Persistence: Files & Preferences

Files & Preferences

Android Files

Persistence is a strategy that allows the reusing of volatile objects and other data items by storing them Into a permanent storage system such as disk files and databases.

File IO management in Android includes –among others- the familiar IO Java classes: Streams, Scanner, PrintWriter, and so on.

Permanent files can be stored *internally* in the device’s main memory (usually small, but not volatile) or *externally* in the much larger SD card.

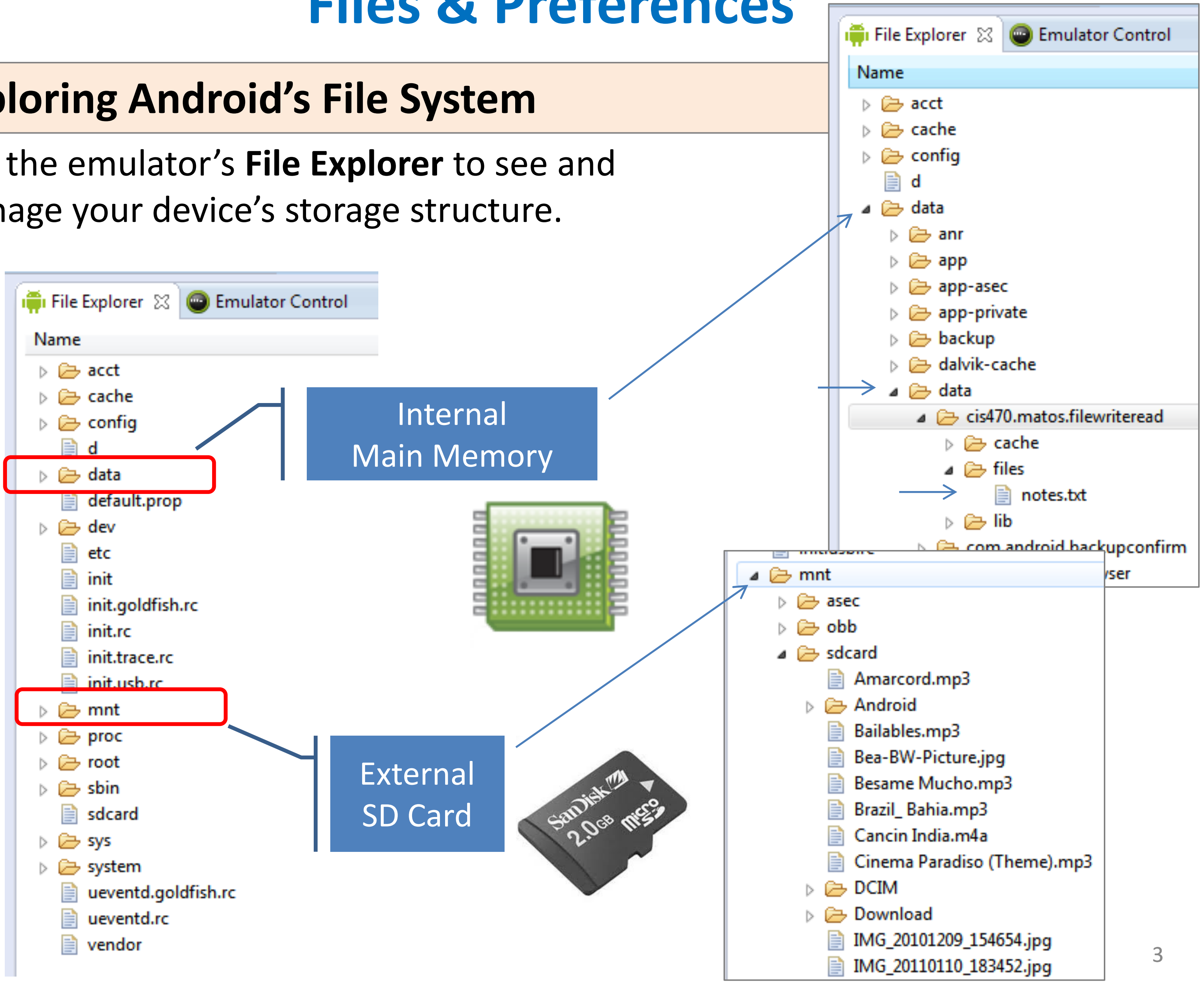
Files stored in the device’s memory, share space with other application’s resources such as code, icons, pictures, music, etc.

Internal files are called: **Resource Files** or **Embedded Files.**

Files & Preferences

Exploring Android’s File System

Use the emulator’s **File Explorer** to see and manage your device’s storage structure.



```
Name
▷ acct
▷ cache
▷ config
  d
▷ data
  default.prop
▷ dev
  etc
  init
  init.goldfish.rc
  init.rc
  init.trace.rc
  init.usb.rc
▷ mnt
▷ proc
▷ root
▷ sbin
  sdcard
▷ sys
▷ system
  ueventd.goldfish.rc
  ueventd.rc
  vendor
```

```
Name
▷ acct
▷ cache
▷ config
  d
◢ data
  ▷ anr
  ▷ app
  ▷ app-asec
  ▷ app-private
  ▷ backup
  ▷ dalvik-cache
  ◢ data
    ◢ cis470.matos.filewriteread
      ▷ cache
      ◢ files
          notes.txt
      ▷ lib
    ▷ com.android.backupconfirm
```

```
◢ mnt
  ▷ asec
  ▷ obb
  ◢ sdcard
      Amarcord.mp3
    ▷ Android
      Bailables.mp3
      Bea-BW-Picture.jpg
      Besame Mucho.mp3
      Brazil_ Bahia.mp3
      Cancin India.m4a
      Cinema Paradiso (Theme).mp3
    ▷ DCIM
    ▷ Download
      IMG_20101209_154654.jpg
      IMG_20110110_183452.jpg
```

Files & Preferences

Choosing a Persistent Environment

Your permanent data storage destination is usually determined by parameters such as:

- size (small/large),
- location (internal/external),
- accessibility (private/public).

Depending of your situation the following options are available:

1.	**Shared Preferences**	Store private primitive data in *key-value* pairs.
2.	**Internal Storage**	Store private data on the device's main memory.
3.	**External Storage**	Store public data on the shared external storage.
4.	**SQLite Databases**	Store structured data in a private/public database.
5.	**Network Connection**	Store data on the web.

Files & Preferences

Shared Preferences

SharedPreferences files are good for handling a handful of Items. Data in this type of container is saved as **<Key, Value>** pairs where the *key* is a string and its associated *value* must be a primitive data type.

KEY	VALUE

This class is functionally similar to Java Maps, however; unlike Maps they are *permanent*.

Data is stored in the device's internal main memory.

PREFERENCES are typically used to keep state information and shared data among several activities of an application.

