ANDROID platforma
komunikacija između aktivnosti
intents, multithreading

Mobilni i distribuirani informacioni sistemi

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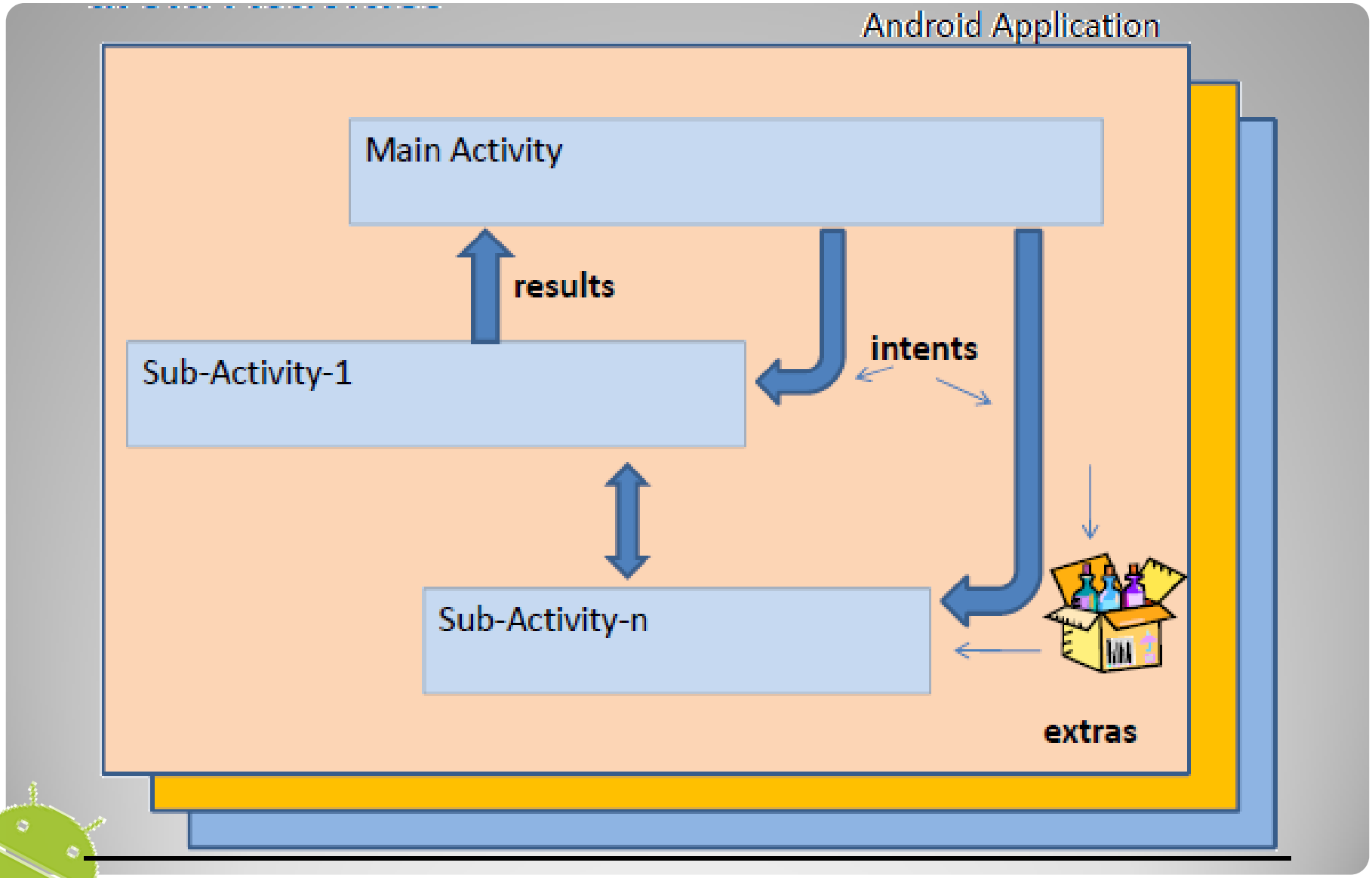
Intents - namena

- Tipična Android aplikacija ima više aktivnosti
- Aktivnost sa *setContentView()* prikazuje UI
- Aktivnosti su nezavisne ali mogu razmenjivati podatke
- Tipično je jedna aktivnost glavna (main) i ona se startuje po startovanju aplikacije
- Aktiviranje drugih aktivnosti aplikacije se radi korišćenjem **intent**-a
- Aktivnosti međusobno komuniciraju u asinhronom režimu

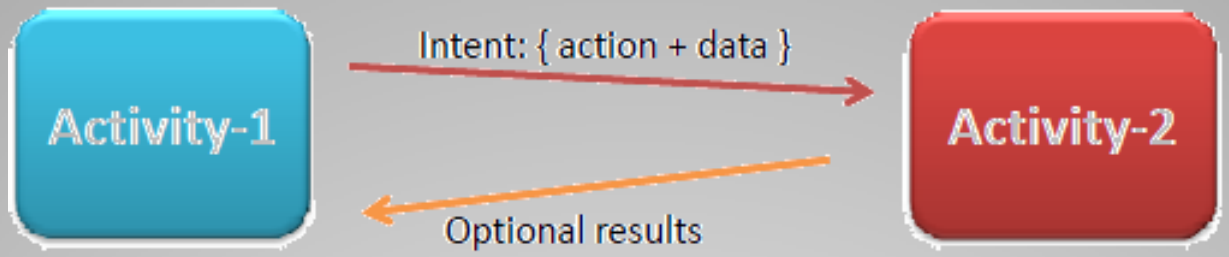
Intents - namena



Intents - namena

- Intent-i se aktiviraju pozivima:
  - *startActivity(intent)*
    Startuje drugu aktivnost
  - *sendBradcast(intent)*
    Šalje intent svim zainteresovanim *BradcastReceiver* komponentama
  - *startService(intent)*
    bindService(intent)
    Koriste se za komunikaciju sa pozadinskim servisima
- Argumenti Intent-a
  - **Action** – predefinisane: ACTION_VIEW, ACTION_EDIT, ACTION_MAIN...
  - **Data** – podaci sa kojima se radi

Intents - kreiranje



- Tipično se intent šalje na sledeći način

```
Intent myActivity = new Intent(action, data);
startActivity(myActivity);
```

- Akcija može biti ugrađena uli korisnički definisana
- Podaci su vezani za akciju


```
Intent myActivity = new Intent(Intent.ACTION_DIAL,
                                    Uri.parse("tel:555-1234"));
startActivity(myActivity);
```

Intents - kreiranje

- Prilikom kreiranja intent-a mogu se zadati i sekundarni atributi
  - Category
  - Type
  - Components
  - Extras

