



Fighting application size with ProGuard and beyond

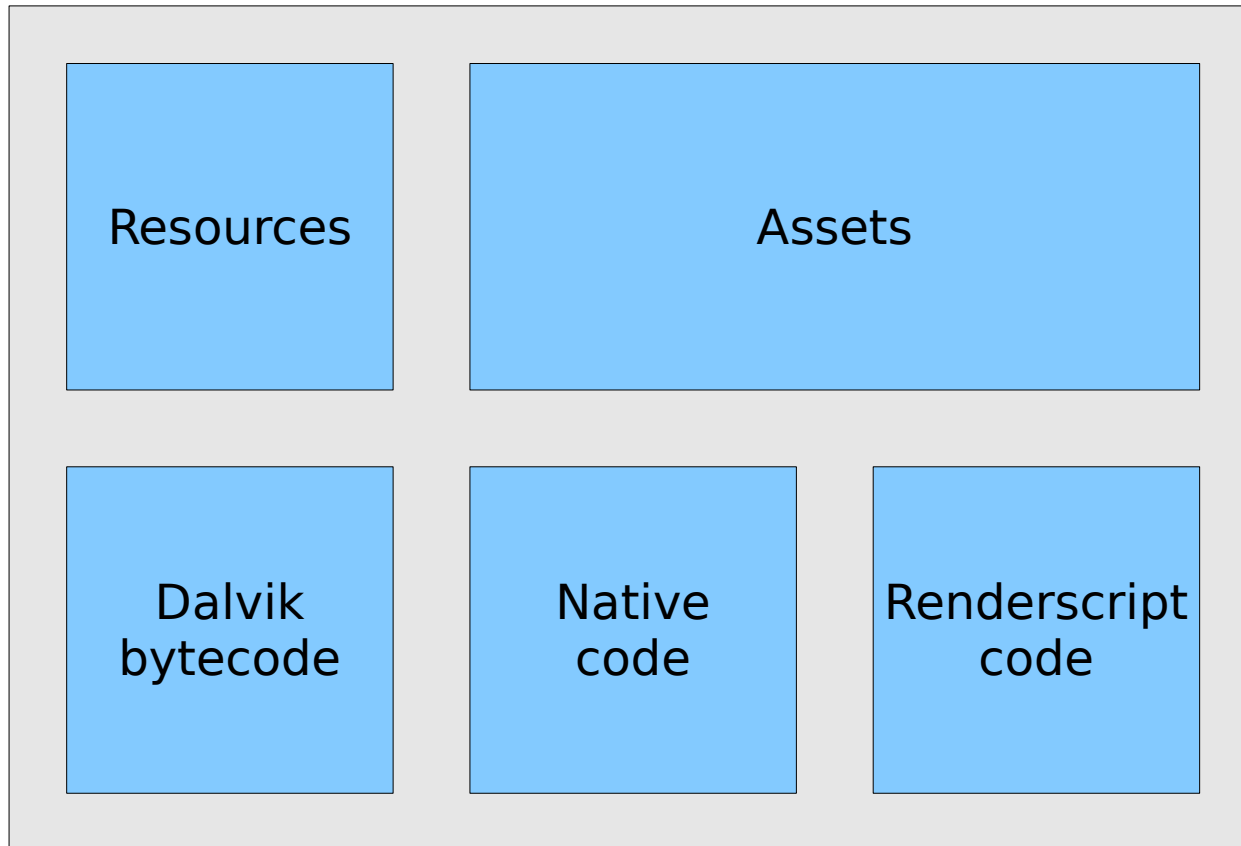
Eric Lafortune

Developer of ProGuard and DexGuard

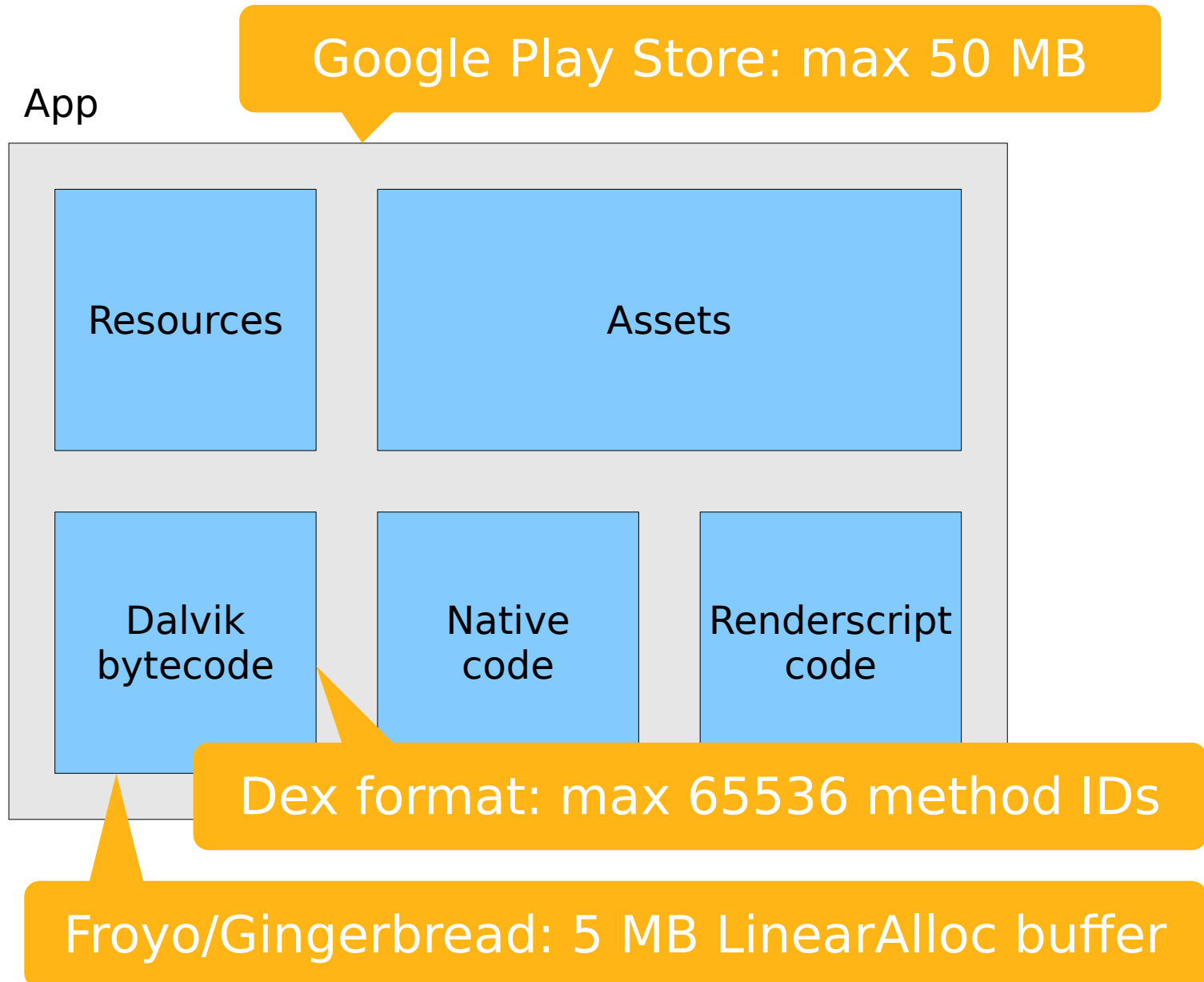
Technical director at Saikoa
www.saikoa.com