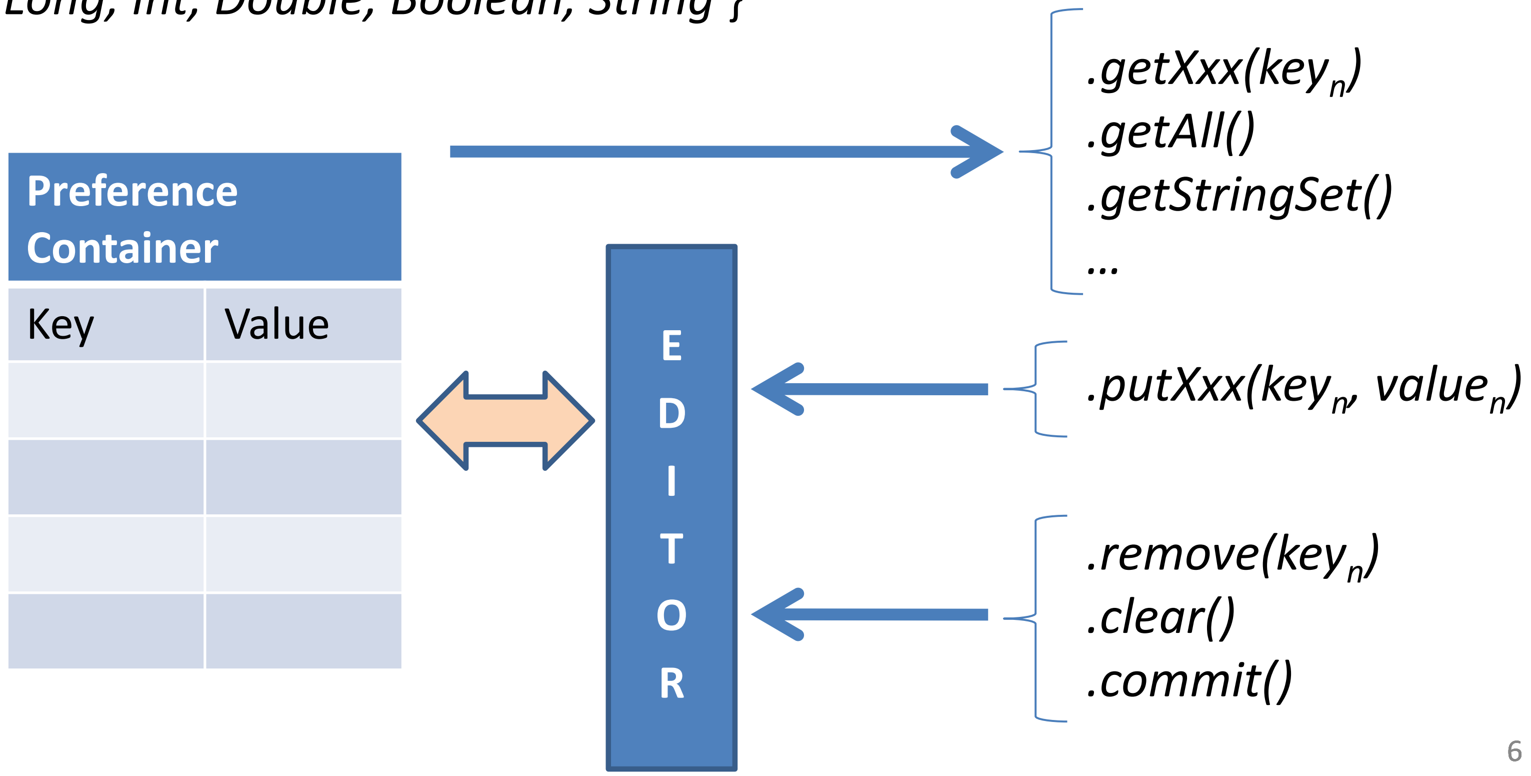
Files & Preferences

Shared Preferences

Using Preferences API calls

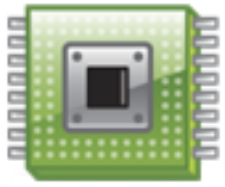
Each of the Preference mutator methods carries a typed-value content that can be manipulated by an *editor* that allows *putXxx… and getXxx…* commands to place data in and out of the Preference container.

Xxx = { *Long, Int, Double, Boolean, String* }



Files & Preferences

Key	Value
chosenColor	RED
chosenNumber	7



Example. Shared Preferences

In this example the user selects a preferred 'color' and 'number'. Both values are stored in a SharedPreferences file.

```
private void usingPreferences(){
  // Save data in a SharedPreferences container
  // We need an Editor object to make preference changes.

❶ SharedPreferences myPrefs = getSharedPreferences("my_preferred_choices",
                                                  Activity.MODE_PRIVATE);
  SharedPreferences.Editor editor = myPrefs.edit();
❷         editor.putString("chosenColor", "RED");
          editor.putInt("chosenNumber", 7 );
  editor.commit();

  // retrieving data from SharedPreferences container (apply default if needed)
❸ String favoriteColor = myPrefs.getString("chosenColor", "BLACK");
  int favoriteNumber = myPrefs.getInt("chosenNumber", 11 );

}
```

Files & Preferences

Shared Preferences. Example - Comments

1. The method `getSharedPreferences(…)` creates (or retrieves) a table called *my_preferred_choices* file, using the default *`MODE_PRIVATE`* access. Under this access mode only the calling application can operate on the file.

2. A SharedPreferences editor is needed to make any changes on the file. For instance `editor.putString("chosenColor", "RED") creates(or updates) the` key "chosenColor" and assigns to it the value "RED". All editing actions must be explicitly committed for the file to be updated.

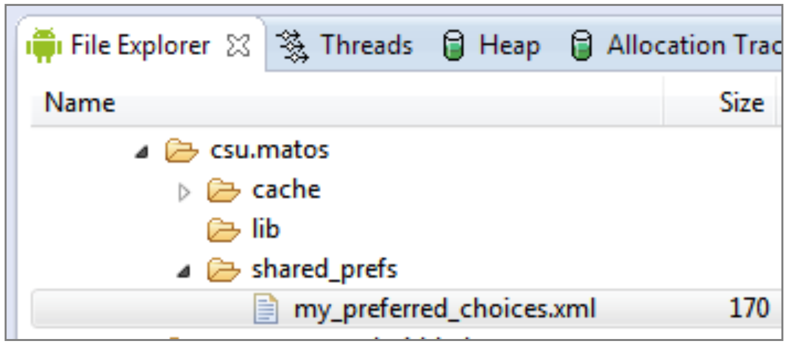
3. The method **getXXX(…)** is used to extract a value for a given key. If no key exists for the supplied name, the method uses the designated default value. For instance `myPrefs.getString("chosenColor", "BLACK")` looks into the file *myPrefs* for the key "chosenColor" to returns its value, however if the key is not found it returns the default value "BLACK".

