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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

Data

Category

Type

Component

Extras

Flags

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

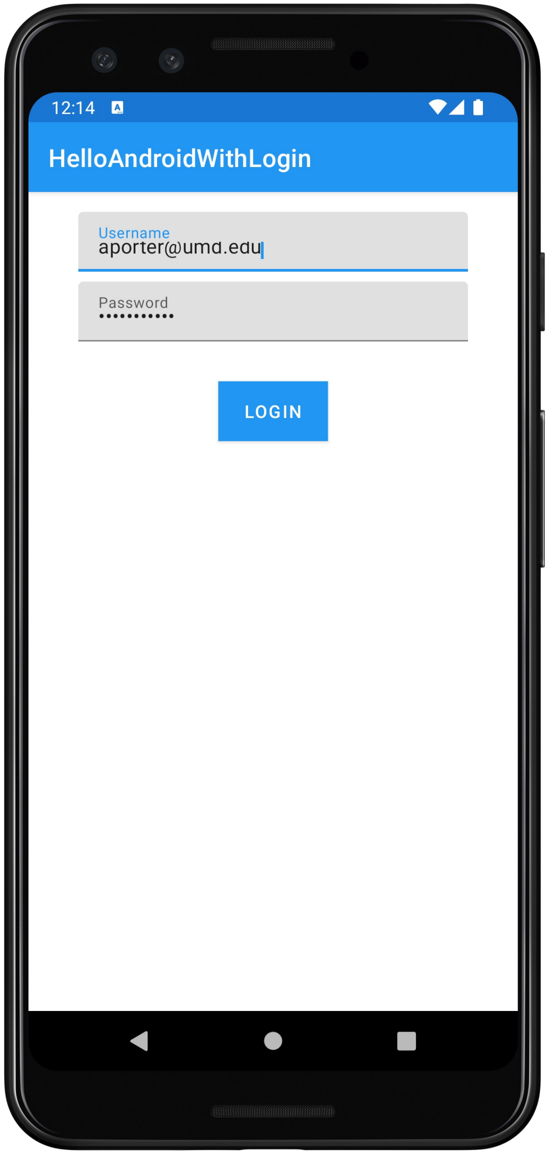
Android starts the target Activity on startActivity() call

Consider an app that has two activities

- LoginActivity checks username & password and then explicitly activates HelloAndroidActivity
- HelloAndroidActivity shows “Hello username” message

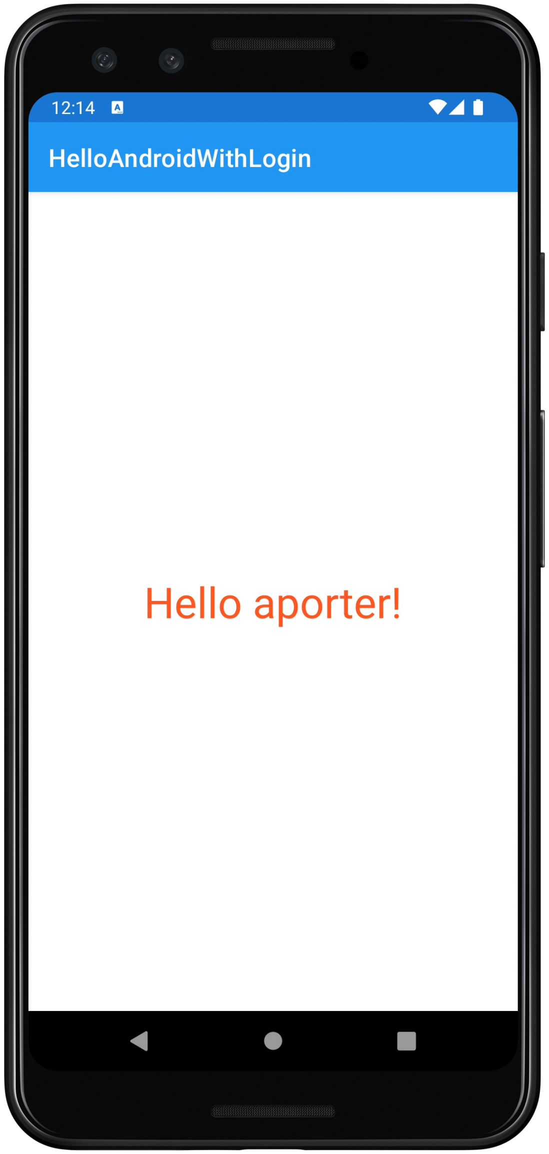
Note: More modern Android code will use two Fragments rather than two Activities for this use case. See HelloAndroidWithLoginFragment (will revisit in later classes)

