crashlytics

Advanced Techniques for Developing Powerful, Yet Lightweight Android SDKs

Andrea Falcone
Engineer

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SAMSUNG
SDK

yelp
TOUT
box
HBO GO
500
Bb
NEW

AT&T
4:22 PM
shopkick
Redeem your rewards
Collect
4:22 PM
Jumeirah Carlton Tower
Location
9 Reviews
Book Now
10:42 AM
Path
1:08 PM
Arrived in San Francisco
Listening to Beautiful Day by U2
11:45 AM
groupme
Family
Brunch Club
Start a Group
Ask a Question
Send a Direct Message
College Buddies
11:43 AM
Ciara
Basic Instinct
Ride

crashlytics

Issues 22

Support

App Name 2.0.1

CRASH # 232,352,532

ISSUE #89,232

89,231 / 235,352

DemoFileManager.m Line 25

processingLoop + 1095

device

DEVICE iPhone 4s

PROXIMITY On

BATTERY 90%

LOCATION N/A

ORIENTATION Landsc.

CHARGING Yes

43% 57% FREE RAM 43%

90% 10% FREE SPACE 25%

iOS VERSION iOS 5.0

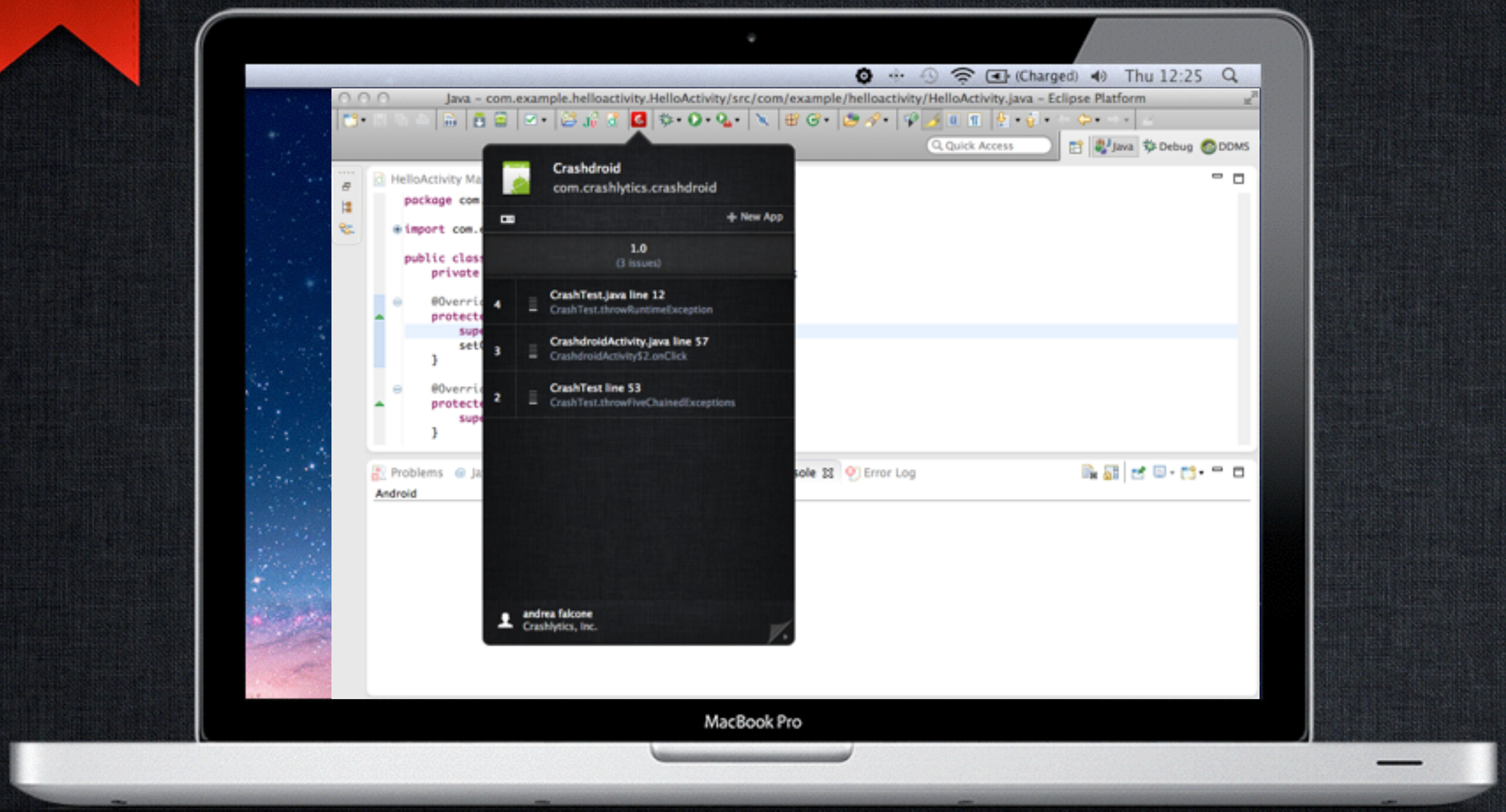
JAILBREAK Yes

UI ORIENTATION Vertical

WIFI NETWORK N/A

PROCESSES 006

operating system


(Charged)
Thu 12:25
Java - com.example.helloactivity.HelloActivity/src/com/example/helloactivity/HelloActivity.java - Eclipse Platform
Quick Access
Java
Debug
DDMS
Crashdroid
com.crashlytics.crashdroid
New App
1.0
(3 issues)
4
CrashTest.java line 12
CrashTest.throwRuntimeException
3
CrashdroidActivity.java line 57
CrashdroidActivity$2.onClick
2
CrashTest line 53
CrashTest.throwFiveChainedExceptions
andrea falcone
Crashlytics, Inc.
Problems
Android
Error Log
MacBook Pro

SAMSUNG
SDK

Powerful

Lightweight

Let’s build an SDK!

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Getting Started

```
public class SDK {

    public static void start(Activity activity) {
          ...
    }
}
```


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Getting Started: Load API Key

```
public class SDK {

    private static final String API_KEY = "com.andevcon.ApiKey";

    public static void start(Activity activity) {

     Context ac = activity.getApplicationContext();
         ApplicationInfo ai =
         ac.getPackageManager().getApplicationInfo(ac.getPackageName(),PackageManager.GET_META_DATA);
         String apiKey = ai.metaData.getString(API_KEY);

        SDK.getInstance().initializeWithAPIKey(apiKey, activity);
    }
}
```


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Getting Started: Building

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Getting Started: Building

```
# use javac to compile .java into .classes
> javac -target 1.6 -g -sourcepath ... -classpath ... files
```


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Getting Started: Building

```
# use javac to compile .java into .classes
> javac -target 1.6 -g -sourcepath ... -classpath ... files

# jar the classes into the given file using the manifest
> jar cfm classes #{sdk_jar_debug} manifest.xml
```


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Getting Started: Building

```
# use javac to compile .java into .classes
> javac -target 1.6 -g -sourcepath ... -classpath ... files

# jar the classes into the given file using the manifest
> jar cfm classes #{sdk_jar_debug} manifest.xml

# proguard that jar to protect your IP
> java -jar #{proguard_jar} @#{proguard_config} -libraryjars
#{android_jar} -injars #{sdk_jar_debug} -outjars #{sdk_jar}
```


