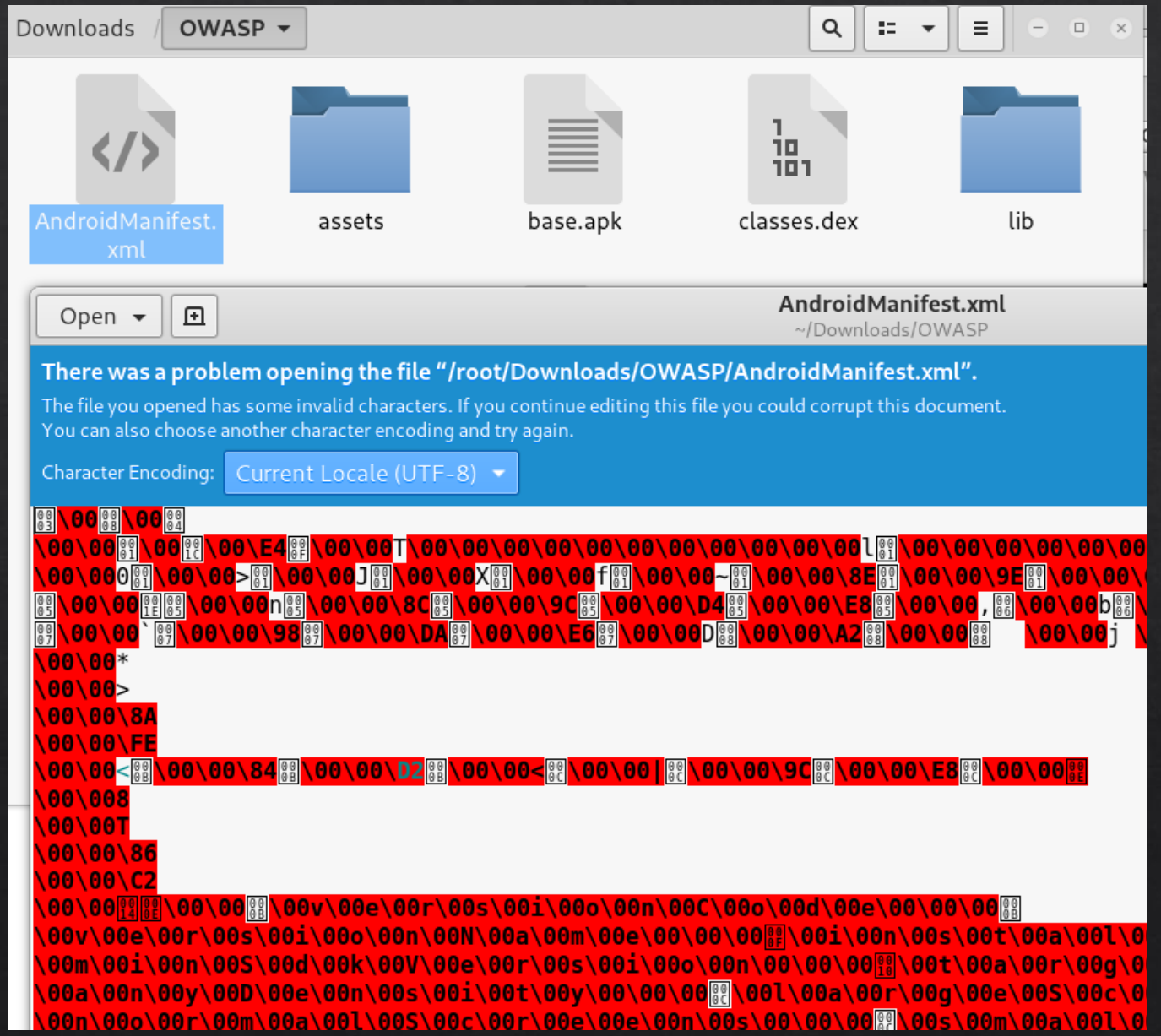
Let's open the AndroidManifest.xml file from unzipped APK →