Applications

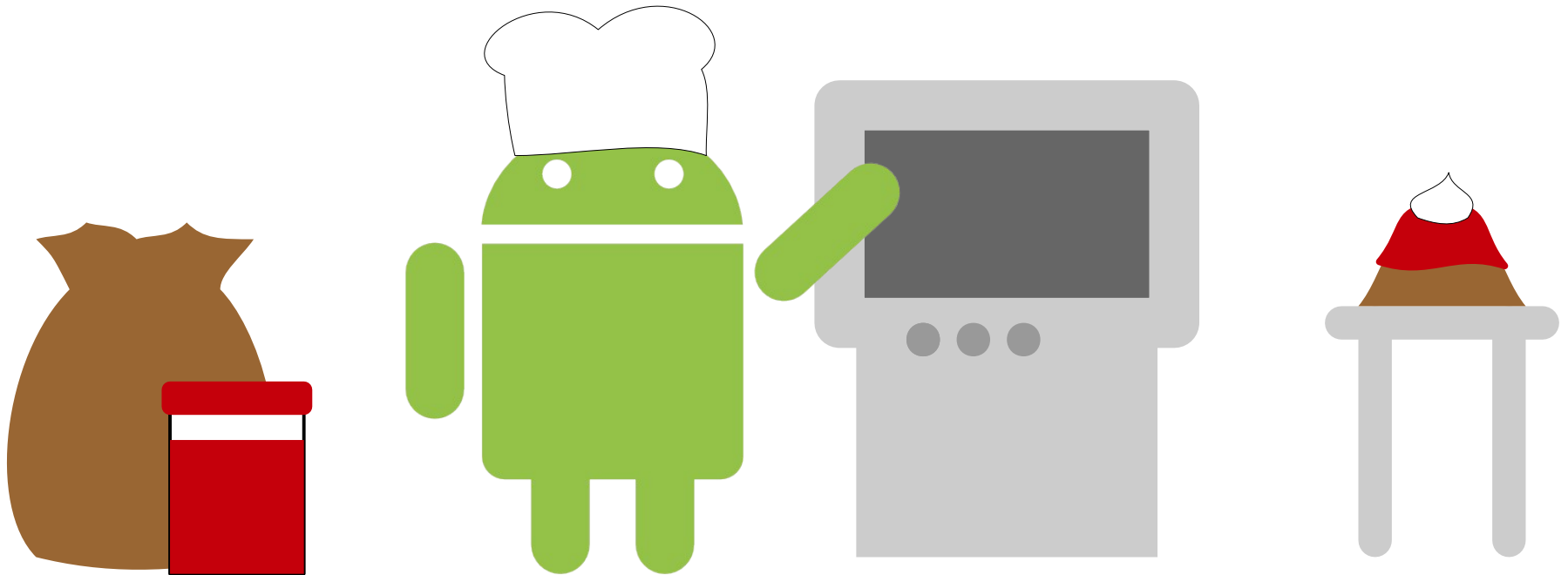
App



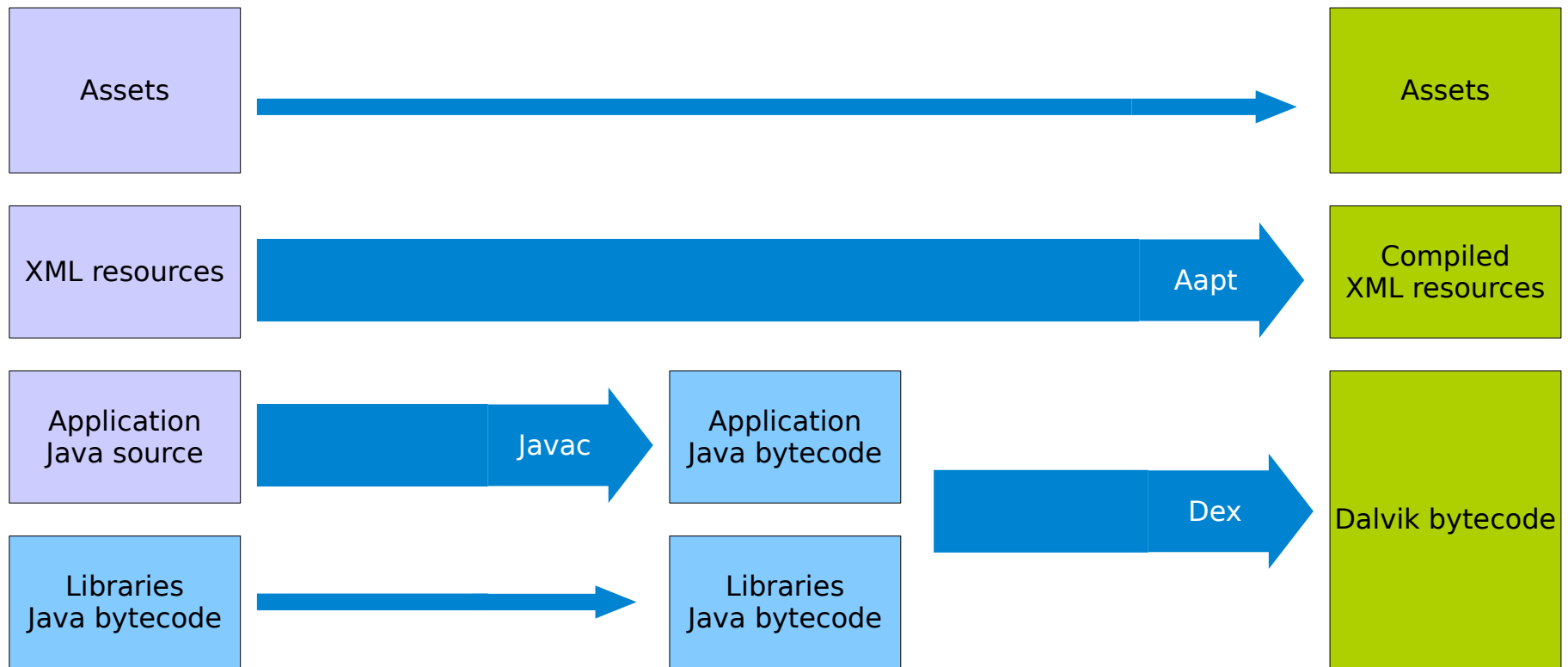
Technical constraints



Android build process



Android build process



Compress media

- Images: JPEG (lossy)
- Images: PNG

```
aapt crunch -S input_dir -C output_dir
```