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Getting Started: Building

```
# use javac to compile .java into .classes
> javac -target 1.6 -g -sourcepath ... -classpath ... files

# jar the classes into the given file using the manifest
> jar cfm classes #{sdk_jar_debug} manifest.xml

# proguard that jar to protect your IP
> java -jar #{proguard_jar} @#{proguard_config} -libraryjars
#{android_jar} -injars #{sdk_jar_debug} -outjars #{sdk_jar}

# sign your jar
> jarsigner -keystore ... -storepass ... -keypass ...
#{sdk_jar} alias
```


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Getting Started: Building

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Using the SDK: Initialize

```
public class MainActivity extends Activity {

    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);



        setContentView(R.layout.activity_main);
    }
}
```


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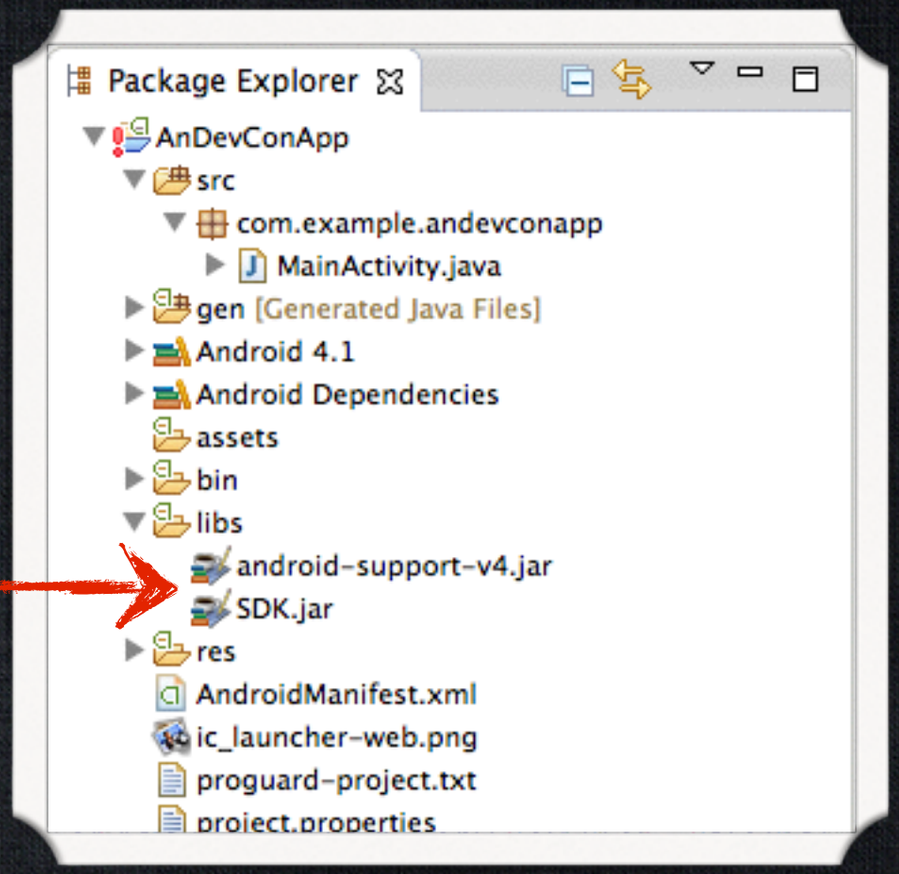
Using the SDK: Add



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Using the SDK: Maven

```
mvn install:install-file -Dfile=PATH_TO_sdk.jar -DgroupId=com.andevcon
-DartifactId=sdk -Dversion=1.0 -Dpackaging=jar
```

```
<dependency>
        <groupId>com.andevcon</groupId>
        <artifactId>SDK</artifactId>
        <version>1.0</version>
</dependency>
```


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Using the SDK: Maven

```
<repositories>
    <repository>
      <id>SDK-repo</id>
      <url>http:/yourSDKrepo.com</url>
    </repository>
  </repositories>

  <dependency>
        <groupId>com.andevcon</groupId>
        <artifactId>SDK</artifactId>
        <version>1.0</version>
  </dependency>
```


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Powerful

Stability

Add value.
Dont take
it away!

Stability: Catch all Exceptions

```
try {

  } catch (Exception e){

  }
```


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Stability: Debug Mode

```
public class SDK {

   private static final String API_KEY = "com.andevcon.ApiKey";
   private static String tag = "AnDevCon";
   private static boolean _debugMode;

   public static void start(Activity activity) {
       ...
       String apiKey = bundle.getString(API_KEY);

       if (_debugMode && (apiKey == null || apiKey.length() == 0)){
          throw new IllegalArgumentException("apiKey cannot be null!");
       }

       SDK.getInstance().initializeWithAPIKey(apiKey, activity);
   }

   public void setDebugMode(boolean debugMode){
   _debugMode = debugMode;
   }
}
```


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Stability: Release Frequency

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Testability

Testability: Unit Tests

```
> adb shell am instrument -w com.andevcon/
android.test.InstrumentationTestRunner > results.txt
```

```
com.andevcon.android.SDKListenerTest:....
com.andevcon.android.SDKTest:..........
com.andevcon.android.UtilsTest:............
Test results for InstrumentationTestRunner=.................................
Time: 44.579

OK (35 tests)
```


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Testability: Wait for the Emulator

```
puts "starting #{avd_location}"
cmd = "emulator -cpu-delay 0"
cmd << " -no-boot-anim" # boot faster
cmd << " -no-window"    # save some resources on the CI box.
cmd << " -avd emulator.avd"
Thread.new { system(cmd) }
```


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Testability: Wait for the Emulator

```
puts "starting #{avd_location}"
cmd = "emulator -cpu-delay 0"
cmd << " -no-boot-anim" # boot faster
cmd << " -no-window"    # save some resources on the CI box.
cmd << " -avd emulator.avd"
Thread.new { system(cmd) }
puts "Waiting for emulator..."
waitingresults = 'error'
while waitingresults =~ /error/ do
    sleep 5
    waitingresults = sh "adb -e wait-for-device"
end
```


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Testability: Wait for the Emulator

```
puts "starting #{avd_location}"
cmd = "emulator -cpu-delay 0"
cmd << " -no-boot-anim" # boot faster
cmd << " -no-window"    # save some resources on the CI box.
cmd << " -avd emulator.avd"
Thread.new { system(cmd) }
puts "Waiting for emulator..."
waitingresults = 'error'
while waitingresults =~ /error/ do
     sleep 5
     waitingresults = sh "adb -e wait-for-device"
end
startedWaitingtime = Time.now
while ( Time.now - startedWaitingtime < 180 )
     sleep 5
     waitingresults = IO.popen("adb -e shell ps")
     emustarted = false
     waitingresults.each do |thisline|
          emustarted = true if thisline =~ /android\.process\.acore/
     end
     if (emustarted)
          break
     end
end
```