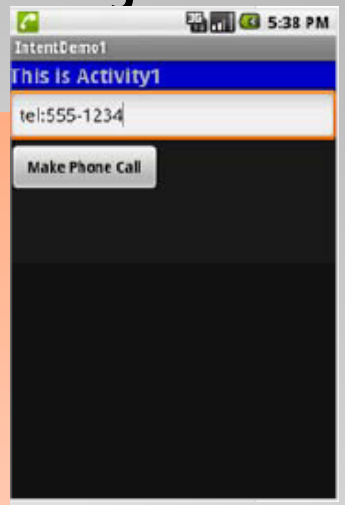
```
Intent intent =
        new Intent(Intent.ACTION_WEB_SEARCH);
intent.putExtra(SearchManager.QUERY,
                "straight hitting golf club");
startActivity(intent);
```

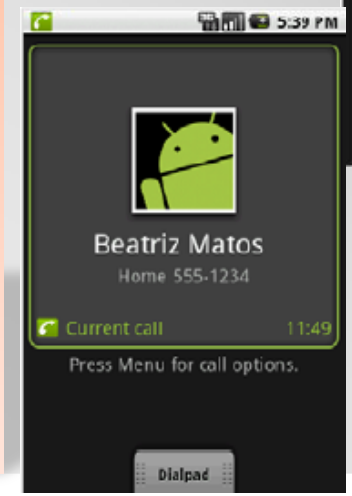
```
Intent intent =  new Intent(Intent.ACTION_SENDTO,
                        Uri.parse("sms:555-1234"));
intent.putExtra("sms_body",
                "are we playing golf next Saturday?");
startActivity(intent);
```

Intents – kompletan primer

- Aktivnost prihvata broj i šalje intent koji aktivira ugrađenu aktivnost koja obavlja poziv

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout
xmlns:android="http://schemas.android.com/apk/res/android"
          android:orientation="vertical"
          android:layout_width="fill_parent"
          android:layout_height="fill_parent" >
  <TextView android:id="@+id/label1"
          android:layout_width="fill_parent"
          android:layout_height="wrap_content"
          android:background="#ff0000cc"
          android:text="This is Activity1"
          android:textStyle="bold"
          android:textSize="20sp" />
  <EditText android:id="@+id/text1"
          android:layout width="fill parent"
          android:layout_height="54px"
          android:text="tel:555-1234"
          android:textSize="18sp" />
  <Button android:id="@+id/btnCallActivity2"
          android:layout_width="149px"
          android:layout_height="wrap_content"
          android:text="Make Phone Call"
          android:textStyle="bold" />
</LinearLayout>
```





Intents – kompletan primer

- Source code aktivnosti

```
import android.app.Activity;
import android.content.Intent;
import android.net.Uri;
import android.os.Bundle;
import android.view.View;
import android.view.View.OnClickListener;
import android.widget.*;

public class IntentDemo1 extends Activity {
  TextView label1;
  EditText text1;
  Button btnCallActivity2;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    try {
      setContentView(R.layout.main);
      label1 = (TextView)findViewById(R.id.label1);
      text1 = (EditText)findViewById(R.id.text1);
      btnCallActivity2 = (Button)findViewById(R.id.btnCallActivity2);
      btnCallActivity2.setOnClickListener(new ClickHandler());
    } catch (Exception e) {
      Toast.makeText(getBaseContext(), e.getMessage(),
      Toast.LENGTH_LONG).show();
    }
}//onCreate
```

Intents – kompletan primer

```
private class ClickHandler implements OnClickListener {
  @Override
  public void onClick(View v) {
    try {
      // myActivity2 places a phone call
      // for ACTION_CALL or ACTION_DIAL
      // use 'tel:' formatted data: "tel:555-1234"
      // for ACTION_VIEW use data: "http://www.youtube.com"
      // (you also need INTERNET permission - see Manifest)
      String myData = text1.getText().toString();
      Intent myActivity2 = new Intent(Intent.ACTION_DIAL,
                                      Uri.parse(myData));
      startActivity(myActivity2);
    } catch (Exception e) {
      Toast.makeText(getBaseContext(), e.getMessage(),
      Toast.LENGTH_LONG).show();
    }
  }//onClick
 }//ClickHandler
}//IntentDemo1
```

- Intent filter

```
<application android:icon="@drawable/icon"
             android:label="@string/app_name">
  <activity  android:name=".IntentDemo1"
             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>
```

Action/category

Intents – standardne akcije

- Prikaz svih kontakata

```
String myData = "content://contacts/people/";
Intent myActivity = new Intent(Intent.ACTION_VIEW,
                               Uri.parse(myData));
startActivity(myActivity);
```

- Izmena konkretnog kontakta

```
String myData = "content://contacts/people/8";
Intent myActivity = new Intent(Intent.ACTION_EDIT,
                               Uri.parse(myData));
startActivity(myActivity);
```

- Prikaz adrese u GoogleMaps

```
String myData = "geo:0,0?1860+east+18th+street+clevelend+oh";
Intent myActivity = new Intent(Intent.ACTION_VIEW,
                               Uri.parse(myData));
startActivity(myActivity);
```

Obavezan dodatak u Manifest

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

Intents – standardne akcije

- Puštanje zvučnog fajla

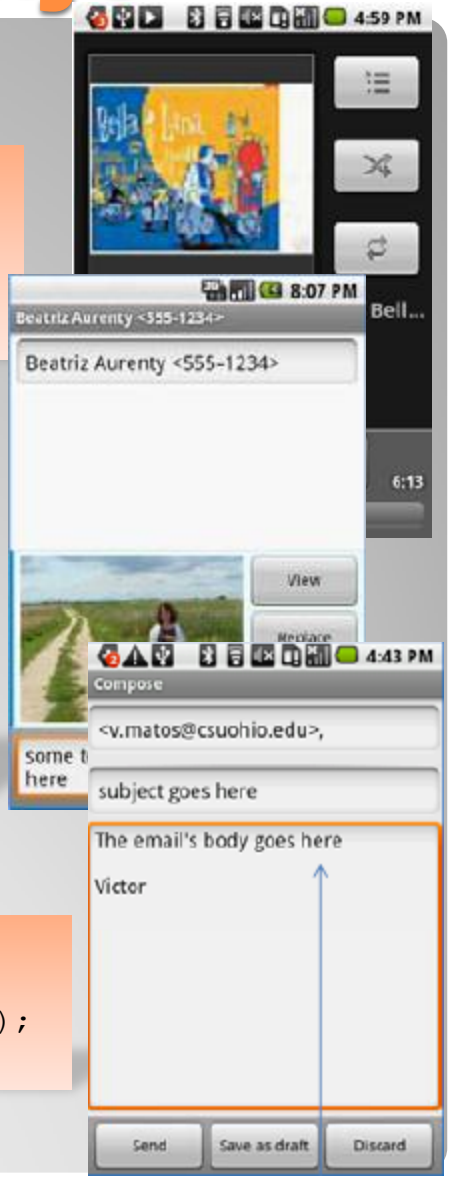
```
Intent myActivity2 = new Intent(android.content.Intent.ACTION_VIEW);
Uri data = Uri.parse("file:///sdcard/amarcord.mp3");
String type = "audio/mp3";
myActivity2.setDataAndType(data, type);
startActivity(myActivity2);
```

- Slanje slike MMS porukom

