Android 4: New features for Application Development

Develop Android applications using the new features of Android Ice Cream Sandwich

Murat Aydin

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Preface

This book is a practical and hands-on guide for developing Android applications using new features of Android Ice Cream Sandwich (Android 4.0), with a step-by-step approach and clearly explained sample codes. You will learn the new APIs in Android 4.0 with these sample codes.
What this book covers

*Chapter 1, Action Bar for All*, introduces us to the action bar and shows us how to use and configure the action bar.

*Chapter 2, A New Layout – GridLayout*, introduces us to GridLayout and shows us how to use and configure GridLayout. GridLayout is a new layout introduced with Android Ice Cream Sandwich. This layout is an optimized layout and could be used instead of LinearLayout and RelativeLayout.

*Chapter 3, Social APIs*, covers the Social APIs that were introduced with Android Ice Cream Sandwich. This API makes it easy to integrate the social networks. Furthermore, high resolution photos can now be used as a contact’s photo after Ice Cream Sandwich was released. This chapter shows Social API usage with examples.

*Chapter 4, Calendar APIs*, covers the Calendar APIs which were introduced with Android Ice Cream Sandwich for managing calendars. Event, attendee, alert, and reminder databases can be managed with these APIs. These APIs allow us to easily integrate calendars with our Android applications. This chapter shows how to use Calendar APIs with examples.

*Chapter 5, Fragments*, introduces us to the basics of fragments and how to use them.

*Chapter 6, Supporting Different Screen Sizes*, introduces us to the ways of designing user interfaces that support different screen sizes.

*Chapter 7, Android Compatibility Package*, introduces us to the Android Compatibility Package and shows us how to use it. The Android Compatibility Package is to allow the porting of the new APIs to the older versions of the Android platform.

*Chapter 8, New Connectivity APIs – Android Beam and Wi-Fi Direct*, introduces us to Android Beam, which uses the NFC hardware of the device and Wi-Fi Direct which allows devices to connect to each other without using wireless access points. This chapter will teach us the usage of Android Beam and Wi-Fi Direct.

*Chapter 9, Multiple APK Support*, introduces us to Multiple APK Support which is a new option in Google Play (Android Market) by which multiple versions of APKs could be uploaded for a single application.

This chapter is available for download at
This chapter is available for download at http://www.packtpub.com/sites/default/files/downloads/Android_JellyBean.pdf.
What you need for this book

To follow the examples in this book, the Android Development Tools should be set up and ready. The necessary software list is as follows:

• Eclipse with ADT plugin
• Android SDK Tools
• Android platform tools
• The latest Android platform

The Operating Systems that can be used are as follows:

• Windows XP (32-bit), Vista (32- or 64-bit), or Windows 7 (32- or 64-bit)
• Mac OS X 10.5.8 or later (x86 only)
• Linux (tested on Ubuntu Linux, Lucid Lynx)
  ° GNU C Library (glibc) 2.7 or later is required
  ° On Ubuntu Linux, version 8.04 or later is required
  ° 64-bit distributions must be capable of running 32-bit applications

The specifications for use of the Eclipse IDE is as follows:

• Eclipse 3.6.2 (Helios) or greater (Eclipse 3.5 (Galileo) is no longer supported with the latest version of ADT)
• Eclipse JDT plugin (included in most Eclipse IDE packages)
• JDK 6 (JRE alone is not sufficient)
• Android Development Tools plugin (recommended)
Who this book is for

This book is for developers who are experienced with the Android platform, but who may not be familiar with the new features and APIs of Android 4.0. Android developers who want to learn about supporting multiple screen sizes and multiple Android versions; this book is also for you.
Conventions

In this book, you will find a number of styles of text that distinguish between different kinds of information. Here are some examples of these styles, and an explanation of their meaning.

Code words in text are shown as follows: “Implement onCreateOptionsMenu and onOptionsItemSelected methods.”

A block of code is set as follows:

```xml
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
  <item android:id="@+id/settings" android:title="Settings">
  </item>
  <item android:id="@+id/about" android:title="About">
  </item>
</menu>
```

When we wish to draw your attention to a particular part of a code block, the relevant lines or items are set in bold:

```java
@Override
public void onPrepareSubMenu(SubMenu subMenu) {
    // In order to add submenus, we should override this method we dynamically created submenus
    subMenu.clear();
    subMenu.add("SubItem1").setOnMenuItemClickListener(this);
    subMenu.add("SubItem2").setOnMenuItemClickListener(this);
}
```

New terms and important words are shown in bold. Words that you see on the screen, in menus or dialog boxes for example, appear in the text like this: “Click on the Insert button and then click on the List button”.

Warnings or important notes appear in a box like this. Tips and tricks appear like this.
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The source code will also be available on the author’s website at www.ottodroid.net.
Errata

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Action Bar for All

**Action bar** API was firstly introduced with Android 3.0. With Android Ice Cream Sandwich, action bar supports small screen sizes. This chapter shows how to use and configure the action bar.

The topics covered in this chapter are as follows:

- Action bar types
- Adding an action bar
- Adding an ActionProvider and ShareActionProvider
- Adding an action view
- Using action bar for navigation
**Action bar**

Action bar is a user interface element located on top of the user’s device screen. It provides actions and navigation capabilities to the user. Action bar has been available since API Level 11 (Android 3.0 Honeycomb) and after Ice Cream Sandwich was released, it supports small screen devices too. A sample Action Bar with tabs is shown in the following screenshot:

As it can be seen in the preceding screenshot, on the left of the bar there is an application logo and title, and then come the tabs for navigation. Lastly, the action buttons are placed after the tabs. The action buttons that do not fit to screen are displayed as an overflow menu with three dots on the right of the bar. In the previous screenshot, the action bar is displayed on a large screen device. However, in small screen devices, the Action Bar is displayed as a stack of bars as seen in the following screenshot:

As it can be seen in the preceding screenshot, there is not enough space to display all action bar items and the action bar is displayed with two bars on top of the screen.

Another type of action bar is the **split** action bar. In this type of action bar, action buttons are displayed in a bar at the bottom of the screen in narrow screens as shown in the following screenshot:
Fragment A

Toggle title
Adding an action bar

After Ice Cream Sandwich, Android doesn’t require the menu button to reach the options menu. The best practice is to use action bar instead of the menu button. It is very easy to migrate from the options menu to the action bar. Now we are going to create a menu and then migrate that menu to the action bar.

Firstly, create an Android project and then add a menu that contains Settings and About as menu items. The resulting menu XML file should look like the following code block:

```
<?xml version="1.0" encoding="utf-8"?><menu xmlns:android="http://schemas.android.com/apk/res/android">
  <item android:id="@+id/settings" android:title="Settings"></item>
  <item android:id="@+id/about" android:title="About"></item>
</menu>
```

The layout XML for this sample is a LinearLayout layout with a TextView component in it as shown in the following code block:

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

Implement the onCreateOptionsMenu and onOptionsItemSelected methods as shown in the following code block, in order to show the menu items:

```
package com.chapter1;

import android.app.Activity;
import android.os.Bundle;
import android.view.Menu;
import android.view.MenuItem;
import android.widget.Toast;
```
public class Chapter1Activity extends Activity {

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

    @Override
    public boolean onCreateOptionsMenu(Menu menu) {
        // Inflate the menu.xml of the android project //in order to create menu
        MenuInflater inflater = getMenuInflater();
        inflater.inflate(R.menu.menu, menu);
        return true;
    }

    @Override
    public boolean onOptionsItemSelected(MenuItem item) {
        // Handle item selection
        // According to selection, show the Toast message
        // of the selected button
        switch (item.getItemId()) {
        case R.id.settings:
            Toast.makeText(this, “Settings options menu button is pressed”,
            Toast.LENGTH_LONG).show();
            return true;
            
            case R.id.about:
            Toast.makeText(this, “About options menu button is pressed”,
            Toast.LENGTH_LONG).show();
            return true;
            
        default:
            return super.onOptionsItemSelected(item);
        }
    }
}

In order to display the action bar, the Android applications should target a minimum of API Level 11 in theAndroidManifest.xml file as shown in the following code block:

<?xml version="1.0" encoding="utf-8"?>
<!—set targetSDKversion to 11 because Action Bar is available since API Level 11—>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.chapter1"
    android:versionCode="1"
    android:versionName="1.0" >
With this configuration, when the application runs on devices that have Android 3.0 or greater, the action bar will be displayed.

When we run this application on an emulator with API Level 15, we will see the overflow menu on the right of the action bar and the options menu buttons will be displayed when the overflow menu is pressed. In order to show the options menu buttons on the action bar (not as an overflow menu), just add android:showAsAction="ifRoom|withText" in the item tags of the menu XML file. The resulting menu XML file should look like the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
    <item android:id="@+id/settings" android:title="Settings" android:showAsAction="ifRoom|withText"/>
    <item android:id="@+id/about" android:title="About" android:showAsAction="ifRoom|withText"/>
</menu>
```

If there is not enough space (ifRoom) to display the options menu buttons, the buttons will be displayed as an overflow menu. In order to show the options menu buttons with icon only (if an icon is provided), withText should be removed. When you run the application it will look like the following screenshot:
In some cases, you may not want to display the action bar. In order to remove the action bar, add `android:theme="@android:style/Theme.Holo.NoActionBar"` to the `activity` tag in the `AndroidManifest.xml` file. The resulting `AndroidManifest.xml` should look like the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
package="com.chapter1"
android:versionCode="1"
android:versionName="1.0">
<uses-sdk android:minSdkVersion="5"
android:targetSdkVersion="11" />
<application
android:icon="@drawable/ic_launcher"
android:label="@string/app_name">
<activity
android:name=".Chapter1Activity"
android:label="@string/app_name"
android:theme="@android:style/Theme.Holo.NoActionBar">
<intent-filter>
<action android:name="android.intent.action.MAIN" />
<category android:name="android.intent.category.LAUNCHER" />
</intent-filter>
</activity>
</application>
```
In order to show the action bar as a *split* action bar, add the `android:uiOptions="splitActionBarWhenNarrow"` application in the activity tag in AndroidManifest.xml. The resulting AndroidManifest.xml should look like the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<manifest
    xmlns:android="http://schemas.android.com/apk/res/android"
package="com.chapter1"
android:versionCode="1"
android:versionName="1.0">
<uses-sdk
    android:minSdkVersion="5"
    android:targetSdkVersion="11"/>
<application
    android:icon="@drawable/ic_launcher"
    android:label="@string/app_name"
    android:uiOptions="splitActionBarWhenNarrow">
<activity
    android:name=".Chapter1Activity"
    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>
```

When you run this application on an emulator, the screen will look like the following screenshot:
Hello World, Chapter1 Activity!
Adding an ActionProvider

In order to use a custom view instead of a simple button in action bar, the ActionProvider class could be the solution. **ActionProvider** has been available since API Level 14. ActionProvider can generate a custom view in the action bar, can generate submenus, and can handle events of the views that it generates. In order to create an ActionProvider, we should extend the ActionProvider class. The following code shows a sample class that extends the ActionProvider class and displays a custom layout instead of a simple button in action bar:

```java
import android.content.Context;
import android.view.ActionProvider;
import android.view.LayoutInflater;
import android.view.View;
import android.widget.ImageButton;
import android.widget.Toast;

public class Chapter1ActionProvider extends ActionProvider {
    Context mContext;

    public Chapter1ActionProvider(Context context) {
        super(context);
        mContext = context;
    }

    @Override
    public View onCreateActionView() {
        // This method is the place where we generate a custom layout for the ActionBar menu item
        LayoutInflater layoutInflater = LayoutInflater.from(mContext);
        View view = layoutInflater.inflate(R.layout.action_provider, null);
        ImageButton button = (ImageButton) view.findViewById(R.id.button);
        button.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                Toast.makeText(mContext, "Action Provider click", Toast.LENGTH_LONG).show();
            }
        });
        return view;
    }

    @Override
    public boolean onPerformDefaultAction() {
        // This is the method which is called when the ActionBar menu item is in overflow menu and clicked from there
    }
}
```
We have to add a constructor and override the `onCreateActionView()` method. In the constructor, we assign `Context` to a variable because we are going to need it in further implementations. The `onCreateActionView()` method is the place where we generate a custom layout for the action bar menu item. `onPerformDefaultAction()` is the method which is called when the action bar menu item is in the overflow menu and is clicked from there. If the `ActionProvider` provides submenus, this method is never called. The layout XML for the custom layout used in the `onCreateActionView()` method is shown in the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="wrap_content"
    android:layout_height="match_parent"
    android:layout_gravity="center"
    android:focusable="true"
    android:addStatesFromChildren="true"
    android:background="?android:attr/actionBarItemBackground" style="?android:attr/actionButtonStyle">
    <ImageButton android:id="@+id/button"
        android:background="@drawable/ic_launcher"
        android:layout_width="32dip"
        android:layout_height="32dip"
        android:layout_gravity="center"
        android:scaleType="fitCenter"
        android:adjustViewBounds="true"/>
    <TextView android:id="@+id/textView"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Some Text"
        android:textAppearance="?android:attr/textAppearanceLarge"/>
</LinearLayout>
```

As you can see in the XML file, we added an `ImageButton` component and a `TextView` component to a `LinearLayout` layout. The `onClickListener()` event of `ImageButton` is implemented in the `onCreateActionView()` method of the `Chapter1ActionProvider` class. In this event, a Toast message is displayed. The
Activity class that displays the action bar is shown the following code block:

```java
public class Chapter1ActionProviderActivity extends Activity{

    @Override
    protected void onCreate(Bundle savedInstanceState) { // TODO Auto-generated method stub
        super.onCreate(savedInstanceState);
        setContentView(R.layout.main);
    }

    @Override
    public boolean onCreateOptionsMenu(Menu menu)
    {
        MenuInflater inflater = getMenuInflater();
        inflater.inflate(R.menu.menu, menu);
        return true;
    }

    @Override
    public boolean onOptionsItemSelected(MenuItem item)
    {
        // Handle item selection
        switch (item.getItemId())
        {
        case R.id.about:
            Toast.makeText(this, “About options menu button is pressed”,
            Toast.LENGTH_LONG).show();
            return true;
        default:
            return super.onOptionsItemSelected(item);
        }
    }
}
```

In order to display a custom layout for an action bar menu item, we have to assign an ActionProvider class in the menu XML file. We assign Chapter1ActionProvider which was implemented as in the earlier code as ActionProvider. The menu XML file in our example is as follows:

```xml
<?xml version=“1.0” encoding=“utf-8”?>
    <item android:id=”@+id/settings” android:title=“Settings”
        android:showAsAction=“ifRoom|withText”
        android:actionProviderClass=“com.chapter1. Chapter1ActionProvider”></item>
    <item android:id=”@+id/about” android:title=“About”
        android:showAsAction=“ifRoom|withText”></item>
</menu>
```

As you see in the menuXML file, we provided anActionProvider class to the settings menu item. The last important thing is setting the minimum SDK version to API Level 14 in theAndroidManifest.xml file, becauseActionProvider is
a new feature released in API Level 14. The AndroidManifest.xml file should look like the following code block:

```xml
<?xml version="1.0" encoding="utf-8" ?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
package="com.chapter1"
android:versionCode="1"
android:versionName="1.0" >
  <!--set minSDKversion to 11 because ActionProvider is available since API Level 11-->
  <uses-sdk android:minSdkVersion="14" android:targetSdkVersion="14" />
  <application
    android:icon="@drawable/ic_launcher"
    android:label="@string/app_name"
  >
    <activity
      android:name=".Chapter1ActionProviderActivity"
      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>
```

When you run this application in an emulator, a user interface component with an image button and a text view will be displayed in the action bar. A toast message will be displayed if you press the image button. The screen will look like the following:
Hello World, Chapter1 Activity!
Adding submenus to the ActionProvider

It is possible to show submenus with ActionProvider. In order to add submenus, we should override the `onPrepareSubMenu(SubMenu subMenu)` and `hasSubMenu()` methods in the `Chapter1ActionProvider` class. The resulting code of the `Chapter1ActionProvider` class should look like the following code block:

```java
package com.chapter1;
import android.app.Activity;
import android.content.Context;
import android.view.ActionProvider;
import android.view.LayoutInflater;
import android.view.MenuInflater;
import android.view.MenuItem;
import android.view.MenuItem.OnMenuItemClickListener;
import android.view.SubMenu;
import android.view.View;
import android.widget.ImageButton;
import android.widget.Toast;

public class Chapter1ActionProvider extends ActionProvider implements OnMenuItemClickListener {
    Context mContext;

    public Chapter1ActionProvider(Context context) {
        super(context);
        mContext = context;
    }

    @Override
    public View onCreateActionView() {
        return null;
    }

    @Override
    public boolean onPerformDefaultAction() {
        Toast.makeText(mContext, "Action Provider click", Toast.LENGTH_LONG).show();
        return true;
    }

    @Override
    public void onPrepareSubMenu(SubMenu subMenu) {
        // In order to add submenus, we should override this method
        // we dynamically created submenus
        subMenu.clear();
        subMenu.add("SubItem1").setOnMenuItemClickListener(this);
        subMenu.add("SubItem2").setOnMenuItemClickListener(this);
    }
}
```
public boolean onMenuItemClick(MenuItem item) {
    Toast.makeText(mContext, "Sub Item click", Toast.LENGTH_LONG).show();
    return true;
}

@Override public boolean hasSubMenu() {
    // we implemented it as returning true because we have menu
    return true;
}
}

In the onPrepareSubMenu(SubMenu subMenu) method, we dynamically created submenus and set their onMenuItemClickListener events. The onPrepareSubMenu(SubMenu subMenu) method is called if the hasSubMenu() method returns true, so we implemented it as returning true.