HelloAndroid WithLogin



Username
aporter@umd.edu

Password
•••••••••••



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 …>
      …
      <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 <= 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()

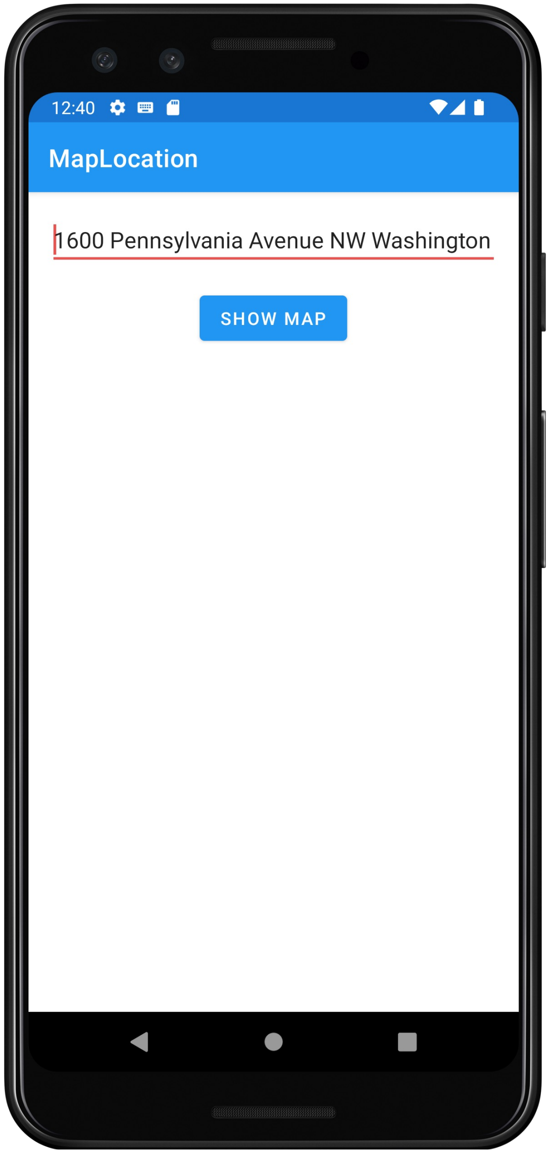
- The goal is to start a Maps app

What if the user has uninstalled all Maps apps?

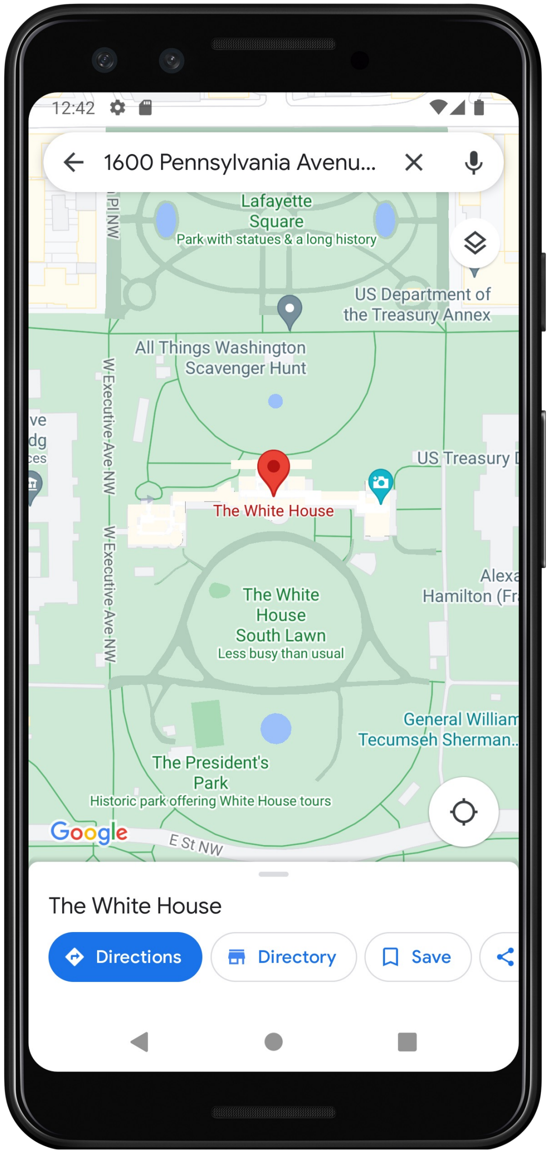
Your code should always check before attempting to start an Activity with an implicit Intent

