

Create Effective Apps on Android

Performance Tips

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Don't do work that you don't need to do.

Performance Tips

Don't do work that you don't need to do.

Don't allocate memory if you can avoid it.

- Object Creation
- Static vs. Virtual
- Static Final Constants
- Internal Getters/Setters

For Loop

For Loop

```
static class Foo {  
    int bar;  
}
```

```
Foo[] array;
```

For Loop

```
static class Foo {  
    int bar;  
}
```

```
Foo[] array;
```

```
public void zero() {  
    int sum = 0;  
    for (int i = 0; i < array.length; ++i) {  
        sum += array[i].bar;  
    }  
}
```

For Loop

```
static class Foo {  
    int bar;  
}
```

```
Foo[] array;
```

```
public void one() {  
    int sum = 0;  
    Foo[] localArray = array;  
    int len = localArray.length;  
  
    for (int i = 0; i < len; ++i) {  
        sum += localArray[i].bar;  
    }  
}
```

For Loop

```
static class Foo {  
    int bar;  
}
```

```
Foo[] array;
```

```
public void two() {  
    int sum = 0;  
    for (Foo a : array) {  
        sum += a.bar;  
    }  
}
```

Private Inner Class

Private Inner Class

```
public class Foo {  
    private class Inner {  
        void stuff() {  
            Foo.this.doStuff(Foo.this.mValue);  
        }  
    }  
}  
  
private int mValue;  
  
public void run() {  
    Inner in = new Inner();  
    mValue = 27;  
    in.stuff();  
}  
  
private void doStuff(int value) {  
    System.out.println("Value is " + value);  
}  
}
```

Private Inner Class

```
public class Foo {
    private class Inner {
        void stuff() {
            Foo.this.doStuff(Foo.this.mValue);
        }
    }

    private int mValue;

    public void run() {
        Inner in = new Inner();
        mValue = 27;
        in.stuff();
    }

    private void doStuff(int value) {
        System.out.println("Value is " + value);
    }
}

/*package*/ static int Foo.access$100(Foo foo) {
    return foo.mValue;
}
```

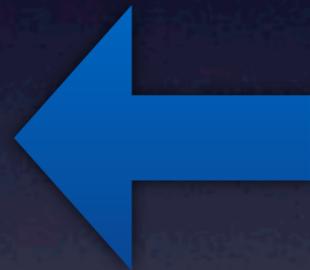
Private Inner Class

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public class Foo {  
    private class Inner {  
        void stuff() {  
            Foo.this.doStuff(Foo.this.mValue);  
        }  
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```
private int mValue;
```

```
public void run() {  
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```
/*package*/ static int Foo.access$100(Foo foo) {  
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Private Inner Class

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        }  
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}
```

```
private int mValue;
```

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public void run() {  
    Inner in = new Inner();  
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}
```

```
private void doStuff(int value) {  
    System.out.println("Value is " + value);  
}
```



```
/*package*/ static int Foo.access$100(Foo foo) {  
    return foo.mValue;  
}
```

```
/*package*/ static void Foo.access$200(Foo foo, int value) {  
    foo.doStuff(value);  
}
```

Private Inner Class

```
public class Foo {  
    private class Inner {  
        void stuff() {  
            Foo.this.doStuff(Foo.this.mValue);  
        }  
    }  
}
```

```
private int mValue;
```

```
public void run() {  
    Inner in = new Inner();  
    mValue = 27;  
    in.stuff();  
}
```

```
private void doStuff(int value) {  
    System.out.println("Value is " + value);  
}
```

```
/*package*/ static int Foo.access$100(Foo foo) {  
    return foo.mValue;  
}
```



```
/*package*/ static void Foo.access$200(Foo foo, int value) {  
    foo.doStuff(value);  
}
```