- Audio: AAC
- Video: H264 AVC

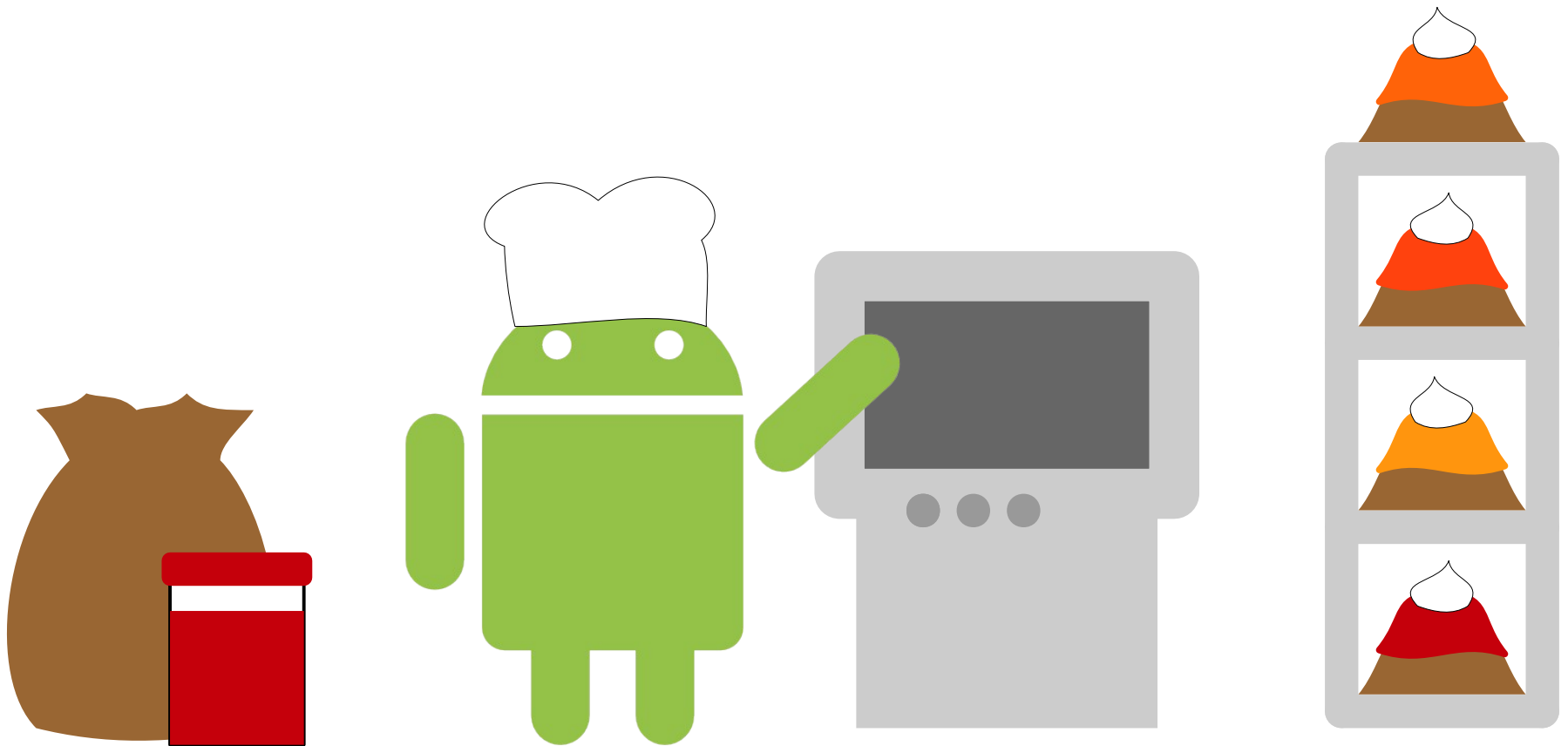
Remove unused resources

- Lint (Android SDK)

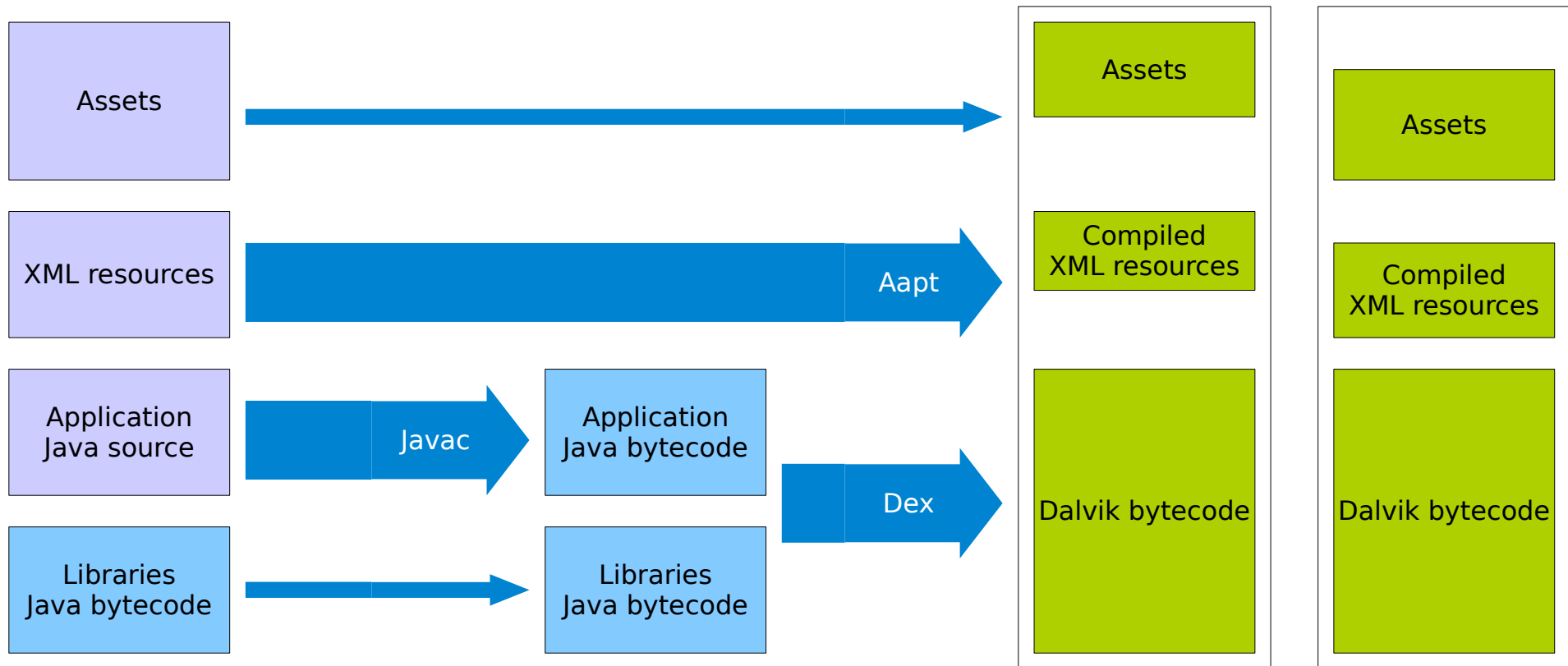
```
gradle lint
```

- android-resource-remover (Philipp Berner)
- android-unused-resources (S. Kennedy)

Splitting apk files



Splitting apk files



Splitting apk files

- Different variants in Gradle:

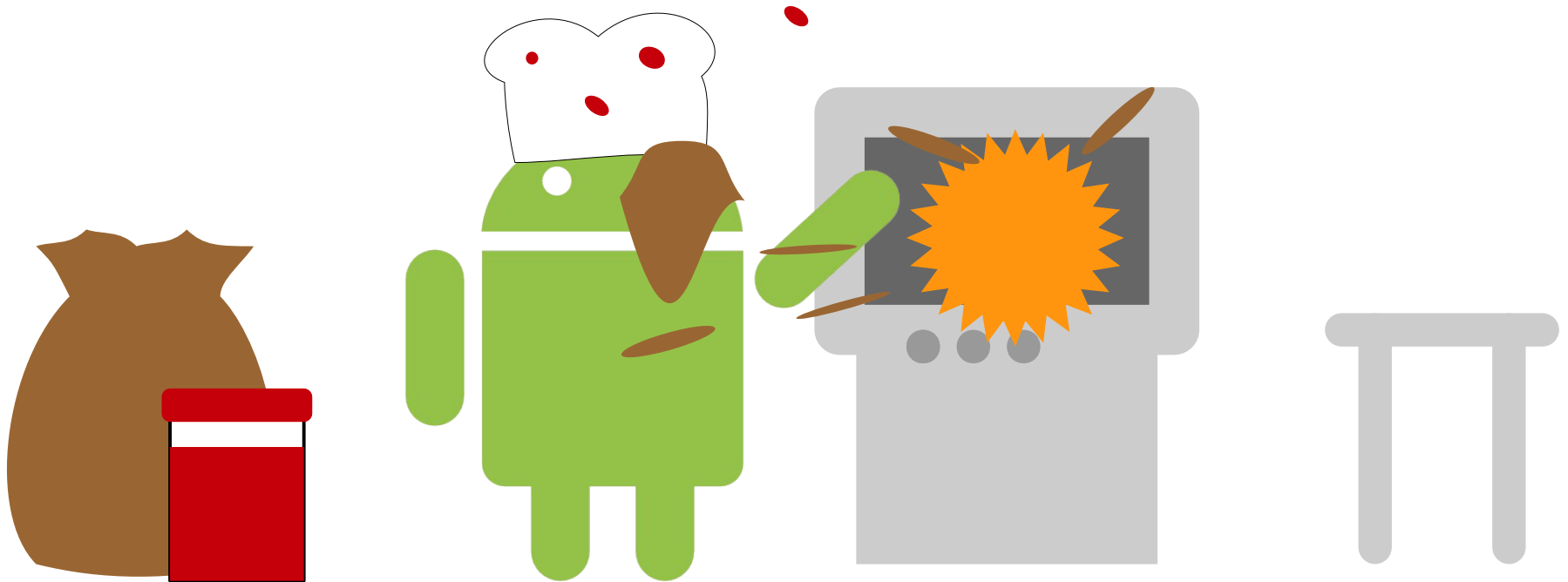
```
android {  
    ...  
    productFlavors {  
        flavor1 {  
            ignoreAssetsPattern '!*_large.png'  
            assets.srcDirs = ['assets1']  
            res.srcDirs    = ['res1']  
        }  
        flavor2 {  
            ignoreAssetsPattern '!*_small.png'  
            assets.srcDirs = ['assets2']  
            res.srcDirs    = ['res2']  
        }  
    }  
}
```

Splitting apk files

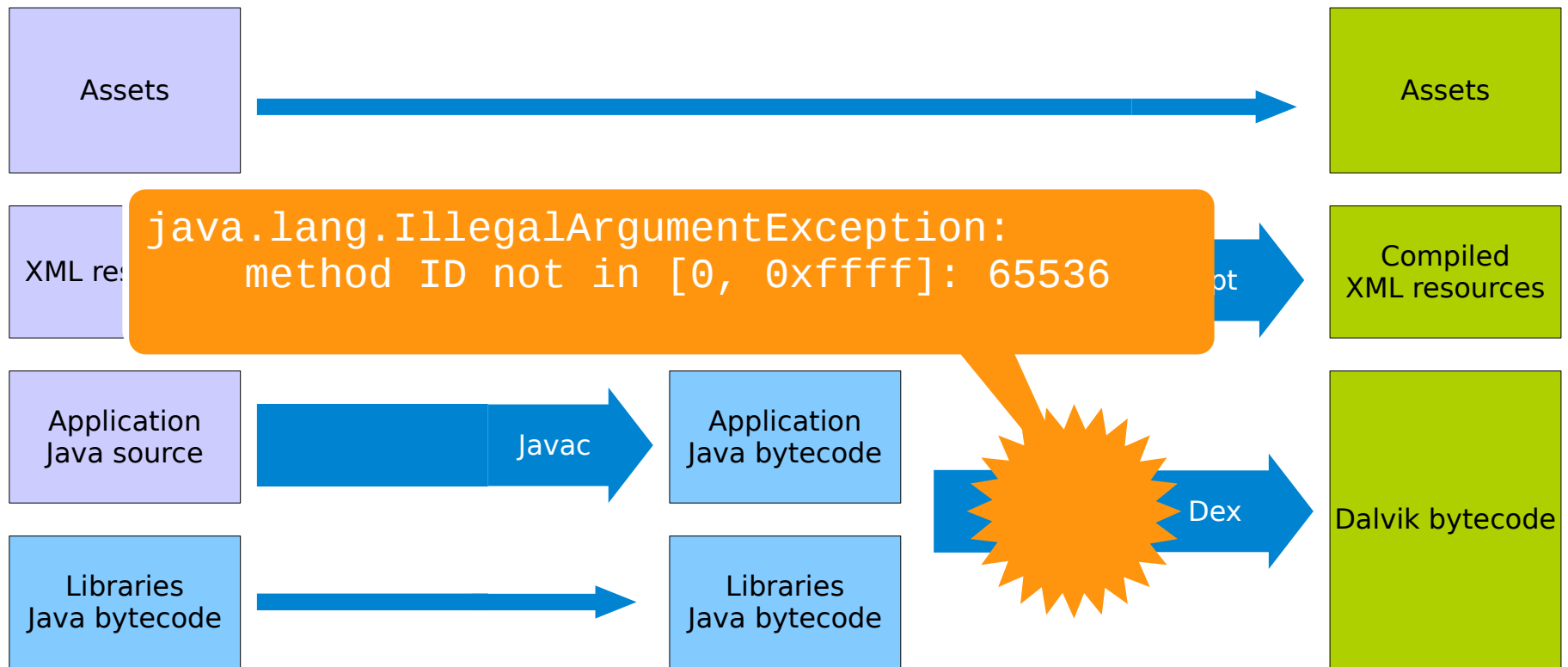
- Splits in Gradle:

```
android {  
    ...  
    splits {  
        density {  
            enable true  
            reset()  
            include 'mdpi', 'hdpi', 'xhdpi'  
        }  
        abi {  
            enable true  
            reset()  
            include 'armeabi-v7a', 'x86', 'mips'  
        }  
    }  
}
```