It is also possible to create submenus from a menu XML file. If you want to create submenus from a menu XML file, onPrepareSubMenu(SubMenu subMenu) should look like the following code block:

@Override
public void onPrepareSubMenu(SubMenu subMenu) {
    MenuInflater inflater =
    ((Activity)mContext).getMenuInflater();
    inflater.inflate(R.menu.menu2, subMenu);
}

This code shows how we could inflate an XML file to create the submenus using the menu XML file menu2.
**ShareActionProvider**

*ShareActionProvider* provides a consistent way of sharing. It puts an action button on the action bar with a share icon. When you click that button, it lists the available applications for sharing. All you need is to declare ShareActionProvider in the menu item as shown in the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
  <item android:id="@+id/share" android:title="Share" android:showAsAction="ifRoom" android:actionProviderClass="android.widget.ShareActionProvider"/>
  <item android:id="@+id/about" android:title="About" android:showAsAction="ifRoom"></item>
  <item android:id="@+id/settings" android:title="Settings" android:showAsAction="ifRoom"></item>
</menu>
```

The Activity class that uses ShareActionProvider should look like the following code block:

```java
package com.chapter1;
import android.app.Activity;
import android.content.Intent;
import android.os.Bundle;
import android.view.Menu;
import android.view.MenuInflater;
import android.view.MenuItem;
import android.widget.ShareActionProvider;

public class Chapter1ShareActionProviderActivity extends Activity {
  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);
  }

  @Override
  public boolean onCreateOptionsMenu(Menu menu) {
    ShareActionProvider myShareActionProvider;
    MenuInflater inflater = getMenuInflater();
    inflater.inflate(R.menu.menu, menu);
    MenuItem item = menu.findItem(R.id.share);
    myShareActionProvider = 
```
As you can see in the code, we get the ShareActionProvider attribute of the menu item in the onCreateOptionsMenu(Menu menu) method. Then we define the intent for sharing with the setShareIntent method of ShareActionProvider. getShareIntent() method creates an intent for sharing text. We use this method to define intent for the ShareActionProvider instance.

ShareActionProvider keeps the history of applications used for sharing in a file. The default file that ShareActionProvider uses is ShareActionProvider. DEFAULT_SHARE_HISTORY_FILE_NAME. It is possible to change this file with the setShareHistoryFileName method. All you need is to pass an XML file name with the .xml extension to this method. ShareActionProvider uses this file to find the most frequently used application for sharing. Then it displays the most frequently used application near the share action button as a default sharing target.

The screen of the application with ShareActionProvider looks like the following:
Since the ShareActionProvider was introduced in API Level 14, we have to set
the minimum SDK to 14 in the AndroidManifest.xml file as shown in the
following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
package="com.chapter1"
android:versionCode="1"
android:versionName="1.0"/>
<!—set minSdkVersion to 14 because ShareActionProvider is available since API
Level 14—>
<uses-sdk android:minSdkVersion="14" />
<application
android:icon="@drawable/ic_launcher"
android:label="@string/app_name" >
<activity

android:name=".Chapter1ShareActionProviderActivity"
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>
Adding an action view

An **action view** is a user interface component that appears in the action bar instead of an action button. This view is collapsible, that is if it is configured as collapsible, meaning it expands when the action button is pressed. If it is not configured as collapsible, it is viewed expanded by default. In the following example, we added an action view and showed its events and how to handle these events.

Firstly, add a layout for the action view that has three buttons with the text Large, Medium, and Small as shown in the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="horizontal">
    <Button
        android:id="@+id/buttonLarge"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_weight="1"
        android:text="Large"
        android:textSize="15dp"/>
    <Button
        android:id="@+id/buttonMedium"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_weight="1"
        android:text="Medium"
        android:textSize="12dp"/>
    <Button
        android:id="@+id/buttonSmall"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_weight="1"
        android:text="Small"
        android:textSize="9dp"/>
</LinearLayout>
```

Then we need to bind this action view to an action bar menu item. The XML code of menu is shown in the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<menu xmlns:android="http://schemas.android.com/apk/res/android">
    <item android:id="@+id/size" android:title="Size"
        android:showAsAction="ifRoom|collapseActionView"/>
</menu>
```
As you can see in the menu XML code, we bind the action view to the size menu item by setting the actionLayout property. We also set the showAsAction property to collapseActionView. This way the action view is collapsible and it expands when the action button item is pressed. This option helps us to save space in the action bar. If this property is not set as collapseActionView, the action view is displayed as expanded by default.

The Activity class that handles action view events is shown in the following code block:

doctor

```java
package com.chapter1;

import android.app.Activity; import android.os.Bundle; import android.view.Menu;
import android.view.MenuInflater;
import android.view.MenuItem;
import android.widget.Button; import android.widget.Toast;

public class Chapter1ActionViewActivity extends Activity implements OnClickListener {
    Button buttonLarge;
    Button buttonMedium;
    Button buttonSmall;
    Menu menu;

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

    @Override
    public boolean onCreateOptionsMenu(Menu menu) {
        //you can set on click listeners of the items in Action View in this method
        this.menu = menu;
        MenuInflater inflater = getMenuInflater();
        inflater.inflate(R.menu.menu, menu);
        MenuItem item = menu.findItem(R.id.size);
```
item.setOnActionExpandListener(new
Chapter1ActionListener(this));

buttonLarge =
(Button)item.getActionView().findViewById(R.id.buttonLarge);
buttonLarge.setOnClickListener(this);

buttonMedium =
(Button)item.getActionView().findViewById(R.id.buttonMedium);
buttonMedium.setOnClickListener(this);

buttonSmall =
(Button)item.getActionView().findViewById(R.id.buttonSmall);
buttonSmall.setOnClickListener(this);
return true; }

@Override
public boolean onOptionsItemSelected(MenuItem item) {
    // Handle item selection
    switch (item.getItemId()) {
    case R.id.size:
        Toast.makeText(this, “Size options menu button is pressed”,
        Toast.LENGTH_LONG).show();
        return true;
    case R.id.about:
        Toast.makeText(this, “About options menu button is pressed”,
        Toast.LENGTH_LONG).show();
        return true;
    case R.id.settings:
        Toast.makeText(this, “Settings options menu button is pressed”,
        Toast.LENGTH_LONG).show();
        return true;
    default:
        return super.onOptionsItemSelected(item);
    }
}

@Override
public void onClick(View v) {
    if(v == buttonLarge ) {
        Toast.makeText(this, “Large button is pressed”, Toast.LENGTH_LONG).show();
        //Collapse the action view
        menu.findItem(R.id.size).collapseActionView();
    }
    else if(v == buttonMedium )
    {
        Toast.makeText(this, “Medium button is pressed”, Toast.LENGTH_LONG).show();
        //Collapse the action view
        menu.findItem(R.id.size).collapseActionView();
    }
else if(v == buttonSmall) {
    Toast.makeText(this, “Small button is pressed”, Toast.LENGTH_LONG).show();
    //Collapse the action view menu.findItem(R.id.size).collapseActionView();
}

// This class returns a callback when Action View is expanded or collapsed
public static class Chapter1ActionListener implements OnActionExpandListener {

    Activity activity;

    public Chapter1ActionListener(Activity activity) {
        this.activity = activity;
    }

    @Override
    public boolean onMenuItemActionCollapse(MenuItem item) {
        Toast.makeText(activity, item.getTitle() + “ button is collapsed”, Toast.LENGTH_LONG).show();
        return true;
    }

    @Override
    public boolean onMenuItemActionExpand(MenuItem item) {
        Toast.makeText(activity, item.getTitle() + “ button is expanded”, Toast.LENGTH_LONG).show();
        return true;
    }
}

As you see in the Chapter1ActionViewActivity, you can set event listeners of the items in action view in the onCreateOptionsMenu(Menu menu) method. We set the onClickListener event of the buttons in the action view in the onCreateOptionsMenu(Menu menu) method.

It is possible to expand and collapse the action view programmatically with the expandActionView() and collapseActionView() methods. As you can see in the onClick(View v) method of the Chapter1ActionViewActivity method, we manually collapsed the action view with the collapseActionView() method.

You can do an action when the action view is expanded or collapsed with the OnActionExpandListener class. As you can see in the code, we defined the Chapter1ActionListener class that implements OnActionExpandListener. We override the onMenuItemActionCollapse(MenuItem item) and
onMenuItemActionExpand(MenuItem item) methods of this class in order to show a Toast message. We passed Activity as a parameter to the constructor of Chapter1ActionListener because we need the Activity when showing the Toast message. We have to register the setOnActionExpandListener() method with the OnActionExpandListener class, in order to handle expand and collapse events. As you can see in the code, we registered this event in the onCreateOptionsMenu(Menu menu) method. We show a Toast message when the action view is collapsed and expanded.

Since the action view is introduced in API Level 14, we have to set the minimum SDK property to 14 or greater in the AndroidManifest.xml file as shown in the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
package="com.chapter1"
android:versionCode="1"
android:versionName="1.0" >
<!—set minSdkVersion to 14 because Action View is available since API Level 14—>
<uses-sdk android:minSdkVersion="14"/>

<application
android:icon="@drawable/ic_launcher"
android:label="@string/app_name" >
<activity
android:name=".Chapter1ActionViewActivity"
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>

When you run this application on an emulator it will look like the following screenshot:
Hello World, Chapter 1 ActionViewActivity!

Size button is expanded
Using the action bar for navigation

Tabbed navigation could also be implemented with the TabWidget class. However, the action bar has some advantages. The action bar automatically adjusts itself according to the device screen size. For instance, if there is not enough space for tabs, it will display tabs in a stacked bar manner. Thus, it’s better to use the action bar for tabbed navigation implementation.

Now, we are going to see how to use the action bar for tabbed navigation. Firstly, create an Android project and add two fragments: one that displays Fragment A and an other that displays Fragment B. The layout XML for fragments should look like the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical">
    <TextView
        android:id="@+id/textView1"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Fragment A"
        android:textAppearance="?android:attr/textAppearanceLarge"
        android:layout_gravity="center_horizontal"/>
</LinearLayout>

<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical">
    <TextView
        android:id="@+id/textView1"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Fragment B"
        android:textAppearance="?android:attr/textAppearanceLarge"
        android:layout_gravity="center_horizontal"/>
</LinearLayout>
```

The classes that extend the Fragment class for the two fragments should look like the following code block:

```java
package com.chapter1;
```
import android.app.Fragment;
import android.os.Bundle;
import android.view.LayoutInflater;
import android.view.View;
import android.view.ViewGroup;

public class FragmentA extends Fragment {

    @Override
    public View onCreateView(LayoutInflater inflater, ViewGroup container, Bundle savedInstanceState) {
        View view = inflater.inflate(R.layout.fragment_a, container, false);
        return view;
    }
}

package com.chapter1;

import android.app.Fragment;
import android.os.Bundle;
import android.view.LayoutInflater;
import android.view.View;
import android.view.ViewGroup;

public class FragmentB extends Fragment {

    @Override
    public View onCreateView(LayoutInflater inflater, ViewGroup container, Bundle savedInstanceState) {
        View view = inflater.inflate(R.layout.fragment_b, container, false);
        return view;
    }
}

In order to use action bar for tabbed navigation, we should firstly implement the ActionBar.TabListener class. The class that implements TabListener is going to be used in the Activity class in adding tabs. The Activity class with the TabListener implementation should look like the following code block:

package com.chapter1;

import android.app.ActionBar;
import android.app.ActionBar.Tab;
import android.app.ActionBar.TabListener;
import android.app.Activity;
import android.app.Fragment;
import android.app.FragmentTransaction;
import android.os.Bundle;

public class Chapter1ActionBarTabActivity extends Activity {

    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.main);
    }
}
ActionBar actionBar = getActionBar();
actionBar.setNavigationMode(ActionBar.NAVIGATION_MODE_TABS);

Tab tab = actionBar
    .newTab()
    .setText("First tab")
    .setTabListener(new
        Chapter1TabListener<FragmentA>(this, "fragmentA", FragmentA.class));
actionBar.addTab(tab);

Tab tab = actionBar
    .newTab()
    .setText("Second Tab")
    .setTabListener(new
        Chapter1TabListener<FragmentB>(this, "fragmentB", FragmentB.class));
actionBar.addTab(tab);

}

public static class Chapter1TabListener<T extends Fragment> implements TabListener {
    private Fragment mFragment;
    private final Activity mActivity;
    private final String mTag;
    private final Class<T> mClass;

    public Chapter1TabListener(Activity activity, String tag, Class<T> clz) {
        mActivity = activity;
        mTag = tag;
        mClass = clz;
    }

    @Override
    public void onTabSelected(Tab tab, FragmentTransaction ft) {
        // we initialize and add the fragment to our Activity if it doesn’t exist
        if (mFragment == null) {
            mFragment = Fragment.instantiate(mActivity, mClass.getName());
            ft.add(android.R.id.content, mFragment, mTag);
        } else {
            // If it exists, we simply attach it
            ft.attach(mFragment);
        }
    }

    @Override
    public void onTabUnselected(Tab tab, FragmentTransaction ft) {
        // in this method we detach the fragment because
// it shouldn’t be displayed
if (mFragment != null) {
    ft.detach(mFragment);
}

@Override
public void onTabReselected(Tab tab, FragmentTransaction ft) {
    // This method is called when the tab is reselected
}

In the Chapter1TabListener class there are three methods that need to be overridden:
onTabReselected(Tab tab, FragmentTransaction ft), onTabUnselected(Tab tab, FragmentTransaction ft), and onTabSelected(Tab tab, FragmentTransaction ft). In the onTabSelected(Tab tab, FragmentTransaction ft) method, we initialize and add the fragment to our activity if it doesn’t exist. If it exists, we simply attach to it. When the tab is unselected, the onTabUnselected(Tab tab, FragmentTransaction ft) method is called. In this method, we detach the fragment because it shouldn’t be displayed. When the tab is reselected, the onTabReselected(Tab tab, FragmentTransaction ft) method is called. We do nothing in this method. In the Chapter1ActionBarTabActivity class, we create and set up the action bar. Layout for our activity has nothing but a LinearLayout layout and we use fragments for the user interface. Firstly, we set the navigation mode of action bar to ActionBar.NAVIGATION_MODE_TABS because we want tabbed navigation. Then we create two tabs, set their TabListener events, and add them to the action bar instance. When you run the application, you will see two tabs named FIRST TAB and SECOND TAB. The first tab will display Fragment A and the second tab will display Fragment B. The screen will look like the following:
It is important not to forget to set the minimum SDK level to API Level 11 or higher, because the action bar was introduced in API Level 11.
Summary

In this chapter, you learned how to use the action bar as this approach is more consistent than using the options menu. You also saw how to create custom layouts in the action bar using the ActionProvider. You learned how to use ShareActionProvider and how it is an effective way of implementing sharing in your app. You learned how to use the action view and how to make it collapsible. Finally, you learned how to use the action bar for tabbed navigation. It has the advantages of adapting itself to device screen size, so it is better to use the action bar than using older APIs. In the next chapter, we are going to learn about an Android layout called GridLayout and we will see how to add and configure it.
A New Layout – GridLayout

A new layout is introduced with Android Ice Cream Sandwich known as the GridLayout. This layout is an optimized layout and could be used instead of LinearLayout and RelativeLayout. This chapter shows how to use and configure GridLayout.