- Floating - Point
- Libraries
- Exact Type vs. Interface
- Native Methods

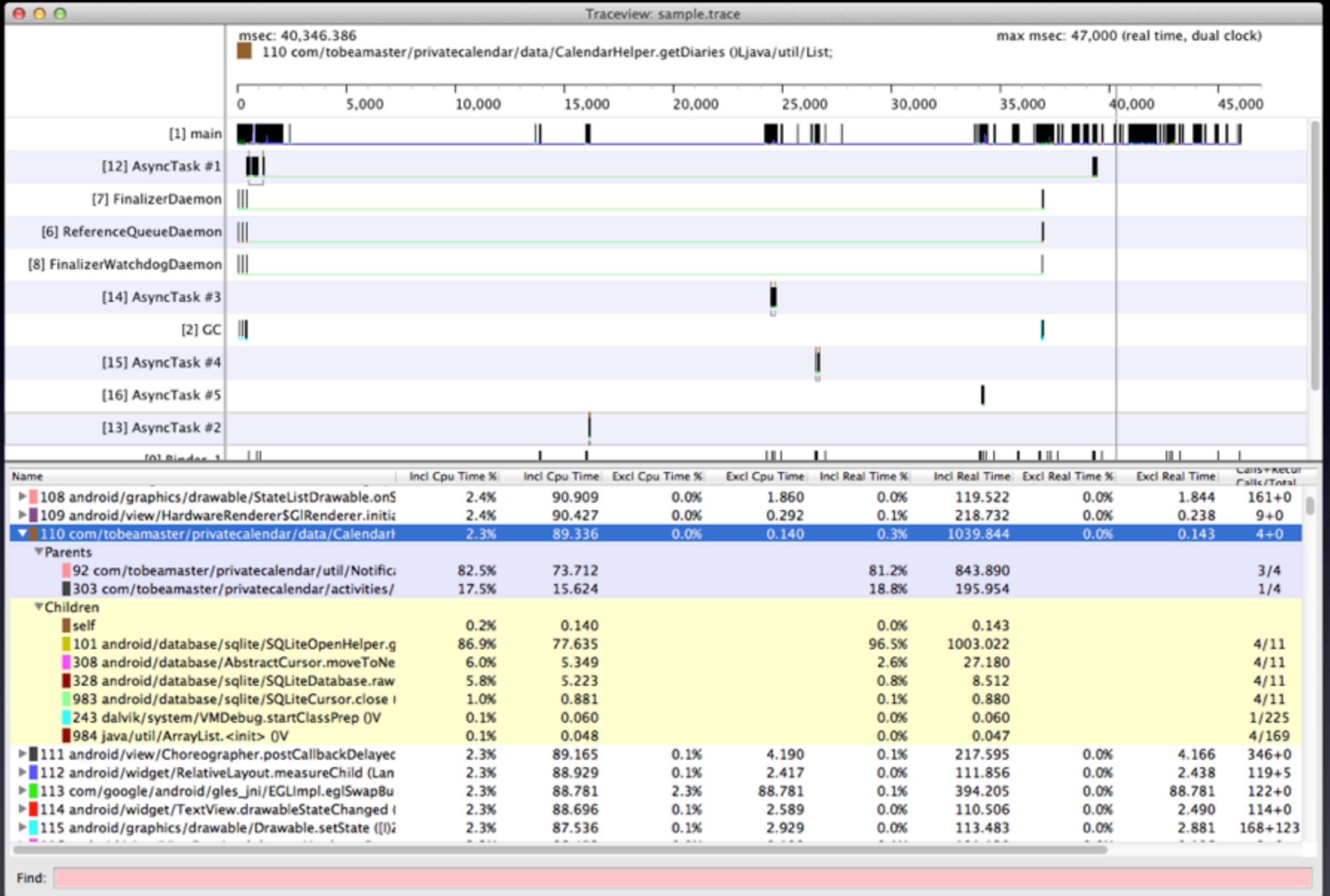
Measure

- Traceview
- Systrace

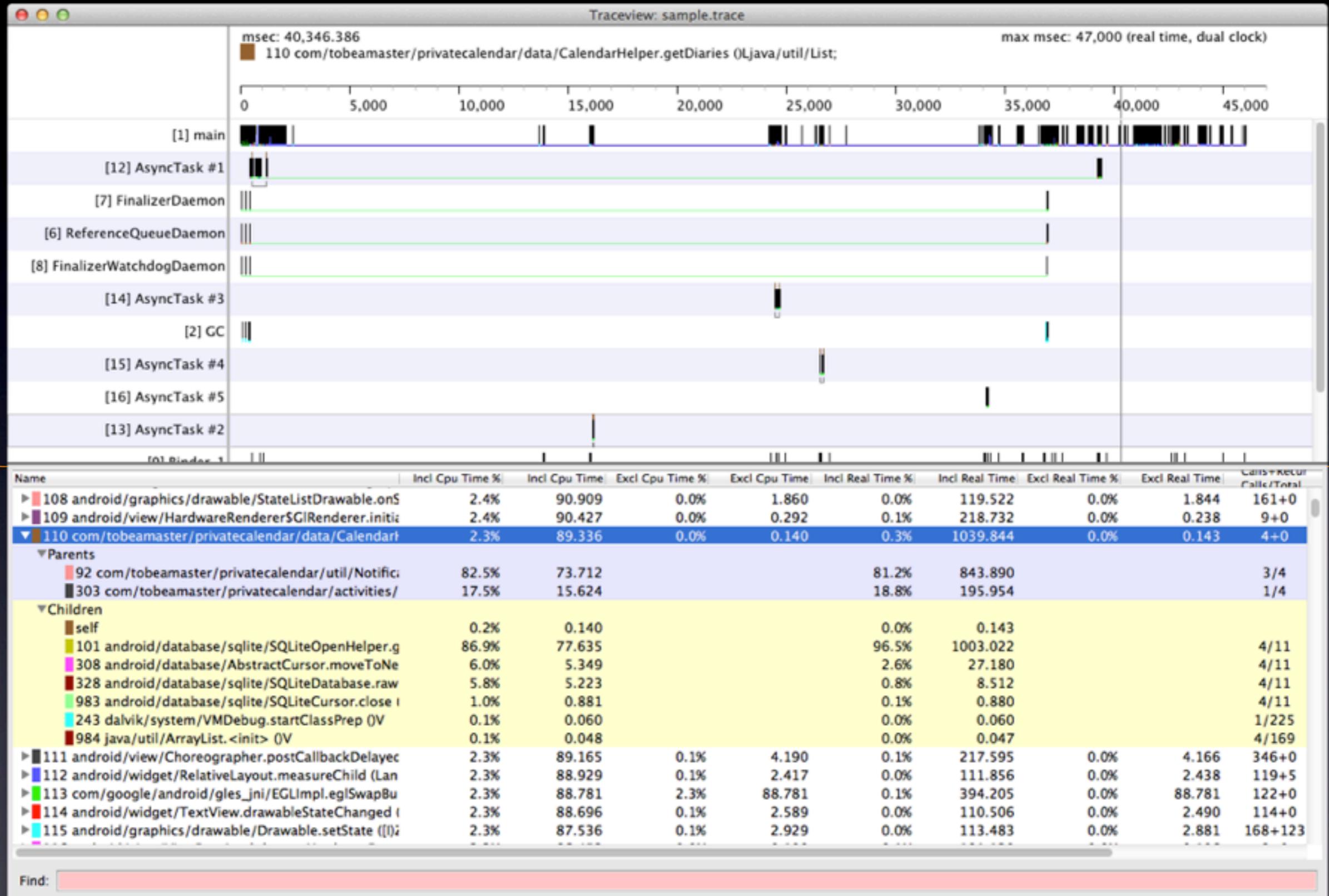
Traceview

```
Debug.startMethodTracing("filename");
```

