Android: annotations to the rescue

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2016.03.30

Introduction

Introduction

- Gain of productivity
    - Don't (re)write boilerplate code
    - Automatic code generation
- Code quality improvements
    - Widely tested and documented third-party libraries
    - Less code to write, less bugs to fix
- What about performances?
    - Annotations processing compile time vs. runtime

Android compliance

Android compliance

- android-apt plugin for Android Studio
  - Allows developers to configure a compile time annotation processor as a dependency in the `build.gradle` file
  - Runs annotation processing
  - Example:

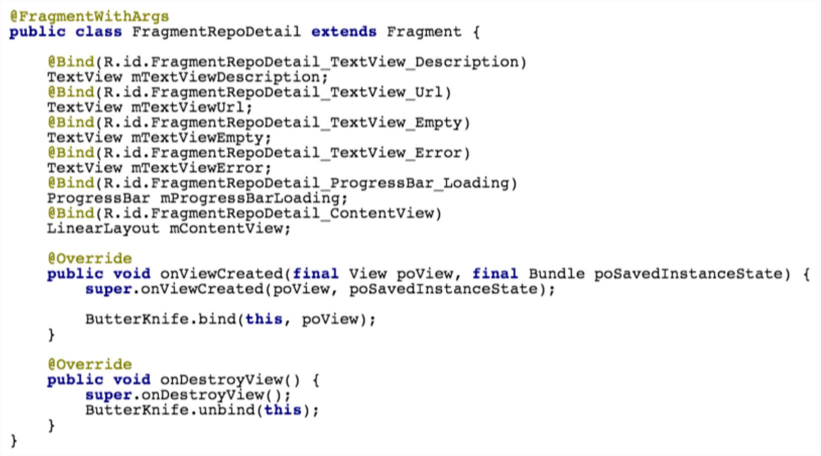
```
dependencies {
    compile 'a.group:annotation:x.x.x'
    apt 'a.group:processor:x.x.x'
}
```

Views

Butter Knife

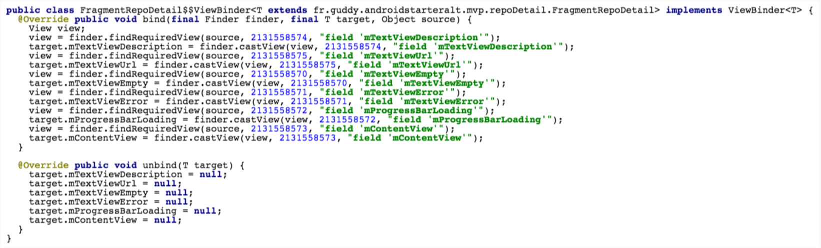
- No `findViewById` anymore, elegant binding mechanism
- Simple way to bind resources
- Bind anything: activities, fragments, views, view holders
- The power of view lists (actions, setters)

- Event bindings:
    - OnClick/OnLongClick, OnItemSelected, OnCheckedChanged, OnEditorAction, OnFocusChange, OnItemLongClick, OnPageChange, OnTextChanged, OnTouch
- Under the hood
    - Same package binding class generation
    - A single entry point: the `ButterKnife` class, that resolves the concrete binder



```java
@FragmentWithArgs
public class FragmentRepoDetail extends Fragment {

    @Bind(R.id.FragmentRepoDetail_TextView_Description)
    TextView mTextViewDescription;
    @Bind(R.id.FragmentRepoDetail_TextView_Url)
    TextView mTextViewUrl;
    @Bind(R.id.FragmentRepoDetail_TextView_Empty)
    TextView mTextViewEmpty;
    @Bind(R.id.FragmentRepoDetail_TextView_Error)
    TextView mTextViewError;
    @Bind(R.id.FragmentRepoDetail_ProgressBar_Loading)
    ProgressBar mProgressBarLoading;
    @Bind(R.id.FragmentRepoDetail_ContentView)
    LinearLayout mContentView;

    @Override
    public void onViewCreated(final View poView, final Bundle poSavedInstanceState) {
        super.onViewCreated(poView, poSavedInstanceState);

        ButterKnife.bind(this, poView);
    }

    @Override
    public void onDestroyView() {
        super.onDestroyView();
        ButterKnife.unbind(this);
    }
}
```

Figure 1: FragmentRepoDetail.java (Butter Knife)