The topics covered in this chapter are as follows:

• Why to use GridLayout
• Adding a GridLayout
• Configuring GridLayout
GridLayout

GridLayout is a layout that divides its view space into rows, columns, and cells. GridLayout places views in it automatically, but it is also possible to define the column and row index to place a view into GridLayout. With the span property of cells, it is possible to make a view span multiple rows or columns. The following code block shows a sample layout file using a GridLayout layout:

```xml
<?xml version="1.0" encoding="utf-8"?>
<GridLayout xmlns:android="http://schemas.android.com/apk/res/android"
android:id="@+id/GridLayout1"
android:layout_width="match_parent"
android:layout_height="match_parent"
android:columnCount="2"
android:orientation="horizontal" android:rowCount="2">
    <TextView android:id="@+id/textView1" android:text="Cell 1,1" android:textAppearance="?android:attr/textAppearanceLarge" />
    <TextView android:id="@+id/textView2" android:text="Cell 1,2" android:textAppearance="?android:attr/textAppearanceLarge" />
    <TextView android:id="@+id/textView3" android:text="Cell 2,1" android:textAppearance="?android:attr/textAppearanceLarge" />
    <TextView android:id="@+id/textView4" android:text="Cell 2,2" android:textAppearance="?android:attr/textAppearanceLarge" />
</GridLayout>
```

When this layout XML is viewed in the emulator it will look like the following screenshot:
In this layout XML file, we placed four TextView components with the texts Cell 1,1, Cell 1,2, Cell 2,1, and Cell 2,2. With the GridLayout orientation set to horizontal and the columnCount and rowCount properties set to 2, GridLayout firstly places items automatically to the first row, and when the number of items reaches columnCount; it starts placing items in the second row.

The first thing you will notice in this layout is that TextView components don’t have layout_width and layout_height properties. These properties are not used because GridLayout uses the layout_gravity property for determining the size of cells instead of layout_width and layout_height properties. Normally the gravity property is used to align the content of a view, but in GridLayout it is used for a different purpose. The available gravity constants include left, top, right, bottom, center_horizontal, center_vertical, center, fill_horizontal, fill_vertical, and fill.

In GridLayout, you can explicitly define the cell that a view will be placed in by specifying the index of the column and row. If the index is not specified, GridLayout will automatically place the views to the first available position according to the orientation of the GridLayout layout.
Why to use GridLayout

LinearLayout and RelativeLayout are the most common layouts used in user interface design in Android. For simple user interfaces they are a good choice but when the user interface gets complicated, the use of nested LinearLayout tends to increase. Nested layouts (of any type) can hurt performance, and furthermore nested LinearLayout deeper than 10 may cause a crash in your application. Thus, you should either avoid using too many nested LinearLayout blocks or you should use RelativeLayout in order to decrease nested LinearLayout blocks. Another drawback of these layouts for complicated user interfaces is the difficulty in readability. It is difficult to maintain nested LinearLayout or RelativeLayout layouts that have many views. It is a good choice to use GridLayout in these cases. Too many nested LinearLayouts could be avoided by using GridLayout. Furthermore, it is much easier to maintain GridLayout. Many of the user interfaces that use LinearLayout, RelativeLayout, or TableLayout can be converted to GridLayout where GridLayout will provide performance enhancements. One of the major advantages of GridLayout over other layouts is that you can control the alignment of a view in both horizontal and vertical axes.
Adding a GridLayout

In this section we are going to migrate an Android application from **LinearLayout** to **GridLayout**. The layout’s XML code of the application with LinearLayout is shown in the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
android:layout_width="match_parent"
android:layout_height="match_parent"
android:orientation="vertical"
android:background="#ffffff">
<!— we used 3 nested LinearLayout—>
<LinearLayout
android:layout_width="match_parent"
android:layout_height="wrap_content"
android:orientation="horizontal">
<!—LinearLayout that contains labels—>
<LinearLayout
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:orientation="vertical">
<TextView
android:id="@+id/textView1"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:text="Username:" android:textAppearance="?android:attr/textAppearanceSmall"
android:textColor="#000000" android:layout_gravity="right"/>
<TextView
android:id="@+id/textView2"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:text="Password:" android:textAppearance="?android:attr/textAppearanceLarge"
android:textColor="#000000" />
</LinearLayout>
<!—LinearLayout that contains fields—>
<LinearLayout
android:layout_width="match_parent"
android:layout_height="wrap_content"
android:orientation="vertical">
<EditText
android:id="@+id/editText1"
android:layout_width="match_parent"
android:layout_height="wrap_content"
android:textColor="#000000"/>
</LinearLayout>
</LinearLayout>
</LinearLayout>
</LinearLayout>
</LinearLayout>
</LinearLayout>
</LinearLayout>
</LinearLayout>
</LinearLayout>
</LinearLayout>
```
The drawable borders_bottom_right background used in the preceding layout file is shown in the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<layer-list xmlns:android="http://schemas.android.com/apk/res/android">
  <item>
    <shape android:shape="rectangle">
      <stroke android:width="1dp" android:color="#FFFFFF"/>
      <solid android:color="#000000"/>
    </shape>
  </item>
</layer-list>
```

The screen will look like the following:

As you can see in the layout XML code, we used three nested LinearLayouts.
instances in order to achieve a simple login screen. If this screen was designed with GridLayout, the XML code of the layout would look like the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<GridLayout xmlns:android="http://schemas.android.com/apk/res/android"
android:layout_width="fill_parent"
android:layout_height="fill_parent"
android:background="#ffffff" android:columnCount="2"
android:orientation="horizontal">
    <TextView
        android:id="@+id/textView1"
        android:layout_gravity="right"
        android:text="Username:" android:textColor="#000000"/>
    <EditText
        android:id="@+id/editText1"
        android:ems="10" android:background="@drawable/borders"/>
    <TextView
        android:id="@+id/textView2"
        android:text="Password:" android:textAppearance="?android:attr/textAppearanceLarge"
        android:textColor="#000000"/>
    <EditText
        android:id="@+id/editText2"
        android:ems="10" android:background="@drawable/borders">
    </EditText>
    <Button
        android:id="@+id/button1"
        android:layout_columnSpan="2"
        android:text="Button"
        android:layout_gravity="center_horizontal"/>
</GridLayout>

We set the columnCount property to 2 because we have a TextView component and an EditText component in a row. After that we placed the views and didn’t specify the row or column index. GridLayout placed them automatically according to orientation and columnCount. We set the layout_columnSpan property to 2 in order to make the button span two columns. With the layout_gravity property we made the button appear in the center of the row. As you can see in the XML code of the layout, it is very simple and easy to design the same screen with GridLayout. Furthermore, alignments are much easier with GridLayout and this code has better readability.
GridLayout has been available since API Level 14, so the minimum SDK property in the AndroidManifest.xml file should be set to 14 or greater as shown in the following code line:

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

Firstly, we will write a sample GridLayout XML code and then we will use this code as a base for other examples. The XML code of the sample layout will look like the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<GridLayout
xmlns:android="http://schemas.android.com/apk/res/android"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:layout_gravity="center_horizontal"
android:columnCount="3"
android:rowCount="3">

<TextView
android:text="[1,1]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[1,2]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[1,3]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[2,1]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[2,2]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[3,1]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[3,2]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[3,3]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

</GridLayout>

Using the preceding code block the screen will look like the following:
As you can see in the layout XML code, TextView components are placed without indices and they are automatically positioned in GridLayout according to orientation, columnCount, and rowCount. Now we will set the index number of [1, 3] to [2, 1]. The layout XML code should look like the following:

```xml
<?xml version="1.0" encoding="utf-8"?>
<GridLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_gravity="center_horizontal"
    android:columnCount="3"
    android:rowCount="3">
    <TextView
        android:textAppearance="@android:attr/textAppearanceLarge"/>
    <TextView
        android:text="[1,2]"
        android:textAppearance="@android:attr/textAppearanceLarge" />
    <TextView
        android:text="[1,3]"
        android:textAppearance="@android:attr/textAppearanceLarge"
        android:layout_row="1" android:layout_column="1"/>
    <TextView
        android:text="[2,1]"
        android:textAppearance="@android:attr/textAppearanceLarge"/>
    <TextView
        android:text="[2,2]"
        android:textAppearance="@android:attr/textAppearanceLarge"/>
    <TextView
        android:text="[2,3]"
        android:textAppearance="@android:attr/textAppearanceLarge"/>
    <TextView
        android:text="[3,1]"
        android:textAppearance="@android:attr/textAppearanceLarge"/>
</GridLayout>
```
The screen should look like the following:

As you see in the layout XML code (the highlighted part), we set the row and column index with `layout_row` and `layout_column` properties. The index is zero-based, thus the `TextView` component with text `[1, 3]` is placed to the second row and second column. The interesting part here is that the `TextView` component with text `[2, 1]` is placed after `[1, 3]`. This is because `[2, 1]` doesn’t have an index and **GridLayout** continues positioning after `[1, 3]`. That is **GridLayout** looks for the first available position after the last placed view. Another noteworthy thing is that after shifting indices, the row count increased to 4 although we set the row count to 3. **GridLayout** doesn’t throw exception in such cases.

In the following sample, we will swap `[1, 2]` and `[2, 2]`. The layout XML code should look like the following:

```xml
<?xml version="1.0" encoding="utf-8"?>
<GridLayout xmlns:android="http://schemas.android.com/apk/res/android"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:layout_gravity="center_horizontal"
android:columnCount="3"
android:rowCount="3" >

<TextView
android:text="[1,1]"
android:textAppearance="?android:attr/textAppearanceLarge" />

<TextView
android:text="[1,2]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[1,3]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[2,1]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[2,2]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[2,3]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[3,1]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[3,2]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[3,3]"
android:textAppearance="?android:attr/textAppearanceLarge"/>
</GridLayout>
```
The screen should look like the following:
As you see in the layout XML code, we firstly set `layout_row` of `[1, 2]` to 1. By this way, it will appear in place of `[2, 2]`. Then we have to set `layout_row` of `[1, 3]` to 0 and `layout_column` to 2, because the cursor position of `GridLayout` was changed by setting the index of `[1, 2]`. If we don’t change the index of `[1, 3]`, it will be placed after the `[1, 2]` index’s new position. After that, in order to make `[2, 2]` appear in position of `[1, 2]`, we set `layout_row` of `[2, 2]` to 0 and `layout_column` to 1. Lastly, we have to set `layout_row` of `[2, 3]` to 1 in order to make it appear after `[1, 2]` index’s new position. It seems a little complex to configure views in `GridLayout`, but if you try it in an emulator, you will see that it isn’t that difficult.

In the following sample code, we will delete `[2, 2]` and make `[1, 2]` to span two rows. The layout XML code look like the following:

```xml
<?xml version="1.0" encoding="utf-8"?>
<GridLayout
 xmlns:android="http://schemas.android.com/apk/res/android"
 android:layout_width="wrap_content"
 android:layout_height="wrap_content"
 android:layout_gravity="center_horizontal"
 android:columnCount="3"
 android:rowCount="3">
 <TextView
 android:text="[1,1]"
 android:textAppearance="@android:attr/textAppearanceLarge"/>
 <!-- set layout_rowSpan property of [1,2] to 2. By this way [1,2] will cover 2 rows. -->
 <TextView
 android:text="[1,2]"
 android:textAppearance="@android:attr/textAppearanceLarge"
 android:layout_rowSpan="2" android:layout_gravity="fill"
 android:gravity="center"/>
 <TextView
 android:text="[1,3]"
 android:textAppearance="@android:attr/textAppearanceLarge"/>
 <TextView
 android:text="[2,1]"
 android:textAppearance="@android:attr/textAppearanceLarge"/>
 <TextView
 android:text="[2,2]"
 android:textAppearance="@android:attr/textAppearanceLarge"/>
 <TextView
 android:text="[2,3]"
 android:textAppearance="@android:attr/textAppearanceLarge"/>
 <TextView
 android:text="[3,1]"
 android:textAppearance="@android:attr/textAppearanceLarge"/>
 <TextView
 android:text="[3,2]"
 android:textAppearance="@android:attr/textAppearanceLarge"/>
</GridLayout>
```
Using the preceding code block we get the following screen:

As you can see in the layout XML code, we deleted the cell [2,2] and set the layout_rowSpan property of [1,2] to 2. By this way, [1,2] will cover two rows. We set the layout_gravity property to fill in order to make it fill the space of two rows. Then we set the gravity property to center in order to make the content of the TextView component to align to the center of space that it covers.
**A new view – Space**

**Space** is a new view introduced with Android Ice Cream Sandwich. It is used for putting spaces between views. It is very useful in **GridLayout**. In the following sample layout XML code, we removed **TextView** components with text [2, 2] and [2, 3] and then put **Space** instead of them as shown in the following code block:

```xml
<GridLayout xmlns:android="http://schemas.android.com/apk/res/android"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:layout_gravity="center_horizontal"
android:columnCount="3" android:rowCount="3">

<TextView
android:text="[1,1]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[1,2]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[1,3]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[2,1]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<Space
android:layout_row="1"
android:layout_column="1"
android:layout_columnSpan="2"
android:layout_gravity="fill"/>

<TextView
android:text="[3,1]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[3,2]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

<TextView
android:text="[3,3]"
android:textAppearance="?android:attr/textAppearanceLarge"/>

</GridLayout>
```

As you can see in the layout XML code, we removed **TextView** components
with text [2,2] and [2,3]. We put a Space view to row 1 and column 1. We set `layout_columnSpan` to 2 in order to make it span two columns. The screen will look like the following:
Summary

**LinearLayout** and **RelativeLayout** are the most common layouts in Android application development. However, when designing complex user interfaces you may need to use nested LinearLayout or RelativeLayout. This is a drawback in the performance and readability of your code because these layouts increase the view hierarchy which results in unnecessary iterations on view refreshes. **GridLayout** is a new layout introduced in Android Ice Cream Sandwich that overcomes these kinds of issues. You may design user interfaces without the need for nesting layouts. If you are developing applications for API Level 14 and more, it is better to use GridLayout. In the next chapter, we are going to learn about the new Social APIs introduced with Android Ice Cream Sandwich.
Social APIs

New Social APIs have been introduced with Android Ice Cream Sandwich and this API makes it easy to integrate social networks. Furthermore, high resolution photos could be used as contact photos after Android Ice Cream Sandwich was released. This chapter shows Social API usage with examples.