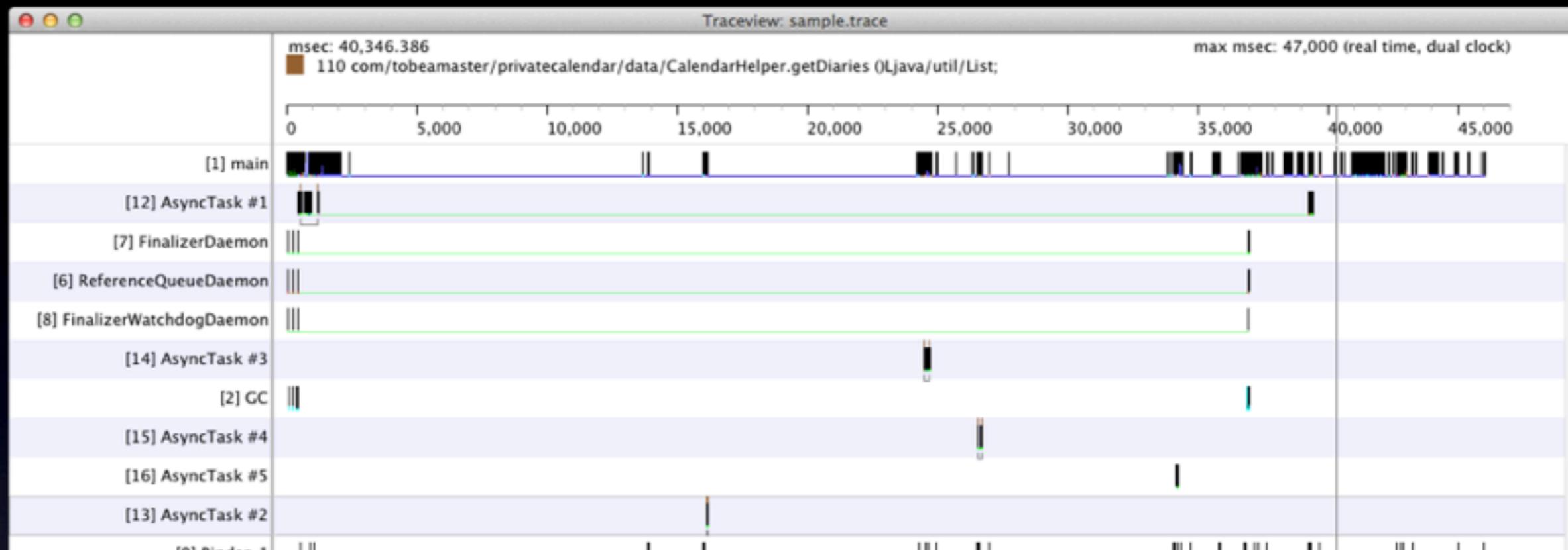
```
Debug.stopMethodTracing();
```



Timeline Panel



Timeline Panel



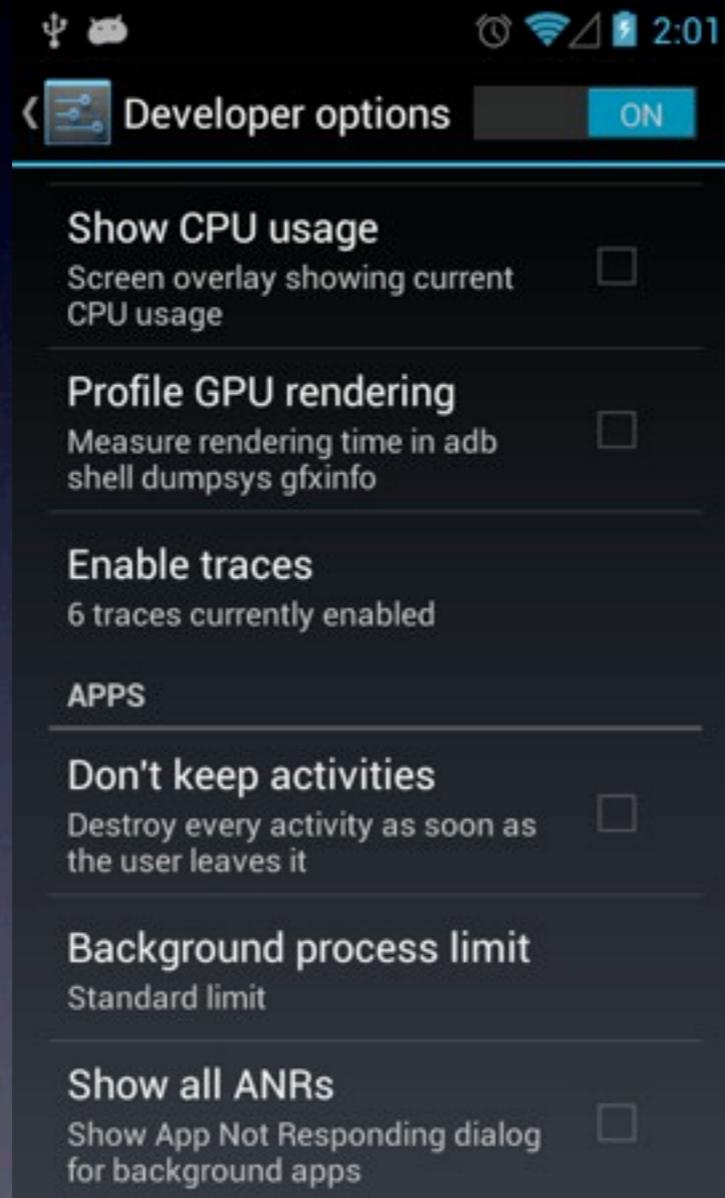
Name	Incl Cpu Time %	Incl Cpu Time	Excl Cpu Time %	Excl Cpu Time	Incl Real Time %	Incl Real Time	Excl Real Time %	Excl Real Time	Calls+Recur Calls/Total
▶ 108 android/graphics/drawable/StateListDrawable.onS	2.4%	90.909	0.0%	1.860	0.0%	119.522	0.0%	1.844	161+0
▶ 109 android/view/HardwareRenderer\$GRenderer.initia	2.4%	90.427	0.0%	0.292	0.1%	218.732	0.0%	0.238	9+0
▼ 110 com/tobeamaster/privatecalendar/data/Calendar	2.3%	89.336	0.0%	0.140	0.3%	1039.844	0.0%	0.143	4+0
▼ Parents									
92 com/tobeamaster/privatecalendar/util/Notifici	82.5%	73.712			81.2%	843.890			3/4
303 com/tobeamaster/privatecalendar/activities/	17.5%	15.624			18.8%	195.954			1/4
▼ Children									
self	0.2%	0.140			0.0%	0.143			
101 android/database/sqlite/SQLiteOpenHelper.g	86.9%	77.635			96.5%	1003.022			4/11
308 android/database/AbstractCursor.moveToNe	6.0%	5.349			2.6%	27.180			4/11
328 android/database/sqlite/SQLiteDatabase.raw	5.8%	5.223			0.8%	8.512			4/11
983 android/database/sqlite/SQLiteCursor.close t	1.0%	0.881			0.1%	0.880			4/11
243 dalvik/system/VMDebug.startClassPrep (V	0.1%	0.060			0.0%	0.060			1/225
984 java/util/ArrayList.<init> (V	0.1%	0.048			0.0%	0.047			4/169
▶ 111 android/view/Choreographer.postCallbackDelayec	2.3%	89.165	0.1%	4.190	0.1%	217.595	0.0%	4.166	346+0
▶ 112 android/widget/RelativeLayout.measureChild (Lan	2.3%	88.929	0.1%	2.417	0.0%	111.856	0.0%	2.438	119+5
▶ 113 com/google/android/gles_jni/EGLImpl.eglSwapBu	2.3%	88.781	2.3%	88.781	0.1%	394.205	0.0%	88.781	122+0
▶ 114 android/widget/TextView.drawableStateChanged t	2.3%	88.696	0.1%	2.589	0.0%	110.506	0.0%	2.490	114+0
▶ 115 android/graphics/drawable/Drawable.setState (I	2.3%	87.536	0.1%	2.929	0.0%	113.483	0.0%	2.881	168+123

Find:

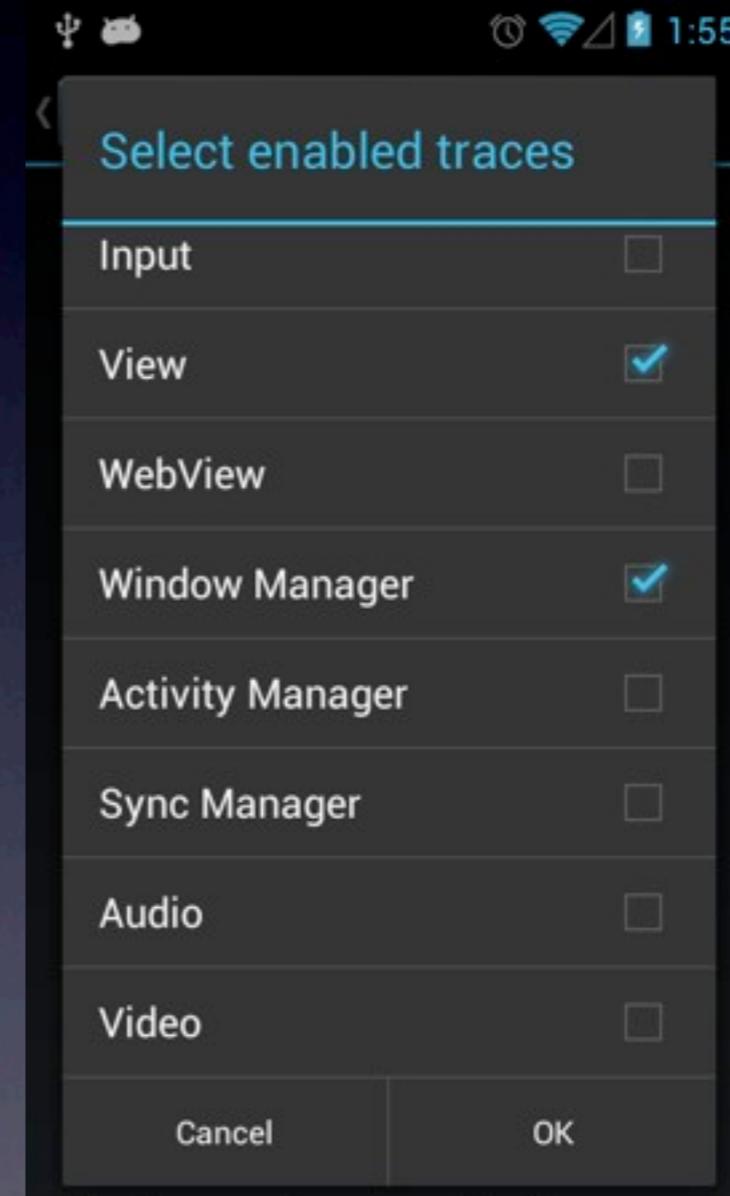
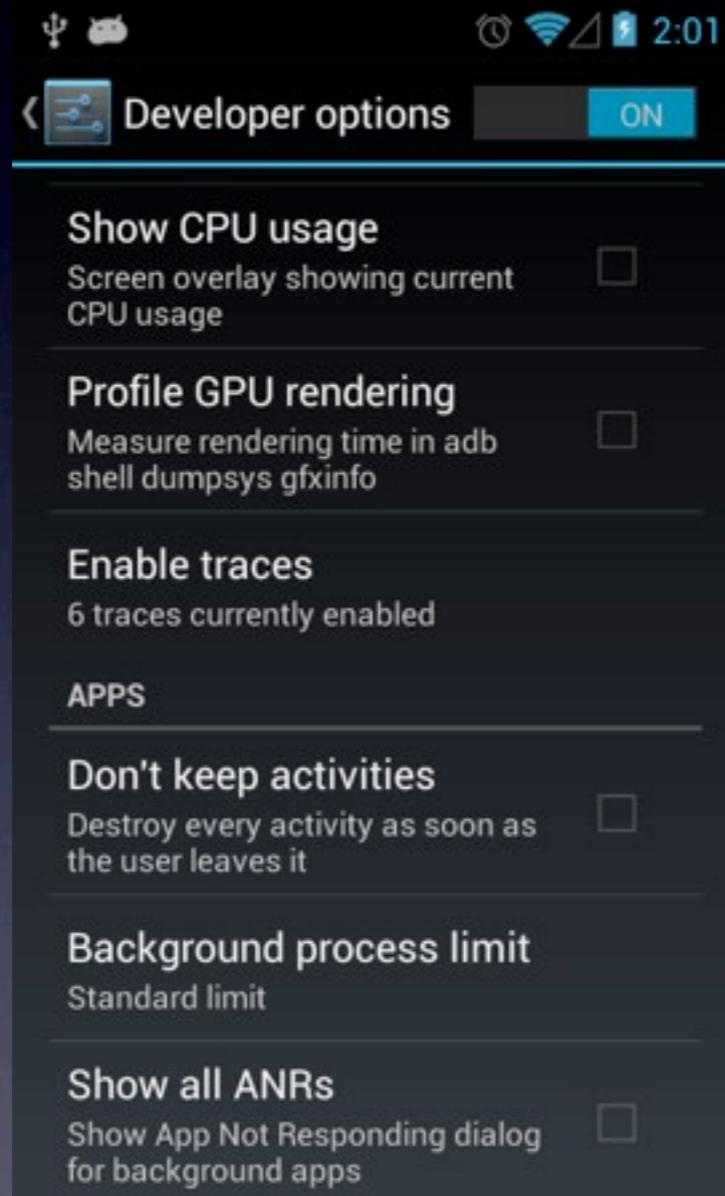
Profile Panel