Files & Preferences

Shared Preferences. Example - Comments

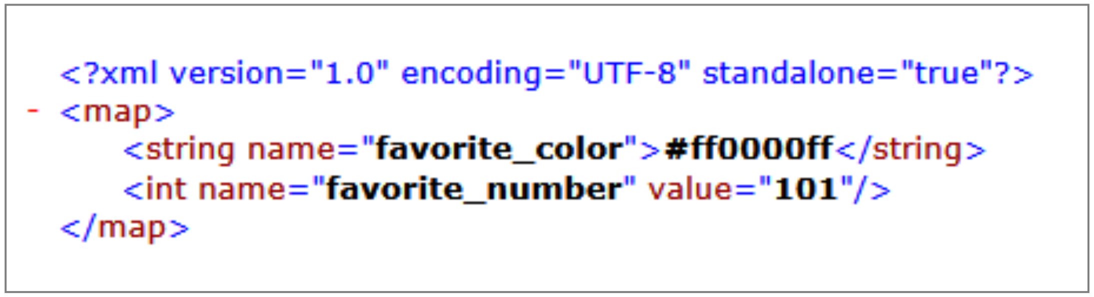
SharedPreference containers are saved as XML files in the application's internal memory space. The path to a preference files is
/data/data/packageName/shared_prefs/filename.

For instance in this example we have:



```
Name                                   Size
  csu.matos
    cache
    lib
    shared_prefs
      my_preferred_choices.xml          170
```

If you pull the file from the device, you will see the following



```
  <?xml version="1.0" encoding="UTF-8" standalone="true"?>
- <map>
      <string name="favorite_color">#ff0000ff</string>
      <int name="favorite_number" value="101"/>
  </map>
```

Files & Preferences

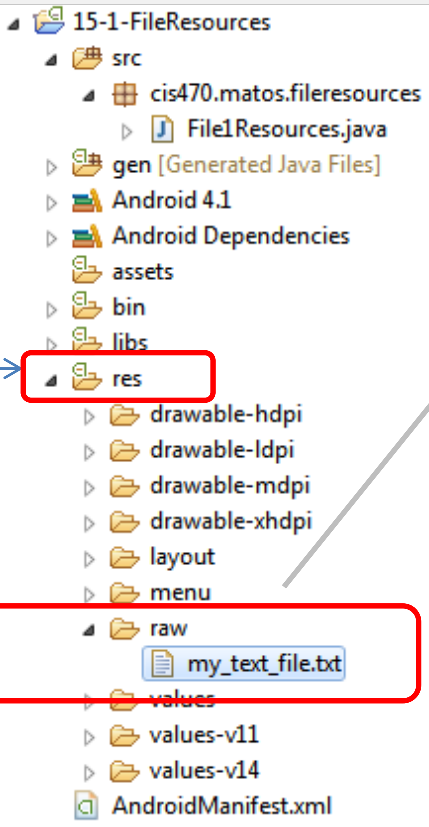
Internal Storage. Reading an Internal Resource File

An Android application may include resource elements such as those in:

res/drawable , **res/raw**, **res/menu**, **res/style**, etc.

Resources could be accessed through the **.getResources(…)** method. The method's argument is the ID assigned by Android to the element in the R resource file. For example:

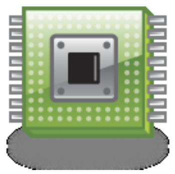
```
InputStream is = this.getResources()
                          .openRawResource(R.raw.my_text_file);
```

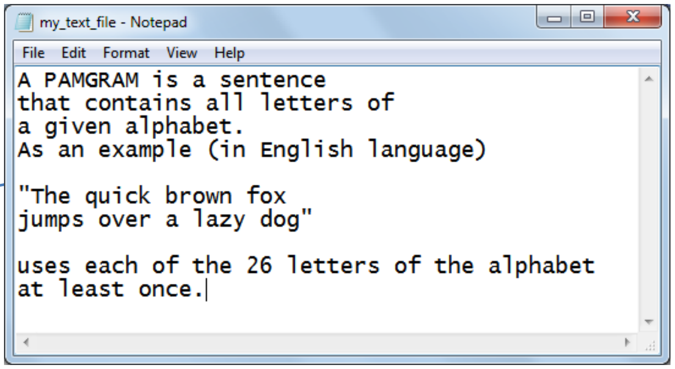


```
15-1-FileResources
  src
    cis470.matos.fileresources
      File1Resources.java
  gen [Generated Java Files]
  Android 4.1
  Android Dependencies
  assets
  bin
  libs
  res
    drawable-hdpi
    drawable-ldpi
    drawable-mdpi
    drawable-xhdpi
    layout
    menu
    raw
      my_text_file.txt
    values
    values-v11
    values-v14
  AndroidManifest.xml
```

If needed create the **res/raw** folder.

Use drag/drop to place the file **my_text_file.txt** in **res** folder. It will be stored in the device's memory as part of the .apk





```
A PAMGRAM is a sentence
that contains all letters of
a given alphabet.
As an example (in English language)

"The quick brown fox
jumps over a lazy dog"

uses each of the 26 letters of the alphabet
at least once.
```

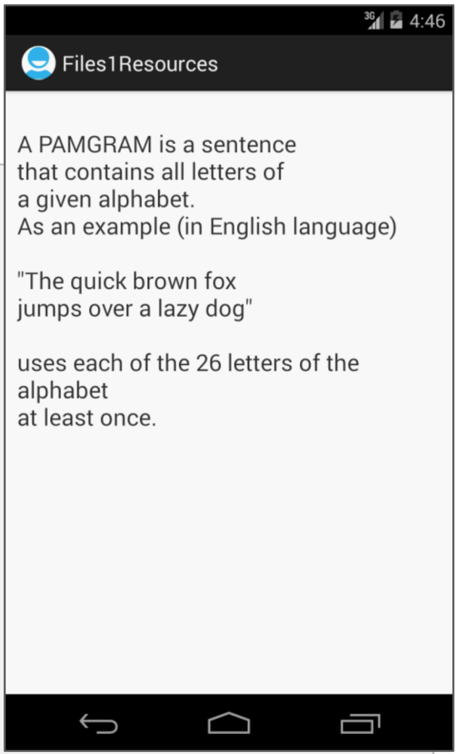
Example of a pamgram in Spanish:
La cigüeña tocaba cada vez mejor el saxofón y el búho pedía whiskey y queso.

Files & Preferences

Example 1. Reading an Internal Resource File 1 of 2

This app stores a text file in its RESOURCE (**res/raw**) folder. The embedded raw data (containing a *pamgram*) is read and displayed in a text box (see previous image)

```
//reading an embedded RAW data file
public class File1Resources extends Activity {
   TextView txtMsg;
   @Override
   public void onCreate(Bundle savedInstanceState) {
      super.onCreate(savedInstanceState);
      setContentView(R.layout.main);

      txtMsg = (TextView) findViewById(R.id.textView1);
      try {
         PlayWithRawFiles();

      } catch (IOException e) {
         txtMsg.setText( "Problems: " + e.getMessage() );
      }
   }// onCreate
```



A PAMGRAM is a sentence
that contains all letters of
a given alphabet.
As an example (in English language)

"The quick brown fox
jumps over a lazy dog"

uses each of the 26 letters of the
alphabet
at least once.