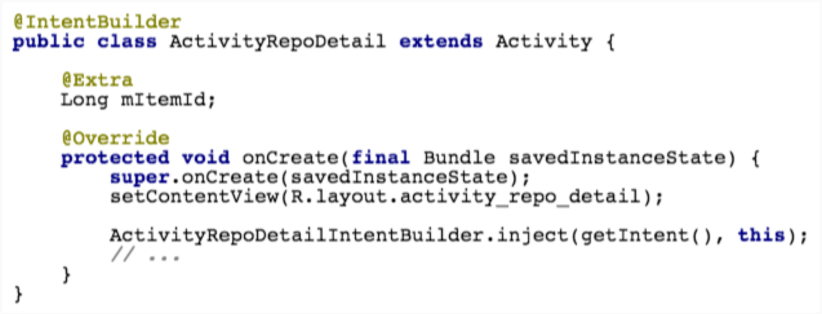
```java
public class FragmentRepoDetail$$ViewBinder<T extends fr.guddy.androidstarteralt.mvp.repoDetail.FragmentRepoDetail> implements ViewBinder<T> {
  @Override public void bind(final Finder finder, final T target, Object source) {
    View view;
    view = finder.findRequiredView(source, 2131558574, "field 'mTextViewDescription'");
    target.mTextViewDescription = finder.castView(view, 2131558574, "field 'mTextViewDescription'");
    view = finder.findRequiredView(source, 2131558575, "field 'mTextViewUrl'");
    target.mTextViewUrl = finder.castView(view, 2131558575, "field 'mTextViewUrl'");
    view = finder.findRequiredView(source, 2131558570, "field 'mTextViewEmpty'");
    target.mTextViewEmpty = finder.castView(view, 2131558570, "field 'mTextViewEmpty'");
    view = finder.findRequiredView(source, 2131558571, "field 'mTextViewError'");
    target.mTextViewError = finder.castView(view, 2131558571, "field 'mTextViewError'");
    view = finder.findRequiredView(source, 2131558572, "field 'mProgressBarLoading'");
    target.mProgressBarLoading = finder.castView(view, 2131558572, "field 'mProgressBarLoading'");
    view = finder.findRequiredView(source, 2131558573, "field 'mContentView'");
    target.mContentView = finder.castView(view, 2131558573, "field 'mContentView'");
  }

  @Override public void unbind(T target) {
    target.mTextViewDescription = null;
    target.mTextViewUrl = null;
    target.mTextViewEmpty = null;
    target.mTextViewError = null;
    target.mProgressBarLoading = null;
    target.mContentView = null;
  }
}
```

Figure 2: FragmentRepoDetail$$ViewBinder.java

Navigation

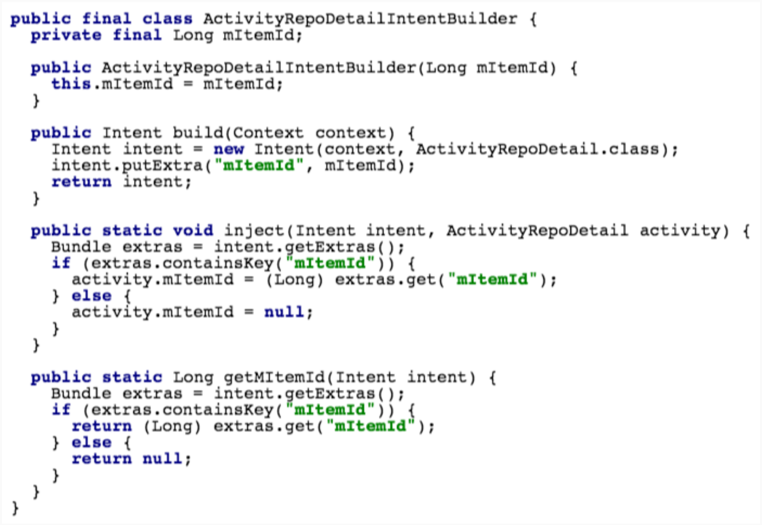
IntentBuilder and FragmentArgs

- Problem:
    - Boilerplate and unsafe code to declare a new screen
- Solution:
    - Annotations to declare an Activity/Fragment
    - Annotations to declare (optional) parameter(s) to pass
    - Class generation following the Builder pattern
    - Method to inject parameter(s) in the target class