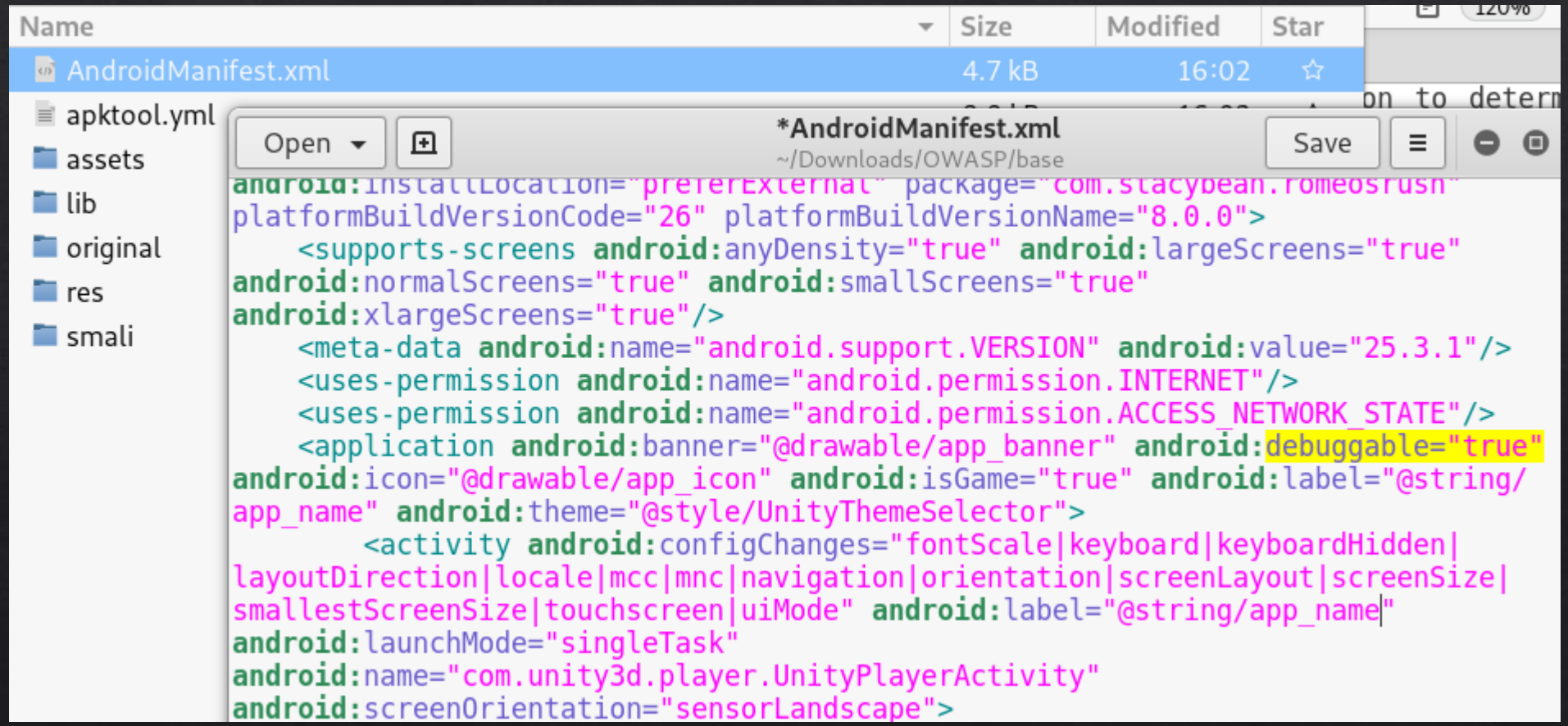
Okay so we need to decompile the APK properly so let's decompile it using APKTOOL →

```
root@Black-Box:~/Downloads/OWASP# apktool d base.apk
I: Using Apktool 2.3.4-dirty on base.apk
I: Loading resource table...
I: Decoding AndroidManifest.xml with resources...
I: Loading resource table from file: /root/.local/share/ap
I: Regular manifest package...
I: Decoding file-resources...
I: Decoding values */* XMLs...
I: Baksmaling classes.dex...
I: Copying assets and libs...
I: Copying unknown files...
I: Copying original files...
```

YAY ☺ let's see what's in there after decompiling →

```
root@Black-Box:~/Downloads/OWASP/base# ls -al
total 48
drwxr-xr-x   7 root root 4096 Feb 21 16:02 .
drwxr-xr-x   7 root root 4096 Feb 21 16:02 ..
-rw-r--r--   1 root root 4722 Feb 21 16:02 AndroidManifest.xml
-rw-r--r--   1 root root 8864 Feb 21 16:02 apktool.yml
drwxr-xr-x   3 root root 4096 Feb 21 16:02 assets
drwxr-xr-x   4 root root 4096 Feb 21 16:02 lib
drwxr-xr-x   3 root root 4096 Feb 21 16:02 original
drwxr-xr-x 162 root root 4096 Feb 21 16:02 res
drwxr-xr-x   7 root root 4096 Feb 21 16:02 smali
```

