Handmade Android Apps

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Handmade NYC Meetup 10/4/2023

“Handmade” = C + Vulkan

Anatomy

Key:
Written by Android
Written by You

app_process64 - launched by the system

FooActivity - java class instantiated by app_process64

libfoo.so - C library loaded in FooActivity

Runtime

<touch> - detected by os

FooActivity.dispatchTouchEvent(motionEvent) - java method called by os

Java_com_foo_FooActivity_dispatchTouchEventNative - C method called by FooActivity

(Also FooView)

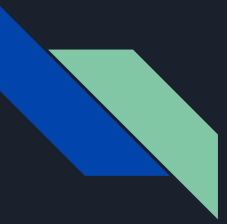
FooActivity.java

```
class FooActivity extends Activity {
        static { System.loadLibrary("foo"); }

        private native void onCreateNative(Bundle savedInstanceState);
        protected void onCreate(Bundle savedInstanceState) {
                onCreateNative(savedInstanceState);
        }

        private native boolean dispatchTouchEventNative(MotionEvent event);
        protected boolean dispatchTouchEvent(MotionEvent event) {
                return dispatchTouchEventNative(event);
        }

        <etc...>
}
```



foo.c

Java:

```
boolean dispatchTouchEvent(MotionEvent e) {
  float x = e.getX();
  if (x > 50) doSomeStuff();
  return true;
}
```

C:

```
JNIEXPORT jboolean JNICALL
Java_com_foo_FooActivity_dispatchTouchEventNative(JNIEnv *env, jobject this, jobject e) {
  jclass MotionEvent = (*env)->GetObjectClass(env, e);
  jmethodID getX = (*env)->GetMethodID(env, MotionEvent, “getX”, “()F”);
  jfloat x = (*env)->CallFloatMethod(env, e, getX);
  if (x > 50) doSomeStuff();
  return 1;
}
```

“JNI” - Java Native Interface

Vulkan

1. FooActivity.surfaceCreated(SurfaceHolder holder) -> JNI C method
2. dlopen("libvulkan.so")
3. vkCreateInstance(…
   .ppEnabledExtensionNames={"VK_KHR_surface","VK_KHR_android_surface"})
4. jobject surface = holder.getSurface();
5. ANativeWindow *window = ANativeWindow_fromSurface(surface);
6. vkCreateAndroidSurfaceKHR(... .window=window)
7. Draw like normal

Building

1. aapt to initialize apk file
2. ecj and dx for the java
3. clang for the C
4. zip to add libraries and things at the right locations (.apk = .zip)

Debugging

Lldb (`adb shell` gets you a shell as your app)

logcat

NativeActivity?

- No java? Is it some lower level?
- No, it’s just an included class (google NativeActivity.java)
- Does a lot of things you may or may not want
- Have to conform to their organization, e.g. they make threads passing stuff around
- You will eventually need to override some method
- Just extend Activity and implement SurfaceHolder.Callback, then call view.getHolder().addCallback(this) for the 5% behavior you actually want from NativeActivity

Experience

- Lots of setup
- Not bad after
- Ported to iOS, windows
- Haven’t shipped with lots of users yet…

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