

# EMBEDDED SYSTEMS PROGRAMMING 2016-17

Application Tip: Saving State



# THE PROBLEM

- How to save the state (of a UI, for instance) so that it survives even when the application is closed/killed
- The state should be restored when the application is opened again: to the user it is as if the application has always been there
- We will consider a UI with an editable text field, a checkbox, and a seekbar
- Solution: use the facilities provided by (and follow the rules dictated by) Android's frameworks

# ACTIVITIES AND APPS

- Android UIs are managed inside **activities**
- An Android app may contain several activities
- Activities are independent by a large extent, but they share some resources associated with the app (e.g., the user ID)
- An activity may be destroyed by the OS while the app that hosts it survives. Later on, a new **instance** of the same activity may be created

# INSTANCE STATE

- If an activity is destroyed and recreated by the OS (e.g., because the screen is rotated):  
the new activity is a new instance of the old one
- If an activity is destroyed due to normal app behavior (user presses the *Back* button, `destroy()` is invoked):  
“the activity instance is gone forever”
- **Instance state:** information associated with an activity instance



# PERSISTENT STATE

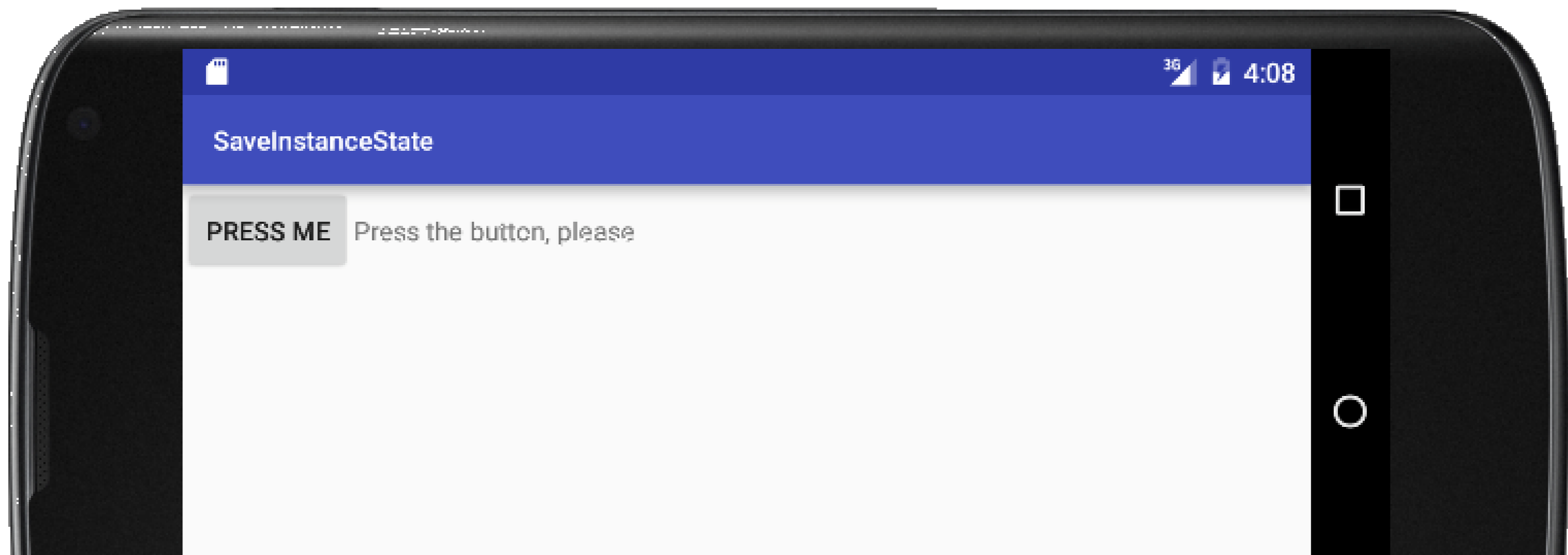
- **Persistent state:** information associated with an application (e.g., user preferences)
- Persistent state must be preserved between different runs of an application. Instance state must not