Files & Preferences

Example 1. Reading an Internal Resource File 2 of 2

Reading an embedded file containing lines of text.

```
public void PlayWithRawFiles() throws IOException {
    String str="";
    StringBuffer buf = new StringBuffer();

❶ → int fileResourceId = R.raw.my_text_file;
    InputStream is = this.getResources().openRawResource(fileResourceId);
❷ → BufferedReader reader = new BufferedReader(new
                                      InputStreamReader(is) );

    if (is!=null) {
      while ((str = reader.readLine()) != null) {
❸ →       buf.append(str + "\n" );
          }
    }
    reader.close();
    is.close();
    txtMsg.setText( buf.toString() );

  }// PlayWithRawFiles
} // File1Resources
```

Files & Preferences

Example1 - Comments

1. A **raw file** is an arbitrary dataset stored in its original raw format (such as .docx, pdf, gif, jpeg, etc). Raw files can be accessed through an *InputStream* acting on a *R.raw.filename* resource entity.
   CAUTION: *Android requires resource file names to be in lowercase form.*

2. The expression `getResources().openRawResource(fileResourceId)` creates an InputStream object that sends the bytes from the selected resource file to an input buffer. If the resource file is not found it raises a *NotFoundException* condition.

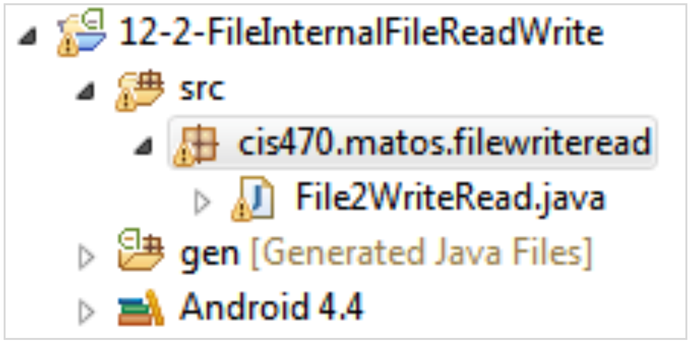
3. A *BufferedReader* object is responsible for extracting lines from the input buffer and assembling a string which finally will be shown to the user in a textbox. Protocol expects that conventional IO housekeeping operations should be issued to close the reader and stream objects.

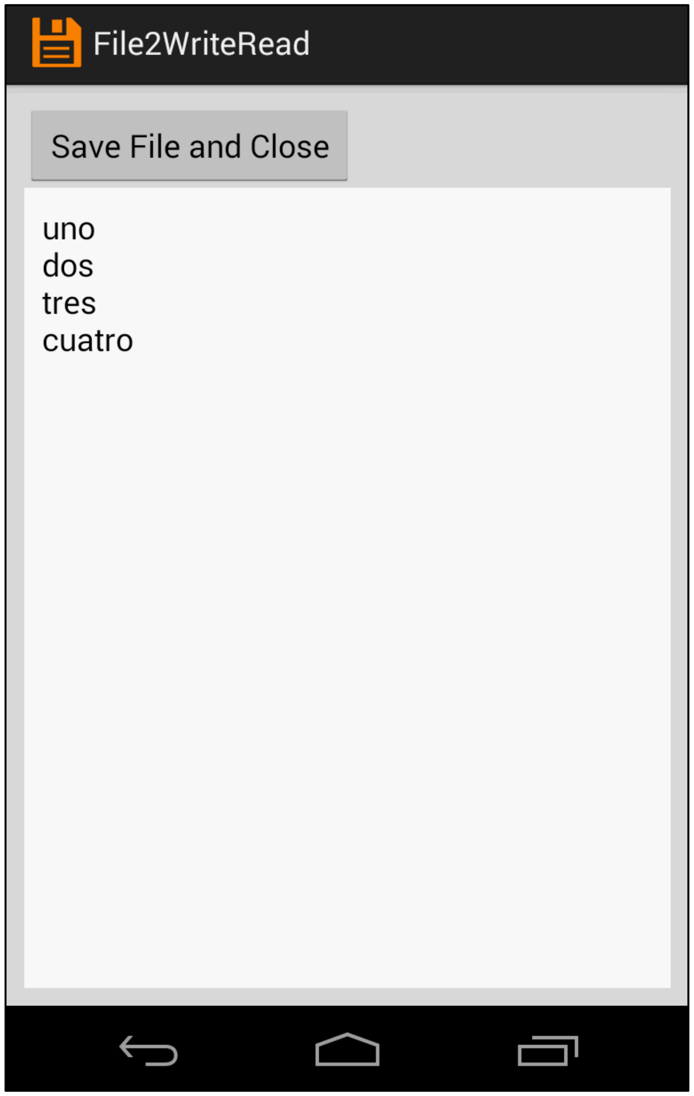
Files & Preferences

Example 2. Reading /Writing an Internal Resource File 1 of 6

In this example an application exposes a GUI on which the user enters a few lines of data. The app collects the input lines and **writes** them to a persistent **internal data file.**

Next time the application is executed the *Resource File* will be **read** and its data will be shown on the UI.


12-2-FileInternalFileReadWrite
src
cis470.matos.filewriteread
File2WriteRead.java
gen [Generated Java Files]
Android 4.4