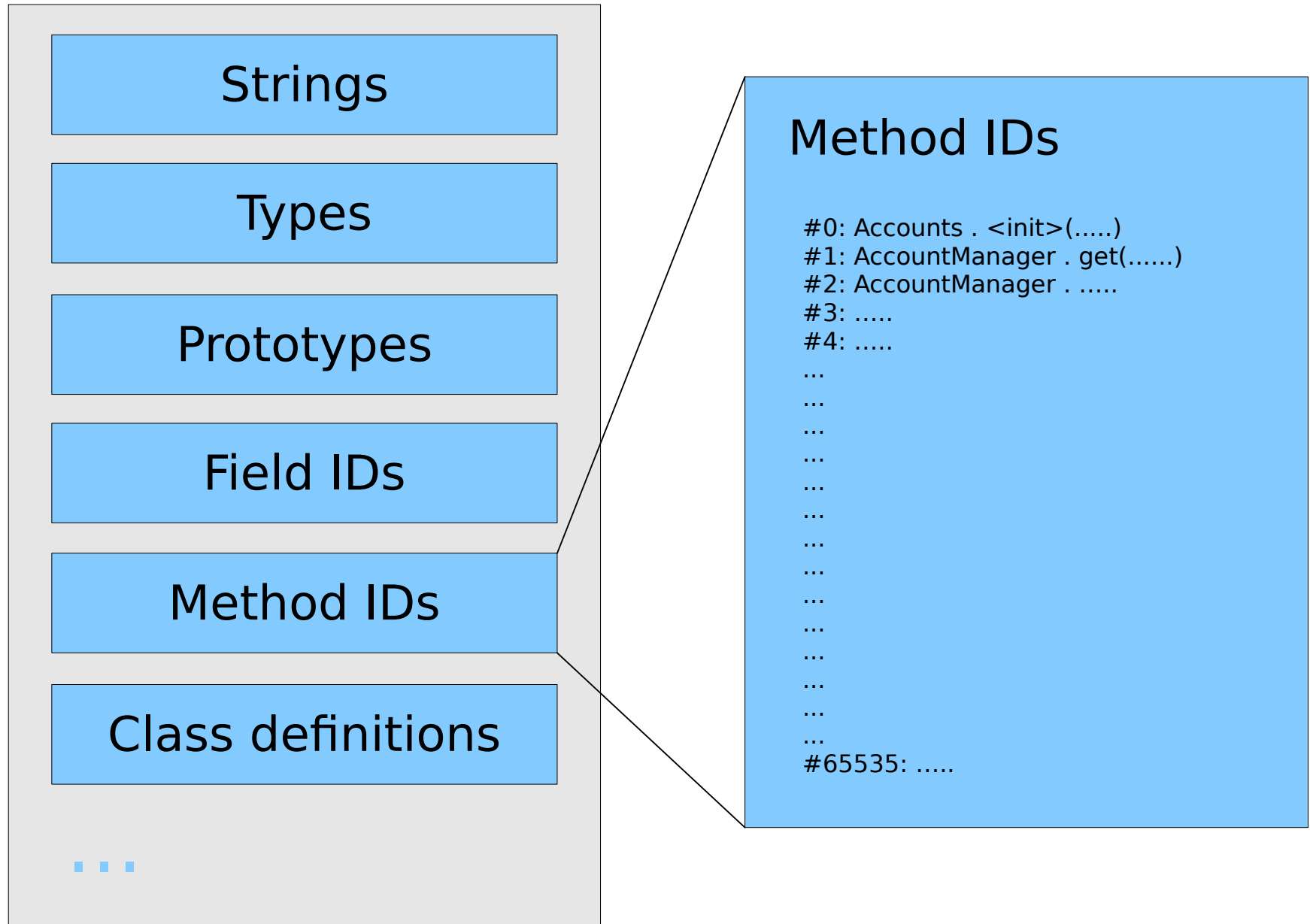
Code size



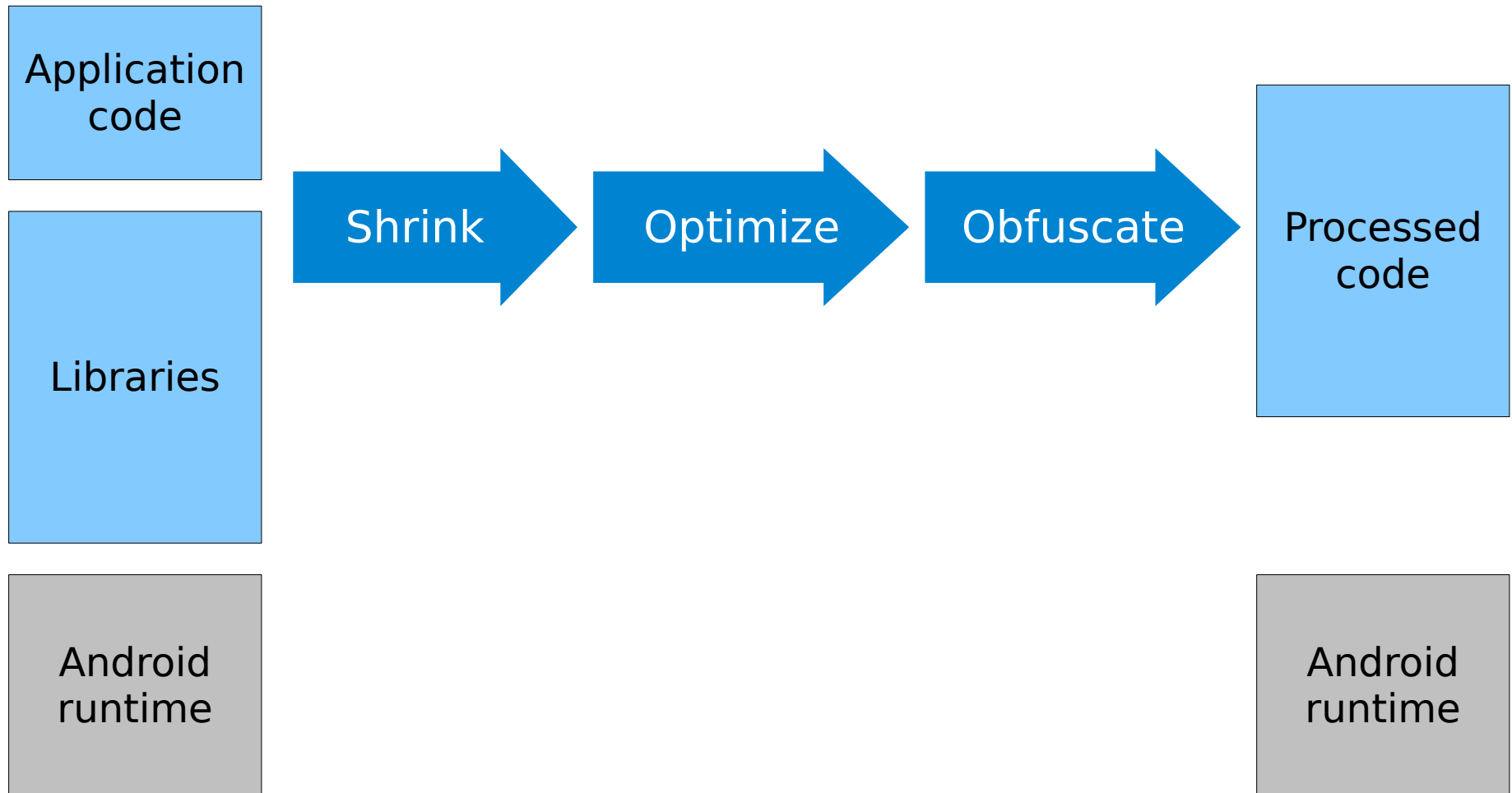
Code size



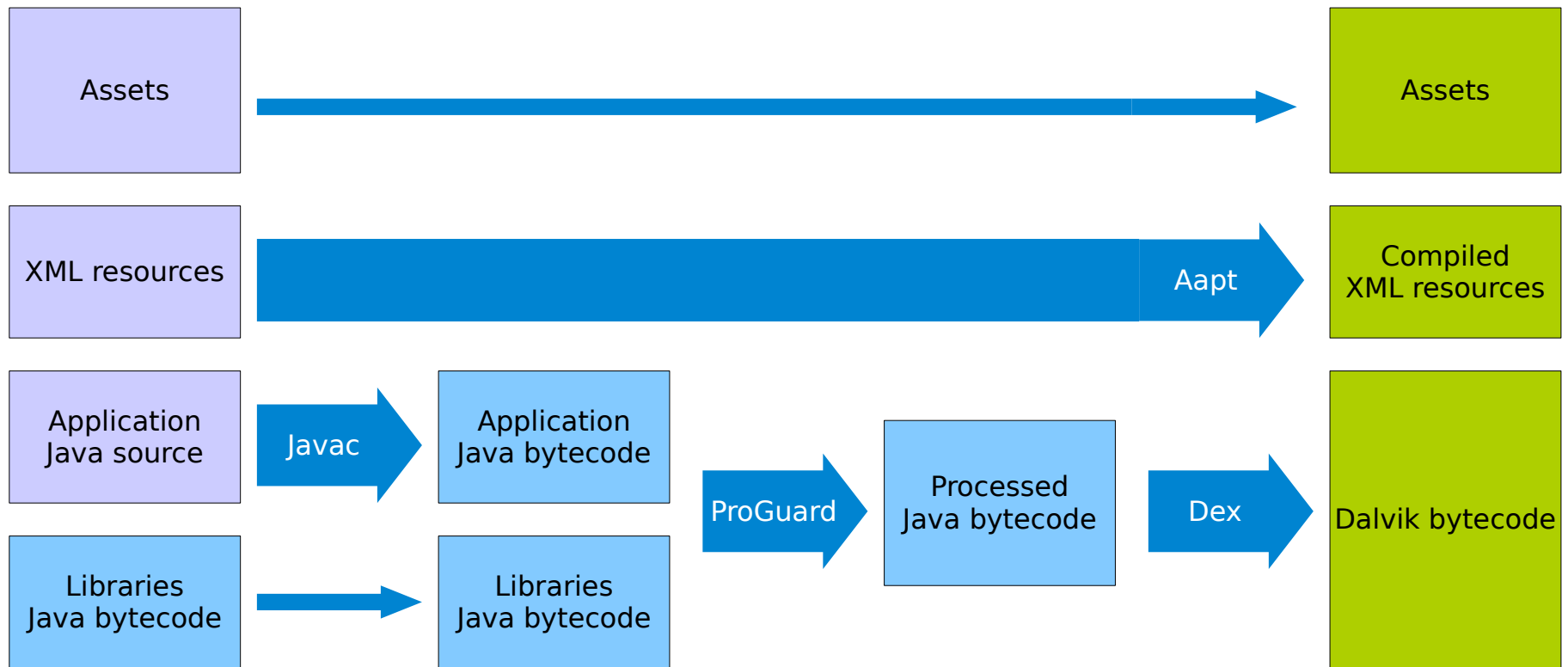
Dex file



ProGuard



ProGuard



Example configuration: Dagger

```
-keepclassmembers,allowobfuscation class * {  
    @dagger.** <fields>;  
    @dagger.** <methods>;  
}
```

```
-keep class **$$ModuleAdapter  
-keep class **$$InjectAdapter  
-keep class **$$StaticInjection
```

```
-keep class com.example.DemoModule  
-keep class com.example.AndroidModule  
-keep class com.example.HomeActivity
```

```
-keepnames class dagger.Lazy
```

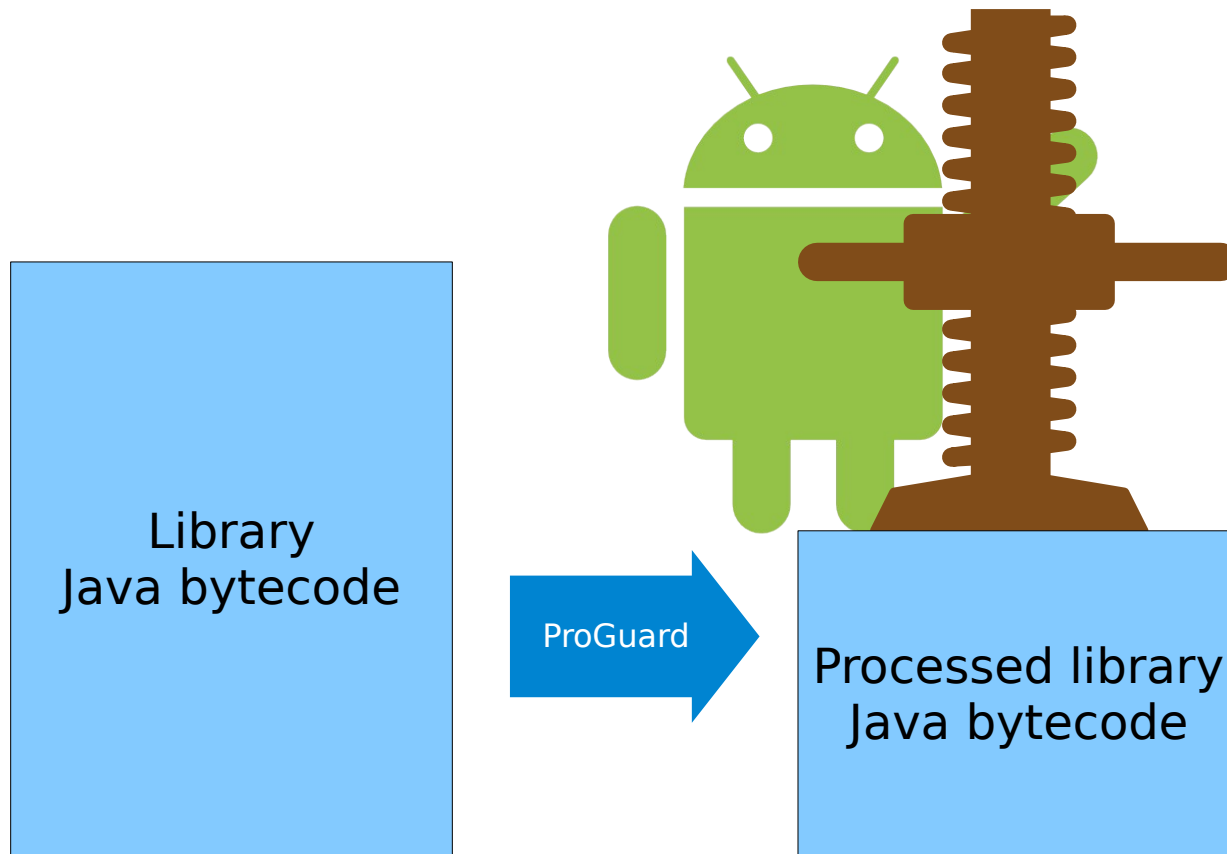
Generated classes

Corresponding base classes

Libraries

Library	Method IDs
Google Play Services 6.0	23,607
Guava 15.0	14,495