# THE TIP: INSTANCE STATE (1/2)

- Consider the `HelloWithButton` example
- When the screen orientation changes, the `HelloWithButton` activity is destroyed, then a new instance of the activity is launched to redraw the screen according to the new orientation
- Let's modify the `HelloWithButton` example so that the instance state is preserved

# THE TIP: INSTANCE STATE (2/2)

- The state of the TextView must be saved
- Platform solution: save it in the `savedInstanceState` **Bundle**





# CODE (1/3)

- Only one source file: `HelloWithButton.java`

```
package it.unipd.dei.espl516.saveinstancestate;

import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.LinearLayout;
import android.widget.TextView;

public class HelloWithButton extends AppCompatActivity
{
    /* Class variables */
    private TextView tv;
    private Button bu;

    /** Called when the activity is first created. */
    @Override
    protected void onCreate(Bundle savedInstanceState)
    {
        super.onCreate(savedInstanceState);

        // Create the TextView
        tv = new TextView(this);
        tv.setText("Press the button, please");
    }
    ...
}
```



# CODE (2/3)

```
...  
  
    // Restore TextView state from the savedInstanceState  
    if (savedInstanceState != null)  
    {  
        String strValue = savedInstanceState.getString("strTV");  
        if (strValue != null) tv.setText(strValue);  
    }  
  
    // Create the Button  
    bu = new Button(this);  
    bu.setText("Press me");  
  
    // Set the action to be performed when the button is pressed  
    bu.setOnClickListener(new View.OnClickListener() {  
        public void onClick(View v) {  
            // Perform action on click  
            tv.setText("Good job!");  
        }  
    });  
  
    // Create the layout  
    LinearLayout mylayout = new LinearLayout(this);  
  
    // Add the UI elements to the layout  
    mylayout.addView(bu);  
    mylayout.addView(tv);  
  
    // Display the layout  
    setContentView(mylayout);  
}  
  
...
```

# CODE (3/3)

...

```
/** Called when the system is about to pause the activity because it is  
 * resuming a previous one. This method allows you to save any  
 * dynamic INSTANCE state in your activity into the given Bundle,  
 * to be later received in onCreate(Bundle) if the activity needs  
 * to be re-created.  
 * Note: PERSISTENT state (which is different from instance state!)  
 * should be saved in the onPause() method because onSaveInstanceState()  
 * is not part of the life cycle callbacks, hence it will not be called  
 * in every situation */
```

```
@Override
```

```
public void onSaveInstanceState(Bundle savedInstanceState)
```

```
{
```

```
    // NOTE: with the implementation of this method inherited from  
    // Activity, some widgets save their state in the bundle by default.  
    // Once the user interface contains AT LEAST one non-autosaving  
    // element, you should provide a custom implementation of  
    // the method
```

```
    String strTV = tv.getText().toString();  
    savedInstanceState.putString("strTV", strTV);
```

```
    super.onSaveInstanceState(savedInstanceState);
```

```
}
```

```
}
```