```
Uri uri = Uri.parse("content://media/external/images/media/1");
Intent myActivity2 = new Intent(Intent.ACTION_SEND);
myActivity2.putExtra("address", "555-1234");
myActivity2.putExtra("sms_body", "some text message goes here");
myActivity2.putExtra(Intent.EXTRA_STREAM, uri);
myActivity2.setType("image/png");
startActivity(myActivity2);
```

- Slanje Email poruke

```
Uri uri = Uri.parse("mailto:v.matos@csuohio.edu");
myActivity2.putExtra(Intent.EXTRA_SUBJECT,"subject goes here");
myActivity2.putExtra(Intent.EXTRA_TEXT,"The email's body goes here");
startActivity(myActivity2);
```



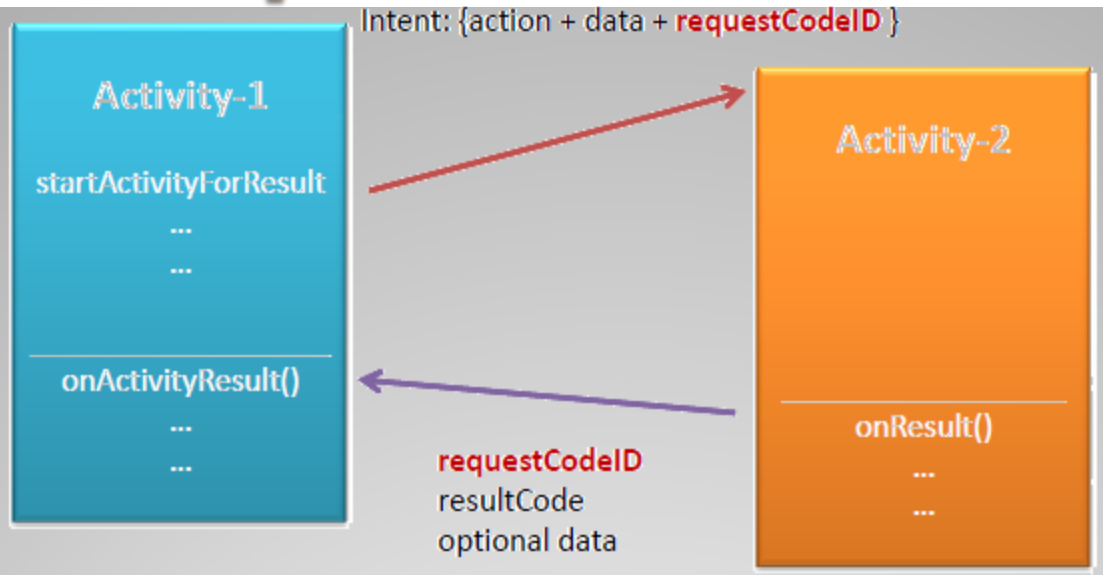
Intents – povratna informacija

- Nekada želimo da pozovemo neku aktivnost i da nam ona vrati neki rezultat kada se završi
  - Primer: ako startujemo aktivnost za prikaz kontakata želimo da dobijemo kao povratnu vrednost kontakt koji je korisnik izabrao
- Poseban poziv za aktiviranje
  - *startActivityForResult (Intent, requestCodeID)*
- *requestCodeID* – jedinsteveni identifikator poziva
- Rezultat se hvata listener-om
  - *onActivityResult(requestCodeID,resultCode,Intent)*

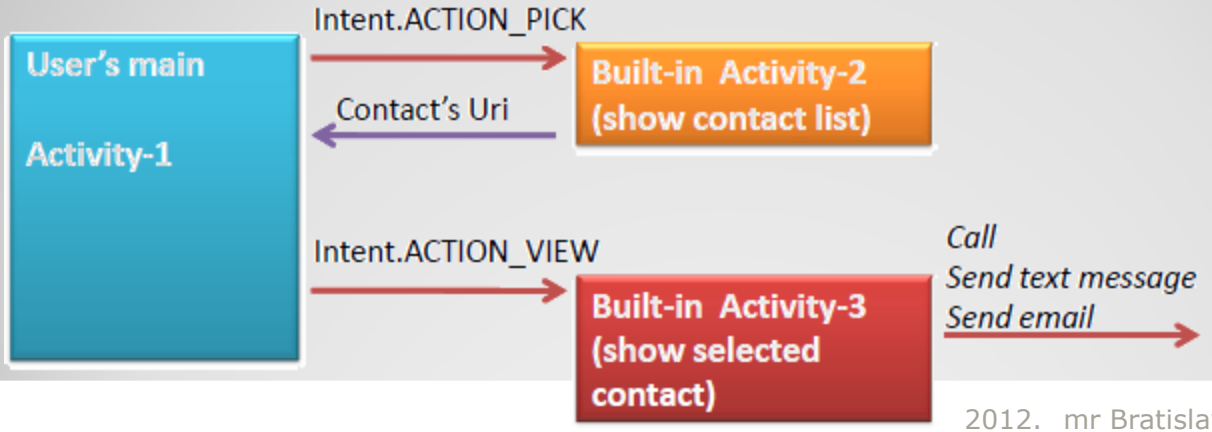
Intents – povratna informacija

- Pre nego što podaktivnost izađe može roditeljskoj aktivnosti da pošalje signal
  - *setResult (resultCode)*
- resultCode – može biti neki od standardnih ili custom
  - *Activity.RESULT_CANCELED*
  - *Activity.RESULT_OK*
  - *Custom*
- Roditeljska aktivnost rezultat hvata sa
  - *onActivityResult(int requestCodeID int resultCode, Intent data)*
- U slučaju greške vraća se *RESULT_CANELED*

Intents – povratna informacija



- Primer: Izaberimo kontakt i omogućimo poziv, SMS ili email ka izabranom kontaktu



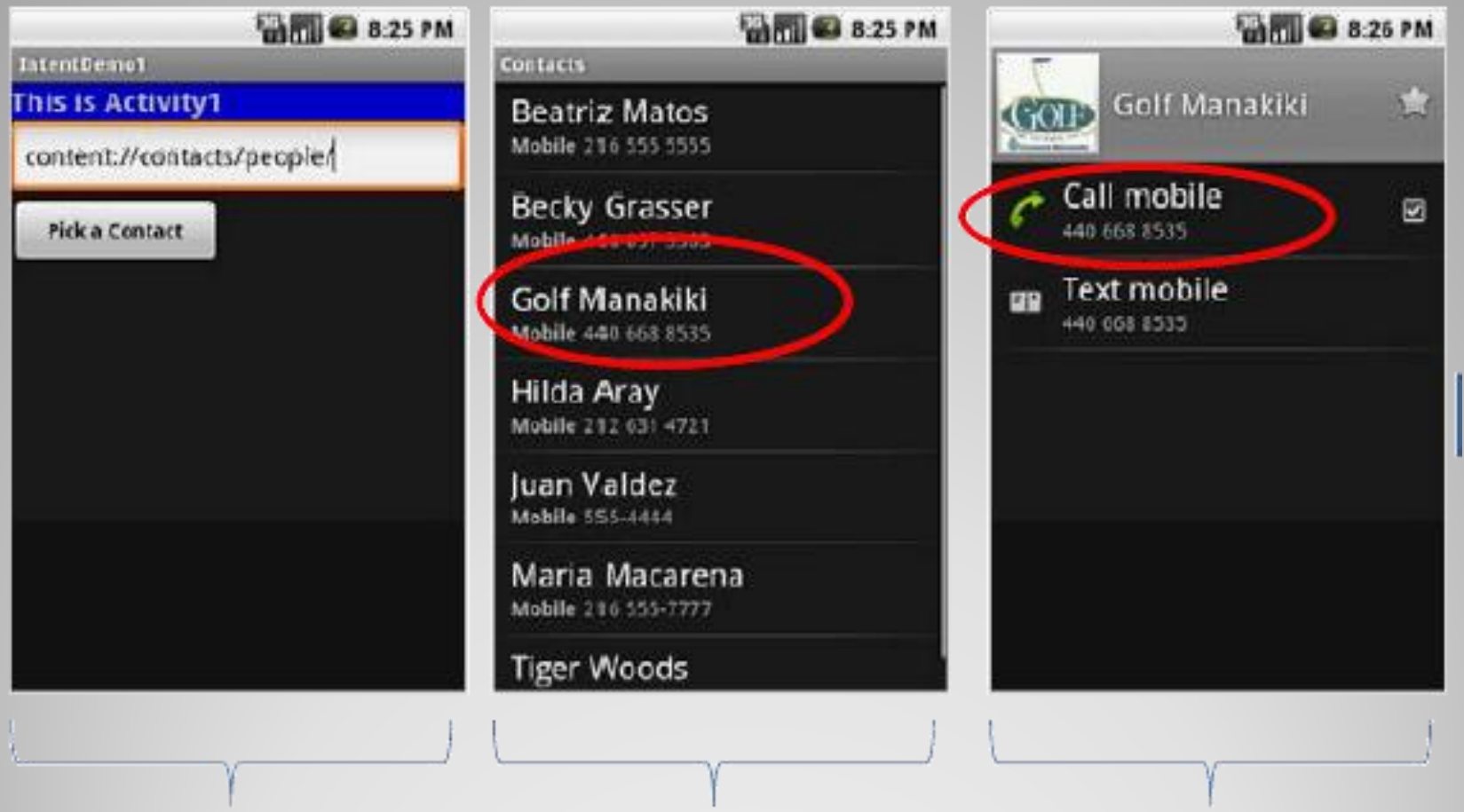
Primer povratne informacije

