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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

```
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

```
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

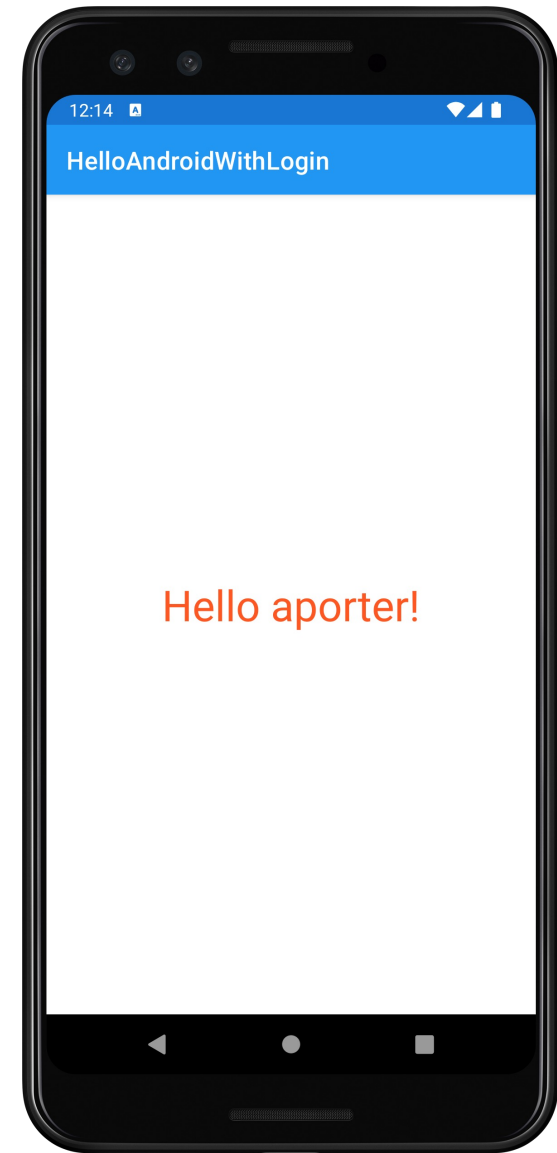
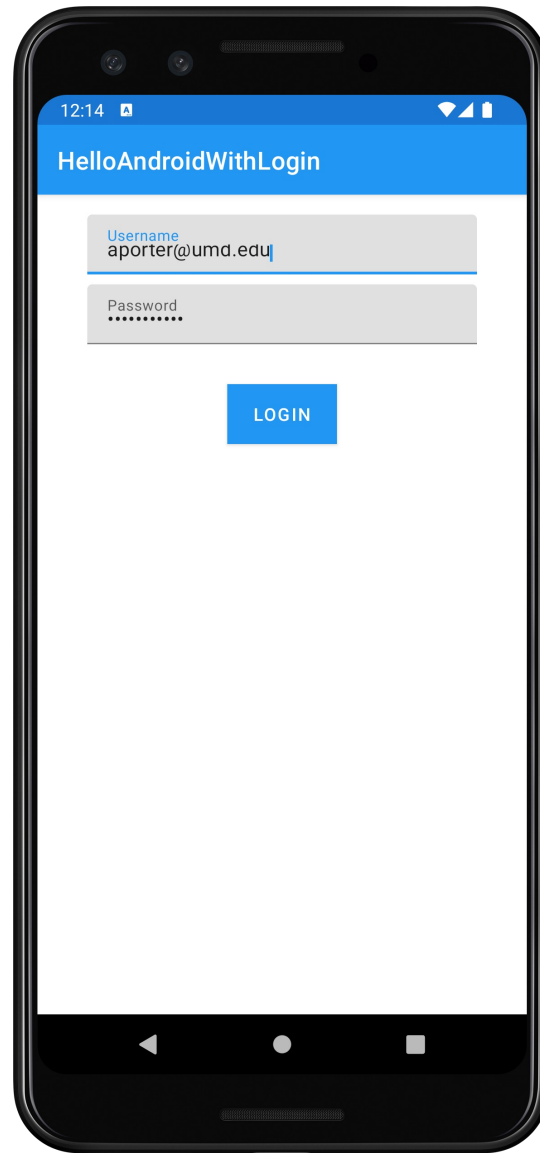
Consider an app that has two activities