The topics covered in this chapter are as follows:
• Basics of contacts in Android
• Using the Social API
Basics of contacts in Android

A person may have multiple contact information details. In Android, these multiple contact information details are joined and displayed as one contact detail. For instance; a person may have a Google+ contact, a Skype contact, and a phone contact, and Android joins all these contacts into one contact. Each of these sources of contacts is **RawContact**. Each RawContact has one or more data row, which holds some data about the contact such as phone number, e-mail, and so on. Refer to the following block diagram for a better understanding of their relationship:

Each RawContact has support for storing social network streams—texts and photos—with Android Ice Cream Sandwich. Each RawContact is associated with **StreamItems** which contains texts, timestamp, and comments from social media updates, such as Google+, and each StreamItem is associated with **StreamItemPhotos** which contains photos (such as photos in a Google+ post). However, there is a limit for the number of StreamItems stored in RawContact. This number can be fetched with a query with StreamItems.CONTENT_LIMIT_URI URI. When the number exceeds the limit, the stream item with the oldest time stamp is removed. The following block diagram depicts the relationship between these blocks:
Using Social API

In the following example, we are going to show how to add StreamItem and then how to display added StreamItems. Firstly, we inserted two buttons into the user interface, one for triggering an insert and one for listing StreamItems. In order to display StreamItems, we put three TextView components in the layout. The layout XML should look like the following:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
android:layout_width="fill_parent"
android:layout_height="fill_parent"
android:orientation="vertical">
<!— we put two buttons to the user interface, one for triggering insert and one for listing stream items—>
<LinearLayout
android:layout_width="match_parent"
android:layout_height="wrap_content">
<Button
android:id="@+id/buttonInsert"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:text="Insert"/>
<Button
android:id="@+id/buttonList"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:text="List"/>
</LinearLayout>
<!— In order to display stream items, we put three TextViews to the layout—>
<TextView
android:id="@+id/txt1"
android:layout_width="fill_parent"
android:layout_height="wrap_content"
android:textAppearance="?android:attr/textAppearanceLarge"/>
<TextView
android:id="@+id/txt2"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:textAppearance="?android:attr/textAppearanceLarge"/>
<TextView
android:id="@+id/txt3"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:textAppearance="?android:attr/textAppearanceLarge"/>
</LinearLayout>
```
We will implement the Activity class step-by-step that firstly adds a contact and then adds StreamItems and displays them. The Activity class with the onCreate() method is shown in the following code block:

```java
package com.chapter3;

import java.io.IOException;
import java.io.InputStream;
import java.util.Calendar;
import android.app.Activity;
import android.content.ContentResolver;
import android.content.ContentUris;
import android.content.ContentValues;
import android.database.Cursor;
import android.net.Uri;
import android.os.Bundle;
import android.provider.ContactsContract;
import android.provider.ContactsContract.Data;
import android.view.View.OnClickListener;
import android.widget.Button;
import android.widget.TextView;

public class Chapter3_1Activity extends Activity implements OnClickListener {
    Button insertButton; Button listButton; Button chooseButton; TextView txt1;
    TextView txt2;
    TextView txt3;
    long rawContactId;

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

        //initialize UI components
        insertButton = (Button) this.findViewById(R.id.buttonInsert);
        insertButton.setOnClickListener(this);
        listButton = (Button) this.findViewById(R.id.buttonList);
```

As you can see in this code, we firstly get instances of Button and TextView in the layout in the onCreate(Bundle savedInstanceState) method. The Chapter3_1Activity class implements OnClickListener for the buttons. As you can see in the onClick(View v) method, when the Insert button is clicked, the addContact() method is called. The addContact() method is defined as follows:

```java
public long addContact(String name, String phone, String email, String accountName, String accountType) {
    // firstly a raw contact is created with the // addRawContact method
    Uri rawContactUri = addRawContact(accountName, accountType);
    if (rawContactUri != null) {
        long rawContactId = ContentUris.parseId(rawContactUri); // we use the ID of the created raw contact in // creating name, email, phone number and stream // items
        addName(name, rawContactId);
        addPhoneNumber(phone, rawContactId);
        addEmail(email, rawContactId);
        addContactStreamItem(rawContactId, accountName, accountType, “Social Media Update 1”);
        addContactStreamItem(rawContactId, accountName, accountType, “Social Media Update 2”);
        addContactStreamItem(rawContactId, accountName, accountType, “Social Media Update 3”);
        return rawContactId; }
    return 0;
}
```

In the addContact() method, firstly a RawContact is created with the
addRawContact() method. In the addRawContact() method, we use accountName and accountType to create a raw contact. The addRawContact() method is defined as follows:

```java
public Uri addRawContact(String accountName, String accountType) { // we use account name and type to create a raw contact
    ContentResolver cr = getContentResolver();
    ContentValues values = new ContentValues();
    values.put(RawContacts.ACCOUNT_TYPE, accountType);
    values.put(RawContacts.ACCOUNT_NAME, accountName);
    Uri rawContactUri = cr.insert(RawContacts.CONTENT_URI, values);
    return rawContactUri;
}
```

After the raw contact is created, we use the ID of the created raw contact in creating the name, e-mail, phone number, and StreamItems. addName(), addEmail(), and addPhoneNumber() methods are using ContentValues class to create the name, e-mail, and phone number data as shown in the following code block:

```java
// This method is for creating email data
private void addEmail(String email, long rawContactId) {
    ContentResolver cr = getContentResolver();
    ContentValues values = new ContentValues();
    values.put(Email.ADDRESS, email);
    values.put(Email.TYPE, Email.TYPE_OTHER);
    values.put(Email.MIMETYPE, Email.CONTENT_ITEM_TYPE);
    values.put(Data.RAW_CONTACT_ID, rawContactId);
    cr.insert(Data.CONTENT_URI, values);
}
```

```java
//This method is for creating phone number data
private void addPhoneNumber(String phone, long rawContactId) {
    ContentResolver cr = getContentResolver();
    ContentValues values = new ContentValues();
    values.put(Phone.NUMBER, phone);
    values.put(Phone.TYPE, Phone.TYPE_OTHER);
    values.put(Phone.MIMETYPE, Phone.CONTENT_ITEM_TYPE);
    values.put(Data.RAW_CONTACT_ID, rawContactId);
    cr.insert(Data.CONTENT_URI, values);
}
```

```java
//This method is for adding name data
private void addName(String name, long rawContactId) {
    ContentValues values = new ContentValues();
    values.put(Data.RAW_CONTACT_ID, rawContactId);
    values.put(Data.MIMETYPE, StructuredName.CONTENT_ITEM_TYPE);
    values.put(StructuredName.DISPLAY_NAME, name);
    getContentResolver().insert(Data.CONTENT_URI, values);
}
```
In the `addContactStreamItem()` method, we create the StreamItems. We provide the raw contact ID, text of the StreamItem, time stamp in milliseconds in which the StreamItem is created, account name, and type to create StreamItems. Raw contact ID, account name, and type are required fields for creating a StreamItem. The `addContactStreamItem()` method is defined as follows:

```java
//StreamItems are created in this method
private long addContactStreamItem(long rawContactId, String accountName, String accountType, String text) { 
    // Raw contact ID, account name and type are required // fields for creating a stream item.
    ContentResolver cr = getContentResolver();
    ContentValues values = new ContentValues();
    values.put(StreamItems.RAW_CONTACT_ID, rawContactId);
    values.put(StreamItems.TEXT, text);
    values.put(StreamItems.TIMESTAMP, Calendar.getInstance().getTime());
    Uri.Builder builder = StreamItems.CONTENT_URI.buildUpon();
    builder.appendQueryParameter(RawContacts.ACCOUNT_NAME, accountName);
    builder.appendQueryParameter(RawContacts.ACCOUNT_TYPE, accountType);
    Uri streamItemUri = cr.insert(builder.build(), values);
    long streamItemId = ContentUris.parseId(streamItemUri);
    addContactStreamPhoto(streamItemId, accountName, accountType);
    return streamItemId;
}
```

The `addContactStreamPhoto()` method is used for creating StreamItemPhotos for a StreamItem. We have to provide a photo in binary, or `PHOTO_FILE_ID`, or `PHOTO_URI`. As you can see in the following code block, we used a drawable to create a photo in binary using `loadPhotoFromResource` and `readInputStream` methods. We also provide the StreamItem ID, sort index, account name, and type for creating a stream photo. If we don’t provide a sort index, the ID column will be used for sorting. The `addContactStreamPhoto()` method is defined as follows:

```java
//This method is used for creating a stream photo for a stream item
private long addContactStreamPhoto(long streamItemId, String accountName, String accountType) {
    // provide stream item ID, sort index, account name and type for creating a stream photo
    ContentValues values = new ContentValues();
    values.put(StreamItemPhotos.STREAM_ITEM_ID, streamItemId);
    values.put(StreamItemPhotos.STREAM_ITEM_ID, streamItemId);
```
When the **List** button is clicked, the *getStreams()* method is called. As you can see in the following code, in the *getStream()* method, we firstly retrieve the *contactId* details of the raw contact using the *getContactId()* method. Then we use this contact ID in querying StreamItems by passing *contactId* as the search parameter. Since we query the StreamItems, *ContactsContract.StreamItems.CONTENT_URI* is used as the URI. Lastly, StreamItems are retrieved with a cursor and texts of StreamItems are displayed in TextViews. The *getStreams()* method and the *getContactId()* method are defined as follows:

```java
public void getStreams(long rawContactId) {
    long contactId = getContactId(rawContactId);
    ContentResolver cr = getContentResolver();
    Cursor pCur = cr.query(ContactsContract.StreamItems.CONTENT_URI,
                           null, ContactsContract.StreamItems.CONTACT_ID + " = " + contactId, null, null);
    int i = 0;
    if (pCur.getCount() > 0) {
        while (pCur.moveToNext()) {
            String text = pCur.getString(pCur.getColumnIndex(ContactsContract.StreamItems.TEXT));
            if (i == 0) {  // This method is used for creating a photo in binary
                byte[] loadPhotoFromResource(int resourceId) { return readInputStream(is); }
            }
        }
    }
    return;
}
```
this.txt1.setText(text);
else if (i == 1)
    this.txt2.setText(text);
else if (i == 2)
    this.txt3.setText(text);
i++;
}
}
pCur.close();
public long getContactId(long rawContactId) {
    Cursor cur = null;
    try {
        cur = this.getContentResolver().query(
            ContactsContract.RawContacts.CONTENT_URI,
            new String[] {
                ContactsContract.RawContacts.CONTACT_ID
            },
            ContactsContract.RawContacts._ID + 
"=" + rawContactId, null, null);
        if (cur.moveToFirst()) {
            return cur.getLong(cur.getColumnIndex(ContactsContract.
RawContacts._ID));
        }
    } catch (Exception e) {
        e.printStackTrace();
    } finally {
        if (cur != null) {
            cur.close();
        }
    }
    return -1l;
}
Lastly, we need some permissions for reading and writing social streams and contacts: READ_SOCIAL_STREAM, WRITE_SOCIAL_STREAM, READ_CONTACTS, and WRITE_CONTACTS. Furthermore, we have to set the minimum SDK to the API Level 15 in order to use Social APIs. The AndroidManifest.xml file should look like the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.chapter3"
    android:versionCode="1"
    android:versionName="1.0"/>
```
When we execute the application in the emulator, click the Insert button and then click the List button; the screen will look like the following:

When you execute the People app in the emulator, you will see that the contact named Murat Aydin is created as seen in the following screenshot:
You will also see the recent social network updates with photos that we created programmatically:
Device user profile

Starting from API Level 14, Android displays the device user profile at the top of the contacts as ME as seen in the following screen:

ContactsContract.Profile.CONTENT_URI and ContactsContract.Profile.CONTENT_RAW_CONTACTS_URI URIs could be used in order to read and write the device user profile. Operations are similar to reading and writing a contact except that READ_PROFILE and WRITE_PROFILE permissions are needed in the AndroidManifest.xml file.
Summary

Integration of contacts and social networks became easier with the new Social APIs introduced with Android Ice Cream Sandwich. StreamItems and StreamItemPhotos classes are used for storing social network updates to be stored in contacts. In this chapter, we learned how to use these classes. Furthermore, we learned the device user profile that displays the contact information of the device user.

New APIs have been introduced with Android Ice Cream Sandwich for managing calendars. In the next chapter, we will learn the new Calendar API and how to use it.
Calendar APIs

New Calendar APIs have been introduced with Android Ice Cream Sandwich for managing calendars. Event, attendee, alert, and reminder databases can be managed with these APIs. These APIs allow us to easily integrate calendars with our Android applications. This chapter shows how to use Calendar APIs with examples.

The topics covered in this chapter are as follows:

- Using Calendar APIs
- Creating an event
- Adding an attendee
- Adding a reminder
Using Calendar APIs

The main class that manages the calendar data is the CalendarContract class. Noteworthy tables that store the calendar information are as follows:

• CalendarContract.Calendar: This table stores calendar specific data for each calendar
• CalendarContract.Event: This table stores event specific data for each event
• CalendarContract.Attendee: This table stores data about the attendee of an event
• CalendarContract.Reminder: This table stores data about the reminder for an event

In the following examples, we will execute the applications in an Android device, because in order to test the Calendar API in an emulator, an account is needed. If you want to test examples in an emulator, make sure to choose the Google API's API Level 14 or higher when creating the AVD. The Google API allows you to add a Google account to an emulator, which is needed for the Calendar APIs. You also need to set up the Calendar to sync with Gmail. You can use m.google.com as the server and your_email@gmail.com as the Domain/ Username when adding an account. After creating and syncing your account, you can run the following examples in the emulator.
Creating an event

In order to create a calendar event, we need to create a ContentValues instance and put event information to this instance. Then, using the ContentResolver class, we could insert the event information into the calendar. There are some required fields in order to insert an event into calendar. These fields are as follows:

- Start time of the event
- End time of the event if the event is not repeating
- Recurrence rule or recurrence date of the event if the event is repeating
- Duration if the event is repeating
- Event time zone and calendar ID

The Activity class that inserts an event is defined as follows:

```java
package com.chapter4;
import java.util.Calendar;
import java.util.TimeZone;

import android.app.Activity;
import android.content.ContentValues;
import android.database.Cursor;
import android.os.Bundle;
import android.content.ContentUris;
import android.net.Uri;
import android.provider.CalendarContract;
import android.view.View;
import android.view.View.OnClickListener;
import android.widget.Button;

public class Chapter4_1Activity extends Activity implements OnClickListener {

    Button insertButton;
    long calendarID;
    long eventID;

    /**
     * Called when the activity is first created. */
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.main);
        insertButton = (Button)this.findViewById(R.id.buttonInsertEvent);
        insertButton.setOnClickListener(this);
    }

    @Override
    public void onClick(View v) {

    }

    @Override
    public void onClick(View v) {

        // Insert event code here
    }
}
```
addEvent();
}

private void addEvent()
{
calendarID = getCalendarID();
ContentValues eventValues = new ContentValues();

// provide the required fields for creating an event to // ContentValues instance and insert event using // ContentResolver

eventValues.put(CalendarContract.Events.CALENDAR_ID, calendarID);
eventValues.put(CalendarContract.Events.TITLE, "Event 1");
eventValues.put(CalendarContract.Events.DESCRIPTION, "Testing Calendar API");
eventValues.put(CalendarContract.Events.DTSTART, Calendar.getInstance().getTimeInMillis());
eventValues.put(CalendarContract.Events.DTEND, Calendar.getInstance().getTimeInMillis());
eventValues.put(CalendarContract.Events.EVENT_TIMEZONE, TimeZone.getDefault().toString());
Uri eventUri = this.getContentResolver().insert(CalendarContract.Events.CONTENT_URI, eventValues);
eventID = ContentUris.parseId(eventUri);
}

// we use this method in order to get the ID of the calendar because // calendar ID is a required field in creating an event
public long getCalendarID()
{
Cursor cur = null;
try {
// provide CalendarContract.Calendars.CONTENT_URI to // ContentResolver to query calendars
cur = this.getContentResolver().query(CalendarContract.Calendars.CONTENT_URI, null, null, null);
if (cur.moveToFirst()) {
return cur
.getLong(cur
.getColumnIndex(CalendarContract.Calendars._ID));
}
} catch (Exception e) {
e.printStackTrace();
}
finally {
if (cur != null) {
cur.close();
}
}
As you can see in this code, we use the getCalendarID() method in order to get the ID of the calendar because calendarID is a required field in creating an event. We provided CalendarContract.Calendars.CONTENT_URI to ContentResolver to query calendars.

We used a button click event in order to add an event. On the clicking of this button, we call the addEvent() method. In the addEvent() method, we provide the required fields for creating an event to the ContentValues instance and insert the event using the ContentResolver. We provide CalendarContract.Events.CONTENT_URI to ContentResolver in order to add an event.