```
import android.app.Activity;
import android.content.Intent;
import android.net.Uri;
import android.os.Bundle;
import android.view.View;
import android.view.View.OnClickListener;
import android.widget.*;

public class IntentDemo2 extends Activity {
  TextView label1;
  EditText text1;
  Button btnCallActivity2;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    try {
      setContentView(R.layout.main);
      label1 = (TextView)findViewById(R.id.label1);
      text1 = (EditText)findViewById(R.id.text1);
      btnCallActivity2 = (Button)findViewById(R.id.btnPickContact);
      btnCallActivity2.setOnClickListener(new ClickHandler());
    } catch (Exception e) {
      Toast.makeText(getBaseContext(),
      e.getMessage(), Toast.LENGTH_LONG).show();
    }
  }//onCreate
```

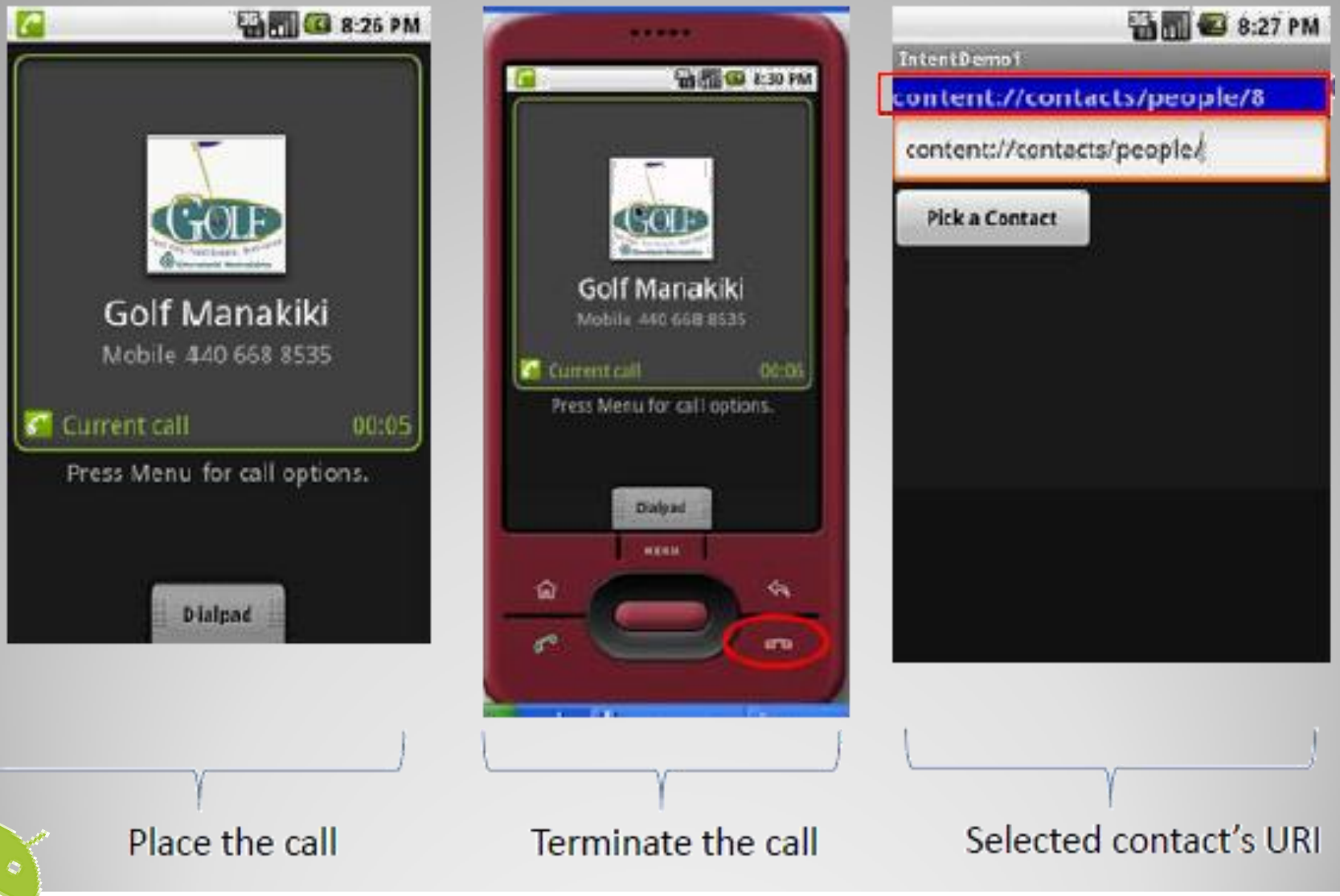
Primer povratne informacije

