant model. Then, we will add an options menu that will display the note as a Toast.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the 06-Tabs edition of LunchList to use as a starting point.

Step #1: Add Notes to the Restaurant

First, our restaurant model does not have any spot for notes. Add a String notes data member plus an associated getter and setter. Your resulting class should look like:

```
package apt.tutorial;

public class Restaurant {
  private String name="";
  private String address="";
  private String type="";
  private String notes="";

  public String getName() {
    return(name);
  }

  public void setName(String name) {
    this.name=name;
  }

  public String getAddress() {
    return(address);
  }

  public void setAddress(String address) {
    this.address=address;
  }

  public String getType() {
    return(type);
  }

  public void setType(String type) {
    this.type=type;
  }

  public String getNotes() {
    return(notes);
  }

  public void setNotes(String notes) {
    this.notes=notes;
  }

  public String toString() {
    return(getName());
  }
}
```

Step #2: Add Notes to the Detail Form

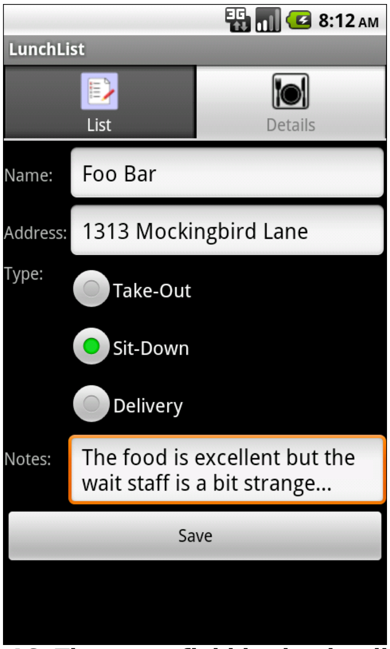
Next, we need `LunchList` to make use of the notes. To do this, first add the following `TableRow` above the Save button in our `TableLayout` in `LunchList/res/layout/main.xml`:

```
<TableRow>
  <TextView android:text="Notes:" />
  <EditText android:id="@+id/notes"
    android:singleLine="false"
    android:gravity="top"
    android:lines="2"
    android:scrollHorizontally="false"
    android:maxLines="2"
    android:maxWidth="200sp"
  />
</TableRow>
```

Then, we need to modify the `LunchList` activity itself, by:

1. Adding another data member for the `notes` `EditText` widget defined above
2. Find our `notes` `EditText` widget as part of `onCreate()`, like we do with other `EditText` widgets
3. Save our notes to our restaurant in `onSave`
4. Restore our notes to the `EditText` in `onListClick`

At this point, you can recompile and reinstall the application to see your notes field in action:



Name: Foo Bar

Address: 1313 Mockingbird Lane

Type: Take-Out [✓ Sit-Down] Delivery

Notes: The food is excellent but the wait staff is a bit strange...

Figure 16. The notes field in the details form

Step #3: Define the Option Menu

Now, we need to create an option menu and arrange for it to be displayed when the user clicks the [MENU] button.

The menu itself can be defined as a small piece of XML. Enter the following as `LunchList/res/menu/option.xml`:

```xml
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
  <item android:id="@+id/toast"
    android:title="Raise Toast"
    android:icon="@drawable/toast"
  />
</menu>
```

This code relies upon an icon stored in `LunchList/res/drawable/toast.png`. Find something suitable to use, preferably around 32px high.

Then, to arrange for the menu to be displayed, add the following method to `LunchList`:

```java
@Override
public boolean onCreateOptionsMenu(Menu menu) {
  new MenuInflater(this).inflate(R.menu.option, menu);


  return(super.onCreateOptionsMenu(menu));
}
```

Note that you will also need to define imports for `android.view.Menu` and `android.view.MenuInflater` for this to compile cleanly.

At this point, you can rebuild and reinstall the application. Click the [MENU] button, from either tab, to see the option menu with its icon:

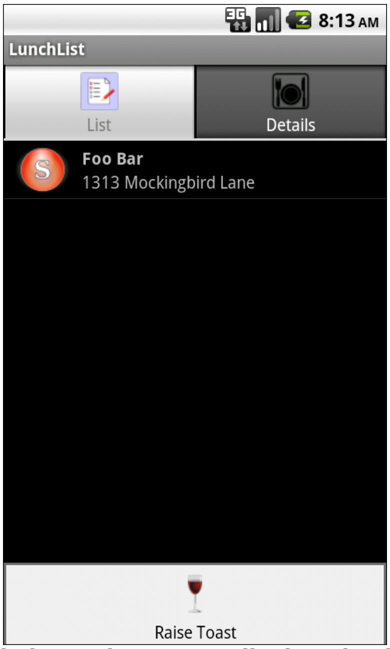


Figure 17. The LunchList option menu, displayed, with one menu choice

Step #4: Show the Notes as a Toast

Finally, we need to get control when the user selects the Raise Toast menu choice and display the notes in a `Toast`.

The problem is that, to do this, we need to know what restaurant to show. So far, we have not been holding onto a specific restaurant except when we needed it, such as when we populate the details form. Now, we need to know our current restaurant, defined as the one visible in the detail form...which could be none, if we have not yet saved anything in the form.

To make all of this work, do the following:

1. Add another data member, restaurant `current`, to hold the current restaurant. Be sure to initialize it to `null`.
2. In `onSave` and `onListClick`, rather than declaring local restaurant variables, use `current` to hold the restaurant we are saving (in

onSave) or have clicked on (in onListClick). You will need to change all references to the old r variable to be current in these two objects.

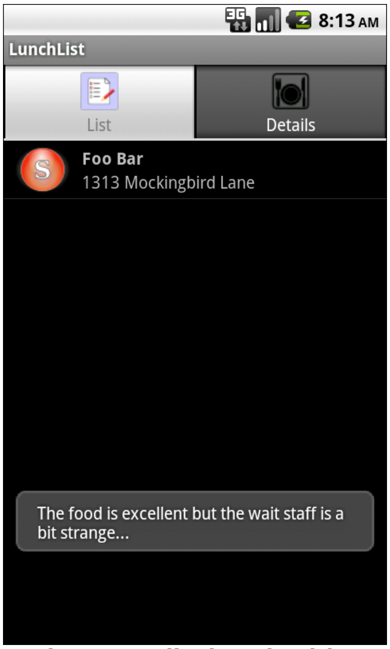
3. Add imports for android.view.MenuItem and android.widget.Toast.

4. Add the following implementation of onOptionsItemSelected() to your LunchList class:

```
@Override
public boolean onOptionsItemSelected(MenuItem item) {
  if (item.getItemId()==R.id.toast) {
    String message="No restaurant selected";

    if (current!=null) {
      message=current.getNotes();
    }

    Toast.makeText(this, message, Toast.LENGTH_LONG).show();

    return(true);
  }

  return(super.onOptionsItemSelected(item));
}
```

Note how we will either display "No restaurant selected" (if current is null) or the restaurant's notes, depending on our current state.

You can now rebuild and reinstall the application. Enter and save a restaurant, with notes, then choose the Raise Toast option menu item, and you will briefly see your notes in a Toast:



Foo Bar
1313 Mockingbird Lane

The food is excellent but the wait staff is a bit strange...

Figure 18. The Toast displayed, with some notes

The `LunchList` activity, as a whole, is shown below, incorporating all of the changes outlined in this tutorial:

```java
package apt.tutorial;

import android.app.TabActivity;
import android.os.Bundle;
import android.view.Menu;
import android.view.MenuInflater;
import android.view.MenuItem;
import android.view.View;
import android.view.ViewGroup;
import android.view.LayoutInflater;
import android.widget.AdapterView;
import android.widget.ArrayAdapter;
import android.widget.Button;
import android.widget.EditText;
import android.widget.ImageView;
import android.widget.ListView;
import android.widget.RadioGroup;
import android.widget.TabHost;
import android.widget.TextView;
import android.widget.Toast;
import java.util.ArrayList;
import java.util.List;
```

```
public class LunchList extends TabActivity {
  List<Restaurant> model=new ArrayList<Restaurant>();
  RestaurantAdapter adapter=null;
  EditText name=null;
  EditText address=null;
  EditText notes=null;
  RadioGroup types=null;
  Restaurant current=null;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);

    name=(EditText)findViewById(R.id.name);
    address=(EditText)findViewById(R.id.addr);
    notes=(EditText)findViewById(R.id.notes);
    types=(RadioGroup)findViewById(R.id.types);

    Button save=(Button)findViewById(R.id.save);

    save.setOnClickListener(onSave);

    ListView list=(ListView)findViewById(R.id.restaurants);

    adapter=new RestaurantAdapter();
    list.setAdapter(adapter);

    TabHost.TabSpec spec=getTabHost().newTabSpec("tag1");

    spec.setContent(R.id.restaurants);
    spec.setIndicator("List", getResources()
                            .getDrawable(R.drawable.list));
    getTabHost().addTab(spec);

    spec=getTabHost().newTabSpec("tag2");
    spec.setContent(R.id.details);
    spec.setIndicator("Details", getResources()
                              .getDrawable(R.drawable.restaurant));
    getTabHost().addTab(spec);

    getTabHost().setCurrentTab(0);

    list.setOnItemClickListener(onListClick);
  }

  @Override
  public boolean onCreateOptionsMenu(Menu menu) {
    new MenuInflater(this).inflate(R.menu.option, menu);


    return(super.onCreateOptionsMenu(menu));
  }
  @Override
  public boolean onOptionsItemSelected(MenuItem item) {
    if (item.getItemId()==R.id.toast) {
      String message="No restaurant selected";

      if (current!=null) {
        message=current.getNotes();
      }

      Toast.makeText(this, message, Toast.LENGTH_LONG).show();

      return(true);
    }

    return(super.onOptionsItemSelected(item));
  }

  private View.OnClickListener onSave=new View.OnClickListener() {
    public void onClick(View v) {
      current=new Restaurant();
      current.setName(name.getText().toString());
      current.setAddress(address.getText().toString());
      current.setNotes(notes.getText().toString());

      switch (types.getCheckedRadioButtonId()) {
        case R.id.sit_down:
          current.setType("sit_down");
          break;

        case R.id.take_out:
          current.setType("take_out");
          break;

        case R.id.delivery:
          current.setType("delivery");
          break;
      }

      adapter.add(current);
    }
  };

  private AdapterView.OnItemClickListener onListClick=new
AdapterView.OnItemClickListener() {
    public void onItemClick(AdapterView<?> parent,
                            View view, int position,
                            long id) {
      current=model.get(position);

      name.setText(current.getName());
      address.setText(current.getAddress());
      notes.setText(current.getNotes());
      if (current.getType().equals("sit_down")) {
        types.check(R.id.sit_down);
      }
      else if (current.getType().equals("take_out")) {
        types.check(R.id.take_out);
      }
      else {
        types.check(R.id.delivery);
      }

      getTabHost().setCurrentTab(1);
    }
  };

  class RestaurantAdapter extends ArrayAdapter<Restaurant> {
    RestaurantAdapter() {
      super(LunchList.this, R.layout.row, model);
    }

    public View getView(int position, View convertView,
                        ViewGroup parent) {
      View row=convertView;
      RestaurantHolder holder=null;

      if (row==null) {
        LayoutInflater inflater=getLayoutInflater();

        row=inflater.inflate(R.layout.row, parent, false);
        holder=new RestaurantHolder(row);
        row.setTag(holder);
      }
      else {
        holder=(RestaurantHolder)row.getTag();
      }

      holder.populateFrom(model.get(position));

      return(row);
    }
  }

  static class RestaurantHolder {
    private TextView name=null;
    private TextView address=null;
    private ImageView icon=null;
    private View row=null;

    RestaurantHolder(View row) {
      this.row=row;

      name=(TextView)row.findViewById(R.id.title);
      address=(TextView)row.findViewById(R.id.address);
      icon=(ImageView)row.findViewById(R.id.icon);
    }
    void populateFrom(Restaurant r) {
      name.setText(r.getName());
      address.setText(r.getAddress());

      if (r.getType().equals("sit_down")) {
        icon.setImageResource(R.drawable.ball_red);
      }
      else if (r.getType().equals("take_out")) {
        icon.setImageResource(R.drawable.ball_yellow);
      }
      else {
        icon.setImageResource(R.drawable.ball_green);
      }
    }
  }
}
```

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Try using an `AlertDialog` instead of a `Toast` to display the message.
- Try adding a menu option to switch you between tabs. In particular, change the text and icon on the menu option to reflect the other tab (i.e., on the List tab, the menu should show "Details" and the details tab icon; on the Details tab, the menu should show "List" and the List tab icon).
- Try creating an `ErrorDialog` designed to display exceptions in a "pleasant" format to the end user. The `ErrorDialog` should also log the exceptions via `android.util.Log`. Use some sort of runtime exception (e.g., division by zero) for generating exceptions to pass to the dialog.

Further Reading

You can learn more about menus – both option menus and context menus – in the "Applying Menus" chapter of The Busy Coder's Guide to Android Development. The use of a `Toast` is covered in the "Showing Pop-Up Messages" chapter of the same book.

TUTORIAL 8

Sitting in the Background

In this tutorial, we will simulate having the `LunchList` do some background processing in a secondary thread, updating the user interface via a progress bar. While all of these tutorials are somewhat contrived, this one will be more contrived than most, as there is not much we are really able to do in a `LunchList` that would even require long processing in a background thread. So, please forgive us if this tutorial is a bit goofy.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `07-MenusMessages` edition of `LunchList` to use as a starting point.

Step #1: Initialize the Progress Bar

For this application, rather than use a `ProgressBar` widget, we will use the progress bar feature of the `Activity` window. This will put a progress bar in the title bar, rather than clutter up our layouts.

This requires a bit of initialization. Specifically, we need to add a line to `onCreate()` that will request this feature be activated. We have to do this before calling `setContentView()`, so we add it right after chaining to the superclass:

```
@Override
public void onCreate(Bundle savedInstanceState) {
  super.onCreate(savedInstanceState);
  requestWindowFeature(Window.FEATURE_PROGRESS);
  setContentView(R.layout.main);

  name=(EditText)findViewById(R.id.name);
  address=(EditText)findViewById(R.id.addr);
  notes=(EditText)findViewById(R.id.notes);
  types=(RadioGroup)findViewById(R.id.types);

  Button save=(Button)findViewById(R.id.save);

  save.setOnClickListener(onSave);

  ListView list=(ListView)findViewById(R.id.restaurants);

  adapter=new RestaurantAdapter();
  list.setAdapter(adapter);

  TabHost.TabSpec spec=getTabHost().newTabSpec("tag1");

  spec.setContent(R.id.restaurants);
  spec.setIndicator("List", getResources()
                              .getDrawable(R.drawable.list));
  getTabHost().addTab(spec);

  spec=getTabHost().newTabSpec("tag2");
  spec.setContent(R.id.details);
  spec.setIndicator("Details", getResources()
                                .getDrawable(R.drawable.restaurant));
  getTabHost().addTab(spec);

  getTabHost().setCurrentTab(0);

  list.setOnItemClickListener(onListClick);
}
```

Also, add another data member, an `int` named `progress`.

Step #2: Create the Work Method

The theory of this demo is that we have something that takes a long time, and we want to have that work done in a background thread and update the progress along the way. So, the first step is to build something that will run a long time.

To do that, first, implement a `doSomeLongWork()` method on `LunchList` as follows:

```
private void doSomeLongWork(final int incr) {
  SystemClock.sleep(250);  // should be something more useful!
}
```

Here, we sleep for 250 milliseconds, simulating doing some meaningful work.

Then, create a private `Runnable` in `LunchList` that will fire off `doSomeLongWork()` a number of times, as follows:

```
private Runnable longTask=new Runnable() {
  public void run() {
    for (int i=0;i<20;i++) {
      doSomeLongWork(500);
    }
  }
};
```

Here, we just loop 20 times, so the overall background thread will run for 5 seconds.

Step #3: Fork the Thread from the Menu

Next, we need to arrange to do this (fake) long work at some point. The easiest way to do that is add another menu choice. Update the `LunchList/res/menu/option.xml` file to look like the following:

```
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
  <item android:id="@+id/toast"
    android:title="Raise Toast"
    android:icon="@drawable/toast"
  />
  <item android:id="@+id/run"
    android:title="Run Long Task"
    android:icon="@drawable/run"
  />
</menu>
```

This requires a graphic image in `LunchList/res/drawable/run.png` – find something that you can use that is around 32px high.

Since the menu item is in the menu XML, we do not need to do anything special to display the item – it will just be added to the menu automatically. We do, however, need to arrange to do something useful when the menu choice is chosen. So, update `onOptionsItemSelected()` in `LunchList` to look like the following:

```
@Override
public boolean onOptionsItemSelected(MenuItem item) {
  if (item.getItemId()==R.id.toast) {
    String message="No restaurant selected";

    if (current!=null) {
      message=current.getNotes();
    }

    Toast.makeText(this, message, Toast.LENGTH_LONG).show();

    return(true);
  }
  else if (item.getItemId()==R.id.run) {
    new Thread(longTask).start();
  }

  return(super.onOptionsItemSelected(item));
}
```

You are welcome to recompile, reinstall, and run the application. However, since our background thread does not do anything visible at the moment, all you will see that is different is the new menu item:

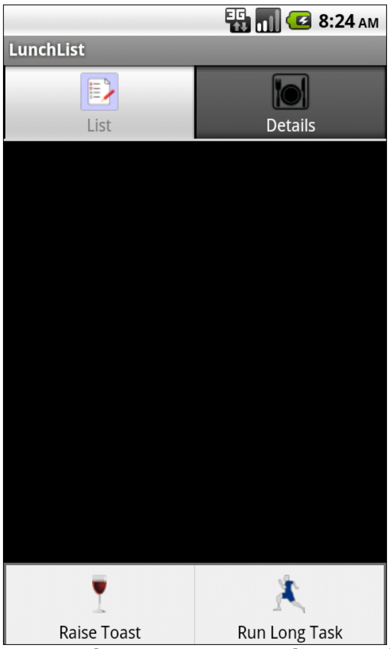


Figure 19. The Run Long Task menu item

Step #4: Manage the Progress Bar

Finally, we need to actually make use of the progress indicator. This involves making it visible when we start our long-running task, updating it as the task proceeds, and hiding it again when the task is complete.

First, make it visible by updating `onOptionsItemSelected()` to show it:

```
@Override
public boolean onOptionsItemSelected(MenuItem item) {
  if (item.getItemId()==R.id.toast) {
    String message="No restaurant selected";

    if (current!=null) {
      message=current.getNotes();
    }

    Toast.makeText(this, message, Toast.LENGTH_LONG).show();

    return(true);
  }
  else if (item.getItemId()==R.id.run) {
    setProgressBarVisibility(true);
    progress=0;
    new Thread(longTask).start();

    return(true);
  }

  return(super.onOptionsItemSelected(item));
}
```

Notice the extra line that makes progress visible.

Then, we need to update the progress bar on each pass, so make this change to `doSomeLongWork()`:

```
private void doSomeLongWork(final int incr) {
  runOnUiThread(new Runnable() {
    public void run() {
      progress+=incr;
      setProgress(progress);
    }
  });

  SystemClock.sleep(250);  // should be something more useful!
}
```

Notice how we use `runOnUiThread()` to make sure our progress bar update occurs on the UI thread.

Finally, we need to hide the progress bar when we are done, so make this change to our `longTask` `Runnable`:

```
private Runnable longTask=new Runnable() {
  public void run() {
    for (int i=0;i<20;i++) {
      doSomeLongWork(500);
    }

    runOnUiThread(new Runnable() {
      public void run() {
        setProgressBarVisibility(false);
      }
    });
  }
};
```

At this point, you can rebuild, reinstall, and run the application. When you choose the Run Long Task menu item, you will see the progress bar appear for five seconds, progressively updated as the "work" gets done:

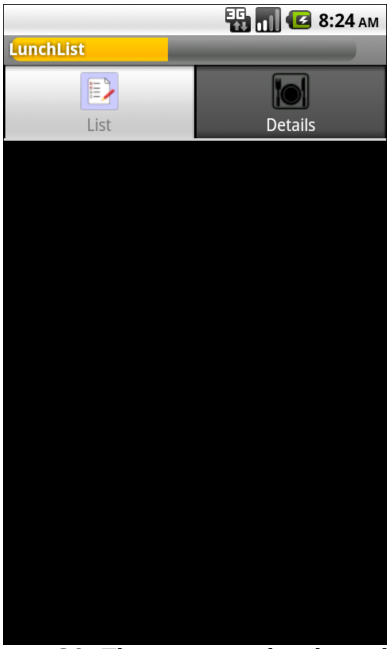


Figure 20. The progress bar in action

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Have the background thread also update some UI element when the work is completed, beyond dismissing the progress bar. Make sure you arrange to update the UI on the UI thread!
- Instead of using `Activity#runOnUiThread()`, try using a `Handler` for communication between the background thread and the UI thread.
- Instead of starting a `Thread` from the menu choice, have the `Thread` be created in `onCreate()` and have it monitor a `LinkedBlockingQueue` (from `java.util.concurrent`) as a source of work to be done. Create a `FakeJob` that does what our current long-running method does, and

a `KillJob` that causes the `Thread` to fall out of its queue-monitoring loop.

Further Reading

Coverage of the Android concept of "the UI thread" and tools like the Handler for managing communication between threads can be found in the "Dealing with Threads" chapter of The Busy Coder's Guide to Android Development. You will also learn about `AsyncTask` in that chapter, which is another important means of coordinating background and UI thread operations.

If you are interested in Java threading in general, particularly the use of the `java.util.concurrent` set of thread-management classes, the book Java Concurrency in Practice is a popular source of information.

TUTORIAL 9

Life and Times

In this tutorial, we will make our background task take a bit longer, then arrange to pause the background work when we start up another activity and restart the background work when our activity regains control. This pattern – stopping unnecessary background work when the activity is paused – is a good design pattern and is not merely something used for a tutorial.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `08-Threads` edition of `LunchList` to use as a starting point.

Step #1: Lengthen the Background Work

First, let us make the background work take a bit longer, so we have a bigger "window" in which to test whether our pause-and-resume logic works. It is also helpful, in our case, to synchronize our loop with our progress, so rather than counting `0` to `20` by `1`, we should count from `0` to `10000` by `200`, so the loop counter and progress are the same.

In the `longTask` `Runnable`, change the loop to look like this:

```
for (int i=progress;
    i<10000;
    i+=200) {
  doSomeLongWork(200);
}
```

Step #2: Pause in onPause()

Now, we need to arrange to have our thread stop running when the activity is paused (e.g., some other activity has taken over the screen). Since threads are relatively cheap to create and destroy, we can simply have our current running thread stop and start a fresh one, if needed, in `onResume()`.

While there are some deprecated methods on `Thread` to try to forcibly terminate them, it is generally better to let the `Thread` stop itself by falling out of whatever processing loop it is in. So, what we want to do is let the background thread know the activity is not active.

To do this, first import `java.util.concurrent.atomic.AtomicBoolean` in `LunchList` and add an `AtomicBoolean` data member named `isActive`, initially set to `true` (`new AtomicBoolean(true);`).

Then, in the `longTask` `Runnable`, change the loop to also watch for the state of `isActive`, falling out of the loop if the activity is no longer active:

```
for (int i=progress;
    i<10000 && isActive.get();
    i+=200) {
  doSomeLongWork(200);
}
```

Finally, implement `onPause()` to update the state of `isActive`:

```
@Override
public void onPause() {
  super.onPause();

  isActive.set(false);
}
```

Note how we chain to the superclass in `onPause()` – if we fail to do this, we will get a runtime error.

With this implementation, our background thread will run to completion or until `isActive` is `false`, whichever comes first.

Step #3: Resume in onResume()

Now, we need to restart our thread if it is needed. It will be needed if the progress is greater than `0`, indicating we were in the middle of our background work when our activity was so rudely interrupted.

So, add the following implementation of `onResume()`:

```
@Override
public void onResume() {
  super.onResume();

  isActive.set(true);

  if (progress>0) {
    startWork();
  }
}
```

This assumes we have pulled out our thread-starting logic into a `startWork()` method, which you should implement as follows:

```
private void startWork() {
  setProgressBarVisibility(true);
  new Thread(longTask).start();
}
```

And you can change our menu handler to also use `startWork()`:

```
@Override
public boolean onOptionsItemSelected(MenuItem item) {
  if (item.getItemId()==R.id.toast) {
    String message="No restaurant selected";

    if (current!=null) {
      message=current.getNotes();
    }
    Toast.makeText(this, message, Toast.LENGTH_LONG).show();

    return(true);
  }
  else if (item.getItemId()==R.id.run) {
    startWork();

    return(true);
  }

  return(super.onOptionsItemSelected(item));
}
```

Finally, we need to not reset and hide the progress indicator when our background thread ends if it ends because our activity is not active. Otherwise, we will never restart it, since the progress will be reset to `0` every time. So, change `longTask` one more time, to look like this:

```
private Runnable longTask=new Runnable() {
  public void run() {
    for (int i=progress;
        i<10000 && isActive.get();
        i+=200) {
      doSomeLongWork(200);
    }

    if (isActive.get()) {
      runOnUiThread(new Runnable() {
        public void run() {
          setProgressBarVisibility(false);
          progress=0;
        }
      });
    }
  }
};
```

What this does is reset the progress only if we are active when the work is complete, so we are ready for the next round of work. If we are inactive, and fell out of our loop for that reason, we leave the progress as-is.

At this point, recompile and reinstall the application. To test this feature:

1. Use the [MENU] button to run the long task.

2. While it is running, click the green phone button on the emulator (lower-left corner of the "phone"). This will bring up the call log activity and, as a result, pause our `LunchList` activity.
3. After a while, click the BACK button – you should see the `LunchList` resuming the background work from the point where it left off.

Here is the full `LunchList` implementation, including the changes shown above:

```
package apt.tutorial;

import android.app.TabActivity;
import android.os.Bundle;
import android.os.SystemClock;
import android.view.Menu;
import android.view.MenuInflater;
import android.view.MenuItem;
import android.view.View;
import android.view.ViewGroup;
import android.view.LayoutInflater;
import android.view.Window;
import android.widget.AdapterView;
import android.widget.ArrayAdapter;
import android.widget.Button;
import android.widget.EditText;
import android.widget.ImageView;
import android.widget.ListView;
import android.widget.RadioGroup;
import android.widget.TabHost;
import android.widget.TextView;
import android.widget.Toast;
import java.util.ArrayList;
import java.util.List;
import java.util.concurrent.atomic.AtomicBoolean;

public class LunchList extends TabActivity {
  List<Restaurant> model=new ArrayList<Restaurant>();
  RestaurantAdapter adapter=null;
  EditText name=null;
  EditText address=null;
  EditText notes=null;
  RadioGroup types=null;
  Restaurant current=null;
  AtomicBoolean isActive=new AtomicBoolean(true);
  int progress=0;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    requestWindowFeature(Window.FEATURE_PROGRESS);
    setContentView(R.layout.main);

    name=(EditText)findViewById(R.id.name);
    address=(EditText)findViewById(R.id.addr);
    notes=(EditText)findViewById(R.id.notes);
    types=(RadioGroup)findViewById(R.id.types);

    Button save=(Button)findViewById(R.id.save);

    save.setOnClickListener(onSave);

    ListView list=(ListView)findViewById(R.id.restaurants);

    adapter=new RestaurantAdapter();
    list.setAdapter(adapter);

    TabHost.TabSpec spec=getTabHost().newTabSpec("tag1");

    spec.setContent(R.id.restaurants);
    spec.setIndicator("List", getResources()
                              .getDrawable(R.drawable.list));
    getTabHost().addTab(spec);

    spec=getTabHost().newTabSpec("tag2");
    spec.setContent(R.id.details);
    spec.setIndicator("Details", getResources()
                                .getDrawable(R.drawable.restaurant));
    getTabHost().addTab(spec);

    getTabHost().setCurrentTab(0);

    list.setOnItemClickListener(onListClick);
  }

  @Override
  public void onPause() {
    super.onPause();

    isActive.set(false);
  }

  @Override
  public void onResume() {
    super.onResume();

    isActive.set(true);

    if (progress>0) {
      startWork();
    }
  }

  @Override
  public boolean onCreateOptionsMenu(Menu menu) {
    new MenuInflater(this).inflate(R.menu.option, menu);


    return(super.onCreateOptionsMenu(menu));
  }

  @Override
  public boolean onOptionsItemSelected(MenuItem item) {
    if (item.getItemId()==R.id.toast) {
      String message="No restaurant selected";

      if (current!=null) {
        message=current.getNotes();
      }

      Toast.makeText(this, message, Toast.LENGTH_LONG).show();

      return(true);
    }
    else if (item.getItemId()==R.id.run) {
      startWork();

      return(true);
    }

    return(super.onOptionsItemSelected(item));
  }

  private void startWork() {
    setProgressBarVisibility(true);
    new Thread(longTask).start();
  }

  private void doSomeLongWork(final int incr) {
    runOnUiThread(new Runnable() {
      public void run() {
        progress+=incr;
        setProgress(progress);
      }
    });

    SystemClock.sleep(250);  // should be something more useful!
  }

  private View.OnClickListener onSave=new View.OnClickListener() {
    public void onClick(View v) {
      current=new Restaurant();
      current.setName(name.getText().toString());
      current.setAddress(address.getText().toString());
      current.setNotes(notes.getText().toString());

      switch (types.getCheckedRadioButtonId()) {
        case R.id.sit_down:
          current.setType("sit_down");
          break;

        case R.id.take_out:
          current.setType("take_out");
          break;

        case R.id.delivery:
          current.setType("delivery");
          break;
      }

      adapter.add(current);
    }
  };

  private AdapterView.OnItemClickListener onListClick=new
AdapterView.OnItemClickListener() {
    public void onItemClick(AdapterView<?> parent,
                             View view, int position,
                             long id) {
      current=model.get(position);

      name.setText(current.getName());
      address.setText(current.getAddress());
      notes.setText(current.getNotes());

      if (current.getType().equals("sit_down")) {
        types.check(R.id.sit_down);
      }
      else if (current.getType().equals("take_out")) {
        types.check(R.id.take_out);
      }
      else {
        types.check(R.id.delivery);
      }

      getTabHost().setCurrentTab(1);
    }
  };

  private Runnable longTask=new Runnable() {
    public void run() {
      for (int i=progress;
          i<10000 && isActive.get();
          i+=200) {
        doSomeLongWork(200);
      }

      if (isActive.get()) {
        runOnUiThread(new Runnable() {
          public void run() {
            setProgressBarVisibility(false);
            progress=0;
          }
        });
      }
    }
  };

  class RestaurantAdapter extends ArrayAdapter<Restaurant> {
    RestaurantAdapter() {
      super(LunchList.this, R.layout.row, model);
    }

    public View getView(int position, View convertView,
                        ViewGroup parent) {
      View row=convertView;
      RestaurantHolder holder=null;

      if (row==null) {
        LayoutInflater inflater=getLayoutInflater();

        row=inflater.inflate(R.layout.row, parent, false);
        holder=new RestaurantHolder(row);
        row.setTag(holder);
      }
      else {
        holder=(RestaurantHolder)row.getTag();
      }

      holder.populateFrom(model.get(position));

      return(row);
    }
  }

  static class RestaurantHolder {
    private TextView name=null;
    private TextView address=null;
    private ImageView icon=null;
    private View row=null;

    RestaurantHolder(View row) {
      this.row=row;

      name=(TextView)row.findViewById(R.id.title);
      address=(TextView)row.findViewById(R.id.address);
      icon=(ImageView)row.findViewById(R.id.icon);
    }

    void populateFrom(Restaurant r) {
      name.setText(r.getName());
      address.setText(r.getAddress());

      if (r.getType().equals("sit_down")) {
        icon.setImageResource(R.drawable.ball_red);
      }
      else if (r.getType().equals("take_out")) {
        icon.setImageResource(R.drawable.ball_yellow);
      }
      else {
        icon.setImageResource(R.drawable.ball_green);
      }
    }
  }
}
```

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Have the progress position be persisted via `onSaveInstanceState()`. When the activity is started in `onCreate()`, see if the background work was in progress when the activity was shut down (i.e., progress further than `0`), and restart the background thread immediately if it was. To test this, you can press `<Ctrl>-<F12>` to simulate opening the keyboard and rotating the screen – by default, this causes your activity to be destroyed and recreated, with `onSaveInstanceState()` called along the way.
- Try moving the pause/resume logic to `onStop()` and `onStart()`.

Further Reading

You can find material on the topics shown in this tutorial in the "Handling Activity Lifecycle Events" chapter of The Busy Coder's Guide to Android Development.

You are also strongly encouraged to read the class overview for Activity in the JavaDocs.

TUTORIAL 10

A Few Good Resources

We have already used many types of resources in the preceding tutorials. After reviewing what we have used so far, we set up an alternate layout for our `LunchList` activity to be used when the activity is in landscape orientation instead of portrait.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `09-Lifecycle` edition of `LunchList` to use as a starting point.

Step #1: Review our Current Resources

Now that we have completed ten tutorials, this is a good time to recap what resources we have been using along the way. Right now, `LunchList` has:

- Seven icons in `LunchList/res/drawable/`, all PNGs
- Two XML files in `LunchList/res/layout/`, representing the main `LunchList` UI and the definition of each row
- One XML file in `LunchList/res/menu/`, containing our option menu definition

- The system-created `strings.xml` file in `LunchList/res/values/`, which presently just holds the name of our application:

```
<?xml version="1.0" encoding="utf-8"?>
<resources>
    <string name="app_name">LunchList</string>
</resources>
```

Step #2: Create a Landscape Layout

In the emulator, with `LunchList` running and showing the details form, press `<Ctrl>-<F12>`. This simulates opening and closing the keyboard, causing the screen to rotate to landscape and portrait, respectively. Our current layout is not very good in landscape orientation:

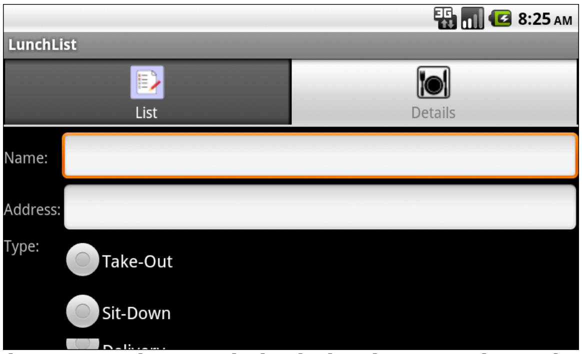


Figure 21. The LunchList in landscape orientation

So, let us come up with an alternative layout that will work better.

First, create a `LunchList/res/layout-land/` directory in your project. This will hold layout files that we wish to use when the device (or emulator) is in the landscape orientation.

Then, copy `LunchList/res/layout/main.xml` into `LunchList/res/layout-land/`, so we can start with the same layout we were using for portrait mode.

Then, change the layout to look like this:

```xml
<?xml version="1.0" encoding="utf-8"?>
<TabHost xmlns:android="http://schemas.android.com/apk/res/android"
  android:id="@android:id/tabhost"
  android:layout_width="fill_parent"
  android:layout_height="fill_parent">
  <LinearLayout
    android:orientation="vertical"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent">
    <TabWidget android:id="@android:id/tabs"
      android:layout_width="fill_parent"
      android:layout_height="wrap_content"
    />
    <FrameLayout android:id="@android:id/tabcontent"
      android:layout_width="fill_parent"
      android:layout_height="fill_parent"
      >
      <LinearLayout
        android:layout_width="fill_parent"
        android:layout_height="fill_parent"
        >
        <ListView android:id="@+id/restaurants"
          android:layout_width="fill_parent"
          android:layout_height="wrap_content"
        />
      </LinearLayout>
      <TableLayout android:id="@+id/details"
        android:layout_width="fill_parent"
        android:layout_height="wrap_content"
        android:stretchColumns="1,3"
        android:paddingTop="4px"
        >
        <TableRow>
          <TextView
            android:text="Name:"
            android:paddingRight="2px"
          />
          <EditText
            android:id="@+id/name"
            android:maxWidth="140sp"
          />
          <TextView
            android:text="Address:"
            android:paddingLeft="2px"
            android:paddingRight="2px"
          />
          <EditText
            android:id="@+id/addr"
            android:maxWidth="140sp"
          />
        </TableRow>
        <TableRow>
          <TextView android:text="Type:" />
          <RadioGroup android:id="@+id/types">
```

```
            <RadioButton android:id="@+id/take_out"
              android:text="Take-Out"
            />
            <RadioButton android:id="@+id/sit_down"
              android:text="Sit-Down"
            />
            <RadioButton android:id="@+id/delivery"
              android:text="Delivery"
            />
          </RadioGroup>
          <TextView
            android:text="Notes:"
            android:paddingLeft="2px"
          />
          <LinearLayout
            android:layout_width="fill_parent"
            android:layout_height="fill_parent"
            android:orientation="vertical"
            >
            <EditText android:id="@+id/notes"
              android:singleLine="false"
              android:gravity="top"
              android:lines="3"
              android:scrollHorizontally="false"
              android:maxLines="3"
              android:maxWidth="140sp"
              android:layout_width="fill_parent"
              android:layout_height="wrap_content"
            />
            <Button android:id="@+id/save"
              android:layout_width="fill_parent"
              android:layout_height="wrap_content"
              android:text="Save"
            />
          </LinearLayout>
        </TableRow>
      </TableLayout>
    </FrameLayout>
  </LinearLayout>
</TabHost>
```

In this revised layout, we:

- Switched to four columns in our table, with columns #1 and #3 as stretchable
- Put the name and address labels and fields on the same row
- Put the type, notes, and Save button on the same row, with the notes and Save button stacked via a `LinearLayout`
- Made the notes three lines instead of two, since we have the room

- Fixed the maximum width of the `EditText` widgets to 140 scaled pixels (`sp`), so they do not automatically grow outlandishly large if we type a lot
- Added a bit of padding in places to make the placement of the labels and fields look a bit better

If you rebuild and reinstall the application, then run it in landscape mode, you will see a form that looks like this:

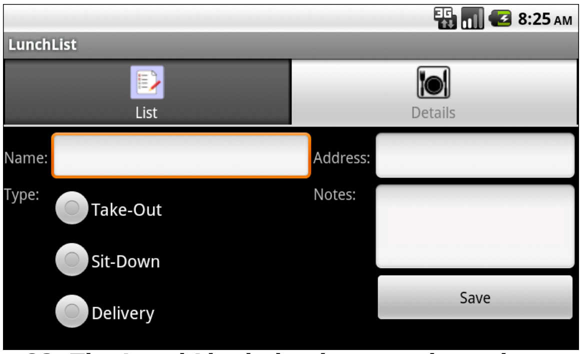


Figure 22. The LunchList in landscape orientation, revised

Note that we did not create a `LunchList/res/layout-land/` edition of our row layout (`row.xml`). Android, upon not finding one in `LunchList/res/layout-land/`, will fall back to the one in `LunchList/res/layout/`. Since we do not really need our row to change, we can leave it as-is.

Note that when you change the screen orientation, your existing restaurants will vanish. That is because we are not persisting them anywhere, and rotating the screen by default destroys and recreates the activity. These issues will be addressed in later tutorials.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Find some other icons to use and create a `LunchList/res/drawable-land` directory with the replacement icons, using the same names as found in `LunchList/res/drawable`. See if exposing the keyboard swaps the icons as well as the layouts.

- Change the text of the labels in our main layout file to be string resources. You will need to add those values to `LunchList/res/values/strings.xml` and reference them in `LunchList/res/layout/main.xml`.
- Use `onSaveInstanceState()` to save the current contents of the details form, and restore those contents in `onCreate()` if an instance state is available (e.g., after the screen was rotated). Note how this does not cover the list – you will still lose all existing restaurants on a rotation event. However, in a later tutorial, we will move that data to the database, which will solve that problem.

Further Reading

You can learn more about resource sets, particularly with respect to UI impacts, in the "Working with Resources" chapter of The Busy Coder's Guide to Android Development.

You will also find "Table 2" in the Alternate Resources section of the Android developer guide to be of great use for determining the priority of different resource set suffixes.

TUTORIAL 11

The Restaurant Store

In this tutorial, we will create a database and table for holding our restaurant data and switch from our ArrayAdapter to a CursorAdapter, to make use of that database. This will allow our restaurants to persist from run to run of LunchList.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the 10-Resources edition of LunchList to use as a starting point.

Step #1: Create a Stub SQLiteOpenHelper

First, we need to be able to define what our database name is, what the schema is for the table for our restaurants, etc. That is best wrapped up in a SQLiteOpenHelper implementation.

So, create LunchList/src/apt/tutorial/RestaurantHelper.java, and enter in the following code:

```
package apt.tutorial;

import android.content.Context;
import android.database.SQLException;
import android.database.sqlite.SQLiteOpenHelper;
import android.database.sqlite.SQLiteDatabase;
import android.database.sqlite.SQLiteQueryBuilder;

class RestaurantHelper extends SQLiteOpenHelper {
  private static final String DATABASE_NAME="lunchlist.db";
  private static final int SCHEMA_VERSION=1;

  public RestaurantHelper(Context context) {
    super(context, DATABASE_NAME, null, SCHEMA_VERSION);
  }

  @Override
  public void onCreate(SQLiteDatabase db) {
  }

  @Override
  public void onUpgrade(SQLiteDatabase db, int oldVersion, int newVersion) {
  }
}
```

This says that our database name is `lunchlist.db`, we are using the first version of the schema...and not much else. However, the project should still compile cleanly after adding this class.

Step #2: Manage our Schema

Next, we need to flesh out the `onCreate()` and `onUpgrade()` methods in `RestaurantHelper`, to actually create the schema we want.

To do this, add an import for `android.database.Cursor` and use the following implementation of `onCreate()`:

```
@Override
public void onCreate(SQLiteDatabase db) {
  db.execSQL("CREATE TABLE restaurants (_id INTEGER PRIMARY KEY AUTOINCREMENT,
name TEXT, address TEXT, type TEXT, notes TEXT);");
}
```

We are seeing if there already is a `restaurant` table, and if not, executing a SQL statement to create it.

For `onUpgrade()`, there is nothing we really need to do now, since this method will not be executed until we have at least two schema versions. So far, we barely have our first schema version. So, just put a comment to that effect in `onUpgrade()`, perhaps something like this:

```
@Override
public void onUpgrade(SQLiteDatabase db, int oldVersion, int newVersion) {
  // no-op, since will not be called until 2nd schema
  // version exists
}
```

In a production system, of course, we would want to make a temporary table, copy our current data to it, fix up the real table's schema, then migrate the data back.