The XML code of the layout of this application is LinearLayout with a Button component as seen in the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
android:layout_width="fill_parent"
android:layout_height="fill_parent"
android:orientation="vertical">
<Button
android:id="@+id/buttonInsertEvent"
android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:text="insert event"/>
</LinearLayout>
```

The screen will look like the following when you execute this code:
In order to use the new Calendar APIs, the minimum SDK version in the AndroidManifest.xml file should be API Level 14 or more. Furthermore, WRITE_CALENDAR and READ_CALENDAR permissions are required for reading and writing to the calendar. The AndroidManifest.xml file should look like the following:

```xml
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
  package="com.chapter4"
  android:versionCode="1"
  android:versionName="1.0">
  <uses-sdk android:minSdkVersion="14"/>
  <uses-permission android:name="android.permission.WRITE_CALENDAR"/>
  <uses-permission android:name="android.permission.READ_CALENDAR"/>
  <application
    android:icon="@drawable/ic_launcher"
    android:label="@string/app_name">
    <activity
      android:name=".Chapter4_1Activity"
      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>
```
When the event is created, the calendar will look like the following:
Using Intents for creating events

The same event could also be created using Intent objects. The following method shows how to add an event using Intent objects:

```java
private void addEventUsingIntent() {
    calendarID = getCalendarID();
    Intent intent = new Intent(Intent.ACTION_INSERT)
        .setData(CalendarContract.Events.CONTENT_URI)
        .putExtra(CalendarContract.Events.DTSTART, Calendar.getInstance().getTimeInMillis())
        .putExtra(CalendarContract.Events.DTEND, Calendar.getInstance().getTimeInMillis())
        .putExtra(CalendarContract.Events.TITLE, "Event 1")
        .putExtra(CalendarContract.Events.DESCRIPTION, "Testing Calendar API");
    startActivity(intent);
}
```

We can call this method instead of the `addEvent()` method in order to create an event using Intent objects. By using Intent objects, we don’t need to create a view in order to create an event. Using Intent objects is a best practice for modifying and showing calendars.
Adding an attendee

Adding an attendee is similar to creating an event. We use CalendarContract.Attendees.CONTENT_URI as the URI for inserting an attendee. The required fields for inserting an attendee are event ID, attendee e-mail, attendee relationship, attendee status, and attendee type. We put a Button component in the XML layout of the application. The resulting layout is as follows:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
android:layout_width="fill_parent"
android:layout_height="fill_parent"
android:orientation="vertical">
<Button android:id="@+id/buttonInsertEvent" android:layout_width="wrap_content"
android:layout_height="wrap_content" android:text="insert event"/>
<Button android:id="@+id/buttonInsertAttendee" android:layout_width="wrap_content"
android:layout_height="wrap_content" android:text="insert attendee"/>
</LinearLayout>
```

Then we call the following method on clicking the insert attendee button:

```java
private void addAttendee()
{
ContentValues cv = new ContentValues();
cv.put(Attendees.ATTENDEE_NAME, "Murat AYDIN");
cv.put(Attendees.ATTENDEE_EMAIL, "maydin@gmail.com");
cv.put(Attendees.EVENT_ID, eventID);
cv.put(Attendees.ATTENDEE_RELATIONSHIP, Attendees.RELATIONSHIP_ATTENDEE);
cv.put(Attendees.ATTENDEE_STATUS, Attendees.ATTENDEE_STATUS_INVITED);
cv.put(Attendees.ATTENDEE_TYPE, Attendees.TYPE_OPTIONAL);
this.getContentResolver().insert(CalendarContract.Attendees.CONTENT_URI, cv);
}
```

Before clicking on the insert attendee button, an event should be created because we are using an event ID when inserting an attendee.
Adding a reminder

We use CalendarContract.Reminder.CONTENT_URI as the URI in inserting a reminder for an event. The required fields for inserting a reminder are event ID, minutes that the reminder needs to fire before the event, and method. We put a Button component in the XML layout of the application. The resulting layout is as follows:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
    android:orientation="vertical">
    <Button
        android:id="@+id/buttonInsertEvent"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="insert event"/>
    <Button
        android:id="@+id/buttonInsertAttendee"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="insert attendee"/>
    <Button
        android:id="@+id/buttonInsertReminder"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="insert reminder"/>
</LinearLayout>
```

Then we call the following method on the click of the insert reminder button:

```java
private void addReminder()
{
    ContentValues values = new ContentValues();
    values.put(Reminders.MINUTES, 15);
    values.put(Reminders.EVENT_ID, eventID);
    values.put(Reminders.METHOD, Reminders.METHOD_ALERT);
    this.getContentResolver().insert(CalendarContract.Reminders.CONTENT_URI, values);
}
```

As you see in this code, this reminder will fire 15 minutes before the event’s time. Before pressing the insert reminder button, an event should be created because we are using the event ID when inserting a reminder.

When the reminder is added, the calendar will look like the following:
Summary

With the new Calendar API, integrating calendars to Android applications became easier. In this chapter, we learned how to create an event and the required fields for creating an event. Then we learned about adding an attendee and a reminder to an event. We need to set the required permissions for modifying the calendar.

Although Fragments were introduced with Android 3.0, they are now available for small screen devices with Android Ice Cream Sandwich. In the next chapter, we will cover the basics of Fragments and how to use them.
Fragments

Although fragments were introduced with Android 3.0, they are now available for small screen devices with Android Ice Cream Sandwich. This chapter will cover the basics of fragments and how to use them.

The topics covered in this chapter are as follows:

• Fragment basics
• Creating and managing fragments
• Types of fragments
**Fragment basics**

**Fragment** is a modular component in an activity which has its own life cycle and event handling, and it is very similar to an activity. Although fragments have their own life cycle, they are directly affected by their owner activity’s life cycle. For instance, if an activity is destroyed, its fragments are also destroyed. Every fragment should have an owner activity. A fragment could be added to or removed from an activity dynamically.

Fragments increase software reusability and provide flexibility in user interface design. A fragment could be used by more than one activity. This way you implement once and use multiple times. Furthermore, it is possible to use a fragment for different layout configurations and different screen modes. This way it provides flexibility in user interface design.

It is important to design fragments such that they could work independently, that is, they should not depend on other fragments and activities. In this way it is possible to reuse fragments independently from other fragments.
**Fragment lifecycle**

Fragments have their own lifecycle; however, they are still directly affected by their owner activity’s lifecycle. The following diagram shows the creation flow of lifecycle of a fragment:

The blocks in the diagram perform the following tasks:

- **onAttach()**: When a fragment is added to an activity, the `onAttach()` method is called.
- **onCreate()**: This method is called when a fragment is created.
- **onCreateView()**: This method returns a view. This view is the user interface of the fragment. If the fragment is doing background works and doesn’t have a user interface, then this method should return null.
- **onActivityCreated()**: This method is called after the owner activity is created.
- **onStart()**: After this method is called, the fragment’s view becomes visible to the user.
- **onResume()**: After this method is called, the fragment becomes active and the user can interact with the fragment. This method could be called more than once, because this method is called after the application is restarted or paused.

The following diagram shows the destruction flow of the lifecycle of a fragment:

The blocks in the diagram perform the following tasks:

- **onPause()**: This method is called when the fragment is paused and no longer interacts with the user.
- **onStop()**: This method is called when the fragment is stopped. The fragment is not visible to the user after this method is called.
- **onDestroyView()**: This method is called when the view of the fragment is destroyed.
- **onDestroy()**: This method is called when the fragment is no longer in use.
- **onDetach()**: This method is called when the fragment is removed from the activity.
Creating and managing fragments

We are going to learn how to create and manage fragments with a sample Android application. This application is going to list book names. When a book name is clicked, the author of the book will be displayed. This application will be designed for small and large screen devices, this way we will see how to use fragments for different screen sizes. The following is the screenshot of this application for small screens. As you can see in this screenshot, the left hand side of the screen has the list of books and when a book is clicked, the right hand side of the screen will be displayed which shows the author of the clicked book:

We will firstly implement these screens, and then we will design this application for large screens.
In this application, we have two activities, one for the first screen and one for the second screen. Each activity consists of one fragment. The following diagram shows the structure of this application:

The XML code for the layout of Fragment B is as follows:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android">
```
As you can see in this code, it has a LinearLayout layout with a TextView component. TextView is for displaying the author of the book. We don’t have a layout for Fragment A, because it is a ListFragment property which includes the ListView component.

Now we need two classes that extend the Fragment classes for each fragment. The following is the class for Fragment A:

```java
package com.chapter5;
import android.app.ListFragment;
import android.content.Intent;
import android.os.Bundle;
import android.view.View;
import android.widget.AdapterView;
import android.widget.AdapterView.OnItemClickListener;
import android.widget.ArrayAdapter;
public class Chapter5_1FragmentA extends ListFragment implements OnItemClickListener {
    @Override
    public void onActivityCreated(Bundle savedInstanceState) {
        super.onActivityCreated(savedInstanceState);
        //initialize the adapter and set on click events of items
        ArrayAdapter<String> adapter = new ArrayAdapter<String>(getActivity(),
            android.R.layout.simple_list_item_1, Book.BOOK_NAMES);
        this.setListAdapter(adapter);
        getListView().setOnItemClickListener(this);
    }
    @Override
    public void onItemClick(AdapterView<?> parent, View view, int position, long id) {
        //Start a new Activity in order to display author name String author =
        Book.AUTHOR_NAMES[position];
        Intent intent = new Intent(getActivity().getApplicationContext(), Chapter5_1Activity_B.class);
    }
```
As you can see, the Chapter5_1FragmentA class extends ListFragment, because we are listing the books in this screen. It is similar to ListActivity and this class has a ListView view. In the onActivityCreated method we set theListAdapter property of the ListFragment. The source for the adapter is a class that contains the string arrays of book names and authors as shown in the following code block:

```java
package com.chapter5;

public class Book {
    public static final String[] BOOK_NAMES = {
        "Book Name 1", "Book Name 2", "Book Name 3", "Book Name 4", "Book Name 5", "Book Name 6", "Book Name 7", "Book Name 8"};
    public static final String[] AUTHOR_NAMES = {
        "Author of Book 1", "Author of Book 2", "Author of Book 3", "Author of Book 4", "Author of Book 5", "Author of Book 6", "Author of Book 7", "Author of Book 8"};
}
```

After initializing ListAdapter, we set the OnItemClickListener event of the ListView view. This event is called when a ListView item is clicked. When an item is clicked, the onItemClick method is called. In this method, a new activity is started with the author of the book. As you can see in the code, we reach the owner activity of the fragment with the getActivity() method. We could receive the ApplicationContext with the getActivity() method. Remember that the OnCreateView method is called before onActivityCreated, and because of that we initialized ListAdapter and ListView in the onActivityCreated method, because we need the user interface components to be created before we initialize them and they are created in OnCreateView. We don’t need to override the OnCreateView method of ListFragment, because it returns a ListView. You can override the OnCreateView method if you want to use a customized ListView.

The following is the class for Fragment B:

```java
package com.chapter5;

import android.app.Fragment;
import android.os.Bundle;
import android.view.LayoutInflater;
import android.view.View;
import android.view.ViewGroup;

public class Chapter5_1FragmentB extends Fragment {
    @Override
    public View onCreateView(LayoutInflater inflater, ViewGroup container,
```
Bundle savedInstanceState) {
View view = inflater.inflate(R.layout.fragment_b, container, false);
return view;
}

As you can see from this code, if a fragment has a user interface, this method should be overridden and should return a view. In our sample application, we are returning a view inflated with the XML layout that we previously implemented. Now we need two activity classes that host these fragments. The following is the Activity class of Activity A that hosts Fragment A:

```java
package com.chapter5;
import android.app.Activity; import android.os.Bundle;
public class Chapter5_1Activity_A extends Activity {
    /**
     * Called when the activity is first created.
     */
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_a);
    }
}
```

It is a simple Activity class that just sets the content view with a layout. The XML layout code of the Activity A class is as follows:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
    android:orientation="vertical">
    <fragment android:id="@+id/fragment_a"
        android:layout_width="match_parent"
        android:layout_height="match_parent"
        class="com.chapter5.Chapter5_1FragmentA"/>
</LinearLayout>
```

As you can see from this code, we specified Fragment A with the class property com.chapter5.Chapter5_1FragmentA. Furthermore, we specified the id property. Fragments should have either an id or a tag property as an identifier because Android needs that in restoring the fragment when the activity is restarted.

The Activity class for Activity B that hosts Fragment B is as follows:

```java
package com.chapter5;
import android.app.Activity; import android.os.Bundle; import android.widget.TextView;
```
public class Chapter5_1Activity_B extends Activity {
    /** Called when the activity is first created. */
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_b);
        Bundle extras = getIntent().getExtras();
        if (extras != null) {
            String s = extras.getString("author");
            TextView view = (TextView) findViewById(R.id.textViewAuthor);
            view.setText(s);
        }
    }
}

It is a simple Activity class that just sets the content view with a layout. The XML layout code of Activity B is as follows:

```xml
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical">
    <fragment
        android:id="@+id/fragment_b"
        android:layout_width="match_parent" android:layout_height="match_parent"
        class="com.chapter5.Chapter5_1FragmentB" />
</LinearLayout>
```

As you can see from this code, we specified Fragment B with the class property com.chapter5.Chapter5_1FragmentB.
Programmatically adding a fragment

In our previous sample application, we added a fragment to an activity layout in XML layout code. You can also add a fragment to an activity programmatically. The following is the programmatically added fragment version of our previous sample application and XML layout code of the activity:

```java
package com.chapter5;

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

public class Chapter5_1Activity_A extends Activity {  /**
 ** Called when the activity is first created. */
 @Override
 public void onCreate(Bundle savedInstanceState) {
 super.onCreate(savedInstanceState);
 setContentView(R.layout.activity_a);
 addFragment();
 }

 public void addFragment() {
 FragmentManager fragmentManager = getFragmentManager();
 FragmentTransaction fragmentTransaction = fragmentManager
 .beginTransaction();

 Chapter5_1FragmentA fragment = new Chapter5_1FragmentA();
 fragmentTransaction.add(R.id.layout_activity_a, fragment);
 fragmentTransaction.commit();
 }

 <LinearLayout
 xmlns:android="http://schemas.android.com/apk/res/android"
 android:id="@+id/layout_activity_a"
 android:layout_width="fill_parent"
 android:layout_height="fill_parent"
 android:orientation="vertical" />
```

As you can see from this XML code, we removed the Fragment tags because we are adding Fragment A programmatically. As you can see in the Chapter5_1Activity_A class, we added a method called addFragment(). We used the FragmentTransaction class in order to add Fragment A. The FragmentTransaction class is used for operations such as adding fragments, removing fragments,
attaching fragments to the UI, and so on. As you can see in the addMethod() method, you can get an instance of FragmentTransaction with FragmentManager using the beginTransaction() method. Finally we have to call the commit() method for the changes to be applied.

FragmentManager is used for managing fragments. As you can see in the code, you can get an instance of FragmentManager by the getFragmentManager() method. FragmentManager allows you to begin a transaction by the beginTransaction() method, get a fragment in activity by the findFragmentById() or findFragmentbyTag() methods, and pop a fragment off the back stack by the popBackStack() method.
Event sharing with activity

In our example, we started an activity in the ListFragment class’ onItemClick method. We can establish the same operation by creating a callback interface in ListFragment and make the Activity class implement that callback. By this way the Fragment class will notify the owner Activity class. When the owner Activity class is notified, it can share the notification by other fragments. This way, fragments can share an event and communicate. We can go about this operation using the following steps:

1. We create the callback interface in the Chapter5_1FragmentA class:

```java
public interface OnBookSelectedListener {
    public void onBookSelected(int bookIndex);
}
```

2. We create an instance of OnBookSelectedListener and assign the owner activity to that instance in the Chapter5_1FragmentA class:

```java
OnBookSelectedListener mListener;
@Override
public void onAttach(Activity activity) {
    super.onAttach(activity);
    mListener = (OnBookSelectedListener) activity;
}
```

As you can see from this code, the owner activity class of Chapter5_1FragmentA should implement the OnBookSelectedListener instance or there will be a class cast exception.

3. We make the Chapter5_1Activity_A class implement the OnBookSelectedListener interface:

```java
public class Chapter5_1Activity_A extends Activity implements OnBookSelectedListener {
    //some code here

    @Override
    public void onBookSelected(int bookIndex) {
        String author = Book.AUTHOR_NAMES[bookIndex];
        Intent intent = new Intent(this, Chapter5_1Activity_B.class);
        intent.putExtra("author", author);
        startActivity(intent);
    }
    //some more code here
}
```
As you can see from this code, Chapter5_1Activity_A receives a selected book index in the event callback and starts the activity with author data. 4. We call the onBookSelected method in the onItemClick method of the Chapter5_1FragmentA class:

```java
@override
public void onItemClick(AdapterView<?> parent, View view, int position, long id) {
    mListener.onBookSelected(position);
}
```

In this way, we made the activity and fragment share an event callback.
Our sample book listing application is designed for small screens. When you execute this application on a larger screen, it will look bad. We have to use the space efficiently in larger screen sizes. In order to achieve this, we have to create a new layout for large screens. The new layout is as follows:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:id="@+id/layout_small_a" android:layout_width="fill_parent"
    android:layout_height="fill_parent" android:orientation="horizontal">
    <fragment android:id="@+id/fragment_a"
        android:layout_width="fill_parent" android:layout_height="fill_parent"
        class="com.chapter5.Chapter5_1FragmentA" android:layout_weight="1"/>
    <fragment android:id="@+id/fragment_b"
        android:layout_width="fill_parent" android:layout_height="fill_parent"
        class="com.chapter5.Chapter5_1FragmentB" android:layout_weight="1"/>
</LinearLayout>
```

As you can see from this code, we put two fragments in a horizontal LinearLayout layout. In the previous sample application, there was one fragment in each activity, but in this activity there are two fragments in order to use the space efficiently. By setting the layout_weight property to 1, we make the fragments consume equal spaces on the screen.