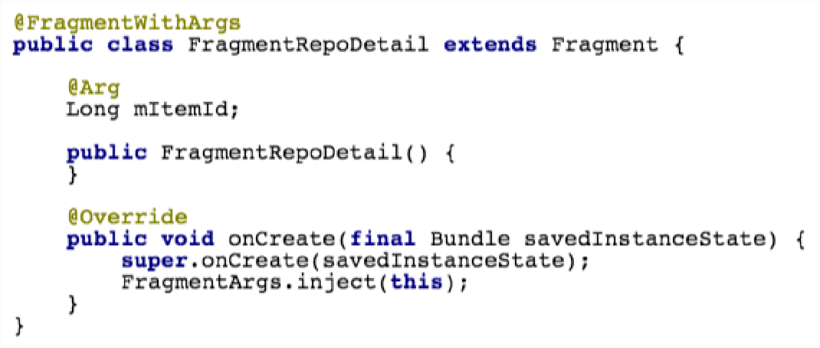
```java
@IntentBuilder
public class ActivityRepoDetail extends Activity {

    @Extra
    Long mItemId;

    @Override
    protected void onCreate(final Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_repo_detail);

        ActivityRepoDetailIntentBuilder.inject(getIntent(), this);
        // ...
    }
}
```

Figure 3: ActivityRepoDetail.java



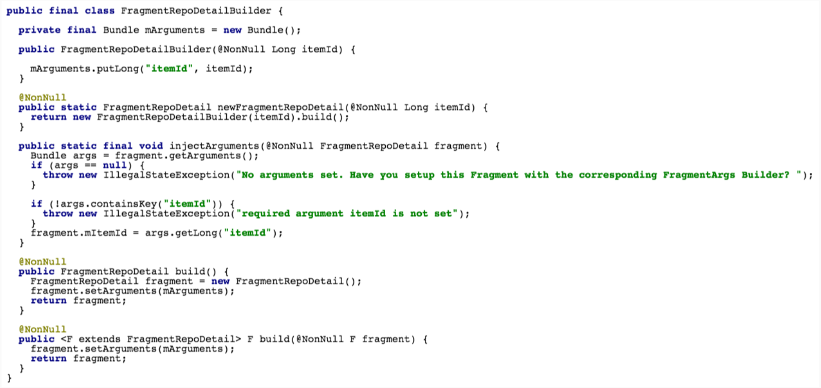
```java
public final class ActivityRepoDetailIntentBuilder {
  private final Long mItemId;

  public ActivityRepoDetailIntentBuilder(Long mItemId) {
    this.mItemId = mItemId;
  }

  public Intent build(Context context) {
    Intent intent = new Intent(context, ActivityRepoDetail.class);
    intent.putExtra("mItemId", mItemId);
    return intent;
  }

  public static void inject(Intent intent, ActivityRepoDetail activity) {
    Bundle extras = intent.getExtras();
    if (extras.containsKey("mItemId")) {
      activity.mItemId = (Long) extras.get("mItemId");
    } else {
      activity.mItemId = null;
    }
  }

  public static Long getMItemId(Intent intent) {
    Bundle extras = intent.getExtras();
    if (extras.containsKey("mItemId")) {
      return (Long) extras.get("mItemId");
    } else {
      return null;
    }
  }
}
```

Figure 4: ActivityRepoDetailIntentBuilder.java



```java
@FragmentWithArgs
public class FragmentRepoDetail extends Fragment {

    @Arg
    Long mItemId;

    public FragmentRepoDetail() {
    }

    @Override
    public void onCreate(final Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        FragmentArgs.inject(this);
    }
}
```

Figure 5: FragmentRepoDetail.java (FragmentArgs)



```java
public final class FragmentRepoDetailBuilder {

  private final Bundle mArguments = new Bundle();

  public FragmentRepoDetailBuilder(@NonNull Long itemId) {

    mArguments.putLong("itemId", itemId);
  }

  @NonNull
  public static FragmentRepoDetail newFragmentRepoDetail(@NonNull Long itemId) {
    return new FragmentRepoDetailBuilder(itemId).build();
  }

  public static final void injectArguments(@NonNull FragmentRepoDetail fragment) {
    Bundle args = fragment.getArguments();
    if (args == null) {
      throw new IllegalStateException("No arguments set. Have you setup this Fragment with the corresponding FragmentArgs Builder? ");
    }

    if (!args.containsKey("itemId")) {
      throw new IllegalStateException("required argument itemId is not set");
    }
    fragment.mItemId = args.getLong("itemId");
  }

  @NonNull
  public FragmentRepoDetail build() {
    FragmentRepoDetail fragment = new FragmentRepoDetail();
    fragment.setArguments(mArguments);
    return fragment;
  }

  @NonNull
  public <F extends FragmentRepoDetail> F build(@NonNull F fragment) {
    fragment.setArguments(mArguments);
    return fragment;
  }
}
```