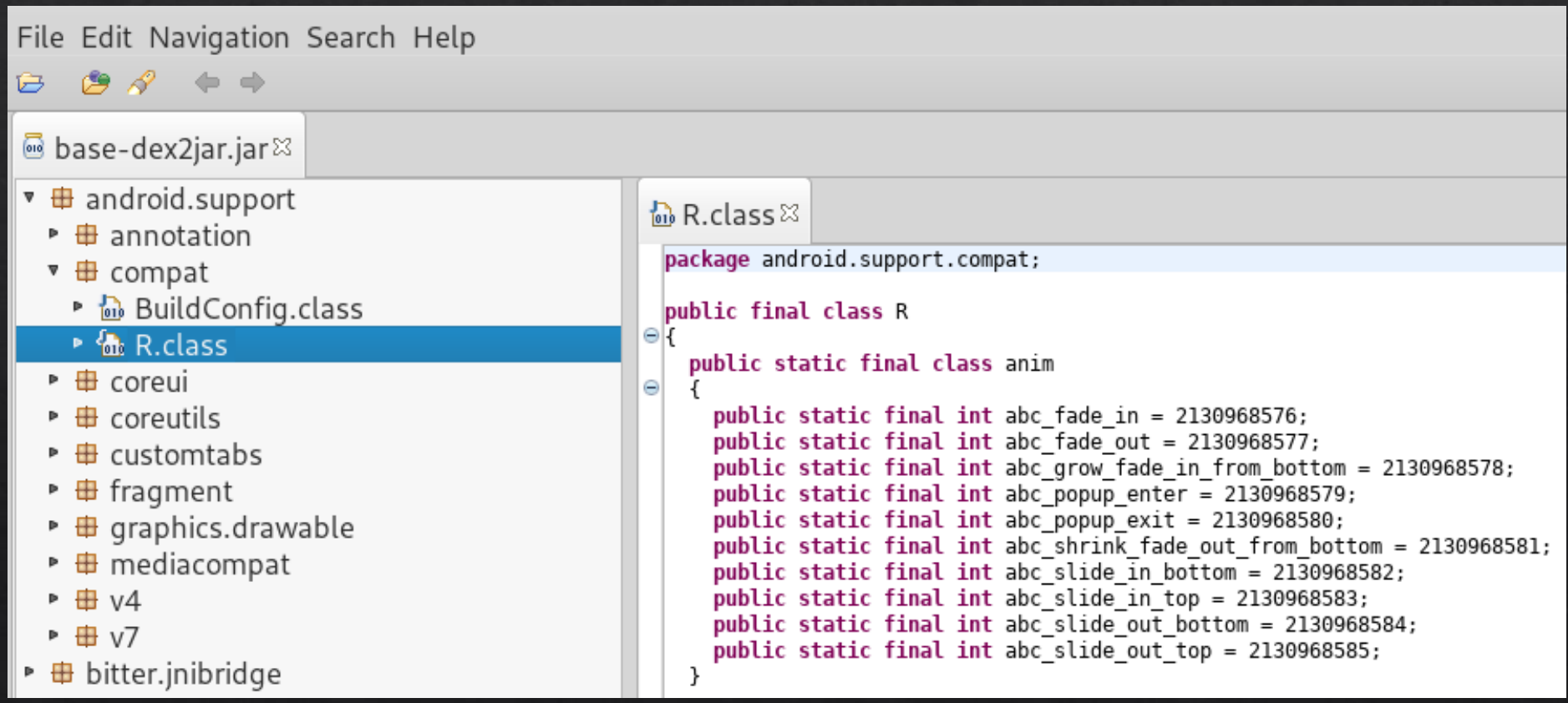
Now let's modify the AndroidManifest.xml file and set the debuggable option to True so we can later hook this app into a debugger ☺



You can also convert an APK file directly into a JAR format using dex2jar →

```
root@Black-Box:~/Downloads/OWASP# d2j-dex2jar base.apk
dex2jar base.apk -> base-dex2jar.jar
root@Black-Box:~/Downloads/OWASP# ls
AndroidManifest.xml  assets  base  base.apk  base-dex2jar.jar
root@Black-Box:~/Downloads/OWASP#
```

Once done, we can then open this .jar file in JD – GUI →



We are now ready to recompile our app back to .APK file. We will use APKTOOL again to achieve this.

```
root@Black-Box:~/Downloads/OWASP# apktool b base
I: Using Apktool 2.3.4-dirty
I: Checking whether sources has changed...
I: Checking whether resources has changed...
I: Building apk file...
I: Copying unknown files/dir...
I: Built apk...
root@Black-Box:~/Downloads/OWASP# cd base/dist
root@Black-Box:~/Downloads/OWASP/base/dist# ls -al
total 78844
drwxr-xr-x 2 root root     4096 Feb 21 16:21 .
drwxr-xr-x 9 root root     4096 Feb 21 16:21 ..
-rw-r--r-- 1 root root 80727908 Feb 21 16:21 base.apk
root@Black-Box:~/Downloads/OWASP/base/dist#
```