We have to put this new layout XML file under a folder named layout-xlargeland under the res folder. In this way, the Android uses this layout file when the device screen is large and in landscape mode. Android decides which layout file to use on runtime according to layout folder names. layout is the default folder name for Android. If Android can’t find a suitable layout folder for a device screen size and mode, it uses the layout in the layout folder. Some of the common qualifiers for layout are as follows:

- small for small screen sizes
- normal for normal screen sizes
- large for large screen sizes
- xlarge for extra large screen sizes
- land for landscape orientation
- port for portrait orientation

However, this layout is not enough to make our sample function correctly on
large screens. To make the new layout function correctly, we have to change how the fragments are managed. Update the onBookSelected property in Chapter5_1Activity_A as follows:

```java
@Override
public void onBookSelected(int bookIndex) {
    FragmentManager fragmentManager = getFragmentManager();
    Fragment fragment_b = fragmentManager.findFragmentById(R.id.fragment_b);
    String author = Book.AUTHOR_NAMES[bookIndex];
    if (fragment_b == null) {
        Intent intent = new Intent(this, Chapter5_1Activity_B.class);
        intent.putExtra("author", author);
        startActivity(intent);
    } else {
        TextView textViewAuthor = (TextView) fragment_b.getView().findViewById(R.id.textViewAuthor);
        textViewAuthor.setText(author);
    }
}
```

As you can see from this code, we get the Fragment B class by using FragmentManager. If the fragment_b is not null, we understand that this activity contains Fragment B, and the device has a large screen, because Fragment B is used in Activity A only when the screen is large and in landscape mode. Then using fragment_b, we get the textViewAuthor TextView component and update its text with the chosen book’s author name. On the right of the screen we see the author name of the chosen book.

If fragment_b is null, we understand that the device has a small screen, and we start a new activity using Intent.

In the AndroidManifest.xml file, we have to set the minimum SDK version to API Level 14, because fragments have been available for small screens since API Level 14. The AndroidManifest.xml file should look like the following code block:

```xml
<manifest version="1.0" encoding="utf-8">
    <manifest xmlns:android="http://schemas.android.com/apk/res/android"
        package="com.chapter5" 
        android:versionCode="1" android:versionName="1.0">
        <uses-sdk android:minSdkVersion="14" />
    </manifest>
</manifest>
```
Our sample application will look like the following on a large screen:
**Types of fragments**

There are four types of fragments:

- ListFragment
- DialogFragment
- PreferenceFragment
- WebViewFragment

In this section, we will develop a sample application that uses these fragments. At the end of this section, the application will be completed.
**ListFragment**

This fragment is similar to ListActivity and contains a ListView view by default. It is used for displaying a list of items. In our previous sample code, we used ListFragment; see the *Creating and managing fragments* section for ListFragment.
DialogFragment

This fragment displays a dialog on top of its owner activity. In the following sample application, we are going to create a fragment that has a Delete button. When the button is clicked, a DialogFragment dialog box will be displayed. The DialogFragment dialog box will have a confirmation message and two buttons – OK and Cancel buttons. If the OK button is clicked, a message will be displayed and DialogFragment will be dismissed. The screens of the sample application will look like the following screenshot:

The layout XML code of the fragment with a Delete button is shown in the following code block:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:gravity="center_horizontal"
    android:orientation="vertical">
    <Button
        android:id="@+id/buttonFragment"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Delete" />
</LinearLayout>
```

This layout is a simple layout with a LinearLayout layout and a Button component in it. The Fragment class of this layout is as follows:

```java
package com.chapter5;
import android.app.Fragment;
import android.app.FragmentTransaction; import android.os.Bundle;
import android.view.LayoutInflater; import android.view.View;
import android.view.View.OnClickListener; import android.view.ViewGroup;
```
import android.widget.Button;

public class Chapter5_2Fragment extends Fragment implements OnClickListener{

    Button fragmentButton;

    @Override
    public View onCreateView(LayoutInflater inflater, ViewGroup container,
            Bundle savedInstanceState) {
        View view = inflater.inflate(R.layout.fragment, container, false);
        fragmentButton = (Button)view.findViewById(R.id.buttonFragment);
        fragmentButton.setOnClickListener(this);
        return view;
    }

    @Override
    public void onClick(View v) {
        // we need a FragmentTransaction in order to display a dialog
        FragmentTransaction transaction = getFragmentManager().beginTransaction();
        Chapter5_2DialogFragment dialogFragment = new Chapter5_2DialogFragment();
        dialogFragment.show(transaction, “dialog_fragment”);
    }
}

As you can see from this code, in the onClick method of Chapter5_2Fragment class, an instance of the Chapter5_2DialogFragment class is created and using this instance, a dialog is displayed with its show() method.

The layout code of the **DialogFragment** dialog box is as follows:

```xml
<?xml version=“1.0” encoding=“utf-8”?>
<GridLayout android:layout_width=“wrap_content”
android:layout_height=“wrap_content”
android:layout_gravity=“center_horizontal”
android:columnCount=“2”
android:orientation=“horizontal”

    <TextView
        android:id=“@+id/textViewMessage”
        android:layout_width=“fill_parent”
        android:layout_height=“wrap_content”
        android:layout_columnSpan=“2”
        android:layout_gravity=“fill”
        android:text=“This item will be deleted. Do you want to continue?”
        android:textAppearance=“?android:attr/textAppearanceLarge” />

<!--we used a linear layout here because we need it in order to evenly distribute the buttons -->
As you can see from this previous code, we used GridLayout as the root layout. Then we input a TextView component which displays the confirmation message. Finally, two buttons are added to the layout—OK and Cancel buttons. The following is the DialogFragment class of this layout:

```java
package com.chapter5;

public class Chapter5_2DialogFragment extends DialogFragment implements OnClickListener{
    Button okButton;
    Button cancelButton;
    @Override
    public View onCreateView(LayoutInflater inflater, ViewGroup container, Bundle savedInstanceState) {
        View view = inflater.inflate(R.layout.dialog_fragment, container, false);
        //initialize the buttons and set click events
        okButton = (Button)view.findViewById(R.id.buttonOk);
        okButton.setOnClickListener(this);
        cancelButton = (Button)view.findViewById(R.id.buttonCancel);
        cancelButton.setOnClickListener(this);
        return view; }
    @Override
    public void onClick(View v) {
        if(v == cancelButton) dismiss();
    }
}
```
else if( v == okButton)
{
    Toast.makeText(this.getActivity(), “Item is deleted.”, Toast.LENGTH_LONG).show();
dismiss();
}
}

As you the see from this code, this class extends can DialogFragment class. In the onCreateView method of the Chapter5_2DialogFragment class, we initialize the buttons and set their onClick events. In the onClick method of the Chapter5_2DialogFragment class, we handle the button click events. If the clicked button is Cancel, we dismiss the dialog window. If the clicked button is OK, we show an information message and dismiss the dialog. As you can see from the preceding code, the dismiss() method is used for closing the dialog.
PreferenceFragment

This fragment is similar to PreferenceActivity. It shows the preferences and saves them to SharedPreferences. In this section, we will extend the previous example code. We will put a preference about showing the confirmation message during deletion. The user could be able to choose to see or not to see confirmation message. We perform the following steps for using PreferenceFragment:

1. Create a source XML for the preference screen and put it under the res/xml folder:

```xml
<?xml version="1.0" encoding="utf-8"?>
  <CheckBoxPreference android:summary="check this in order to show confirmation message when deleting"
                      android:title="show confirmation message"
                      android:key="checkbox_preference"/>
</PreferenceScreen>
```

As you can see from the previous code, our preference screen contains a checkbox preference for the confirmation message.

2. Create a class that extends PreferenceFragment:

```java
package com.chapter5;
import android.os.Bundle;
import android.preference.PreferenceFragment;
public class Chapter5_2PreferenceFragment extends PreferenceFragment {
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        addPreferencesFromResource(R.xml.pref);
    }
}
```

As you can see from this code, creating a preference screen is very easy; you just call the `addPreferencesFromResource` method with the XML file you created for the preferences. Now, we will in put a settings option menu item and we will open the preference screen by clicking on this menu item. In order to achieve this, we will modify the `Chapter5_2Fragment` class using the following steps:

1. We will add `setHasOptionsMenu(true)` to the `onCreateView` method of the `Chapter5_2Fragment` class:

```java
@Override
public View onCreateView(LayoutInflater inflater, ViewGroup container, Bundle
```
savedInstanceState) {
    View view = inflater.inflate(R.layout.fragment, container, false);
    fragmentButton = (Button)view.findViewById(R.id.buttonFragment);
    fragmentButton.setOnClickListener(this);
    setHasOptionsMenu(true); return view;
}
2. We will add the following methods to the Chapter5_2Fragment class:

```java
@Override
public void onCreateOptionsMenu(Menu menu, MenuInflater inflater) {
    inflater.inflate(R.menu.fragment_menu, menu);
}
@Override
public boolean onOptionsItemSelected(MenuItem item) {
    Intent intent = new Intent(getActivity(), Chapter5_2PreferenceActivity.class);
    startActivity(intent);
    return true;
}
```

As you can see from this code, onCreateOptionsMenu is contributing to the options menu. This is the how a fragment contributes to the owner activity’s menu. When the options menu item is clicked, a new activity is started with the onOptionsItemSelected method.

The fragment_menu menu XML is as follows:

```xml
<menu xmlns:android="http://schemas.android.com/apk/res/android">
    <item android:id="@+id/itemSettings"
          android:title="Settings"/>
</menu>
```

Chapter5_2PreferenceActivity is the class that hosts Chapter5_2PereferenceFragment:

```java
package com.chapter5;
import android.app.Activity; import android.os.Bundle;
public class Chapter5_2PreferenceActivity extends Activity {
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        getFragmentManager().beginTransaction()
            .replace(android.R.id.content, new Chapter5_2PereferenceFragment())
            .commit();
```
As you can see from this code, we programmatically add
Chapter5_2PreferenceFragment to the Chapter5_2PreferenceActivity
class.
The preference screen should look like the following screenshot:

![Preference Screen Screenshot]

By adding this preference option, the user has the choice of whether or not to receive the confirmation message. (To read the setting, use the standard SharedPreferences APIs.)
**WebViewFragment**

WebViewFragment is a premade WebView wrapped in a fragment. WebView inside this fragment is automatically paused or resumed when the fragment is paused or resumed. In this section, we will extend the previous sample codes to show the usage of WebViewFragment.

1. We add an **open web** button to the Chapter5_2Fragment class’ layout XML code. The resulting layout is as follows:

```xml
<?xml version="1.0" encoding="utf-8"?><LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
android:id="@+id/layout_fragment"
android:layout_width="match_parent"
android:layout_height="match_parent"
android:gravity="center_horizontal"
android:orientation="vertical">
    <Button android:id="@+id/buttonFragment" android:layout_width="wrap_content"
android:layout_height="wrap_content" android:text="Delete" />
    <Button android:id="@+id/buttonOpenWeb" android:layout_width="wrap_content"
android:layout_height="wrap_content" android:text="Open Web" />
</LinearLayout>
```

2. We create a class that extends WebViewFragment and an activity that hosts this fragment using the following code block:

```java
package com.chapter5;
import android.os.Bundle;
import android.webkit.WebViewFragment; public class Chapter5_2WebViewFragment extends WebViewFragment {
    @Override
    public void onActivityCreated(Bundle savedInstanceState) {
        super.onActivityCreated(savedInstanceState);
        getWebView().loadUrl("http://www.google.com");
    }
}
```

As you can see from this code, we get the WebView instance in the onActivityCreated method and load a URL that opens Google’s website. The activity that hosts this fragment is as follows:

```java
package com.chapter5;
import android.app.Activity; import android.os.Bundle;
public class Chapter5_2WebActivity extends Activity {
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
```
As you can see from this code, we programmatically add Chapter5_2WebViewFragment to Chapter5_2WebViewActivity. This sample application opens the www.google.com website when the open web button is clicked.

The final version of the Chapter5_2Fragment class is as follows:

```java
package com.chapter5;
import android.app.Fragment;
import android.app.FragmentTransaction;
import android.content.Intent;
import android.os.Bundle;
import android.view.LayoutInflater;
import android.view.Menu;
import android.view.MenuInflater;
import android.view.MenuItem;
import android.view.View;
import android.view.View.OnClickListener;
import android.view.ViewGroup;
import android.widget.Button;

public class Chapter5_2Fragment extends Fragment implements OnClickListener{
    Button fragmentButton;
    Button openWebButton;

    @Override
    public View onCreateView(LayoutInflater inflater, ViewGroup container, Bundle savedInstanceState) {
        View view = inflater.inflate(R.layout.fragment, container, false);
        fragmentButton = (Button)view.findViewById(R.id.buttonFragment);
        fragmentButton.setOnClickListener(this);
        openWebButton = (Button)view.findViewById(R.id.buttonOpenWeb);
        openWebButton.setOnClickListener(this);
        setHasOptionsMenu(true);
        return view;
    }

    @Override
    public void onClick(View v) {
        if(v == fragmentButton) {
            FragmentTransaction transaction = getFragmentManager().beginTransaction();
            Chapter5_2DialogFragment dialogFragment = new Chapter5_2DialogFragment();
            dialogFragment.show(transaction, "dialog_fragment");
        } else if(v == openWebButton) {
```

Intent intent = new Intent(getActivity(), Chapter5_2WebActivity.class);
startActivity(intent);
}

@Override
public void onCreateOptionsMenu(Menu menu, MenuInflater inflater) {
    inflater.inflate(R.menu.fragment_menu, menu);
}

@Override
public boolean onOptionsItemSelected(MenuItem item) {
    Intent intent = new Intent(getActivity(), Chapter5_2PreferenceActivity.class);
    startActivity(intent);
    return true;
}

The main Activity class for this application is as follows:

package com.chapter5;
import android.app.Activity;
import android.os.Bundle;
public class Chapter5_2Activity extends Activity {

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

This Activity class is the owner activity of Chapter5_2Fragment. The layout of the preceding Activity is as follows:

<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
android:id="@+id/layout_small_a"
android:layout_width="fill_parent" android:layout_height="fill_parent"
android:orientation="vertical">
    <fragment android:id="@+id/fragment"
        android:layout_width="match_parent" android:layout_height="match_parent"
        class="com.chapter5.Chapter5_2Fragment" />
</LinearLayout>
The AndroidManifest.xml file of this sample application should look like the following:

```xml
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
package="com.chapter5"
android:versionCode="1"
android:versionName="1.0" >

<uses-sdk
android:minSdkVersion="14"
android:targetSdkVersion="15" />

<uses-permission android:name="android.permission.INTERNET" />

<application
android:icon="@drawable/ic_launcher"
android:label="@string/app_name"
android:theme="@style/AppTheme" >

<activity
android:name=".Chapter5_2Activity"
android:label="@string/title_activity_main" >
<intent-filter>
<action android:name="android.intent.action.MAIN" />
<category
android:name="android.intent.category.LAUNCHER" />
</intent-filter>
</activity>

<activity
android:name=".Chapter5_2PreferenceActivity"/>
<activity
android:name=".Chapter5_2WebActivity"/>

</application>
</manifest>
```

As you can see in this code, we need Internet permission to open a website. Furthermore, we need to set the minimum SDK to API Level 14 in order to use fragments with small screens.
Summary

Fragments are available for small screen devices with Android Ice Cream Sandwich being introduced. In this chapter, we first learned the basics of fragments, and the construction and destruction life cycle of fragments. Then, we learned about creating and managing fragments with a sample application. Finally, we learned the specialized types of fragments—ListFragment, DialogFragment, PreferenceFragment, and WebViewFragment. In the next chapter, we will see some practices to develop applications that support different screen sizes.
Supporting Different Screen Sizes

Android 3.0 is only for large screen devices. However, Android Ice Cream Sandwich is for all small and large screen devices. Developers should create applications that support both large and small screen sizes. This chapter will show the ways of designing user interfaces that support different screen sizes.