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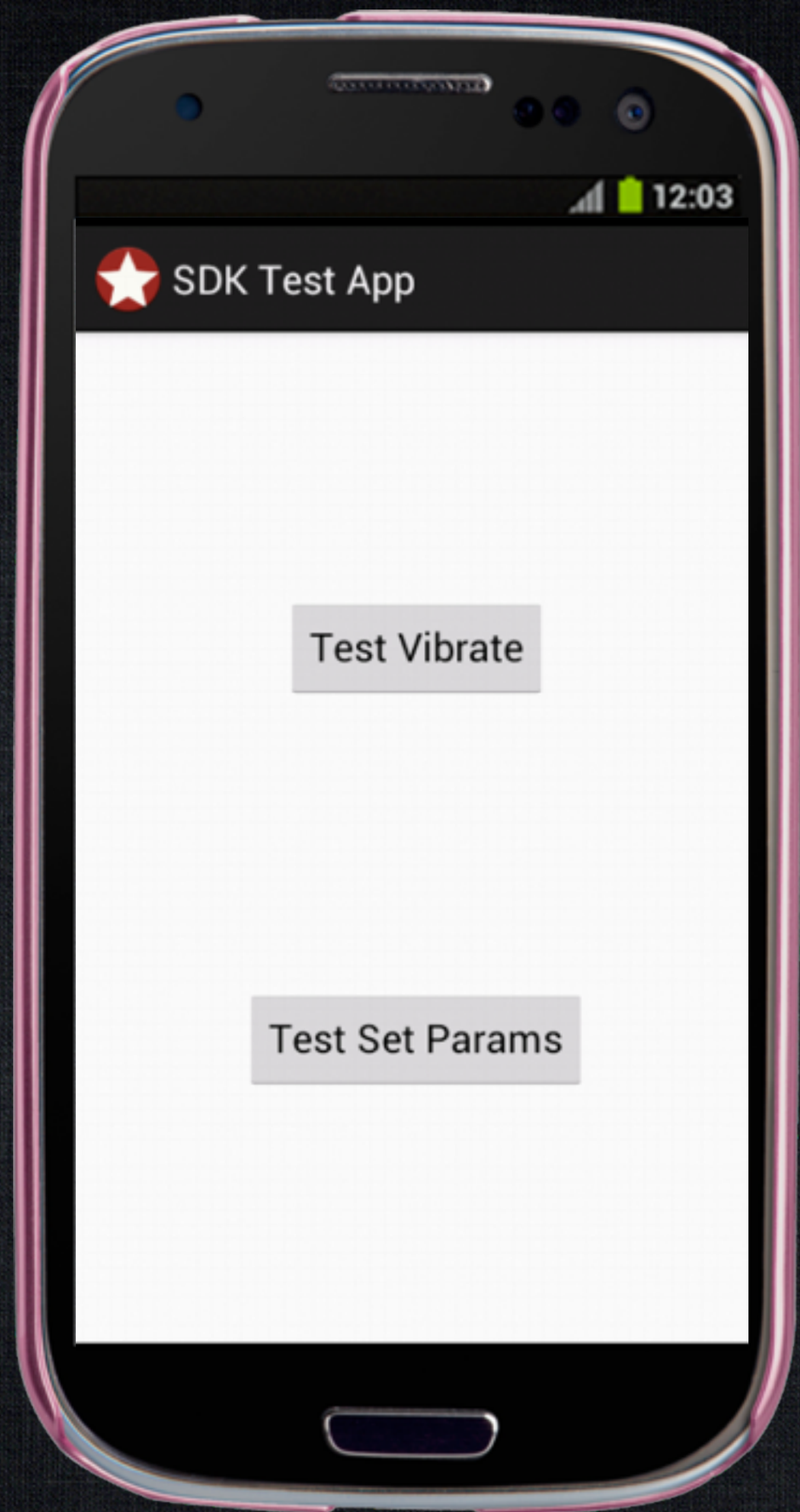
12:03
SDK Test App
Test Vibrate
Test Set Params

Ease of Integration

```
com.andevcon.SDK.start(this);
```

Ease of Integration: API Keys

```
<manifest ...
    package="com.andevcon.SDK" >
  <application ... >
    ...
    <meta-data android:value="11235813213455" android:name="com.andevcon.ApiKey"></meta-data>
  </application>
</manifest>
```


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Ease of Integration: API Keys

```
<manifest ...
    package="com.andevcon.SDK" >
  <application ... >
    ...
    <meta-data android:value="@string/ApiKey" android:name="com.andevcon.ApiKey"></meta-data>
  </application>
</manifest>
```


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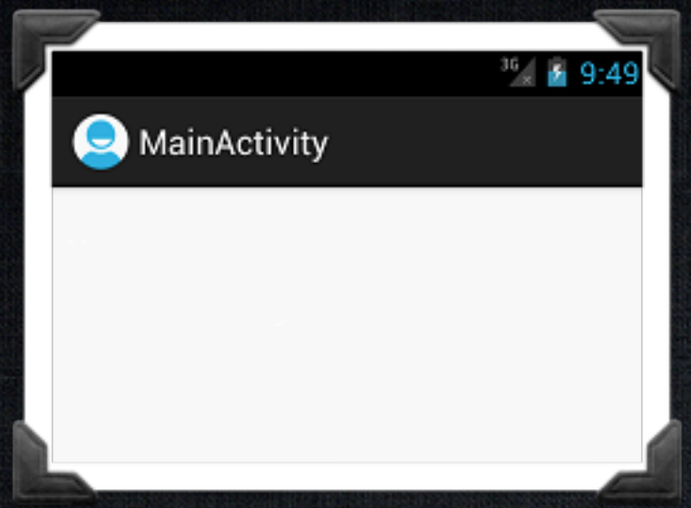
Support all Application Types




```
package com.example.andevcon;

import android.app.Service;

public class MyService extends Service {

}
```

Support All Application Types

```
public class SDK {

    ...

    public static void start(Activity activity) {
        ApplicationInfo ai = null;
         try {
             Context ac = activity.getApplicationContext();
             ai = ac.getPackageManager().getApplicationInfo(ac.getPackageName(),
             PackageManager.GET_META_DATA);
         } catch (NameNotFoundException e) {
             Log.d(tag, "Could not get ApiKey");
             return;
         }

        Bundle bundle = ai.metaData;
        String apiKey = bundle.getString(API_KEY);

        SDK.getInstance().initializeWithAPIKey(apiKey, activity);
    }

    private void initializeWithAPIKey(String apiKey, Activity activity) {
         ...
   }
}
```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Support All Application Types

```
public class SDK {

    ...

    public static void start(Context context) {
        ApplicationInfo ai = null;
         try {
             Context ac = context.getApplicationContext();
             ai = ac.getPackageManager().getApplicationInfo(ac.getPackageName(),
             PackageManager.GET_META_DATA);
         } catch (NameNotFoundException e) {
             Log.d(tag, "Could not get ApiKey");
             return;
         }

        Bundle bundle = ai.metaData;
        String apiKey = bundle.getString(API_KEY);

        SDK.getInstance().initializeWithAPIKey(apiKey, context);
    }

    private void initializeWithAPIKey(String apiKey, Context context) {
         ...
    }
}
```