Step #3: Remove Extraneous Code from LunchList

With our menu and thread samples behind us, we can get rid of our option menu and simplify the code. Get rid of the following items from your implementation of `LunchList`:

- The `isActive` and `progress` data members
- The call to `requestWindowFeature()` in `onCreate()`
- The implementations of `onPause()`, `onResume()`, `onCreateOptionsMenu()`, and `onOptionsItemSelected()`
- The `startWork()` and `doSomeLongWork()` methods, along with the `longTask` `Runnable`

Step #4: Get Access to the Helper

We will be using `RestaurantHelper` as our bridge to the database. Hence, `LunchList` will need a `RestaurantHelper`, to retrieve existing restaurants and add new ones.

In order to really use the database, though, we need to open and close access to it from `LunchList`.

First, create a `RestaurantHelper` data member named `helper`.

Then, in `onCreate()` in `LunchList`, after the call to `setContentView()`, initialize `RestaurantHelper` like this:

```
helper=new RestaurantHelper(this);
```

Finally, implement `onDestroy()` on `LunchList` as follows:

```
@Override
public void onDestroy() {
  super.onDestroy();

  helper.close();
}
```

All we do in `onDestroy()`, besides chain to the superclass, is close the helper we opened in `onCreate()`. This will close the underlying SQLite database as well.

Step #5: Save a Restaurant to the Database

We are going to be replacing our restaurant object model (and its associated `ArrayList`) with the database and a `Cursor` representing the roster of restaurants. This will involve adding some more logic to `RestaurantHelper` to aid in this process, while also starting to use it from `LunchList`.

First, add an `import` statement for `android.content.ContentValues` to `RestaurantHelper`.

Then, implement `insert()` on `RestaurantHelper` as follows:

```
public void insert(String name, String address,
                   String type, String notes) {
  ContentValues cv=new ContentValues();

  cv.put("name", name);
  cv.put("address", address);
  cv.put("type", type);
  cv.put("notes", notes);

  getWritableDatabase().insert("restaurants", "name", cv);
}
```

With this code, we pour the individual pieces of a restaurant (e.g., its name) into a `ContentValues` and tell the `SQLiteDatabase` to insert it into the database. We call `getWritableDatabase()` to get at the `SQLiteDatabase`. Our helper will automatically open the database in write mode if it has not already been opened by the helper before.

Finally, we need to actually call `insert()` at the appropriate time. Right now, our Save button adds a restaurant to our `RestaurantAdapter` – now, we need it to persist the restaurant to the database. So, modify the `onSave` object in `LunchList` to look like this:

```
private View.OnClickListener onSave=new View.OnClickListener() {
   public void onClick(View v) {
     String type=null;

     switch (types.getCheckedRadioButtonId()) {
       case R.id.sit_down:
         type="sit_down";
         break;
       case R.id.take_out:
         type="take_out";
         break;
       case R.id.delivery:
         type="delivery";
         break;
     }

     helper.insert(name.getText().toString(),
                  address.getText().toString(), type,
                  notes.getText().toString());
   }
 };
```

We simply get the four pieces of data from their respective widgets and call `insert()`.

Step #6: Get the List of Restaurants from the Database

This puts restaurants into the database. Presumably, it would be useful to get them back out sometime. Hence, we need some logic that can query the database and return a `Cursor` with columnar data from our `restaurant` table. A `Cursor` in Android is much like a cursor in other database access libraries

– it is an encapsulation of the result set of the query, plus the query that was used to create it.

To do this, add the following method to RestaurantHelper:

```
public Cursor getAll() {
  return(getReadableDatabase()
          .rawQuery("SELECT _id, name, address, type, notes FROM restaurants
ORDER BY name",
                    null));
}
```

Here, we get access to the underlying SQLiteDatabase (opening it in read mode if it is not already open) and call rawQuery(), passing in a suitable query string to retrieve all restaurants, sorted by name.

We will also need to have some way to get the individual pieces of data out of the Cursor (e.g., name). To that end, add a few getter-style methods to RestaurantHelper that will retrieve the proper columns from a Cursor positioned on the desired row:

```
public String getName(Cursor c) {
  return(c.getString(1));
}

public String getAddress(Cursor c) {
  return(c.getString(2));
}

public String getType(Cursor c) {
  return(c.getString(3));
}

public String getNotes(Cursor c) {
  return(c.getString(4));
}
```

Step #7: Change our Adapter and Wrapper

Of course, our existing RestaurantAdapter extends ArrayAdapter and cannot use a Cursor very effectively. So, we need to change our RestaurantAdapter into something that can use a Cursor…such as a CursorAdapter. Just as an ArrayAdapter creates a View for every needed item in an array or List, CursorAdapter creates a View for every needed row in a Cursor.

A CursorAdapter does not use getView(), but rather bindView() and newView(). The newView() method handles the case where we need to inflate a new row; bindView() is when we are recycling an existing row. So, our current getView() logic needs to be split between bindView() and newView().

Replace our existing RestaurantAdapter implementation in LunchList with the following:

```
class RestaurantAdapter extends CursorAdapter {
  RestaurantAdapter(Cursor c) {
    super(LunchList.this, c);
  }

  @Override
  public void bindView(View row, Context ctxt,
                       Cursor c) {
    RestaurantHolder holder=(RestaurantHolder)row.getTag();

    holder.populateFrom(c, helper);
  }

  @Override
  public View newView(Context ctxt, Cursor c,
                       ViewGroup parent) {
    LayoutInflater inflater=getLayoutInflater();
    View row=inflater.inflate(R.layout.row, parent, false);
    RestaurantHolder holder=new RestaurantHolder(row);

    row.setTag(holder);

    return(row);
  }
}
```

Then, you need to make use of this refined adapter, by changing the model in LunchList from an ArrayList to a Cursor. After you have changed that data member, replace the current onCreate() code that populates our RestaurantAdapter with the following:

```
model=helper.getAll();
startManagingCursor(model);
adapter=new RestaurantAdapter(model);
list.setAdapter(adapter);
```

After getting the Cursor from getAll(), we call startManagingCursor(), so Android will deal with refreshing its contents if the activity is paused and resumed. Then, we hand the Cursor off to the RestaurantAdapter.

Also, you will need to import android.content.Context and android.widget.CursorAdapter in LunchList.

Then, we need to update RestaurantHolder to work with Cursor objects rather than a restaurant directly. Replace the existing implementation with the following:

```
static class RestaurantHolder {
  private TextView name=null;
  private TextView address=null;
  private ImageView icon=null;
  private View row=null;
  
  RestaurantHolder(View row) {
    this.row=row;
    
    name=(TextView)row.findViewById(R.id.title);
    address=(TextView)row.findViewById(R.id.address);
    icon=(ImageView)row.findViewById(R.id.icon);
  }
  
  void populateFrom(Cursor c, RestaurantHelper helper) {
    name.setText(helper.getName(c));
    address.setText(helper.getAddress(c));
    
    if (helper.getType(c).equals("sit_down")) {
      icon.setImageResource(R.drawable.ball_red);
    }
    else if (helper.getType(c).equals("take_out")) {
      icon.setImageResource(R.drawable.ball_yellow);
    }
    else {
      icon.setImageResource(R.drawable.ball_green);
    }
  }
}
```

Step #8: Clean Up Lingering ArrayList References

Since we changed our model in `LunchList` from an `ArrayList` to a `Cursor`, anything that still assumes an `ArrayList` will not work.

Notably, the `onListClick` listener object tries to obtain a restaurant from the `ArrayList`. Now, we need to move the `Cursor` to the appropriate position and get a restaurant from that. So, modify `onListClick` to use the `Cursor` and the property getter methods on `RestaurantHelper` instead:

```
private AdapterView.OnItemClickListener onListClick=new
AdapterView.OnItemClickListener() {
  public void onItemClick(AdapterView<?> parent,
                          View view, int position,
                          long id) {
    model.moveToPosition(position);
    name.setText(helper.getName(model));
    address.setText(helper.getAddress(model));
    notes.setText(helper.getNotes(model));

    if (helper.getType(model).equals("sit_down")) {
      types.check(R.id.sit_down);
    }
    else if (helper.getType(model).equals("take_out")) {
      types.check(R.id.take_out);
    }
    else {
      types.check(R.id.delivery);
    }

    getTabHost().setCurrentTab(1);
  }
};
```

At this point, you can recompile and reinstall your application. If you try using it, it will launch and you can save restaurants to the database. However, you will find that the list of restaurants will not update unless you exit and restart the `LunchList` activity.

Step #9: Refresh Our List

The reason the list does not update is because neither the `Cursor` nor the `CursorAdapter` realize that the database contents have changed when we save our restaurant. To resolve this, add `model.requery();` immediately after the call to `insert()` in the `onSave` object in `LunchList`. This causes the `Cursor` to reload its contents from the database, which in turn will cause the `CursorAdapter` to redisplay the list.

Rebuild and reinstall the application and try it out. You should have all the functionality you had before, with the added benefit of restaurants living from run to run of `LunchList`.

Here is an implementation of `LunchList` that incorporates all of the changes shown in this tutorial:

```
package apt.tutorial;

import android.app.TabActivity;
import android.content.Context;
import android.database.Cursor;
import android.os.Bundle;
import android.view.View;
import android.view.ViewGroup;
import android.view.LayoutInflater;
import android.widget.AdapterView;
import android.widget.CursorAdapter;
import android.widget.Button;
import android.widget.EditText;
import android.widget.ImageView;
import android.widget.ListView;
import android.widget.RadioGroup;
import android.widget.TabHost;
import android.widget.TextView;

public class LunchList extends TabActivity {
  Cursor model=null;
  RestaurantAdapter adapter=null;
  EditText name=null;
  EditText address=null;
  EditText notes=null;
  RadioGroup types=null;
  RestaurantHelper helper=null;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);

    helper=new RestaurantHelper(this);

    name=(EditText)findViewById(R.id.name);
    address=(EditText)findViewById(R.id.addr);
    notes=(EditText)findViewById(R.id.notes);
    types=(RadioGroup)findViewById(R.id.types);

    Button save=(Button)findViewById(R.id.save);

    save.setOnClickListener(onSave);

    ListView list=(ListView)findViewById(R.id.restaurants);

    model=helper.getAll();
    startManagingCursor(model);
    adapter=new RestaurantAdapter(model);
    list.setAdapter(adapter);

    TabHost.TabSpec spec=getTabHost().newTabSpec("tag1");

    spec.setContent(R.id.restaurants);
    spec.setIndicator("List", getResources()
                              .getDrawable(R.drawable.list));
    getTabHost().addTab(spec);

    spec=getTabHost().newTabSpec("tag2");
    spec.setContent(R.id.details);
    spec.setIndicator("Details", getResources()
                                .getDrawable(R.drawable.restaurant));
    getTabHost().addTab(spec);

    getTabHost().setCurrentTab(0);

    list.setOnItemClickListener(onListClick);
  }

  @Override
  public void onDestroy() {
    super.onDestroy();

    helper.close();
  }

  private View.OnClickListener onSave=new View.OnClickListener() {
    public void onClick(View v) {
      String type=null;

      switch (types.getCheckedRadioButtonId()) {
        case R.id.sit_down:
          type="sit_down";
          break;
        case R.id.take_out:
          type="take_out";
          break;
        case R.id.delivery:
          type="delivery";
          break;
      }

      helper.insert(name.getText().toString(),
                    address.getText().toString(), type,
                    notes.getText().toString());
      model.requery();
    }
  };

  private AdapterView.OnItemClickListener onListClick=new
AdapterView.OnItemClickListener() {
    public void onItemClick(AdapterView<?> parent,
                            View view, int position,
                            long id) {
      model.moveToPosition(position);
      name.setText(helper.getName(model));
      address.setText(helper.getAddress(model));
      notes.setText(helper.getNotes(model));

      if (helper.getType(model).equals("sit_down")) {
        types.check(R.id.sit_down);
      }
      else if (helper.getType(model).equals("take_out")) {
        types.check(R.id.take_out);
      }
      else {
        types.check(R.id.delivery);
      }

      getTabHost().setCurrentTab(1);
    }
  };

  class RestaurantAdapter extends CursorAdapter {
    RestaurantAdapter(Cursor c) {
      super(LunchList.this, c);
    }

    @Override
    public void bindView(View row, Context ctxt,
                         Cursor c) {
      RestaurantHolder holder=(RestaurantHolder)row.getTag();

      holder.populateFrom(c, helper);
    }

    @Override
    public View newView(Context ctxt, Cursor c,
                       ViewGroup parent) {
      LayoutInflater inflater=getLayoutInflater();
      View row=inflater.inflate(R.layout.row, parent, false);
      RestaurantHolder holder=new RestaurantHolder(row);

      row.setTag(holder);

      return(row);
    }
  }

  static class RestaurantHolder {
    private TextView name=null;
    private TextView address=null;
    private ImageView icon=null;
    private View row=null;

    RestaurantHolder(View row) {
      this.row=row;

      name=(TextView)row.findViewById(R.id.title);
      address=(TextView)row.findViewById(R.id.address);
      icon=(ImageView)row.findViewById(R.id.icon);
    }

    void populateFrom(Cursor c, RestaurantHelper helper) {
      name.setText(helper.getName(c));
      address.setText(helper.getAddress(c));

      if (helper.getType(c).equals("sit_down")) {
        icon.setImageResource(R.drawable.ball_red);
      }
      else if (helper.getType(c).equals("take_out")) {
        icon.setImageResource(R.drawable.ball_yellow);
      }
      else {
        icon.setImageResource(R.drawable.ball_green);
      }
    }
  }
}
```

Similarly, here is a full implementation of `RestaurantHelper` that contains the modifications from this tutorial:

```
package apt.tutorial;

import android.content.Context;
import android.content.ContentValues;
import android.database.Cursor;
import android.database.SQLException;
import android.database.sqlite.SQLiteOpenHelper;
import android.database.sqlite.SQLiteDatabase;
import android.database.sqlite.SQLiteQueryBuilder;

class RestaurantHelper extends SQLiteOpenHelper {
  private static final String DATABASE_NAME="lunchlist.db";
  private static final int SCHEMA_VERSION=1;

  public RestaurantHelper(Context context) {
    super(context, DATABASE_NAME, null, SCHEMA_VERSION);
  }

  @Override
  public void onCreate(SQLiteDatabase db) {
    db.execSQL("CREATE TABLE restaurants (_id INTEGER PRIMARY KEY AUTOINCREMENT, 
name TEXT, address TEXT, type TEXT, notes TEXT);");
  }

  @Override
  public void onUpgrade(SQLiteDatabase db, int oldVersion, int newVersion) {
    // no-op, since will not be called until 2nd schema
    // version exists
  }

  public Cursor getAll() {
    return(getReadableDatabase()
            .rawQuery("SELECT _id, name, address, type, notes FROM restaurants 
ORDER BY name",
                      null));
  }

  public void insert(String name, String address,
                     String type, String notes) {
    ContentValues cv=new ContentValues();

    cv.put("name", name);
    cv.put("address", address);
    cv.put("type", type);
    cv.put("notes", notes);

    getWritableDatabase().insert("restaurants", "name", cv);
  }

  public String getName(Cursor c) {
    return(c.getString(1));
  }

  public String getAddress(Cursor c) {
    return(c.getString(2));
  }

  public String getType(Cursor c) {
    return(c.getString(3));
  }
  public String getNotes(Cursor c) {
    return(c.getString(4));
  }
}
```

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Download the database off the emulator (or device) and examine it using a SQLite client program. You can use `adb pull` to download `/data/data/apt.tutorial/databases/lunchlist.db`, or use Eclipse or DDMS to browse the emulator graphically to retrieve the same file.
- Use `adb shell` and the `sqlite3` program built into the emulator to examine the database in the emulator itself, without downloading it.

Further Reading

You can learn more about how Android and SQLite work together in the "Managing and Accessing Local Databases" chapter of The Busy Coder's Guide to Android Development.

However, if you are looking for more general documentation on SQLite itself, such as it's particular flavor of SQL, you will want to use the SQLite site, or perhaps The Definitive Guide to SQLite.

TUTORIAL 12

Getting More Active

In this tutorial, we will add support for both creating new restaurants and editing ones that were previously entered. Along the way, we will get rid of our tabs, splitting the application into two activities: one for the list, and one for the detail form.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `11-Database` edition of `LunchList` to use as a starting point.

Also, for this specific tutorial, since there is a lot of cutting and pasting, you may wish to save off a copy of your current work before starting in on the modifications, so you can clip code from the original and paste it where it is needed.

Step #1: Create a Stub Activity

The first thing we need to do is create an activity to serve as our detail form. In a flash of inspiration, let's call it `DetailForm`. So, create a `LunchList/src/apt/tutorial/DetailForm.java` file with the following content:

```
package apt.tutorial;

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

public class DetailForm extends Activity {
  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
//    setContentView(R.layout.main);
  }
}
```

This is just a stub activity, except it has the `setContentView()` line commented out. That is because we do not want to use `main.xml`, as that is the layout for `LunchList`. Since we do not have another layout ready yet, we can just comment out the line. As we will see, this is perfectly legal, but it means the activity will have no UI.

Step #2: Launch the Stub Activity on List Click

Now, we need to arrange to display this activity when the user clicks on a `LunchList` list item, instead of flipping to the original detail form tab in `LunchList`.

First, we need to add `DetailForm` to the `AndroidManifest.xml` file, so it is recognized by the system as being an available activity. Change the manifest to look like the following:

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
      package="apt.tutorial"
      android:versionCode="1"
      android:versionName="1.0">
    <application android:label="@string/app_name">
        <activity android:name=".LunchList"
                  android:label="@string/app_name">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
        <activity android:name=".DetailForm">
        </activity>
    </application>
</manifest>
```

Notice the second `<activity>` element, referencing the `DetailForm` class. Also note that it does not need an `<intent-filter>`, since we will be launching it ourselves rather than expecting the system to launch it for us.

Then, we need to start this activity when the list item is clicked. That is handled by our `onListClick` listener object. So, replace our current implementation with the following:

```
private AdapterView.OnItemClickListener onListClick=new
AdapterView.OnItemClickListener() {
  public void onItemClick(AdapterView<?> parent,
                          View view, int position,
                          long id) {
    Intent i=new Intent(LunchList.this, DetailForm.class);

    startActivity(i);
  }
};
```

Here we create an `Intent` that points to our `DetailForm` and call `startActivity()` on that `Intent`. You will need to add an import for `android.content.Intent` to `LunchList`.

At this point, you should be able to recompile and reinstall the application. If you run it and click on an item in the list, it will open up the empty `DetailForm`. From there, you can click the BACK button to return to the main `LunchList` activity.

Step #3: Move the Detail Form UI

Now, the shredding begins – we need to start moving our detail form smarts out of `LunchList` and its layout to `DetailForm`.

First, create a `LunchList/res/layout/detail_form.xml`, using the detail form from `LunchList/res/layout/main.xml` as a basis:

```xml
<TableLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:layout_width="fill_parent"
  android:layout_height="wrap_content"
  android:stretchColumns="1"
  >
  <TableRow>
    <TextView android:text="Name:" />
    <EditText android:id="@+id/name" />
  </TableRow>
  <TableRow>
    <TextView android:text="Address:" />
    <EditText android:id="@+id/addr" />
  </TableRow>
  <TableRow>
    <TextView android:text="Type:" />
    <RadioGroup android:id="@+id/types">
      <RadioButton android:id="@+id/take_out"
        android:text="Take-Out"
      />
      <RadioButton android:id="@+id/sit_down"
        android:text="Sit-Down"
      />
      <RadioButton android:id="@+id/delivery"
        android:text="Delivery"
      />
    </RadioGroup>
  </TableRow>
  <TableRow>
    <TextView android:text="Notes:" />
    <EditText android:id="@+id/notes"
      android:singleLine="false"
      android:gravity="top"
      android:lines="2"
      android:scrollHorizontally="false"
      android:maxLines="2"
      android:maxWidth="200sp"
    />
  </TableRow>
  <Button android:id="@+id/save"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:text="Save"
  />
</TableLayout>
```

This is just the detail form turned into its own standalone layout file.

Next, un-comment the `setContentView()` call in `onCreate()` in `DetailForm` and have it load this layout:

```java
setContentView(R.layout.detail_form);
```

Then, we need to add all our logic for accessing the various form widgets, plus an `onSave` listener for our Save button, plus all necessary imports.

Set the import list for `DetailForm` to be:

```
import android.app.Activity;
import android.database.Cursor;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;
import android.widget.RadioGroup;
import android.widget.TextView;
```

Then, add the following data members to the `DetailForm` class:

```
EditText name=null;
EditText address=null;
EditText notes=null;
RadioGroup types=null;
RestaurantHelper helper=null;
```

Then, copy the widget finders and stuff from `onCreate()` in `LunchList` into the same spot in `DetailForm`:

```
helper=new RestaurantHelper(this);

name=(EditText)findViewById(R.id.name);
address=(EditText)findViewById(R.id.addr);
notes=(EditText)findViewById(R.id.notes);
types=(RadioGroup)findViewById(R.id.types);

Button save=(Button)findViewById(R.id.save);
```

Finally, add the `onSave` listener object with a subset of the implementation from `LunchList`:

```
private View.OnClickListener onSave=new View.OnClickListener() {
  public void onClick(View v) {
    String type=null;

    switch (types.getCheckedRadioButtonId()) {
      case R.id.sit_down:
        type="sit_down";
        break;
      case R.id.take_out:
        type="take_out";
        break;
      case R.id.delivery:
        type="delivery";
        break;
    }
  }
};
```

Step #4: Clean Up the Original UI

Now we need to clean up `LunchList` and its layout to reflect the fact that we moved much of the logic over to `DetailForm`.

First, get rid of the tabs and the detail form from `LunchList/res/layout/main.xml`, and alter the `ListView`'s `android:id` to something suitable for `ListActivity`, leaving us with:

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

Next, delete `LunchList/res/layout_land/main.xml`, as we will revisit landscape layouts in a later tutorial.

At present, `LunchList` extends `TabActivity`, which is no longer what we need. Change it to extend `ListActivity` instead, adding an import for `android.app.ListActivity`.

Finally, get rid of the code from `onCreate()` that sets up the tabs and the Save button, since they are no longer needed. Also, you no longer need to find the `ListView` widget, since you can call `setListAdapter()` on the `ListActivity` to associate your `RestaurantAdapter` with the `ListActivity`'s `ListView`. The resulting `onCreate()` implementation should look like:

```
@Override
public void onCreate(Bundle savedInstanceState) {
  super.onCreate(savedInstanceState);
  setContentView(R.layout.main);

  helper=new RestaurantHelper(this);

  name=(EditText)findViewById(R.id.name);
  address=(EditText)findViewById(R.id.addr);
  notes=(EditText)findViewById(R.id.notes);
  types=(RadioGroup)findViewById(R.id.types);

  model=helper.getAll();
  startManagingCursor(model);
  adapter=new RestaurantAdapter(model);
  setListAdapter(adapter);
}
```

Step #5: Pass the Restaurant _ID

Now, let's step back a bit and think about what we are trying to achieve.

We want to be able to use `DetailForm` for both adding new restaurants and editing an existing restaurant. `DetailForm` needs to be able to tell those two scenarios apart. Also, `DetailForm` needs to know which item is to be edited.

To achieve this, we will pass an "extra" in our `Intent` that launches `DetailForm`, containing the ID (`_id` column) of the restaurant to edit. We will use this if the `DetailForm` was launched by clicking on an existing restaurant. If `DetailForm` receives an `Intent` lacking our "extra", it will know to add a new restaurant.

First, we need to define a name for this "extra", so add the following data member to `LunchList`:

```
public final static String ID_EXTRA="apt.tutorial._ID";
```

We use the `apt.tutorial` namespace to ensure our "extra" name will not collide with any names perhaps used by the Android system.

Next, convert the `onListClick` object to an `onListItemClick()` method (available to us on `ListActivity`) and have it add this "extra" to the Intent it uses to start the `DetailForm`:

```
public void onListItemClick(ListView list, View view,
                            int position, long id) {
  Intent i=new Intent(LunchList.this, DetailForm.class);

  i.putExtra(ID_EXTRA, String.valueOf(id));
  startActivity(i);
}
```

The `_id` of the restaurant happens to be provided to us as the fourth parameter to `onListItemClick()`. We turn it into a `String` because `DetailForm` will want it in `String` format, as we will see shortly.

Next, add the following data member to `DetailForm`:

```
String restaurantId=null;
```

This will be `null` if we are adding a new restaurant or the string form of the ID if we are editing an existing restaurant.

Finally, add the following line to the end of `onCreate()` in `DetailForm`:

```
restaurantId=getIntent().getStringExtra(LunchList.ID_EXTRA);
```

This will pull out our "extra", or leave `restaurantId` as `null` if there is no such "extra".

Step #6: Load the Restaurant Into the Form

In the case where we are editing an existing restaurant, we need to load that restaurant from the database, then load it into the `DetailForm`.

Since we created a `RestaurantHelper` in `onCreate()`, we need to close it again, so add an `onDestroy()` implementation to `DetailForm` as follows:

```
@Override
public void onDestroy() {
  super.onDestroy();

  helper.close();
}
```

Now that we have a handle to the database, we need to load a restaurant given its ID. So, add the following method to `RestaurantHelper`:

```
public Cursor getById(String id) {
  String[] args={id};

  return(getReadableDatabase()
          .rawQuery("SELECT _id, name, address, type, notes FROM restaurants 
WHERE _ID=?",
                    args));
}
```

Then, add the following lines to the bottom of `onCreate()` in `DetailForm`, to load in the specified restaurant into the form if its ID was specified in the `Intent`:

```
if (restaurantId!=null) {
  load();
}
```

The code snippet above references a `load()` method, which we need to add to `DetailForm`, based off of code originally in `LunchList`:

```
private void load() {
  Cursor c=helper.getById(restaurantId);

  c.moveToFirst();
  name.setText(helper.getName(c));
  address.setText(helper.getAddress(c));
  notes.setText(helper.getNotes(c));

  if (helper.getType(c).equals("sit_down")) {
    types.check(R.id.sit_down);
  }
  else if (helper.getType(c).equals("take_out")) {
    types.check(R.id.take_out);
  }
  else {
    types.check(R.id.delivery);
  }

  c.close();
}
```

Step #7: Add an "Add" Menu Option

We have most of the logic in place to edit existing restaurants. However, we still need to add a menu item for adding a new restaurant.

To do this, change `LunchList/res/menu/option.xml` to replace the existing options with one for `add`:

```
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
  <item android:id="@+id/add"
    android:title="Add"
    android:icon="@drawable/ic_menu_add"
  />
</menu>
```

Note that the `add` menu item references an icon supplied by Android. You can find a copy of this icon in your Android SDK. Go to the directory where you installed the SDK, and go into the `platforms/` directory inside of it. Then, go into the directory for some version of Android (e.g., `android-8/`), and into `data/res/drawable-mdpi/`. You will find `ic_menu_add.png` in there.

Now that we have the menu option, we need to adjust our menu handling to match. Restore our older implementation of `onCreateOptionMenu()` to `LunchList`:

```
public boolean onCreateOptionsMenu(Menu menu) {
  new MenuInflater(this).inflate(R.menu.option, menu);

  return(super.onCreateOptionsMenu(menu));
}
```

Then, add an `onOptionsItemSelected()` implementation in `LunchList` with the following:

```
public boolean onOptionsItemSelected(MenuItem item) {
  if (item.getItemId()==R.id.add) {
    startActivity(new Intent(LunchList.this, DetailForm.class));

    return(true);
  }

  return(super.onOptionsItemSelected(item));
}
```

Here, we launch the `DetailForm` activity without our "extra", signalling to `DetailForm` that it is to add a new restaurant. You will need imports again for `android.view.Menu`, `android.view.MenuInflater`, and `android.view.MenuItem`.

Step #8: Detail Form Supports Add and Edit

Last, but certainly not least, we need to have `DetailForm` properly do useful work when the Save button is clicked. Specifically, we need to either insert or update the database. It would also be nice if we dismissed the `DetailForm` at that point and returned to the main `LunchList` activity.

To accomplish this, we first need to add an `update()` method to `RestaurantHelper` that can perform a database update:

```
public void update(String id, String name, String address,
                   String type, String notes) {
  ContentValues cv=new ContentValues();
  String[] args={id};

  cv.put("name", name);
  cv.put("address", address);
  cv.put("type", type);
  cv.put("notes", notes);

  getWritableDatabase().update("restaurants", cv, "_ID=?",
                               args);
}
```

Then, we need to adjust our `onSave` listener object in `DetailForm` to call the right method (`save()` or `update()`) and `finish()` our activity:

```
private View.OnClickListener onSave=new View.OnClickListener() {
  public void onClick(View v) {
    String type=null;

    switch (types.getCheckedRadioButtonId()) {
      case R.id.sit_down:
        type="sit_down";
        break;
      case R.id.take_out:
        type="take_out";
        break;
      case R.id.delivery:
        type="delivery";
        break;
    }

    if (restaurantId==null) {
      helper.insert(name.getText().toString(),
                    address.getText().toString(), type,
                    notes.getText().toString());
    }
    else {
      helper.update(restaurantId, name.getText().toString(),
                    address.getText().toString(), type,
                    notes.getText().toString());
    }

    finish();
  }
};
```

At this point, you should be able to recompile and reinstall the application. When you first bring up the application, it will no longer show the tabs:

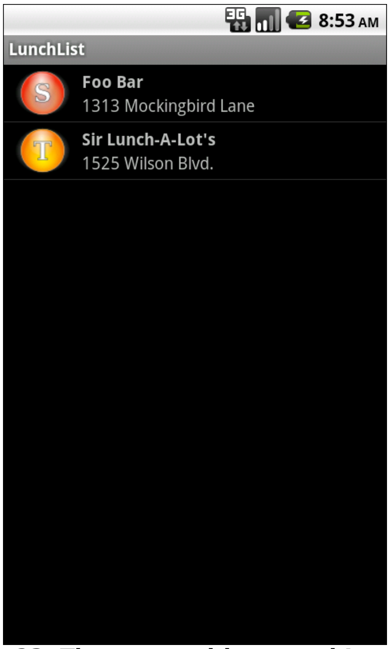


Figure 23. The new-and-improved LunchList

However, it will have an "add" menu option:

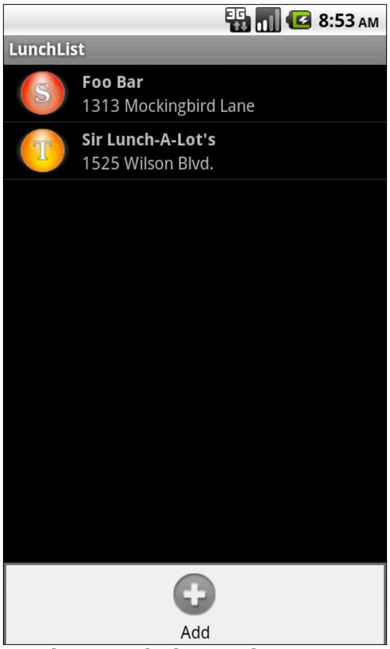


Figure 24. The LunchList option menu, with Add

If you choose the "add" menu option, it will bring up a blank `DetailForm`:

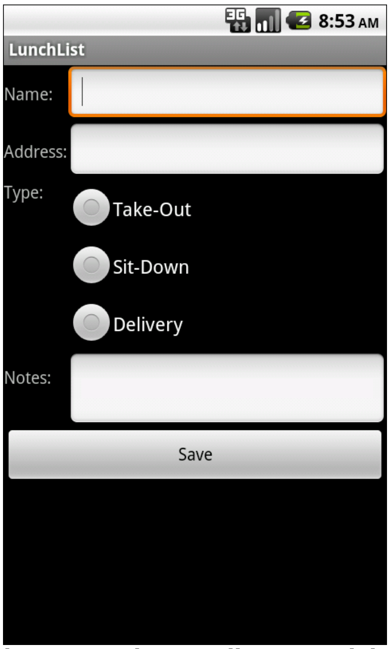
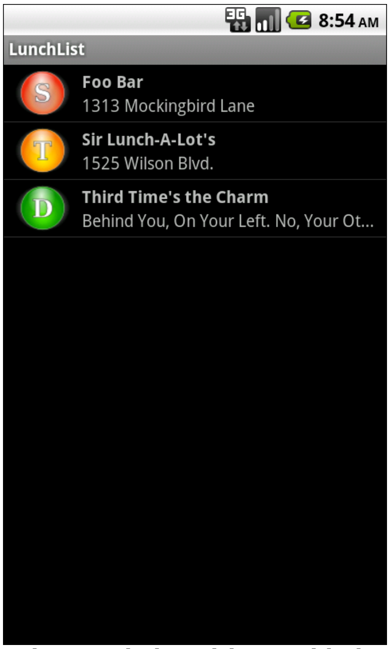


Figure 25. The DetailForm activity

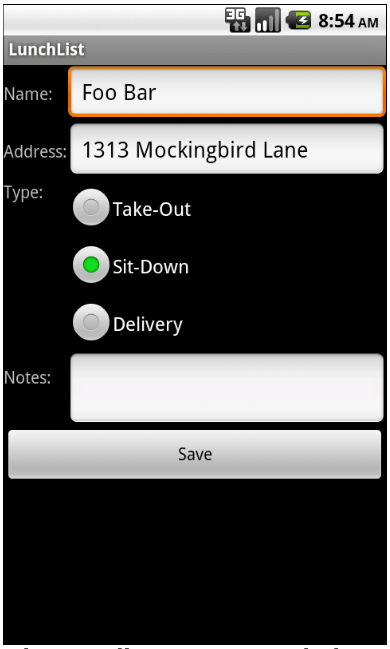
If you fill out the form and click Save, it will return you to the `LunchList` and immediately shows the new restaurant (courtesy of our using a managed `Cursor` in `LunchList`):



Foo Bar
1313 Mockingbird Lane
Sir Lunch-A-Lot's
1525 Wilson Blvd.
Third Time's the Charm
Behind You, On Your Left. No, Your Ot...

Figure 26. The LunchList with an added Restaurant

If you click an existing restaurant, it will bring up the `DetailForm` for that object:



Name: Foo Bar

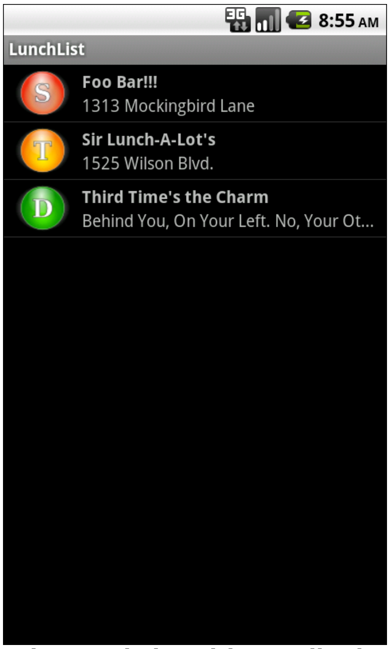
Address: 1313 Mockingbird Lane

Type: Take-Out / [✓ Sit-Down] / Delivery

Notes:

Figure 27. The DetailForm on an existing Restaurant

Making changes and clicking Save will update the database and list:



S Foo Bar!!!
1313 Mockingbird Lane

T Sir Lunch-A-Lot's
1525 Wilson Blvd.

D Third Time's the Charm
Behind You, On Your Left. No, Your Ot...

Figure 28. The LunchList with an edited Restaurant

Here is one implementation of `LunchList` that incorporates all of this tutorial's changes:

```
package apt.tutorial;

import android.app.ListActivity;
import android.content.Context;
import android.content.Intent;
import android.database.Cursor;
import android.os.Bundle;
import android.view.Menu;
import android.view.MenuInflater;
import android.view.MenuItem;
import android.view.View;
import android.view.ViewGroup;
import android.view.LayoutInflater;
import android.widget.AdapterView;
import android.widget.CursorAdapter;
import android.widget.Button;
import android.widget.EditText;
import android.widget.ImageView;
import android.widget.ListView;
import android.widget.RadioGroup;
import android.widget.TabHost;
import android.widget.TextView;
```

```
public class LunchList extends ListActivity {
  public final static String ID_EXTRA="apt.tutorial._ID";
  Cursor model=null;
  RestaurantAdapter adapter=null;
  EditText name=null;
  EditText address=null;
  EditText notes=null;
  RadioGroup types=null;
  RestaurantHelper helper=null;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);

    helper=new RestaurantHelper(this);

    name=(EditText)findViewById(R.id.name);
    address=(EditText)findViewById(R.id.addr);
    notes=(EditText)findViewById(R.id.notes);
    types=(RadioGroup)findViewById(R.id.types);

    model=helper.getAll();
    startManagingCursor(model);
    adapter=new RestaurantAdapter(model);
    setListAdapter(adapter);
  }

  @Override
  public void onDestroy() {
    super.onDestroy();

    helper.close();
  }

  @Override
  public void onListItemClick(ListView list, View view,
                              int position, long id) {
    Intent i=new Intent(LunchList.this, DetailForm.class);

    i.putExtra(ID_EXTRA, String.valueOf(id));
    startActivity(i);
  }

  @Override
  public boolean onCreateOptionsMenu(Menu menu) {
    new MenuInflater(this).inflate(R.menu.option, menu);

    return(super.onCreateOptionsMenu(menu));
  }

  @Override
  public boolean onOptionsItemSelected(MenuItem item) {
    if (item.getItemId()==R.id.add) {
      startActivity(new Intent(LunchList.this, DetailForm.class));

      return(true);
    }

    return(super.onOptionsItemSelected(item));
  }

  private View.OnClickListener onSave=new View.OnClickListener() {
    public void onClick(View v) {
      String type=null;

      switch (types.getCheckedRadioButtonId()) {
        case R.id.sit_down:
          type="sit_down";
          break;
        case R.id.take_out:
          type="take_out";
          break;
        case R.id.delivery:
          type="delivery";
          break;
      }

      helper.insert(name.getText().toString(),
                    address.getText().toString(), type,
                    notes.getText().toString());
      model.requery();
    }
  };

  class RestaurantAdapter extends CursorAdapter {
    RestaurantAdapter(Cursor c) {
      super(LunchList.this, c);
    }

    @Override
    public void bindView(View row, Context ctxt,
                         Cursor c) {
      RestaurantHolder holder=(RestaurantHolder)row.getTag();

      holder.populateFrom(c, helper);
    }

    @Override
    public View newView(Context ctxt, Cursor c,
                         ViewGroup parent) {
      LayoutInflater inflater=getLayoutInflater();
      View row=inflater.inflate(R.layout.row, parent, false);
      RestaurantHolder holder=new RestaurantHolder(row);

      row.setTag(holder);
      return(row);
    }
  }

  static class RestaurantHolder {
    private TextView name=null;
    private TextView address=null;
    private ImageView icon=null;
    private View row=null;

    RestaurantHolder(View row) {
      this.row=row;

      name=(TextView)row.findViewById(R.id.title);
      address=(TextView)row.findViewById(R.id.address);
      icon=(ImageView)row.findViewById(R.id.icon);
    }

    void populateFrom(Cursor c, RestaurantHelper helper) {
      name.setText(helper.getName(c));
      address.setText(helper.getAddress(c));

      if (helper.getType(c).equals("sit_down")) {
        icon.setImageResource(R.drawable.ball_red);
      }
      else if (helper.getType(c).equals("take_out")) {
        icon.setImageResource(R.drawable.ball_yellow);
      }
      else {
        icon.setImageResource(R.drawable.ball_green);
      }
    }
  }
}
```

Here is one implementation of `DetailForm` that works with the revised `LunchList`:

```
package apt.tutorial;

import android.app.Activity;
import android.database.Cursor;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;
import android.widget.RadioGroup;
import android.widget.TextView;

public class DetailForm extends Activity {
  EditText name=null;
  EditText address=null;
  EditText notes=null;
  RadioGroup types=null;
  RestaurantHelper helper=null;
  String restaurantId=null;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.detail_form);

    helper=new RestaurantHelper(this);

    name=(EditText)findViewById(R.id.name);
    address=(EditText)findViewById(R.id.addr);
    notes=(EditText)findViewById(R.id.notes);
    types=(RadioGroup)findViewById(R.id.types);

    Button save=(Button)findViewById(R.id.save);

    save.setOnClickListener(onSave);

    restaurantId=getIntent().getStringExtra(LunchList.ID_EXTRA);

    if (restaurantId!=null) {
      load();
    }
  }

  @Override
  public void onDestroy() {
    super.onDestroy();

    helper.close();
  }

  private void load() {
    Cursor c=helper.getById(restaurantId);

    c.moveToFirst();
    name.setText(helper.getName(c));
    address.setText(helper.getAddress(c));
    notes.setText(helper.getNotes(c));

    if (helper.getType(c).equals("sit_down")) {
      types.check(R.id.sit_down);
    }
    else if (helper.getType(c).equals("take_out")) {
      types.check(R.id.take_out);
    }
    else {
      types.check(R.id.delivery);
    }

    c.close();
  }

  private View.OnClickListener onSave=new View.OnClickListener() {
    public void onClick(View v) {
      String type=null;

      switch (types.getCheckedRadioButtonId()) {
        case R.id.sit_down:
          type="sit_down";
          break;
        case R.id.take_out:
          type="take_out";
          break;
        case R.id.delivery:
          type="delivery";
          break;
      }

      if (restaurantId==null) {
        helper.insert(name.getText().toString(),
                      address.getText().toString(), type,
                      notes.getText().toString());
      }
      else {
        helper.update(restaurantId, name.getText().toString(),
                      address.getText().toString(), type,
                      notes.getText().toString());
      }

      finish();
    }
  };
}
```

And, here is an implementation of `RestaurantHelper` with the changes needed by `DetailForm`:

```
package apt.tutorial;

import android.content.Context;
import android.content.ContentValues;
import android.database.Cursor;
import android.database.SQLException;
import android.database.sqlite.SQLiteOpenHelper;
import android.database.sqlite.SQLiteDatabase;
import android.database.sqlite.SQLiteQueryBuilder;

class RestaurantHelper extends SQLiteOpenHelper {
  private static final String DATABASE_NAME="lunchlist.db";
  private static final int SCHEMA_VERSION=1;

  public RestaurantHelper(Context context) {
    super(context, DATABASE_NAME, null, SCHEMA_VERSION);
  }

  @Override
  public void onCreate(SQLiteDatabase db) {
    db.execSQL("CREATE TABLE restaurants (_id INTEGER PRIMARY KEY AUTOINCREMENT,
name TEXT, address TEXT, type TEXT, notes TEXT);");
  }

  @Override
  public void onUpgrade(SQLiteDatabase db, int oldVersion, int newVersion) {
    // no-op, since will not be called until 2nd schema
    // version exists
  }

  public Cursor getAll() {
    return(getReadableDatabase()
            .rawQuery("SELECT _id, name, address, type, notes FROM restaurants
ORDER BY name",
                     null));
  }

  public Cursor getById(String id) {
    String[] args={id};

    return(getReadableDatabase()
            .rawQuery("SELECT _id, name, address, type, notes FROM restaurants
WHERE _ID=?",
                     args));
  }

  public void insert(String name, String address,
                    String type, String notes) {
    ContentValues cv=new ContentValues();

    cv.put("name", name);
    cv.put("address", address);
    cv.put("type", type);
    cv.put("notes", notes);

    getWritableDatabase().insert("restaurants", "name", cv);
  }

  public void update(String id, String name, String address,
                    String type, String notes) {
    ContentValues cv=new ContentValues();
    String[] args={id};

    cv.put("name", name);
    cv.put("address", address);
    cv.put("type", type);
    cv.put("notes", notes);

    getWritableDatabase().update("restaurants", cv, "_ID=?",
                             args);
  }

  public String getName(Cursor c) {
    return(c.getString(1));
  }

  public String getAddress(Cursor c) {
    return(c.getString(2));
  }

  public String getType(Cursor c) {
    return(c.getString(3));
  }

  public String getNotes(Cursor c) {
    return(c.getString(4));
  }
}
```

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Have the database hold a URL for the restaurant's Web site. Update the UI to collect this address in the detail form. Launch that URL via `startActivity()` via an option menu choice from the restaurant list, so you can view the restaurant's Web site.
- Add an option menu to delete a restaurant . Raise an `AlertDialog` to confirm that the user wants the restaurant deleted. Delete it from the database and refresh the list if the user confirms the deletion.

Further Reading

You can read up on having multiple activities in your application, or linking to activities supplied by others, in the "Launching Activities and Sub-Activities" chapter of The Busy Coder's Guide to Android Development.

TUTORIAL 13

What's Your Preference?

In this tutorial, we will add a preference setting for the sort order of the restaurant list. To do this, we will create a PreferenceScreen definition in XML, load that into a PreferenceActivity, connect that activity to the application, and finally actually use the preference to control the sort order.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the 12-Activities edition of LunchList to use as a starting point.

Step #1: Define the Preference XML

First, add a LunchList/res/xml/preferences.xml file as follows:

```
<PreferenceScreen
  xmlns:android="http://schemas.android.com/apk/res/android">
  <ListPreference
    android:key="sort_order"
    android:title="Sort Order"
    android:summary="Choose the order the list uses"
    android:entries="@array/sort_names"
    android:entryValues="@array/sort_clauses"
    android:dialogTitle="Choose a sort order" />
</PreferenceScreen>
```

This sets up a single-item PreferenceScreen. Note that it references two string arrays, one for the display labels of the sort-order selection list, and one for the values actually stored in the SharedPreferences.

So, to define those string arrays, add a LunchList/res/values/arrays.xml file with the following content:

```
<?xml version="1.0" encoding="utf-8"?>
<resources>
  <string-array name="sort_names">
    <item>By Name, Ascending</item>
    <item>By Name, Descending</item>
    <item>By Type</item>
    <item>By Address, Ascending</item>
    <item>By Address, Descending</item>
  </string-array>
  <string-array name="sort_clauses">
    <item>name ASC</item>
    <item>name DESC</item>
    <item>type, name ASC</item>
    <item>address ASC</item>
    <item>address DESC</item>
  </string-array>
</resources>
```

Note we are saying that the value stored in the SharedPreferences will actually be an ORDER BY clause for use in our SQL query. This is a convenient trick, though it does tend to make the system a bit more fragile – if we change our column names, we might have to change our preferences to match and deal with older invalid preference values.

Step #2: Create the Preference Activity

Next, we need to create a PreferenceActivity that will actually use these preferences. To do this, add a PreferenceActivity implementation, stored as LunchList/src/apt/tutorial/EditPreferences.java:

```
package apt.tutorial;

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

public class EditPreferences extends PreferenceActivity {
  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);

    addPreferencesFromResource(R.xml.preferences);
  }
}
```

We also need to update `AndroidManifest.xml` to reference this activity, so we can launch it later:

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
      package="apt.tutorial"
      android:versionCode="1"
      android:versionName="1.0">
    <application android:label="@string/app_name">
        <activity android:name=".LunchList"
                  android:label="@string/app_name">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
        <activity android:name=".DetailForm">
        </activity>
        <activity android:name=".EditPreferences">
        </activity>
    </application>
</manifest>
```

Step #3: Connect the Preference Activity to the Option Menu

Now, we can add a menu option to launch the `EditPreferences` activity.