The topics covered in this chapter are as follows:

• Using match_parent and wrap_content
• Using nine-patch
• Using dip instead of px
Android 4.0 supports different screen sizes

There is a vast variety of Android devices and hence there are many different screen sizes. The following graph (source opensignalmaps.com) shows the Android device fragmentation:

As you see in the graph, there is a vast variety of devices (nearly 4000 distinct devices). This means many different screen sizes and densities. Android scales and resizes the user interface of your Android applications. However, this is not enough all the time. For instance, a user interface designed for a small screen will be magnified for a large screen by the Android. This doesn’t look good on large screens. The space on large screens should be used efficiently and the user interfaces of large screens should be different than the user interfaces for small screens. Android provides some APIs for designing the user interfaces that fit the different screen sizes and densities. You should use these APIs to make your application look good on different screen sizes and densities. In this way, user experience of Android applications could be increased.

The things to be considered in designing user interfaces for Android applications are as follows:

• **Screen Sizes**: This is the physical screen size of the devices. Screen sizes may range from 2.5” to 10.1” for smart phones and tablets.

• **Resolution**: This is the number of pixels that a device has in each dimension. It is usually defined as width x height such as 640 x 480.

• **Screen Density**: This is the maximum number of pixels in a physical area.
High density screens have more pixels than low density screens in an area.

- **Screen Orientation**: A device could be in landscape or portrait mode. When in landscape mode its width increases.
Using match_parent and wrap_content

match_parent and wrap_content could be used to set the layout_height and layout_width properties of a view. When match_parent is used, Android expands the view to make its size the same as its parent. When wrap_content is used, Android expands the view according to its content’s size. It is also possible to set the width and height using pixel values. However, it is not a good practice to use pixel values, because the number of pixels change according to the screen properties and a given pixel value is not of the same size in every screen. In the following example, we use the pixel value in order to set the width and height of the view. The layout XML code is shown in the following code block:

```xml
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
xmlns:tools="http://schemas.android.com/tools"
android:layout_width="match_parent"
android:layout_height="match_parent">

    <TextView
        android:layout_width="240px"
        android:layout_height="30px"
        android:layout_centerHorizontal="true"
        android:layout_centerVertical="true"
        android:padding="@dimen/padding_medium"
        android:text="hello world1 hello world 2 hello world 3 hello"
        tools:context=".Chapter6_1Activity" />

</RelativeLayout>
```

Some of the definitions such as @dimen used in the preceding layout XML files will be available in the source code files of this book.

As you can see in the code, we set layout_width to 240px and layout_height to 30px. We will execute this application in three different emulators with different screen properties. The emulator properties are as follows:

- **Small Screen Properties**: This configuration is for small screens. These properties can be configured as shown in the following screenshot:
• **Normal Screen Properties:** This configuration is for normal screens. These properties can be configured as shown in the following screenshot:

![Normal Screen Properties](image)

• **Large Screen Properties:** This configuration is for large screens. These properties can be configured as shown in the following screenshot:

![Large Screen Properties](image)
When this application is executed in the previous emulator configurations, the screens will look like the following:

As you can see in the screenshot, it looks fine on the small screen. However,
on the normal screen, the text is cropped and not all the content of the TextView component is visible. On the large screen, nothing is visible. This sample shows that using pixel as a width and height value is not a good practice.

Now, we will use wrap_content and match_parent to set the height and width lengths. The layout XML code will look like the following:

```xml
<RelativeLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent">
    <TextView
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_centerHorizontal="true"
        android:layout_centerVertical="true"
        android:padding="@dimen/padding_medium"
        android:text="hello world1 hello world 2 hello world 3 hello"
        tools:context=".Chapter6_1Activity"/>
</RelativeLayout>
```

When the application is executed with same emulator configurations, the screen will look like the following:
As you can see in this screenshot, the application looks the same in each emulator and screen configurations, and all the content of the TextView component is displayed. Thus, using `wrap_content` and `match_parent` is a best practice in designing user interfaces.
Using dip instead of px

Another option for the previous sample is to use the dip (density independent pixels) value instead of the px value. In this way, the TextView component will look nearly the same in different screen sizes. The code will look like the following:

```xml
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent">

    <TextView
        android:layout_width="350dip"
        android:layout_height="40dip"
        android:layout_centerHorizontal="true"
        android:layout_centerVertical="true"
        android:padding="@dimen(padding_medium)"
        android:text="hello world1 hello world 2 hello world 3 hello"
        tools:context=".Chapter6_1Activity"/>

</RelativeLayout>
```

As you can see in this code, we used the dip value for the width and height. If you execute this application in the emulators defined in the previous section, it would look like the following:
For the font sizes, the sp (scale independent pixel) unit could be used instead of px.
Omit using AbsoluteLayout

**AbsoluteLayout** is a deprecated layout which uses fixed positions for the views in it. AbsoluteLayout is not a good practice in designing user interfaces because it will not look same in different screen sizes. We will see this with the following example layout:

```xml
<?xml version="1.0" encoding="utf-8"?>
<AbsoluteLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical" >

    <TextView
        android:id="@+id/textView5"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="96dp"
        android:layout_y="8dp"
        android:text="Text Top"
        android:textAppearance="@android:attr/textAppearanceLarge" />

    <TextView
        android:id="@+id/textView4"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_x="89dp"
        android:layout_y="376dp"
        android:text="Text Bottom"
        android:textAppearance="@android:attr/textAppearanceLarge" />

</AbsoluteLayout>
```

As you can see in this XML code, fixed positions are used for the views in AbsoluteLayout. When this application is executed in the emulators defined in previous section, it will look like the following:
As you can see in the screen shots, the text at the bottom is not visible on the small screen, but it is visible on the other screens. AbsoluteLayout is not a good practice in user interface design.
Providing different bitmap drawables for different screen densities

Android scales bitmaps according to screen density. However, images will not look good if only one bitmap is provided. The image would look blurry or corrupted. Providing different bitmap drawables for different screen densities is a good practice. In the following screenshot, two image buttons are used. Different bitmap drawables are provided for the first image button and a low density bitmap drawable is provided for the second image button. As you can see in the screenshot, the bitmap in the second image button looks blurry; however, the bitmap in the first image button looks fine.

If the images are put in the drawable-nodpi folder they won’t be scaled.
Providing different layouts for different screen sizes

Android scales the layouts to make them fit to device screens. However, this is not enough in some cases. In *Chapter 5, Fragments*, we developed an application that lists the books and when a book is clicked, the author of the book is displayed. The following is the screenshot that is displayed on small screens:

For larger screens, this design is not a good alternative. The user interface will look bad. We should use the space in larger screens efficiently. We can use a different layout for larger screens that combines the two screens displayed on smaller screens. The user interface should look like the following:
The layout files should be put in appropriate folders. For instance, the layout files for large screens should be put in the res/layout-large folder and for small screens should be put in the res/layout-small folder.

New screen size qualifiers are introduced with Android 3.2 in addition to existing ones. The new qualifiers are as follows:
- sw<N>dp: This qualifier defines the smallest width. For example, res/layout-sw600dp.
  - When the screen width is at least N dp, regardless of the screen orientation, the layout file in this folder is used.
- w<N>dp: This qualifier defines the exact available width. For example, res/layout-w600dp.
- h<N>dp: This qualifier defines the exact available height. For example, res/layout-h600dp.
Nine-patch

The **nine-patch** feature allows the using of stretchable bitmaps as resources. Bitmaps are stretched according to defined stretchable areas. Stretchable areas are defined by a 1-pixel width black line. The following is a sample nine-patch drawable:

![Nine-Patch Example](image)

The image file should be put into the drawable folder with an extension of .9.png. The top and the left black lines define the stretchable area and the bottom and the right black lines define the stretchable area to fit content.

There is a tool called **Draw 9-patch** that is bundled with Android SDK. You can easily create nine-patch images with this editor.
Summary

In this chapter we learned some design guidelines in order to support different screen sizes and densities. We shouldn’t use hardcoded pixel values to define layout width and height. Instead, we should use wrap_content and match_parent properties, or use dip values instead of px values. We should use different layouts for different screen sizes to make applications look good in all screen sizes. We also learned about using nine-patch rule to create stretchable bitmaps. After developing an application, we should test the application in various screen sizes and densities in an Android emulator to see how it looks. In this way we could detect user interface problems and bugs.

In the next chapter, we are going to learn about the Android Compatibility Package and we will see how to use it.
Android Compatibility Package

New Android APIs do not work in the previous versions of Android, so the Android Compatibility Package was thus introduced to allow the porting of the new APIs to the older versions of the Android platform. This chapter shows how we can use the Android Compatibility Package.

The topics covered in this chapter are as follows:
• What is and why do we use the Android Compatibility Package
• How to use the Android Compatibility Package
What is Android Compatibility Package

Android has some great new APIs released with Android 3.0 and its later versions. However, many users don’t upgrade their devices to the latest Android platform. Google released the Android Compatibility Package that contains support for some of the new APIs released with Android 3.0 and its later versions. In this way, developers could develop applications that use new APIs and work in older Android versions. Some of the classes that are included in the Android Compatibility Package are as follows:

- Fragment
- FragmentManager
- FragmentTransaction
- ListFragment
- DialogFragment
- LoaderManager
- Loader
- AsyncTaskLoader
- CursorLoader

Some useful APIs such as animation classes, action bar, and FragmentMapActivity are not included in the Android Compatibility Package.
How to use the Android Compatibility Package

1. We need to download and install the Android Compatibility Package. In order to download the Android Compatibility Package, click on the Android SDK Manager button in the Eclipse menu as shown in the following screenshot:

Alternately, we can reach the Android SDK Manager by the Eclipse menu using Window | Android SDK Manager. After the Android SDK Manager window is opened, check the Android Support Library option as shown in the following screenshot:

2. Then, click on the Install button and install the package. Now we are ready
to develop an Android project that can use the Android Compatibility Package. Firstly, create an Android project in Eclipse. Then, we need to add the support library to our Android project. If it doesn’t exist, create a folder named libs under the Android project’s root folder as shown in the following screenshot:

3. Now, find and copy the <your android sdk folder>/extras/android/support/v4/android-support-v4.jar file to the libs folder. The folder structure should be as shown in the following screenshot:

4. Lastly, if the .jar file is not in the project build path, add the .jar file to the project build path as shown in the following screenshot:
Now you know how to manually add the support library. Eclipse makes this process easy with the **Add Support Library** menu option. Use the following steps:

1. Right-click on the project in the explorer.
2. Go to the **Android Tools | Add Support Library…** option.
3. Follow the steps to complete the wizard.

Now we can make use of the compatibility package. We are going to create an application that uses the `Fragment` class, but the `Fragment` class present in the compatibility package, to display a text using the following steps:

1. Firstly, create a layout XML for the fragment and name the XML file `fragment.xml`:

```xml
<?xml version="1.0" encoding="utf-8" standalone="no"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:gravity="center_horizontal"
    android:orientation="vertical">
    
    <TextView
        android:id="@+id/textView"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Hello Android Compatibility Package"
        android:textAppearance="?android:attr/textAppearanceLarge" />
</LinearLayout>
```
2. Then, create a layout for the activity using the following code block:

```xml
<RelativeLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:id="@+id/main_layout"
    android:layout_width="match_parent"
    android:layout_height="match_parent">
</RelativeLayout>
```

3. Now we are going to create the Fragment class for the fragment.xml layout:

```java
package com.chapter7;

import android.os.Bundle;
import android.support.v4.app.Fragment;
import android.view.LayoutInflater;
import android.view.View;
import android.view.ViewGroup;

public class Chapter7Fragment extends Fragment {
    @Override
    public View onCreateView(LayoutInflater inflater, ViewGroup container, Bundle savedInstanceState) {
        View view = inflater.inflate(R.layout.fragment, container, false);
        return view;
    }
}
```

As you can see from the preceding code, the Fragment class is from the android.
support.v4.app.Fragment package. This means that we are using the Android Compatibility Package. If we don’t want to use the compatibility package, then we should use the Fragment class from the android.app.Fragment package.

The Activity class for our application is as follows:

```java
package com.chapter7;

import android.os.Bundle;
import android.support.v4.app.FragmentActivity;
import android.support.v4.app.FragmentManager;
import android.support.v4.app.FragmentTransaction;
import android.view.Menu;

public class Chapter7Activity extends FragmentActivity {
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.main);
    }
}
```
addFragment();
}

public void addFragment() {
FragmentManager fragmentManager = this.getSupportFragmentManager();
FragmentTransaction fragmentTransaction = fragmentManager.beginTransaction();
Chapter7Fragment fragment = new Chapter7Fragment();
fragmentTransaction.add(R.id.main_layout, fragment); fragmentTransaction.commit();
}

@Override
public boolean onCreateOptionsMenu(Menu menu) {
getMenuInflater().inflate(R.menu.main, menu);
return true;
}

As you can see from the preceding code block, the support library APIs follow the same naming as the standard APIs. We just need to use the correct imports and call the correct managers. We have to add android.support.v4.app to our import list in order to use classes that are in the compatibility package.

In order to get the FragmentManager instance, we call the getSupportFragmentManager() method of our Activity class. As you will have noticed, the Activity class extends the FragmentActivity class. We need to do this because it is the only way in which we can use Fragments.

The AndroidManifest.xml file should look like the following:

```xml
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
package="com.chapter7"
android:versionCode="1"
android:versionName="1.0" >
<uses-sdk
android:minSdkVersion="8"
android:targetSdkVersion="15"/>

<application
android:icon="@drawable/ic_launcher"
android:label="@string/app_name"
android:theme="@style/AppTheme" >
<activity
android:name=".Chapter7Activity"
android:label="@string/title_activity_chapter7" > <intent-filter>
<action android:name="android.intent.action.MAIN" />
<category android:name="android.intent.category.LAUNCHER" />
</intent-filter> </activity>
</application>
```
As you can see in this code, the minimum SDK level is set to API Level 8. We can set the minimum API Level to 4 or more. In this way, we can use the new APIs in older versions of Android.
Summary

In this chapter, we learned what the Android Compatibility Package is and how we can use it. We also learned how with the help of this library, we can use the new APIs in the older versions of Android.

In the next chapter, we are going to learn using new connectivity APIs – Android Beam and Wi-Fi Direct.
New Connectivity APIs – Android Beam and Wi-Fi Direct

New connectivity APIs have been introduced with Android Ice Cream Sandwich – **Android Beam** which uses the NFC hardware of the device, and **Wi-Fi Direct** which allows devices to connect to each other without using a wireless access point. This chapter will teach us Android Beam and Wi-Fi Direct APIs’ usage.

The topics covered in this chapter are as follows:

- Android Beam
- Beaming NdefMessages
- Sharing data with Wi-Fi Direct
**Android Beam**

Devices that have NFC hardware can share data by tapping them together. This could be done with the help of the Android Beam feature. It is similar to Bluetooth, as we get seamless discovery and pairing as in a Bluetooth connection. Devices connect when they are close to each other (not more than a few centimeters). Users can share pictures, videos, contacts, and so on, using the Android Beam feature.
Beaming NdefMessages

In this section, we are going to implement a simple Android Beam application. This application will send an image to another device when two devices are tapped together. There are three methods that are introduced with Android Ice Cream Sandwich that are used in sending NdefMessages. These methods are as follows:

• **setNdefPushMessage()**: This method takes an NdefMessage as a parameter and sends it to another device automatically when devices are tapped together. This is commonly used when the message is static and doesn’t change.

• **setNdefPushMessageCallback()**: This method is used for creating dynamic NdefMessages. When two devices are tapped together, the createNdefMessage() method is called.

• **setOnNdefPushCompleteCallback()**: This method sets a callback which is called when the Android Beam is successful.

We are going to use the second method in our sample application.