Systrace

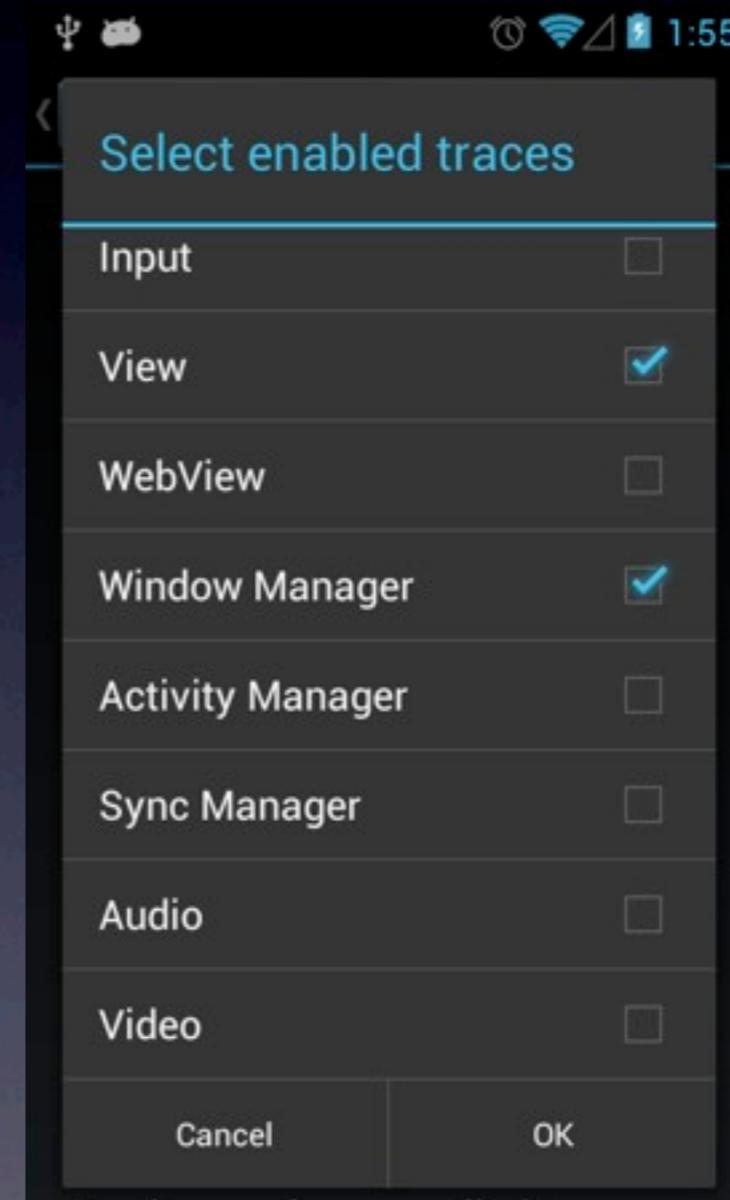
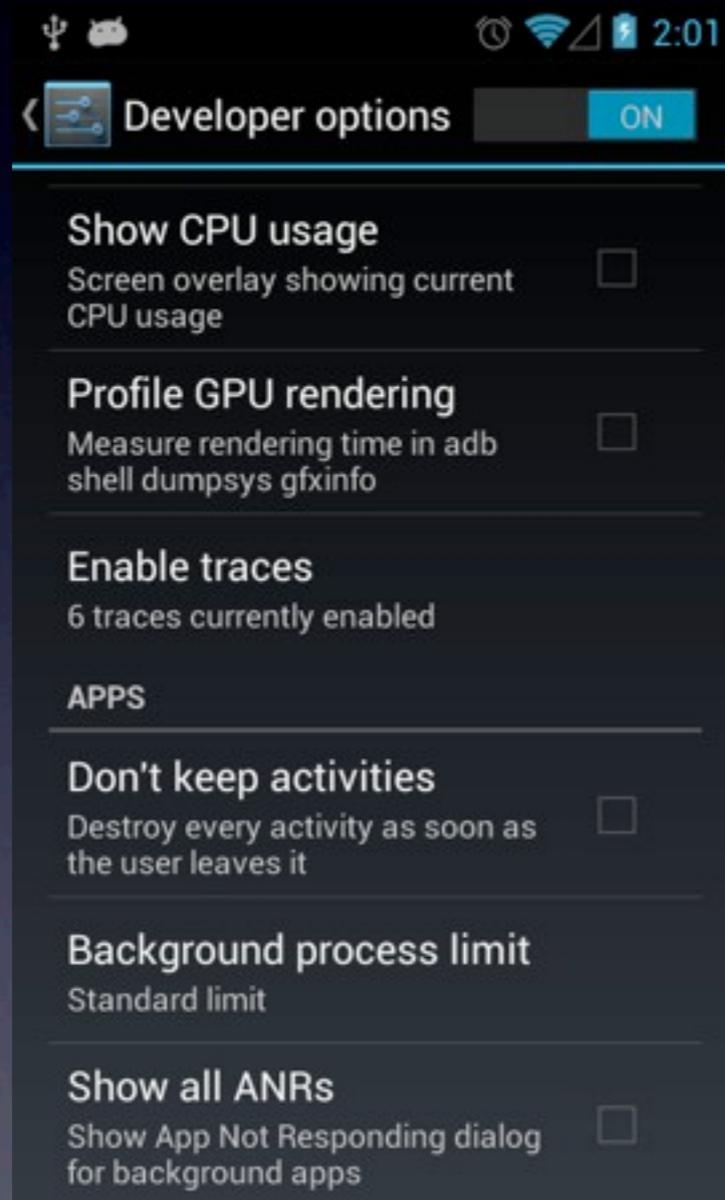
Systrace



Systrace



Systrace



```
$> python systrace.py --cpu-freq --cpu-load --time=10 -o mytracefile.html
```

Android System Trace

file://localhost/Users/monkey/Desktop/mytracefile.html

Tracing:

Timeline markers: 1166 ms, 1167 ms, 1168 ms, 1169 ms, 1170 ms, 1171 ms, 1172 ms, 1173 ms

Traced components and events:

- CPU 0: sonic.brickgame, Bin..., sonic.br..., m, UE..., 86: SurfaceFinger, 260: <...>
- CPU 0 Clock Frequency: [teal bar]
- Starting com.supersonic.brickgame:
- StatusBar:
- SurfaceView:
- VSYNC: [green bar]
- com.android.launcher/com.android...
- com.supersonic.brickgame/com.sup...
- 86: Binder_1:
- 86: Binder_2:
- 86: Binder_3:
- 86: Binder_4:
- 86: SurfaceFlinger: [purple bar labeled onMessageReceived]

Selected item:

```

Title      : onMessageReceived
Start     : 1171.234 ms
Duration  : 3.493 ms
  
```

UI Performance

View Adapter

```
View getView(int position, View convertView, ViewGroup parent);
```

View Adapter

```
View getView(int position, View convertView, ViewGroup parent);
```

```
public View getView(int pos, View convertView, ViewGroup parent) {  
    View item = inflater.inflate(R.layout.list_item, null);  
    ((TextView) item.findViewById(R.id.text)).setText(DATA[pos]);  
    ((ImageView) item.findViewById(R.id.icon)).setImageBitmap((pos & 1) == 1 ? mlcon1 : mlcon2);  
    return item;  
}
```

View Adapter

```
View getView(int position, View convertView, ViewGroup parent);
```

```
public View getView(int pos, View convertView, ViewGroup parent) {  
    if (convertView == null) {  
        convertView = inflater.inflate(R.layout.list_item, parent, false);  
    }  
  
    ((TextView) convertView.findViewById(R.id.text)).setText(DATA[pos]);  
    ((ImageView) convertView.findViewById(R.id.icon)).setImageBitmap((pos & 1) == 1 ? mlcon1 : mlcon2);  
    return convertView;  
}
```