Yahoo Flurry Ads 4.1.0	8,511
ActionBarSherlock 4.4.0	4,300
RoboGuice 2.0	3,787
Facebook 3.5.2	3,166
Yahoo Flurry Analytics 4.1.0	1,148
Scala Core 2.11.2	50,786

ProGuard on libraries



Shrink Ads library

configuration.txt

```
-injars  google-play-services.jar
-outjars google-play-services-ads.jar

-libraryjars android-sdk/extras/android/support/v4/android-support-v4.jar
-libraryjars android-sdk/platforms/android-20/android.jar

-dontoptimize
-dontobfuscate
-dontwarn com.google.**.R
-dontwarn com.google.**.R$*
-dontnote

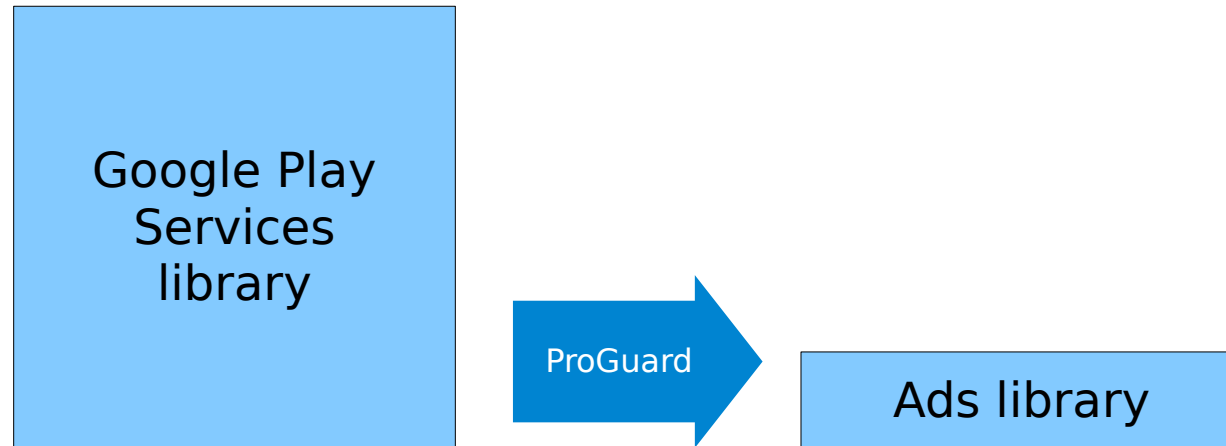
-keep public class com.google.android.gms.ads.** {
    public protected *;
}

-keep class com.google.android.gms.common.internal.safeParcelable.SafeParcelable {
    java.lang.String NULL;
}
```