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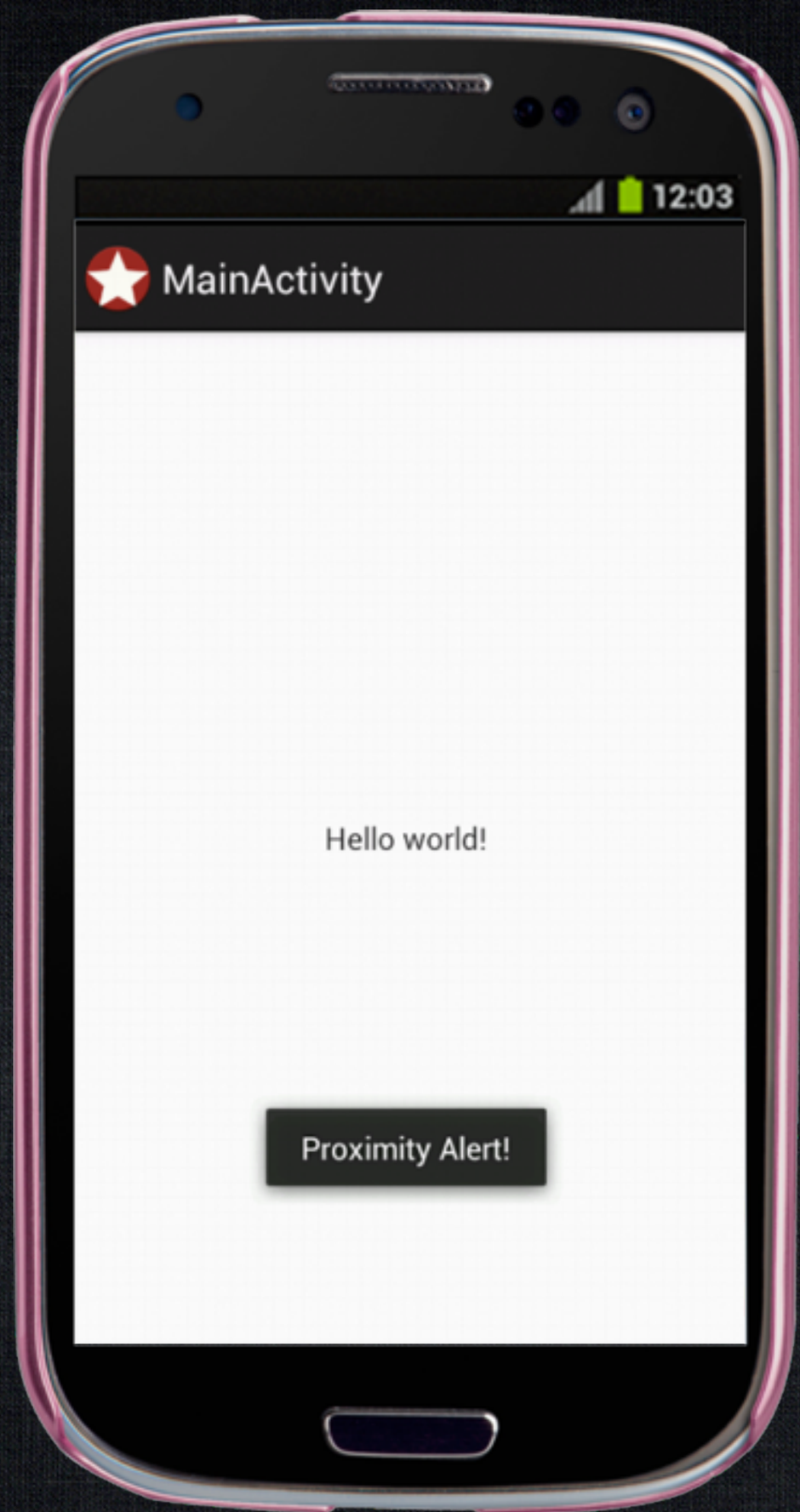
12:03
MainActivity
Hello world!
Proximity Alert!

Support All Application Types

```
private void showToast() {
    CharSequence text = "Proximity Alert!";
    int duration = Toast.LENGTH_SHORT;
    Toast toast = Toast.makeText(_appContext, text, duration);
    toast.show();
}
```


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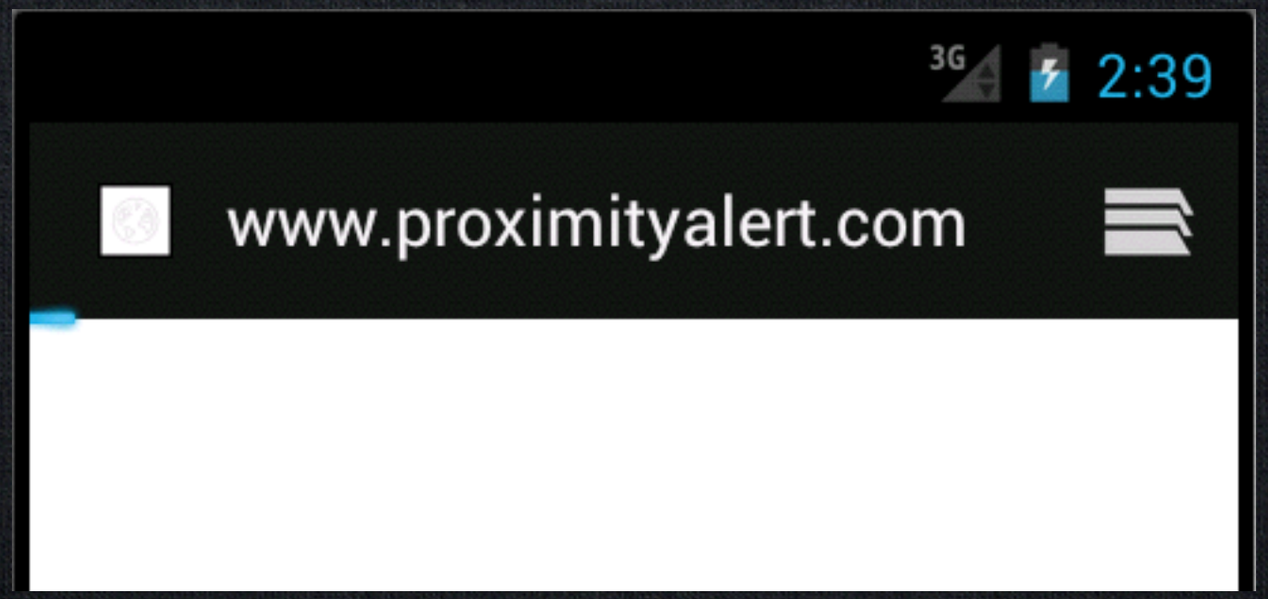
Support All Application Types

```
private void showBrowser(){
    Uri uriUrl = Uri.parse("http://www.proximityalert.com");
    Intent launchBrowser = new Intent(Intent.ACTION_VIEW, uriUrl);
    launchBrowser.setFlags(Intent.FLAG_ACTIVITY_NEW_TASK);
    _appContext.startActivity(launchBrowser);
}
```