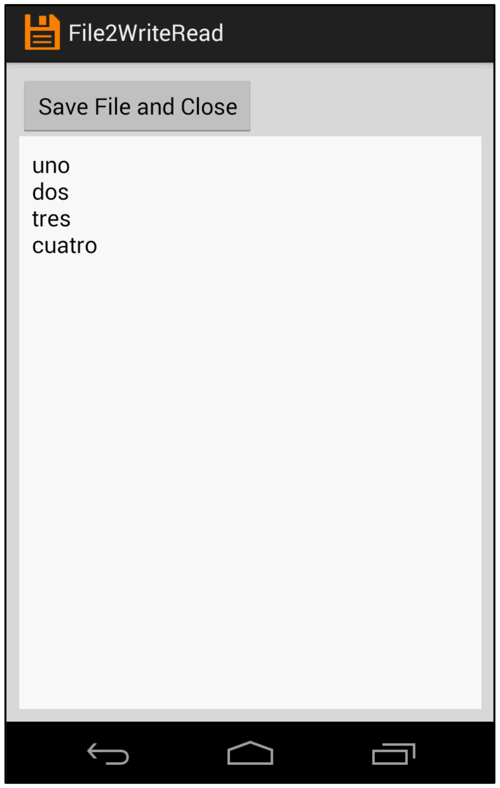
```
uno
dos
tres
cuatro
```

Files & Preferences

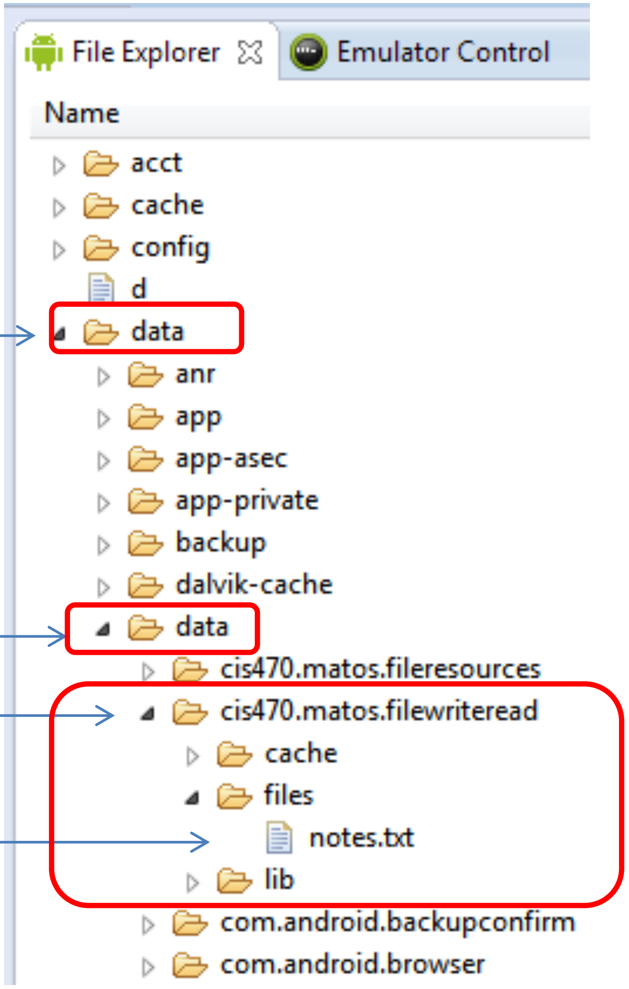
Example 2. Reading /Writing an Internal Resource File 2 of 6

The *internal resource file* (notes.txt) is private and cannot be seen by other apps residing in main memory.

In our example the files **notes.txt** is stored in the phone's internal memory under the name:
/data/data/cis470.matos.fileresources/files/notes.txt



```
uno
dos
tres
cuatro
```

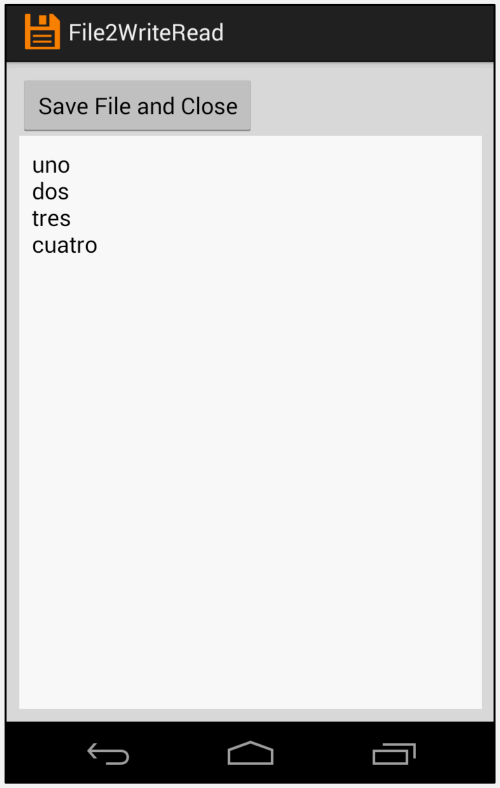


```
▷ acct
▷ cache
▷ config
  d
◢ data
    ▷ anr
    ▷ app
    ▷ app-asec
    ▷ app-private
    ▷ backup
    ▷ dalvik-cache
    ◢ data
        ▷ cis470.matos.fileresources
        ◢ cis470.matos.filewriteread
            ▷ cache
            ◢ files
                  notes.txt
            ▷ lib
        ▷ com.android.backupconfirm
        ▷ com.android.browser
```

Files & Preferences

Example 2. Reading /Writing an Internal Resource File 3 of 6

```
<?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:background="#ffdddddd"
    android:padding="10dp"
    android:orientation="vertical" >

    <Button android:id="@+id/btnFinish"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
         android:padding="10dp"
        android:text=" Save File and Close " />

    <EditText
        android:id="@+id/txtMsg"
        android:layout_width="match_parent"
        android:layout_height="match_parent"
        android:padding="10dp"
        android:background="#ffffffff"
        android:gravity="top"
        android:hint="Enter some lines of data here..."  />

</LinearLayout>
```



uno
dos
tres
cuatro

Files & Preferences

Example 2. Reading /Writing an Internal Resource File 4 of 6

```
public class File2WriteRead extends Activity {

   private final static String FILE_NAME = "notes.txt";
   private EditText txtMsg;

   @Override
   public void onCreate(Bundle icicle) {
      super.onCreate(icicle);
      setContentView(R.layout.main);
      txtMsg = (EditText) findViewById(R.id.txtMsg);

      // deleteFile();  //keep for debugging

      Button btnFinish = (Button) findViewById(R.id.btnFinish);
      btnFinish.setOnClickListener(new Button.OnClickListener() {
         public void onClick(View v) {
            finish();
         }
      });

   }// onCreate
```

Files & Preferences

Example 2. Reading /Writing an Internal Resource File 5 of 6

```
public void onStart() {
  super.onStart();

  try {
1 →   InputStream inputStream = openFileInput(FILE_NAME);

    if (inputStream != null) {

      BufferedReader reader = new BufferedReader(new
                                 InputStreamReader(inputStream));
2 →   String str = "";
      StringBuffer stringBuffer = new StringBuffer();

      while ((str = reader.readLine()) != null) {
        stringBuffer.append(str + "\n");
      }

      inputStream.close();
      txtMsg.setText(stringBuffer.toString());
    }
  }
  catch ( Exception ex ) {
    Toast.makeText(CONTEXT, ex.getMessage() , 1).show();
  }
}// onStart
```

Files & Preferences

Example 2. Reading /Writing an Internal Resource File   6 of 6

```
   public void onPause() {
      super.onPause();
      try {
         OutputStreamWriter out = new OutputStreamWriter(
3 →                                       openFileOutput(FILE_NAME, 0));
         out.write(txtMsg.getText().toString());
         out.close();
      } catch (Throwable t) {
         txtMsg.setText( t.getMessage() );
      }
   }// onPause
```

```
   private void deleteFile() {
      String path = "/data/data/cis470.matos.filewriteread/files/" + FILE_NAME;
      File f1 = new File(path);
      Toast.makeText(getApplicationContext(), "Exists?" + f1.exists() , 1).show();
4 →   boolean success = f1.delete();
      if (!success){
        Toast.makeText(getApplicationContext(), "Delete op. failed.", 1).show();
      }else{
         Toast.makeText(getApplicationContext(), "File deleted.", 1).show();
      }
   }
```

Files & Preferences

Example2 - Comments

1. The expression **`openFileInput`**`(`*`FILE_NAME`*`)` opens a private file linked to this *Context's* application package for reading. This is an alternative to the method `getResources().openRawResource(fileResourceId)` discussed in the previous example.

2. A *BufferedReader* object moves data line by line from the input file to a textbox. After the buffer is emptied the data sources are closed.