View Adapter

View Holder

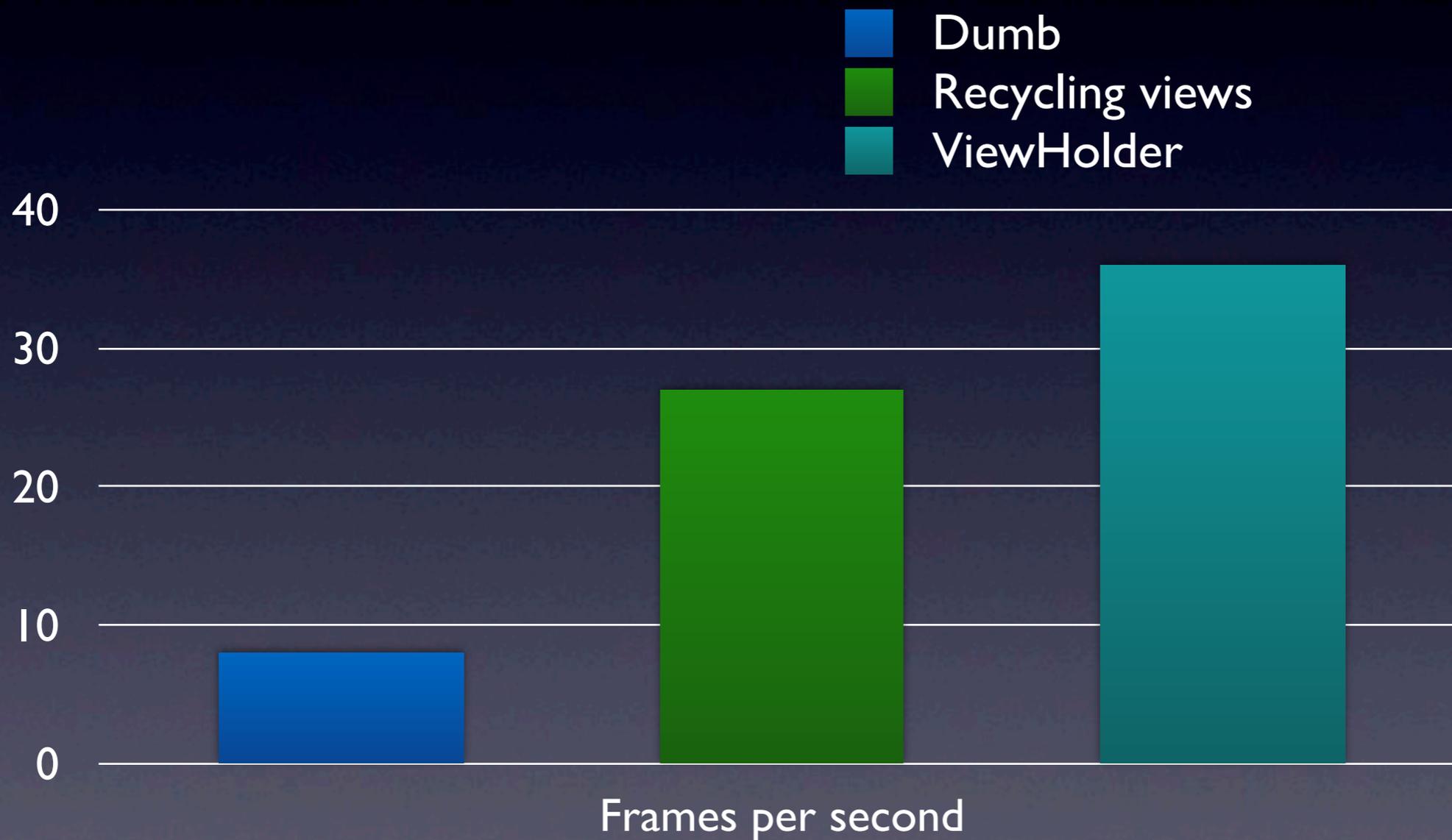
```
static class ViewHolder {
    TextView text;
    ImageView icon;
}

public View getView(int pos, View convertView, ViewGroup parent) {
    ViewHolder holder;
    if (convertView == null) {
        convertView = inflater.inflate(R.layout.list_item, parent, false);
        holder = new ViewHolder();
        holder.text = (TextView) convertView.findViewById(R.id.text);
        holder.icon = (ImageView) convertView.findViewById(R.id.icon);
        convertView.setTag(holder);
    } else {
        holder = (ViewHolder) convertView.getTag();
    }

    holder.text.setText(DATA[pos]);
    holder.icon.setImageBitmap((pos & 1) == 1 ? mlcon1 : mlcon2);
    return convertView;
}
```