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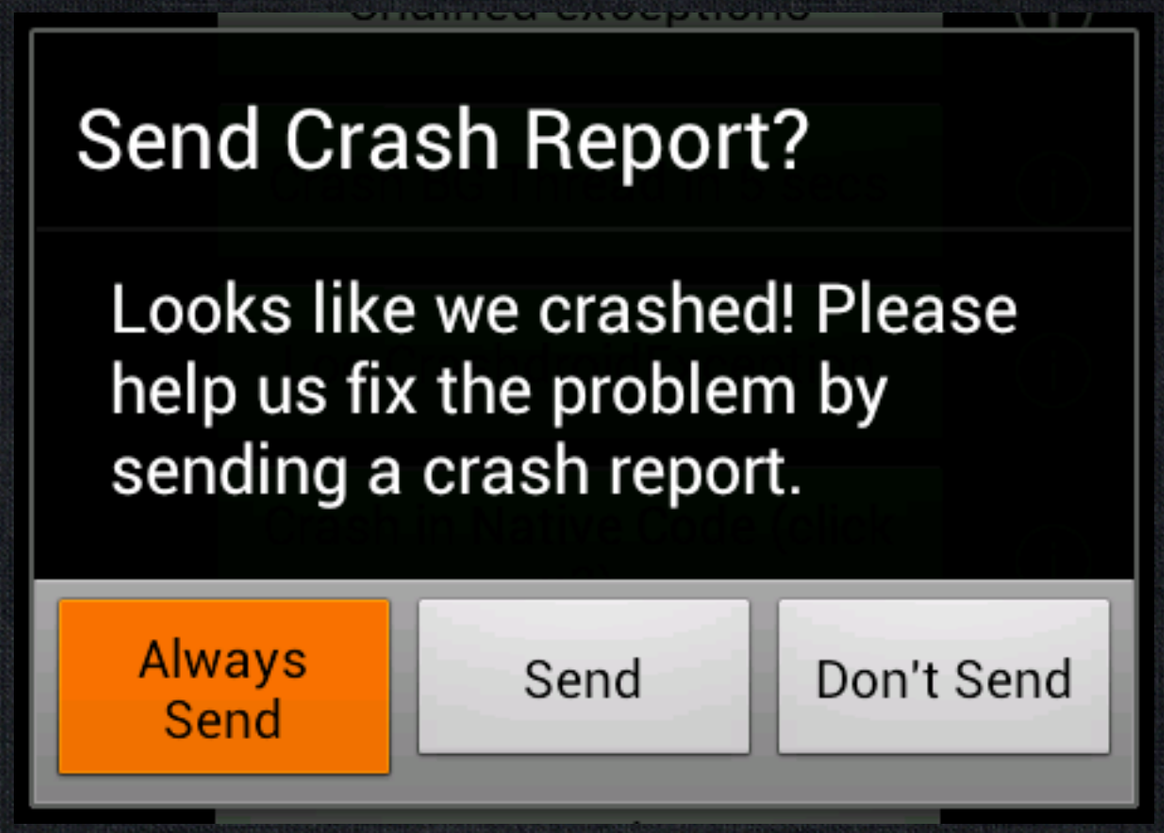
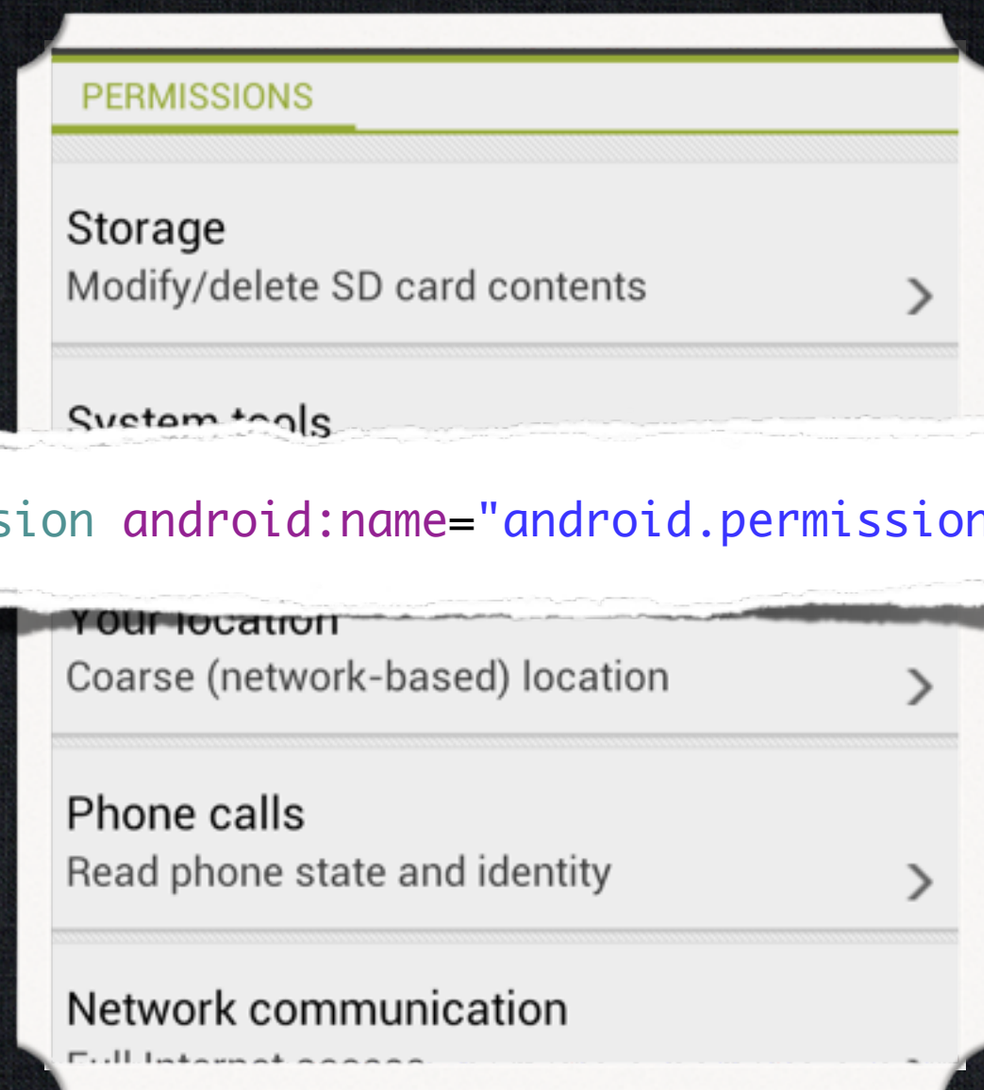
End-User Privacy


Send Crash Report?
Looks like we crashed! Please help us fix the problem by sending a crash report.
Always Send
Send
Don't Send

Permissions




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

Permissions: Runtime Detection

```
protected boolean canVibrate() {
    String permission = "android.permission.VIBRATE";
    int result = _appContext.checkCallingOrSelfPermission(permission)

  return (result == PackageManager.PERMISSION_GRANTED);
}
```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Feature Detection

SDK
SDK
SDK
SDK

SDK
SDK
SDK
SDK
Google
Google
Google

Feature Detection

public static final String **HARDWARE** Added in API level 8

The name of the hardware (from the kernel command line or /proc).

```
if (Build.VERSION.SDK_INT >= 8) {
    try {
        Field field = android.os.Build.class.getField("HARDWARE");

        return formatId((String) field.get(null));
    } catch (Exception e) {
        log("Could not retrieve HARDWARE value", e);
    }
}

return null;
```


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Feature Detection

```
try {
   Activity a = startActivityForResult(new Intent(RecognizerIntent.ACTION_RECOGNIZE_SPEECH), 0);
} catch (ActivityNotFoundException e){

}
```

```
PackageManager pm = context.getApplicationContext().getPackageManager();
List<ResolveInfo> activities =
pm.queryIntentActivities(new Intent(RecognizerIntent.ACTION_RECOGNIZE_SPEECH), 0);

if (activities.size() > 0) {
    // you have an app that can recognize speech
}
```