And now it is time to sign the newly compiled APK file with the Android test certificate. I am using APK Sign for this. https://github.com/appium/sign

```
root@Black-Box:~/Downloads/sign# ls
build.sh  dist  license  pom.xml  readme.md  signapk_jar  sign.bat  sign_jar  src  testkey.pk8  testkey.x509.pem
root@Black-Box:~/Downloads/sign# java -jar dist/signapk.jar testkey.x509.pem testkey.pk8 ~/Downloads/OWASP/base/dist/base.apk signed.apk
root@Black-Box:~/Downloads/sign# ls -al
total 78856
drwxr-xr-x  8 root root     4096 Feb 21 16:28 .
drwxr-xr-x 16 root root     4096 Feb 21 15:30 ..
-rwxr-xr-x  1 root root      285 Feb 18 22:59 build.sh
drwxr-xr-x  2 root root     4096 Feb 20 20:14 dist
drwxr-xr-x  8 root root     4096 Feb 18 22:59 .git
-rw-r--r--  1 root root       48 Feb 18 22:59 .gitignore
drwxr-xr-x  3 root root     4096 Feb 18 22:59 license
-rw-r--r--  1 root root     1784 Feb 18 22:59 pom.xml
-rw-r--r--  1 root root     2130 Feb 18 22:59 readme.md
drwxr-xr-x  3 root root     4096 Feb 18 22:59 signapk_jar
-rw-r--r--  1 root root      176 Feb 18 22:59 sign.bat
-rw-r--r--  1 root root 80679901 Feb 21 16:29 signed.apk
drwxr-xr-x  3 root root     4096 Feb 18 22:59 sign_jar
drwxr-xr-x  4 root root     4096 Feb 18 22:59 src
-rw-r--r--  1 root root     1217 Feb 18 22:59 testkey.pk8
-rw-r--r--  1 root root     1675 Feb 18 22:59 testkey.x509.pem
```