See MapLocation app for example

MapLocation



1600 Pennsylvania Avenue NW Washington


12:42
Lafayette Square
Park with statues & a long history
US Department of the Treasury Annex
All Things Washington Scavenger Hunt
W-Executive-Ave-NW
US Treasury
The White House
Alexa Hamilton (Fr
The White House South Lawn
Less busy than usual
General William Tecumseh Sherman...
The President's Park
Historic park offering White House tours
Google
E St NW
Directions
Directory
Save

1600 Pennsylvania Avenu...

The White House

Using Implicit Intents

Implicit Intents can pose security hazards

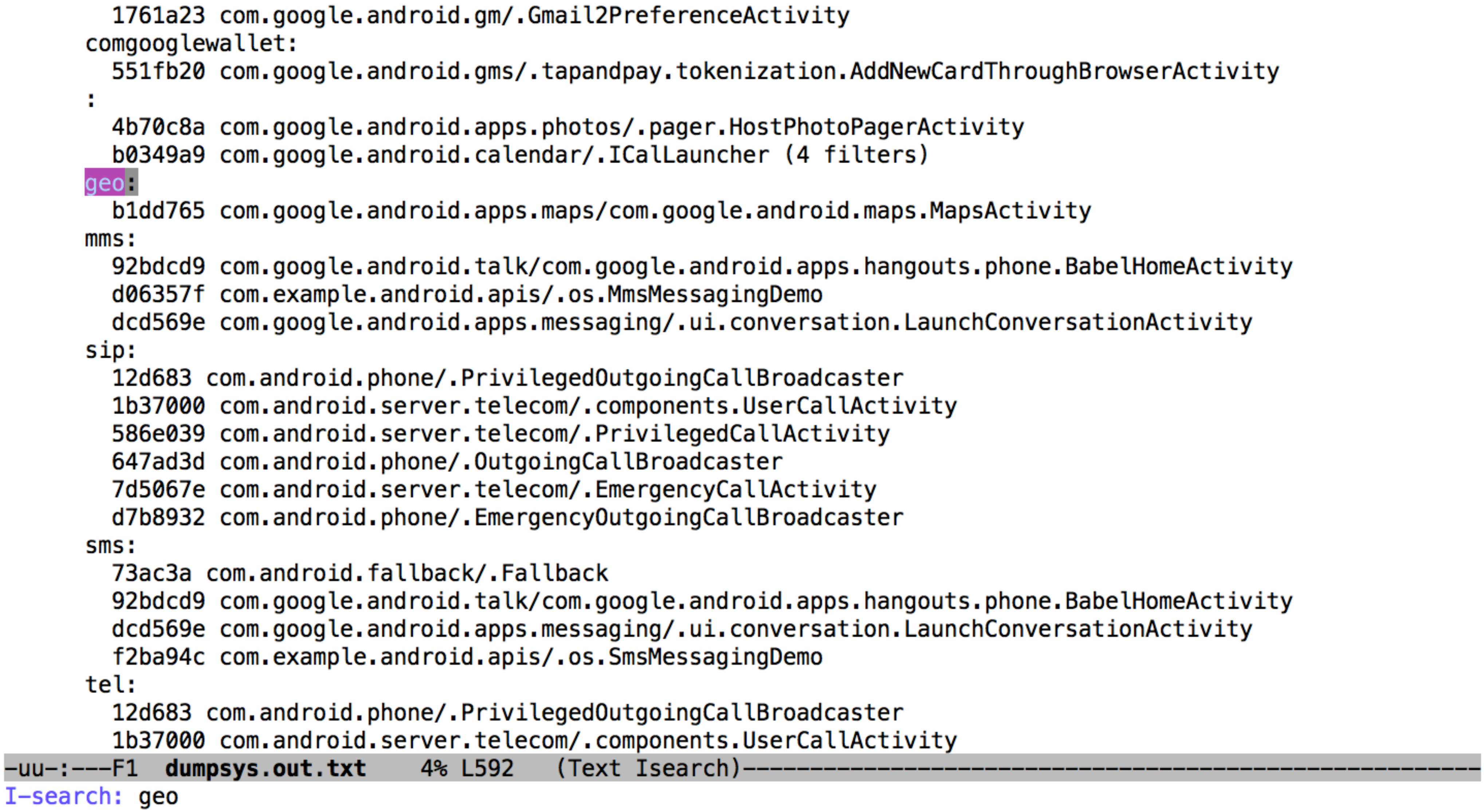
Prefer explicit Intents when possible

- 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

MapLocation