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API Design

API Design: Generic Hooks

```
public class SDK implements SensorEventListener {

  @Override
  public void onSensorChanged(SensorEvent event) {
    if (shouldTrigger(event)){
      if (canVibrate()) {
        Vibrator viber = (Vibrator) _appContext.getSystemService(Service.VIBRATOR_SERVICE);
                viber.vibrate(500);
      }


            callServer();


    }
  }

}
```


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API Design: Generic Hooks

```
/**
 * Set implementation specific parameters, to be send as header parameters on each call
 * @param key
 * @param value
 */
public void setParam(String key, String value){
    _paramsTable.put(key, value);
}

private void callServer() {

    HttpURLConnection conn;
    try {
        conn = (HttpURLConnection) _url.openConnection();
        for (String key : _paramsTable.keySet() ) {
            conn.addRequestProperty(key, _paramsTable.get(key));
        }
    } catch (IOException e) {
        e.printStackTrace();
    }
}
```


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API Design: Generic Hooks

```
// Requires android.permission.READ_PHONE_STATE
TelephonyManager tMgr = (TelephonyManager)this.getSystemService(Context.TELEPHONY_SERVICE);

SDK.getInstance().setParam("phone", tMgr.getLine1Number());
```


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API Design: Callbacks

```
public interface SDKListener {
    public void proximityAlert();
}

public static void setProximityCallBack(SDKListener listener) {
    _listener = listener;
}


@Override
public void onSensorChanged(SensorEvent event) {
  if (shouldTrigger(event)){
    if (canVibrate()) {
        vibrate();
    }

    callServer();

    if (_listener != null) {
        _listener.proximityAlert();
    }
  }
}
```


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API Design: Javadoc

Package **Class** Tree Deprecated Index Help

PREV CLASS NEXT CLASS
SUMMARY: NESTED | FIELD | CONSTR | METHOD

com.andevcon

Interface SDKListener

```
# run javadoc
> javadoc -d html -sourcepath src/com/andevcon/*.java
```

void	**proximityAlert**() This method is invoked when a proximity alert is fired

Method Detail

proximityAlert

`void` **`proximityAlert`**`()`

This method is invoked when a proximity alert is fired

void com.andevcon.SDK.setProximityCallBack(SDKListener listener)

Sets the proximity callback listener that is triggered when the SDK gets a SensorChanged event for PROXIMITY

Parameters:
listener the listener to trigger

```
SDK.setProximityCallBack(new SDKListener() {

    @Override
    public void proximityAlert() {

        //do something UI or App Specific that the SDK can't do!
    }
});
```

API Design: Deprecation

```
@Deprecated
/**
 * Allows developer to set debug mode
 * @see #setDeveloperMode
 * @deprecated
 */
public void setDebugMode(boolean debugMode){
        _debugMode = debugMode;
}
```

```
SDK.getInstance().setDebugMode(true);
```


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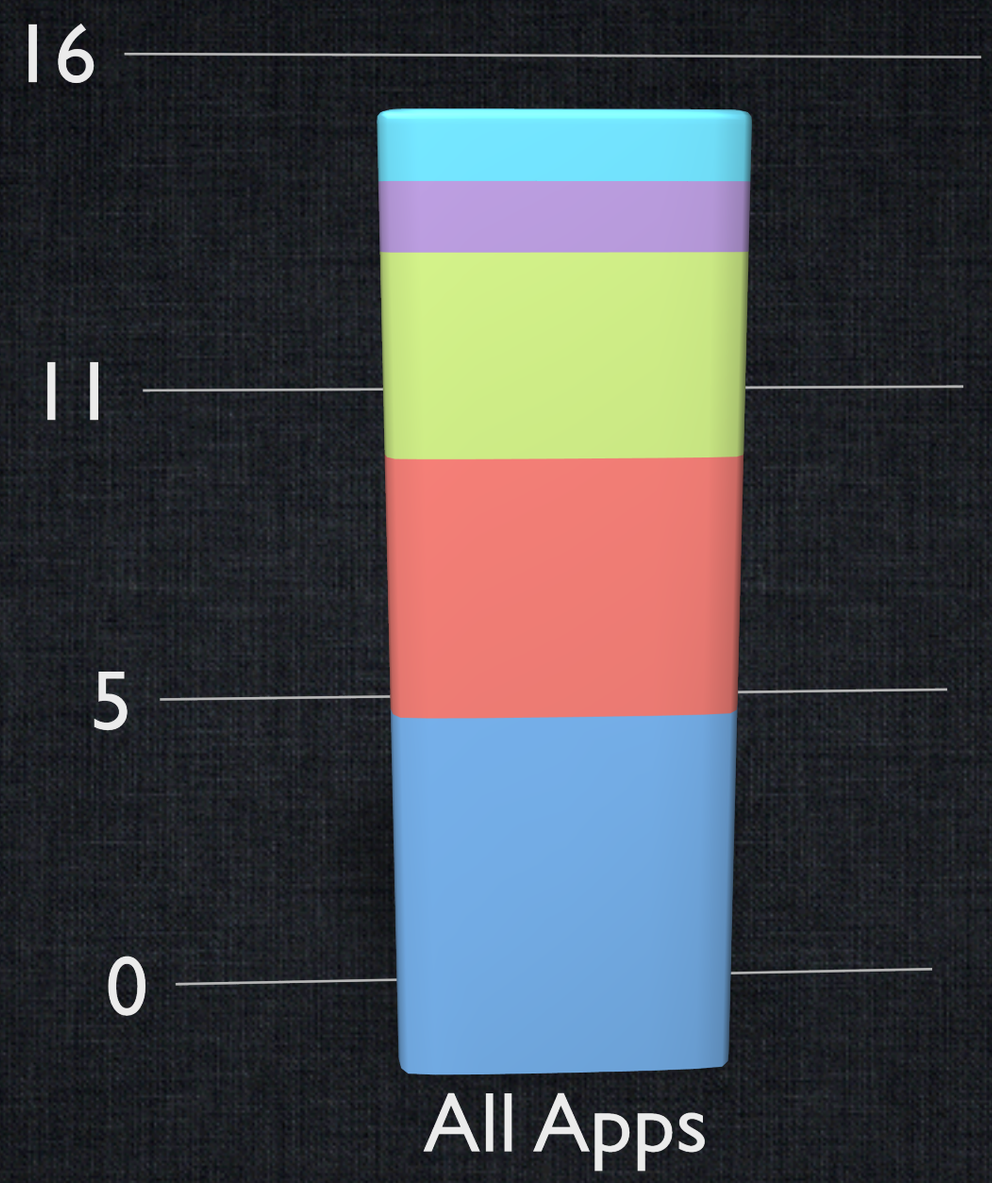
Lightweight

Binary Footprint

4MB

amazon
web services


16
11
5
0
All Apps

protobuf	ours
700	10
KB	KB

Binary Footprint: Proguard

developer.android.com/tools/help/proguard.html

Developers | Design | Develop | Distribute

Training | API Guides | Reference | Tools

- Developer Tools
- Download
- Workflow
- Tools Help
  - adb
  - ADT
  - android
  - bmgr
  - Device Monitor
  - dmtracedump
  - Draw 9-Patch

ProGuard

The ProGuard tool shrinks, optimizes, and obfuscates your code by removing unused code and renaming classes, fields, and methods with semantically obscure names. The result is a smaller sized `.apk` file that is more difficult to reverse engineer. Because ProGuard makes your application harder to reverse engineer, it is important that you use it when your application utilizes features that are sensitive to security like when you are Licensing Your Applications.