We need to add another `<item>` to our `LunchList/res/menu/option.xml` file:

```
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
  <item android:id="@+id/add"
    android:title="Add"
    android:icon="@drawable/ic_menu_add"
  />
  <item android:id="@+id/prefs"
    android:title="Settings"
    android:icon="@drawable/ic_menu_preferences"
  />
</menu>
```

We reference an `ic_menu_preferences.png` file, which you can obtain from the same directory where you got `ic_menu_add.png`.

Of course, if we modify the menu XML, we also need to modify the `LunchList` implementation of `onOptionsItemSelected()` to match, so replace the current implementation with the following:

```
@Override
public boolean onOptionsItemSelected(MenuItem item) {
  if (item.getItemId()==R.id.add) {
    startActivity(new Intent(LunchList.this, DetailForm.class));

    return(true);
  }
  else if (item.getItemId()==R.id.prefs) {
    startActivity(new Intent(this, EditPreferences.class));

    return(true);
  }

  return(super.onOptionsItemSelected(item));
}
```

All we are doing is starting up our `EditPreferences` activity.

If you recompile and reinstall the application, you will see our new menu option:

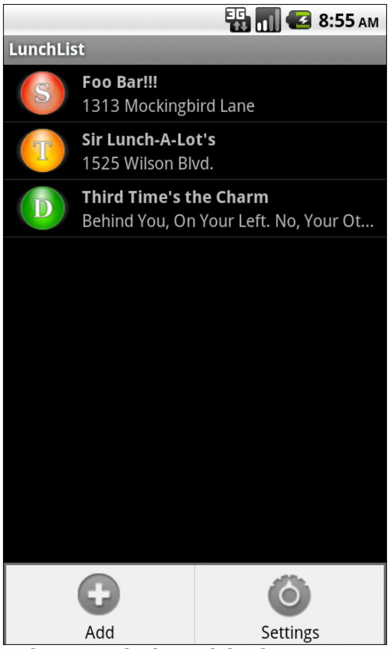
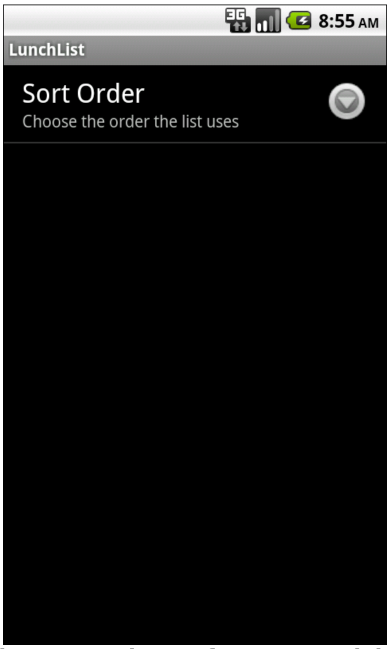


Figure 29. The LunchList with the new menu option

And if you choose that menu option, you will get the `EditPreferences` activity:



Sort Order

Choose the order the list uses

Figure 30. The preferences activity

Clicking the Sort Order item will bring up a selection list of available sort orders:

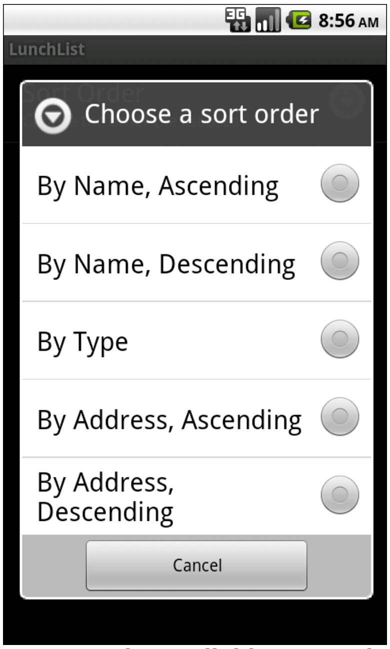


Figure 31. The available sort orders

Of course, none of this is actually having any effect on the sort order itself, which we will address in the next section.

Step #4: Apply the Sort Order on Startup

Now, given that the user has chosen a sort order, we need to actually use it. First, we can apply it when the application starts up – the next section will handle changing the sort order after the user changes the preference value.

First, the `getAll()` method on `RestaurantHelper` needs to take a sort order as a parameter, rather than apply one of its own. So, change that method as follows:

```
public Cursor getAll(String orderBy) {
  return(getReadableDatabase()
          .rawQuery("SELECT _id, name, address, type, notes FROM restaurants
ORDER BY "+orderBy,
                    null));
}
```

Then, we need to get our hands on our SharedPreferences instance. Add imports to LunchList for android.content.SharedPreferences and android.preference.PreferenceManager, along with a SharedPreferences data member named prefs.

Next, add this line near the top of onCreate() in LunchList, to initialize prefs to be the SharedPreferences our preference activity uses:

```
prefs=PreferenceManager.getDefaultSharedPreferences(this);
```

Finally, change the call to getAll() to use the SharedPreferences:

```
model=helper.getAll(prefs.getString("sort_order", "name"));
```

Here, we use name as the default value, so if the user has not specified a sort order yet, the sort order will be by name.

Now, if you recompile and reinstall the application, then set a sort order preference, you can see that preference take effect if you exit and reopen the application.

Step #5: Listen for Preference Changes

That works, but users will get annoyed if they have to exit the application just to get their preference choice to take effect. To change the sort order on the fly, we first need to know when they change the sort order.

SharedPreferences has the notion of a preference listener object, to be notified on such changes. To take advantage of this, add the following line at the end of onCreate() in LunchList:

```
prefs.registerOnSharedPreferenceChangeListener(prefListener);
```

This snippet refers to a prefListener object, so add the following code to LunchList to create a stub implementation of that object:

```
private SharedPreferences.OnSharedPreferenceChangeListener prefListener=
  new SharedPreferences.OnSharedPreferenceChangeListener() {
  public void onSharedPreferenceChanged(SharedPreferences sharedPrefs, String
key) {
    if (key.equals("sort_order")) {
    }
  }
};
```

All we are doing right now is watching for our specific preference of interest (`sort_order`), though we are not actually taking advantage of the changed value.

Step #6: Re-Apply the Sort Order on Changes

Finally, we actually need to change the sort order. For simple lists like this, the easiest way to accomplish this is to get a fresh `Cursor` representing our list (from `getAll()` on `RestaurantHelper`) with the proper sort order, and use the new `Cursor` instead of the old one.

First, pull some of the list-population logic out of `onCreate()`, by implementing an `initList()` method as follows:

```
private void initList() {
  if (model!=null) {
    stopManagingCursor(model);
    model.close();
  }

  model=helper.getAll(prefs.getString("sort_order", "name"));
  startManagingCursor(model);
  adapter=new RestaurantAdapter(model);
  setListAdapter(adapter);
}
```

Note that we call `stopManagingCursor()` so Android will ignore the old `Cursor`, then we close it, before we get and apply the new `Cursor`. Of course, we only do those things if there is an old `Cursor`.

The `onCreate()` method needs to change to take advantage of `initList()`:

```
@Override
public void onCreate(Bundle savedInstanceState) {
  super.onCreate(savedInstanceState);
  setContentView(R.layout.main);

  helper=new RestaurantHelper(this);
  prefs=PreferenceManager.getDefaultSharedPreferences(this);

  name=(EditText)findViewById(R.id.name);
  address=(EditText)findViewById(R.id.addr);
  notes=(EditText)findViewById(R.id.notes);
  types=(RadioGroup)findViewById(R.id.types);

  initList();
  prefs.registerOnSharedPreferenceChangeListener(prefListener);
}
```

Also, we can call `initList()` from `prefListener`:

```
private SharedPreferences.OnSharedPreferenceChangeListener prefListener=
 new SharedPreferences.OnSharedPreferenceChangeListener() {
  public void onSharedPreferenceChanged(SharedPreferences sharedPrefs,
                                        String key) {
    if (key.equals("sort_order")) {
      initList();
    }
  }
};
```

At this point, if you recompile and reinstall the application, you should see the sort order change immediately as you change the order via the preferences.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Add a preference for the default type of restaurant (e.g., take-out). Use that preference in detail forms when creating a new restaurant.
- Add an option menu to the detail form activity and have it be able to start the preference activity the way we did from the option menu for the list.
- Rather than use preferences, store the preference values in a JSON file that you read in at startup and re-read in `onResume()` (to find out

about changes). This means you will need to create your own preference UI, rather than rely upon the one created by the preference XML.

Further Reading

Learn more about setting up preference XML files and reading shared preferences in the "Using Preferences" chapter of The Busy Coder's Guide to Android Development.

TUTORIAL 14

Turn, Turn, Turn

In this tutorial, we will make our application somewhat more intelligent about screen rotations, ensuring that partially-entered restaurant information remains intact even after the screen rotates.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `13-Prefs` edition of `LunchList` to use as a starting point.

Step #1: Add a Stub onSaveInstanceState()

Since we are not holding onto network connections or other things that cannot be stored in a `Bundle`, we can use `onSaveInstanceState()` to track our state as the screen is rotated.

To that end, add a stub implementation of `onSaveInstanceState()` to `DetailForm` as follows:

```
@Override
public void onSaveInstanceState(Bundle savedInstanceState) {
  super.onSaveInstanceState(savedInstanceState);
}
```

Step #2: Pour the Form Into the Bundle

Now, fill in the details of `onSaveInstanceState()`, putting our widget contents into the supplied `Bundle`:

```
@Override
public void onSaveInstanceState(Bundle state) {
  super.onSaveInstanceState(state);

  state.putString("name", name.getText().toString());
  state.putString("address", address.getText().toString());
  state.putString("notes", notes.getText().toString());
  state.putInt("type", types.getCheckedRadioButtonId());
}
```

Step #3: Repopulate the Form

Next, we need to make use of that saved state. We could do this in `onCreate()`, if the passed-in `Bundle` is non-`null`. However, it is usually easier just to override `onRestoreInstanceState()`. This is called only when there is state to restore, supplying the `Bundle` with your state. So, add an implementation of `onRestoreInstanceState()` to `DetailForm`:

```
@Override
public void onRestoreInstanceState(Bundle state) {
  super.onRestoreInstanceState(state);

  name.setText(state.getString("name"));
  address.setText(state.getString("address"));
  notes.setText(state.getString("notes"));
  types.check(state.getInt("type"));
}
```

At this point, you can recompile and reinstall the application. Use `<Ctrl>-<F12>` to simulate rotating the screen of your emulator. If you do this after making changes (but not saving) on the `DetailForm`, you will see those changes survive the rotation.

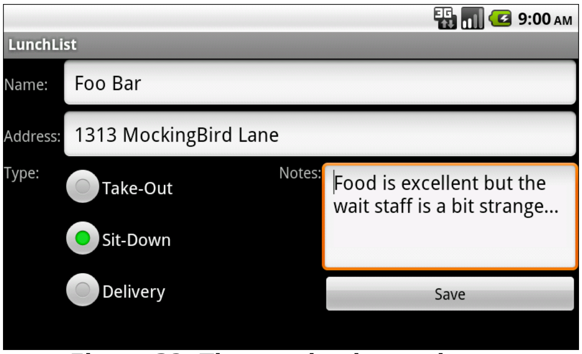
Step #4: Fix Up the Landscape Detail Form

As you tested the work from the previous section, you no doubt noticed that the `DetailForm` layout is not well-suited for landscape – the notes text area is chopped off and the Save button is missing. To fix this, we need to create a `LunchList/res/layout-land/detail_form.xml` file, derived from our original, but set up to take advantage of the whitespace to the right of the radio buttons:

```
<TableLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:layout_width="fill_parent"
  android:layout_height="wrap_content"
  android:stretchColumns="1,3"
  >
  <TableRow>
    <TextView android:text="Name:" />
    <EditText android:id="@+id/name"
      android:layout_span="3"
    />
  </TableRow>
  <TableRow>
    <TextView android:text="Address:" />
    <EditText android:id="@+id/addr"
      android:layout_span="3"
    />
  </TableRow>
  <TableRow>
    <TextView android:text="Type:" />
    <RadioGroup android:id="@+id/types">
      <RadioButton android:id="@+id/take_out"
        android:text="Take-Out"
      />
      <RadioButton android:id="@+id/sit_down"
        android:text="Sit-Down"
      />
      <RadioButton android:id="@+id/delivery"
        android:text="Delivery"
      />
    </RadioGroup>
    <TextView android:text="Notes:" />
    <LinearLayout
      android:layout_width="fill_parent"
      android:layout_height="fill_parent"
      android:orientation="vertical"
      >
      <EditText android:id="@+id/notes"
        android:singleLine="false"
        android:gravity="top"
        android:lines="4"
        android:scrollHorizontally="false"
        android:maxLines="4"
        android:maxWidth="140sp"
        android:layout_width="fill_parent"
        android:layout_height="wrap_content"
      />
      <Button android:id="@+id/save"
```

```
        android:layout_width="fill_parent"
        android:layout_height="wrap_content"
        android:text="Save"
      />
    </LinearLayout>
  </TableRow>
</TableLayout>
```

Now, if you recompile and reinstall the application, you should see a better landscape rendition of the detail form:



Foo Bar
1313 MockingBird Lane
Food is excellent but the wait staff is a bit strange...

Figure 32. The new landscape layout

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Try switching to `onRetainNonConfigurationInstance()` instead of `onSaveInstanceState()`.
- Try commenting out `onSaveInstanceState()`. Does the activity still retain its instance state? Why or why not?
- Have the application automatically rotate based on physical orientation instead of keyboard position. Hint: find a place to apply `android:screenOrientation = "sensor"`.

Further Reading

Additional coverage of screen rotations and how to control what happens during them can be found in the "Handling Rotation" chapter of The Busy Coder's Guide to Android Development.

PART II – Network Application Tutorials

TUTORIAL 15

Raising (Something Like) a Tweet

In this tutorial, we will experiment with the Apache HttpClient library in Android, using it to post a status update to our identi.ca account. The identi.ca service, powered by StatusNet, is a microblogging service similar to Twitter. In fact, this book used to profile a Twitter client. However, Twitter's new authentication models, while good for Twitter, are a bit too complicated to implement for this book.

Over the course of several tutorials, we will focus on microblog-related functionality in an application we will call `Patchy` (which used to be short for "Patchy: Another Twitter Client? Heck, Yeah!").

Step-By-Step Instructions

This tutorial starts a new application, independent from the `LunchList` application developed in the preceding tutorials. Hence, we will have you create a new application from scratch.

Step #1: Set Up an Identi.ca Account

Twitter is a micro-blogging service that you may have heard about. On the other hand, you may not have an identi.ca account.

If you have such an account and do not mind using it for creating a Patchy application, feel free to stick with it. Otherwise, create an identi.ca account that you can use for your experimentation. Visit the identi.ca Web site and sign up. Note that identi.ca will send a confirmation email to you, and you must click the link on that email in order to be able to work with the REST API.

Step #2: Create a Stub Application and Activity

Using Eclipse or `android create project`, make a project named `Patchy` with a stub activity named `apt.tutorial.two.Patchy`. The generated activity class should resemble the following:

```java
package apt.tutorial.two;

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

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

Step #3: Create a Layout

Next, we need a layout for use with the `Patchy` activity. At the outset, we want:

- A field for your identi.ca user name
- A field for your identi.ca password, needed to use much of the identi.ca REST API
- A multi-line field for a status update you want to publish
- A Send button that will send the status update

Here is a simple TableLayout containing those items, one that looks a bit like the DetailForm from the LunchList tutorial earlier in this book:

```
<TableLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:layout_width="fill_parent"
  android:layout_height="wrap_content"
  android:stretchColumns="1"
  >
  <TableRow>
    <TextView android:text="User Name:" />
    <EditText android:id="@+id/user" />
  </TableRow>
  <TableRow>
    <TextView android:text="Password:" />
    <EditText android:id="@+id/password"
      android:password="true"
    />
  </TableRow>
  <TableRow>
    <TextView android:text="Status:" />
    <EditText android:id="@+id/status"
      android:singleLine="false"
      android:gravity="top"
      android:lines="5"
      android:scrollHorizontally="false"
      android:maxLines="5"
      android:maxWidth="200sp"
    />
  </TableRow>
  <Button android:id="@+id/send"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:text="Send"
  />
</TableLayout>
```

If you compile and reinstall this application, you will see the layout in action:

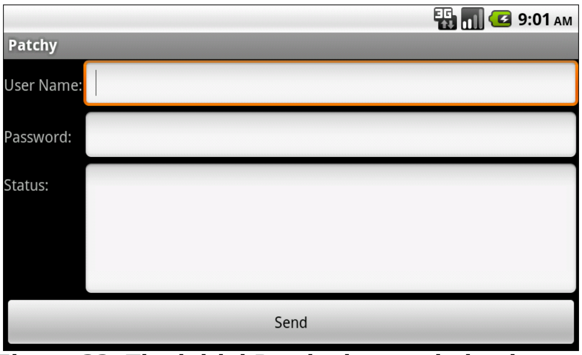


Figure 33. The initial Patchy layout, in landscape

Step #4: Listen for Send Actions

Next, we need to get control when the user clicks the Send button. This involves finding the Send button in our layout and attaching a listener to it.

Replace the stock implementation of `Patchy` with the following:

```java
package apt.tutorial.two;

import android.app.Activity;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;

public class Patchy extends Activity {
  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);
    
    Button send=(Button)findViewById(R.id.send);
    
    send.setOnClickListener(onSend);
  }
  
  private View.OnClickListener onSend=new View.OnClickListener() {
    public void onClick(View v) {
    }
  };
}
```

Step #5: Make the Status Post Request

With all that done, we can actually invoke the identi.ca REST API. This is somewhat tedious, for a few reasons:

- identi.ca requires HTTP Basic authentication to pass over the user name and password, rather than embedding them as values in, say, an HTTP POST request. HttpClient does not handle preemptive HTTP authentication very well.
- HTTP Basic authentication requires Base64 encoding, and Android (before 2.2) lacks a publicly-visible Base64 encoder.

Here is what you need to do to get past all of this and make `Patchy` work:

First, find a suitable Base64 encoder, such as this public domain one. Put the `Base64` class in your project in `Patchy/src/apt/tutorial/two/` and add the matching package line to the top of the file, so it is available to your `Patchy` implementation. Note that Android 2.2 has a `Base64` encoder class, though that has not been tried as a part of this tutorial.

Next, replace your existing `Patchy` implementation with the following:

```
package apt.tutorial.two;

import android.app.Activity;
import android.app.AlertDialog;
import android.os.Bundle;
import android.view.View;
import android.util.Log;
import android.widget.Button;
import android.widget.EditText;
import java.io.IOException;
import java.util.ArrayList;
import java.util.List;
import org.apache.http.NameValuePair;
import org.apache.http.HttpVersion;
import org.apache.http.client.ResponseHandler;
import org.apache.http.client.HttpClient;
import org.apache.http.client.entity.UrlEncodedFormEntity;
import org.apache.http.client.methods.HttpPost;
import org.apache.http.impl.client.BasicResponseHandler;
import org.apache.http.impl.client.DefaultHttpClient;
import org.apache.http.message.BasicNameValuePair;
import org.apache.http.protocol.HTTP;
import org.json.JSONObject;

public class Patchy extends Activity {
  private DefaultHttpClient client=null;
  private EditText user=null;
  private EditText password=null;
  private EditText status=null;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);

    user=(EditText)findViewById(R.id.user);
    password=(EditText)findViewById(R.id.password);
    status=(EditText)findViewById(R.id.status);

    Button send=(Button)findViewById(R.id.send);

    send.setOnClickListener(onSend);

    client=new DefaultHttpClient();
  }

  @Override
  public void onDestroy() {
    super.onDestroy();

    client.getConnectionManager().shutdown();
  }

  private String getCredentials() {
    String u=user.getText().toString();
    String p=password.getText().toString();

    return(Base64.encodeBytes((u+":"+p).getBytes()));
  }

  private void updateStatus() {
    try {
      String s=status.getText().toString();

      HttpPost post=new HttpPost("https://identi.ca/api/statuses/update.json");

      post.addHeader("Authorization",
                     "Basic "+getCredentials());

      List<NameValuePair> form=new ArrayList<NameValuePair>();

      form.add(new BasicNameValuePair("status", s));

      post.setEntity(new UrlEncodedFormEntity(form, HTTP.UTF_8));

      ResponseHandler<String> responseHandler=new BasicResponseHandler();
      String responseBody=client.execute(post, responseHandler);
      JSONObject response=new JSONObject(responseBody);
    }
    catch (Throwable t) {
      Log.e("Patchy", "Exception in updateStatus()", t);
      goBlooey(t);
    }
  }

  private void goBlooey(Throwable t) {
    AlertDialog.Builder builder=new AlertDialog.Builder(this);

    builder
      .setTitle("Exception!")
      .setMessage(t.toString())
      .setPositiveButton("OK", null)
      .show();
  }

  private View.OnClickListener onSend=new View.OnClickListener() {
    public void onClick(View v) {
      updateStatus();
    }
  };
}
```

Here, we:

- Set up an `DefaultHttpClient` instance for accessing the Apache HttpClient engine
- Get access to our `EditText` widgets from the layout
- On a Send button click, call `updateStatus()`
- In `updateStatus()`, we create an `HttpPost` object to represent the request, fill in the authentication credentials, fill in the status as a form element, turn the whole thing into a valid HTTP POST operation, execute it, and parse the response as a JSON object

If things work, at present, we do nothing to update the activity; if an `Exception` is raised, we log it to the Android log and raise an `AlertDialog`.

You also need to add the `INTERNET` permission to your `AndroidManifest.xml` file:

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
      package="apt.tutorial.two"
      android:versionCode="1"
      android:versionName="1.0">
  <uses-permission android:name="android.permission.INTERNET" />
    <application android:label="@string/app_name">
        <activity android:name=".Patchy"
                  android:label="@string/app_name">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
    </application>
</manifest>
```

If you recompile and reinstall the application, you should now be able to update your identi.ca status by filling in the fields and clicking the Send button.

You will notice that we are making this HTTP request on the main application thread. That is not a good practice – it can freeze the user interface, and if the request takes too long, Android will display the dreaded "application not responding" dialog box. However, we will address that problem in the next tutorial (or in an Extra Credit item, if you prefer).

If you work in a facility that requires a proxy server, your emulator may be unhappy (as might Android devices operating on WiFi behind the proxy). You may need to add the following snippet of code to work past that, adjusting the parameters to suit your office's setup:

```
Properties systemSettings=System.getProperties();

systemSettings.put("http.proxyHost", "your.proxy.host.here");
systemSettings.put("http.proxyPort", "8080"); // use actual proxy port
```

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Process the post request in a background thread and display a `Toast` when the request is complete and successful.

- Add logic to check for the 140-character message limit before sending the request. If the message is too long, display an `AlertDialog`.
- Make the `AlertDialog` from the previous point obsolete by adding the `android:maxLength` attribute to the `EditText` for the message, to constrain it to 140 characters.
- Add in TinyURL support by adding a field for a URL to append to the end of the message, then using the TinyURL REST API (`http://tinyurl.com/api-create.php?url = ...` returns the shortened URL as a response) to generate the shortened URL, then attach it to the message before making the request.
- Experiment with the Android 2.2 `AndroidHttpClient` class, as an alternative to `DefaultHttpClient`.

Further Reading

Additional examples of interacting with HttpClient from Android can be found in the "Communicating via the Internet" chapter of The Busy Coder's Guide to Android Development.

However, the definitive resource for HttpClient is the Apache site for HttpClient itself. In particular, their samples show a number of techniques we will not be using here.

TUTORIAL 16

Opening a JAR

Writing our own identi.ca API seems silly, considering that there are so many of them available as open source, including three for Java. In this tutorial, we will replace our HttpClient with JTwitter, an LGPL Twitter/identi.ca API that works with Android.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `15-HttpClient` edition of `Patchy` to use as a starting point.

Step #1: Obtain the JTwitter JAR

The current official JTwitter distribution appears to drop support for identi.ca. Hence, this tutorial will have you use a patched version of an identi.ca-compatible JTwitter distribution.

Download the modified JTwitter JAR. Then, put the JAR in the `Patchy/libs/` directory, so it is available to your application. Or, you can obtain the same modified JTwitter JAR from the tutorial results.

NOTE: Eclipse users will also need to add the `jtwitter.jar` file to their build path.

The source code to this modified JTwitter implementation can be found on the CommonsWare Web site.

Step #2: Switch from HttpClient to JTwitter

Now, we can get rid of most of our previous `Patchy` implementation, including all of the HttpClient code, and replace it with the delightfully simply JTwitter API.

Replace the current implementation of `Patchy` with the following:

```
package apt.tutorial.two;

import android.app.Activity;
import android.app.AlertDialog;
import android.os.Bundle;
import android.view.View;
import android.util.Log;
import android.widget.Button;
import android.widget.EditText;
import winterwell.jtwitter.Twitter;

public class Patchy extends Activity {
  private EditText user=null;
  private EditText password=null;
  private EditText status=null;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);

    user=(EditText)findViewById(R.id.user);
    password=(EditText)findViewById(R.id.password);
    status=(EditText)findViewById(R.id.status);

    Button send=(Button)findViewById(R.id.send);

    send.setOnClickListener(onSend);
  }

  private void updateStatus() {
    try {
      Twitter client=new Twitter(user.getText().toString(),
                                 password.getText().toString());

      client.setAPIRootUrl("https://identi.ca/api");
      client.updateStatus(status.getText().toString());
    }
    catch (Throwable t) {
      Log.e("Patchy", "Exception in updateStatus()", t);
      goBlooey(t);
    }
  }

  private void goBlooey(Throwable t) {
    AlertDialog.Builder builder=new AlertDialog.Builder(this);

    builder
      .setTitle("Exception!")
      .setMessage(t.toString())
      .setPositiveButton("OK", null)
      .show();
  }

  private View.OnClickListener onSend=new View.OnClickListener() {
    public void onClick(View v) {
      updateStatus();
    }
  };
}
```

Besides getting rid of all HttpClient references, we reimplemented `updateStatus()` to create a `Twitter` object (with our user name and password), then called its own `updateStatus()` method with the typed-in status.

If you rebuild and reinstall `Patchy`, you can once again update your status, just with half of the lines of code.

Step #3: Create Preferences for Account Information

Rather than have the user enter their account information every time they run `Patchy`, we should store that information in user preferences, so it can be entered only on occasion.

First, we need a preference XML file, so create a new file, `Patchy/res/xml/preferences.xml`, with the following contents:

```
<PreferenceScreen
  xmlns:android="http://schemas.android.com/apk/res/android">
  <PreferenceCategory android:title="User Account">
    <EditTextPreference
      android:key="user"
      android:title="User Name"
      android:summary="Your identi.ca screen name"
      android:dialogTitle="Enter your identi.ca user name" />
    <EditTextPreference
      android:key="password"
      android:title="Password"
      android:summary="Your identi.ca account password"
      android:password="true"
      android:dialogTitle="Enter your identi.ca password" />
  </PreferenceCategory>
</PreferenceScreen>
```

Note the use of `android:password = "true"` to turn the second one into a password-style preference. Any `EditText` attributes found in the `EditTextPreference` element are passed through to the `EditText` used in the popup dialog.

Then, we need another `EditPreference` activity akin to the one we used in `LunchList` – call it `Patchy/src/apt/tutorial/two/EditPreferences.java`:

```
package apt.tutorial.two;

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

public class EditPreferences extends PreferenceActivity {
  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);

    addPreferencesFromResource(R.xml.preferences);
  }
}
```

We must not forget to update our `AndroidManifest.xml` file to reference the new activity, so amend yours to look like:

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

```
  <uses-permission android:name="android.permission.INTERNET" />
    <application android:label="@string/app_name">
        <activity android:name=".Patchy"
                  android:label="@string/app_name">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
        <activity android:name=".EditPreferences">
        </activity>
    </application>
</manifest>
```

Then, we want to have an option menu to trigger editing the preferences, so create `Patchy/res/menu/option.xml` with the following XML:

```
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
  <item android:id="@+id/prefs"
    android:title="Settings"
    android:icon="@drawable/ic_menu_preferences"
  />
</menu>
```

You will need an `ic_menu_preferences.png` drawable resource, perhaps the one you used in the `LunchList` tutorials.

Finally, we need to clone the code from `LunchList` that opens our option menu using the above XML and routes the item click to the `EditPreference` activity. Paste the following methods into `Patchy`:

```
@Override
public boolean onCreateOptionsMenu(Menu menu) {
  new MenuInflater(getApplication())
                               .inflate(R.menu.option, menu);

  return(super.onCreateOptionsMenu(menu));
}

@Override
public boolean onOptionsItemSelected(MenuItem item) {
  if (item.getItemId()==R.id.prefs) {
    startActivity(new Intent(this, EditPreferences.class));

    return(true);
  }
  return(super.onOptionsItemSelected(item));
}
```

You will also need to add some imports (`Intent`, `Menu`, `MenuInflater`, `MenuItem`) to allow this to compile.

At this point, you can recompile and reinstall the application and see our preference activity in action, even though the values are not being used yet:

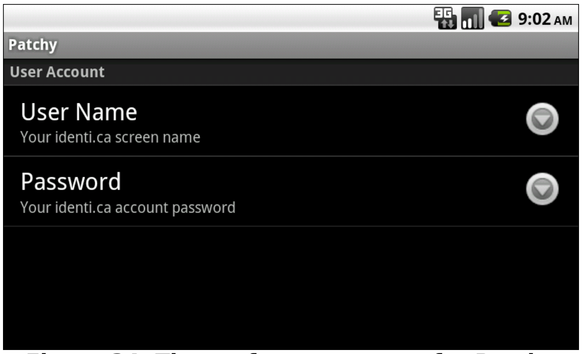

9:02 AM
Patchy
User Account
User Name
Your identi.ca screen name
Password
Your identi.ca account password

Figure 34. The preference screen for Patchy

Step #4: Use Account Information from Preferences

Now, we can get rid of the extraneous widgets on our layout and use the preferences for our account information. We can even arrange to update our `Twitter` object when the user changes account information.

First, go into `Patchy/res/layout/main.xml` and get rid of the first two `TableRow` elements, leaving you with:

```
<TableLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:layout_width="fill_parent"
  android:layout_height="wrap_content"
  android:stretchColumns="1"
  >
  <TableRow>
    <TextView android:text="Status:" />
    <EditText android:id="@+id/status"
      android:singleLine="false"
      android:gravity="top"
      android:lines="5"
      android:scrollHorizontally="false"
      android:maxLines="5"
      android:maxWidth="200sp"
    />
  </TableRow>
  <Button android:id="@+id/send"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:text="Send"
  />
</TableLayout>
```

Then, eliminate references to the removed widgets from the list of data members and from `onCreate()`.

Next, create a private `SharedPreferences` data member named `prefs` and set it up in `onCreate()`:

```
prefs=PreferenceManager.getDefaultSharedPreferences(this);
prefs.registerOnSharedPreferenceChangeListener(prefListener);
```

The aforementioned code references an `prefListener` object, so define it as follows:

```
private SharedPreferences.OnSharedPreferenceChangeListener prefListener=
  new SharedPreferences.OnSharedPreferenceChangeListener() {
  public void onSharedPreferenceChanged(SharedPreferences sharedPrefs, String
key) {
    if (key.equals("user") || key.equals("password")) {
      resetClient();
    }
  }
};
```

Basically, when the preference changes, we want to reset our `Twitter` client. This, of course, assumes we have a `Twitter` client hanging around, so create a private `Twitter` data member named `client`, and add two methods to work with it as follows:

```
synchronized private Twitter getClient() {
  if (client==null) {
    client=new Twitter(prefs.getString("user", ""),
                       prefs.getString("password", ""));

    client.setAPIRootUrl("https://identi.ca/api");
  }

  return(client);
}

synchronized private void resetClient() {
  client=null;
}
```

Finally, in `updateStatus()`, get rid of the references to the former widgets and use `getClient()` to lazy-create our `Twitter` object, as follows:

```
private void updateStatus() {
  try {
    getClient().updateStatus(status.getText().toString());
  }
  catch (Throwable t) {
    Log.e("Patchy", "Exception in updateStatus()", t);
    goBlooey(t);
  }
}
```

The net is that we will use one `Twitter` object, on our first status update, until the application is closed or the user changes credentials.

If you rebuild and reinstall the application, you should now be able to update your status, yet only enter the status information, using the user name and password from the preferences.

Here is the complete implementation of `Patchy` after completing this tutorial:

```
package apt.tutorial.two;

import android.app.Activity;
import android.app.AlertDialog;
import android.content.Intent;
import android.content.SharedPreferences;
import android.os.Bundle;
import android.preference.PreferenceManager;
import android.view.Menu;
import android.view.MenuInflater;
import android.view.MenuItem;
import android.view.View;
import android.util.Log;
import android.widget.Button;
import android.widget.EditText;
import winterwell.jtwitter.Twitter;

public class Patchy extends Activity {
  private EditText status=null;
  private SharedPreferences prefs=null;
  private Twitter client=null;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);

    status=(EditText)findViewById(R.id.status);

    Button send=(Button)findViewById(R.id.send);

    send.setOnClickListener(onSend);

    prefs=PreferenceManager.getDefaultSharedPreferences(this);
    prefs.registerOnSharedPreferenceChangeListener(prefListener);
  }

  @Override
  public boolean onCreateOptionsMenu(Menu menu) {
    new MenuInflater(getApplication())
                              .inflate(R.menu.option, menu);

    return(super.onCreateOptionsMenu(menu));
  }

  @Override
  public boolean onOptionsItemSelected(MenuItem item) {
    if (item.getItemId()==R.id.prefs) {
      startActivity(new Intent(this, EditPreferences.class));

      return(true);
    }

    return(super.onOptionsItemSelected(item));
  }

  synchronized private Twitter getClient() {
    if (client==null) {
      client=new Twitter(prefs.getString("user", ""),
                         prefs.getString("password", ""));

      client.setAPIRootUrl("https://identi.ca/api");
    }

    return(client);
  }

  synchronized private void resetClient() {
    client=null;
  }

  private void updateStatus() {
    try {
      getClient().updateStatus(status.getText().toString());
    }
    catch (Throwable t) {
      Log.e("Patchy", "Exception in updateStatus()", t);
      goBlooey(t);
    }
  }

  private void goBlooey(Throwable t) {
    AlertDialog.Builder builder=new AlertDialog.Builder(this);

    builder
      .setTitle("Exception!")
      .setMessage(t.toString())
      .setPositiveButton("OK", null)
      .show();
  }

  private View.OnClickListener onSend=new View.OnClickListener() {
    public void onClick(View v) {
      updateStatus();
    }
  };

  private SharedPreferences.OnSharedPreferenceChangeListener prefListener=
    new SharedPreferences.OnSharedPreferenceChangeListener() {
    public void onSharedPreferenceChanged(SharedPreferences sharedPrefs, String
key) {
      if (key.equals("user") || key.equals("password")) {
        resetClient();
      }
    }
  };
}
```

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Add a checkbox to toggle whether the activity is creating a direct message or a status update. If the checkbox is checked, enable a `Spinner` containing the list of the user's followers (obtained from `getFollowers()`). For a direct message, use `sendMessage()` on the

`Twitter` object. You may need to "follow" some classmates for everyone to have followers in their accounts to direct message.

- Use the `getStatus()` method on `Twitter` to display the user's current status at the top of the activity when the activity is opened. Re-fetch the status one second after submitting a status update, so the current status shows identi.ca's rendition of your status – a good way to make sure the round-trip of status information is working as you expect.
- Store the password in an encrypted form in the user preferences, so that if somebody hacked a user's phone and got the preference store, they would still need the encryption key to find out the user's account password.

Further Reading

You can learn more about the rules for what third-party code will work with Android in the "Leveraging Java Libraries" chapter of The Busy Coder's Guide to Android Development.

TUTORIAL 17

Listening To Your Friends

In this tutorial, we will start watching our friends' timelines, polling them for updates in a background thread managed by a service.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `16-JAR` edition of `Patchy` to use as a starting point.

Step #1: Create a Service Stub

Since we are creating a service to monitor information related to our account, let us create a service named `PostMonitor` (so named because identi.ca supports the original Twitter API). Create a file named `Patchy/src/apt/tutorial/two/PostMonitor.java` with the following content:

```
package apt.tutorial.two;

import android.app.Service;
import android.content.Intent;
import android.os.IBinder;

public class PostMonitor extends Service {
  @Override
  public void onCreate() {
    super.onCreate();
  }

  @Override
  public IBinder onBind(Intent intent) {
    return(null);
  }

  @Override
  public void onDestroy() {
    super.onDestroy();
  }
}
```

We also need to add our service to `AndroidManifest.xml`, so add `<service android:name = ".PostMonitor" />` inside the `<application>` element.

At this point, your project will still compile and run, though our service is not yet doing anything.

Step #2: Set Up a Background Thread

Next, we need a well-managed background thread that can do our timeline polling for us.

First, add an import for `java.util.concurrent.atomic.AtomicBoolean`, along with a private `AtomicBoolean` data member named `active`. Initialize this to `true`.

Also, define a static int value named `POLL_PERIOD` to be the amount of time you want between timeline polling operations. Please make this no less than `60000` (one minute in milliseconds).