3. An *OutputStreamWriter* takes the data entered by the user and send this stream to an internal file. The method **`openFileOutput()`** opens a private file for writing and creates the file if it doesn't already exist. The file's path is: **/data/data/packageName/FileName**

4. You may delete an existing resource file using conventional `.delete()` method.

Files & Preferences

Reading /Writing External SD Files

SD cards offer the advantage of a *much larger capacity* as well as *portability.*

Many devices allow SD cards to be easily removed and reused in another device.

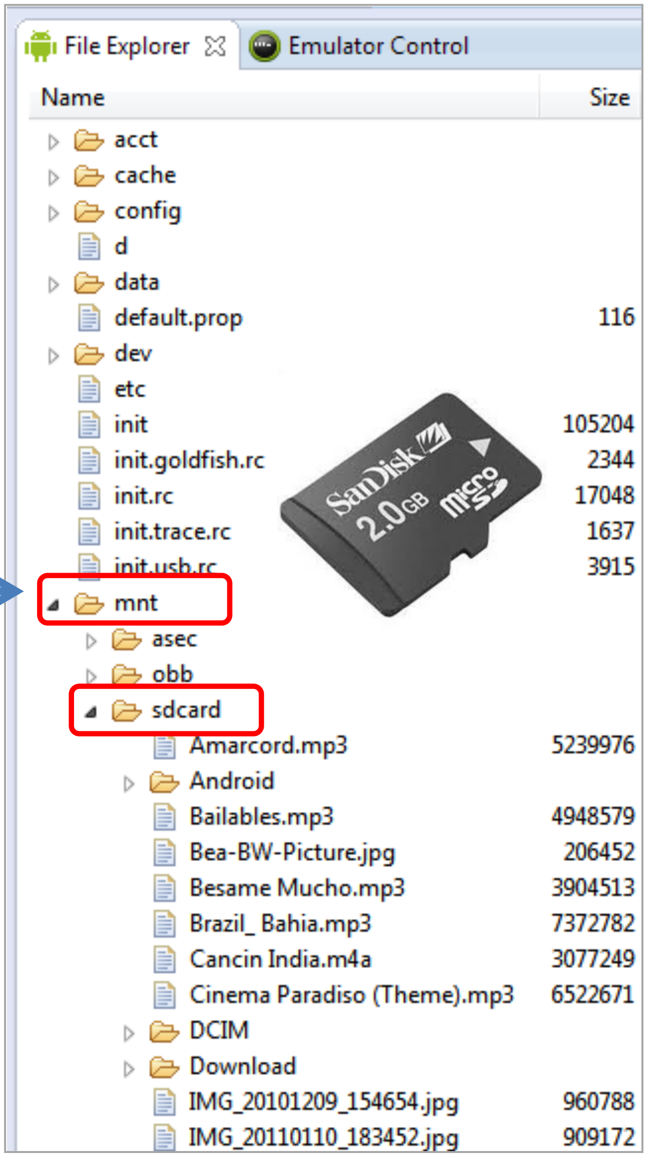
SD cards are ideal for keeping your collection of music, picture, ebooks, and video files.

Files & Preferences

Reading /Writing External SD Files

Use the **File Explorer** tool to locate files in your device (or emulator).

Look into the folder: **mnt/sdcard/**
there you typically keep music, pictures, videos, etc.



Name	Size
acct	
cache	
config	
d	
data	
default.prop	116
dev	
etc	
init	105204
init.goldfish.rc	2344
init.rc	17048
init.trace.rc	1637
init.usb.rc	3915
mnt	
asec	
obb	
sdcard	
Amarcord.mp3	5239976
Android	
Bailables.mp3	4948579
Bea-BW-Picture.jpg	206452
Besame Mucho.mp3	3904513
Brazil_ Bahia.mp3	7372782
Cancin India.m4a	3077249
Cinema Paradiso (Theme).mp3	6522671
DCIM	
Download	
IMG_20101209_154654.jpg	960788
IMG_20110110_183452.jpg	909172

Files & Preferences

Reading /Writing External SD Files

Although you may use the specific path to an SD file, such as:

```
mnt/sdcard/mysdfile.txt
```

it is a better practice to determine the SD location as suggested below

```
String sdPath = Environment.getExternalStorageDirectory().getAbsolutePath() ;
```

WARNING

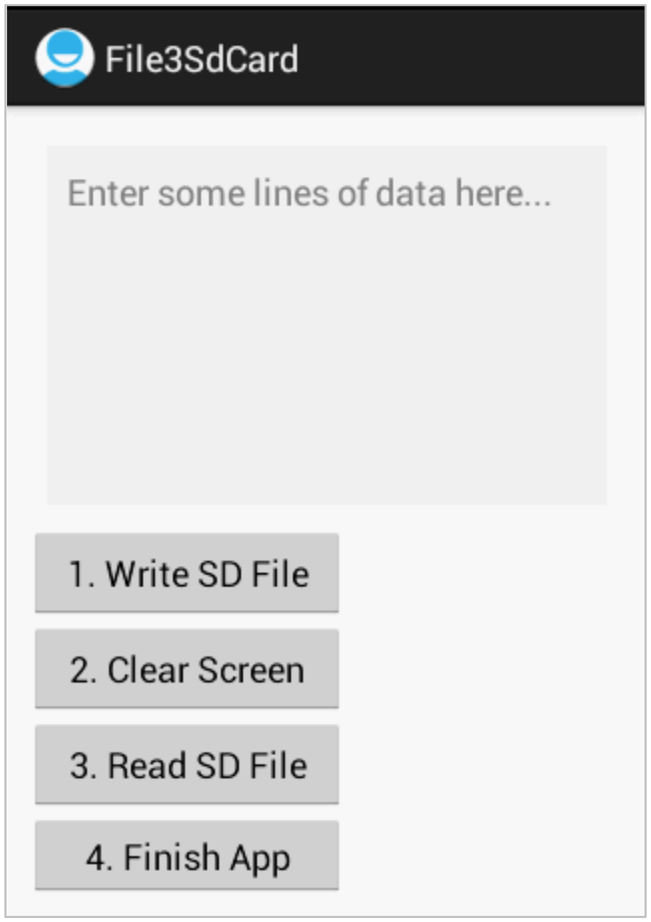
When you deal with external files you need to request permission to read and write to the SD card. Add the following clauses to your AndroidManifest.xml