Command line:

```
proguard @ configuration.txt
```

Shrink Ads library



	Before	After	Reduction
Size	3.3 M	578 K	83 %
Classes	3294	497	85 %
Method IDs	23607	3751	84 %

Shrink Maps library

```
-injars  google-play-services.jar
-outjars google-play-services-maps.jar

-libraryjars android-sdk/extras/android/support/v4/android-support-v4.jar
-libraryjars android-sdk/platforms/android-20/android.jar

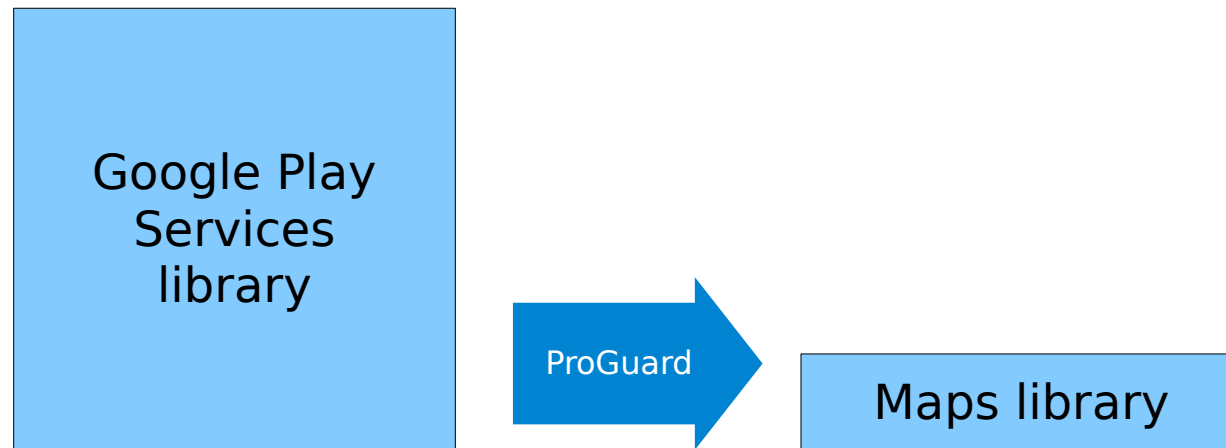
-dontoptimize
-dontobfuscate
-dontwarn com.google.**.R
-dontwarn com.google.**.R$*
-dontnote

-keep public class com.google.android.gms.maps.**,
                    com.google.android.gms.common.**,
                    com.google.android.gms.location.** {
    public protected *;
}

-keep class com.google.android.gms.common.internal.safeParcelable.SafeParcelable {
    java.lang.String NULL;
}
```