Then, create a `Runnable` named `threadBody` that will loop, sleeping `POLL_PERIOD` each pass, until `active` is toggled to `false`:

```
private Runnable threadBody=new Runnable() {
  public void run() {
    while (active.get()) {
      // do something with Twitter

      SystemClock.sleep(POLL_PERIOD);
    }
  }
};
```

In `onCreate()`, add a statement to start up our background thread on `threadBody`:

```
@Override
public void onCreate() {
  super.onCreate();

  new Thread(threadBody).start();
}
```

Finally, in `onDestroy()`, set the `active` flag to `false`. Once the background thread wakes up from its current sleep cycle, it will see the `false` flag and fall out of its loop, terminating its thread:

```
@Override
public void onDestroy() {
  super.onDestroy();

  active.set(false);
}
```

Step #3: Poll Your Friends

Now, we have a service that will do work in the background. We just need to set up the work itself.

What we want to do is load our timeline (with our status and those from our friends) every poll period and find out those that are new. To do this, we need to create a `Twitter` object, use it to load the timeline, track the already-seen status messages, and identify the new ones. Right now, let us focus on loading the timeline.

First, add an import to `winterwell.jtwitter.Twitter` so we can create `Twitter` objects. We will also need `java.util.List` in a moment, so add an import for it as well.

Then, in our threadBody loop, add a call to a poll() method:

```
private Runnable threadBody=new Runnable() {
  public void run() {
    while (active.get()) {
      poll();
      SystemClock.sleep(POLL_PERIOD);
    }
  }
};
```

Finally, add this as the implementation of poll() in PostMonitor:

```
private void poll() {
  Twitter client=new Twitter();  // need credentials!
  List<Twitter.Status> timeline=client.getFriendsTimeline();
}
```

While this will compile, it will not run, since we do not have our user name or password. We will get that from the Patchy client of our service in the next tutorial.

Right now, all we are doing in poll() is creating a fresh Twitter object and using it to load the timeline via getFriendsTimeline().

Step #4: Find New Statuses

Once we have our timeline, we need to figure out which of the statuses are new. On the first poll, all will be new; subsequent polls should have a handful of new statuses, if any.

For the time being, let us track the already-seen status IDs via a Set<Long>, so add the following data member (and the HashSet and Set imports to match):

```
private Set<Long> seenStatus=new HashSet<Long>();
```

Then, we can walk the timeline, see if each status ID is in the Set, and process those that are not, via this change to poll():

```
private void poll() {
  Twitter client=new Twitter();  // need credentials!
  List<Twitter.Status> timeline=client.getFriendsTimeline();

  for (Twitter.Status s : timeline) {
    if (!seenStatus.contains(s.id)) {
      // found a new one!
      seenStatus.add(s.id);
    }
  }
}
```

Of course, eventually, we will need to alert `Patchy` to the new statuses, but we can leave that for the next tutorial.

Step #5: Set up the Public API

Finally, we need to begin the process of adding a public API that the `Patchy` activity will be able to access.

First, we should define a Java interface that will represent our public API. Create a `src/apt/tutorial/IPostMonitor.java` file with the following content:

```
package apt.tutorial;

public interface IPostMonitor {
}
```

Then, we need to create a "binder" that implements this API. The binder will be supplied to `Patchy` when it binds to the `PostMonitor` service. So, add the following inner class to `PostMonitor`:

```
public class LocalBinder extends Binder implements IPostMonitor {
  void registerAccount(String user, String password) {
  }
}
```

Next, create an instance of our `LocalBinder` as part of initializing our `PostMonitor` instance:

```
private final Binder binder=new LocalBinder();
```

Finally, return that binder from `onBind()`:

```
@Override
public IBinder onBind(Intent intent) {
  return(binder);
}
```

Of course, this API does not do much, but we will expand it shortly.

At this point, you can compile your project, but it will not run properly, because we have not provided account information to the JTwitter API. That is fine for now, as we will correct that flaw in the next tutorial.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Add a preference for the timeline polling period. Use that polling period in the service, including changing the polling period when the preference changes.
- If you added direct-message support in the previous tutorial, have the service also poll for changes to the list of followers, to eventually control the contents of your direct-message `Spinner`.

Further Reading

You can learn more about the roles of services and how to create them in the "Creating a Service" chapter of The Busy Coder's Guide to Android Development.

TUTORIAL 18

No, Really Listening To Your Friends

In the previous tutorial, we set up a service to watch for new timeline entries from our friends. The service merely finds out about these new statuses – now we need to get those someplace for our activity to display them.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the 17-CreateService edition of Patchy to use as a starting point.

Step #1: Define the Callback

We need to provide some sort of callback to the service, so our activity can be notified when new status updates are available. With that in mind, create an Patchy/src/apt/tutorial/IPostListener.java interface as follows:

```
package apt.tutorial;

public interface IPostListener {
  void newFriendStatus(String friend, String status,
                        String createdAt);
}
```

Step #2: Enable Callbacks in the Service

Now we need to set up a means for the service client (Patchy) to start the service and register an IPostListener that will be invoked when a new status arrives. The callback will be associated with a user name and password, so we have the credentials with which to call identi.ca via its API.

First, let us create an inner class in PostMonitor to represent the callback and login credentials. Add this implementation of Account to your PostMonitor:

```
class Account {
  String user=null;
  String password=null;
  IPostListener callback=null;

  Account(String user, String password,
          IPostListener callback) {
    this.user=user;
    this.password=password;
    this.callback=callback;
  }
}
```

Next, import java.util.Map and java.util.concurrent.ConcurrentHashMap and set up a private data member representing the roster of outstanding accounts:

```
private Map<IPostListener, Account> accounts=
        new ConcurrentHashMap<IPostListener, Account>();
```

Now, we can set up public APIs on our binder for our client to use to register and remove an account, by extending IPostMonitor:

```
package apt.tutorial;

import apt.tutorial.IPostListener;

public interface IPostMonitor {
  void registerAccount(String user, String password,
                       IPostListener callback);
  void removeAccount(IPostListener callback);
}
```

...and by augmenting its implementation:

```
public class LocalBinder extends Binder implements IPostMonitor {
  public void registerAccount(String user, String password,
                              IPostListener callback) {
    Account l=new Account(user, password, callback);

    poll(l);
    accounts.put(callback, l);
  }

  public void removeAccount(IPostListener callback) {
    accounts.remove(callback);
  }
}
```

Notice that we call `poll()` with our `Account` when it is registered. This will fetch our current timeline right away, rather than wait for our polling loop to cycle back around. The downside is that this `poll()` is called on the main thread rather than a background thread – we will address this in a later tutorial.

Next, update our `threadBody` to make use of our roster of `Account` objects:

```
private Runnable threadBody=new Runnable() {
  public void run() {
    while (active.get()) {
      for (Account l : accounts.values()) {
        poll(l);
      }

      SystemClock.sleep(POLL_PERIOD);
    }
  }
};
```

This too calls `poll()` with the `Account` information. Hence, we need to update `poll()` to use the `Account` and call the callback on new status messages:

```
private void poll(Account l) {
  try {
    Twitter client=new Twitter(l.user, l.password);

    client.setAPIRootUrl("https://identi.ca/api");

    List<Twitter.Status> timeline=client.getFriendsTimeline();

    for (Twitter.Status s : timeline) {
      if (!seenStatus.contains(s.id)) {
        l.callback.newFriendStatus(s.user.screenName, s.text,
                                   s.createdAt.toString());
        seenStatus.add(s.id);
      }
    }
  }
  catch (Throwable t) {
    android.util.Log.e("PostMonitor",
                     "Exception in poll()", t);
  }
}
```

Step #3: Manage the Service and Register the Account

Next, we need to take steps in `Patchy` to connect to the `PostMonitor` service and arrange to get callbacks when new timeline entries are ready.

First, modify `onCreate()` in `Patchy` to call `bindService()`, which will auto-create our `PostMonitor` service and give us control when it has been started and bound:

```
bindService(new Intent(this, PostMonitor.class), svcConn,
            BIND_AUTO_CREATE);
```

Specifically, it gives us control via a `ServiceConnection` object, which you will need to add as a data member of `Patchy`:

```
private ServiceConnection svcConn=new ServiceConnection() {
  public void onServiceConnected(ComponentName className,
                                 IBinder binder) {
    service=(IPostMonitor)binder;

    try {
      service.registerAccount(prefs.getString("user", null),
                              prefs.getString("password", null),
                              listener);
    }
    catch (Throwable t) {
      Log.e("Patchy", "Exception in call to registerAccount()", t);
      goBlooey(t);
    }
  }
  public void onServiceDisconnected(ComponentName className) {
    service=null;
  }
};
```

Notice how it will obtain our `IPostMonitor` API via the "binder" object passed to it – since this is a local service, in the same VM, this is the actual `LocalBinder` object from `PostMonitor`. Also note that we register our account information and an `IPostListener` instance at this point.

We need to unbind our service, after removing our account, when we are done, so add an implementation of `onDestroy()` to `Patchy` as follows:

```
@Override
public void onDestroy() {
  super.onDestroy();

  service.removeAccount(listener);
  unbindService(svcConn);
}
```

Our code in `onCreate()` refers to a `listener` instance, so add a definition of it as an `IPostListener` implementation to `Patchy`:

```
private IPostListener listener=new IPostListener() {
  public void newFriendStatus(String friend, String status,
                              String createdAt) {
  }
};
```

Right now, this listener does not do anything – we will address that minor shortcoming in the next section.

At this point, we register our account at startup and remove it on shutdown. What we are missing is account changes. If the user, via the preferences, adjusts the user name or password, we need to get that information to the service. The cleanest way to do that is to remove our current account and register a fresh one.

With that in mind, modify `resetClient()` to handle that chore:

```
synchronized private void resetClient() {
  client=null;
  service.removeAccount(listener);
  service.registerAccount(prefs.getString("user", ""),
                          prefs.getString("password", ""),
                          listener);
}
```

Step #4: Display the Timeline

At this point, `Patchy` is fully integrated with the service and should receive callbacks on timeline changes. However, it does not do anything with those changes. So, we need to add something to our UI to actually display the timeline. One easy way to do that is via a `ListView` and custom row layout – that way, the timeline can be as long as we want, and it will scroll to show all of the entries.

So, modify `Patchy/res/layout/main.xml` to add a `ListView`, as shown below:

```
<TableLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:layout_width="fill_parent"
  android:layout_height="wrap_content"
  android:stretchColumns="1"
  >
  <TableRow>
    <TextView android:text="Status:" />
    <EditText android:id="@+id/status"
      android:singleLine="false"
      android:gravity="top"
      android:lines="5"
      android:scrollHorizontally="false"
      android:maxLines="5"
      android:maxWidth="200sp"
    />
  </TableRow>
  <Button android:id="@+id/send"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:text="Send"
  />
  <ListView android:id="@+id/timeline"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
  />
</TableLayout>
```

We also need to create a layout for our rows. We have three pieces of information to display: the screen name of the friend, the status message, and the date the status was modified. Create `Patchy/res/layout/row.xml` with the following layout to display all three of those pieces:

```
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:layout_width="fill_parent"
  android:layout_height="wrap_content"
  android:orientation="vertical"
  android:padding="4px"
  >
  <LinearLayout
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:orientation="horizontal"
    android:layout_weight="1"
    android:gravity="center_vertical"
    >
    <TextView android:id="@+id/friend"
      android:layout_width="0px"
      android:layout_height="wrap_content"
      android:layout_weight="1"
      android:gravity="left"
      android:textStyle="bold"
      android:singleLine="true"
      android:ellipsize="end"
    />
    <TextView android:id="@+id/created_at"
      android:layout_width="0px"
      android:layout_height="wrap_content"
      android:layout_weight="1"
      android:gravity="right"
      android:singleLine="true"
      android:ellipsize="end"
    />
  </LinearLayout>
  <TextView android:id="@+id/status"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:layout_weight="1"
    android:gravity="center_vertical"
    android:singleLine="false"
  />
</LinearLayout>
```

Now we need to replicate a lot of the logic from `LunchList` to populate this custom list in `Patchy`.

Add a `TimelineEntry` inner class to `Patchy` to hold a single timeline entry:

```
class TimelineEntry {
  String friend="";
  String createdAt="";
  String status="";

  TimelineEntry(String friend, String createdAt,
              String status) {
    this.friend=friend;
    this.createdAt=createdAt;
    this.status=status;
  }
}
```

Now, add an `ArrayList` of `TimelineEntry` objects to serve as the timeline itself, as a private data member of `Patchy`:

```
private List<TimelineEntry> timeline=new ArrayList<TimelineEntry>();
```

Then, add a `TimelineEntryWrapper` that will update one of our rows with the contents of a `TimelineEntry`:

```
class TimelineEntryWrapper {
  private TextView friend=null;
  private TextView createdAt=null;
  private TextView status=null;
  private View row=null;

  TimelineEntryWrapper(View row) {
    this.row=row;
  }

  void populateFrom(TimelineEntry s) {
    getFriend().setText(s.friend);
    getCreatedAt().setText(s.createdAt);
    getStatus().setText(s.status);
  }

  TextView getFriend() {
    if (friend==null) {
      friend=(TextView)row.findViewById(R.id.friend);
    }

    return(friend);
  }

  TextView getCreatedAt() {
    if (createdAt==null) {
      createdAt=(TextView)row.findViewById(R.id.created_at);
    }
    return(createdAt);
  }

  TextView getStatus() {
    if (status==null) {
      status=(TextView)row.findViewById(R.id.status);
    }

    return(status);
  }
}
```

Next, add a `TimelineAdapter` implementation that will display our timeline:

```
class TimelineAdapter extends ArrayAdapter<TimelineEntry> {
  TimelineAdapter() {
    super(Patchy.this, R.layout.row, timeline);
  }

  public View getView(int position, View convertView,
                      ViewGroup parent) {
    View row=convertView;
    TimelineEntryWrapper wrapper=null;

    if (row==null) {
      LayoutInflater inflater=getLayoutInflater();

      row=inflater.inflate(R.layout.row, parent, false);
      wrapper=new TimelineEntryWrapper(row);
      row.setTag(wrapper);
    }
    else {
      wrapper=(TimelineEntryWrapper)row.getTag();
    }

    wrapper.populateFrom(timeline.get(position));

    return(row);
  }
}
```

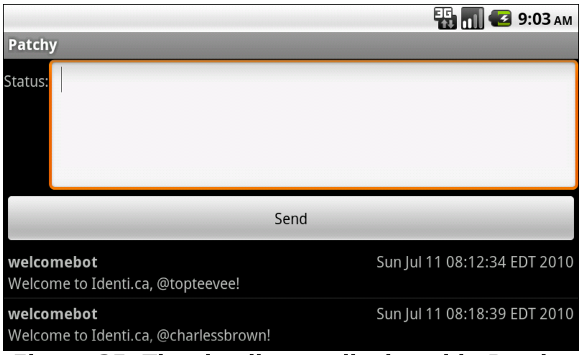
We need to have a `TimelineAdapter` as a private data member, so add one (initialized to `null`), then instantiate the adapter in `onCreate()`:

```
@Override
public void onCreate(Bundle savedInstanceState) {
  super.onCreate(savedInstanceState);
  setContentView(R.layout.main);

  status=(EditText)findViewById(R.id.status);
  Button send=(Button)findViewById(R.id.send);

  send.setOnClickListener(onSend);

  prefs=PreferenceManager.getDefaultSharedPreferences(this);
  prefs.registerOnSharedPreferenceChangeListener(prefListener);

  bindService(new Intent(this, PostMonitor.class), svcConn,
              BIND_AUTO_CREATE);

  adapter=new TimelineAdapter();
  ((ListView)findViewById(R.id.timeline)).setAdapter(adapter);
}
```

Finally, add logic to our `listener` object to create a `TimelineEntry` and add it to the top of the `TimelineAdapter`, so new entries are added to the head of the list:

```
private IPostListener listener=new IPostListener() {
  public void newFriendStatus(final String friend, final String status,
                              final String createdAt) {
    runOnUiThread(new Runnable() {
      public void run() {
        adapter.insert(new TimelineEntry(friend,
                                          createdAt,
                                          status),
                        0);
      }
    });
  }
};
```

With all that behind you, recompile and reinstall the application. Now, `Patchy` will display your timeline and should keep the timeline current as new entries roll in:



welcomebot Sun Jul 11 08:12:34 EDT 2010
Welcome to Identi.ca, @topteevee!

welcomebot Sun Jul 11 08:18:39 EDT 2010
Welcome to Identi.ca, @charlessbrown!

Figure 35. The timeline as displayed in Patchy

Most likely, you will find that some poll requests fail with a "TwitterException: -1" recorded in LogCat. This is due to some issue with the identi.ca Web service disconnecting some API requests. It should succeed much of the time, and so these sporadic failures are not your fault.

Here is a full implementation of `Patchy` after all of the above changes:

```java
package apt.tutorial.two;

import android.app.Activity;
import android.app.AlertDialog;
import android.content.ComponentName;
import android.content.Intent;
import android.content.ServiceConnection;
import android.content.SharedPreferences;
import android.os.Bundle;
import android.os.IBinder;
import android.preference.PreferenceManager;
import android.view.LayoutInflater;
import android.view.Menu;
import android.view.MenuInflater;
import android.view.MenuItem;
import android.view.View;
import android.view.ViewGroup;
import android.util.Log;
import android.widget.ArrayAdapter;
import android.widget.Button;
import android.widget.EditText;
import android.widget.ListView;
import android.widget.TextView;
import java.util.ArrayList;
import java.util.List;
import winterwell.jtwitter.Twitter;
import apt.tutorial.IPostListener;
import apt.tutorial.IPostMonitor;
```

```
public class Patchy extends Activity {
  private EditText status=null;
  private SharedPreferences prefs=null;
  private Twitter client=null;
  private List<TimelineEntry> timeline=new ArrayList<TimelineEntry>();
  private TimelineAdapter adapter=null;
  private IPostMonitor service=null;
  private ServiceConnection svcConn=new ServiceConnection() {
    public void onServiceConnected(ComponentName className,
                                   IBinder binder) {
      service=(IPostMonitor)binder;

      try {
        service.registerAccount(prefs.getString("user", null),
                               prefs.getString("password", null),
                               listener);
      }
      catch (Throwable t) {
        Log.e("Patchy", "Exception in call to registerAccount()", t);
        goBlooey(t);
      }
    }

    public void onServiceDisconnected(ComponentName className) {
      service=null;
    }
  };

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);

    status=(EditText)findViewById(R.id.status);

    Button send=(Button)findViewById(R.id.send);

    send.setOnClickListener(onSend);

    prefs=PreferenceManager.getDefaultSharedPreferences(this);
    prefs.registerOnSharedPreferenceChangeListener(prefListener);

    bindService(new Intent(this, PostMonitor.class), svcConn,
               BIND_AUTO_CREATE);

    adapter=new TimelineAdapter();
    ((ListView)findViewById(R.id.timeline)).setAdapter(adapter);
  }

  @Override
  public void onDestroy() {
    super.onDestroy();
    service.removeAccount(listener);
    unbindService(svcConn);
  }

  @Override
  public boolean onCreateOptionsMenu(Menu menu) {
    new MenuInflater(getApplication())
                                  .inflate(R.menu.option, menu);

    return(super.onCreateOptionsMenu(menu));
  }

  @Override
  public boolean onOptionsItemSelected(MenuItem item) {
    if (item.getItemId()==R.id.prefs) {
      startActivity(new Intent(this, EditPreferences.class));

      return(true);
    }

    return(super.onOptionsItemSelected(item));
  }

  synchronized private Twitter getClient() {
    if (client==null) {
      client=new Twitter(prefs.getString("user", ""),
                         prefs.getString("password", ""));
      client.setAPIRootUrl("https://identi.ca/api");
    }

    return(client);
  }

  synchronized private void resetClient() {
    client=null;
    service.removeAccount(listener);
    service.registerAccount(prefs.getString("user", ""),
                           prefs.getString("password", ""),
                           listener);
  }

  private void updateStatus() {
    try {
      getClient().updateStatus(status.getText().toString());
    }
    catch (Throwable t) {
      Log.e("Patchy", "Exception in updateStatus()", t);
      goBlooey(t);
    }
  }

  private void goBlooey(Throwable t) {
    AlertDialog.Builder builder=new AlertDialog.Builder(this);
    builder
      .setTitle("Exception!")
      .setMessage(t.toString())
      .setPositiveButton("OK", null)
      .show();
  }

  private View.OnClickListener onSend=new View.OnClickListener() {
    public void onClick(View v) {
      updateStatus();
    }
  };

  private SharedPreferences.OnSharedPreferenceChangeListener prefListener=
    new SharedPreferences.OnSharedPreferenceChangeListener() {
    public void onSharedPreferenceChanged(SharedPreferences sharedPrefs,
                                          String key) {
      if (key.equals("user") || key.equals("password")) {
        resetClient();
      }
    }
  };

  private IPostListener listener=new IPostListener() {
    public void newFriendStatus(final String friend, final String status,
                               final String createdAt) {
      runOnUiThread(new Runnable() {
        public void run() {
          adapter.insert(new TimelineEntry(friend,
                                           createdAt,
                                           status),
                         0);
        }
      });
    }
  };

  class TimelineEntry {
    String friend="";
    String createdAt="";
    String status="";

    TimelineEntry(String friend, String createdAt,
                  String status) {
      this.friend=friend;
      this.createdAt=createdAt;
      this.status=status;
    }
  }

  class TimelineAdapter extends ArrayAdapter<TimelineEntry> {
    TimelineAdapter() {
      super(Patchy.this, R.layout.row, timeline);
    }
    public View getView(int position, View convertView,
                          ViewGroup parent) {
      View row=convertView;
      TimelineEntryWrapper wrapper=null;

      if (row==null) {
        LayoutInflater inflater=getLayoutInflater();

        row=inflater.inflate(R.layout.row, parent, false);
        wrapper=new TimelineEntryWrapper(row);
        row.setTag(wrapper);
      }
      else {
        wrapper=(TimelineEntryWrapper)row.getTag();
      }

      wrapper.populateFrom(timeline.get(position));

      return(row);
    }
  }

  class TimelineEntryWrapper {
    private TextView friend=null;
    private TextView createdAt=null;
    private TextView status=null;
    private View row=null;

    TimelineEntryWrapper(View row) {
      this.row=row;
    }

    void populateFrom(TimelineEntry s) {
      getFriend().setText(s.friend);
      getCreatedAt().setText(s.createdAt);
      getStatus().setText(s.status);
    }

    TextView getFriend() {
      if (friend==null) {
        friend=(TextView)row.findViewById(R.id.friend);
      }

      return(friend);
    }

    TextView getCreatedAt() {
      if (createdAt==null) {
        createdAt=(TextView)row.findViewById(R.id.created_at);
      }

      return(createdAt);
    }
    TextView getStatus() {
      if (status==null) {
        status=(TextView)row.findViewById(R.id.status);
      }

      return(status);
    }
  }
}
```

Similarly, here is a full implementation of `PostMonitor` as of this point:

```
package apt.tutorial.two;

import android.app.Service;
import android.content.Intent;
import android.os.Binder;
import android.os.IBinder;
import android.os.SystemClock;
import java.util.HashSet;
import java.util.List;
import java.util.Map;
import java.util.Set;
import java.util.concurrent.ConcurrentHashMap;
import java.util.concurrent.atomic.AtomicBoolean;
import winterwell.jtwitter.Twitter;
import apt.tutorial.IPostListener;
import apt.tutorial.IPostMonitor;

public class PostMonitor extends Service {
  private static final int POLL_PERIOD=60000;
  private AtomicBoolean active=new AtomicBoolean(true);
  private Set<Long> seenStatus=new HashSet<Long>();
  private Map<IPostListener, Account> accounts=
          new ConcurrentHashMap<IPostListener, Account>();
  private final Binder binder=new LocalBinder();

  @Override
  public void onCreate() {
    super.onCreate();

    new Thread(threadBody).start();
  }

  @Override
  public IBinder onBind(Intent intent) {
    return(binder);
  }

  @Override
  public void onDestroy() {
    super.onDestroy();
    active.set(false);
  }

  private void poll(Account l) {
    try {
      Twitter client=new Twitter(l.user, l.password);

      client.setAPIRootUrl("https://identi.ca/api");

      List<Twitter.Status> timeline=client.getFriendsTimeline();

      for (Twitter.Status s : timeline) {
        if (!seenStatus.contains(s.id)) {
          l.callback.newFriendStatus(s.user.screenName, s.text,
                                   s.createdAt.toString());
          seenStatus.add(s.id);
        }
      }
    }
    catch (Throwable t) {
      android.util.Log.e("PostMonitor",
                       "Exception in poll()", t);
    }
  }

  private Runnable threadBody=new Runnable() {
    public void run() {
      while (active.get()) {
        for (Account l : accounts.values()) {
          poll(l);
        }

        SystemClock.sleep(POLL_PERIOD);
      }
    }
  };

  class Account {
    String user=null;
    String password=null;
    IPostListener callback=null;

    Account(String user, String password,
            IPostListener callback) {
      this.user=user;
      this.password=password;
      this.callback=callback;
    }
  }

  public class LocalBinder extends Binder implements IPostMonitor {
    public void registerAccount(String user, String password,
                                 IPostListener callback) {
```

```
      Account l=new Account(user, password, callback);

      poll(l);
      accounts.put(callback, l);
    }

    public void removeAccount(IPostListener callback) {
      accounts.remove(callback);
    }
  }
}
```

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Switch to using a database as the storage mechanism for statuses, rather than RAM. The service can insert new statuses into the database and keep the table trimmed to some maximum number of statuses (to keep storage requirements down). The callback would notify the activity that there were updates requiring a refresh of the activity's `CursorAdapter` on the database. Consider using a preference to allow the user to control the maximum number of statuses to track.
- Right now, when several timeline entries are added through one API call (e.g., the initial poll), they are put in the list in the wrong order. Change `Patchy` and `PostMonitor` to have them appear in the proper order, no matter how many entries are retrieved in a single poll.
- If you added direct-message support in the previous tutorials, have the service also invoke the callback on a change to the follower roster, and have that affect the follower `Spinner` contents.
- Have the background thread running only if there is one or more registered listeners.

Further Reading

For more coverage of the local binding pattern and connecting to a service that way, you will want to look at the "Creating a Service" and "Invoking a Service" chapters of The Busy Coder's Guide to Android Development.

TUTORIAL 19

Your Friends Seem Remote

In the previous example, we implemented the friends timeline via a local service. Now, let us re-implement this as a remote service, so we can allow other applications to possibly use our service.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `18-LocalService` edition of `Patchy` to use as a starting point.

Step #1: Back Up or Branch Your Project

This tutorial is a branch off of the main flow of the tutorials. The next tutorial will have you pick up where the last tutorial left off, so that you do not need to keep dealing with the remote service throughout the entire rest of the book. Hence, you may want to back up or otherwise keep a copy of your code as it exists, so you can return to it later.

Step #2: Create a Fresh Project

First, we should create a separate project for the `PostMonitor`, to simulate it being some third-party component and to force it to run in a separate process as a separate user.

So, via `android create project` or Eclipse, create a `TMonitor` project peer of `Patchy`, using the package `apt.tutorial.three` (so `TMonitor` and `Patchy` can both be on the emulator at the same time).

Step #3: Move the Service to the New Project

Now, let us move the `PostMonitor` code from `Patchy` into the new `TMonitor` project.

First, move `Patchy/src/apt/tutorial/two/PostMonitor.java` to `TMonitor/src/apt/tutorial/two`, replacing the automatically-generated `PostMonitor.java`. Also, go in and fix up the package statement, reflecting that the new `PostMonitor` is in `apt.tutorial.three`.

Then, since both `Patchy` and `PostMonitor` need the JTwitter JAR, copy that jar from `Patchy/libs/` to `TMonitor/libs/`.

Next, modify `TMonitor/AndroidManifest.xml` to get rid of the `<activity>` element (since `TMonitor` has no activity) and replace it with the `<service>` element from `Patchy/AndroidManifest.xml`. While you have `Patchy/AndroidManifest.xml` open, get rid of that `<service>` element after you have put it in the `TMonitor/AndroidManifest.xml` file.

Finally, since we removed the `PostMonitor` class from `Patchy`, we need to get rid of the compiled edition of that class. If you are using Eclipse, force a rebuild of your project; otherwise, get rid of `Patchy/bin/`, so on the next recompile, it will not have any of the old code lying around.

At this point, if you recompile each project, you will see they both have compiler errors – PostMonitor cannot find IPostListener and Patchy cannot find PostMonitor, for example.

Step #4: Implement and Copy the AIDL

Now, we need to implement AIDL to represent the interface that the service exposes to the client and the callback that the client exposes to the service.

We already almost have the callback AIDL, since AIDL closely resembles Java interfaces. Move Patchy/src/apt/tutorial/two/IPostListener.java to Patchy/src/apt/tutorial/IPostListener.aidl, moving it up one directory and changing the file extension to .aidl. Then, remove the public keywords, and the AIDL is set. Repeat this process with IPostMonitor.java as well.

Then, copy the new IPostListener.aidl and IPostMonitor.aidl files to the corresponding directory in TMonitor (TMonitor/src/apt/tutorial). We also have to deal with the possibility of an android.os.RemoteException when using the callback, since the calling process might have unexpectedly terminated. So, we need to wrap our callback use in a try/catch block as follows:

```
private void poll(Account l) {
  try {
    Twitter client=new Twitter(l.user, l.password);

    client.setAPIRootUrl("https://identi.ca/api");

    List<Twitter.Status> timeline=client.getFriendsTimeline();

    for (Twitter.Status s : timeline) {
      if (!seenStatus.contains(s.id)) {
        try {
          l.callback.newFriendStatus(s.user.screenName, s.text,
                                     s.createdAt.toString());
          seenStatus.add(s.id);
        }
        catch (Throwable t) {
          Log.e("PostMonitor", "Exception in callback", t);
        }
      }
    }
  }
  catch (Throwable t) {
    Log.e("PostMonitor", "Exception in poll()", t);
  }
}
```

Step #5: Implement the Client Side

Next, we need to fix up the Patchy client, so it uses the remote service interface instead of attempting to access a local PostMonitor.

Then, we need to make one slight modification to our IPostListener implementation: our anonymous inner class actually has to implement IPostListener.Stub instead of IPostListener. So, change the listener implementation to:

```
private IPostListener listener=new IPostListener.Stub() {
  public void newFriendStatus(final String friend,
                              final String status,
                              final String createdAt) {
    runOnUiThread(new Runnable() {
      public void run() {
        adapter.insert(new TimelineEntry(friend,
                                         createdAt,
                                         status), 0);
      }
    });
  }
};
```

Next, modify your ServiceConnection data member named svcConn to have following implementation, to change the way we access our service interface:

```
private ServiceConnection svcConn=new ServiceConnection() {
  public void onServiceConnected(ComponentName className,
                                 IBinder binder) {
    service=IPostMonitor.Stub.asInterface(binder);

    try {
      service.registerAccount(prefs.getString("user", null),
                              prefs.getString("password", null),
                              listener);
    }
    catch (Throwable t) {
      Log.e("Patchy", "Exception in call to registerAccount()", t);
      goBlooey(t);
    }
  }

  public void onServiceDisconnected(ComponentName className) {
    service=null;
  }
};
```

Then, in `onDestroy()`, wrap the `removeCallback()` in a `try/catch` block, to deal with the possibility that our connection to the `PostMonitor` service has been broken for some reason:

```
@Override
public void onDestroy() {
  super.onDestroy();

  try {
    service.removeAccount(listener);
  }
  catch (Throwable t) {
    Log.e("Patchy", "Exception in call to removeAccount()", t);
    goBlooey(t);
  }

  unbindService(svcConn);
}
```

We also need to change `resetClient()` to wrap its service API calls in a `try/catch` block, as follows:

```
synchronized private void resetClient() {
  client=null;

  try {
    service.removeAccount(listener);
    service.registerAccount(prefs.getString("user", ""),
                          prefs.getString("password", ""),
                          listener);
  }
  catch (Throwable t) {
    Log.e("Patchy", "Exception in resetClient()", t);
    goBlooey(t);
  }
}
```

At this point, the Patchy project should compile cleanly. It will not run, though, without the corresponding service.

Step #6: Implement the Service Side

Finally, we need to make similar sorts of changes on the PostMonitor service.

First, modify TMonitor/AndroidManifest.xml to add an <intent-filter> (so Patchy can reference it from another process and package) and add the INTERNET permission that JTwitter will need:

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
      package="apt.tutorial.three"
      android:versionCode="1"
      android:versionName="1.0">
  <uses-permission android:name="android.permission.INTERNET" />
  <application android:label="@string/app_name">
    <service android:name=".PostMonitor">
      <intent-filter>
        <action android:name="apt.tutorial.IPostMonitor" />
      </intent-filter>
    </service>
  </application>
</manifest>
```

Next, change our binder object from being an instance of LocalBinder to being an instance of an IPostMonitor.Stub anonymous inner class instance as follows:

```
private final IPostMonitor.Stub binder=new IPostMonitor.Stub() {
  public void registerAccount(String user, String password,
                               IPostListener callback) {
    Account l=new Account(user, password, callback);

    poll(l);
    accounts.put(callback, l);
  }

  public void removeAccount(IPostListener callback) {
    accounts.remove(callback);
  }
};
```

The easiest way to make the above change is to change the first line of the LocalBinder definition to the first line in the above listing, add the semicolon at the end, and get rid of the separate declaration and initializer of binder.

Then, we need to do something about our polling logic, so when we register an account we do not tie up the UI thread of the client doing an immediate poll(), yet we still quickly get status updates rather than waiting a full minute. To help resolve this, we will use two polling periods: a one-second period when we have no accounts, and the original one-minute period for when we do have accounts. That way, we will find out about our first account within one second of it being registered; only then will we slow down, so as not to abuse the service.

To that end, add the following data members to PostMonitor:

```
private static final int INITIAL_POLL_PERIOD=1000;
private int pollPeriod=INITIAL_POLL_PERIOD;
```

Also, change threadBody to use the new polling logic:

```
private Runnable threadBody=new Runnable() {
  public void run() {
    while (active.get()) {
      for (Account l : accounts.values()) {
        poll(l);
        pollPeriod=POLL_PERIOD;
      }

      SystemClock.sleep(pollPeriod);
    }
  }
};
```

Now, you should be able to recompile and reinstall both projects. Launching Patchy will give you similar results as before – the difference being that now it is using the remote PostMonitor service, rather than a local one.

Here is an implementation of Patchy after making this tutorial's modifications:

```
package apt.tutorial.two;

import android.app.Activity;
import android.app.AlertDialog;
import android.content.ComponentName;
import android.content.Context;
import android.content.Intent;
import android.content.ServiceConnection;
import android.content.SharedPreferences;
import android.os.Bundle;
import android.os.IBinder;
import android.preference.PreferenceManager;
import android.view.LayoutInflater;
import android.view.Menu;
import android.view.MenuInflater;
import android.view.MenuItem;
import android.view.View;
import android.view.ViewGroup;
import android.util.Log;
import android.widget.ArrayAdapter;
import android.widget.Button;
import android.widget.EditText;
import android.widget.ListView;
import android.widget.TextView;
import java.util.ArrayList;
import java.util.List;
import winterwell.jtwitter.Twitter;
import apt.tutorial.IPostListener;
import apt.tutorial.IPostMonitor;

public class Patchy extends Activity {
  private EditText status=null;
  private SharedPreferences prefs=null;
  private Twitter client=null;
  private List<TimelineEntry> timeline=new ArrayList<TimelineEntry>();
  private TimelineAdapter adapter=null;
  private IPostMonitor service=null;
  private ServiceConnection svcConn=new ServiceConnection() {
    public void onServiceConnected(ComponentName className,
                                   IBinder binder) {
      service=IPostMonitor.Stub.asInterface(binder);

      try {
        service.registerAccount(prefs.getString("user", null),
                               prefs.getString("password", null),
                               listener);
      }
      catch (Throwable t) {
        Log.e("Patchy", "Exception in call to registerAccount()", t);
        goBlooey(t);
      }
    }

    public void onServiceDisconnected(ComponentName className) {
      service=null;
    }
  };

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);

    status=(EditText)findViewById(R.id.status);

    Button send=(Button)findViewById(R.id.send);

    send.setOnClickListener(onSend);

    prefs=PreferenceManager.getDefaultSharedPreferences(this);
    prefs.registerOnSharedPreferenceChangeListener(prefListener);

    bindService(new Intent(IPostMonitor.class.getName()),
                svcConn, Context.BIND_AUTO_CREATE);

    adapter=new TimelineAdapter();
    ((ListView)findViewById(R.id.timeline)).setAdapter(adapter);
  }

  @Override
  public void onDestroy() {
    super.onDestroy();

    try {
      service.removeAccount(listener);
    }
    catch (Throwable t) {
      Log.e("Patchy", "Exception in call to removeAccount()", t);
      goBlooey(t);
    }

    unbindService(svcConn);
  }

  @Override
  public boolean onCreateOptionsMenu(Menu menu) {
    new MenuInflater(getApplication())
                             .inflate(R.menu.option, menu);

    return(super.onCreateOptionsMenu(menu));
  }

  @Override
  public boolean onOptionsItemSelected(MenuItem item) {
    if (item.getItemId()==R.id.prefs) {
      startActivity(new Intent(this, EditPreferences.class));

      return(true);
    }

    return(super.onOptionsItemSelected(item));
  }

  synchronized private Twitter getClient() {
    if (client==null) {
      client=new Twitter(prefs.getString("user", ""),
                         prefs.getString("password", ""));
      client.setAPIRootUrl("https://identi.ca/api");
    }

    return(client);
  }

  synchronized private void resetClient() {
    client=null;

    try {
      service.removeAccount(listener);
      service.registerAccount(prefs.getString("user", ""),
                              prefs.getString("password", ""),
                              listener);
    }
    catch (Throwable t) {
      Log.e("Patchy", "Exception in resetClient()", t);
      goBlooey(t);
    }
  }

  private void updateStatus() {
    try {
      getClient().updateStatus(status.getText().toString());
    }
    catch (Throwable t) {
      Log.e("Patchy", "Exception in updateStatus()", t);
      goBlooey(t);
    }
  }

  private void goBlooey(Throwable t) {
    AlertDialog.Builder builder=new AlertDialog.Builder(this);

    builder
      .setTitle("Exception!")
      .setMessage(t.toString())
      .setPositiveButton("OK", null)
      .show();
  }

  private View.OnClickListener onSend=new View.OnClickListener() {
    public void onClick(View v) {
      updateStatus();
    }
  };

  private SharedPreferences.OnSharedPreferenceChangeListener prefListener=
    new SharedPreferences.OnSharedPreferenceChangeListener() {
    public void onSharedPreferenceChanged(SharedPreferences sharedPrefs, String
key) {
      if (key.equals("user") || key.equals("password")) {
        resetClient();
      }
    }
  };

  private IPostListener listener=new IPostListener.Stub() {
    public void newFriendStatus(final String friend,
                                final String status,
                                final String createdAt) {
      runOnUiThread(new Runnable() {
        public void run() {
          adapter.insert(new TimelineEntry(friend,
                                           createdAt,
                                           status), 0);
        }
      });
    }
  };

  class TimelineEntry {
    String friend="";
    String createdAt="";
    String status="";

    TimelineEntry(String friend, String createdAt,
                  String status) {
      this.friend=friend;
      this.createdAt=createdAt;
      this.status=status;
    }
  }

  class TimelineAdapter extends ArrayAdapter<TimelineEntry> {
    TimelineAdapter() {
      super(Patchy.this, R.layout.row, timeline);
    }

    public View getView(int position, View convertView,
                        ViewGroup parent) {
      View row=convertView;
      TimelineEntryWrapper wrapper=null;

      if (row==null) {
        LayoutInflater inflater=getLayoutInflater();

        row=inflater.inflate(R.layout.row, null);
        wrapper=new TimelineEntryWrapper(row);
        row.setTag(wrapper);
      }
      else {
        wrapper=(TimelineEntryWrapper)row.getTag();
      }

      wrapper.populateFrom(timeline.get(position));

      return(row);
    }
  }

  class TimelineEntryWrapper {
    private TextView friend=null;
    private TextView createdAt=null;
    private TextView status=null;
    private View row=null;

    TimelineEntryWrapper(View row) {
      this.row=row;
    }

    void populateFrom(TimelineEntry s) {
      getFriend().setText(s.friend);
      getCreatedAt().setText(s.createdAt);
      getStatus().setText(s.status);
    }

    TextView getFriend() {
      if (friend==null) {
        friend=(TextView)row.findViewById(R.id.friend);
      }

      return(friend);
    }

    TextView getCreatedAt() {
      if (createdAt==null) {
        createdAt=(TextView)row.findViewById(R.id.created_at);
      }

      return(createdAt);
    }

    TextView getStatus() {
      if (status==null) {
        status=(TextView)row.findViewById(R.id.status);
      }

      return(status);
    }
  }
}
```

And here is an implementation of `PostMonitor` after making this tutorial's modifications:

```
package apt.tutorial.three;

import android.app.Service;
import android.content.Intent;
import android.os.IBinder;
import android.os.SystemClock;
import android.util.Log;
import java.util.HashSet;
import java.util.List;
import java.util.Map;
import java.util.Set;
import java.util.concurrent.ConcurrentHashMap;
import java.util.concurrent.atomic.AtomicBoolean;
import winterwell.jtwitter.Twitter;
import apt.tutorial.IPostListener;
import apt.tutorial.IPostMonitor;

public class PostMonitor extends Service {
  private static final int POLL_PERIOD=60000;
  private static final int INITIAL_POLL_PERIOD=1000;
  private int pollPeriod=INITIAL_POLL_PERIOD;
  private AtomicBoolean active=new AtomicBoolean(true);
  private Set<Long> seenStatus=new HashSet<Long>();
  private Map<IPostListener, Account> accounts=
          new ConcurrentHashMap<IPostListener, Account>();