```
private class ClickHandler implements OnClickListener {
  @Override
  public void onClick(View v) {
    try {
      String myData = text1.getText().toString();
      Intent myActivity2 = new Intent(Intent.ACTION_PICK,
      Uri.parse(myData));
      startActivityForResult(myActivity2, 222);
    } catch (Exception e) {
        label1.setText(e.getMessage());
    }
  }//onClick
}//ClickHandler

@Override
protected void onActivityResult(int requestCode, int resultCode, Intent data) {
  super.onActivityResult(requestCode, resultCode, data);
  try {
    switch (requestCode){
      case (222): {
        if (resultCode == Activity.RESULT_OK) {
          String selectedContact = data.getDataString();
          label1.setText(selectedContact.toString());
          Intent myAct3 = new Intent (Intent.ACTION_VIEW, Uri.parse(selectedContact));
          startActivity(myAct3);
        } else {
          label1.setText("Selection CANCELLED " + requestCode + " " + resultCode);
        }
       break;
     }
    }//switch
```

Primer povratne informacije



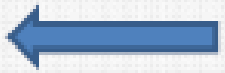
Primer povratne informacije

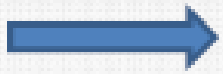


Prenos podataka između aktivnosti

- Komunikacija između aktivnosti je asinhrona, koriste se listener-i *(onActivityResult(...))*
- Intent opciono može da prenosi između aktivnosti imenovanu listu podataka **(bundle)**
- Bundle je kolekcija <type,value> parova sa odgovarajućim *get* i *set* metodama

```
Bundle myBundle = new Bundle();
myBundle.putDouble ("var1", 3.1415);
...
Double v1 = myBundle.getDouble("var1");
```



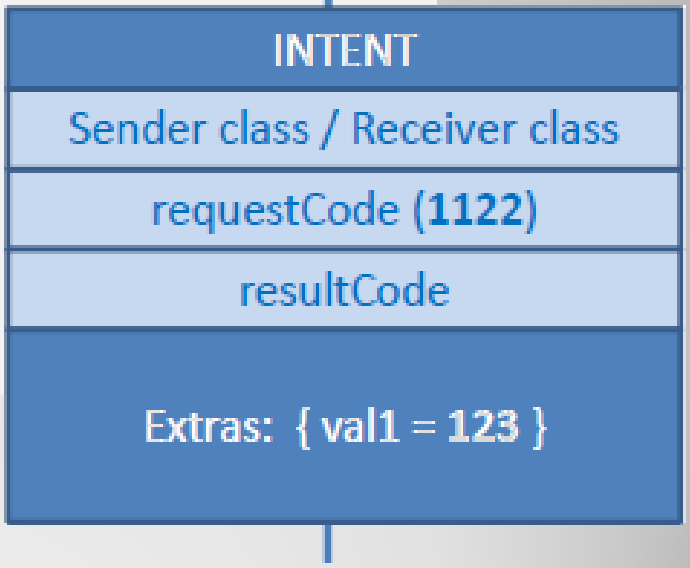


Prenos podataka između aktivnosti

- Intent-i i bundle

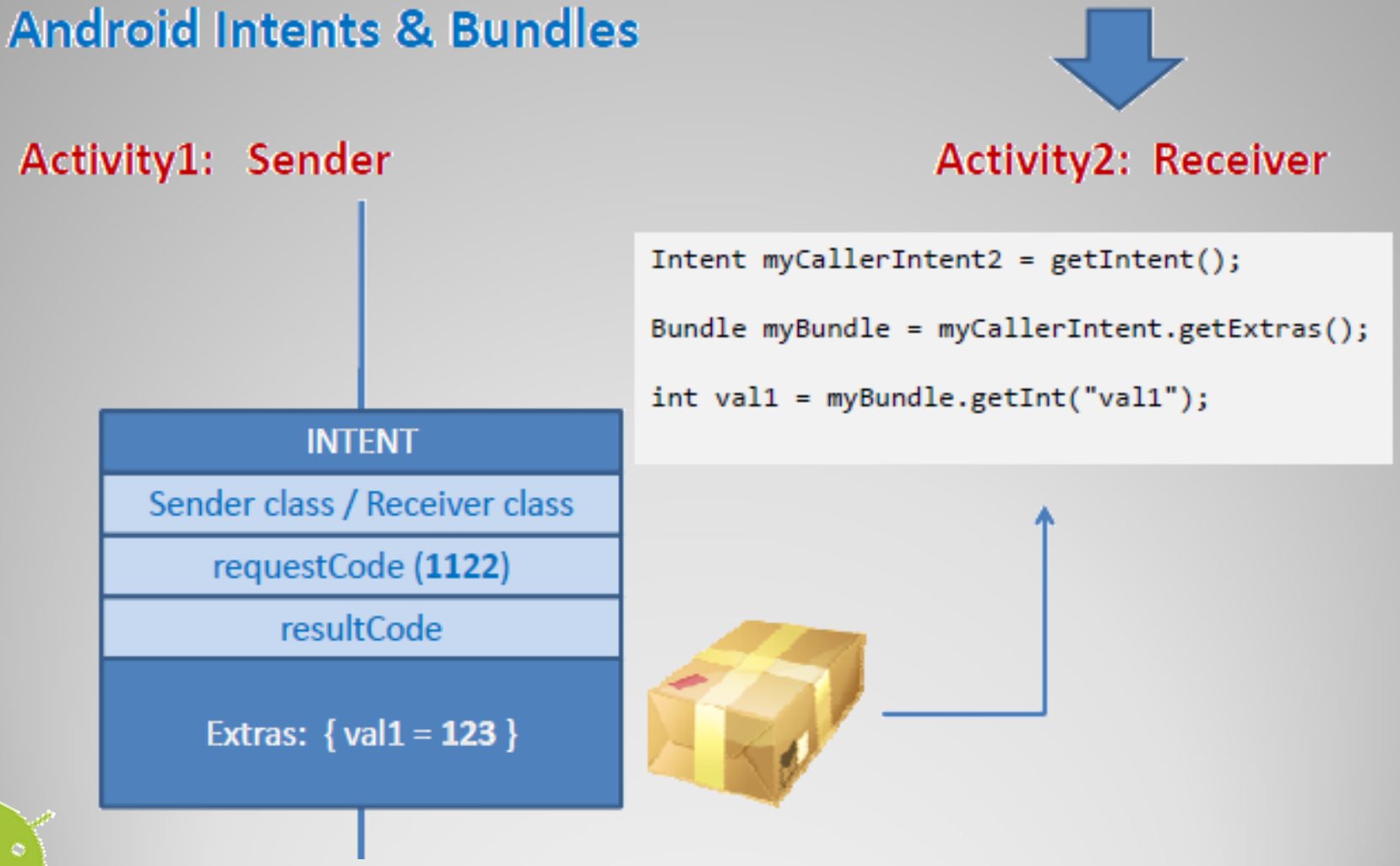
Activity1: Sender → **Activity2: Receiver**