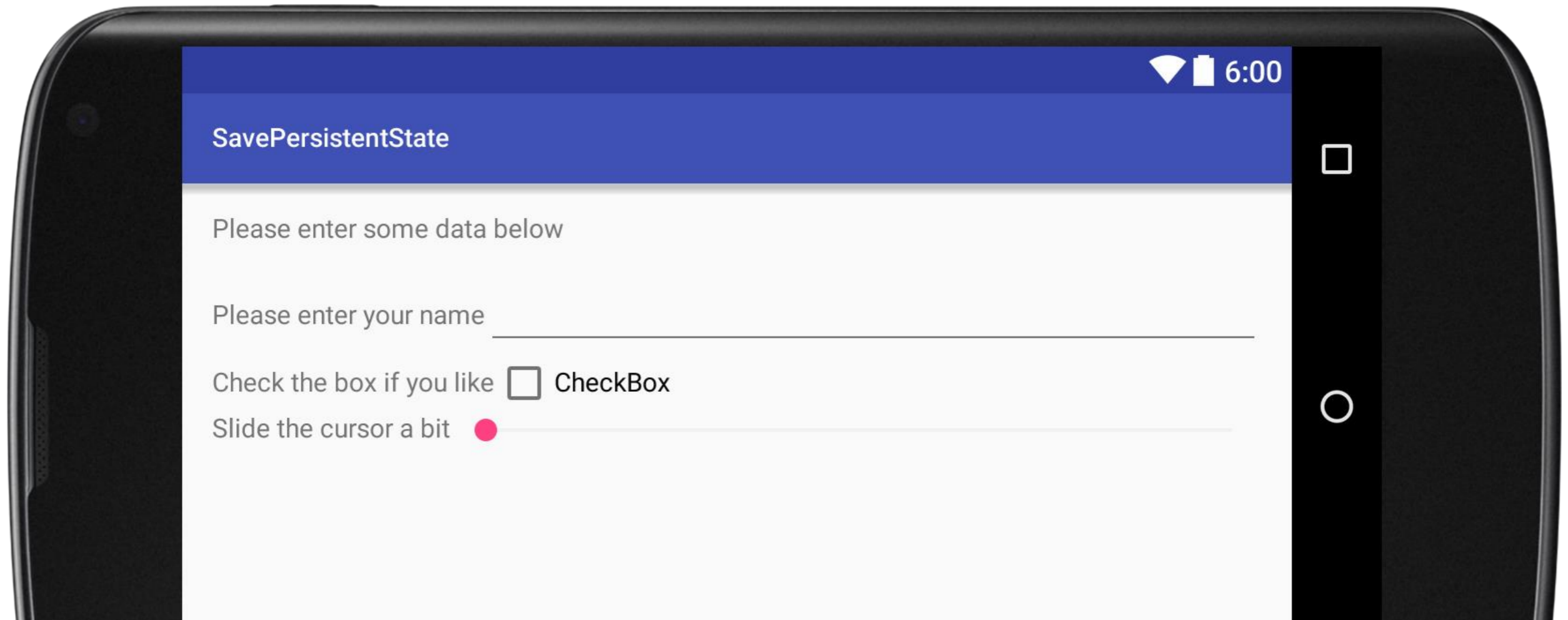


# THE TIP: PERSISTENT STATE (1/2)

- Back on track: the UI state must now survive even when the application is closed/killed (this is not the case for `HelloWithButton`: try force-quitting it)
- Platform solution: save data as `SharedPreferences`

# THE TIP: PERSISTENT STATE (2/2)

- New application: the UI contains an editable text field, a checkbox, and a seekbar





# CODE (1/6)

- Source files:
  - `PersistenceActivity.java`
- Other resources:
  - `activity_persistence.xml` (UI layout),
  - `strings.xml` (UI strings)

# CODE (2/6)

- strings.xml

```
<resources>
  <string name="app_name">SavePersistentState</string>
  <string name="hello">Please enter some data below</string>
  <string name="please1">Please enter your name</string>
  <string name="please2">Check the box if you like</string>
  <string name="please3">Slide the cursor a bit</string>
  <string name="label1">CheckBox</string>
</resources>
```



# CODE (3/6)

## ● activity\_persistence.xml (1/2)

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:orientation="vertical"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:paddingBottom="@dimen/activity_vertical_margin"
    android:paddingLeft="@dimen/activity_horizontal_margin"
    android:paddingRight="@dimen/activity_horizontal_margin"
    android:paddingTop="@dimen/activity_vertical_margin"
    tools:context="it.unipd.dei.esp1516.savepersistentstate.PersistenceActivity">

    <TextView
        android:layout_width="fill_parent" android:layout_height="wrap_content"
        android:text="@string/hello" android:minHeight="32dp"/>

    <LinearLayout android:layout_width="match_parent" android:layout_height="wrap_content"
        android:id="@+id/linearLayout1">

        <TextView android:text="@string/please1" android:id="@+id/textView1"
            android:layout_width="wrap_content" android:layout_height="wrap_content" android:minWidth="130dp"/>
        <EditText android:text="" android:id="@+id/editText1" android:layout_height="wrap_content"
            android:layout_width="fill_parent" android:inputType="text"/>

    </LinearLayout>

</LinearLayout>
```

...

# CODE (4/6)

## ● activity\_persistence.xml (2/2)

...