  @Override
  public void onCreate() {
    super.onCreate();

    new Thread(threadBody).start();
  }

  @Override
  public IBinder onBind(Intent intent) {
    return(binder);
  }

  @Override
  public void onDestroy() {
    super.onDestroy();

    active.set(false);
  }

  private void poll(Account l) {
    try {
      Twitter client=new Twitter(l.user, l.password);

      client.setAPIRootUrl("https://identi.ca/api");
      List<Twitter.Status> timeline=client.getFriendsTimeline();

      for (Twitter.Status s : timeline) {
        if (!seenStatus.contains(s.id)) {
          try {
            l.callback.newFriendStatus(s.user.screenName, s.text,
                                     s.createdAt.toString());
            seenStatus.add(s.id);
          }
          catch (Throwable t) {
            Log.e("PostMonitor", "Exception in callback", t);
          }
        }
      }
    }
    catch (Throwable t) {
      Log.e("PostMonitor", "Exception in poll()", t);
    }
  }

  private Runnable threadBody=new Runnable() {
    public void run() {
      while (active.get()) {
        for (Account l : accounts.values()) {
          poll(l);
          pollPeriod=POLL_PERIOD;
        }

        SystemClock.sleep(pollPeriod);
      }
    }
  };

  class Account {
    String user=null;
    String password=null;
    IPostListener callback=null;

    Account(String user, String password,
            IPostListener callback) {
      this.user=user;
      this.password=password;
      this.callback=callback;
    }
  }

  private final IPostMonitor.Stub binder=new IPostMonitor.Stub() {
    public void registerAccount(String user, String password,
                                 IPostListener callback) {
      Account l=new Account(user, password, callback);

      poll(l);
      accounts.put(callback, l);
    }

    public void removeAccount(IPostListener callback) {
      accounts.remove(callback);
    }
  };
}
```

Step #7: Restore Your Project

In Step #1, you should have backed up or otherwise saved a copy of your project. After doing any desired "extra credit" items, restore that project, so you are in position to continue with the rest of the tutorials. You can also get rid of the TMonitor application from your device or emulator, via going into the Settings application in the launcher, choosing Applications, then choosing Manage Applications and uninstalling TMonitor.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Design two other applications that could use identi.ca services (perhaps beyond those you have already implemented) and could take advantage of a common identi.ca component.
- If you added direct-message support in the previous tutorials, convert the follower roster callback to use AIDL as well.

Further Reading

Learn more about remote services and AIDL in the "Your Own (Advanced) Services" chapter of The Busy Coder's Guide to *Advanced* Android Development.

TUTORIAL 20

A Subtle Notification

Right now, the only way you find out about status updates from your friends is by looking at your application. However, perhaps there is a certain keyword that you want to specifically watch for – perhaps your company name. In this tutorial, we augment `Patchy` and `PostMonitor` to watch for such a keyword, putting a Notification in the status bar when there is a match.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `18-LocalService` edition of `Patchy` to use as a starting point.

Step #1: Pick a Word and Icon

`PostMonitor` will watch for posts containing some word (or phrase) that you choose…but you need to choose it. Determine what you want to watch for, then add it as a `NOTIFY_KEYWORD` value in `PostMonitor`:

```
private static final String NOTIFY_KEYWORD="snicklefritz";
```

You will also need an icon, named `status.png`, in your `res/drawable/` resource directory, that will be used with the `Notification`. You can grab something suitable from the Android SDK (look for `status_*` icons), draw one yourself, or use the one supplied in the source code for this book.

Step #2: Raise the Notification

Next, we need to add a method to `PostMonitor` that will use the `NotificationManager` and raise a `Notification`. Add the following `showNotification()` method to `PostMonitor`:

```
private void showNotification() {
  final NotificationManager mgr=
    (NotificationManager)getSystemService(NOTIFICATION_SERVICE);
  Notification note=new Notification(R.drawable.status,
                                     "New matching post!",
                                     System.currentTimeMillis());
  Intent i=new Intent(this, Patchy.class);

  i.setFlags(Intent.FLAG_ACTIVITY_CLEAR_TOP|
          Intent.FLAG_ACTIVITY_SINGLE_TOP);

  PendingIntent pi=PendingIntent.getActivity(this, 0,
                                          i,
                                          0);

  note.setLatestEventInfo(this, "Identi.ca Post!",
                          "Found your keyword: "+NOTIFY_KEYWORD,
                          pi);

  mgr.notify(NOTIFICATION_ID, note);
}
```

Here we get access to the `NotificationManager` via `getSystemService()`, create an configure a `Notification` object, and tell the `NotificationManager` to show the `Notification`.

The one part of this that is a bit tricky is the work with the `Intent` and `PendingIntent`. A `PendingIntent` is a wrapper around an `Intent`, stating how it should be used (in our case, to start an `Activity`) and allowing some other process to execute this `Intent` using our security profile. In this case, this means that the operating system will call `startActivity()` on the `Intent` using the `Patchy` application's set of permissions, not the permissions of the operating system itself.

The Intent has a pair of flags added, FLAG_ACTIVITY_CLEAR_TOP and FLAG_ACTIVITY_SINGLE_TOP. The combination of these means that if there is a copy of Patchy presently active, it will be brought to the foreground, rather than start a new copy of Patchy.

To use this new method, you will also need to declare the NOTIFICATION_ID value in PostMonitor:

```
public static final int NOTIFICATION_ID=1337;
```

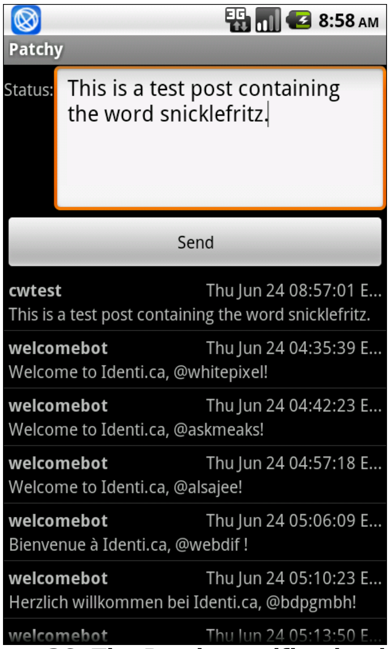
You will also need to add imports for android.app.Notification, android.app.NotificationManager, and android.app.PendingIntent.

Step #3: Watch for the Keyword

Armed with the implementation of showNotification(), we can now modify the poll() method to watch for hits on the keyword, so make your implementation of poll() in PostMonitor look like this:

```
private void poll(Account l) {
  try {
    Twitter client=new Twitter(l.user, l.password);

    client.setAPIRootUrl("https://identi.ca/api");

    List<Twitter.Status> timeline=client.getFriendsTimeline();

    for (Twitter.Status s : timeline) {
      if (!seenStatus.contains(s.id)) {
        l.callback.newFriendStatus(s.user.screenName, s.text,
                                   s.createdAt.toString());
        seenStatus.add(s.id);

        if (s.text.indexOf(NOTIFY_KEYWORD)>-1) {
          showNotification();
        }
      }
    }
  }
  catch (Throwable t) {
    android.util.Log.e("PostMonitor",
                     "Exception in poll()", t);
  }
}
```

At this point, if you compile and reinstall the application, then update your own status containing your keyword, you will see the notification icon appear:



This is a test post containing the word snicklefritz.

cwtest Thu Jun 24 08:57:01 E...
This is a test post containing the word snicklefritz.

welcomebot Thu Jun 24 04:35:39 E...
Welcome to Identi.ca, @whitepixel!

welcomebot Thu Jun 24 04:42:23 E...
Welcome to Identi.ca, @askmeaks!

welcomebot Thu Jun 24 04:57:18 E...
Welcome to Identi.ca, @alsajee!

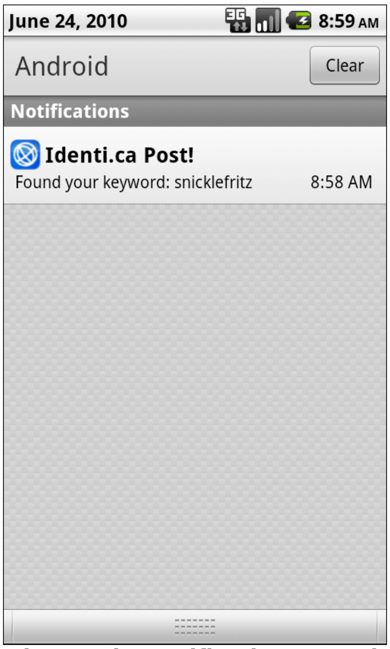
welcomebot Thu Jun 24 05:06:09 E...
Bienvenue à Identi.ca, @webdif !

welcomebot Thu Jun 24 05:10:23 E...
Herzlich willkommen bei Identi.ca, @bdpgmbh!

welcomebot Thu Jun 24 05:13:50 E...

Figure 36. The Patchy notification icon

And, if you slide down the notification drawer, you will see the event information:



Identi.ca Post!
Found your keyword: snicklefritz 8:58 AM

Figure 37. The Patchy notification event information

If you tap on that event, you will be returned to `Patchy`, even if you had closed out of it earlier. However, the icon will stick around, even after re-opening `Patchy`, unless you manually clear it using the Clear button in the notification drawer.

Step #4: Clearing the Notification

What would be nice is to clear the `Notification` automatically once the user clicks on it. To do this, first implement a `clearNotification()` method in `Patchy`:

```
private void clearNotification() {
  NotificationManager mgr=
    (NotificationManager)getSystemService(NOTIFICATION_SERVICE);

  mgr.cancel(PostMonitor.NOTIFICATION_ID);
}
```

Then, make a call to `clearNotification()` from `onCreate()`:

```
@Override
public void onCreate(Bundle savedInstanceState) {
  super.onCreate(savedInstanceState);
  setContentView(R.layout.main);

  status=(EditText)findViewById(R.id.status);

  Button send=(Button)findViewById(R.id.send);

  send.setOnClickListener(onSend);

  prefs=PreferenceManager.getDefaultSharedPreferences(this);
  prefs.registerOnSharedPreferenceChangeListener(prefListener);

  bindService(new Intent(this, PostMonitor.class), svcConn,
              BIND_AUTO_CREATE);

  adapter=new TimelineAdapter();
  ((ListView)findViewById(R.id.timeline)).setAdapter(adapter);

  clearNotification();
}
```

If you try this, it will work...if `Patchy` had been closed. If, however, `Patchy` were open, and you click on the event, the icon would remain intact.

The reason is that if `Patchy` were open, the currently-running `Patchy` is being brought to the foreground. Since a new `Patchy` instance is not being created, `onCreate()` does not get called.

However, in this case, a separate callback method, `onNewIntent()`, will be called. So, override `onNewIntent()` in `Patchy` and call `clearNotification()` from there:

```
@Override
public void onNewIntent(Intent i) {
  super.onNewIntent(i);

  clearNotification();
}
```

Now, the icon should go away even if `Patchy` were already running when you click on the event.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- If you exit and re-open `Patchy`, you will notice that the timeline appears to vanish. That would occur if `PostMonitor` had not yet been destroyed, and the new Patchy instance reconnects to it. Modify `PostMonitor` to always send over the first timeline on the initial poll().
- Support a user-configurable keyword (or set of keywords) via a `Preference`.
- Use the count field on a `Notification` to indicate how many matches on the keyword were found in between taps on the event information in the notification drawer.

Further Reading

Notifications are covered in the "Alerting Users Via Notifications" chapter of The Busy Coder's Guide to Android Development.

TUTORIAL 21

Posts On Location

In this tutorial, we will integrate location tracking, such that we can optionally embed our location in our status updates following the Twittervision convention.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `20-Notifications` edition of `Patchy` to use as a starting point.

Step #1: Get the LocationManager

First, we need to arrange to have access to Android location services through the `LocationManager`.

This requires a permission, either `ACCESS_COARSE_LOCATION` or `ACCESS_FINE_LOCATION`. Since the emulator simulates GPS, which needs `ACCESS_FINE_LOCATION`, modify `Patchy/AndroidManifest.xml` to add this permission:

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
      package="apt.tutorial.two"
      android:versionCode="1"
      android:versionName="1.0">
  <uses-permission android:name="android.permission.INTERNET" />
  <uses-permission android:name="android.permission.ACCESS_FINE_LOCATION" />
    <application android:label="@string/app_name">
        <activity android:name=".Patchy"
                  android:label="@string/app_name">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
        <activity android:name=".EditPreferences">
        </activity>
        <service android:name=".PostMonitor" />
    </application>
</manifest>
```

Then, add some imports to `Patchy` for location-related classes that we will need:

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

Next, add a `LocationManager` data member named `locMgr` in `Patchy`, then initialize it in `onCreate()`:

```
locMgr=(LocationManager)getSystemService(LOCATION_SERVICE);
```

At this point, we can start using the `LocationManager` for getting the location to embed in the status update.

Step #2: Register for Location Updates

Next, we need to do something to cause Android to actually activate GPS and get fixes. Just having access to `LocationManager` is insufficient. The simplest answer is to register for location updates, even if we will use another way to get our current fix, as you will see later in this tutorial.

So, add the following statement to `onCreate()` in `Patchy`, after you have initialized `locMgr` as shown in the preceding section:

```
locMgr.requestLocationUpdates(LocationManager.GPS_PROVIDER,
                              10000, 10000.0f,
                              onLocationChange);
```

This refers to an `onLocationChange` object, which is a `LocationListener`. We do not truly care about the updates (though, in principle, our application could do something with them). Hence, for this tutorial's purpose, all you need is a stub implementation of `LocationListener`. Add the following to `Patchy`:

```
private LocationListener onLocationChange=new LocationListener() {
  public void onLocationChanged(Location location) {
    // required for interface, not used
  }
  public void onProviderDisabled(String provider) {
    // required for interface, not used
  }
  public void onProviderEnabled(String provider) {
    // required for interface, not used
  }
  public void onStatusChanged(String provider, int status,
                              Bundle extras) {
    // required for interface, not used
  }
};
```

Finally, since we registered for location updates in `onCreate()`, we should remove that request in `onDestroy()`. Modify `onDestroy()` in `Patchy` to look like this:

```
@Override
public void onDestroy() {
  super.onDestroy();

  locMgr.removeUpdates(onLocationChange);
  service.removeAccount(listener);
  unbindService(svcConn);
}
```

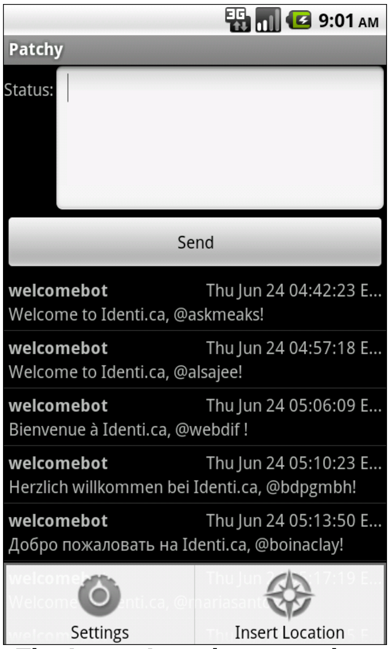
Step #3: Add "Insert Location" Menu

Now, we need to give the user a way to inject the current location into the status update being written. The simplest way to do that is by adding a menu item to `Patchy/res/menu/option.xml`:

```
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
  <item android:id="@+id/prefs"
    android:title="Settings"
    android:icon="@drawable/ic_menu_preferences"
  />
  <item android:id="@+id/location"
    android:title="Insert Location"
    android:icon="@drawable/ic_menu_compass"
  />
</menu>
```

You will also need a suitable icon, such as `ic_menu_compass.png` from the Android SDK.

If you recompile and reinstall the application, you will see the new menu option, even though it does not do anything just yet:



welcomebot Thu Jun 24 04:42:23 E...
Welcome to Identi.ca, @askmeaks!

welcomebot Thu Jun 24 04:57:18 E...
Welcome to Identi.ca, @alsajee!

welcomebot Thu Jun 24 05:06:09 E...
Bienvenue à Identi.ca, @webdif !

welcomebot Thu Jun 24 05:10:23 E...
Herzlich willkommen bei Identi.ca, @bdpgmbh!

welcomebot Thu Jun 24 05:13:50 E...
Добро пожаловать на Identi.ca, @boinaclay!

Figure 38. The Insert Location menu item in Patchy

Step #4: Insert the Last Known Location

Finally, we need to do something to add the location to our status message.

Change `onOptionsItemSelected()` in `Patchy` to look like this:

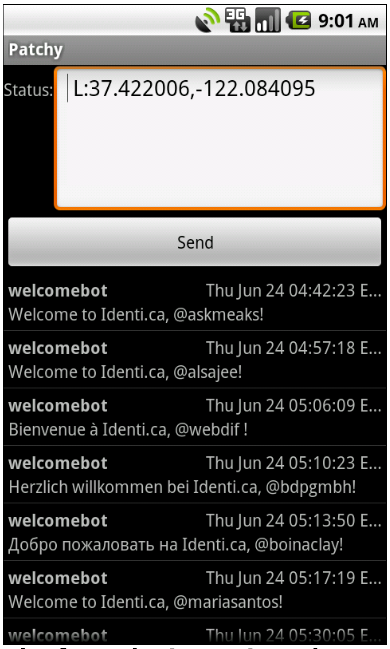
```
@Override
public boolean onOptionsItemSelected(MenuItem item) {
  if (item.getItemId()==R.id.prefs) {
    startActivity(new Intent(this, EditPreferences.class));

    return(true);
  }
  else if (item.getItemId()==R.id.location) {
    insertLocation();

    return(true);
  }

  return(super.onOptionsItemSelected(item));
}
```

Then, add in the following implementation of `insertLocation()` in `Patchy`:

```
private void insertLocation() {
  Location loc=locMgr.getLastKnownLocation(LocationManager.GPS_PROVIDER);

  if (loc==null) {
    Toast
      .makeText(this, "No location available", Toast.LENGTH_SHORT)
      .show();
  }
  else {
    StringBuilder buf=new StringBuilder(status
                                .getText()
                                .toString());
    buf.append(" L:");
    buf.append(String.valueOf(loc.getLatitude()));
    buf.append(",");
    buf.append(String.valueOf(loc.getLongitude()));
    status.setText(buf.toString());
  }
}
```

You will need to add an import for `android.widget.Toast`, used to handle the case where we do not have a GPS fix yet. Otherwise, if we have a fix, we create a piece of text in Twittervision format, using the `Location` object, and inject that into the `EditText` for the status.

Now, if you recompile and reinstall `Patchy`, and if you use DDMS to supply a fake location (assuming you are running this on an emulator), the location will be appended to the end of the status update when you choose the Insert Location option menu item:



L:37.422006,-122.084095

welcomebot Thu Jun 24 04:42:23 E...
Welcome to Identi.ca, @askmeaks!

welcomebot Thu Jun 24 04:57:18 E...
Welcome to Identi.ca, @alsajee!

welcomebot Thu Jun 24 05:06:09 E...
Bienvenue à Identi.ca, @webdif !

welcomebot Thu Jun 24 05:10:23 E...
Herzlich willkommen bei Identi.ca, @bdpgmbh!

welcomebot Thu Jun 24 05:13:50 E...
Добро пожаловать на Identi.ca, @boinaclay!

welcomebot Thu Jun 24 05:17:19 E...
Welcome to Identi.ca, @mariasantos!

welcomebot Thu Jun 24 05:30:05 E...

Figure 39. The results from the Insert Location menu item in Patchy

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Allow the user to choose the `LocationProvider` via a set of preferences that specify the attributes of a `Criteria` object, then using that `Criteria` object to get the best-matching `LocationProvider`.
- Use `onKeyDown()` to add "hot-key" support, such that some key (e.g., <Alt>-<X>) will inject the location, instead of having to use the option menu.

Further Reading

Location tracking, via GPS or other technologies, is covered in the "Accessing Location-Based Services" chapter of The Busy Coder's Guide to Android Development.

TUTORIAL 22

Here a Post, There a Post

In this tutorial, we will integrate maps, so we can plot the location for status updates that provide such information. Along the way, we will add support to view the public timeline to `Patchy`.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `21-Location` edition of `Patchy` to use as a starting point.

For this application to work, you will need to have a device or emulator AVD set up with the Google APIs, and you will need to have your project set up to build with the Google APIs. If you followed the instructions in the first tutorial, this will already be done.

Step #1: Register for a Map API Key

First, you need to register for an API key to use with the mapping services and set it up in your development environment with your debug certificate. Full instructions for doing this can be found on the Android developer site.

Step #2: Create a Basic MapActivity

Next, we need to create a stub `MapActivity` implementation that we can then use in `Patchy`.

Create `Patchy/res/layout/status_map.xml` with the following content:

```
<?xml version="1.0" encoding="utf-8"?>
<com.google.android.maps.MapView
  xmlns:android="http://schemas.android.com/apk/res/android"
  android:id="@+id/map"
  android:layout_width="fill_parent"
  android:layout_height="fill_parent"
  android:apiKey="00yHj0k7_7vzHbUFXzY2j94lYYCqW3NAIW8EEEw"
  android:clickable="true" />
```

Note that you will need to substitute your API key for the one shown in `android:apiKey` in the above code listing.

Next, create `Patchy/src/apt/tutorial/two/StatusMap.java` with the following content:

```
package apt.tutorial.two;

import android.app.Activity;
import android.os.Bundle;
import android.view.ViewGroup;
import com.google.android.maps.MapActivity;
import com.google.android.maps.MapController;
import com.google.android.maps.MapView;

public class StatusMap extends MapActivity {
  private MapView map=null;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.status_map);

    map=(MapView)findViewById(R.id.map);

    map.getController().setZoom(17);
  }

  @Override
  protected boolean isRouteDisplayed() {
    return(false);
  }
}
```

All we do here is create a map and set the initial zoom level.

Then, we need to make two changes to our `AndroidManifest.xml` file: we need to add the `StatusMap` activity, and we need to indicate that we are using the mapping services library. Alter `Patchy/AndroidManifest.xml` to look like the following:

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
      package="apt.tutorial.two"
      android:versionCode="1"
      android:versionName="1.0">
  <uses-permission android:name="android.permission.INTERNET" />
  <uses-permission android:name="android.permission.ACCESS_FINE_LOCATION" />
    <application android:label="@string/app_name">
        <uses-library android:name="com.google.android.maps" />
        <activity android:name=".Patchy"
                  android:label="@string/app_name">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
        <activity android:name=".EditPreferences">
        </activity>
        <activity android:name=".StatusMap">
        </activity>
        <service android:name=".PostMonitor" />
    </application>
</manifest>
```

Step #3: Launch the Map on Location-Bearing Status Click

Now, we need to tie `Patchy` and `StatusMap` together, such that a click on a status that has an embedded location triggers the display of the map.

To do this, first we need to get control when a status is clicked. Right now, the `onCreate()` in `Patchy` has a line that looks like:

```
((ListView)findViewById(R.id.timeline)).setAdapter(adapter);
```

Remove that line and replace it with:

```
ListView list=(ListView)findViewById(R.id.timeline);

list.setAdapter(adapter);
list.setOnItemClickListener(onStatusClick);
```

That gives control on a click to an `onStatusClick` object. In there, we need to get the `TimelineEntry` corresponding with the click, scan the status to find the location (if any), and pass that information to `StatusMap` via `startActivity()`.

Add the following `onStatusClick` implementation to `Patchy`:

```
private AdapterView.OnItemClickListener onStatusClick=
                  new AdapterView.OnItemClickListener() {
  public void onItemClick(AdapterView<?> parent, View view,
                         int position, long id) {
    TimelineEntry entry=timeline.get(position);
    Matcher r=regexLocation.matcher(entry.status);

    if (r.find()) {
      double latitude=Double.valueOf(r.group(1));
      double longitude=Double.valueOf(r.group(4));

      Intent i=new Intent(Patchy.this, StatusMap.class);

      i.putExtra(LATITUDE, latitude);
      i.putExtra(LONGITUDE, longitude);
      i.putExtra(STATUS_TEXT, entry.status);

      startActivity(i);
    }
  }
};
```

This requires a few constants to be added to `Patchy` as well:

```
public static final String LATITUDE="apt.tutorial.latitude";
public static final String LONGITUDE="apt.tutorial.longitude";
public static final String STATUS_TEXT="apt.tutorial.statusText";
```

We also need the `Pattern` that defines the regular expression we are searching for:

```
private Pattern regexLocation=Pattern.compile("L\\:((\\-)?[0-9]+(\\.[0-9]+)?)\\,
((\\-)?[0-9]+(\\.[0-9]+)?)");
```

That regular expression is ugly, but it effectively matches any string of the form `L:AAA,OOO`, where `AAA` and `OOO` are floating-point numeric values.

You will also need to add imports for `android.widget.AdapterView`, `java.util.regex.Matcher`, and `java.util.regex.Pattern`.

Now, when we click on a location-bearing status, `StatusMap` will open – you can test this via the post you may have added from the previous tutorial, containing your location. However, we need to add some logic to `StatusMap` to unpack the latitude and longitude and center the map on that position.

Change `StatusMap` to look like the following:

```
package apt.tutorial.two;

import android.app.Activity;
import android.os.Bundle;
import android.view.ViewGroup;
import com.google.android.maps.GeoPoint;
import com.google.android.maps.MapActivity;
import com.google.android.maps.MapController;
import com.google.android.maps.MapView;

public class StatusMap extends MapActivity {
  private MapView map=null;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.status_map);

    map=(MapView)findViewById(R.id.map);

    map.getController().setZoom(17);

    double lat=getIntent().getDoubleExtra(Patchy.LATITUDE, 0);
    double lon=getIntent().getDoubleExtra(Patchy.LONGITUDE, 0);

    GeoPoint status=new GeoPoint((int)(lat*1000000.0),
                                 (int)(lon*1000000.0));

    map.getController().setCenter(status);
    map.setBuiltInZoomControls(true);
  }
  @Override
  protected boolean isRouteDisplayed() {
    return(false);
  }
}
```

Now, if you rebuild and reinstall `Patchy` (and `TMonitor`!), and you click on a status that has a location (`L:nnn.nn,nnn.nn` – you may need somebody to update their status with a location for you!), it will open the map on that location.

Step #4: Show the Location Via a Pin

Finally, it would be good to put a pin on the map at the spot identified by the status. Not only will this help the user find the location again after panning around the map, but we can also have the pin respond to a click by displaying the text of the status update.

First, find yourself a suitable pin image, probably on the order of 32x32 pixels. In this code, we assume that the pin image is called `marker`.

Next, add the following lines to `onCreate()` in `StatusMap`:

```
String statusText=getIntent().getStringExtra(Patchy.STATUS_TEXT);
Drawable marker=getResources().getDrawable(R.drawable.marker);

marker.setBounds(0, 0, marker.getIntrinsicWidth(),
                       marker.getIntrinsicHeight());

map.getOverlays().add(new StatusOverlay(marker, status,
                                        statusText));
```

This requires an implementation of `StatusOverlay` – add the following inner class to `StatusMap`:

```
private class StatusOverlay extends ItemizedOverlay<OverlayItem> {
  private OverlayItem item=null;
  private Drawable marker=null;

  public StatusOverlay(Drawable marker, GeoPoint status,
                       String statusText) {
```

```
    super(marker);
    this.marker=marker;

    item=new OverlayItem(status, "Tweet!", statusText);

    populate();
  }

  @Override
  protected OverlayItem createItem(int i) {
    return(item);
  }

  @Override
  public void draw(Canvas canvas, MapView mapView,
                    boolean shadow) {
    super.draw(canvas, mapView, shadow);

    boundCenterBottom(marker);
  }

  @Override
  protected boolean onTap(int i) {
    Toast.makeText(StatusMap.this,
                    item.getSnippet(),
                    Toast.LENGTH_SHORT).show();

    return(true);
  }

  @Override
  public int size() {
    return(1);
  }
}
```

Now, when you view the map, you will see the pin at the spot of the location:

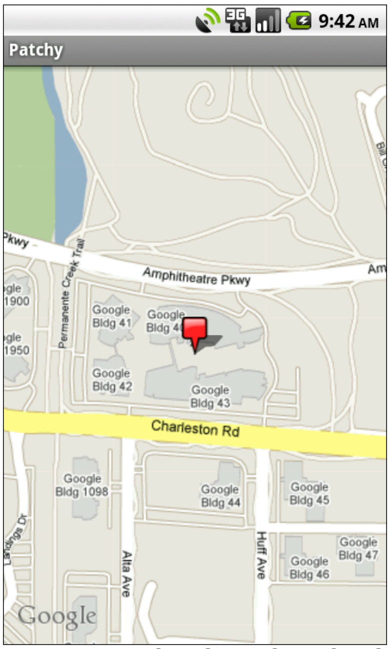
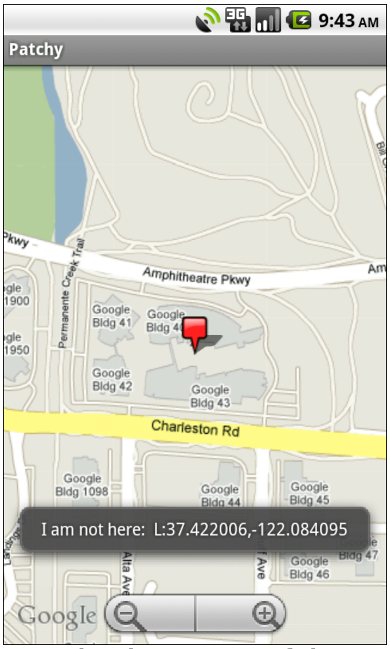


Figure 40. The StatusMap, showing a location in New York City

Clicking on the pin will display a `Toast` with the text of the status update itself:



I am not here: L:37.422006,-122.084095

Figure 41. The StatusMap, showing a Toast of the status update associated with the location

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Support other map perspectives, such as street view or terrain mode.
- Allow the user to control the initial zoom level via a preference.
- Enable the compass rose, via `MyLocationOverlay`.

Further Reading

Integration with Google Maps is covered in the "Mapping with MapView and MapActivity" chapter of The Busy Coder's Guide to Android Development.

Also, bear in mind that the documentation for Android's mapping code is not found in the Android developer guide directly, but rather at the site for the Google add-on for Android.

Media

In this tutorial, we will integrate a video clip, to serve as a placeholder for some sort of future "helpcast" to assist users with `Patchy`.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `22-Maps` edition of `Patchy` to use as a starting point.

Step #1: Obtain and Install a Video Clip

First, we need a suitable video clip to serve as our helpcast placeholder. A 320x240 MP4 video file should do nicely. Please, though, respect creators' copyrights – consider using a Creative Commons-licensed clip, such as one of these.

For something the size of your typical video clip, you should store it in an SD card, since space in on-board flash memory is at a premium. We need to upload the MP4 file there as `helpcast.mp4`. To do that, either use Eclipse's file-browsing tools, or use DDMS, or use the `adb push` command from the command line. The SD card can be found at either `/sdcard` or `/mnt/sdcard`, depending on your emulator or device.

Step #2: Create the Stub Helpcast Activity

Now, we need to add an activity that will use the `VideoView` widget to display our video clip.

First, add the following layout as `Patchy/res/layout/helpcast.xml`:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:orientation="vertical"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
    >
  <VideoView
    android:id="@+id/video"
      android:layout_width="fill_parent"
      android:layout_height="fill_parent"
    />
</LinearLayout>
```

Then, create `Patchy/src/apt/tutorial/two/HelpCast.java` with the following code:

```java
package apt.tutorial.two;

import android.app.Activity;
import android.graphics.PixelFormat;
import android.os.Bundle;
import android.os.Environment;
import android.view.View;
import android.widget.MediaController;
import android.widget.VideoView;
import java.io.File;

public class HelpCast extends Activity {
  private VideoView video;
  private MediaController ctlr;

  @Override
  public void onCreate(Bundle icicle) {
    super.onCreate(icicle);
    getWindow().setFormat(PixelFormat.TRANSLUCENT);
    setContentView(R.layout.helpcast);

    File clip=new File(Environment.getExternalStorageDirectory(),
                       "helpcast.mp4");

    if (clip.exists()) {
      video=(VideoView)findViewById(R.id.video);
      video.setVideoPath(clip.getAbsolutePath());

      ctlr=new MediaController(this);
      ctlr.setMediaPlayer(video);
      video.setMediaController(ctlr);
      video.requestFocus();
      video.start();
    }
  }
}
```

Here, we simply configure the `VideoView`, including the `MediaController` to give us buttons to control playback of the video. At the end, we call `start()`, to begin playback automatically.

And, as always, when we add an activity to our project, we need to add it to `AndroidManifest.xml`, so add the following `<activity>` element alongside the others:

```
<activity android:name=".HelpCast">
</activity>
```

Step #3: Launch the Helpcast from the Menu

Finally, we need to integrate `HelpCast` into `Patchy` overall, so users can display the help video. As we have done in previous tutorials, we will accomplish this by extending the option menu with another menu item.

First, add the following `<item>` to `Patchy/res/menu/option.xml`:

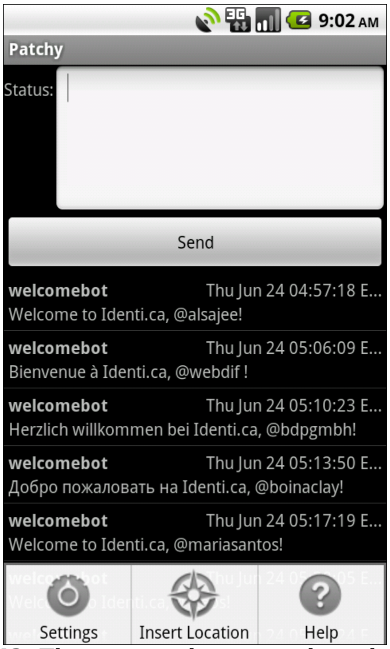
```
<item android:id="@+id/help"
  android:title="Help"
  android:icon="@drawable/ic_menu_help"
/>
```

You will also need a suitable menu icon, such as the `ic_menu_help.png` image from the Android SDK.

Then, update `onOptionsItemSelected()` in `Patchy` to launch `HelpCast` when our item is selected:

```
@Override
public boolean onOptionsItemSelected(MenuItem item) {
  if (item.getItemId()==R.id.prefs) {
    startActivity(new Intent(this, EditPreferences.class));

    return(true);
  }
  else if (item.getItemId()==R.id.location) {
    insertLocation();

    return(true);
  }
  else if (item.getItemId()==R.id.help) {
    startActivity(new Intent(this, HelpCast.class));

    return(true);
  }

  return(super.onOptionsItemSelected(item));
}
```

With all that complete, we have our helpcast ready to go. Rebuild and reinstall the application, and you will see the new help menu item:



welcomebot Thu Jun 24 04:57:18 E...
Welcome to Identi.ca, @alsajee!

welcomebot Thu Jun 24 05:06:09 E...
Bienvenue à Identi.ca, @webdif !

welcomebot Thu Jun 24 05:10:23 E...
Herzlich willkommen bei Identi.ca, @bdpgmbh!

welcomebot Thu Jun 24 05:13:50 E...
Добро пожаловать на Identi.ca, @boinaclay!

welcomebot Thu Jun 24 05:17:19 E...
Welcome to Identi.ca, @mariasantos!

Figure 42. The new option menu item in Patchy

Clicking on it will bring up our "helpcast" video clip, though you will need to tap on the top portion of the screen to get the media controls to appear, so you can play it back:

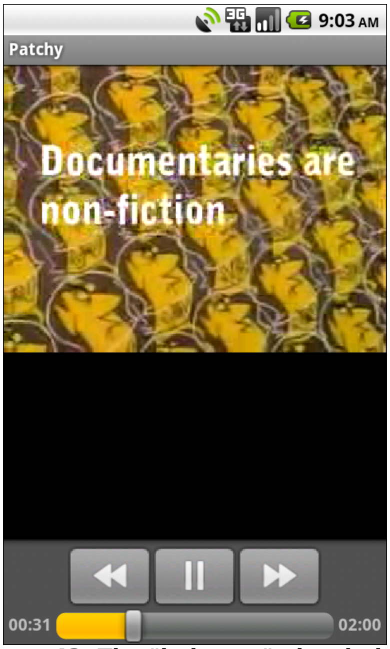


Figure 43. The "helpcast" placeholder

Note, however, that playback may or may not work, depending on the version of the emulator you are using, the file you are using, and the speed of the development machine hosting the emulator instance.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Experiment with streaming video. Note that the requirements for Android streaming video are rather arcane and ill-documented.
- If you can find several media clips that work, put a `Spinner` on the `HelpcastActivity` to allow the user to switch between video clips.

Further Reading

Instruction on how to integrate media – audio and video, local and streaming – to your Android app can be found in the "Media" chapter of The Busy Coder's Guide to *Advanced* Android Development.

TUTORIAL 24

Browsing Some Posts

In this tutorial, we will support clicking on links found in status updates, popping those up in the Browser application. We will also add a help screen that loads a local help HTML file, by integrating WebKit into `Patchy`.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `23-Media` edition of `Patchy` to use as a starting point.

Step #1: Add Auto-Linking

We can start by letting Android "do the heavy lifting for us" in making links in status updates click-able. That is merely a matter of adding `android:autoLink = "all"` to the `TextView` for the status text in `Patchy/res/layout/row.xml`. With a value of `"all"`, we are saying that we want all recognized patterns to be converted to links: Web URLs, email addresses, phone numbers, etc.

If you make this change, then recompile and reinstall the application, you will notice two things:

1. All of the click-able items show up in blue underlined text, and when clicked they pop up the appropriate application (e.g., clicking a Web URL brings up the Browser application).
2. Clicking on a row with a location, as we introduced in a previous tutorial, does not spawn our `StatusMap`.

Step #2: Draft and Package the Help HTML

Next, we need some placeholder HTML to serve as our help prose. This does not need to be terribly fancy – in fact, simpler HTML works better, because it loads faster.

So, write a Web page that will serve as the placeholder for the `Patchy` help. The key is where you put the page: create an `assets/` directory in your project and store it as `help.html` in there. That will line up with the URL we will use in the next section to reference that help file.

Step #3: Create a Help Activity

Now, we can create a help activity class that will load our Web page and do some other useful things.

First, create `Patchy/res/layout/help.xml` with the following content:

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:orientation="vertical"
  android:layout_width="fill_parent"
  android:layout_height="fill_parent"
  >
  <WebView android:id="@+id/webkit"
    android:layout_width="fill_parent"
    android:layout_height="0px"
    android:layout_weight="1"
  />
</LinearLayout>
```

Then, create `Patchy/src/apt/tutorial/two/HelpPage.java` with the following code:

```
package apt.tutorial.two;

import android.app.Activity;
import android.content.Intent;
import android.os.Bundle;
import android.webkit.WebView;

public class HelpPage extends Activity {
  private WebView browser;

  @Override
  public void onCreate(Bundle icicle) {
    super.onCreate(icicle);
    setContentView(R.layout.help);

    browser=(WebView)findViewById(R.id.webkit);
    browser.loadUrl("file:///android_asset/help.html");
  }
}
```

Note how we use `file:///android_asset/help.html` as the URL syntax to reach into our APK's assets to load the desired Web page.

Finally, as normal, we need to add another `<activity>` element to our `AndroidManifest.xml` file:

```
<activity android:name=".HelpPage">
</activity>
```

Step #4: Splice In the Help Activity

Right now, the option menu in `Patchy` for help launches the `HelpCast` activity. We want to change that so `Patchy` launches `HelpPage` instead, then augment `HelpPage` to display `HelpCast` on demand.

Making the change to display `HelpPage` is easy – just replace the `HelpCast` reference with `HelpPage` in `onOptionsItemSelected()`:

```
startActivity(new Intent(this, HelpPage.class));
```

At this point, if you rebuild and reinstall the application, then click on the help menu item, you will see your help page in a full-screen browser.

To get to `HelpCast`, let us add a `Button` to the `HelpPage` layout and wire it up so, when clicked, the `Button` launches `HelpCast`.

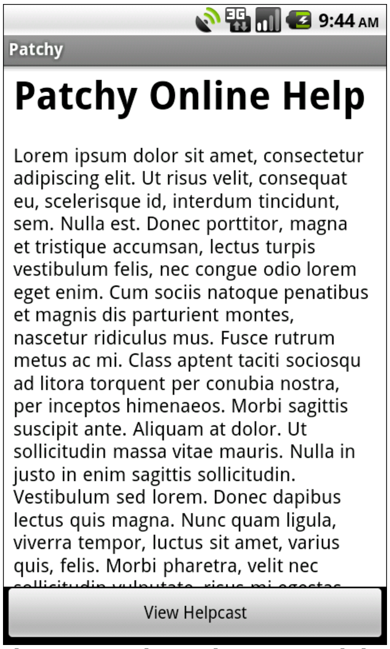
First, add a suitable `Button` to `Patchy/res/layout/help.xml`:

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:orientation="vertical"
  android:layout_width="fill_parent"
  android:layout_height="fill_parent"
  >
  <WebView android:id="@+id/webkit"
    android:layout_width="fill_parent"
    android:layout_height="0px"
    android:layout_weight="1"
  />
  <Button android:id="@+id/helpcast"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:text="View Helpcast"
  />
</LinearLayout>
```

Then, add logic to `HelpPage` to find the `Button` and set the on-click listener to an object that will call `startActivity()` on `HelpCast`:

```
package apt.tutorial.two;

import android.app.Activity;
import android.content.Intent;
import android.os.Bundle;
import android.view.View;
import android.webkit.WebView;
import android.widget.Button;

public class HelpPage extends Activity {
  private WebView browser;

  @Override
  public void onCreate(Bundle icicle) {
    super.onCreate(icicle);
    setContentView(R.layout.help);

    browser=(WebView)findViewById(R.id.webkit);
    browser.loadUrl("file:///android_asset/help.html");

    Button cast=(Button)findViewById(R.id.helpcast);

    cast.setOnClickListener(onCast);
  }
  private View.OnClickListener onCast=new View.OnClickListener() {
    public void onClick(View v) {
      startActivity(new Intent(HelpPage.this, HelpCast.class));
    }
  };
}
```

Now, if you recompile and reinstall the application, clicking the help menu item brings up `HelpPage` with both help content and the "View HelpCast" button:



Patchy Online Help

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut risus velit, consequat eu, scelerisque id, interdum tincidunt, sem. Nulla est. Donec porttitor, magna et tristique accumsan, lectus turpis vestibulum felis, nec congue odio lorem eget enim. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Fusce rutrum metus ac mi. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos. Morbi sagittis suscipit ante. Aliquam at dolor. Ut sollicitudin massa vitae mauris. Nulla in justo in enim sagittis sollicitudin. Vestibulum sed lorem. Donec dapibus lectus quis magna. Nunc quam ligula, viverra tempor, luctus sit amet, varius quis, felis. Morbi pharetra, velit nec

Figure 44. The HelpPage activity

Clicking the button, in turn, will display the "helpcast" video clip.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Support multiple pages of help text, by using `WebViewClient` and `shouldOverrideUrlLoading()`.