ProGuard is integrated into the Android build system, so you do not have to invoke it manually. ProGuard runs only when you build your application in release mode, so you do not have to deal with obfuscated code when you build your application in debug mode. Having ProGuard run is completely optional, but highly recommended.

This document describes how to enable and configure ProGuard as well as use the `retrace` tool to decode obfuscated stack traces.

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Binary Footprint: ProGuard

ProGuard - .apk Size

	Without ProGuard	With ProGuard	Reduction
ApiDemo	2.6MB	2.5MB	4%
Google I/O App	1.9MB	906KB	53%

Eric Lafortune - http://www.saikoa.com/downloads/ProGuard_DroidconLondon2012.pdf

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Binary Footprint: Reporting

Projects | My Changes | Agents (1) | Build Queue (0) | Welcome, Andrea Falcone | Administration

```
task :sdkfootprint => [:testclient] do
  sdk_project_size = File.size?("#{testclient_dir}/SDKAndroidProject/bin/SDKAndroidProject-debug.apk")
  project_size                                                                    ect-debug.apk")

  sdk_footprin
  build_time = DateTime.now.strftime(%...)

  `echo "SDK footprint is #{sdk_footprint} kb at #{build_time}" > #{artifacts_dir}/sdkfootprint.txt`
end
```

```
SDK footprint is 32 kb at 2012-10-24 12:04:56 PM
```

crashlytics.zip (1.44Mb)

sdkfootprint.txt (49b)

3 successful

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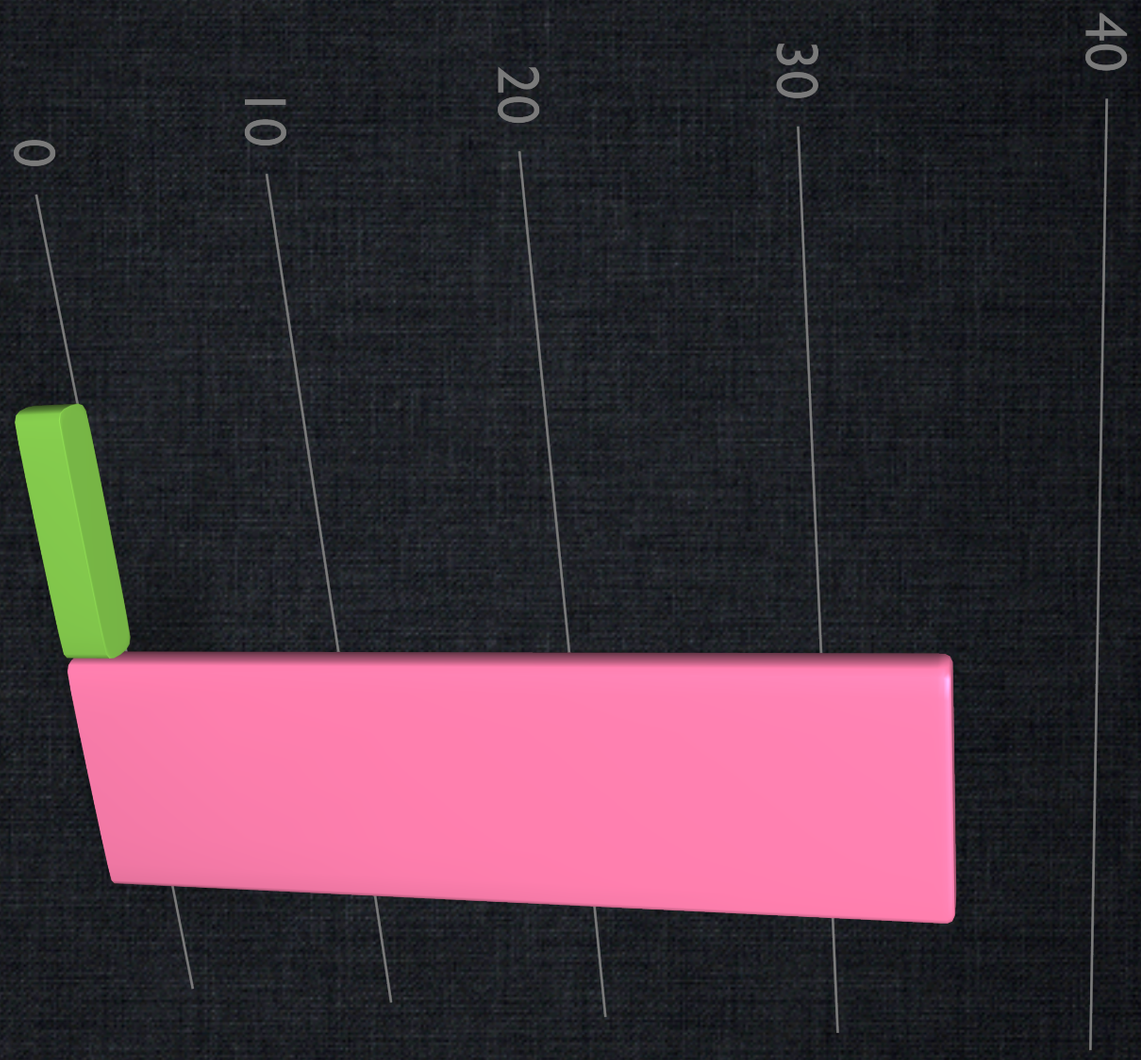
Startup Time

```
Thread.start();
```