View Adapter

FPS



Auto-scaled vs. Pre-scaled

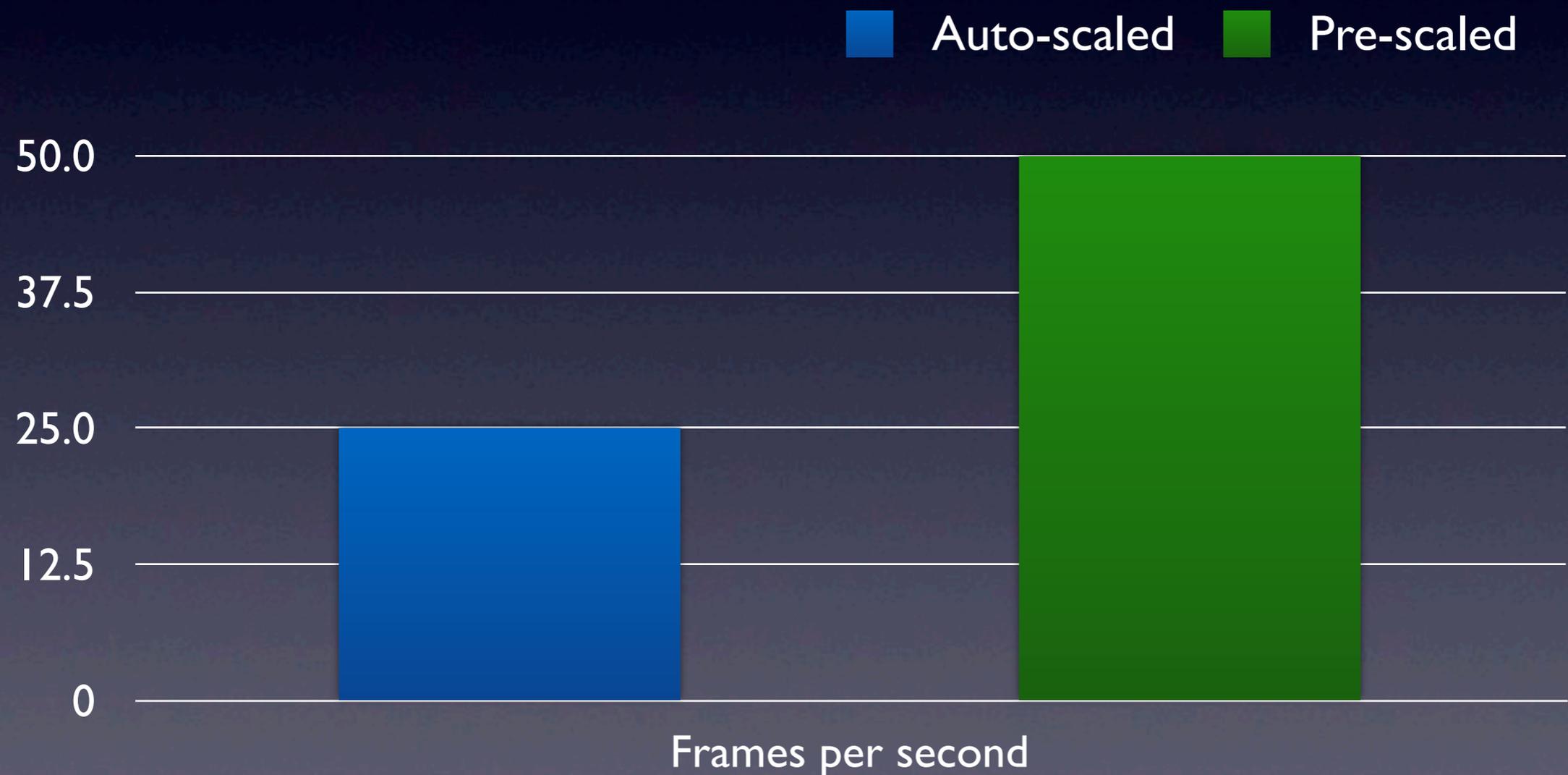
- Avoid auto-scaled

Auto-scaled vs. Pre-scaled

- Avoid auto-scaled

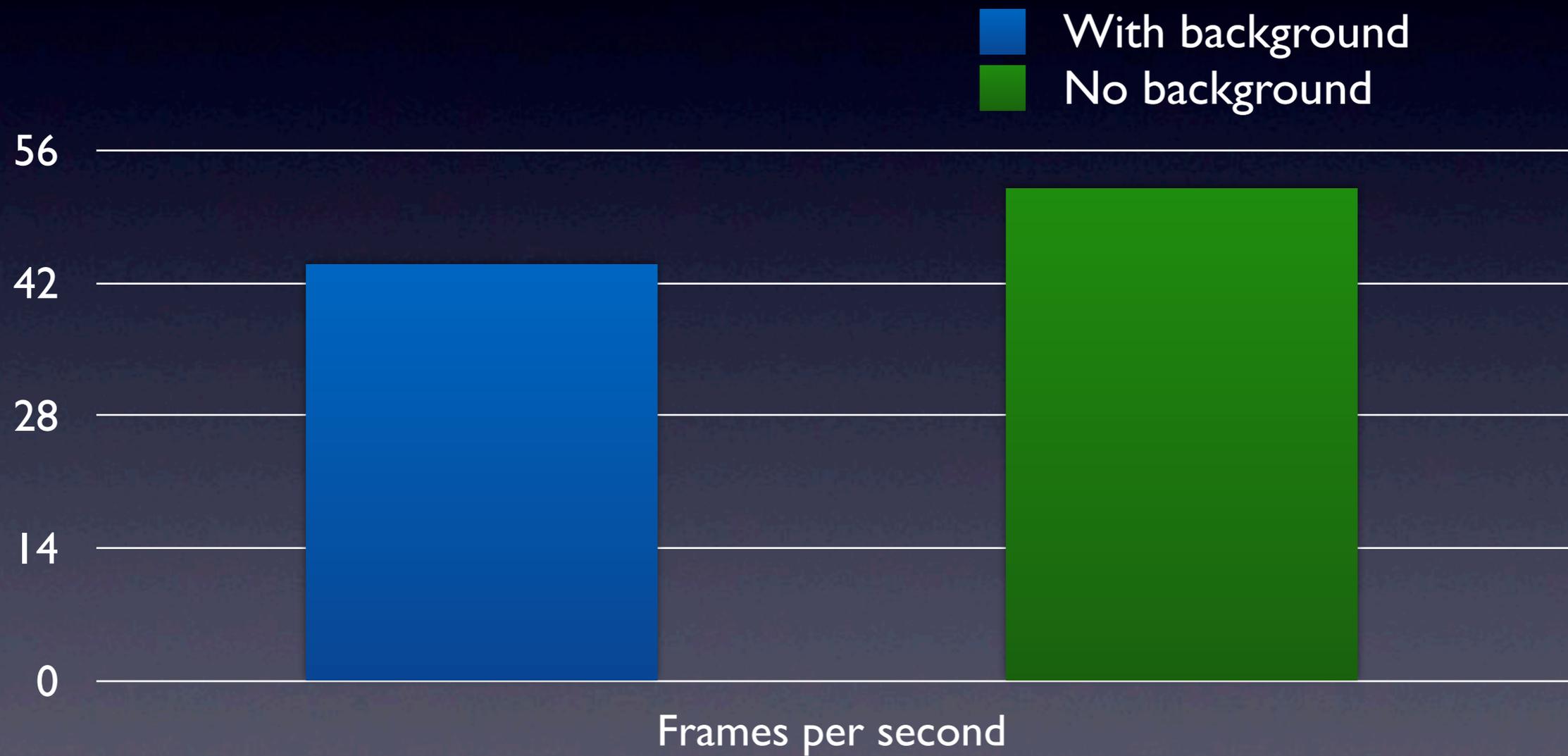
Auto-scaled vs. Pre-scaled

- Avoid auto-scaled



Background

Background



Layout

- TextView
- ViewStub
- <merge>
- RelativeLayout
- Customized view & customized layout