- Experiment with adding images or CSS stylesheets to the help page.
- Support the notion of the help being updated separately from the APK. Search some URL for help updates, downloading them in the background, and using them if available, falling back to the in-APK edition if there are no such updates.
- Instead of detecting locations when statuses are clicked upon, detect locations in the constructor for `TimelineEntry`. Then, add a "Map" button to the row layout, set to `GONE` if there is no location, or `VISIBLE` if there is one. Then, arrange to have clicking the Map button bring up the `StatusMap`.

Further Reading

You can learn more about the basics of integrating a `WebView` widget into your activities in the "Embedding the WebKit Browser" chapter of The Busy Coder's Guide to Android Development.

TUTORIAL 25

High-Priced Help

In this tutorial, we will extend our help system to embed user details, such as their identi.ca screen name, in the help text itself on the fly, by way of injecting Java objects into the `WebView` Javascript engine.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `24-WebKit` edition of `Patchy` to use as a starting point.

Step #1: Enable Javascript

By default, `WebView` widgets have Javascript disabled. Since our current help page does not use Javascript, that was not a problem in the previous tutorial. Now, however, we are looking to add a script to the page, so we need to enable Javascript in our `WebView`.

Add this line to `onCreate()` in `HelpPage`:

```
browser.getSettings().setJavaScriptEnabled(true);
```

That is all you need to enable basic Javascript operation.

Step #2: Create the Java Object to Inject

Next, we need to create a Java object from a public class with a public method that we can inject into the Javascript environment of our `WebView` that will give us access to the user's idenit.ca screen name.

To that end, add the following inner class to `HelpPage`:

```
public class CustomHelp {
  SharedPreferences prefs=null;

  CustomHelp() {
    prefs=PreferenceManager
              .getDefaultSharedPreferences(HelpPage.this);
  }

  public String getUserName() {
    return(prefs.getString("user", "<no account>"));
  }
}
```

Step #3: Inject the Java Object

Just because we created the `CustomHelp` inner class does not mean Javascript has access to it. Instead, we need to give the `WebView` an instance of `CustomHelp` and associate it with a name that will be used to make the `CustomHelp` instance look like a global variable in Javascript.

Add the following lines to `onCreate()` in `HelpPage`:

```
browser.addJavascriptInterface(new CustomHelp(),
                               "customHelp");
```

The entirety of `onCreate()` in `HelpPage` should now look like this:

```
@Override
public void onCreate(Bundle icicle) {
  super.onCreate(icicle);
  setContentView(R.layout.help);

  browser=(WebView)findViewById(R.id.webkit);
  browser.getSettings().setJavaScriptEnabled(true);
  browser.addJavascriptInterface(new CustomHelp(),
                                "customHelp");
  browser.loadUrl("file:///android_asset/help.html");

  Button cast=(Button)findViewById(R.id.helpcast);

  cast.setOnClickListener(onCast);
}
```

In particular, we need to enable Javascript in the `WebView` and inject our `CustomHelp` object (under the name `customHelp`) before we load our help Web page.

Step #4: Leverage the Java Object from Javascript

With all that done, we can take advantage of the `customHelp` object in our Web page.

Somewhere on your page, add a `<div>` or `<span>` with an id of `userName`, such as:

```
<p>Your Twitter account name is:
<span id="userName"><i>unknown</i></span>!</p>
```

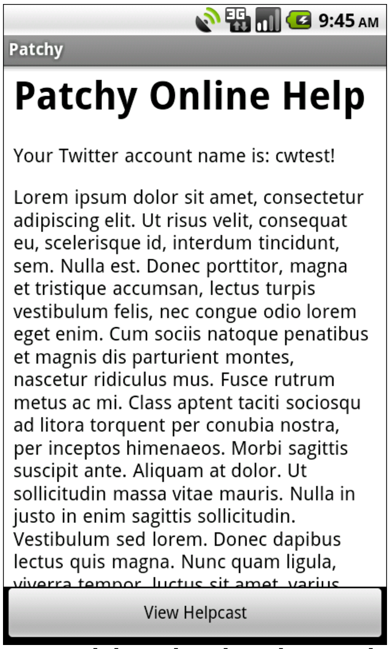
Then, add a global Javascript function that will replace the default contents of the `userName` element with the value obtained from `customHelp`, such as:

```
<script language="javascript">
  function updateUserName() {
    document
      .getElementById("userName")
      .innerHTML=customHelp.getUserName();
  }
</script>
```

Finally, add an `onLoad` attribute to your `<body>` element to trigger calling the global Javascript function, such as:

```
<body onLoad="updateUserName()">
```

If you do all of that, then rebuild and reinstall the application, the `Patchy` help page should show your Twitter user name where you placed it on the page:



Patchy Online Help

Your Twitter account name is: cwtest!

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut risus velit, consequat eu, scelerisque id, interdum tincidunt, sem. Nulla est. Donec porttitor, magna et tristique accumsan, lectus turpis vestibulum felis, nec congue odio lorem eget enim. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Fusce rutrum metus ac mi. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos. Morbi sagittis suscipit ante. Aliquam at dolor. Ut sollicitudin massa vitae mauris. Nulla in justo in enim sagittis sollicitudin. Vestibulum sed lorem. Donec dapibus lectus quis magna. Nunc quam ligula, viverra tempor, luctus sit amet, varius

Figure 45. The HelpPage activity, showing the results of our injected Java object

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Embed a link in the help HTML that will pop open the Browser application on the user's own identi.ca page
- Have the help page optionally show the user's current location as an example of what would be injected into a status message. On a location update, call a global Javascript function in the page, so it can update the help to match the current location.

Further Reading

Connecting Java and Javascript in a `WebView` widget is part of what is covered in the "WebView, Inside and Out" chapter of The Busy Coder's Guide to *Advanced* Android Development.

PART III – Advanced Tutorials

TUTORIAL 26

Now Your Friends Seem Animated

Most of the time, we are reading status updates, not updating our own status. Hence, having the status entry widgets always around takes up a lot of screen space. It would be nice to have them appear or disappear at the user's request.

This tutorial will cover that very process. We will give the user an option menu choice to show or hide the status entry widgets. Initially, we will simply hide and show the widgets without any animation. Then, we will use an `AlphaAnimation` to have the widgets fade in or out.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `25-AdvWebKit` edition of `Patchy` to use as a starting point.

Step #1: Set Up the Option Menu

Let us start by giving the user the option to show and hide the status entry row. That can be handled by just another entry in our option menu…though we will need to do a little work to toggle the menu item from "show" to "hide" mode and back again.

First, modify `Patchy/res/layout/main.xml` to replace our `TableLayout` with some `LinearLayout` containers:

```
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:orientation="vertical"
  android:layout_width="fill_parent"
  android:layout_height="wrap_content"
  >
  <LinearLayout android:id="@+id/status_row"
    android:orientation="vertical"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    >
    <TextView android:text="Status:"
      android:layout_width="fill_parent"
      android:layout_height="wrap_content"
    />
    <EditText android:id="@+id/status"
      android:layout_width="fill_parent"
      android:layout_height="wrap_content"
      android:singleLine="false"
      android:gravity="top"
      android:lines="5"
      android:scrollHorizontally="false"
      android:maxLines="5"
      android:maxWidth="200sp"
    />
    <Button android:id="@+id/send"
      android:layout_width="fill_parent"
      android:layout_height="wrap_content"
      android:text="Send"
    />
  </LinearLayout>
  <ListView android:id="@+id/timeline"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
  />
</LinearLayout>
```

Partially, we did this because we really were not using much of the `TableLayout` functionality anymore. More importantly, though, we need to isolate our collection of widgets we want to animate into a single container – in this case, the innermost nested `LinearLayout`.

Next, add a `statusRow` `View` data member to `Patchy`:

```
private View statusRow=null;
```

...and initialize it somewhere late in `onCreate()`:

```
statusRow=findViewById(R.id.status_row);
```

Then, add a `status_entry` menu option to `Patchy/res/menu/option.xml`:

```
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
  <item android:id="@+id/prefs"
    android:title="Settings"
    android:icon="@drawable/ic_menu_preferences"
  />
  <item android:id="@+id/status_entry"
    android:title="Hide Status Entry"
    android:icon="@drawable/status_hide"
  />
  <item android:id="@+id/location"
    android:title="Insert Location"
    android:icon="@drawable/ic_menu_compass"
  />
  <item android:id="@+id/help"
    android:title="Help"
    android:icon="@drawable/ic_menu_help"
  />
</menu>
```

You will need to supply some PNG image to serve as the menu icon, preferably `32px` tall.

The menu option is initially set up in "hide" mode. However, when the user pops up the menu, we want to change that menu option to "show" mode if the `StatusEntryView` is already hidden. To do this, we can use `onPrepareOptionsMenu()` – add the following method to `Patchy`:

```
@Override
public boolean onPrepareOptionsMenu(Menu menu) {
  MenuItem statusItem=menu.findItem(R.id.status_entry);

  if (statusRow.getVisibility()==View.VISIBLE) {
    statusItem.setIcon(R.drawable.status_hide);
    statusItem.setTitle("Hide Status Entry");
  }
  else {
    statusItem.setIcon(R.drawable.status_show);
    statusItem.setTitle("Show Status Entry");
  }

  return(super.onPrepareOptionsMenu(menu));
}
```

Here, we see if the status entry row is visible and set our menu item accordingly.

At this point, if you recompile and reinstall `Patchy`, you will see the new menu item, though it will not do anything just yet:

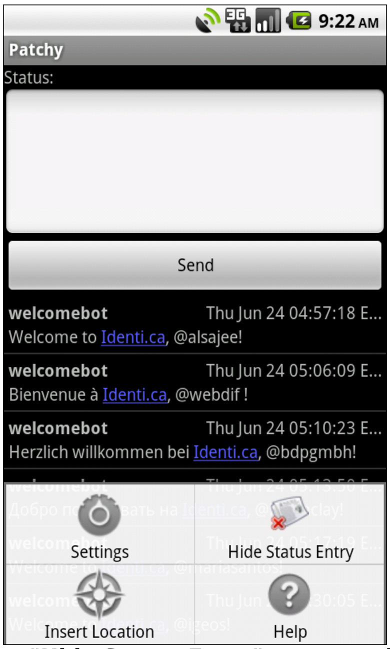


Figure 46. The "Hide Status Entry" menu option in Patchy

Step #2: Show and Hide the Status Entry Widgets

It would be nice, of course, if the newly-created menu item actually did something.

So, we need to add another case to `onOptionsItemSelected()` in `Patchy` to handle this new menu item:

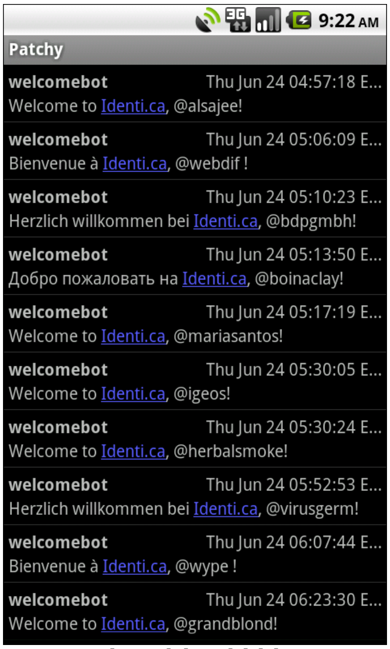
```
@Override
public boolean onOptionsItemSelected(MenuItem item) {
  if (item.getItemId()==R.id.prefs) {
    startActivity(new Intent(this, EditPreferences.class));

    return(true);
  }
  else if (item.getItemId()==R.id.location) {
    insertLocation();

    return(true);
  }
  else if (item.getItemId()==R.id.help) {
    startActivity(new Intent(this, HelpPage.class));

    return(true);
  }
  else if (item.getItemId()==R.id.status_entry) {
    toggleStatusEntry();

    return(true);
  }

  return(super.onOptionsItemSelected(item));
}
```

Here, we merely delegate to a `toggleStatusEntry()` method, so add that method to `Patchy` as shown below:

```
private void toggleStatusEntry() {
  if (status.getVisibility()==View.VISIBLE) {
    status.setVisibility(View.GONE);
  }
  else {
    status.setVisibility(View.VISIBLE);
  }
}
```

All we do here is make the status entry row hidden (`GONE`) or visible (`VISIBLE`), depending on its current state.

Now, when you hide the status entry row, the timeline gets more room:


9:22 AM

Patchy

welcomebot Thu Jun 24 04:57:18 E...
Welcome to Identi.ca, @alsajee!

welcomebot Thu Jun 24 05:06:09 E...
Bienvenue à Identi.ca, @webdif !

welcomebot Thu Jun 24 05:10:23 E...
Herzlich willkommen bei Identi.ca, @bdpgmbh!

welcomebot Thu Jun 24 05:13:50 E...
Добро пожаловать на Identi.ca, @boinaclay!

welcomebot Thu Jun 24 05:17:19 E...
Welcome to Identi.ca, @mariasantos!

welcomebot Thu Jun 24 05:30:05 E...
Welcome to Identi.ca, @igeos!

welcomebot Thu Jun 24 05:30:24 E...
Welcome to Identi.ca, @herbalsmoke!

welcomebot Thu Jun 24 05:52:53 E...
Herzlich willkommen bei Identi.ca, @virusgerm!

welcomebot Thu Jun 24 06:07:44 E...
Bienvenue à Identi.ca, @wype !

welcomebot Thu Jun 24 06:23:30 E...
Welcome to Identi.ca, @grandblond!

Figure 47. Patchy with a hidden status entry

Step #3: Fading In and Out

Of course, we have not yet used an animation, which is the point of this exercise.

First, we need to define our animations. In this case, we will use ones declared in animation XML files.

Create a `Patchy/res/anim` directory, then create `Patchy/res/anim/fade_out.xml` as follows:

```
<?xml version="1.0" encoding="utf-8"?>
<alpha xmlns:android="http://schemas.android.com/apk/res/android"
  android:fromAlpha="1.0"
  android:toAlpha="0.0"
  android:duration="500" />
```

Also create `Patchy/res/anim/fade_in.xml`:

```
<?xml version="1.0" encoding="utf-8"?>
<alpha xmlns:android="http://schemas.android.com/apk/res/android"
  android:fromAlpha="0.0"
  android:toAlpha="1.0"
  android:duration="500"/>
```

These set up 500-millisecond alpha animations that fade out and fade in, respectively.

Next, we need to declare `Animation` objects as data members in `Patchy`, to hold these once we load them:

```
private Animation fadeOut=null;
private Animation fadeIn=null;
```

Then, we can use `AnimationUtils` to load our animation XML resources into the `Animation` objects. Add the following statements sometime late in the `onCreate()` method in `Patchy`:

```
fadeOut=AnimationUtils.loadAnimation(this, R.anim.fade_out);
fadeOut.setAnimationListener(fadeOutListener);
fadeIn=AnimationUtils.loadAnimation(this, R.anim.fade_in);
```

You will note that in addition to loading the animation resources, we attached an `AnimationListener` to the `fadeOut` `Animation`. That way, we get notified when the animation is done, so we can make the widget fully "gone". Add the following implementation of `fadeOutListener` to `Patchy`:

```
Animation.AnimationListener fadeOutListener=new Animation.AnimationListener() {
  public void onAnimationEnd(Animation animation) {
    statusRow.setVisibility(View.GONE);
  }
  public void onAnimationRepeat(Animation animation) {
    // not needed
  }
  public void onAnimationStart(Animation animation) {
    // not needed
  }
};
```

Now, all that remains is to use `fadeOut` and `fadeIn` in our `toggleStatusEntry()` method:

```
private void toggleStatusEntry() {
  if (statusRow.getVisibility()==View.VISIBLE) {
    statusRow.startAnimation(fadeOut);
  }
  else {
    statusRow.setVisibility(View.VISIBLE);
    statusRow.startAnimation(fadeIn);
  }
}
```

You will also need to add imports for `android.view.animation.Animation` and `android.view.animation.AnimationUtils`.

At this point, you can rebuild and reinstall `Patchy`, and you will see your status entry area fade out when you hide it, then fade back in when you show it again.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Have the status entry widget slide out rather than fade out, either sliding out to the top or sliding out to one side.
- Use an `AnimationSet` to have the widget both fade and slide.

Further Reading

So-called "tweened" animations, such as the `AlphaAnimation` used in this chapter, are covered in the "Animating Widgets" chapter of The Busy Coder's Guide to *Advanced* Android Development. This includes coverage of other types of tweened animations (slides, spins, etc.), how to apply several animations in parallel or sequence, etc.

TUTORIAL 27

Messages From The Great Beyond

In this tutorial, we will replace the callback system we used in previous editions of `Patchy` with a broadcast `Intent`. This allows `PostMonitor` to alert applications about new status updates without there having to be an explicit connection between them.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `26-Animation` edition of `Patchy` to use as a starting point.

Step #1: Broadcast the Intent

Sending a broadcast `Intent` is rather simple, particularly for an application like `PostMonitor` that already collects the information to broadcast (in this case, friend, status, and creation date).

First, we need to choose a name for the action of the broadcast `Intent`. We need something that will not collide with other such names, so it is best to use something that has our namespace in it. Similarly, we need to have names for any values we are going to store as "extras" in our Intent, and ideally those are "namespaced" as well.

With that in mind, add the following data members to PostMonitor:

```
public static final String STATUS_UPDATE="apt.tutorial.three.STATUS_UPDATE";
public static final String FRIEND="apt.tutorial.three.FRIEND";
public static final String STATUS="apt.tutorial.three.STATUS";
public static final String CREATED_AT="apt.tutorial.three.CREATED_AT";
```

Then, we need to actually broadcast the Intent, instead of calling the callback. To do that, replace your existing poll() implementation with the following:

```
private void poll(Account l) {
  try {
    Twitter client=new Twitter(l.user, l.password);

    client.setAPIRootUrl("https://identi.ca/api");

    List<Twitter.Status> timeline=client.getFriendsTimeline();

    for (Twitter.Status s : timeline) {
      if (!seenStatus.contains(s.id)) {
        try {
          Intent broadcast=new Intent(STATUS_UPDATE);
          broadcast.putExtra(FRIEND, s.user.screenName);
          broadcast.putExtra(STATUS, s.text);
          broadcast.putExtra(CREATED_AT,
                             s.createdAt.toString());
          sendBroadcast(broadcast);
        }
        catch (Throwable t) {
          Log.e("PostMonitor", "Exception in callback", t);
        }

        seenStatus.add(s.id);

        if (s.text.indexOf(NOTIFY_KEYWORD)>-1) {
          showNotification();
        }
      }
    }
  }
  catch (Throwable t) {
    android.util.Log.e("PostMonitor",
                       "Exception in poll()", t);
  }
}
```

We create a fresh `Intent` on our defined action, populate our variable data as "extras", and call `sendBroadcast()` to send it off.

Step #2: Catch and Use the Intent

Receiving a broadcast `Intent` is similarly simple.

First, we need to decide when we want our receiver to be active and alive. In some situations, where the broadcasts are merely advisory, we can enable them in `onResume()` and disable them in `onPause()`, so we consume no CPU time processing broadcasts when our activity is not visible. In this case, so we do not miss an all-important tweet, we should ensure the receiver is active whenever our account registered with `PostMonitor` is active.

First, we need to register a receiver in `onCreate()` before we bind to our service:

```
registerReceiver(receiver, new IntentFilter(PostMonitor.STATUS_UPDATE));
```

And, we need to unregister said receiver after we unbind from the service:

```
unregisterReceiver(receiver);
```

Of course, none of this will work without a receiver itself. We want the receiver to do what our callback object does, except that instead of getting the data as method parameters, we get it as "extras" on the broadcast `Intent`. Here is one implementation of receiver that will accomplish this end:

```
private BroadcastReceiver receiver=new BroadcastReceiver() {
  public void onReceive(Context context,
                          final Intent intent) {
    String friend=intent.getStringExtra(PostMonitor.FRIEND);
    String createdAt=intent.getStringExtra(PostMonitor.CREATED_AT);
    String status=intent.getStringExtra(PostMonitor.STATUS);

    adapter.insert(new TimelineEntry(friend, createdAt, status),
                    0);
  }
};
```

If we intend to keep support for both the callback and the broadcast `Intent`, we might consider refactoring our code, such that the `TimelineEntry` addition is centrally defined.

You will need to add imports for `android.content.BroadcastReceiver`, `android.content.Context`, and `android.content.IntentFilter`.

At this point, recompile and reinstall `Patchy`. `Patchy` should run as it did before, just via broadcast `Intent` objects instead of the callback.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Get rid of the callback API. Since the service tracks accounts by the callback object (it is the key to the `Map`), you will need to restructure how the service tracks those accounts, such as using the screen name.
- Create a separate "sniffer" project that listens for the same broadcast `Intent`. Confirm that it too receives the broadcasts from `PostMonitor`.

Further Reading

The use of `Intent` filters for broadcast `Intent` objects is covered briefly in the "Creating Intent Filters" chapter of The Busy Coder's Guide to Android Development.

TUTORIAL 28

Contacting Our Friends

In this tutorial, we tie Android contacts to `Patchy`, storing identi.ca screen names in the contacts engine and highlighting those status updates that come from our contacts.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `27-IntentFilters` edition of `Patchy` to use as a starting point.

Also note that this tutorial will work with an Android 2.0 device or emulator but will *not* work with an Android 1.6 or older environment. Furthermore, the Android 2.2 emulator presently seems to have a bug, whereby if you add a contact, it does not appear on the list of contacts, even though the contact is actually there.

Step #1: Fake the Contact Data

Android's contact database does not have a built-in spot to record the Twitter screen name of the contact.

Hopefully, you have gotten over the horror of that news. Fortunately, Android 1.5 added the ability to track IM addresses, and so we will use that for our contacts' identi.ca screen names.

To do this, pick a contact, or create a new one if you do not have any. Fill in the person's display name, then scroll down to the IM area, which may be on this form directly or hidden under a "More" category:

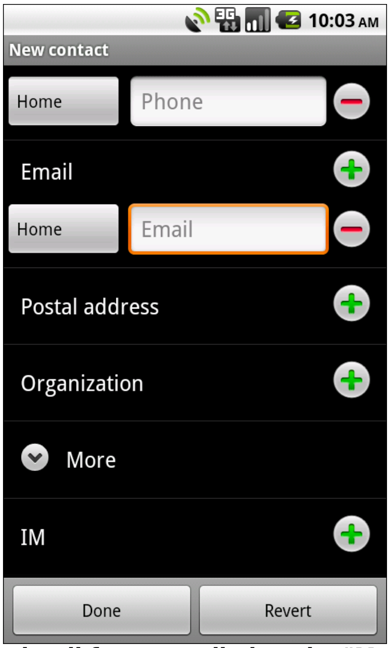


Figure 48. The contact detail form, scrolled to the "More" category, showing the IM option

Click the green plus button, which will add a blank IM set of widgets to your contact detail form:

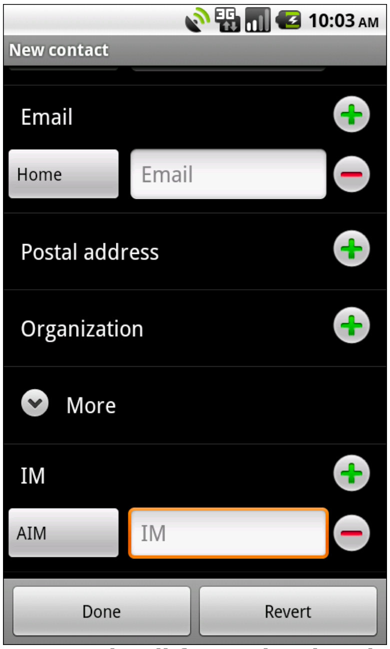


Figure 49. The contact detail form, showing the blank IM field

Click the AIM button to bring up the roster of available IM types:

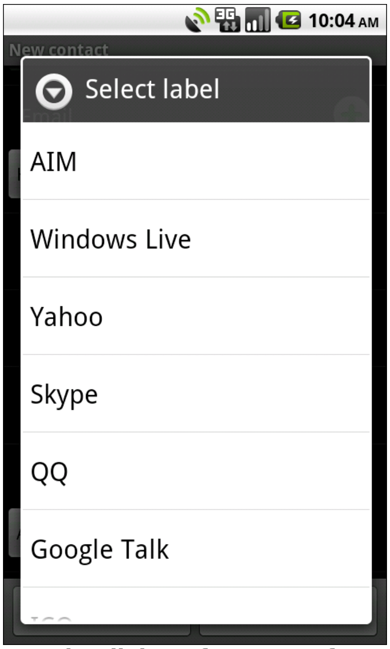


Figure 50. The dialog of IM types for contacts

Choose "Custom...", then fill in "identi.ca" (sans quotes) as the IM type:

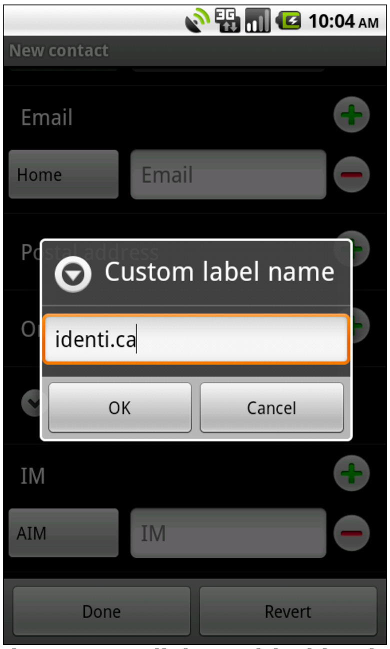


Figure 51. The IM type dialog, with "identi.ca" entered

Click OK, then fill in the identi.ca screen name for this contact in the IM field:

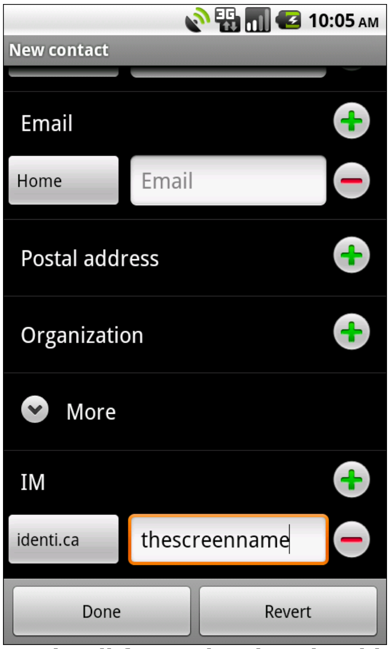


Figure 52. The contact detail form, showing the "identi.ca" IM type and "thescreename" as the screen name

Click the Done button, and you are set. You will need one or more contacts set up with screen names. In particular, you need contacts that will have status updates in your timeline.

Step #2: Design the Highlight

Next, we need to decide how we wish to highlight those friends who are in our contacts database. A simple highlight that we can apply is to put a background color on the friend's name – that will help friends who are contacts to stand out from the rest.

To do that, we first need to amend `TimelineEntry`, so it knows whether or not it is a contact – add the following data member to the `TimelineEntry` inner class of `Patchy`:

```
boolean isContact=false;
```

Then, we need to modify TimelineEntryWrapper so it looks at the isContact property of TimelineEntry and sets the background accordingly, so change populateFrom() in TimelineEntryWrapper to be:

```
void populateFrom(TimelineEntry s) {
  getFriend().setText(s.friend);
  getCreatedAt().setText(s.createdAt);
  getStatus().setText(s.status);

  if (s.isContact) {
    getFriend().setBackgroundColor(0xFF0000FF);
  }
  else {
    getFriend().setBackgroundColor(0x00000000);
  }
}
```

You might think that we only need to set the background when the friend is a contact. However, since rows get recycled, if we do not reset the background when the friend is not a contact, soon all our rows will be highlighted, mostly in error.

Step #3: Find and Highlight Matching Contacts

Of course, our isContact property in TimelineEntry is always set to be false, which is not terribly helpful. Instead, we need to do a lookup to see if a friend is actually a contact, so we can set that flag appropriately. We do not need any data about the contact – all we need to know is if there exists a contact with the appropriate Twitter "organization" and screen name.

First, add the READ_CONTACTS permission to the AndroidManifest.xml file for Patchy. Without this, we cannot find out if a friend is a contact.

Next, add a PROJECTION to Patchy:

```
private static final String[] PROJECTION=new String[] {
                             ContactsContract.Contacts._ID,
                                                    };
```

This just says that the only column we want back is the contact's ID. Also, add imports to `android.provider.ContactsContract` and `android.provider.ContactsContract.CommonDataKinds`.

Finally, modify the `TimelineEntry` constructor to be as follows:

```
TimelineEntry(String friend, String createdAt,
              String status) {
  this.friend=friend;
  this.createdAt=createdAt;
  this.status=status;

  String[] args={friend};
  StringBuilder query=new StringBuilder(CommonDataKinds.Im.CUSTOM_PROTOCOL);

  query.append("='identi.ca' AND ");
  query.append(CommonDataKinds.Im.DATA);
  query.append("=?");
  Cursor c=managedQuery(ContactsContract.Data.CONTENT_URI,
                        PROJECTION,
                        query.toString(),
                        args, null);

  if (c.getCount()>0) {
    this.isContact=true;
  }
}
```

We use `managedQuery()` to get a `Cursor` representing our contact, if any. All we do is look to see if we got one (or, conceivably, more) matches on our screen name, and use that information to set the value of `isContact`.

The net result is that any friends whose screen names are in our contacts will show up with their screen names on a blue background.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Provide a means from the `Patchy` UI to see the contact information for a contact from whom we have received a status update.
- Cache the matching contacts for a short period of time, to reduce contact lookups when new status updates come in.

- Provide a means from the `Patchy` UI to "re-tweet" both inside identi.ca and by forwarding the post (and its URL) to contacts via email or SMS.

Further Reading

Using content providers in general is covered in the "Using a Content Provider" chapter of The Busy Coder's Guide to Android Development. Using the `ContactsContract` content provider specifically is covered in "The Contacts Content Provider", found in The Busy Coder's Guide to *Advanced* Android Development.

TUTORIAL 29

Android Would Like Your Attention

From time to time, Android can tell you things that may be of interest, such as when the battery gets low. This allows you to take action based on those system events, such as reducing the amount of background work you do while the battery is low. In this tutorial, we will update the `PostMonitor` service to be gentler while the battery is low, by polling less frequently.

NOTE: This tutorial requires an actual Android device, as the emulator does not fully emulate a battery.

Step-By-Step Instructions

First, you need to have completed the previous `Patchy` tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `28-UsingCP` edition of `Patchy` to use as a starting point.

Step #1: Track the Battery State

We need to register a `BroadcastListener` from `PostMonitor` to be informed of changes in state in the battery.

First, add the `registerReceiver()` call to `onCreate()` in `PostMonitor`:

```
@Override
public void onCreate() {
  super.onCreate();

  new Thread(threadBody).start();
  registerReceiver(onBatteryChanged,
                   new IntentFilter(Intent.ACTION_BATTERY_CHANGED));
}
```

We set the receiver's `IntentFilter` to watch for `ACTION_BATTERY_CHANGED` events, routing them to an `onBattery` object.

You will need to add an import for `android.content.IntentFilter`.

Next, call `unregisterReceiver()` in `onDestroy()` in `PostMonitor`:

```
@Override
public void onDestroy() {
  super.onDestroy();

  unregisterReceiver(onBatteryChanged);
  active.set(false);
}
```

If we do not do this, our service will keep running and getting battery events even after it would ordinarily have shut down.

Both of these rely on an `onBattery` `BroadcastReceiver` implementation, which you should add to `PostMonitor`:

```
BroadcastReceiver onBatteryChanged=new BroadcastReceiver() {
  public void onReceive(Context context, Intent intent) {
    int pct=100
          *intent.getIntExtra(BatteryManager.EXTRA_LEVEL, 1)
          /intent.getIntExtra(BatteryManager.EXTRA_SCALE, 1);

    isBatteryLow.set(pct<=25);
  }
};
```

All we do is examine the battery level (as measured on the battery level scale) and, if it hits 25% or lower, we set an `isBatteryLow` object to true; otherwise, we set it to false.

You will need to add imports for `android.os.BatteryManager`, `android.content.Context`, and `android.content.BroadcastReceiver`.

The `isBatteryLow` object is actually an `AtomicBoolean`, which you should add to the data members for `PostMonitor`:

```
private AtomicBoolean isBatteryLow=new AtomicBoolean(false);
```

At this point, we are watching for battery events and setting `isBatteryLow`, but we are not making use of that information anywhere.

Step #2: Use the Battery State

Then, all we need to do is look at `isBatteryLow` in our polling loop. Modify `threadBody` in `PostMonitor` to look like this:

```
private Runnable threadBody=new Runnable() {
  public void run() {
    while (active.get()) {
      for (Account l : accounts.values()) {
        poll(l);
      }

      int pollPeriod=POLL_PERIOD;

      if (isBatteryLow.get()) {
        pollPeriod*=10;
      }

      SystemClock.sleep(pollPeriod);
    }
  }
};
```

All we do is multiply our normal polling period by a factor of `10` when the battery is low.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Offer a user preference whereby `PostMonitor` will only poll if there is a WiFi connection available. Then, monitor the WiFi connection state and enable/disable polling as appropriate.
- Offer a user preference whereby `PostMonitor` will start collecting timeline updates on boot and will buffer some number of updates, so when `Patchy` connects, updates are available immediately and fewer are missed in between `Patchy` runs.

Further Reading

Additional coverage of Android-generated broadcast Intent objects can be found in the "Handling System Events" chapter of The Busy Coder's Guide to *Advanced* Android Development.

TUTORIAL 30

Now, Your Friends Are Alarmed

One current flaw with `Patchy` is that if your device goes to sleep, you will not get status updates on your timeline. Clearly, this must be corrected.

In this tutorial you will have `PostMonitor` use `AlarmManager`, instead of its own polling loop, to wake it up as needed. You will also use a `WakeLock` ensure `PostMonitor` stays awake long enough to do a poll of the timeline. Fortunately, much of this is wrapped up in a resuable component that you will employ.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `29-SysEvents` edition of `Patchy` to use as a starting point.

Step #1: Import a Reusable Component

Some guy wrote `WakefulIntentService`, which is covered in some detail in *The Busy Coder's Guide to Advanced Android Development*. `WakefulIntentService` is an ideal component to use in this application, to ensure that if the device wakes up in the middle of the night to poll Twitter for updates, that the device does not fall back asleep in the middle of doing that poll.

To obtain the JAR containing `WakefulIntentService`, you can either download the source code from its GitHub repository and run `ant jar` to build it, or you can download a pre-compiled JAR from that GitHub repository's "Downloads" area, or you can get the JAR out of the source code for this book in the `30-SysSvcs` edition of the `Patchy` project.

Either way, once you have the JAR, put it in your `libs/` directory.

Step #2: Create the Alarm BroadcastReceiver

In order to receive alarms from the `AlarmManager`, we need a `BroadcastReceiver` registered in our `AndroidManifest.xml` file. This `BroadcastReceiver`, in turn, needs to start our `PostMonitor` service, in case it is not running, and to let it know that a poll is required.

Create `Patchy/src/apt/tutorial/two/OnAlarmReceiver.java` with the following implementation:

```java
package apt.tutorial.two;

import android.content.BroadcastReceiver;
import android.content.Context;
import android.content.Intent;
import android.util.Log;
import com.commonsware.cwac.wakeful.WakefulIntentService;

public class OnAlarmReceiver extends BroadcastReceiver {
  @Override
  public void onReceive(Context context, Intent intent) {

    Intent i=new Intent(context, PostMonitor.class);

    i.setAction(PostMonitor.POLL_ACTION);

    WakefulIntentService.sendWakefulWork(context, i);
  }
}
```

Then, add it to `AndroidManifest.xml`, along with the `WAKE_LOCK` permission we need in order to use a `WakeLock`:

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

```
      package="apt.tutorial.two"
      android:versionCode="1"
      android:versionName="1.0">
  <uses-permission android:name="android.permission.INTERNET" />
  <uses-permission android:name="android.permission.ACCESS_FINE_LOCATION" />
  <uses-permission android:name="android.permission.READ_CONTACTS" />
  <uses-permission android:name="android.permission.WAKE_LOCK" />
    <application android:label="@string/app_name">
        <uses-library android:name="com.google.android.maps" />
        <activity android:name=".Patchy"
                  android:label="@string/app_name">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
        <activity android:name=".EditPreferences">
        </activity>
        <activity android:name=".StatusMap">
        </activity>
        <activity android:name=".HelpCast">
        </activity>
        <activity android:name=".HelpPage">
        </activity>
        <service android:name=".PostMonitor" />
        <receiver android:name=".OnAlarmReceiver">
        </receiver>
    </application>
</manifest>
```

`OnAlarmReceiver` tells `WakefulIntentService` to `sendWakefulWork()`, which will:

- Acquire a static `WakeLock`, then
- Call `startService()` on our `PostMonitor` service

This means all `WakeLock` management can be encapsulated in `WakefulIntentService`.

Step #3: Doing the Work

Now, we need to arrange for `PostMonitor` to respond to those polling `Intents`.

First, change `PostMonitor` to have it extend `WakefulIntentService`, adding an import for `com.commonsware.cwac.wakeful.WakefulIntentService`.

Next, add a couple of private data members, one for an AlarmManager and one for a PendingIntent, with suitable imports:

```
private AlarmManager alarm=null;
private PendingIntent pi=null;
```

You will need to add an import for android.app.AlarmManager. The AlarmManager is the gateway to scheduled tasks in Android, while the PendingIntent will be invoked each time the alarm goes off.

Then, update onCreate() to obtain the AlarmManager system service and to set up the PendingIntent that AlarmManager should invoke every polling cycle, plus schedule the initial alarm:

```
@Override
public void onCreate() {
  super.onCreate();

  new Thread(threadBody).start();
  registerReceiver(onBatteryChanged,
                   new IntentFilter(Intent.ACTION_BATTERY_CHANGED));

  alarm=(AlarmManager)getSystemService(Context.ALARM_SERVICE);

  Intent i=new Intent(this, OnAlarmReceiver.class);

  pi=PendingIntent.getBroadcast(this, 0, i, 0);
  setAlarm(INITIAL_POLL_PERIOD);
}
```

Note that we also get rid of our statement to schedule the threadBody Runnable as a background thread, because an IntentService (parent class of WakefulIntentService) automatically lets us do our work on a background thread.

This requires a setAlarm() method to actually schedule the alarm:

```
private void setAlarm(long period) {
  alarm.set(AlarmManager.ELAPSED_REALTIME_WAKEUP,
            SystemClock.elapsedRealtime()+period,
            pi);
}
```

The setAlarm() implementation tells AlarmManager to schedule a one-shot alarm (rather than a recurring alarm), using the time-base of SystemClock.elapsedRealtime(), to go off in period milliseconds from now, invoking our PendingIntent at that point.

We now need to do the actual work itself. According to the protocol for WakefulIntentService, we need to override a doWakefulWork() method, which will be invoked inside a partial WakeLock every time the service is started. For those that are actual polling Intents, we want to poll the Twitter accounts, then schedule the next alarm:

```
@Override
protected void doWakefulWork(Intent i) {
  if (i.getAction().equals(POLL_ACTION)) {
    for (Account l : accounts.values()) {
      poll(l);
    }
  }

  setAlarm(isBatteryLow.get() ? POLL_PERIOD*10 : POLL_PERIOD);
}
```

You will recognize some of this functionality as mimicking the threadBody Runnable that we are no longer using.

Note that while AlarmManager supports recurring alarms, since our polling period may change based upon battery state, we are manually scheduling successive alarms here.

We also need to cancel the outstanding alarm when the service is destroyed:

```
@Override
public void onDestroy() {
  super.onDestroy();

  alarm.cancel(pi);
  unregisterReceiver(onBatteryChanged);
  active.set(false);
}
```

Finally, WakefulIntentService requires a constructor, because IntentService (supplied by Android) does. The WakefulIntentService's constructor takes a String parameter that is the "name" of the service. What role this name plays is unclear. So, add a functional constructor:

```
public PostMonitor() {
  super("PostMonitor");
}
```

Now you can get rid of the isActive and threadBody data members, along with all references to them (which you will find in onCreate() and onDestroy()).

Now, if you rebuild and reinstall the project, Patchy should work as before. The exception is that if you have Patchy on a device, and you let the device fall asleep while Patchy is still active, you should still receive status updates.