```
Intent myIntentA1A2 = new Intent  (Activity1.this,
                                   Activity2.class);

Bundle myBundle1 = new Bundle();
myBundle1.putInt ("val1", 123);

myIntentA1A2.putExtras(myBundle1);

startActivityForResult(myIntentA1A2, 1122);
```



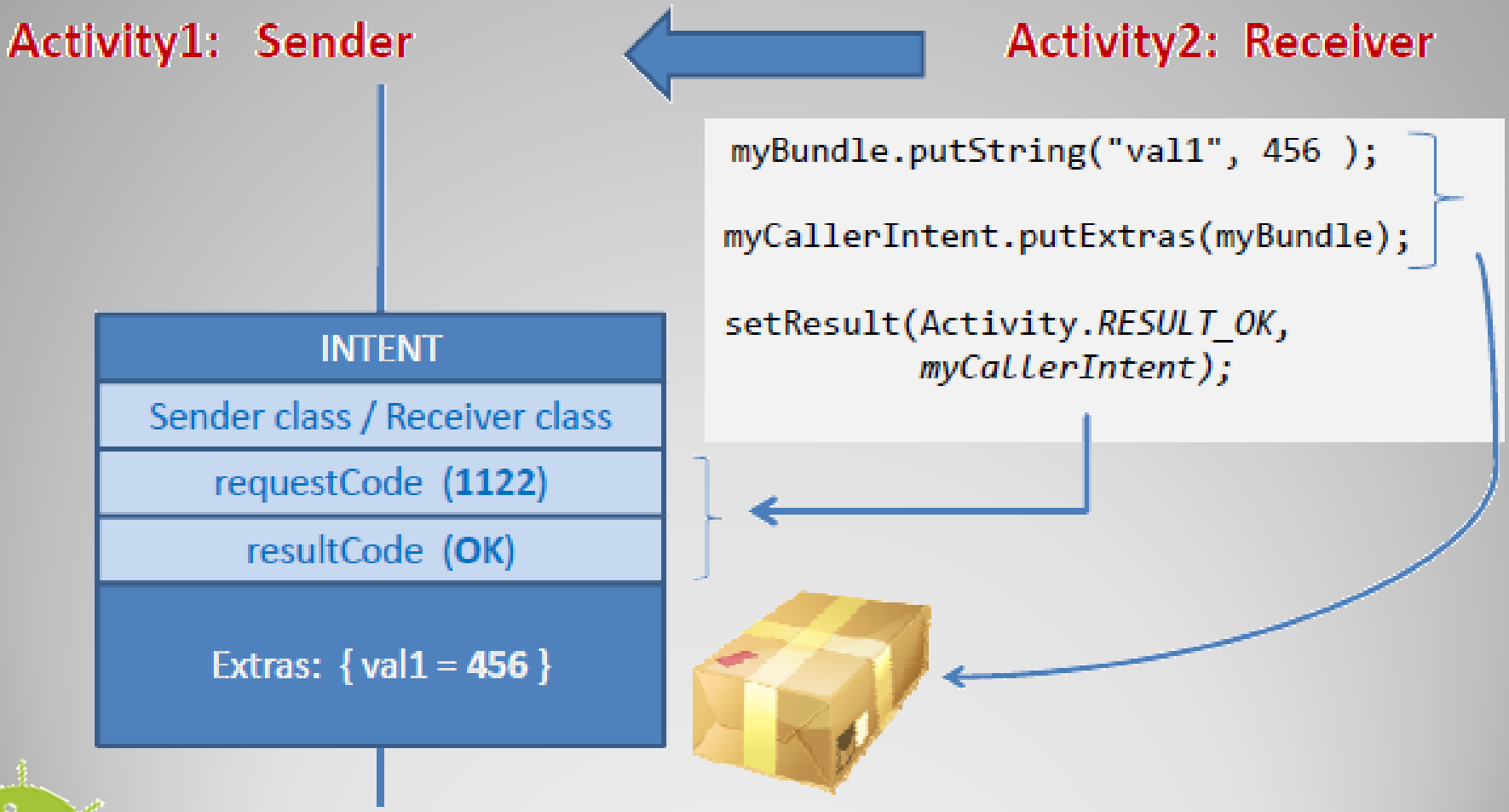
Prenos podataka između aktivnosti

- Intent-i i bundle



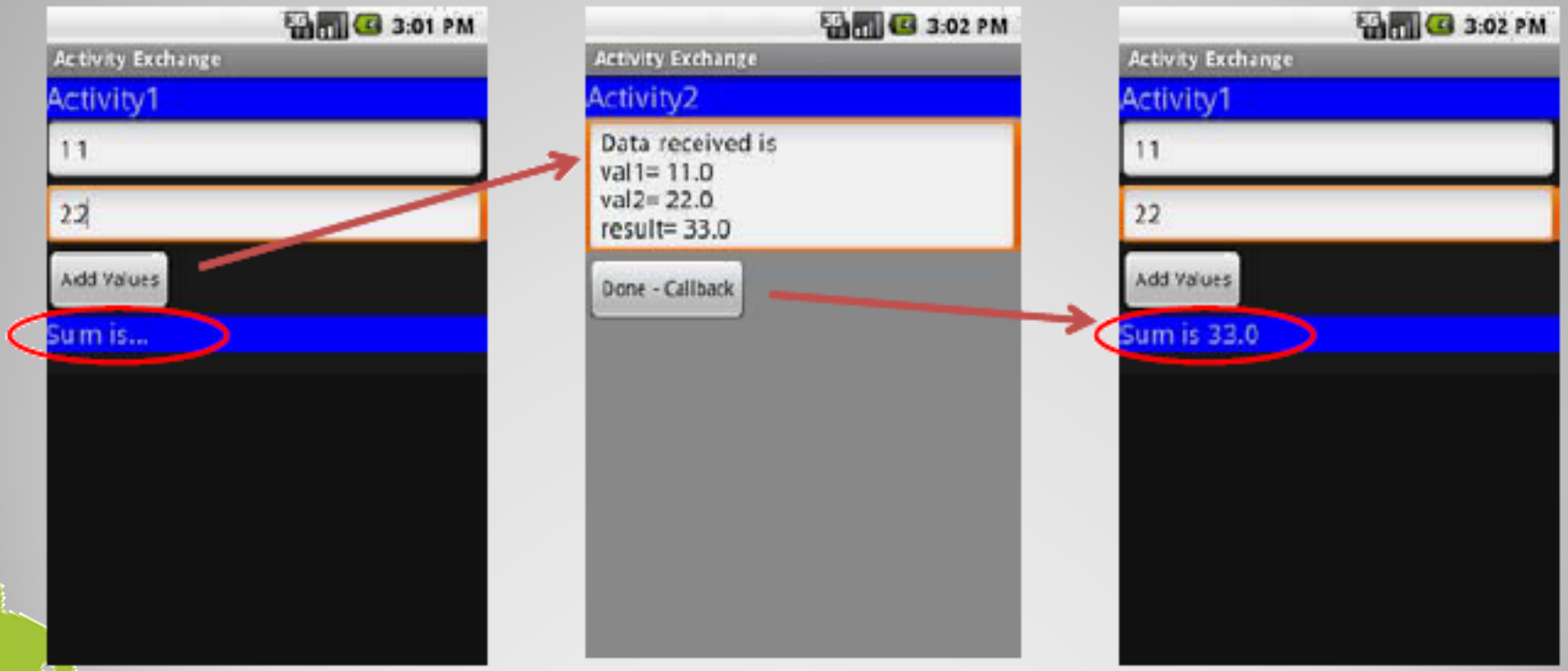
Prenos podataka između aktivnosti

- Povratne vrednosti



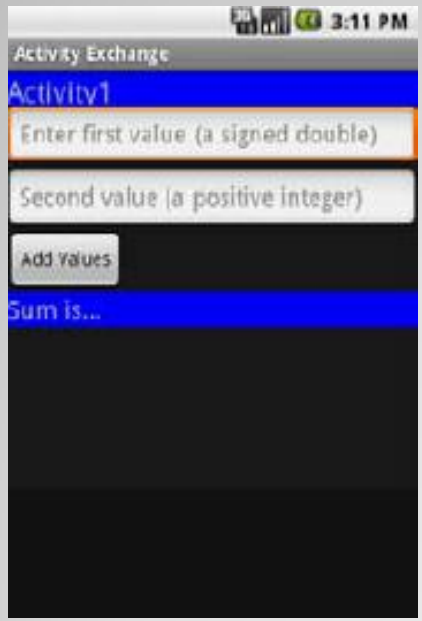
Primer razmene podataka

- Primer na prvoj aktivnosti prihvata dva uneta broja, prosleđuje ih drugoj aktivnosti koja ih sabira i rezultat vraća prvoj aktivnosti koja ga prikazuje



Primer razmene podataka

- Layout za prvu aktivnost
- Uočiti ograničenje *android:inputType*




