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CMSC436: Programming Handheld Systems
The Intent Class
Today’s Topics

The Intent Class

Starting Activities with Intents
  Explicit Activation
  Implicit Activation via Intent resolution
The Intent Class

A data structure that represents

An operation to be performed, or
An event that has occurred
Today’s Focus

Using Intents for operations to be performed

i.e., using an Intent to start a single Activity

We’ll cover using Intents for event notification when we talk about BroadcastReceivers
Intents Identify a Desired Operation

Intents provide a flexible “language” for specifying operations to be performed

  e.g., I want to pick a contact, take a photo, dial a phone number, etc.
Intents Identify a Desired Operation

An Intent is constructed by one component that wants some work done

It is delivered to another component that offers to perform that work
Intent Fields

Action  Component
Data    Extras
Category Flags
Type
Action

String representing the desired operation
Some Platform-Defined Intents Actions

ACTION_DIAL  – Dial a number
ACTION_EDIT  – Display data to edit
ACTION_SYNC  – Synchronize device data with a server
ACTION_MAIN  – Start as initial activity of app
Setting the Intent Action

val newIntent = Intent(Intent.ACTION_DIAL)

Or

val newIntent = Intent()
newIntent.action = Intent.ACTION_DIAL
Data

Data associated with the Intent

Formatted as a Uniform Resource Identifier (URI)
Examples

Data to view on a map

Uri.parse("geo:0,0?q=1600+Pennsylvania +Ave+Washington+DC")

Number to dial in the phone dialer

Uri.parse("tel:+15555555555")
Setting Intent Data

val intent = Intent (Intent.ACTION_DIAL,
    Uri.parse("tel:+15555555555"))

Or

val intent = Intent(Intent.ACTION_DIAL)
intent.data = Uri.parse("tel:+15555555555")
Category

Additional information about the components that are allowed to handle the Intent
Examples

CATEGORY_BROWSABLE – Activity can be invoked to display data referenced by a URI

CATEGORY_LAUNCHER – can be the initial Activity of a task and is listed in top-level app launcher
Type

Specifies an explicit MIME type of the Intent data

Examples

image/*, image/png, image/jpeg

text/html, text/plain

If unspecified, Android will infer the type
Component

The component that should receive this Intent

Use this when there’s exactly one named component that should receive the intent
Setting the component

val intent = Intent(packageContext: Context!, cls: Class<*>!)
Setting the component

Or

Intent intent = new Intent ();

and one of:

setComponent(), setClass(), or setClassName()
Extra

Additional information associated with Intent
Treated as a map (key-value pairs)
Intent.EXTRA_EMAIL: Email Recipient List

val intent = Intent(Intent.ACTION_SEND)
intent.putExtra(Intent.EXTRA_EMAIL,
    arrayOf("aporter@cs.umd.edu",
            "ceo@microsoft.com",
            "potus@whitehouse.gov",
            "mozart@musician.org"))
Setting the Extra Attribute

Several forms depending on data type

```java
putExtra(name: String!, value: String?);
putExtra(name: String!, value: FloatArray?);
...
```
Flags

Specify additional information on how Intent should be handled
Examples

FLAG_ACTIVITY_NO_HISTORY
  Don’t put this Activity in the Task backstack

FLAG_DEBUG_LOG_RESOLUTION
  Print extra logging information when this Intent is processed
Setting Flags

```kotlin
val intent = Intent(Intent.ACTION_SEND)
intent.flags = Intent.FLAG_ACTIVITY_NO_HISTORY
```
Starting an Activity with an Intent

fun startActivity(intent: Intent!): Unit
The Target Activity

Can be named *explicitly* by setting the Intent’s component

Otherwise, it is determined *implicitly*
Explicit Activation

Intent specifies the target Activity

Android starts the target Activity on startActivity() call

Consider an app that has two activities

   LoginActivity checks username & password and then explicitly activates HelloAndroidActivity

   HelloAndroidActivity shows “Hello username” message

Note: More modern Android code will use two Fragments rather than two Activities for this use case. See HelloAndroidWithLoginFragment (will revisit in later classes)
HelloAndroid
WithLogin

Hello aporter!
Implicit Activation

When the Activity to be started is not explicitly named, Android tries to find Activities that match the information contained in the Intent.