Here is the entire listing of PostMonitor after all of these changes:

```
package apt.tutorial.two;

import android.app.AlarmManager;
import android.app.Notification;
import android.app.NotificationManager;
import android.app.PendingIntent;
import android.app.Service;
import android.content.BroadcastReceiver;
import android.content.Context;
import android.content.Intent;
import android.content.IntentFilter;
import android.os.BatteryManager;
import android.os.Binder;
import android.os.IBinder;
import android.os.SystemClock;
import android.util.Log;
import java.util.HashSet;
import java.util.List;
import java.util.Map;
import java.util.Set;
import java.util.concurrent.ConcurrentHashMap;
import java.util.concurrent.atomic.AtomicBoolean;
import winterwell.jtwitter.Twitter;
import apt.tutorial.IPostListener;
import apt.tutorial.IPostMonitor;
import com.commonsware.cwac.wakeful.WakefulIntentService;
```

```
public class PostMonitor extends WakefulIntentService {
  public static final int NOTIFICATION_ID=1337;
  public static final String STATUS_UPDATE="apt.tutorial.three.STATUS_UPDATE";
  public static final String FRIEND="apt.tutorial.three.FRIEND";
  public static final String STATUS="apt.tutorial.three.STATUS";
  public static final String CREATED_AT="apt.tutorial.three.CREATED_AT";
  public static final String POLL_ACTION="apt.tutorial.three.POLL_ACTION";
  private static final String NOTIFY_KEYWORD="snicklefritz";
  private static final int INITIAL_POLL_PERIOD=1000;
  private static final int POLL_PERIOD=60000;
  private AtomicBoolean active=new AtomicBoolean(true);
  private Set<Long> seenStatus=new HashSet<Long>();
  private Map<IPostListener, Account> accounts=
          new ConcurrentHashMap<IPostListener, Account>();
  private final Binder binder=new LocalBinder();
  private AtomicBoolean isBatteryLow=new AtomicBoolean(false);
  private AlarmManager alarm=null;
  private PendingIntent pi=null;

  public PostMonitor() {
    super("PostMonitor");
  }

  @Override
  public void onCreate() {
    super.onCreate();

    new Thread(threadBody).start();
    registerReceiver(onBatteryChanged,
                     new IntentFilter(Intent.ACTION_BATTERY_CHANGED));

    alarm=(AlarmManager)getSystemService(Context.ALARM_SERVICE);

    Intent i=new Intent(this, OnAlarmReceiver.class);

    pi=PendingIntent.getBroadcast(this, 0, i, 0);
    setAlarm(INITIAL_POLL_PERIOD);
  }

  @Override
  public IBinder onBind(Intent intent) {
    return(binder);
  }

  @Override
  public void onDestroy() {
    super.onDestroy();

    alarm.cancel(pi);
    unregisterReceiver(onBatteryChanged);
    active.set(false);
  }

  @Override
```

```
protected void doWakefulWork(Intent i) {
  if (i.getAction().equals(POLL_ACTION)) {
    for (Account l : accounts.values()) {
      poll(l);
    }
  }

  setAlarm(isBatteryLow.get() ? POLL_PERIOD*10 : POLL_PERIOD);
}

private void setAlarm(long period) {
  alarm.set(AlarmManager.ELAPSED_REALTIME_WAKEUP,
            SystemClock.elapsedRealtime()+period,
            pi);
}

private void poll(Account l) {
  try {
    Twitter client=new Twitter(l.user, l.password);

    client.setAPIRootUrl("https://identi.ca/api");

    List<Twitter.Status> timeline=client.getFriendsTimeline();

    for (Twitter.Status s : timeline) {
      if (!seenStatus.contains(s.id)) {
        try {
          Intent broadcast=new Intent(STATUS_UPDATE);
          broadcast.putExtra(FRIEND, s.user.screenName);
          broadcast.putExtra(STATUS, s.text);
          broadcast.putExtra(CREATED_AT,
                             s.createdAt.toString());
          sendBroadcast(broadcast);
        }
        catch (Throwable t) {
          Log.e("PostMonitor", "Exception in callback", t);
        }

        seenStatus.add(s.id);

        if (s.text.indexOf(NOTIFY_KEYWORD)>-1) {
          showNotification();
        }
      }
    }
  }
  catch (Throwable t) {
    android.util.Log.e("PostMonitor",
                       "Exception in poll()", t);
  }
}

private void showNotification() {
  final NotificationManager mgr=
    (NotificationManager)getSystemService(NOTIFICATION_SERVICE);
  Notification note=new Notification(R.drawable.status,
                                     "New matching post!",
                                     System.currentTimeMillis());
  Intent i=new Intent(this, Patchy.class);

  i.setFlags(Intent.FLAG_ACTIVITY_CLEAR_TOP|
            Intent.FLAG_ACTIVITY_SINGLE_TOP);

  PendingIntent pi=PendingIntent.getActivity(this, 0,
                                          i,
                                          0);

  note.setLatestEventInfo(this, "Identi.ca Post!",
                         "Found your keyword: "+NOTIFY_KEYWORD,
                         pi);

  mgr.notify(NOTIFICATION_ID, note);
}

private Runnable threadBody=new Runnable() {
  public void run() {
    while (active.get()) {
      for (Account l : accounts.values()) {
        poll(l);
      }

      int pollPeriod=POLL_PERIOD;

      if (isBatteryLow.get()) {
        pollPeriod*=10;
      }

      SystemClock.sleep(pollPeriod);
    }
  }
};

BroadcastReceiver onBatteryChanged=new BroadcastReceiver() {
  public void onReceive(Context context, Intent intent) {
    int pct=100
              *intent.getIntExtra(BatteryManager.EXTRA_LEVEL, 1)
              /intent.getIntExtra(BatteryManager.EXTRA_SCALE, 1);

    isBatteryLow.set(pct<=25);
  }
};

class Account {
  String user=null;
  String password=null;
  IPostListener callback=null;

  Account(String user, String password,
          IPostListener callback) {
    this.user=user;
    this.password=password;
    this.callback=callback;
  }
}

public class LocalBinder extends Binder implements IPostMonitor {
  public void registerAccount(String user, String password,
                               IPostListener callback) {
    Account l=new Account(user, password, callback);

    poll(l);
    accounts.put(callback, l);
  }

  public void removeAccount(IPostListener callback) {
    accounts.remove(callback);
  }
}
}
```

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Offer a user preference whereby `PostMonitor` will start collecting timeline updates on boot and will buffer some number of updates, so when `Patchy` connects, updates are available immediately and fewer are missed in between `Patchy` runs. This will require the initial alarm to be set from the on-boot receiver, rather than from the service's `onCreate()`.
- Extend the above extra credit component by offering a user preference to have `PostMonitor` raise a `Notification` if certain sorts of status updates are received while `Patchy` itself is *not* running.

Further Reading

You can learn more about the `AlarmManager` and the `WakefulIntentService` in the "Using System Services" chapter of The Busy Coder's Guide to *Advanced* Android Development.

TUTORIAL 31

Searching For Food

In this tutorial, we will enable searching of the restaurant list, so you can find one in the vast array of restaurants you surely will maintain in this application.

Step-By-Step Instructions

First, you need to have completed the previous `LunchList` tutorial. If you are starting from scratch here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `14-Rotation` edition of `LunchList` to use as a starting point.

Step #1: Have the List Conduct the Search

First, we need to be able to trigger the local search. To do this, add another item to our `LunchList/res/menu/options.xml` menu definition:

```
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
  <item android:id="@+id/add"
    android:title="Add"
    android:icon="@drawable/ic_menu_add"
  />
  <item android:id="@+id/search"
    android:title="Search"
    android:icon="@drawable/ic_menu_search"
  />
  <item android:id="@+id/prefs"
```

```
    android:title="Settings"
    android:icon="@drawable/ic_menu_preferences"
  />
</menu>
```

You will need a suitable icon, such as `ic_menu_search.png` from the Android SDK.

Then, add the corresponding segment to `onOptionsItemSelected()` in `LunchList` to handle our new item:

```
@Override
public boolean onOptionsItemSelected(MenuItem item) {
  if (item.getItemId()==R.id.add) {
    startActivity(new Intent(LunchList.this, DetailForm.class));

    return(true);
  }
  else if (item.getItemId()==R.id.prefs) {
    startActivity(new Intent(this, EditPreferences.class));

    return(true);
  }
  else if (item.getItemId()==R.id.search) {
    onSearchRequested();

    return(true);
  }

  return(super.onOptionsItemSelected(item));
}
```

This triggers `onSearchRequested()`, which tells Android that we would like to conduct a search in this application.

Finally, in `initList()` in `LunchList`, we need to see if our activity was launched via a search and, if so, use the search string entered by the user. Here is a revised `initList()` implementation for `LunchList` that does just that:

```
private void initList() {
  if (model!=null) {
    stopManagingCursor(model);
    model.close();
  }
  String where=null;

  if (Intent.ACTION_SEARCH.equals(getIntent().getAction())) {
    where="name LIKE \"%"+getIntent().getStringExtra(SearchManager.QUERY)+"%\"";
  }

  model=helper.getAll(where, prefs.getString("sort_order", "name"));
  startManagingCursor(model);
  adapter=new RestaurantAdapter(model);
  setListAdapter(adapter);
}
```

The `ACTION_SEARCH Intent` will be sent to our activity if the activity was started as the result of a search request. Here, we are having the same activity be the "normal" presentation and display search results – this approach may or may not be appropriate for any given application. The search is simply a `WHERE` clause, searching for the search term (`getIntent().getStringExtra(SearchManager.QUERY)`) anywhere in the restaurant's name.

You will need to add an import for `android.app.SearchManager`.

This also means we need to accept a possible `WHERE` clause in the `getAll()` method of `RestaurantHelper`:

```
public Cursor getAll(String where, String orderBy) {
  StringBuilder buf=new StringBuilder("SELECT _id, name, address, type, notes
FROM restaurants");

  if (where!=null) {
    buf.append(" WHERE ");
    buf.append(where);
  }

  if (orderBy!=null) {
    buf.append(" ORDER BY ");
    buf.append(orderBy);
  }

  return(getReadableDatabase().rawQuery(buf.toString(), null));
}
```

Step #2: Integrate the Search in the Application

Now we need to tell Android that this application is searchable and how to do the search.

First, we need to overhaul our `AndroidManifest.xml` file to indicate that the `LunchList` activity is both searchable and the activity to launch to conduct a search:

```xml
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
      package="apt.tutorial"
      android:versionCode="1"
      android:versionName="1.0">
    <application android:label="@string/app_name">
        <activity android:name=".LunchList"
                  android:label="@string/app_name">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
            <intent-filter>
                <action android:name="android.intent.action.SEARCH" />
                <category android:name="android.intent.category.DEFAULT" />
            </intent-filter>
            <meta-data android:name="android.app.searchable"
                    android:resource="@xml/searchable" />
            <meta-data android:name="android.app.default_searchable"
                    android:value=".LunchList" />
        </activity>
        <activity android:name=".DetailForm">
        </activity>
        <activity android:name=".EditPreferences">
        </activity>
    </application>
</manifest>
```

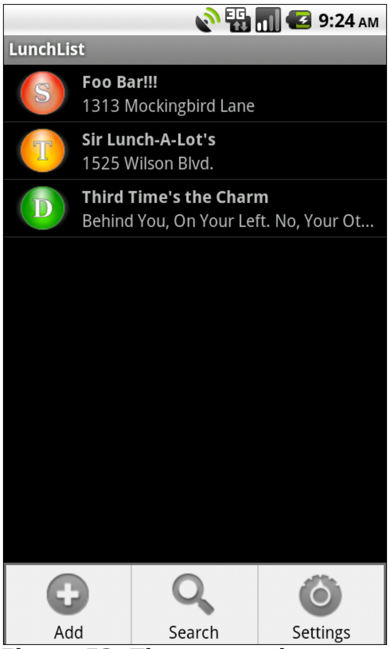
The second `<intent-filter>` indicates that the `LunchList` activity will handle any local search requests. The `android.app.searchable` metadata element names `@xml/searchable` as being the configuration details for the search itself. So, add a `LunchList/res/xml/searchable.xml` file with the following content:

```xml
<searchable xmlns:android="http://schemas.android.com/apk/res/android"
    android:label="@string/searchLabel"
    android:hint="@string/searchHint" />
```

That file, in turn, references a pair of `String` resources, so we need to add them to `LunchList/res/values/strings.xml`:

```
<?xml version="1.0" encoding="utf-8"?>
<resources>
    <string name="app_name">LunchList</string>
    <string name="searchLabel">Restaurants</string>
    <string name="searchHint">lorem</string>
</resources>
```

At this point, you can recompile and reinstall your application. Choosing the option menu will display our new search item:



Foo Bar!!!
1313 Mockingbird Lane
Sir Lunch-A-Lot's
1525 Wilson Blvd.
Third Time's the Charm
Behind You, On Your Left. No, Your Ot...

Figure 53. The new option menu

Choosing the search brings up the search field:

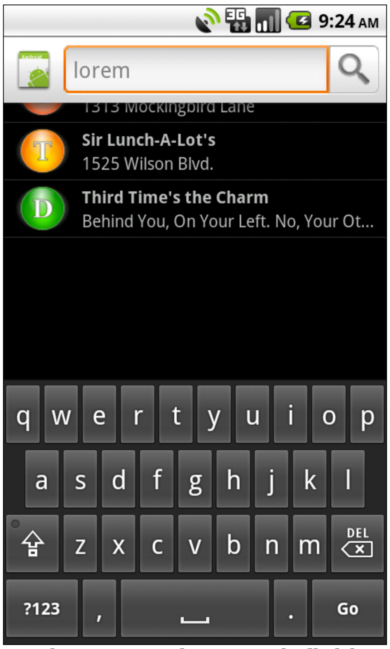


Figure 54. The search field

Entering in some value will give us a new `LunchList` with just the matching subset – those restaurants whose names contain the typed-in string.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Extend the search to search all relevant attributes of the data model, including address, notes, and the phone number.
- Support the Quick Search Box, by implementing another content provider, this one to provide search suggestions.

Further Reading

There is much more you can do to integrate with the Android search system. You will learn how in the "Searching with SearchManager" chapter of The Busy Coder's Guide to *Advanced* Android Development.

TUTORIAL 32

Look Inside Yourself

In this tutorial, we will use the PackageManager to find out what operations are all possible on a contact pulled out of the contacts database on the device or emulator.

Step-By-Step Instructions

This tutorial starts a new application, independent from the LunchList and Patchy applications developed in the preceding tutorials. Hence, we will have you create a new application from scratch.

Note that this tutorial will not work on the Android 2.2 emulator due to some sort of a bug, whereby contacts can be added but do not show up in the contacts list.

Step #1: Create a Stub Project

Using Eclipse or `android create project`, make a project named `Contacter` with a stub activity named `apt.tutorial.four.Contacter`. The generated activity class should resemble the following:

```
package apt.tutorial.four;

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

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

Then, change it to be a ListActivity instead of an ordinary Activity, as we will be using some ListActivity-specific methods and support in this tutorial.

Step #2: Create a Layout

The goal of Contacter is to allow you to choose a contact, then show a list of possible actions on that contact via a ListView. That means we need a layout that lets us accomplish those ends.

With that in mind, create Contacter/res/layout/main.xml with the following content:

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:orientation="vertical"
  android:layout_width="fill_parent"
  android:layout_height="fill_parent"
  >
  <Button
    android:id="@+id/pick"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
    android:text="Gimme a contact!"
    android:layout_weight="1"
  />
  <ListView
    android:id="@android:id/list"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
    android:layout_weight="1"
  />
</LinearLayout>
```

Step #3: Find the Correct Contact Uri

Since we want this particular code to run on a variety of Android releases, we need to figure out the right `Uri` to use to wrap in an `ACTION_PICK Intent` to let the user pick a contact. In Android 2.0 and newer, the `Uri` is `android.provider.ContactsContract.Contacts.CONTENT_URI`, while in Android 1.6 and earlier, the `Uri` is `android.provider.Contacts.People.CONTENT_URI`.

Fortunately, this value will not change during the execution of our application, so we can find out the right value via a static initializer, then use the value throughout the application.

Hence, add the following static data member and initializer block to `Contacter`, along with the required imports:

```
private static Uri CONTENT_URI=null;

static {
  int sdk=new Integer(Build.VERSION.SDK).intValue();

  if (sdk>=5) {
    try {
      Class clazz=Class.forName("android.provider.ContactsContract$Contacts");

      CONTENT_URI=(Uri)clazz.getField("CONTENT_URI").get(clazz);
    }
    catch (Throwable t) {
      Log.e("PickDemo", "Exception when determining CONTENT_URI", t);
    }
  }
  else {
    CONTENT_URI=Contacts.People.CONTENT_URI;
  }
}
```

Step #4: Attach the Button to the Contacts

Next, we want to arrange to let the user pick a contact when the button is clicked.

To do this, add the following implementation of `onCreate()` to `Contacter`:

```
public void onCreate(Bundle icicle) {
  super.onCreate(icicle);

  if (CONTENT_URI==null) {
    Toast
      .makeText(this, "We are experiencing technical difficulties...",
                Toast.LENGTH_LONG)
      .show();
    finish();

    return;
  }

  setContentView(R.layout.main);

  Button btn=(Button)findViewById(R.id.pick);

  btn.setOnClickListener(new View.OnClickListener() {
    public void onClick(View view) {
      Intent i=new Intent(Intent.ACTION_PICK, CONTENT_URI);

      startActivityForResult(i, PICK_REQUEST);
    }
  });
}
```

We first check to ensure our derived `CONTENT_URI` value is found; if not, we shut down the application, since there is nothing we can do. Otherwise, we load the layout, get the `Button`, and have it `startActivityForResult()` on the `ACTION_PICK` `Intent` on a button click.

We also need an implementation of `PICK_REQUEST`:

```
private static final int PICK_REQUEST=1337;
```

Step #5: Populate the List

We are not doing anything presently after the user makes their selection. What we want to do is display a roster of possible actions in the `ListView` in our layout.

First, create a layout to use with our rows, as `Contacter/res/layout/row.xml`:

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

```
  android:layout_width="fill_parent"
  android:layout_height="wrap_content"
  >
  <ImageView android:id="@+id/icon"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_alignParentLeft="true"
    android:paddingLeft="2px"
    android:paddingTop="2px"
    android:paddingBottom="2px"
    android:paddingRight="5px"
  />
  <TextView
    android:id="@+id/label"
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:layout_toRightOf="@id/icon"
    android:textSize="11pt"
    android:paddingTop="2px"
    android:paddingBottom="2px"
  />
</RelativeLayout>
```

Then, let's implement `onActivityResult()` on `Contacter` to get the selected contact, get access to the `PackageManager`, craft an empty `Intent` on the selected contact, and query the `PackageManager` for available activities that work with that `Intent`. Finally, we sort the resulting list of `ResolveInfo` objects and pour them into an `ActionAdapter`:

```
@Override
protected void onActivityResult(int requestCode, int resultCode,
                                 Intent data) {
  if (requestCode==PICK_REQUEST) {
    if (resultCode==RESULT_OK) {
      Uri contact=data.getData();
      Intent stub=new Intent();

      stub.setData(contact);

      PackageManager pm=getPackageManager();
      List<ResolveInfo> actions=pm.queryIntentActivities(stub, 0);

      Collections.sort(actions,
                  new ResolveInfo.DisplayNameComparator(pm));

      setListAdapter(new ActionAdapter(pm, actions));
    }
  }
}
```

ActionAdapter is a class we need to implement, to pour a ResolveInfo into the row layouts for our ListView. Hence, add the following ActionAdapter implementation as an inner class of Contacter:

```
class ActionAdapter extends ArrayAdapter<ResolveInfo> {
  private PackageManager pm=null;

  ActionAdapter(PackageManager pm, List<ResolveInfo> apps) {
    super(Contacter.this, R.layout.row, apps);
    this.pm=pm;
  }

  @Override
  public View getView(int position, View convertView,
                      ViewGroup parent) {
    if (convertView==null) {
      convertView=newView(parent);
    }

    bindView(position, convertView);

    return(convertView);
  }

  private View newView(ViewGroup parent) {
    return(getLayoutInflater().inflate(R.layout.row, parent, false));
  }

  private void bindView(int position, View row) {
    TextView label=(TextView)row.findViewById(R.id.label);

    label.setText(getItem(position).loadLabel(pm));

    ImageView icon=(ImageView)row.findViewById(R.id.icon);

    icon.setImageDrawable(getItem(position).loadIcon(pm));
  }
}
```

At this point, you can compile and install your Contacter application. Initially, the list is empty, so the screen just shows the button:

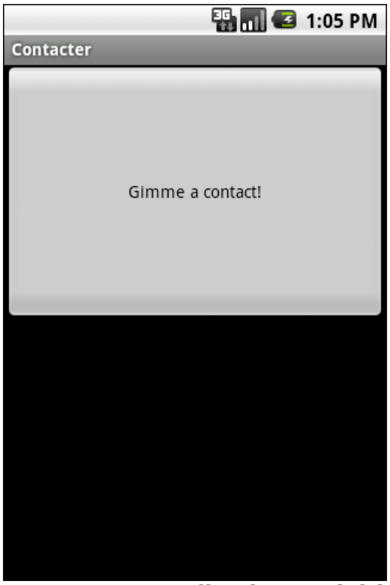


Figure 55. The Contacter application, as initially launched

Then, if you click the button and choose a contact, you will get a list of possible actions at the bottom:

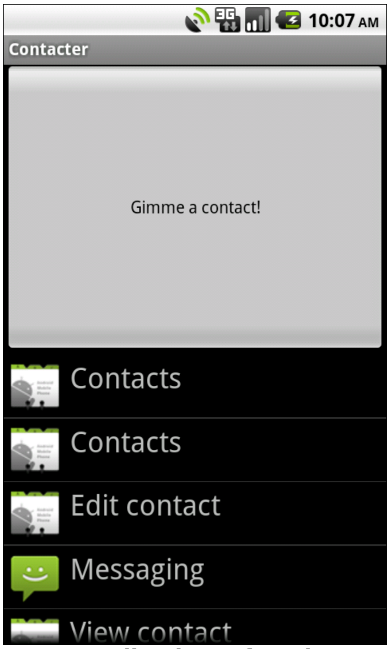


Figure 56. The Contacter application, after the user chooses a contact

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Arrange to get control on a list item click and display more details about the possible action, by getting details out of the `ResolveInfo` object (in particular, the `ActivityInfo` object held onto by the `ResolveInfo` object).
- Find a way to launch an actual activity from the information held in the `ResolveInfo` that starts up the desired action. You might want to take a peek at the source code to addIntentOptions() in the Android source code for ideas on how to accomplish this.

Further Reading

Other facets of `PackageManager` for introspection are covered in the "Introspection and Integration" chapter of The Busy Coder's Guide to *Advanced* Android Development.

TUTORIAL 33

A Restaurant In Your Own Home

In this tutorial, we will create an "app widget", the term Android uses for interactive elements a user can add to their home screen. In particular, we will create an app widget that shows a random restaurant out of the `LunchList` database.

Step-By-Step Instructions

First, you need to have completed the previous `LunchList` tutorial. If you are starting from scratch here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `31-Search` edition of `LunchList` to use as a starting point.

Step #1: Find An App Widget Background and Icon

We are going to need a background to use for our app widget, so its contents do not seem to float in empty space in the home screen. Ideally, this background is resizeable, so we have a choice of using an XML-defined drawable resource, or a nine-patch PNG.

If you examine the `33-AppWidget` project in the book's source code repository, you will see that there is a `widget_background.9.png` file in `LunchList/res/drawable`. That nine-patch image works nicely for your app widget. It is actually a clone of the nine-patch used as the background for the `Toast` class, culled from the Android open source project. You are welcome to use this image or find (or create) another of your choosing.

You will also need an icon, which will go alongside the `LunchList` name in Android's list of available widgets. Find some likely icon (32px square or so) and add it as `LunchList/res/drawable/icon.png`.

Step #2: Design the App Widget Layout

Next, we need to define a layout for our app widgets. App widgets are created via layout files, no different than activities, `ListView` rows, and the like. Right now, all we want is to show the name of the app widget, inside of something to serve as the widget's background.

So, create a `LunchList/res/layout/widget.xml` file with the following content:

```
<?xml version="1.0" encoding="utf-8"?>
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:layout_width="fill_parent"
  android:layout_height="fill_parent"
  android:background="@drawable/widget_frame"
>
  <TextView android:id="@+id/name"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_centerVertical="true"
    android:layout_alignParentLeft="true"
    android:textSize="10pt"
    android:textColor="#FFFFFFFF"
  />
</RelativeLayout>
```

Step #3: Add an (Empty) AppWidgetProvider

Next, we need to create an `AppWidgetProvider`. `AppWidgetProvider`, a subclass of `BroadcastReceiver`, provides the base implementation for an app widget and gives us lifecycle methods like `onUpdate()` we can override to add custom behavior.

For now, though, just create an empty `AppWidgetProvider` implementation, with the truly unique name of `AppWidget`:

```java
package apt.tutorial;

import android.appwidget.AppWidgetProvider;

public class AppWidget extends AppWidgetProvider {
}
```

Step #4: Add the Widget Metadata

As part of wiring our app widget into our application, we need to create a "widget metadata" XML document. This file provides additional configuration definitions for the app widget, for things that cannot readily go into the manifest.

So, create a `LunchList/res/xml/widget_provider.xml` file with the following content:

```xml
<?xml version="1.0" encoding="utf-8"?>
<appwidget-provider xmlns:android="http://schemas.android.com/apk/res/android"
  android:minWidth="300dip"
  android:minHeight="79dip"
  android:updatePeriodMillis="1800000"
  android:initialLayout="@layout/widget"
/>
```

Here, we provide a height and width suggestion, which Android will convert into a number of "cells" given the actual screen size and density. Our height and width will give us a 4x1 cell widget, which means it will take up the entire width of a portrait mode screen.

The metadata also indicates the starting layout to use (the one we created earlier in this tutorial) and an "update period", which tells Android how frequently to ask us to update the app widget's contents (set to 30 minutes, in milliseconds).

Step #5: Update the Manifest

Now, we can add our widget to the manifest file. Edit `AndroidManifest.xml` to look like the following:

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
      package="apt.tutorial"
      android:versionCode="1"
      android:versionName="1.0">
    <application android:label="@string/app_name">
        <activity android:name=".LunchList"
                  android:label="@string/app_name">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
            <intent-filter>
                <action android:name="android.intent.action.SEARCH" />
                <category android:name="android.intent.category.DEFAULT" />
            </intent-filter>
            <meta-data android:name="android.app.searchable"
                    android:resource="@xml/searchable" />
            <meta-data android:name="android.app.default_searchable"
                    android:value=".LunchList" />
        </activity>
        <activity android:name=".DetailForm">
        </activity>
        <activity android:name=".EditPreferences">
        </activity>
        <receiver android:name=".AppWidget"
            android:label="@string/app_name"
            android:icon="@drawable/icon">
            <intent-filter>
                <action
                    android:name="android.appwidget.action.APPWIDGET_UPDATE" />
            </intent-filter>
            <meta-data
                android:name="android.appwidget.provider"
                android:resource="@xml/widget_provider" />
        </receiver>
    </application>
</manifest>
```

In particular, note the `<receiver>` element towards the bottom – that is where we are teaching Android where our code and metadata resides for this app widget. The intent filter for `APPWIDGET_UPDATE` means that we will get control when Android wants us to update the app widget's contents, such as when the app widget is first added to the home screen.

At this point, you can compile and install the updated version of the application. Then, long-tap somewhere on the background of your home screen, to bring up the list of options for things to add to it:

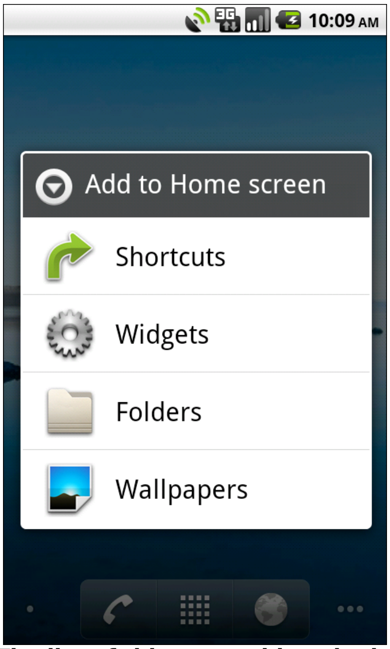


Figure 57. The list of things to add to the home screen

Choose Widgets, to bring up the list of available widgets:

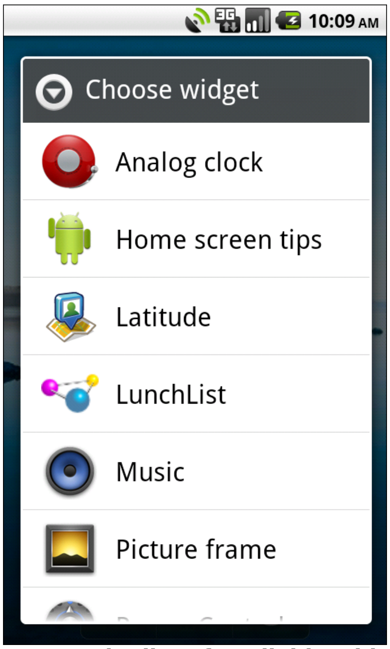


Figure 58. The list of available widgets

Then, choose our `LunchList` widget. It will show up, but have no contents, because we have not defined any contents yet:

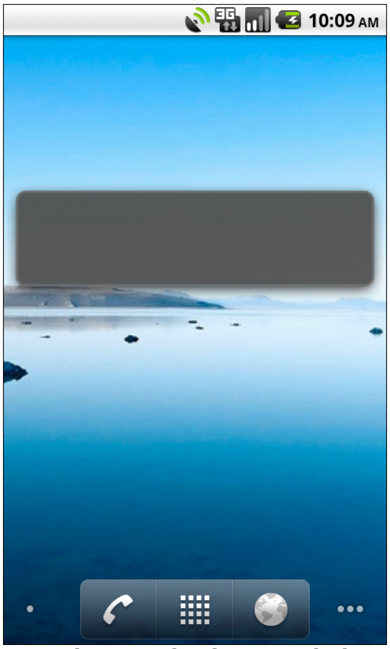


Figure 59. The very boring LunchList widget

Step #6: Show a Random Restaurant

Finally, we need to add some smarts that will actually display a random restaurant in the app widget. To do this, we will override the `onUpdate()` method in our `AppWidget` class and have it do the database I/O to find a random restaurant.

With that in mind, add the following `onUpdate()` implementation to `AppWidget`:

```
@Override
public void onUpdate(Context ctxt,
                     AppWidgetManager mgr,
                     int[] appWidgetIds) {
  ComponentName me=new ComponentName(ctxt, AppWidget.class);
  RemoteViews updateViews=new RemoteViews("apt.tutorial",
                                          R.layout.widget);
  RestaurantHelper helper=new RestaurantHelper(ctxt);
  
  try {
    Cursor c=helper
```

```
              .getReadableDatabase()
              .rawQuery("SELECT COUNT(*) FROM restaurants", null);

    c.moveToFirst();

    int count=c.getInt(0);

    c.close();

    if (count>0) {
      int offset=(int)(count*Math.random());
      String args[]={String.valueOf(offset)};

      c=helper
          .getReadableDatabase()
          .rawQuery("SELECT name FROM restaurants LIMIT 1 OFFSET ?", args);
      c.moveToFirst();
      updateViews.setTextViewText(R.id.name, c.getString(0));
    }
    else {
      updateViews.setTextViewText(R.id.name,
                                  ctxt.getString(R.string.empty));
    }
  }
  finally {
    helper.close();
  }

  mgr.updateAppWidget(me, updateViews);
}
```

Here, we:

- Create a `RemoteViews` object, which represents a set of GUI "commands" to invoke on the home screen that defines how to modify the app widget
- Open up a database connection
- Find out how many restaurants there are via a SQL query
- Load a random restaurant via another SQL query
- Set the `name` `TextView` in the app widget (via the `RemoteViews`) to have either the name of the restaurant or an error message
- Update the app widget itself

You will also need to add a new string resource, named `empty`, that will go into the app widget if there is no restaurant available (e.g., the database is empty).

Make sure you have at least two restaurants in `LunchList` – we will need more than one to show the random effects, particularly starting with the next tutorial.

At this point, compile and reinstall the application. Also, if you got rid of the empty app widget, add a new one to your home screen. You should see the name of one of your restaurants:

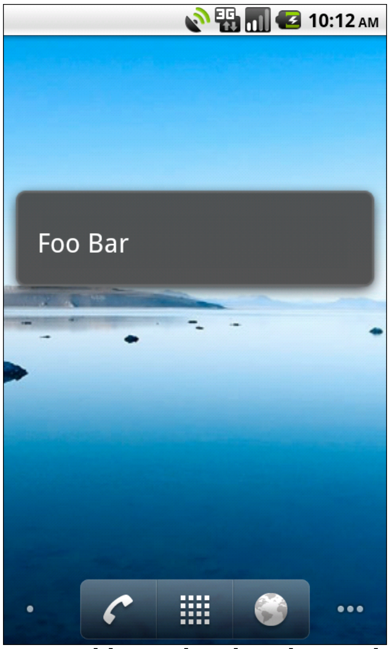


Figure 60. The app widget, showing the random restaurant

As app widgets go, this one is very unimpressive. However, we will make it somewhat better in the next tutorial.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Add other widgets to the app widget layout, such as a logo icon
- Reduce the font size of the name and add a second `TextView` to the layout to show the restaurant's address
- Experiment with other widget sizes instead of the 4x1 cell format used in the widget metadata

Further Reading

App widgets are covered in a chapter of The Busy Coder's Guide to *Advanced* Android Development.

TUTORIAL 34

More Home Cooking

In this tutorial, we will add a few more features to our existing app widget, such as a button to choose another random restaurant. Also, if the user taps on the name of the restaurant, we will open up the detail form activity for that restaurant.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `33-AppWidget` edition of `LunchList` to use as a starting point.

Step #1: Find a Button Graphic

Next, you will need an image to go on an `ImageButton` that will serve to change the restaurant shown by the app widget to another random restaurant.

If you examine the `34-AdvAppWidget` project in the book's source code repository, you will see that there is a `ff.png` file there, culled from the Android open source project, that you could use. Or, substitute your own graphic as you see fit – just name it `ff.png` to match how it is used later in this tutorial.

Step #2: Add the Button to the Layout

Next, we want to modify the app widget layout to incorporate this ImageButton. Revise LunchList/res/layout/widget.xml to look like the following:

```
<?xml version="1.0" encoding="utf-8"?>
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:layout_width="fill_parent"
  android:layout_height="fill_parent"
  android:background="@drawable/widget_frame"
>
  <TextView android:id="@+id/name"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_centerVertical="true"
    android:layout_alignParentLeft="true"
    android:layout_toLeftOf="@+id/next"
    android:textSize="10pt"
    android:textColor="#FFFFFFFF"
  />
  <ImageButton android:id="@id/next"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_centerVertical="true"
    android:layout_alignParentRight="true"
    android:src="@drawable/ff"
  />
</RelativeLayout>
```

At this point, if you compile and reinstall the application, then remove and re-add the app widget from your home screen, you will see the ImageButton appear:

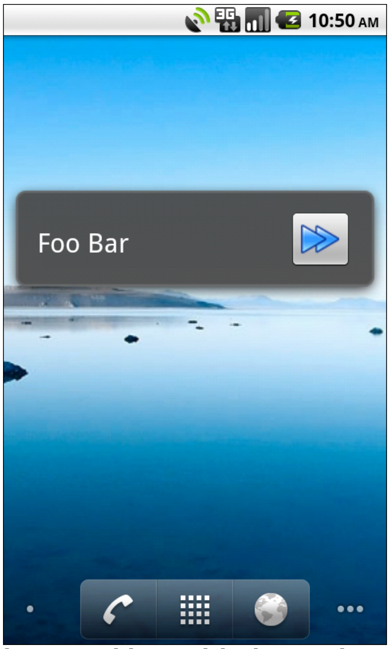


Figure 61. The app widget with the newly-added button

Step #3: Migrate Update Logic to an IntentService

Right now, we are doing our database I/O right in our `AppWidgetProvider` implementation's `onUpdate()` method. That is probably fine, but if we add too much logic, we run the risk of timing out, as `onUpdate()` is called on the main application thread. Since we can update our app widget asynchronously without issue, it is safer if we can delegate this work to something that can be done off the main thread, such as an `IntentService`.

With that in mind, create an `IntentService` named `WidgetService` in the `LunchList` project, with the following implementation:

```
package apt.tutorial;

import android.app.IntentService;
import android.app.PendingIntent;
import android.appwidget.AppWidgetManager;
import android.content.ComponentName;
import android.content.Context;
import android.content.Intent;
import android.database.Cursor;
import android.database.sqlite.SQLiteDatabase;
import android.widget.RemoteViews;

public class WidgetService extends IntentService {
  public WidgetService() {
    super("WidgetService");
  }

  @Override
  public void onHandleIntent(Intent intent) {
    ComponentName me=new ComponentName(this, AppWidget.class);
    RemoteViews updateViews=new RemoteViews("apt.tutorial",
                                            R.layout.widget);
    RestaurantHelper helper=new RestaurantHelper(this);
    AppWidgetManager mgr=AppWidgetManager.getInstance(this);

    try {
      Cursor c=helper
                .getReadableDatabase()
                .rawQuery("SELECT COUNT(*) FROM restaurants", null);

      c.moveToFirst();

      int count=c.getInt(0);

      c.close();

      if (count>0) {
        int offset=(int)(count*Math.random());
        String args[]={String.valueOf(offset)};

        c=helper
            .getReadableDatabase()
            .rawQuery("SELECT _ID, name FROM restaurants LIMIT 1 OFFSET ?",
args);
        c.moveToFirst();
        updateViews.setTextViewText(R.id.name, c.getString(0));
      }
      else {
        updateViews.setTextViewText(R.id.title,
                                    this.getString(R.string.empty));
      }
    }
    finally {
      helper.close();
    }

    mgr.updateAppWidget(me, updateViews);
  }
}
```

You will notice that the `onHandleIntent()` method is almost identical to the current `onUpdate()` method in `AppWidget`. The differences are that all references to `ctxt` are replaced with `this` (since the `IntentService` is a `Context`) and that we need to obtain an `AppWidgetManager` rather than use one passed into us. But, since `onHandleIntent()` is run on a background thread, we can take as much time as is necessary.

Then, add `WidgetService` to the manifest:

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
      package="apt.tutorial"
      android:versionCode="1"
      android:versionName="1.0">
    <application android:label="@string/app_name">
        <activity android:name=".LunchList"
                  android:label="@string/app_name">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
            <intent-filter>
                <action android:name="android.intent.action.SEARCH" />
                <category android:name="android.intent.category.DEFAULT" />
            </intent-filter>
            <meta-data android:name="android.app.searchable"
                    android:resource="@xml/searchable" />
            <meta-data android:name="android.app.default_searchable"
                    android:value=".LunchList" />
        </activity>
        <activity android:name=".DetailForm">
        </activity>
        <activity android:name=".EditPreferences">
        </activity>
        <receiver android:name=".AppWidget"
            android:label="@string/app_name"
            android:icon="@drawable/icon">
            <intent-filter>
                <action
                    android:name="android.appwidget.action.APPWIDGET_UPDATE" />
            </intent-filter>
            <meta-data
                android:name="android.appwidget.provider"
                android:resource="@xml/widget_provider" />
        </receiver>
        <service android:name=".WidgetService" />
    </application>
</manifest>
```

Finally, remove all of the code from the `onUpdate()` implementation in `AppWidget`, and replace it with a single call to `startService()`:

```
package apt.tutorial;

import android.appwidget.AppWidgetManager;
import android.appwidget.AppWidgetProvider;
import android.content.ComponentName;
import android.content.Context;
import android.content.Intent;
import android.database.Cursor;
import android.widget.RemoteViews;
import android.database.sqlite.SQLiteDatabase;

public class AppWidget extends AppWidgetProvider {
  @Override
  public void onUpdate(Context ctxt,
                       AppWidgetManager mgr,
                       int[] appWidgetIds) {
    ctxt.startService(new Intent(ctxt, WidgetService.class));
  }
}
```

At this point, if you rebuild and reinstall the project, you will see that things work as they did before, despite this fairly radical implementation shift.

Step #4: Get Control on Button Clicks

Now, we need to arrange to execute some code when the user presses our new button. Specifically, we want to simply update the app widget itself, so we get a new random restaurant.

Since we pulled our updating logic into the `WidgetService`, we need to have that button call `startService()` to request `WidgetService` to do another update. However, this is an app widget, so we cannot simply add an `OnClickListener` to the button – the button is not in our code, but is in the home screen, configured via the `RemoteViews` object.

Instead, we can register a `PendingIntent`, to tell Android what to do when the button is clicked.

Add the following lines to the end of the `onHandleIntent()` method in `WidgetService`:

```
Intent i=new Intent(this, WidgetService.class);
PendingIntent pi=PendingIntent.getService(this, 0, i, 0);

updateViews.setOnClickPendingIntent(R.id.next, pi);
mgr.updateAppWidget(me, updateViews);
```

Here, we create a service `PendingIntent` and register it as the click handler for the button.

Now, if you recompile and reinstall the project, you will see that pressing the button gives you a new restaurant (unless it happens to randomly select the current one again).

Step #5: Get Control on Name Clicks

Finally, we want to bring up the `DetailForm` activity on the currently-visible restaurant if the user taps on the restaurant's name. To do this, we will need another `PendingIntent`, but we also need a bit more data from the content provider first.

Replace the current implementation of `onHandleIntent()` in `WidgetService` with the following:

```
@Override
public void onHandleIntent(Intent intent) {
  ComponentName me=new ComponentName(this, AppWidget.class);
  RemoteViews updateViews=new RemoteViews("apt.tutorial",
                                          R.layout.widget);
  RestaurantHelper helper=new RestaurantHelper(this);
  AppWidgetManager mgr=AppWidgetManager.getInstance(this);

  try {
    Cursor c=helper
              .getReadableDatabase()
              .rawQuery("SELECT COUNT(*) FROM restaurants", null);

    c.moveToFirst();

    int count=c.getInt(0);
    c.close();

    if (count>0) {
      int offset=(int)(count*Math.random());
      String args[]={String.valueOf(offset)};

      c=helper
          .getReadableDatabase()
          .rawQuery("SELECT _ID, name FROM restaurants LIMIT 1 OFFSET ?", args);
      c.moveToFirst();
      updateViews.setTextViewText(R.id.name, c.getString(1));

      Intent i=new Intent(this, DetailForm.class);

      i.putExtra(LunchList.ID_EXTRA, c.getString(0));

      PendingIntent pi=PendingIntent.getActivity(this, 0, i,
                                                 PendingIntent.FLAG_UPDATE_CURREN
T);

      updateViews.setOnClickPendingIntent(R.id.name, pi);
    }
    else {
      updateViews.setTextViewText(R.id.title,
                                 this.getString(R.string.empty));
    }
  }
  finally {
    helper.close();
  }

  Intent i=new Intent(this, WidgetService.class);
  PendingIntent pi=PendingIntent.getService(this, 0, i, 0);

  updateViews.setOnClickPendingIntent(R.id.next, pi);
  mgr.updateAppWidget(me, updateViews);
}
```

You will notice a few changes:

- We now get the `_ID` column out of our content provider, in addition to the name, and we adjust the code that fills in the name widget's text to match.
- We create an activity `PendingIntent` for the `DetailForm` activity. However, we add in the `ID_EXTRA` "extra", so `DetailForm` knows which restaurant to show. And, since we are changing extras on an otherwise-unchanging `Intent`, we need to add the `FLAG_UPDATE_CURRENT` flag in our `getActivity()` call, so the new extra takes effect

- We then attach the `PendingIntent` to the name widget in the app widget

Now, if you recompile and reinstall the project, you will see that pressing the name of the restaurant brings up the restaurant's `DetailForm`.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Rather than show a random restaurant, keep track of the last restaurant viewed and cycle through them in progression, looping back to the first in the list when you reach the end. Consider adding a second `ImageButton` to move backwards through the list.
- Add another button that, when clicked, displays a `Toast` of the notes for the currently-viewed restaurant.