TextView

Compound Drawable

TextView

Compound Drawable



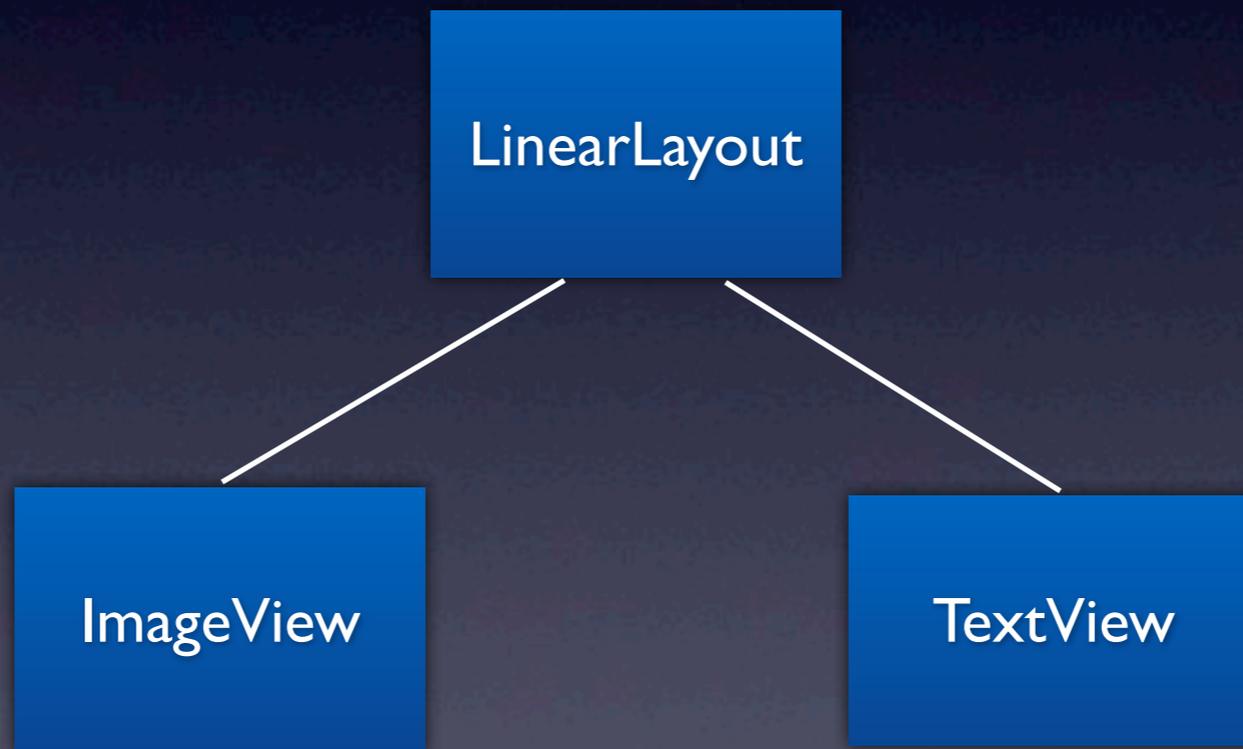
成功支付0.01元！

TextView

Compound Drawable



成功支付0.01元！



TextView

Compound Drawable



成功支付0.01元！

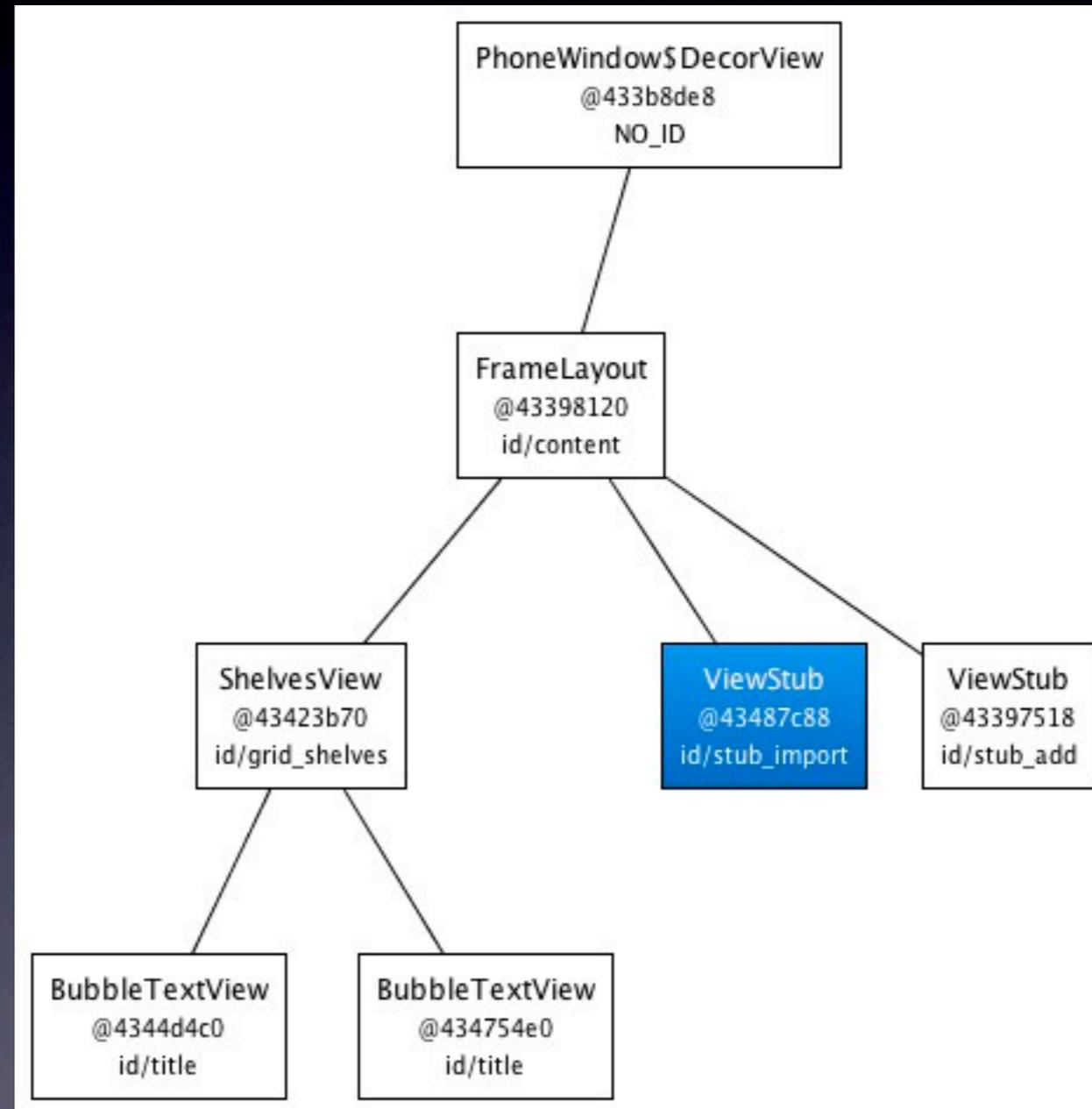
```
<TextView
```

```
    android:layout_width="wrap_content"  
    android:layout_height="wrap_content"  
    android:drawableLeft="@drawable/succeed"  
    android:text="@string/succeed" />
```

TextView

ViewStub

ViewStub



ViewStub

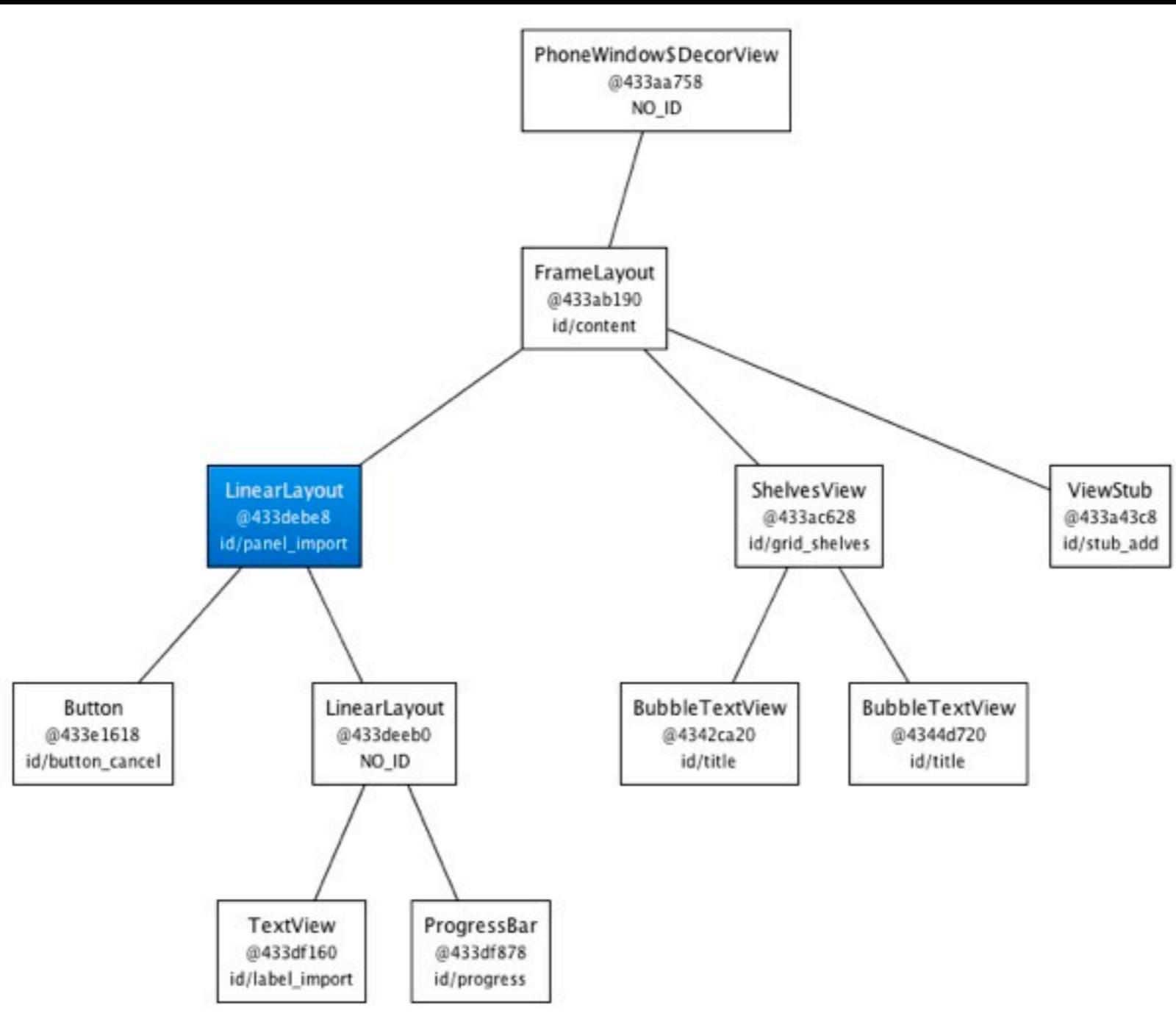
```
<ViewStub android:id = "@+id/stub_import"  
    android:inflatedId="@+id/panel_import"  
    android:layout="@layout/progress_overlay"  
    android:layout_width="fill_parent"  
    android:layout_height="wrap_content"  
    android:layout_gravity="bottom"/>
```

```
findViewById(R.id.stub_import).setVisibility(View.VISIBLE);
```

```
// or
```

```
View importPanel = ((ViewStub) findViewById(R.id.stub_import)).inflate();
```

ViewStub



Merge

```
<FrameLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="fill_parent"
    android:layout_height="fill_parent">

    <ImageView
        android:layout_width="fill_parent"
        android:layout_height="fill_parent"
        android:scaleType="center"
        android:src="@drawable/golden_gate" />

    <TextView
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginBottom="20dip"
        android:layout_gravity="center_horizontal|bottom"
        android:padding="12dip"
        android:background="#AA000000"
        android:textColor="#ffffff"
        android:text="Golden Gate" />

</FrameLayout>
```