This process is called Intent Resolution.
Intent Resolution Process

IntentFilters describe which operations a given Activity can handle

IntentFilters can be specified in AndroidManifest.xml or programmatically

Intents describe desired operations

Android matches Intents with IntentFilters to determine which Activities can handle a given Intent
Intent Resolution Criteria

Action

Type and Data

Categories
Intent Resolution Filters: Action

If the action specified in the Intent matches one action listed in the filter, the intent passes.

If the filter has no actions, the intent fails.

If the Intent has no action, but the filter contains at least one action, the Intent passes.
Intent Resolution Filters: Category

If every category in the Intent matches a category in the filter, it passes

The reverse is not necessary
Intent Resolution Criteria: Type and Data

Each part of the URI is a separate attribute: scheme, host, port, and path.

Attributes have sequential dependencies.

The URI in an intent is only compared to attributes included in the filter.
Intent Resolution Criteria: Type and Data

An intent without a URI and a MIME type only passes if the filter does not specify any URIs or MIME types.

An intent with a URI but no MIME type passes only if its URI matches the filter's URI and the filter doesn't specify a MIME type.

An intent that contains a MIME type but not a URI passes the test only if the filter lists the same MIME type and does not specify a URI format.

An intent with both a URI and a MIME type passes the MIME type test only if that type matches a type listed in the filter. It passes the URI test either if its URI matches a filter URI or if it has a content: or file: URI and the filter does not specify a URI.
Specifying IntentFilters

<activity ...>
...
<intent-filter ...>
...
    <action android:name="actionName" />
...
</intent-filter>
...
</activity>
Handling Intent.ACTION_DIAL

<activity ...
...
</intent-filter>
...
</intent-filter>
...
</activity>
Adding Data to IntentFilter

<intent-filter ...>
    ...
    <data
        android:mimeType="string"
        android:scheme="string"
        android:host="string"
        android:port="string"
        android:path="string"
        android:pathPattern="string"
        android:pathPrefix="string"
    />
    ...
</intent-filter>
Handling Intents with geo Scheme

<intent-filter ...>
  ...
  <data android:scheme="geo" />
  ...
</intent-filter>
Adding a Category to an IntentFilter

<intent-filter ...>
  ...
  <category android:name="string" />
  ...
</intent-filter>
Example: Google Maps Application

<intent-filter ...>
  <action android:name ="android.intent.action.VIEW" />
  <category android:name ="android.intent.category.DEFAULT" />
  <category android:name="android.intent.category.BROWSABLE"/>
  <data android:scheme ="geo"/>
</intent-filter>
Receiving Implicit Intents

Note: to receive implicit intents an Activity should specify an IntentFilter that includes the following category

"android.intent.category.DEFAULT"
Priority

android:priority – Priority given to the parent component when handling matching Intents

Causes Android to prefer one activity over another

-1000 <= priority <=1000

Higher values represent higher priorities
Using Implicit Intents

The MapLocation app created an implicit Intent and then used it in a call to `startActivity()`

The goal is to start a Maps app

What if the user has uninstalled all Maps apps?

Your code should always check before attempting to start an Activity with an implicit Intent

You may need to specify information about 3rd party apps you want to start implicitly

See: https://developer.android.com/training/package-visibility
MapLocation

1600 Pennsylvania Avenue NW Washington
SHOW MAP

The White House
The White House
South Lawn
Less busy than usual
Using Implicit Intents

Implicit Intents can pose security hazards

Prefer explicit Intents when possible

   Can use Fragments for intra-app use cases

Set the android:exported attribute to false in AndroidManifest.xml, if you don’t want other apps to start a given component in your app
Investigate Intent Filters

% adb shell dumpsys package
Next

Permissions
Example Applications

HelloAndroidWithLogin
MapLocation