```
<LinearLayout android:layout_width="match_parent" android:layout_height="wrap_content"
    android:id="@+id/linearLayout2">

    <TextView android:text="@string/please2" android:id="@+id/textView2"
        android:layout_width="wrap_content" android:layout_height="wrap_content"
        android:minWidth="130dp"/>
    <CheckBox android:text="@string/label" android:id="@+id/checkbox1"
        android:layout_width="wrap_content" android:layout_height="wrap_content"/>

</LinearLayout>

<LinearLayout android:layout_width="match_parent" android:layout_height="wrap_content"
    android:id="@+id/linearLayout3">

    <TextView android:text="@string/please3" android:id="@+id/textView3"
        android:layout_width="wrap_content" android:layout_height="wrap_content"
        android:minWidth="130dp"/>
    <SeekBar android:layout_width="match_parent" android:layout_height="wrap_content"
        android:id="@+id/seekBar1"/>

</LinearLayout>

</LinearLayout>
```

# CODE (5/6)

## ● PersistenceActivity.java (1/2)

```
package it.unipd.dei.esp1516.savepersistentstate;

import android.annotation.SuppressLint;
import android.content.SharedPreferences;
...

public class PersistenceActivity extends AppCompatActivity
{
    /** Called when the activity is first created. */
    @Override
    protected void onCreate(Bundle savedInstanceState)
    {
        super.onCreate(savedInstanceState);

        // Set the view
        setContentView(R.layout.activity_persistence);

        // Get persistent data stored as SharedPreferences
        SharedPreferences preferences = getPreferences(MODE_PRIVATE);
        String str_et = preferences.getString("editTextValue", null);
        boolean bln_cb = preferences.getBoolean("checkBoxValue", false);
        int int_sb = preferences.getInt("seekBarValue", 0);

        // Get references to widgets and set them according to persistent data
        EditText et = (EditText) findViewById(R.id.editText1);
        et.setText(str_et);
        CheckBox cb = (CheckBox) findViewById(R.id.checkBox1);
        cb.setChecked(bln_cb);
        SeekBar sb = (SeekBar) findViewById(R.id.seekBar1);
        sb.setProgress(int_sb);
    }
    ...
}
```



# CODE (6/6)

## ● PersistenceActivity.java (2/2)

```
...  
  
/** Called as part of the activity lifecycle when an activity is going  
 * into the background, but has not (yet) been killed.  
 * The counterpart to onResume(). */  
@SuppressWarnings("CommitPrefEdits")  
@Override  
protected void onPause()  
{  
    super.onPause();  
  
    // Store values between instances here  
    SharedPreferences preferences = getPreferences(MODE_PRIVATE);  
    SharedPreferences.Editor editor = preferences.edit();  
  
    // Get references to widgets and read the status  
    // of them all  
    EditText et = (EditText) findViewById(R.id.editText1);  
    String str_et = et.getText().toString();  
    CheckBox cb = (CheckBox) findViewById(R.id.checkBox1);  
    boolean bln_cb = cb.isChecked();  
    SeekBar sb = (SeekBar) findViewById(R.id.seekBar1);  
    int int_sb = sb.getProgress();  
  
    // Store status in the preferences  
    editor.putString("editTextValue", str_et);  
    editor.putBoolean("checkBoxValue", bln_cb);  
    editor.putInt("seekBarValue", int_sb);  
  
    // Commit to storage synchronously  
    editor.commit();  
}  
}
```



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