- 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



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 ...>
```

```
...
```

```
<action android:name="android.intent.action.DIAL" />
```

```
...
```

```
</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

$-1000 \leq \text{priority} \leq 1000$

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

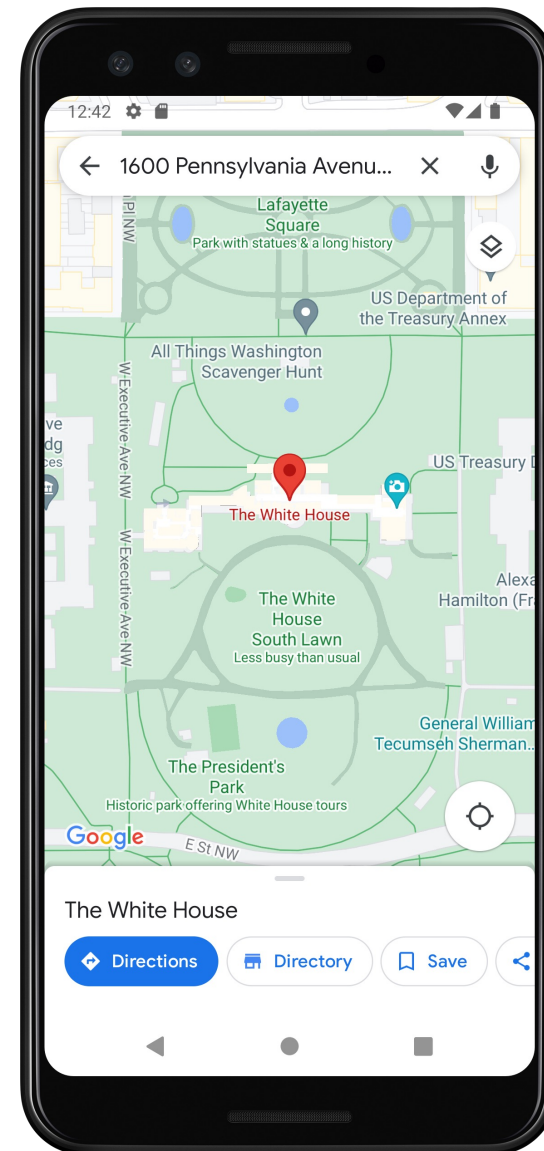
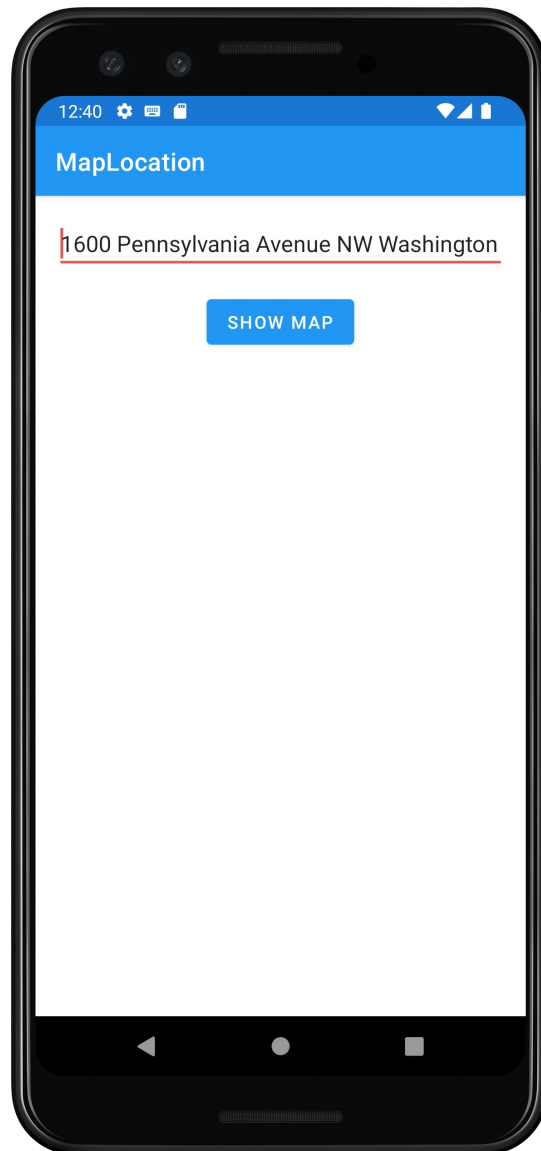
What if the user has uninstalled all Maps apps?

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



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
```

```
1761a23 com.google.android.gm/.Gmail2PreferenceActivity
comgooglewallet:
  551fb20 com.google.android.gms/.tapandpay.tokenization.AddNewCardThroughBrowserActivity
:
  4b70c8a com.google.android.apps.photos/.pager.HostPhotoPagerActivity
  b0349a9 com.google.android.calendar/.ICalLauncher (4 filters)
geo:
  b1dd765 com.google.android.apps.maps/com.google.android.maps.MapsActivity
mms:
  92bdcd9 com.google.android.talk/com.google.android.apps.hangouts.phone.BabelHomeActivity
  d06357f com.example.android.apis/.os.MmsMessagingDemo
  dcd569e com.google.android.apps.messaging/.ui.conversation.LaunchConversationActivity
sip:
  12d683 com.android.phone/.PrivilegedOutgoingCallBroadcaster
  1b37000 com.android.server.telecom/.components.UserCallActivity
  586e039 com.android.server.telecom/.PrivilegedCallActivity
  647ad3d com.android.phone/.OutgoingCallBroadcaster
  7d5067e com.android.server.telecom/.EmergencyCallActivity
  d7b8932 com.android.phone/.EmergencyOutgoingCallBroadcaster
sms:
  73ac3a com.android.fallback/.Fallback
  92bdcd9 com.google.android.talk/com.google.android.apps.hangouts.phone.BabelHomeActivity
  dcd569e com.google.android.apps.messaging/.ui.conversation.LaunchConversationActivity
  f2ba94c com.example.android.apis/.os.SmsMessagingDemo
tel:
  12d683 com.android.phone/.PrivilegedOutgoingCallBroadcaster
  1b37000 com.android.server.telecom/.components.UserCallActivity
```

```
-uu-:---F1 dumpsys.out.txt 4% L592 (Text Isearch)-----
```

```
I-search: geo
```

Next

Permissions

Example Applications

HelloAndroidWithLogin

MapLocation