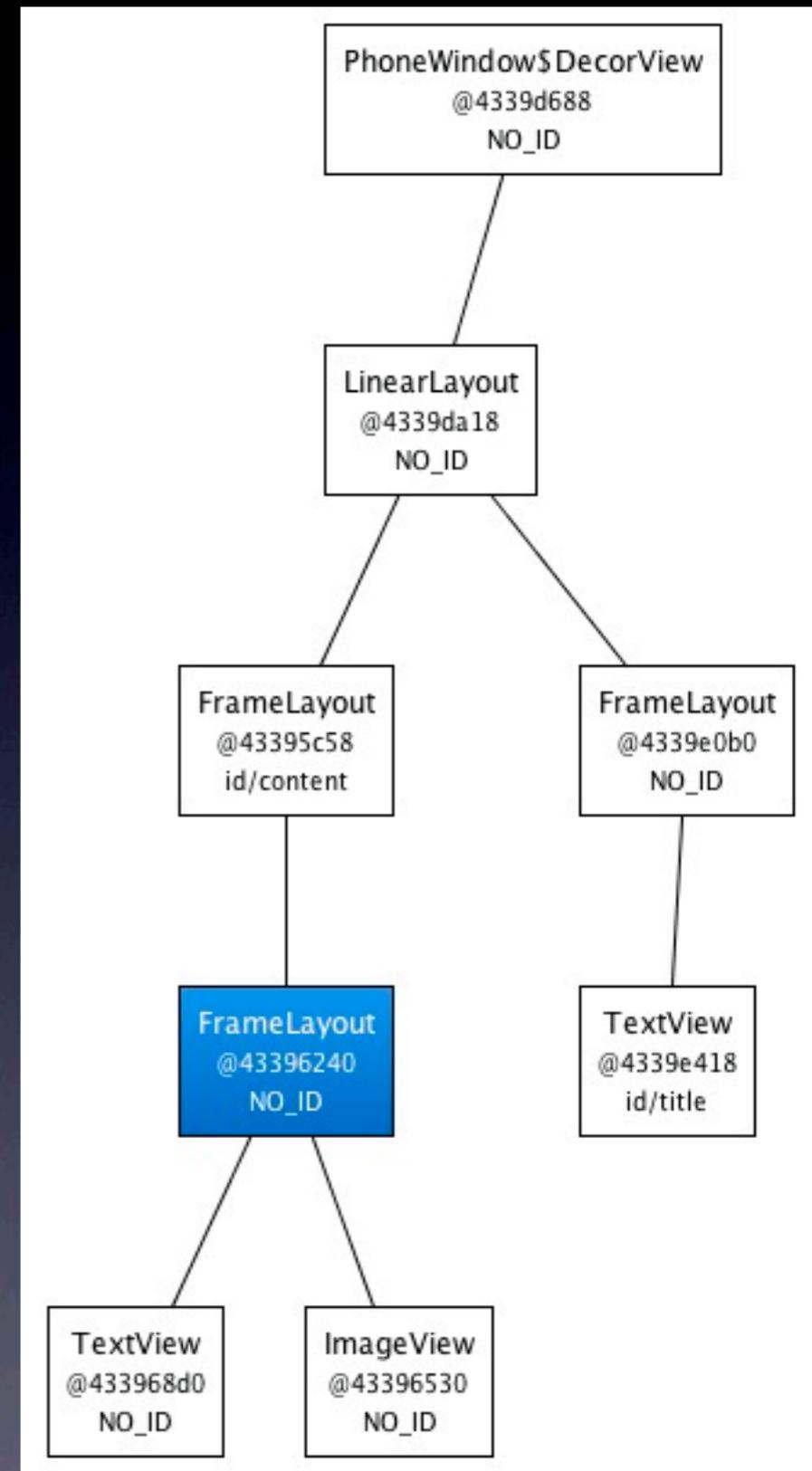
Merge

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<FrameLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="fill_parent"
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    android:padding="12dip"
    android:background="#AA000000"
    android:textColor="#ffffff"
    android:text="Golden Gate" />
```

```
</FrameLayout>
```



Merge

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<merge xmlns:android="http://schemas.android.com/apk/res/android">
```

```
  <ImageView  
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    android:layout_height="fill_parent"  
    android:scaleType="center"  
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```

```
  <TextView  
    android:layout_width="wrap_content"  
    android:layout_height="wrap_content"  
    android:layout_marginBottom="20dip"  
    android:layout_gravity="center_horizontal|bottom"  
    android:padding="12dip"  
    android:background="#AA000000"  
    android:textColor="#ffffff"  
    android:text="Golden Gate" />
```

```
</merge>
```

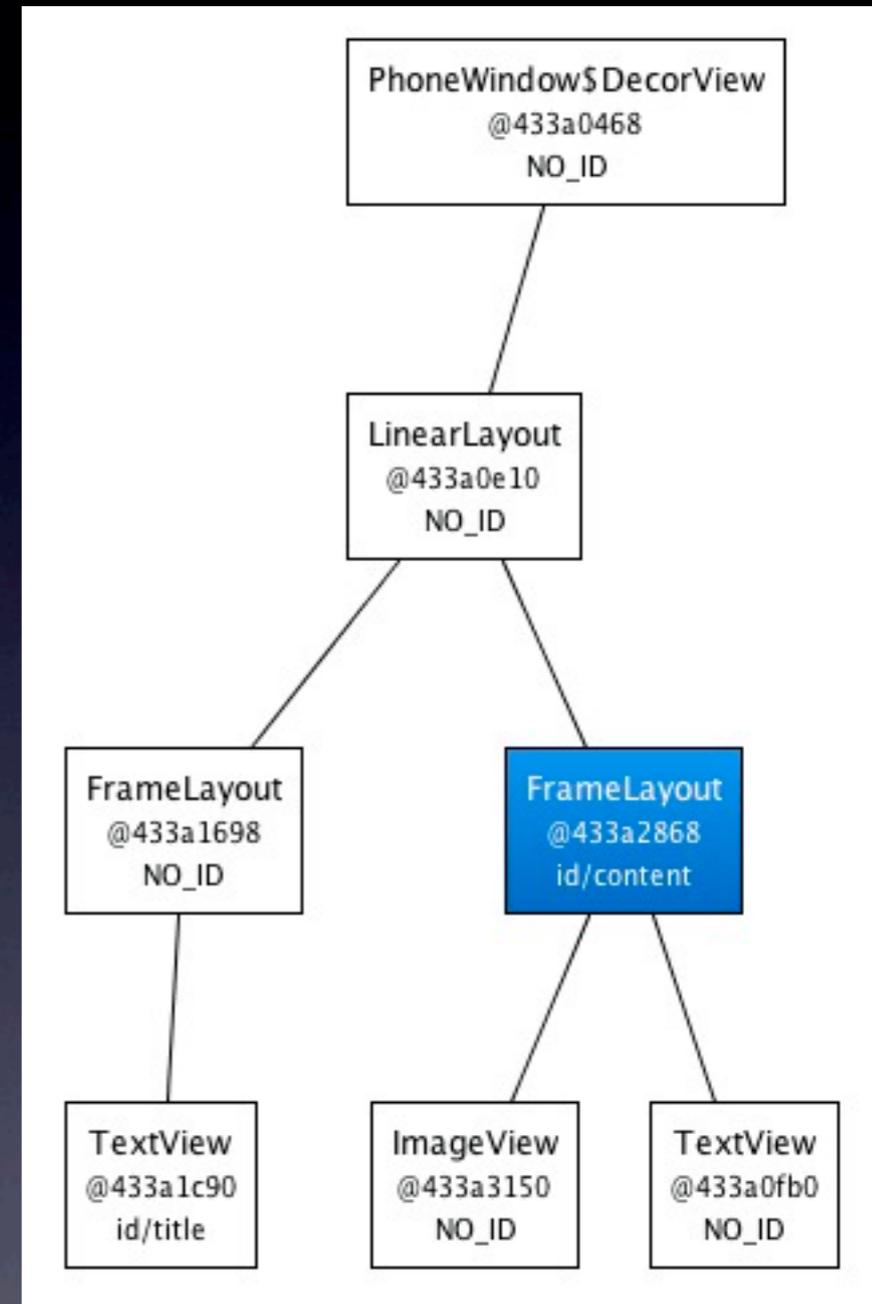
Merge

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<merge xmlns:android="http://schemas.android.com/apk/res/android">
```

```
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  android:layout_width="wrap_content"  
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  android:layout_gravity="center_horizontal|bottom"  
  android:padding="12dip"  
  android:background="#AA000000"  
  android:textColor="#ffffff"  
  android:text="Golden Gate" />
```

```
</merge>
```



Memory Allocated

- Avoid object creation
 - `onMeasure()`
 - `onLayout()`
 - `dispatchDraw()`
 - `dispatchTouchEvent()`, `onTouchEvent()`
 - `getView()`, `BindView()`

Thanks