Further Reading

App widgets are covered in a chapter of The Busy Coder's Guide to *Advanced* Android Development.

TUTORIAL 35

Take a Monkey to Lunch

In this tutorial, we will use the Monkey utility to stress test the LunchList application.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the 34-AdvAppWidget edition of LunchList to use as a starting point.

Step #1: Prep LunchList

Ensure your LunchList has a few restaurants, of different types. Then, leave the LunchList at the LunchList activity itself (i.e., the list of available restaurants).

Step #2: Run the Monkey

Launch a command prompt or shell, and run the following command:

```
adb shell monkey -p apt.tutorial -v --throttle 100 600
```

Note that if you did not add your SDK's `tools/` directory to your system `PATH`, you may need to change to that directory to get this command to execute properly.

This command indicates:

- You want to run the Monkey
- You want the Monkey to limit itself to testing your application (`-p apt.tutorial`), so if the Monkey attempts to do something that would exit your application (e.g., click the HOME button), that simulated input will be skipped
- You want the Monkey to execute one event every 100 milliseconds (`--throttle 100`)
- You want the Monkey to be verbose and report what events it simulates (`-v`)
- You want the Monkey to perform 600 simulated events

What you should see is the `LunchList` application running amok, as if some monkey were trying out different UI operations (clicking buttons, typing in fields, choosing menu options). If all goes well, `LunchList` will survive without errors. If something goes wrong, you will get an exception, and can use the log information (via DDMS or `adb logcat`) to see what failed and, possibly, how to fix it.

Your shell will show a running tally of what has been done, such as simulating screen taps or key presses.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Try updating your test process to be repeatable, so if you encounter some sort of exception, you can make it happen again. To do this, you will need to save your database file (stored in `/data/data/apt.tutorial/databases/lunchlist.db`) before running Monkey with the `-s` switch to provide a known seed value. Each test run should back up the database, run Monkey with a fresh seed, and restore the database. If you got a crash or some other problem, re-run the process with the same seed, and you should be able to reproduce the failure.

- Experiment with additional options to configure the Monkey's operation, as described in the Monkey documentation.
- Experiment with Android's built-in copy of the JUnit test framework to exercise the restaurant model class programmatically.

Further Reading

More about Android's test-related features, including more on the Monkey, can be found in the "Testing" chapter of The Busy Coder's Guide to *Advanced* Android Development.

TUTORIAL 36

Asking Permission to Place a Call

In this tutorial, we will add a bit of code that asks permission to place a call, and we will add a phone number to our restaurant data model and detail form. Then, we will actually place the call.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `35-AdvAppWidget` edition of `LunchList` to use as a starting point.

Step #1: Add a Phone Number to the Database Schema

If we want our phone numbers to stick around, we need to put them in the database.

With that in mind, update `RestaurantHelper` to use the following implementation of `onCreate()`:

```
@Override
public void onCreate(SQLiteDatabase db) {
  db.execSQL("CREATE TABLE restaurants (_id INTEGER PRIMARY KEY AUTOINCREMENT,
name TEXT, address TEXT, type TEXT, notes TEXT, phone TEXT);");
}
```

Any time you make a material modification to the schema, you also need to increment the schema version number. For `RestaurantHelper`, that is held in `SCHEMA_VERSION`, so increment to `2`:

```
private static final int SCHEMA_VERSION=2;
```

Step #2: Intelligently Handle Database Updates

When the schema version increments, `onUpgrade()` is called on `RestaurantHelper` rather than `onCreate()`. It is our job to update the schema, preferably without losing any user data. Here, we just use an `ALTER TABLE` SQL statement, since all we are doing is adding a column:

```
@Override
public void onUpgrade(SQLiteDatabase db, int oldVersion, int newVersion) {
  if (oldVersion==1 && newVersion==2) {
    db.execSQL("ALTER TABLE restaurants ADD phone TEXT;");
  }
}
```

Step #3: Add Phone Number Support to the Rest of the Helper

We also need to update our `insert()` method on `RestaurantHelper` to accept a phone number:

```
public void insert(String name, String address,
                   String type, String notes,
                   String phone) {
  ContentValues cv=new ContentValues();

  cv.put("name", name);
  cv.put("address", address);
  cv.put("type", type);
  cv.put("notes", notes);
  cv.put("phone", phone);

  getWritableDatabase().insert("restaurants", "name", cv);
}
```

and the corresponding `update()` method, also to accept a phone number:

```
public void update(String id, String name, String address,
                  String type, String notes, String phone) {
  ContentValues cv=new ContentValues();
  String[] args={id};

  cv.put("name", name);
  cv.put("address", address);
  cv.put("type", type);
  cv.put("notes", notes);
  cv.put("phone", phone);

  getWritableDatabase().update("restaurants", cv, "_ID=?",
                               args);
}
```

The two query methods, `getAll()` and `getById()`, also should return the phone number from each of their respective queries:

```
public Cursor getAll(String where, String orderBy) {
  StringBuilder buf=new StringBuilder("SELECT _id, name, address, type, notes,
phone FROM restaurants");

  if (where!=null) {
    buf.append(" WHERE ");
    buf.append(where);
  }

  if (orderBy!=null) {
    buf.append(" ORDER BY ");
    buf.append(orderBy);
  }

  return(getReadableDatabase().rawQuery(buf.toString(), null));
}

public Cursor getById(String id) {
  String[] args={id};

  return(getReadableDatabase()
          .rawQuery("SELECT _id, name, address, type, notes, phone FROM
restaurants WHERE _ID=?",
                    args));
}
```

Step #4: Collect the Phone Number on the Detail Form

If we actually want to have phone numbers, though, we need to actually collect them on `DetailForm`.

First, update `LunchList/res/layout/detail_form.xml` to add the following after the `address` row in our `TableLayout`:

```
<TableRow>
  <TextView android:text="Phone:" />
  <EditText android:id="@+id/phone" android:inputType="phone" />
</TableRow>
```

Notice that we are using `android:inputType="phone"` on the new `EditText` widget. This will cause Android to use a soft keyboard set up for entering a phone number (where available), rather than a standard keyboard layout.

Similarly, add the following after the `address` row in `LunchList/res/layout-land/detail_form.xml`:

```
<TableRow>
  <TextView android:text="Phone:" />
  <EditText android:id="@+id/phone"
            android:inputType="phone"
            android:layout_span="3"
  />
</TableRow>
```

Then, as in the previous section, clone all references to `address` in `DetailForm` to make references to our `phone` widgets, such as:

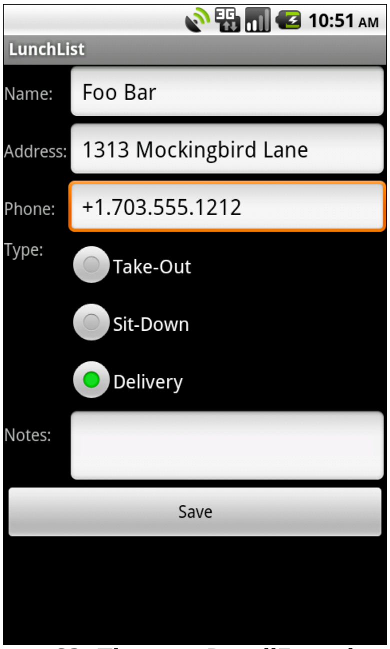
```
EditText address=null;
EditText phone=null;
```

and:

```
address=(EditText)findViewById(R.id.addr);
phone=(EditText)findViewById(R.id.phone);
```

Also, it is safe for you to go ahead and get rid of the implementations of `onSaveInstanceState()` and `onRestoreInstanceState()`.

At this point, you can recompile and reinstall the application. When you first run it, there will be a tiny pause as the database is updated. After that point, you can use the new field to add phone numbers to whichever restaurants you want:



Name: Foo Bar
Address: 1313 Mockingbird Lane
Phone: +1.703.555.1212
Type: Take-Out [✓ Delivery] Sit-Down
Notes:

Figure 62. The new DetailForm layout

Step #5: Ask for Permission to Make Calls

Then, we can update `AndroidManifest.xml` to put in a permission request to be able to place phone calls:

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
      package="apt.tutorial"
      android:versionCode="1"
      android:versionName="1.0">
    <uses-permission android:name="android.permission.CALL_PHONE"/>
    <application android:label="@string/app_name">
        <activity android:name=".LunchList"
                  android:label="@string/app_name">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
            <intent-filter>
                <action android:name="android.intent.action.SEARCH" />
                <category android:name="android.intent.category.DEFAULT" />
            </intent-filter>
            <meta-data android:name="android.app.searchable"
                    android:resource="@xml/searchable" />
            <meta-data android:name="android.app.default_searchable"
                    android:value=".LunchList" />
        </activity>
        <activity android:name=".DetailForm">
        </activity>
        <activity android:name=".EditPreferences">
        </activity>
        <receiver android:name=".AppWidget"
            android:label="@string/app_name"
            android:icon="@drawable/icon">
            <intent-filter>
                <action
                    android:name="android.appwidget.action.APPWIDGET_UPDATE" />
            </intent-filter>
            <meta-data
                android:name="android.appwidget.provider"
                android:resource="@xml/widget_provider" />
        </receiver>
        <service android:name=".WidgetService" />
    </application>
</manifest>
```

Step #6: Dial the Number

Next, let us set up `DetailForm` with its own option menu that contains a Call item. When chosen, we dial the phone number, assuming there is one.

First, create `LunchList/res/menu/option_detail.xml` with the following content:

```
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
  <item android:id="@+id/call"
    android:title="Call"
    android:icon="@drawable/ic_menu_call"
  />
</menu>
```

Then, add the following methods to `DetailForm`:

```
@Override
public boolean onCreateOptionsMenu(Menu menu) {
  new MenuInflater(getApplication())
                                .inflate(R.menu.option_detail, menu);

  return(super.onCreateOptionsMenu(menu));
}

@Override
public boolean onOptionsItemSelected(MenuItem item) {
  if (item.getItemId()==R.id.call) {
    String toDial="tel:"+phone.getText().toString();

    if (toDial.length()>4) {
      startActivity(new Intent(Intent.ACTION_DIAL,
                              Uri.parse(toDial)));
    }
  }

  return(super.onOptionsItemSelected(item));
}
```

Note that you will need to add a number of imports (`Intent`, `Menu`, `MenuInflater`, `MenuItem`, and `Uri`) to get this to compile cleanly.

In the new code, we check to see if there is a phone number. If so, we wrap the phone number in a `tel:` `Uri`, then put that in an `ACTION_DIAL` `Intent` and start an activity on that `Intent`. This puts the phone number in the dialer.

If you rebuild and reinstall the application and try out the new menu choice on some restaurant with a phone number, you will see the `Dialer` appear:

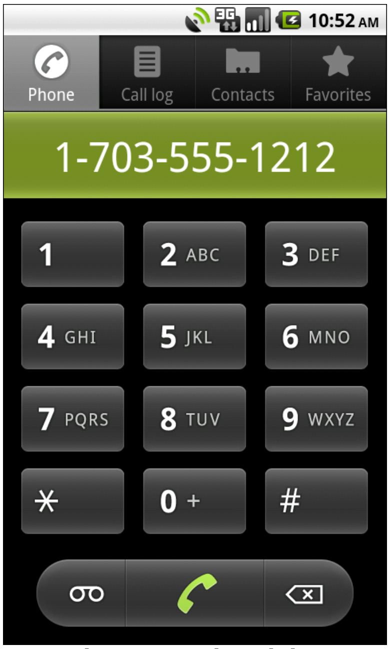


Figure 63. The Dialer

Step #7: Make the Call

Suppose we want to take advantage of the `CALL_PHONE` permission we requested earlier in this tutorial. All that we need to do is switch our `Intent` from `ACTION_DIAL` to `ACTION_CALL`:

```
@Override
public boolean onOptionsItemSelected(MenuItem item) {
  if (item.getItemId()==R.id.call) {
    String toDial="tel:"+phone.getText().toString();

    if (toDial.length()>4) {
      startActivity(new Intent(Intent.ACTION_CALL,
                               Uri.parse(toDial)));

      return(true);
    }
  }

  return(super.onOptionsItemSelected(item));
}
```

Now, if you rebuild and reinstall the application, and try choosing the Call option menu item, you will immediately "call" the phone number…which will actually place a phone call if you are trying this on a device. The emulator, of course, cannot place phone calls.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Add a preference to display the phone number instead of the address in the restaurant list. Have the list detect the preference and fill in the second line of the restaurant rows accordingly.
- Push your APK file to a Web site that is configured to support the proper MIME type for Android application downloads (e.g., Amazon S3). Try installing your APK onto a device from the published location, to see how your requested permission appears to end users at install time.
- Find a revision to the `layout-land` version of `detail_form.xml` that does not clip the bottom radio button.

Further Reading

Permissions in general are covered in the "Requesting and Requiring Permissions" chapter of The Busy Coder's Guide to Android Development. Working with the telephony features of Android is briefly covered in the "Handling Telephone Calls" chapter of the same book.

TUTORIAL 37

Photographic Memory

One logical thing to add to the restaurant information in `LunchList` would be photos: the exterior of the restaurant, favorite dishes, wait staff to avoid, etc. This tutorial will bring us partway there, by allowing users to take a picture while in `LunchList`.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `36-PermsPhone` edition of `LunchList` to use as a starting point.

Step #1: Adjust the Manifest

To date, we have been able to skate by without a number of elements in our manifest that many applications need. At this point, though, we need to make some adjustments. So, make your `LunchList/AndroidManifest.xml` file look like the following:

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
      package="apt.tutorial"
      android:versionCode="1"
      android:versionName="1.0">
    <uses-sdk
        android:minSdkVersion="3"
        android:targetSdkVersion="7"
    />
    <supports-screens
        android:largeScreens="true"
        android:normalScreens="true"
        android:smallScreens="false"
    />
    <uses-feature android:name="android.hardware.camera" />
    <uses-permission android:name="android.permission.CAMERA" />
    <uses-permission android:name="android.permission.CALL_PHONE"/>
    <application android:label="@string/app_name">
        <activity android:name=".LunchList"
                  android:label="@string/app_name">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
            <intent-filter>
                <action android:name="android.intent.action.SEARCH" />
                <category android:name="android.intent.category.DEFAULT" />
            </intent-filter>
            <meta-data android:name="android.app.searchable"
                    android:resource="@xml/searchable" />
            <meta-data android:name="android.app.default_searchable"
                    android:value=".LunchList" />
        </activity>
        <activity android:name=".DetailForm">
        </activity>
        <activity android:name=".EditPreferences">
        </activity>
        <activity android:name=".Photographer"
          android:configChanges="keyboardHidden|orientation"
          android:screenOrientation="landscape"
          android:theme="@android:style/Theme.NoTitleBar.Fullscreen">
        </activity>
        <receiver android:name=".AppWidget"
            android:label="@string/app_name"
            android:icon="@drawable/icon">
            <intent-filter>
                <action
                    android:name="android.appwidget.action.APPWIDGET_UPDATE" />
            </intent-filter>
            <meta-data
                android:name="android.appwidget.provider"
                android:resource="@xml/widget_provider" />
        </receiver>
        <service android:name=".WidgetService" />
    </application>
</manifest>
```

You will need to add:

- The `<uses-sdk>` element, indicating that while the code should run on Android 1.5 and newer (`android:minSdkVersion="3"`), that we are targeting Android 2.1 (`android:targetSdkVersion="7"`).
- The `<supports-screens>` element, indicating that our application supports both large (4" or higher) and normal (3-4") screens, but not small screens.
- The `<uses-feature>` element, indicating that we are going to be using the camera from this point forward. This will tell the system to prevent installation of our application on devices that lack a camera.
- Another `<uses-permission>` element, this time to tell the user that we want to use the camera.
- An `<activity>` element for a `Photographer` class, that we will be adding shortly. Note that we set `Photographer` to be always landscape and use a theme that makes it full-screen, removing the title bar and the status bar.

Step #2: Create the Photographer Layout

We need a layout with a full-screen `SurfaceView` to use as the space to display the "preview" – what the camera currently sees.

Create `LunchList/res/layout/photographer.xml` with the following content:

```
<?xml version="1.0" encoding="utf-8"?>
<android.view.SurfaceView
  xmlns:android="http://schemas.android.com/apk/res/android"
  android:id="@+id/preview"
  android:layout_width="fill_parent"
  android:layout_height="fill_parent"
/>
```

This is merely a full-screen `SurfaceView`, the space on which the camera will draw its preview frames.

Step #3: Create the Photographer Class

Next, we need a class that will both connect the live preview to the `SurfaceView`, plus intercept the camera button for use in taking an actual picture. To keep things simple, we will hold off for now on doing anything "for real" with the actual picture.

With that in mind, add a `Photographer` class that looks like the following:

```
package apt.tutorial;

import android.app.Activity;
import android.graphics.PixelFormat;
import android.hardware.Camera;
import android.os.Bundle;
import android.os.Environment;
import android.util.Log;
import android.view.KeyEvent;
import android.view.SurfaceHolder;
import android.view.SurfaceView;
import android.widget.Toast;

public class Photographer extends Activity {
  private SurfaceView preview=null;
  private SurfaceHolder previewHolder=null;
  private Camera camera=null;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.photographer);

    preview=(SurfaceView)findViewById(R.id.preview);
    previewHolder=preview.getHolder();
    previewHolder.addCallback(surfaceCallback);
    previewHolder.setType(SurfaceHolder.SURFACE_TYPE_PUSH_BUFFERS);
  }

  @Override
  public boolean onKeyDown(int keyCode, KeyEvent event) {
    if (keyCode==KeyEvent.KEYCODE_CAMERA ||
        keyCode==KeyEvent.KEYCODE_SEARCH) {
      takePicture();

      return(true);
    }

    return(super.onKeyDown(keyCode, event));
  }
  private void takePicture() {
    camera.takePicture(null, null, photoCallback);
  }

  SurfaceHolder.Callback surfaceCallback=new SurfaceHolder.Callback() {
    public void surfaceCreated(SurfaceHolder holder) {
      camera=Camera.open();

      try {
        camera.setPreviewDisplay(previewHolder);
      }
      catch (Throwable t) {
        Log.e("Photographer",
              "Exception in setPreviewDisplay()", t);
        Toast
          .makeText(Photographer.this, t.getMessage(),
                    Toast.LENGTH_LONG)
          .show();
      }
    }

    public void surfaceChanged(SurfaceHolder holder,
                               int format, int width,
                               int height) {
      Camera.Parameters parameters=camera.getParameters();

      parameters.setPreviewSize(width, height);
      parameters.setPictureFormat(PixelFormat.JPEG);

      camera.setParameters(parameters);
      camera.startPreview();
    }

    public void surfaceDestroyed(SurfaceHolder holder) {
      camera.stopPreview();
      camera.release();
      camera=null;
    }
  };

  Camera.PictureCallback photoCallback=new Camera.PictureCallback() {
    public void onPictureTaken(byte[] data, Camera camera) {
      // do something with the photo JPEG (data[]) here!
      camera.startPreview();
    }
  };
}
```

Here, we initialize our `SurfaceView` in `onCreate()`. When the `SurfaceView` has been created, we connect the camera to it. When the `SurfaceView` size has been set (in `surfaceChanged()`), we configure the `Camera` to work with the size of the SurfaceView. When the camera button is clicked, we take a picture, re-enabling the preview in the PhotoCallback.

Step #4: Tie In the Photographer Class

Finally, we need to allow the user to take a picture. Since we (theoretically) want our photos taken with Photographer to be associated with the restaurant, we can add an option menu choice to our DetailForm. Here is the revised LunchList/res/menu/option_detail.xml:

```
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
  <item android:id="@+id/call"
    android:title="Call"
    android:icon="@drawable/ic_menu_call"
  />
  <item android:id="@+id/photo"
    android:title="Take a Photo"
    android:icon="@drawable/ic_menu_camera"
  />
</menu>
```

We also need to update onOptionsItemSelected() in DetailForm to watch for this new menu choice, so modify yours to look like:

```
@Override
public boolean onOptionsItemSelected(MenuItem item) {
  if (item.getItemId()==R.id.call) {
    String toDial="tel:"+phone.getText().toString();

    if (toDial.length()>4) {
      startActivity(new Intent(Intent.ACTION_CALL,
                              Uri.parse(toDial)));

      return(true);
    }
  }
  else if (item.getItemId()==R.id.photo) {
    startActivity(new Intent(this, Photographer.class));

    return(true);
  }

  return(super.onOptionsItemSelected(item));
}
```

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Store the photos on the SD card. Remember: the emulator does not emulate an SD card by default, so you will need to create an SD card image and tell the emulator to mount it.
- Store the photos on the SD card in a background thread, so the user regains control more quickly.
- Associate photos with the current restaurant and be able to view them later (perhaps via a `Gallery`).

Further Reading

More on the `Camera` class for taking still pictures can be found in the "Using the Camera" chapter of The Busy Coder's Guide to *Advanced* Android Development.

TUTORIAL 38

Sensing a Disturbance

Continuing our additions to `LunchList`, we really need a solution to the age-old problem of deciding where to go for lunch. For that, a good old-fashioned random selection would be a fine starting point. But, to make it more entertaining, we should trigger the selection by shaking the device. Shake the phone when on the list of restaurants, and a randomly-selected restaurant will be shown via its `DetailForm`.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `37-Camera` edition of `LunchList` to use as a starting point.

Step #1: Implement a Shaker

We need something that hooks into the `SensorManager` and watches for shaking events, where a "shake" is defined as a certain percentage over Earth's gravity, as determined by calculating the total force via the square root of the sum of the squares of all three dimensional forces.

And if that was total gibberish to you, this is why humankind has developed encapsulation and copy-and-paste.

Create LunchList/src/apt/tutorial/Shaker.java with the following source:

```java
package apt.tutorial;

import android.content.Context;
import android.hardware.Sensor;
import android.hardware.SensorEvent;
import android.hardware.SensorEventListener;
import android.hardware.SensorManager;
import android.os.SystemClock;
import java.util.ArrayList;
import java.util.List;

public class Shaker {
  private SensorManager mgr=null;
  private long lastShakeTimestamp=0;
  private double threshold=1.0d;
  private long gap=0;
  private Shaker.Callback cb=null;

  public Shaker(Context ctxt, double threshold, long gap,
                Shaker.Callback cb) {
    this.threshold=threshold*threshold;
    this.threshold=this.threshold
                    *SensorManager.GRAVITY_EARTH
                    *SensorManager.GRAVITY_EARTH;
    this.gap=gap;
    this.cb=cb;

    mgr=(SensorManager)ctxt.getSystemService(Context.SENSOR_SERVICE);
    mgr.registerListener(listener,
                         mgr.getDefaultSensor(Sensor.TYPE_ACCELEROMETER),
                         SensorManager.SENSOR_DELAY_UI);
  }

  public void close() {
    mgr.unregisterListener(listener);
  }

  private void isShaking() {
    long now=SystemClock.uptimeMillis();

    if (lastShakeTimestamp==0) {
      lastShakeTimestamp=now;

      if (cb!=null) {
        cb.shakingStarted();
      }
    }
    else {
      lastShakeTimestamp=now;
    }
  }
  private void isNotShaking() {
    long now=SystemClock.uptimeMillis();

    if (lastShakeTimestamp>0) {
      if (now-lastShakeTimestamp>gap) {
        lastShakeTimestamp=0;

        if (cb!=null) {
          cb.shakingStopped();
        }
      }
    }
  }

  public interface Callback {
    void shakingStarted();
    void shakingStopped();
  }

  private SensorEventListener listener=new SensorEventListener() {
    public void onSensorChanged(SensorEvent e) {
      if (e.sensor.getType()==Sensor.TYPE_ACCELEROMETER) {
        double netForce=e.values[0]*e.values[0];

        netForce+=e.values[1]*e.values[1];
        netForce+=e.values[2]*e.values[2];

        if (threshold<netForce) {
          isShaking();
        }
        else {
          isNotShaking();
        }
      }
    }

    public void onAccuracyChanged(Sensor sensor, int accuracy) {
      // unused
    }
  };
}
```

The `Shaker` class takes four parameters: a `Context` (used to get the `SensorManager`), the percentage of Earth's gravity that is considered a "shake", how long the acceleration is below that level before a shaking event is considered over, and a callback object to alert somebody about shaking starting and stopping. The math to figure out if, for a given amount of acceleration, we are shaking, is found in the `SensorListener` callback object.

As *The Busy Coder's Guide to Advanced Android Development* explains:

> *The `Shaker` simply converts the three individual acceleration components into a combined acceleration value (square root of the sum of the squares), then compares that value to Earth's gravity. If the ratio is higher than the supplied threshold, then we consider the device to be presently shaking, and we call the `shakingStarted()` callback method if the device was not shaking before. Once shaking ends, and time elapses, we call `shakingStopped()` on the callback object and assume that the shake has ended. A more robust implementation of `Shaker` would take into account the possibility that the sensor will not be updated for a while after the shake ends, though in reality, normal human movement will ensure that there are some sensor updates, so we can find out when the shaking ends.*

Step #2: Hook Into the Shaker

Given that you magically now have a `Shaker` object, we need to tie it into the `LunchList` activity.

First, implement a `Shaker.Callback` object named `onShake` in `LunchList`:

```
private Shaker.Callback onShake=new Shaker.Callback() {
  public void shakingStarted() {
  }

  public void shakingStopped() {
  }
};
```

Right now, we do not do anything with the shake events, though we will address that shortcoming in the next section.

Then, add a `Shaker` data member to `LunchList`, called `shaker`.

We do not want to be tying up the accelerometer when LunchList does not have the foreground. One way to do this is to override onResume() and initialize our Shaker there:

```
@Override
public void onResume() {
  super.onResume();

  shaker=new Shaker(this, 1.45d, 500, onShake);
}
```

...then release our Shaker in an implementation of onPause():

```
@Override
public void onPause() {
  super.onPause();

  shaker.close();
}
```

Now when you shake the device, it will invoke our do-nothing callback.

Step #3: Make a Random Selection on a Shake

To actually choose a restaurant, we need to ask our RestaurantAdapter how many restaurants there are, then use Math.random() to pick one. We can then package that in an Intent and start our DetailForm on that restaurant. In particular, we ask our adapter for the _id value (getItemId()) of the randomly-chosen restaurant, which gets used as the primary key when DetailForm looks for it in the database.

With that in mind, here is a revised implementation of the onShake callback object:

```
private Shaker.Callback onShake=new Shaker.Callback() {
  public void shakingStarted() {
    // no-op – only care when the shaking stops
  }

  public void shakingStopped() {
    int selection=(int)(adapter.getCount()*Math.random());
    Intent i=new Intent(LunchList.this, DetailForm.class);

    i.putExtra(ID_EXTRA,
                String.valueOf(adapter.getItemId(selection)));
    startActivity(i);
  }
};
```

If you rebuild and reinstall the application on a device, you can randomly choose a restaurant by giving the phone a solid shake.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Store the GPS coordinates of the restaurant via the `DetailForm`. Then, given your current position and the location of the restaurant, present a compass to help point you in the right direction, in case you forget where the restaurant is. WARNING: this may involve icky math.
- Attempt to use the accelerometer to measure your current speed while walking or jogging. Remind yourself partway through why, exactly, you elected not to be a physics major in college. If you were a physics major in college, the author offers his sincere condolences.

Further Reading

More information about accessing and leveraging the orientation and acceleration sensors in Android is found in the "Sensors" chapter of The Busy Coder's Guide to *Advanced* Android Development.

TUTORIAL 39

Getting the Word Out

If we are getting together with others for lunch, they may not be familiar with every one of the vast array of restaurants that we are tracking in `LunchList`. Hence, it would be nice to be able to send details about the restaurant to people, so that they can find it if they are getting there separately. One likely approach to do this is to send an SMS with the name and address of the restaurant, so that is what we will add to `LunchList` in this tutorial.

This tutorial will only work on Android 2.x, and there is a bug in the Android 2.2 emulator that will make doing this tutorial a bit difficult. Hence, you are best served using Android 2.1 right now. The next tutorial, though, will add backwards compatibility to what we do here, so you can use this feature on earlier versions of Android.

And, of course, to actually send the message, you will need an actual Android phone, not just the emulator.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `38-Sensors` edition of `LunchList` to use as a starting point.

Step #1: Add a "Send SMS" Option Menu

The most likely place to add an option to send an SMS about a restaurant would be the `DetailForm` activity, since that is where we have our per-restaurant operations (e.g., call the restaurant). And, since we already have an option menu for `DetailForm`, all we need to do is add another entry to it for sending an SMS:

```
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
  <item android:id="@+id/call"
    android:title="Call"
    android:icon="@drawable/ic_menu_call"
  />
  <item android:id="@+id/sms"
    android:title="Send SMS"
    android:icon="@drawable/ic_menu_send"
  />
  <item android:id="@+id/photo"
    android:title="Take a Photo"
    android:icon="@drawable/ic_menu_camera"
  />
</menu>
```

Note that you will need a suitable icon, such as `ic_menu_send.png` from the Android SDK.

Then, add a corresponding case to `onOptionsItemSelected()` in `DetailForm`, routing SMS menu requests to an as-yet-unimplemented `sendSMS()` method:

```
@Override
public boolean onOptionsItemSelected(MenuItem item) {
  if (item.getItemId()==R.id.call) {
    String toDial="tel:"+phone.getText().toString();

    if (toDial.length()>4) {
      startActivity(new Intent(Intent.ACTION_CALL,
                              Uri.parse(toDial)));

      return(true);
    }
  }
  else if (item.getItemId()==R.id.photo) {
    startActivity(new Intent(this, Photographer.class));

    return(true);
  }
  else if (item.getItemId()==R.id.sms) {
    sendSMS();

    return(true);
  }

  return(super.onOptionsItemSelected(item));
}
```

Step #2: Find Contacts' Mobile Numbers

To send an SMS, we could just have Android handle the whole thing, by passing control to the user's choice of SMS client application. There, they could pick the contact to send the message to and compose the message, perhaps starting with some prose supplied by `LunchList`.

In this case, though, we are going to send the SMS directly. To do that, we need a phone number of the person to which we should send the message.

The `ContactsContract` content provider in Android 2.x is the way to find out these phone numbers. Specifically, we can query it to find all names and phone numbers, filtering based upon phone type to only get those flagged as mobile numbers.

With that in mind, add this preliminary implementation of the `sendSMS()` method to `DetailForm`:

```
private void sendSMS() {
  String[] PROJECTION=new String[] { Contacts._ID,
                                    Contacts.DISPLAY_NAME,
                                    Phone.NUMBER
                                  };
  String[] ARGS={String.valueOf(Phone.TYPE_MOBILE)};
  final Cursor c=managedQuery(Phone.CONTENT_URI,
                             PROJECTION, Phone.TYPE+"=?",
                             ARGS, Contacts.DISPLAY_NAME);
}
```

This gives us a `Cursor`, containing the ID, name, and mobile phone number of everyone in our contacts database, sorted by name. The reason why the `Cursor` is declared as `final` will become apparent later in the tutorial.

Note that you will need to add the READ_CONTACTS permission to get this to work, since we are directly accessing the contacts' data. Also, you will need to add imports for android.provider.ContactsContract.Contacts and android.provider.ContactsContract.CommonDataKinds.Phone.

Step #3: Pick a Person

Now, we need to let the user pick to whom we should send the SMS. Given the Cursor, we can display a ListView, or a Spinner, or something to let the user make a selection. However, those typically imply another Activity, and that seems a bit much for just picking a person by name. Instead, we will use an AlertDialog.

So, add the following to the end of sendSMS():

```
new AlertDialog.Builder(this)
  .setTitle("Pick a Person")
  .setCursor(c, onSMSClicked, Contacts.DISPLAY_NAME)
  .show();
```

Here, we pop up an AlertDialog, supplying the Cursor, indicating that the entries in the AlertDialog's list should be made from the DISPLAY_NAME column. We will find out the user's selection, if any, in an onSMSClicked listener object that will be defined in the next section.

You will need to add an import to android.app.AlertDialog for this to compile.

Step #4: Send the Message

Now, we can add the code to find out the user's choice of recipient and send the SMS message.

First, add the onSMSClicked object definition to sendSMS(), giving us:

```
private void sendSMS() {
  String[] PROJECTION=new String[] { Contacts._ID,
                                    Contacts.DISPLAY_NAME,
                                    Phone.NUMBER
                                  };
  String[] ARGS={String.valueOf(Phone.TYPE_MOBILE)};
  final Cursor c=managedQuery(Phone.CONTENT_URI,
                              PROJECTION, Phone.TYPE+"=?",
                              ARGS, Contacts.DISPLAY_NAME);
  DialogInterface.OnClickListener onSMSClicked=
    new DialogInterface.OnClickListener() {
    public void onClick(DialogInterface dialog, int position) {
      c.moveToPosition(position);

      noReallySendSMS(c.getString(2));
    }
  };

  new AlertDialog.Builder(this)
    .setTitle("Pick a Person")
    .setCursor(c, onSMSClicked, Contacts.DISPLAY_NAME)
    .show();
}
```

The `onSMSClicked` listener will find out the phone number for the selected person (given the clicked-upon cursor position), then call `noReallySendSMS()` to create and deliver the SMS message.

Then, add `noReallySendSMS()` to `DetailForm` as follows:

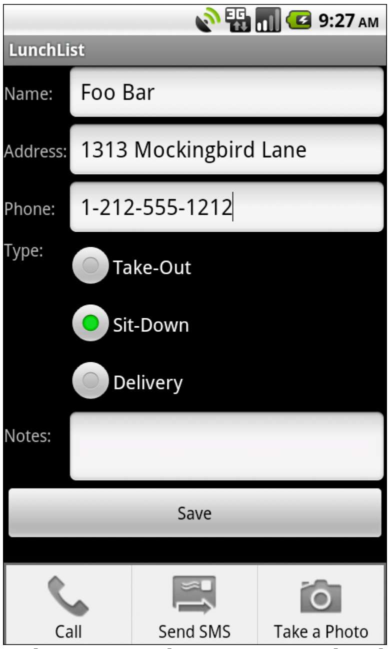
```
private void noReallySendSMS(String phone) {
  StringBuilder buf=new StringBuilder("We are going to ");

  buf.append(name.getText());
  buf.append(" at ");
  buf.append(address.getText());
  buf.append(" for lunch!");

  SmsManager
    .getDefault()
    .sendTextMessage(phone, null,  buf.toString(), null, null);
}
```

Here, we build up a message, incorporating the name and address from the `EditText` widgets. Then, we use `SmsManager` to send the message to its desired target.

You will need to add the `SEND_SMS` permission to your manifest and add imports for:

- `android.content.DialogInterface`
- `android.telephony.SmsManager`

If you compile and install `LunchList` on a phone and choose a restaurant, you can bring up the option menu:



Name:	Foo Bar
Address:	1313 Mockingbird Lane
Phone:	1-212-555-1212
Type:	Take-Out [✓ Sit-Down] Delivery
Notes:	

Figure 64. The new option menu on the detail form

Click on the "Send SMS" option, and you will get a dialog with a list of numbers to choose from:

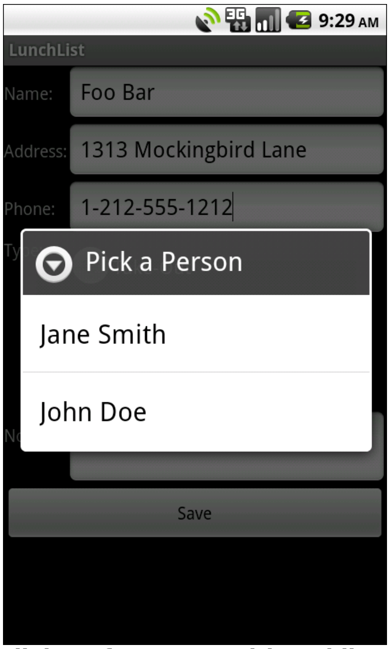


Figure 65. The dialog of contacts with mobile phone numbers

Pick the number, and the SMS is sent.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Also give the user an option to send a restaurant by other means, by using an `ACTION_SEND Intent` and the `createChooser()` method on `Intent`.
- Experiment with the `PendingIntent` objects you can supply on the call to `sendTextMessage()`, to be notified of the message's progress through the system.

Further Reading

More information about working with SMS in Android is found in the "Working with SMS" chapter of The Busy Coder's Guide to *Advanced* Android Development.

TUTORIAL 40

Seeking the Proper Level

The problem with the preceding tutorial is that it only works on Android 2.x. Specifically, our way of getting the mobile phone numbers will have some issues on previous editions of Android, due to the way the contacts engine was overhauled for Android 2.0.

That being said, we can fix this.

This tutorial will revamp the way we get the mobile numbers, to use separate implementations that work on Android 1.x and Android 2.x. Moreover, we will choose the proper implementation at runtime, ensuring that a 1.x device does not accidentally use the 2.x APIs, or vice versa.

Step-By-Step Instructions

First, you need to have completed the previous tutorial. If you are beginning the tutorials here, or if you wish to not use your existing work, you can download a ZIP file with all of the tutorial results, and you can copy the `39-SMS` edition of `LunchList` to use as a starting point.

Step #1: Define an Interface for Mobile Numbers

We need two pieces of information from the contacts database:

- A `Cursor` containing the contact's ID, name, and mobile phone number
- The name of the field that is the contact's name, so we can supply this to the `AlertDialog.Builder`, so it knows how to display the list

With that in mind, let us define a Java interface, for which we will create implementations using the old and new contacts API. Add the following as `LunchList/src/apt/tutorial/MobileContactsBridge.java`:

```
package apt.tutorial;

import android.app.Activity;
import android.database.Cursor;

interface MobileContactsBridge {
  Cursor getMobileNumbers(Activity host);
  String getDisplayNameField();
}
```

Step #2: Implement the Interface: the New Way

The existing code we added to `DetailForm` in the previous tutorial can be largely copied-and-pasted into a `NewMobileContacts` class that implements this interface. Add the following as `LunchList/src/apt/tutorial/NewMobileContacts.java`:

```
package apt.tutorial;

import android.app.Activity;
import android.database.Cursor;
import android.provider.ContactsContract.Contacts;
import android.provider.ContactsContract.CommonDataKinds.Phone;

class NewMobileContacts implements MobileContactsBridge {
  public Cursor getMobileNumbers(Activity host) {
    String[] PROJECTION=new String[] { Contacts._ID,
                                       Contacts.DISPLAY_NAME,
                                       Phone.NUMBER
                                     };
    String[] ARGS={String.valueOf(Phone.TYPE_MOBILE)};

    return(host.managedQuery(Phone.CONTENT_URI,
                             PROJECTION, Phone.TYPE+"=?",
                             ARGS, Contacts.DISPLAY_NAME));
  }
  public String getDisplayNameField() {
    return(Contacts.DISPLAY_NAME);
  }
}
```

We simply generate and return the `Cursor` using the same query as before, and indicate that `Contacts.DISPLAY_NAME` is what should be used from the `Cursor` for the dialog.

Step #3: Implement the Interface: the Old Way

We also need an implementation of this interface that used the old Contacts content provider, as opposed to the new ContactsContract content provider. The good news is that while the classes changed, the general concepts are still the same. It is still a content provider, which we can query against to get the data we need. All we need is the proper content Uri, the proper set of projection columns, the right WHERE clause, and so on.

With that in mind, add the following as `LunchList/src/apt/tutorial/OldMobileContacts.java`:

```
package apt.tutorial;

import android.app.Activity;
import android.database.Cursor;
import android.provider.Contacts;

class OldMobileContacts implements MobileContactsBridge {
  public Cursor getMobileNumbers(Activity host) {
    String[] PROJECTION=new String[] {  Contacts.Phones._ID,
                                        Contacts.Phones.NAME,
                                        Contacts.Phones.NUMBER
                                      };
    String[] ARGS={String.valueOf(Contacts.Phones.TYPE_MOBILE)};

    return(host.managedQuery(Contacts.Phones.CONTENT_URI,
                             PROJECTION,
                             Contacts.Phones.TYPE+"=?", ARGS,
                             Contacts.Phones.NAME));
  }

  public String getDisplayNameField() {
    return(Contacts.Phones.NAME);
  }
}
```

Step #4: Choose and Use the Bridge

With all that behind us, now we need to actually pick the right implementation of the MobileContactsBridge interface and use it, replacing our former hard-wired Android 2.x API usage in sendSMS().

One way to determine which implementation to use is to see what SDK we are running. To do that, we can use the SDK property of the android.os.Build class (which you will need to add as in import to DetailForm). This contains a String representation of our API level, with 5 being Android 2.0, 4 being Android 1.6, and so on. Note that while there is an SDK_INT property that would save us the String-to-integer conversion, it is not available on Android 1.5.

So, replace your current implementation of sendSMS() in DetailForm to:

```
private void sendSMS() {
  MobileContactsBridge bridge=buildBridge();
  final Cursor c=bridge.getMobileNumbers(this);

  DialogInterface.OnClickListener onSMSClicked=
    new DialogInterface.OnClickListener() {
    public void onClick(DialogInterface dialog, int position) {
      c.moveToPosition(position);

      noReallySendSMS(c.getString(2));
    }
  };

  new AlertDialog.Builder(this)
    .setTitle("Pick a Person")
    .setCursor(c, onSMSClicked, bridge.getDisplayNameField())
    .show();
}
```

This delegates the creation of the actual MobileContactsBridge to a buildBridge() method, which you will also need to add to DetailForm:

```
private static MobileContactsBridge buildBridge() {
  int sdk=new Integer(Build.VERSION.SDK).intValue();
  if (sdk<5) {
    return(new OldMobileContacts());
  }

  return(new NewMobileContacts());
}
```

The `buildBridge()` method looks at the SDK value and chooses an implementation to use. The `sendSMS()` message takes the `Cursor` and field name from the bridge and pours that information into the `AlertDialog.Builder`.

You can now compile and run `LunchList` on both Android 2.x and Android 1.x.

Extra Credit

Here are some things you can try beyond those step-by-step instructions:

- Rather than determining which API to use by looking at the SDK version, check to see if the `ContactsContract` class exists, since that class does not exist on Android 1.x.
- Experiment with using pure reflection to get at the `Uri` for the content provider based on the version of Android the code is running on.

Further Reading

More information about supporting multiple API levels in Android is found in the "Handling Platform Changes" chapter of The Busy Coder's Guide to Android Development.

Keyword Index