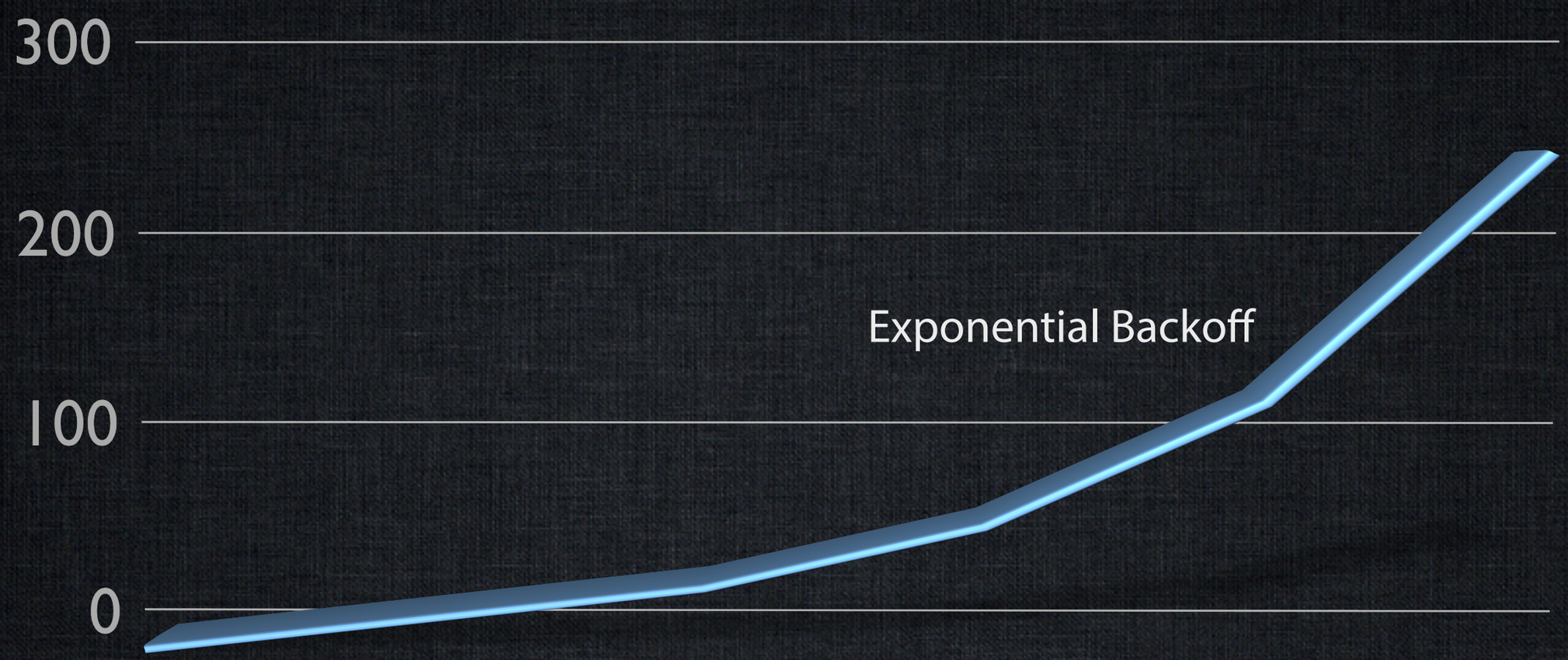

0
10
20
30
40

Network Usage

10x smaller

100x faster

CPU Usage


300
200
100
0
Exponential Backoff

CPU Usage: Log only in Debug

```
// Log.d logs are stripped when you app is compiled with debuggable=false in the manifest
Log.d(tag, "Debugging message");
```

or

```
// Use your own flag for better control
if (_debugMode){
    Log.w(tag, "Warning message");
}
```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CPU Usage: Monitoring

```
> adb shell top -m 10

User 11%, System 11%, IOW 0%, IRQ 0%
User 36 + Nice 2 + Sys 36 + Idle 249 + IOW 1 + IRQ 0 + SIRQ 0 = 324

  PID PR CPU% S  #THR     VSS     RSS PCY UID      Name
 7668  0  10% S    36 424680K  95592K  fg app_40   com.facebook.katana
 8625  0   5% R     1   1124K    472K  fg shell    top
15997  0   4% S     1   1092K    868K  fg root     /sbin/tpd
  640  0   0% S    33 377260K  54840K  fg system   com.android.systemui
  202  0   0% S    22 104676K   7556K  fg system   /system/bin/surfaceflinger
 7395  0   0% S     1      0K      0K  fg root     kworker/u:2
   93  0   0% S     1      0K      0K  fg root     mmcqd/0
  438  0   0% S    89 443620K  77172K  fg system   system_server
 1188  0   0% S     5   5324K    372K  fg root     /system/bin/mpdecision
28663  0   0% S     1      0K      0K  fg root     kworker/0:3
```


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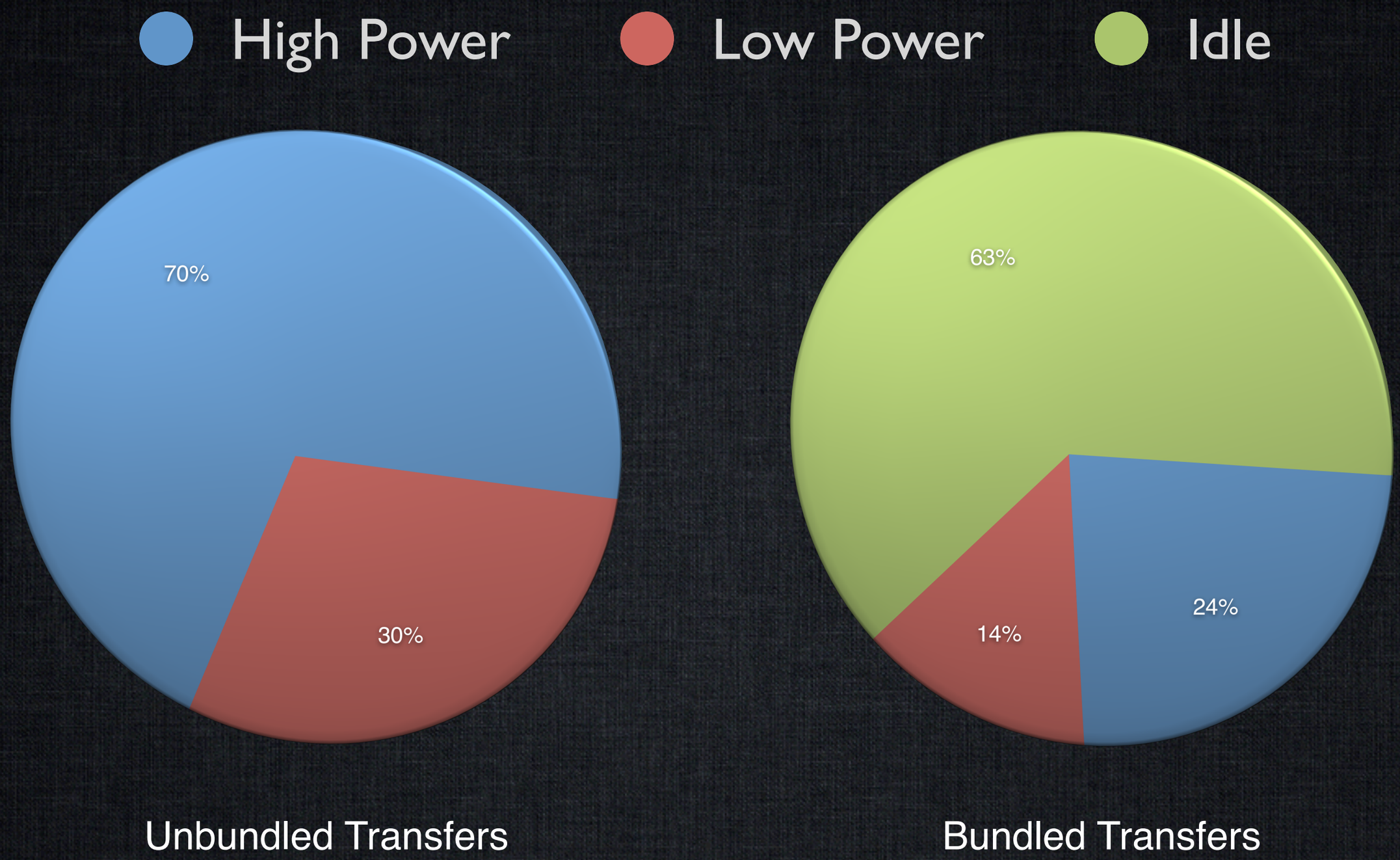
Battery Usage

SAMSUNG
cricket
Market
Maps
Email
Calendar
MyAccount
Storefront
Settings
Google


High Power
Low Power
Idle
70%
30%
Unbundled Transfers
63%
14%
24%
Bundled Transfers

Battery Usage: Radio Activity

```
class PhoneListener extends PhoneStateListener {

    @Override
    public void onDataActivity(int direction) {

  // Radio is already active so make connections now
  // before it goes to low power or idle

      }
}
```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SAMSUNG
SDK

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Q&A

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