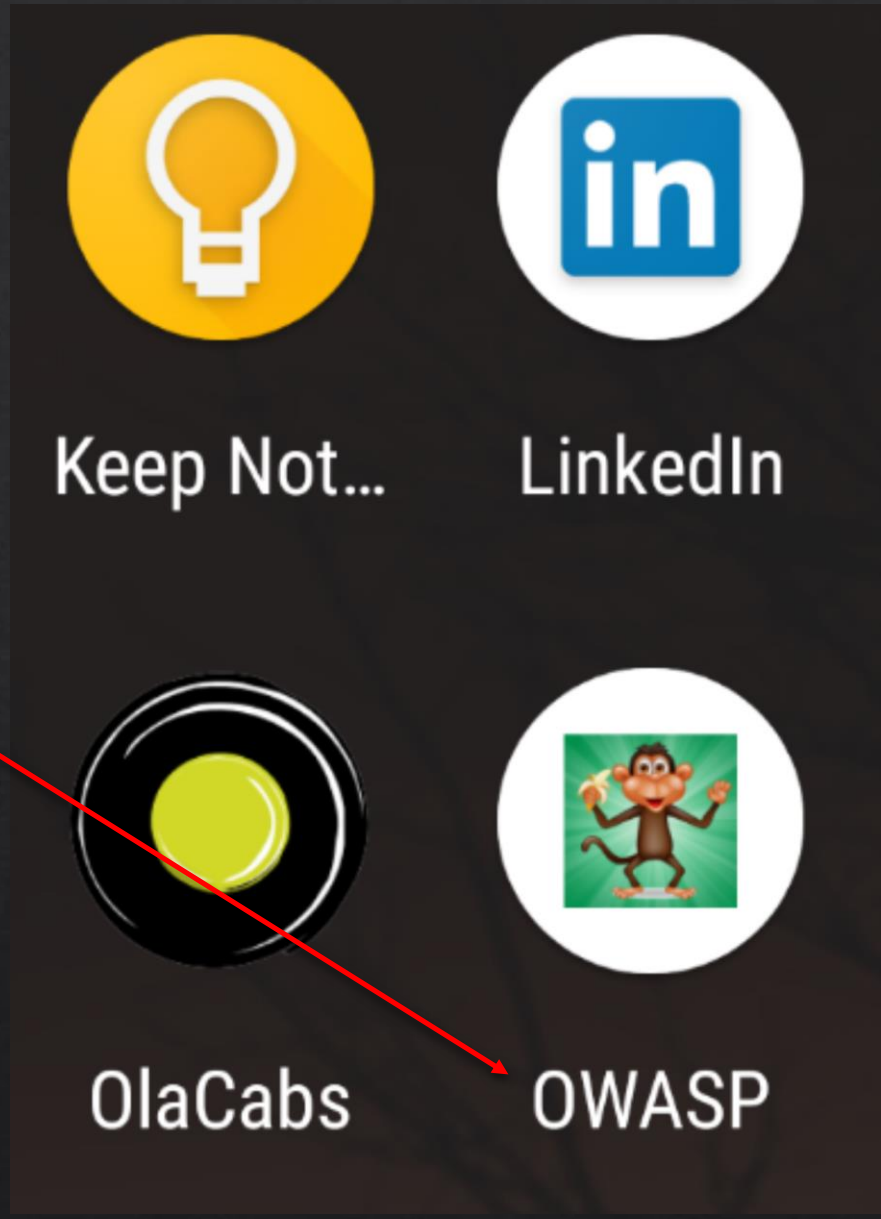
We will use Zipalign (part of Android SDK build-tools) to optimise our newly signed APK. You can read more about Zipalign here:
https://developer.android.com/studio/command-line/zipalign

```
root@Black-Box:~/Downloads/sign# zipalign -v 4 signed.apk base.apk
Verifying alignment of base.apk (4)...
      53 AndroidManifest.xml (OK - compressed)
    2329 assets/bin/Data/Managed/Assembly-CSharp-firstpass.dll (OK - compressed)
    9671 assets/bin/Data/Managed/Assembly-CSharp.dll (OK - compressed)
  179442 assets/bin/Data/Managed/Facebook.Unity.Android.dll (OK - compressed)
  180936 assets/bin/Data/Managed/Facebook.Unity.Gameroom.dll (OK - compressed)
  183847 assets/bin/Data/Managed/Facebook.Unity.IOS.dll (OK - compressed)
  184951 assets/bin/Data/Managed/Facebook.Unity.Settings.dll (OK - compressed)
  188108 assets/bin/Data/Managed/Facebook.Unity.dll (OK - compressed)
  226598 assets/bin/Data/Managed/FacebookNamedPipeClient.dll (OK - compressed)
  237656 assets/bin/Data/Managed/Mono.Security.dll (OK - compressed)
  354630 assets/bin/Data/Managed/System.Core.dll (OK - compressed)
  455878 assets/bin/Data/Managed/System.Xml.dll (OK - compressed)
```

Let's push this to mobile now →

```
root@Black-Box:~/Downloads/sign# adb install base.apk
Success
root@Black-Box:~/Downloads/sign#
```

And we successfully managed to change the name of the app and installed it on the phone ☺



How can I make my App secure?

- Use code obfuscator like ProGuard which is a cross platform tool written in Java.

Original Source Code Before Rename Obfuscation

```
private void
CalculatePayroll(SpecialList
employeeGroup) {
   while(employeeGroup.HasMore()) {
      employee =
employeeGroup.GetNext(true);
      employee.UpdateSalary();
      DistributeCheck(employee);
   }
}
```

Reverse-Engineered Source Code After Rename Obfuscation

```
private void a(a b) {
   while (b.a()) {
      a = b.a(true);
      a.a();
      a(a);
   }
}
```

- Developers can also obfuscate code manually. Code obfuscation may include:
  - encrypting some or all of the code;
  - stripping out potentially revealing metadata
  - renaming useful class and variable names to meaningless labels;
  - adding unused or meaningless code to an application's binary.

- Do Not store any sensitive information in the application source code
- Move important code chunks to the server side
- Do Not store user credentials at the device level and rather store a short lived encrypted token
- Will highly recommend not to store API keys in the code and make use of public/private key exchange to protect your API
- Do Not store app data to external storage since it can be read by all of the applications.
- Enable Anti-Tamper and Anti-Debug by injecting a self-protection code into the application source code. E.g. Random crashes and limited functionality upon tampering detection.

Further reading:

OWASP Mobile Top 10

https://www.owasp.org/index.php/Mobile_Top_10_2016-Top_10

https://hackernoon.com/mobile-application-security-best-practices-for-app-developers-1a6345750b35

https://www.multidots.com/how-to-prevent-reverse-engineering-of-your-mobile-apps/

https://www.preemptive.com/obfuscation

https://www.talentica.com/blogs/reverse-engineering-of-mobile-apps/