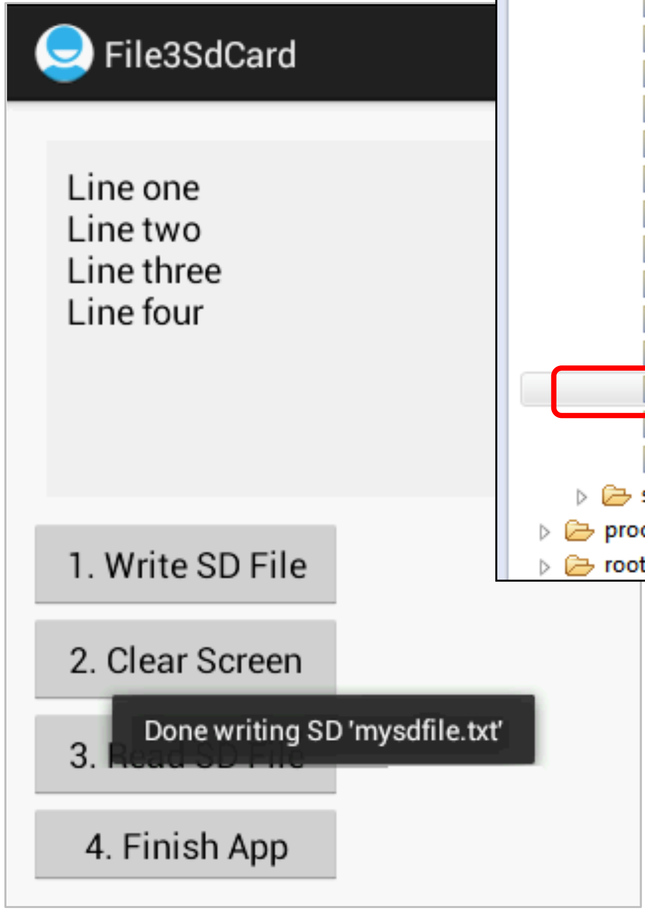
```
<uses-permission  android:name="android.permission.READ_EXTERNAL_STORAGE"/>

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

Files & Preferences

Example 3. Reading /Writing External SD Files

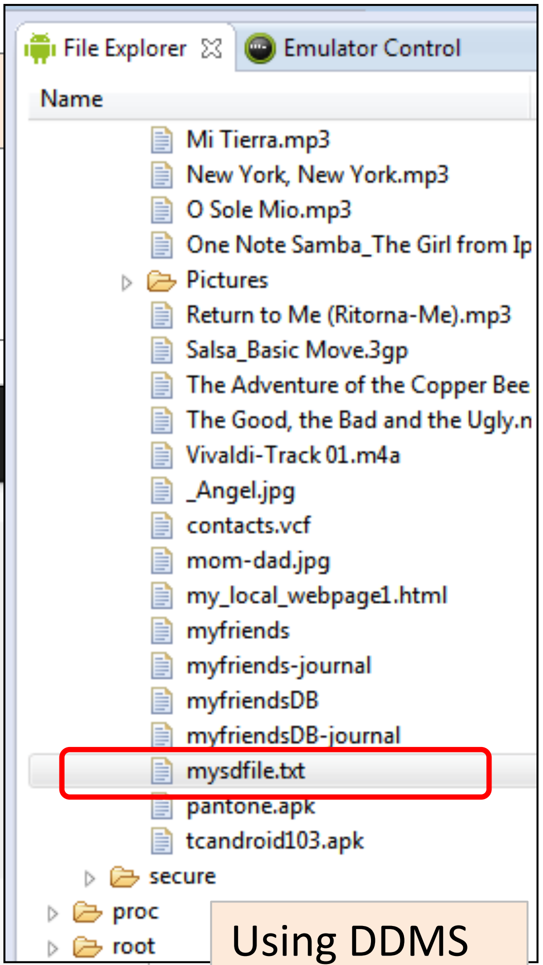
This app accepts a few lines of user input and writes it to the external SD card. User clicks on buttons to either have the data read and brought back, or terminate the app.





Line one
Line two
Line three
Line four

Done writing SD 'mysdfile.txt'



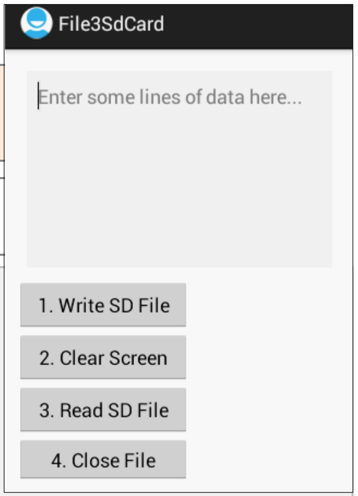
```
Mi Tierra.mp3
New York, New York.mp3
O Sole Mio.mp3
One Note Samba_The Girl from Ip
Pictures
Return to Me (Ritorna-Me).mp3
Salsa_Basic Move.3gp
The Adventure of the Copper Bee
The Good, the Bad and the Ugly.n
Vivaldi-Track 01.m4a
_Angel.jpg
contacts.vcf
mom-dad.jpg
my_local_webpage1.html
myfriends
myfriends-journal
myfriendsDB
myfriendsDB-journal
mysdfile.txt
pantone.apk
tcandroid103.apk
secure
proc
root
```

Using DDMS **File Explorer** to inspect the SD card.

Files & Preferences

Example 3. Reading /Writing External SD Files

Layout



```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    android:id="@+id/widget28"
    android:padding="10dp"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical" >

    <EditText
        android:id="@+id/txtData"
        android:layout_width="match_parent"
        android:layout_height="180dp"
        android:layout_margin="10dp"
        android:background="#55dddddd"
        android:padding="10dp"
        android:gravity="top"
        android:hint=
       "Enter some lines of data here..."
        android:textSize="18sp" />
    <Button
        android:id="@+id/btnWriteSDFile"
        android:layout_width="160dp"
        android:layout_height="wrap_content"
        android:text="1. Write SD File" />

    <Button
        android:id="@+id/btnClearScreen"
        android:layout_width="160dp"
        android:layout_height="wrap_content"
        android:text="2. Clear Screen" />

     <Button
        android:id="@+id/btnReadSDFile"
        android:layout_width="160dp"
        android:layout_height="wrap_content"
        android:text="3. Read SD File" />

     <Button
        android:id="@+id/btnFinish"
        android:layout_width="160dp"
        android:layout_height="wrap_content"
        android:text="4. Finish App" />

</LinearLayout>
```

Files & Preferences

Example 3. Reading /Writing External SD Files 1 of 4

```
public class File3SdCard extends Activity {
   // GUI controls
   private EditText txtData;
   private Button btnWriteSDFile;
   private Button btnReadSDFile;
   private Button btnClearScreen;
   private Button btnClose;
   private String mySdPath;

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

      // find SD card absolute location
1 →   mySdPath = Environment.getExternalStorageDirectory().getAbsolutePath();

      // bind GUI elements to local controls
      txtData = (EditText) findViewById(R.id.txtData);
      txtData.setHint("Enter some lines of data here...");
```

Files & Preferences

Example 3. Reading /Writing External SD Files 2 of 4

❷ →

```
btnWriteSDFile = (Button) findViewById(R.id.btnWriteSDFile);
btnWriteSDFile.setOnClickListener(new OnClickListener() {
  @Override
  public void onClick(View v) {
    // WRITE on SD card file data taken from the text box
    try {
      File myFile = new File(mySdPath + "/mysdfile.txt");

      OutputStreamWriter myOutWriter = new OutputStreamWriter(
                                      new FileOutputStream(myFile));

      myOutWriter.append(txtData.getText());
      myOutWriter.close();