Our sample application’s user interface will contain a TextView component for displaying text messages and an ImageView component for displaying the received images sent from another device. The layout XML code will be as follows:

```xml
<RelativeLayout
    xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent">

    <TextView
        android:id="@+id/textView"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_centerHorizontal="true"
        android:layout_centerVertical="true"
        android:text="" />

    <ImageView
        android:id="@+id/imageView"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_below="@+id/textView"
        android:layout_centerHorizontal="true"
        android:layout_marginTop="14dp" />
</RelativeLayout>
```
Now, we are going to implement, step-by-step, the Activity class of the sample application. The code of the Activity class with the onCreate() method is as follows:

```java
public class Chapter9Activity extends Activity implements CreateNdefMessageCallback {

NfcAdapter mNfcAdapter;
TextView mInfoText;
ImageView imageView;

@Override
public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main);
    imageView = (ImageView) findViewById(R.id.imageView);
    mInfoText = (TextView) findViewById(R.id.textView);

    // Check for available NFC Adapter
    mNfcAdapter = NfcAdapter.getDefaultAdapter(getApplicationContext());

    if (mNfcAdapter == null) {
        mInfoText = (TextView) findViewById(R.id.textView);
        mInfoText.setText("NFC is not available on this device.");
        finish();
        return;
    }

    // Register callback to set NDEF message
    mNfcAdapter.setNdefPushMessageCallback(this, this);
}

@Override
public boolean onCreateOptionsMenu(Menu menu) {
    getMenuInflater().inflate(R.menu.main, menu);
    return true;
}
}
```

As you can see in this code, we can check whether the device provides an NfcAdapter. If it does, we get an instance of NfcAdapter. Then, we call the setNdefPushMessageCallback() method to set the callback using the NfcAdapter instance. We send the Activity class as a callback parameter because the Activity class implements CreateNdefMessageCallback.

In order to implement CreateNdefMessageCallback, we should override the
As you can see in this code, we get a drawable, convert it to bitmap, and then to a byte array. Then we create an NdefMessage with two NdefRecords. The first record contains the mime type and the byte array. The first record is created by the createMimeRecord() method. The second record contains the Android Application Record (AAR). The Android Application Record was introduced with Android Ice Cream Sandwich. This record contains the package name of the application and increases the certainty that your application will start when an NFC Tag is scanned. That is, the system firstly tries to match the intent filter and AAR together to start the activity. If they don’t match, the activity that matches the AAR is started.

When the activity is started by an Android Beam event, we need to handle the message that is sent by the Android Beam. We handle this message in the onResume() method of the Activity class as shown in the following code block:

```java
@Override
public void onResume() {  
super.onResume();  
// Check to see that the Activity started due to an Android Beam
if (NfcAdapter.ACTION_NDEF_DISCOVERED.
```


equals(getIntent().getAction())) {
processIntent(getIntent());
}
}

@Override
public void onNewIntent(Intent intent) {
// onResume gets called after this to handle the intent
setIntent(intent);
}

void processIntent(Intent intent) {
Parcelable[] rawMsgs = intent
   .getParcelableArrayExtra(NfcAdapter.EXTRA_NDEF_MESSAGES); // only one
message sent during the beam
NdefMessage msg = (NdefMessage) rawMsgs[0];
// record 0 contains the MIME type, record 1 is the AAR byte[] bytes =
msg.getRecords()[0].getPayload(); Bitmap bmp =
BitmapFactory.decodeByteArray(bytes, 0, bytes.length);
imageView.setImageBitmap(bmp);
}

As you can see in this code, we firstly check whether the intent is ACTION_NDEF_DISCOVERED. This means the Activity class is started due to an Android Beam. If it is started due to an Android Beam, we process the intent with the processIntent() method. We firstly get NdefMessage from the intent. Then we get the first record and convert the byte array in the first record to bitmap using BitmapFactory. Remember that the second record is AAR, we do nothing with it. Finally, we set the bitmap of the ImageView component.

The AndroidManifest.xml file of the application should be as follows:

<manifest xmlns:android="http://schemas.android.com/apk/res/android"
package="com.chapter9"
android:versionCode="1"
android:versionName="1.0" >

<uses-permission android:name="android.permission.NFC"/>
<uses-feature
android:name="android.hardware.nfc" android:required="false" />

<uses-sdk
android:minSdkVersion="14" android:targetSdkVersion="15" />

<application
android:icon="@drawable/ic_launcher"
android:label="@string/app_name"
android:theme="@style/AppTheme" >
<activity
android:name=".Chapter9Activity"
As you can see in this code, we need to set the minimum SDK to API Level 14 or more in the AndroidManifest.xml file because these APIs are available in API Level 14 or more. Furthermore, we need to set the permissions to use NFC. We also set the uses feature in AndroidManifest.xml. The feature is set as not required. This means that our application would be available for devices that don’t have NFC support. Finally, we create an intent filter for android.nfc.action.NDEF_DISCOVERED with mimeType of application/com.chapter9.

When a device sends an image using our sample application, the screen will be as follows:
Wi-Fi Direct

In a conventional wireless network, devices are connected to each other through a wireless access point. With the help of **Wi-Fi Direct**, devices connect to each other without the need of a wireless access point. It’s similar to Bluetooth, but it is faster and the range of Wi-Fi Direct is longer. New Wi-Fi Direct APIs are introduced with Android Ice Cream Sandwich which allows us to use Wi-Fi Direct properties of Android devices.

The main class that will help us to find and connect peers is the WifiP2pManager class. We are going to use the following Listener classes during finding and connecting to peers:

- WifiP2pManager.ActionListener
- WifiP2pManager.ChannelListener
- WifiP2pManager.ConnectionInfoListener
- WifiP2pManager.PeerListListener

Finally, the following intents will help us in a Wi-Fi Direct connection:

- WIFI_P2P_CONNECTION_CHANGED_ACTION
- WIFI_P2P_PEERS_CHANGED_ACTION
- WIFI_P2P_STATE_CHANGED_ACTION
- WIFI_P2P_THIS_DEVICE_CHANGED_ACTION

In this section, we are going to learn how to use these new Wi-Fi Direct APIs with a sample application.
Sample Wi-Fi Direct application

In order to use Wi-Fi Direct APIs, we need to set the minimum SDK version to API Level 14 or more in AndroidManifest.xml. Furthermore, we need some permission to use Wi-Fi Direct APIs. The AndroidManifest.xml file should be as follows:

```xml
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.chapter9"
    android:versionCode="1"
    android:versionName="1.0">
    <uses-sdk
        android:minSdkVersion="14"
        android:targetSdkVersion="15"/>
    <uses-permission
        android:name="android.permission.ACCESS_WIFI_STATE"/>
    <uses-permission
        android:name="android.permission.CHANGE_WIFI_STATE"/>
    <uses-permission
        android:name="android.permission.CHANGE_NETWORK_STATE"/>
    <uses-permission
        android:name="android.permission.INTERNET"/>
    <uses-permission
        android:name="android.permission.ACCESS_NETWORK_STATE"/>
    <application
        android:icon="@drawable/ic_launcher"
        android:label="@string/app_name"
        android:theme="@style/AppTheme">
        <activity
            android:name=".Chapter9Activity"
            android:label="@string/title_activity_chapter9">
            <intent-filter>
                <action android:name="android.intent.action.MAIN"/>
                <category android:name="android.intent.category.LAUNCHER"/>
            </intent-filter>
        </activity>
    </application>
</manifest>
```

The first class that we need is a class that extends BroadcastReceiver and handles the intents that we listed previously in the onReceive() method. The constructor of this class should be as follows:

```java
package com.chapter9;
import android.content.BroadcastReceiver;
import android.content.Context;
import android.content.Intent;
```

```java
public class MyBroadcastReceiver extends BroadcastReceiver {
    public MyBroadcastReceiver(Context context) {
        super(context);
    }

    @Override
    public void onReceive(Context context, Intent intent) {
        // Handle the intents here.
    }
}
```
As you can see in this code, we passed the Channel, WifiP2pManager, and the Activity classes to the constructor as parameters because we will need them later in the onReceive() method. We need to override the onReceive() method of BroadcastReceiver as shown in the following code block:

@Override
public void onReceive(Context context, Intent intent) {
    String action = intent.getAction();
    if (WifiP2pManager.WIFI_P2P_STATE_CHANGED_ACTION.
        equals(action)) {
        int state =
            intent.getIntExtra(WifiP2pManager.EXTRA_WIFI_STATE, -1);
        if (state == WifiP2pManager.WIFI_P2P_STATE_ENABLED) { // Wifi Direct mode is enabled
            Toast.makeText(activity, "wifi direct is enabled", Toast.LENGTH_LONG).show();
        } else {
            // Wifi Direct mode is disabled
            Toast.makeText(activity, "wifi direct is disabled", Toast.LENGTH_LONG).show();
        }
    } else if (WifiP2pManager.WIFI_P2P_PEERS_CHANGED_ACTION.
        equals(action)) {
        // request peers from the wifi p2p manager
        if (manager != null) {
            manager.requestPeers(channel, (PeerListListener) activity);
        }
    } else if (WifiP2pManager.WIFI_P2P_CONNECTION_CHANGED_ACTION.
        equals(action)) {
if (manager == null) { return;

NetworkInfo networkInfo = (NetworkInfo) intent.getParcelableExtra(WifiP2pManager.EXTRA_NETWORK_INFO);

if (networkInfo.isConnected()) {
    // request connection info
    manager.requestConnectionInfo(channel, activity); } else {
    // It’s a disconnect
}
} else if 
(WifiP2pManager.WIFI_P2P_THIS_DEVICE_CHANGED_ACTION. equals(action)) {
}

In this method, we handle the received intents. Firstly, we check whether the intent is WIFI_P2P_STATE_CHANGED_ACTION. This intent is received when Wi-Fi Direct is enabled or disabled. We receive the Wi-Fi Direct status from the intent and take action according to the Wi-Fi Direct status.

Secondly, we check whether the intent is WIFI_P2P_PEERS_CHANGED_ACTION. This intent is received when the discoverPeers() method of the WifiP2pManager class is called. We get the list of the peers from the requestPeers() method of the Wifi2P2pManager class when we receive the WIFI_P2P_PEERS_CHANGED_ACTION intent.

Next, we check whether the received intent is WIFI_P2P_CONNECTION_CHANGED_ACTION. This intent is received when the Wi-Fi connection changes. We handle connections or disconnections when we receive the WIFI_P2P_CONNECTION_CHANGED_ACTION intent. We firstly get NetworkInfo from the intent to understand whether there is a connection or disconnection. If it is a connection, we call the requestConnectionInfo() method of WifiP2pManager to connect.

Lastly, we check whether the intent is WIFI_P2P_THIS_DEVICE_CHANGED_ACTION. We receive this intent when the device details have changed. We do nothing for this intent.

We have a simple user interface for this application; a layout with two buttons. The first button is to find and second button is to connect peers. The XML code of the layout is as follows:

<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent" android:layout_height="match_parent">
    <Button
        android:id="@+id/buttonFind" android:layout_width="wrap_content"
        android:layout_height="wrap_content" android:text="find"/>
</LinearLayout>
Lastly, we need to implement the Activity class of this application. The code of the Activity class should be as follows:

```java
package com.chapter9;

import android.app.Activity;
import android.content.BroadcastReceiver;
import android.content.Context;
import android.content.IntentFilter;
import android.net.wifi.p2p.WifiP2pConfig;
import android.net.wifi.p2p.WifiP2pDevice;
import android.net.wifi.p2p.WifiP2pDeviceList;
import android.net.wifi.p2p.WifiP2pInfo;
import android.net.wifi.p2p.WifiP2pManager;
import android.net.wifi.p2p.WifiP2pManager.ActionListener;
import android.net.wifi.p2p.WifiP2pManager.Channel;
import android.net.wifi.p2p.WifiP2pManager.ChannelListener;
import android.net.wifi.p2p.WifiP2pManager.ConnectionInfoListener;
import android.net.wifi.p2p.WifiP2pManager.PeerListListener;
import android.os.Bundle;
import android.util.Log;
import android.view.Menu;
import android.view.View;
import android.view.View.OnClickListener;
import android.widget.Button;
import android.widget.Toast;

public class Chapter9Activity extends Activity implements 

ChannelListener, OnClickListener, PeerListListener,
```
The implementation is not complete currently. We will add the necessary methods step-by-step.

As you can see in this code, our Activity class implements various Listeners to handle the Wi-Fi Direct events. ConnectionInfoListener is for the callback when the connection info is available. PeerListListener is for the callback when the peer list is available. ChannelListener is for the callback when the channel is lost.

We create an intent filter and add the intents that we will check in the
onReceive() method of the class that extends BroadcastReceiver.
We initialize the WifiP2pManager class by calling the initialize() method. This will register our application with the Wi-Fi network.
1. We need to override the onChannelDisconnected() method because we implemented ChannelListener, as shown in the following code block:

```java
@Override
public void onChannelDisconnected() {
    // handle the channel lost event
}
```

2. We need to implement the onPeersAvailable() method because we implemented PeerListListener, as shown in the following code block:

```java
@Override
public void onPeersAvailable(WifiP2pDeviceList peerList) {
    for (WifiP2pDevice device : peerList.getDeviceList()) {
        this.device = device;
        break;
    }
}
```

We get the available peerList in this method. We get the first device and break the for loop. We need the device for connection.

3. We need to implement the onConnectionInfoAvailable() method because we implemented ConnectionInfoListener, as shown in the following code block:

```java
@Override
public void onConnectionInfoAvailable(WifiP2pInfo info) {
    String infoname = info.groupOwnerAddress.toString();
}
```

This is the place where we get the connection info and connect and send data to the peer. For instance, an AsyncTask that transfers a file could be executed here.

4. We need to implement the onClick() method for the buttons:

```java
@Override
public void onClick(View v) {
    if (v == buttonConnect) {
        connect(this.device);
    } else if (v == buttonFind) {
        find();
    }
}
```

The find() and connect() methods are as follows:
public void connect(WifiP2pDevice device) {
    WifiP2pConfig config = new WifiP2pConfig(); if(device != null) {
        config.deviceAddress = device.deviceAddress; manager.connect(channel, config, new ActionListener() {
            @Override
            public void onSuccess() {
                //success }
            @Override
            public void onFailure(int reason) { //fail
                }
            });
        } else {
            Toast.makeText(Chapter9Activity.this, “Couldn’t connect, device is not found”, Toast.LENGTH_SHORT).show();}
    }
}
public void find()
{
    manager.discoverPeers(channel, new WifiP2pManager.ActionListener() {
        @Override
        public void onSuccess() {
            Toast.makeText(Chapter9Activity.this, “Finding Peers”, Toast.LENGTH_SHORT).show(); @Override
        public void onFailure(int reasonCode) {
            Toast.makeText(Chapter9Activity.this, “Couldnt find peers “, Toast.LENGTH_SHORT).show();
        }
    });
}

When the **find** button is clicked, we call the discoverPeers() method of WifiP2pManager to discover the available peers. As you will remember, calling the discoverPeers() method will cause BroadcastReceiver to receive the WIFI_P2P_PEERS_CHANGED_ACTION intent. Then we will request the peer list in BroadcastReceiver.

When the **connect** button is clicked, we call the connect() method of the WifiP2pManager using the device info. This starts a peer-to-peer connection with the specified device.

The sample application to introduce the Wi-Fi Direct APIs is complete with these methods.
Summary

In this chapter, we firstly learned the Android Beam feature of Android. With this feature, devices can send data using the NFC hardware. We implemented a sample Android Beam application and learned how to use Android Beam APIs. Secondly, we learned what Wi-Fi Direct is and how to use Wi-Fi Direct APIs.

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2. Develop cross-platform code for iOS, Android, BlackBerry, and more
3. Write robust and extensible JavaScript code
4. Master new HTML5 and CSS3 APIs
5. Full of practical tutorials to get you writing code right away

**Sencha MVC Architecture**


A practical guide for designers and developers to create scalable enterprise-class web applications in ExtJS and Sencha Touch using the Sencha MVC architecture

1. Map general MVC architecture concept to the classes in ExtJS 4.x and Sencha Touch
2. Create a practical application in ExtJS as well as Sencha Touch using various Sencha MVC Architecture concepts and classes
3. Dive deep into the building blocks of the Sencha MVC Architecture including the class system, loader, controller, and application