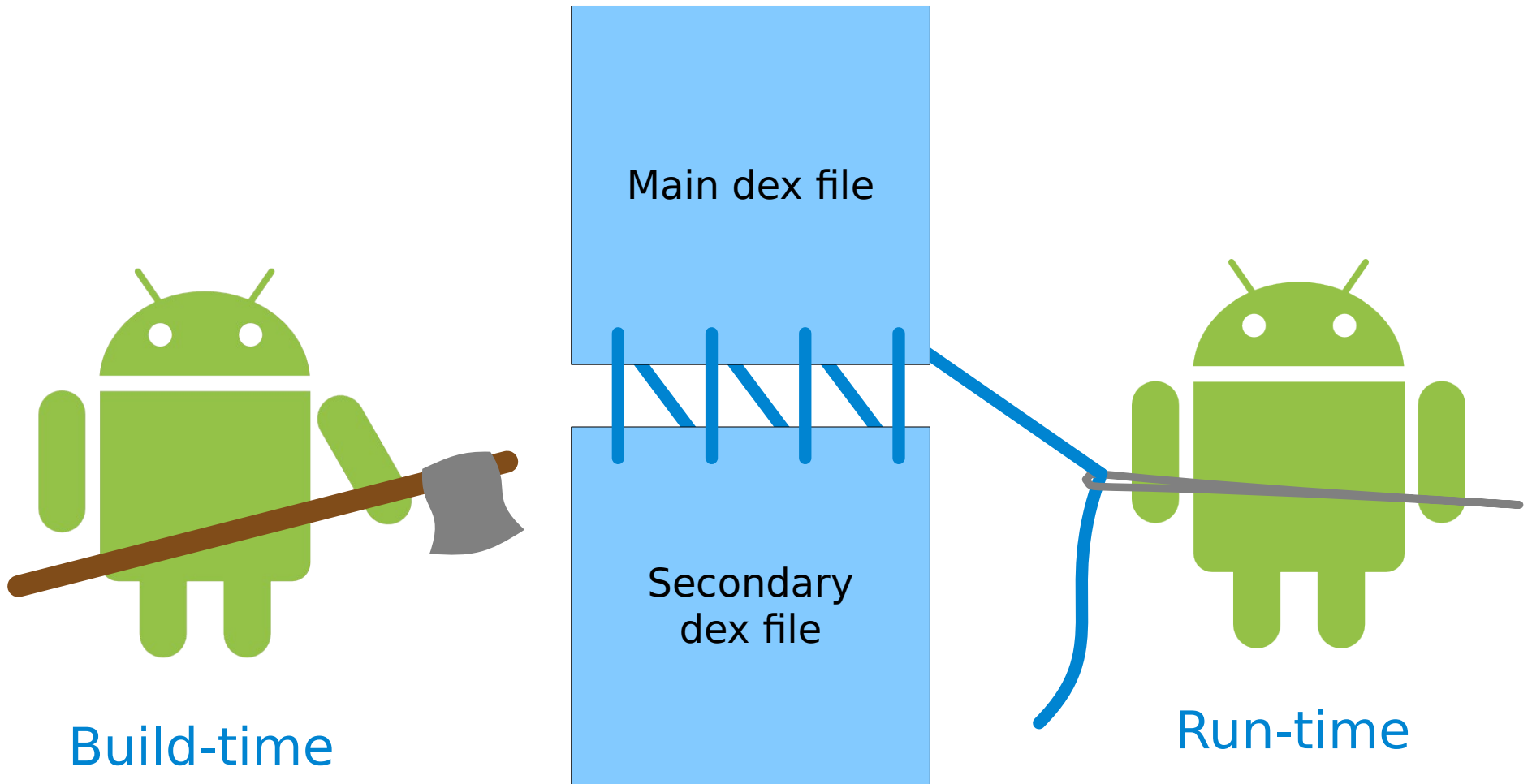
proguard @ configuration.txt

Shrink Maps library

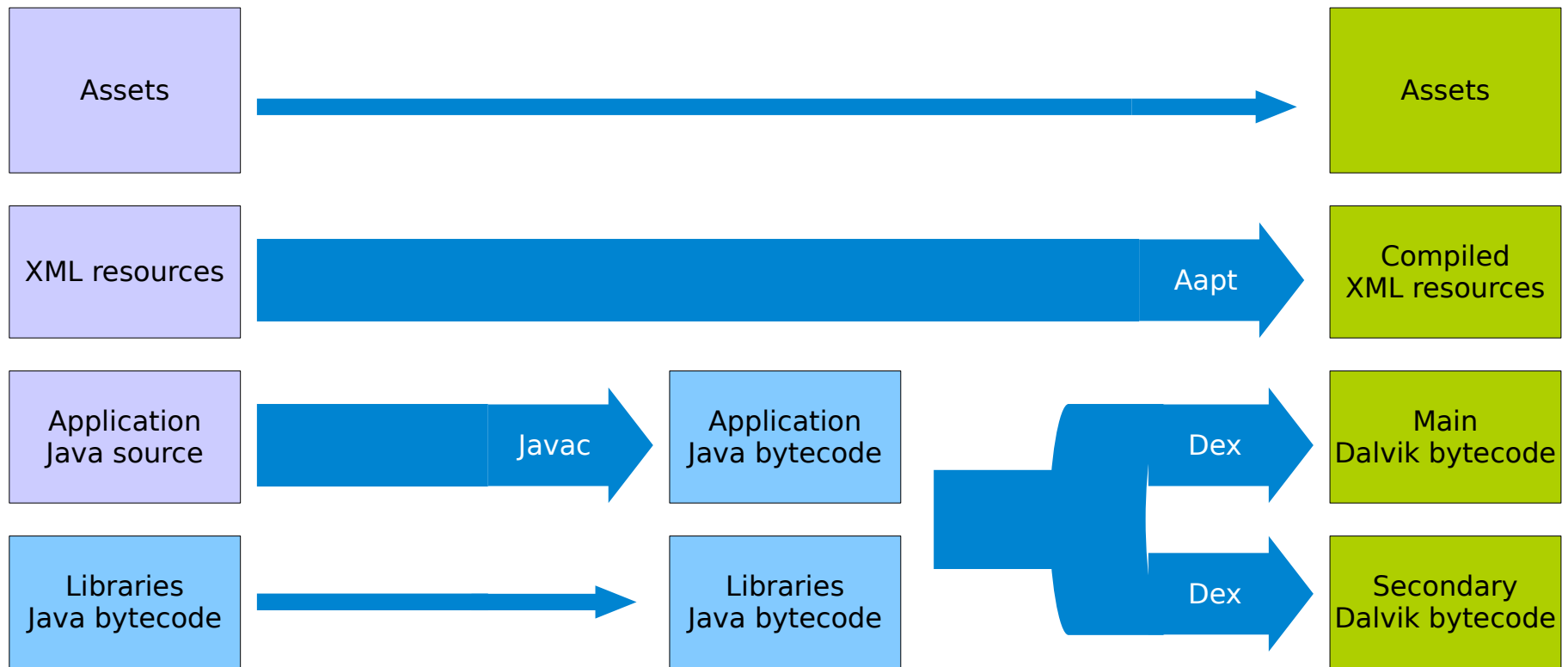


	Before	After	Reduction
Size	3.3 M	583 K	82 %
Classes	3294	546	83 %
Method IDs	23607	4891	79 %

Splitting dex files



Splitting dex files



Dex splitting: tools

- [secondary-dex-gradle](#) (Mohit Kanwal)
- [Dex 65536](#) (Mmin18)
- [DexGuard](#) (Saikoa)
- [Android 5.0 / android.support.multidex](#)

Dex splitting: secondary-dex-gradle

- ApplicationProject
LibraryProject
- settings.gradle

```
include ':ApplicationProject', ':LibraryProject'
```

- AndroidManifest.xml

```
<application  
    android:name="com.example.App"  
    ... >
```

- AppProject/src/com/example/App.java
AppProject/src/com/example/SecondaryDex.java
AppProject/src/com/example/FrameworkHack.java

Dex splitting: secondary-dex-gradle

Advantages:

- It works!

Disadvantages:

- Split project
- No references library → application
- Dex classpath hack

Dex splitting: Dex 65536

- `libs/google-play-services.jar` (for example)
- `custom rules.xml`

```
...  
<pathtool  
  libs="libs/google-play-services.jar"  
  ... />  
...
```

- `AndroidManifest.xml`

```
<application  
  android:name="com.example.App"  
  ... >
```

- `src/com/example/App.java`

```
new DexClassLoader(dexFile.getAbsolutePath(),  
                  dexOpt.getAbsolutePath(),  
                  nativeLibraryDir,  
                  classLoader.getParent());
```

Dex splitting: Dex 65536

Advantages:

- It works!

Disadvantages:

- Only for library jars
- Dex classloader hack

Dex splitting: DexGuard

- Gradle, Ant, Eclipse, Maven, Android Studio,...
- dexguard-project.txt

```
-splitdexfile com.google.**
```

```
-splitdexfile !com.facebook.samples.**, com.facebook.**
```

Dex splitting: DexGuard

Advantages:

- Transparent
- Flexible
- Lazy loading

Disadvantages:

- Reflection

Dex splitting: Android 5.0

Android 5.0 loads classes2.dex, classes3.dex, etc.

- build.gradle

```
...  
dx.additionalParameters += '--multi-dex'  
dx.additionalParameters +=  
    "--main-dex-list=$projectDir/list.txt".toString()
```

- list.txt

```
com/example/SomeClass.class  
...
```

- AndroidManifest.xml (for legacy platforms)

```
<application  
    android:name="android.support.multidex.MultiDexApplication"  
    ... >
```

Dex splitting: Android 5.0

Advantages:

- Latest standard

Disadvantages:

- Eager loading

Summary

Resources and assets:

- Compress
- Trim
- Split apk

Bytecode:

- Shrink libraries
- Shrink application
- Split dex file

Further reading

- “Custom Class Loading in Dalvik”, Fred Chung, Google
<http://android-developers.blogspot.com/2011/07/custom-class-loading-in-dalvik.html>
- “Play Services 5.0 Is A Monolith Abomination”, Jake Wharton
<http://jakewharton.com/play-services-is-a-monolith/>
- “DEX Sky’s the limit? No, 65K methods is”, Sebastiano Gottardo
<https://medium.com/@rotxed/dex-skys-the-limit-no-65k-methods-is-28e6cb40cf71>
- “Multi-dex to rescue from the infamous 65536 methods limit”, Alex Lipov
<http://blog.osom.info/2014/10/multi-dex-to-rescue-from-infamous-65536.html>
- “Under the Hood: Dalvik patch for Facebook for Android”, David Reiss
<https://www.facebook.com/notes/facebook-engineering/under-the-hood-dalvik-patch-for-facebook-for-android/10151345597798920>
- “Tips for reducing APK file size”, David Karlsson, Sony
<http://developer.sonymobile.com/2012/01/31/tips-for-reducing-apk-file-size/>

Software tools

- android-resource-remover, Philipp Berner, KeepSafe
<https://github.com/KeepSafe/android-resource-remover>
- android-unused-resources, S. Kennedy
<https://code.google.com/p/android-unused-resources/>
- secondary-dex-gradle, Mohit Kanwal
<https://github.com/creativepsyco/secondary-dex-gradle>
- Dex 65536, Mmin18
<https://github.com/mmin18/Dex65536>
- ProGuard
<http://proguard.sourceforge.net/>
- DexGuard
<http://www.saikoa.com/dexguard>

Questions?

Open source

ProGuard

Optimization

Shrinking

Saiko

Java bytecode

DexGuard

Dalvik bytecode