      Toast.makeText(getBaseContext(),
          "Done writing SD 'mysdfile.txt'",
          Toast.LENGTH_SHORT).show();
    } catch (Exception e) {
      Toast.makeText(getBaseContext(), e.getMessage(),
          Toast.LENGTH_SHORT).show();
    }
  }// onClick
}); // btnWriteSDFile
```

Files & Preferences

Example 3. Reading /Writing External SD Files 3 of 4

```
btnReadSDFile = (Button) findViewById(R.id.btnReadSDFile);
btnReadSDFile.setOnClickListener(new OnClickListener() {
  @Override
  public void onClick(View v) {
    // READ data from SD card show it in the text box
    try {
      BufferedReader myReader = new BufferedReader(
3 →                                 new InputStreamReader(
                                    new FileInputStream(
                                    new File(mySdPath + "/mysdfile.txt"))));
      String aDataRow = "";
      String aBuffer = "";
      while ((aDataRow = myReader.readLine()) != null) {
        aBuffer += aDataRow + "\n";
      }
      txtData.setText(aBuffer);
      myReader.close();
      Toast.makeText(getApplicationContext(),
          "Done reading SD 'mysdfile.txt'", Toast.LENGTH_SHORT).show();
    } catch (Exception e) {
      Toast.makeText(getApplicationContext(), e.getMessage(),
          Toast.LENGTH_SHORT).show();
    }
  }// onClick
}); // btnReadSDFile
```

Files & Preferences

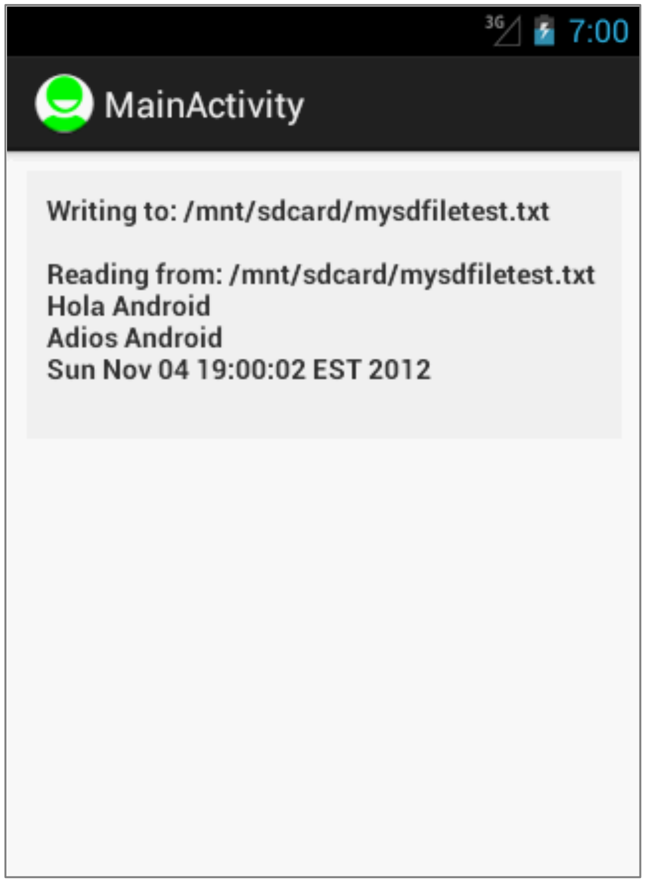
Example 3. Reading /Writing External SD Files 4 of 4

```
      btnClearScreen = (Button) findViewById(R.id.btnClearScreen);
      btnClearScreen.setOnClickListener(new OnClickListener() {
         @Override
         public void onClick(View v) {
            // clear text box
            txtData.setText("");
         }
      }); // btnClearScreen

      btnClose = (Button) findViewById(R.id.btnFinish);
      btnClose.setOnClickListener(new OnClickListener() {
         @Override
         public void onClick(View v) {
            // terminate app
            Toast.makeText(getApplicationContext(),
                  "Adios...", Toast.LENGTH_SHORT).show();
            finish();
         }
      }); // btnClose

   }// onCreate

}// File3SdCard
```

Files & Preferences

Example 4. Using Scanner/PrintWriter on External SD Files 1 of 3

In this example we use the Scanner and PrintWriter classes. Scanners are useful for dissecting formatted input into simple **tokens**. *Whitespace* markers separate the tokens, which could be translated according to their data type.



```
Writing to: /mnt/sdcard/mysdfiletest.txt

Reading from: /mnt/sdcard/mysdfiletest.txt
Hola Android
Adios Android
Sun Nov 04 19:00:02 EST 2012
```

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    android:orientation="vertical"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent"
    android:layout_margin="10dp"
    >

<TextView
    android:layout_width="fill_parent"
    android:layout_height="wrap_content"
    android:padding="10dp"
    android:id="@+id/txtMsg"
    android:textStyle="bold"
    android:background="#77eeeeee"
    />
</LinearLayout>
```

Files & Preferences

Example 4. Using Scanner/PrintWriter on External SD Files 2 of 3

```
public class File4Scanner extends Activity  {
TextView txtMsg;
  @Override
  public void onCreate(Bundle savedInstanceState) {
      super.onCreate(savedInstanceState);
      setContentView(R.layout.main);
      txtMsg = (TextView) findViewById(R.id.txtMsg);
      testScannedFile();
  }//onCreate
```

```
    private void testScannedFile(){
       try {
❶ →        String SDcardPath = Environment.getExternalStorageDirectory().getPath();
          String mySDFileName = SDcardPath + "/" + "mysdfiletest.txt";

          txtMsg.setText("Writing to: " + mySDFileName);
          // write to SD, needs "android.permission.WRITE_EXTERNAL_STORAGE"
          PrintWriter outfile= new PrintWriter( new FileWriter(mySDFileName) );

❷ →        outfile.println("Hola Android");
          outfile.println("Adios Android");
          outfile.println(new Date().toString());

          outfile.close();
```

Files & Preferences

Example 4. Using Scanner/PrintWriter on External SD Files 3 of 3

```
   // read SD-file, show records.
   // needs permission "android.permission.READ_EXTERNAL_STORAGE"

        Scanner infile= new Scanner(new FileReader(mySDFileName));
        String inString= "\n\nReading from: " + mySDFileName + "\n";

❸ →     while(infile.hasNextLine()) {
           inString += infile.nextLine() + "\n";
        }

        txtMsg.append(inString);
        infile.close();

     } catch (FileNotFoundException e) {
        txtMsg.setText( "Error: " + e.getMessage());
     } catch (IOException e) {
        txtMsg.setText( "Error: " + e.getMessage());
     }

   }//testScannerFiles

}//class
```

Files & Preferences

Example 4. Comments

1. You want to use the method
   `Environment.getExternalStorageDirectory().getPath()`
   `to` detemine the path to the external SD card.

2. A PrintWriter object is used to send data tokens to disk using any of the following methods: `print(), println(), printf().`

3. A Scanner accepts whitespace separated tokens and converts then to their corresponding types using methods: `next(), nextInt(), nextDouble(),` etc.