```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
android:orientation="vertical"  android:layout_width="fill_parent"
android:layout_height="fill_parent" >
<TextView
        android:text="Activity1"
        android:textSize="22sp"
        android:background="#ff0000ff"
        android:layout_width="fill_parent"
        android:layout_height="wrap_content" />
<EditText
        android:hint="Enter first value (a signed double)"
        android:id="@+id/EditText01"
        android:layout_width="fill_parent"
        android:layout_height="wrap_content"
        android:inputType="numberDecimal|numberSigned|number" />
<EditText
        android:hint="Second value (a positive integer)"
        android:id="@+id/EditText02"
        android:layout_width="fill_parent"
        android:layout_height="wrap_content"
        android:inputType="number" />
<Button
        android:text="Add Values"
        android:id="@+id/btnAdd"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content" />
<TextView
        android:background="#ff0000ff"
        android:text="Sum is..."
        android:textSize="28sp"
        android:id="@+id/TextView01"
        android:layout_width="fill_parent"
        android:layout_height="wrap_content" />
</LinearLayout>
```

Primer razmene podataka

```
public class Activity1 extends Activity {
  EditText txtVal1;
  EditText txtVal2;
  TextView lblResult;
  Button btnAdd;

  @Override
  public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main1);
    txtVal1 = (EditText)findViewById(R.id.EditText01);
    txtVal2 = (EditText)findViewById(R.id.EditText02);
    lblResult = (TextView) findViewById(R.id.TextView01);
    btnAdd = (Button) findViewById(R.id.btnAdd);
    btnAdd.setOnClickListener(new OnClickListener() {
      @Override
      public void onClick(View v) {
      Double v1 = Double.parseDouble(txtVal1.getText().toString());
      Double v2 = Double.parseDouble(txtVal2.getText().toString());
      Intent myIntentA1A2 = new Intent (Activity1.this, Activity2.class);
      Bundle myData = new Bundle();
      myData.putDouble("val1", v1);
      myData.putDouble("val2", v2);
      myIntentA1A2.putExtras(myData);
      startActivityForResult(myIntentA1A2, 101);
    }
  });
}//onCreate
```

Primer razmene podataka

```
  @Override
  protected void onActivityResult(int requestCode, int resultCode, Intent data) {
    super.onActivityResult(requestCode, resultCode, data);
    try {
      if ((requestCode == 101 ) && (resultCode == Activity.RESULT_OK)){
        Bundle myResults = data.getExtras();
        Double vresult = myResults.getDouble("vresult");
        lblResult.setText("Sum is " + vresult);
      }
    } catch (Exception e) {
      lbl l (" bl " d " " l d)
      lblResult.setText("Problems - + requestCode + + resultCode);
    }
  }//onActivityResult
}//Activity1
```

- Klikom na dugme podaci se pakuju u bundle i šalju drugoj aktivnosti. Listner čeka rezultat iz druge aktivnosti.

Primer razmene podataka

- Druga aktivnost

```
public class Activity2 extends Activity implements OnClickListener{
  EditText dataReceived;
  Button btnDone;

  @Override
  protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.main2);
    dataReceived = (EditText) findViewById(R.id.etDataReceived);
    btnDone = (Button) findViewById(R.id.btnDone);
    btnDone.setOnClickListener(this);
    Intent myLocalIntent = getIntent();
    Bundle myBundle = myLocalIntent.getExtras();
    Double v1 = myBundle.getDouble("val1");
    Double v2 = myBundle.getDouble("val2");
    Double vResult = v1 + v2;
    dataReceived.setText("Data received is \n” + "val1= " + v1 + "\nval2= " + v2
          + "\n\nresult= " + vResult);
    myBundle.putDouble("vresult", vResult);
    myLocalIntent.putExtras(myBundle);
    setResult(Activity.RESULT_OK, myLocalIntent);
  }//onCreate
  @Override
  public void onClick(View v) {
    finish();
  }//onClick
}//Activity2
```

Primer razmene podataka

- Svaku aktivnost je OBAVEZNO dodati u manifest

```
<application android:icon="@drawable/icon" android:label="@string/app_name">
    <activity android:name=".Activity1"
              android:label="@string/app_name">
        <intent-filter>
            <action android:name="android.intent.action.MAIN" />
            <category android:name="android.intent.category.LAUNCHER" />
        </intent-filter>
    </activity>

    <activity
        android:name=".Activity2">
    </activity>

</application>
```

add

Bundle i kompleksni objekti

- Bundle klasa ima metode za rad sa elementarnim tipovima i nizovima
- Ako želimo da prosledimo složene klase postoje dva pristupa
  - Custom klase treba da implementira *Serializable* interfejs
  - Implementacijom *Parcelable* interfejsa
- Serijalizacija na Androidu ima problem sa performansama

Bundle i kompleksni objekti

```
import java.io.Serializable;

public class Person implements Serializable {
  private static final long serialVersionUID = 1L;
  private String firstName;
  private String lastName;

  public Person(String firstName, String lastName) {
    super();
    this.firstName = firstName;
    this.lastName = lastName;
  }

  public String getFullName() {
    return firstName + " " + lastName;
  }
}//Person
```

- Ovakvi objekti se dodaju u bundle metodom *putSerializable(key, object)*

```
Bundle myData = new Bundle();
. . .
Person p1 = new Person("Maria", "Macarena");
myData.putSerializable("person", p1);
// bind the Bundle and the Intent that talks to Activity2
myIntentA1A2.putExtras(myData);
startActivityForResult(myIntentA1A2, IPC_ID);
```

Bundle i kompleksni objekti

- Preuzimanje složenih objekata iz bundle-a

```
// create a local Intent handler – we have been called!
Intent myLocalIntent = getIntent();

//grab the data package with all the pieces sent to us
Bundle myBundle = myLocalIntent.getExtras();

//extract the individual data parts of the bundle
. . .
Person p (Person) myBundle getSerializable("person");

myBundle.String pval = p.getFullName();
. . .
```

Bundle i kompleksni objekti

- Korišćenje *Parcelable* interfejsa

```
import android.os.Parcel;
import android.os.Parcelable;

public class ObjectA implements Parcelable {
  private String strValue;
  private Integer intValue;

  public ObjectA() { ; };

  // Konstruktor objekta iz Parcel-a
  public ObjectA(Parcel in) {  readFromParcel(in);  }

  // Geteri i seteri
  public String getStrValue() {  return strValue;  }
  public void setStrValue(String strValue) { this.strValue = strValue; }
  public Integer getIntValue() { return intValue; }
  public void setIntValue(Integer intValue) { this.intValue = intValue; }

  @Override
  public int describeContents() { return 0; }

  @Override
  public void writeToParcel(Parcel dest, int flags) {
    // Podaci se u Parcel upisuju po FIFO principu
    dest.writeString(strValue);
    dest.writeInt(intValue);
  }
```

Bundle i kompleksni objekti

- Korišćenje *Parcelable* interfejsa

```
private void readFromParcel(Parcel in) {
  // Citamo istim redosledom kao pri upisu
  strValue = in.readString();
  intValue = in.readInt();
}

// Koristi Android framework za kreiranje novih objekata
public static final Parcelable.Creator CREATOR =
  new Parcelable.Creator() {
    public ObjectA createFromParcel(Parcel in) {
      return new ObjectA(in);
    }

    public ObjectA[] newArray(int size) {
      return new ObjectA[size];
    }
  };
}
```

- Šta ako imamo hijerarhiju objekata?

Bundle i kompleksni objekti

- Svi objekti u hijerarhiji moraju biti Parcelable

```
import android.os.Parcel;
import android.os.Parcelable;

public class ObjectB implements Parcelable {
  private ObjectA obj;
  private Long longVal;

  public ObjectB() { ; }
  public ObjectA getObj() { return obj; }

  public ObjectB(Parcel in) { readFromParcel(in); }

  public void setObj(ObjectA obj) { this.obj = obj; }
  public Long getLongVal() { return longVal; }
  public void setLongVal(Long longVal) { this.longVal = longVal; }

  @Override
  public int describeContents() { return 0; }

  @Override
  public void writeToParcel(Parcel dest, int flags) {
    // Prosleđujemo i flagove
    dest.writeParcelable(obj, flags);
    dest.writeLong(longVal);
  }
```

Bundle i kompleksni objekti

- Svi objekti u hijerarhiji moraju biti Parcelable

```
  private void readFromParcel(Parcel in) {
    obj = in.readParcelable(ObjectA.class.getClassLoader());
    longVal = in.readLong();
  }

  public static final Parcelable.Creator CREATOR =
          new Parcelable.Creator() {
            public ObjectB createFromParcel(Parcel in) {
                return new ObjectB(in);
            }

            public ObjectB[] newArray(int size) {
                return new ObjectB[size];
            }
        };
}
```

```
ObjectA obj = new ObjectA();

// Set values etc.

Intent i = new Intent(this, MyActivity.class);
i.putExtra("com.package.ObjectA", obj);

startActivity(i);
```

```
@Override
public void onCreate
            (Bundle savedInstanceState) {
  super.onCreate(savedInstanceState);
  Bundle b = getIntent().getExtras();
  ObjectA obj =
   b.getParcelable("com.package.ObjectA");
}
```