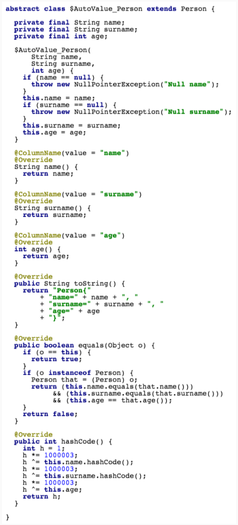
Figure 6: FragmentRepoDetailBuilder.java

Interactions

AutoValue: Cursor Extension

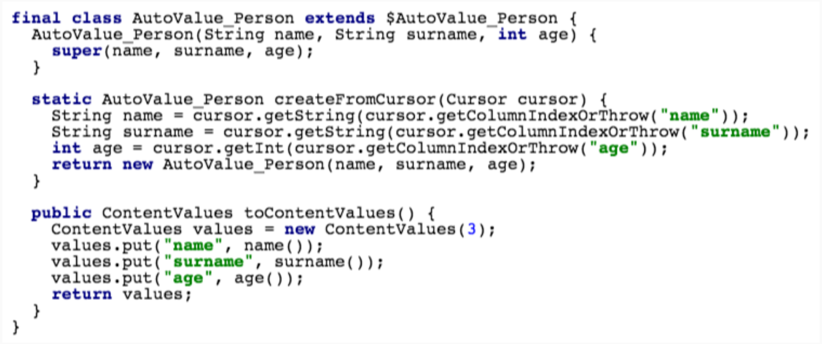
- Abstract class with the `@AutoValue` to define POJO
- Simple `@ColumnName` to define the binding between column names and class fields

```java
@AutoValue
public abstract class Person {
 @ColumnName("name") abstract String name();

 public static Person create(Cursor cursor) {
  return AutoValue_Person.
          createFromCursor(cursor);
 }

 abstract ContentValues toContentValues();
}
```



```java
abstract class $AutoValue_Person extends Person {

  private final String name;
  private final String surname;
  private final int age;

  $AutoValue_Person(
      String name,
      String surname,
      int age) {
    if (name == null) {
      throw new NullPointerException("Null name");
    }
    this.name = name;
    if (surname == null) {
      throw new NullPointerException("Null surname");
    }
    this.surname = surname;
    this.age = age;
  }

  @ColumnName(value = "name")
  @Override
  String name() {
    return name;
  }

  @ColumnName(value = "surname")
  @Override
  String surname() {
    return surname;
  }

  @ColumnName(value = "age")
  @Override
  int age() {
    return age;
  }

  @Override
  public String toString() {
    return "Person{"
        + "name=" + name + ", "
        + "surname=" + surname + ", "
        + "age=" + age
        + "}";
  }

  @Override
  public boolean equals(Object o) {
    if (o == this) {
      return true;
    }
    if (o instanceof Person) {
      Person that = (Person) o;
      return (this.name.equals(that.name()))
           && (this.surname.equals(that.surname()))
           && (this.age == that.age());
    }
    return false;
  }

  @Override
  public int hashCode() {
    int h = 1;
    h *= 1000003;
    h ^= this.name.hashCode();
    h *= 1000003;
    h ^= this.surname.hashCode();
    h *= 1000003;
    h ^= this.age;
    return h;
  }

}
```

Figure 7: $AutoValue_Person.java



```java
final class AutoValue_Person extends $AutoValue_Person {
  AutoValue_Person(String name, String surname, int age) {
    super(name, surname, age);
  }

  static AutoValue_Person createFromCursor(Cursor cursor) {
    String name = cursor.getString(cursor.getColumnIndexOrThrow("name"));
    String surname = cursor.getString(cursor.getColumnIndexOrThrow("surname"));
    int age = cursor.getInt(cursor.getColumnIndexOrThrow("age"));
    return new AutoValue_Person(name, surname, age);
  }

  public ContentValues toContentValues() {
    ContentValues values = new ContentValues(3);
    values.put("name", name());
    values.put("surname", surname());
    values.put("age", age());
    return values;
  }
}
```

Figure 8: AutoValue_Person.java

Others

Others

- ORM: requery
- JSON parsing: LoganSquare
- Bus: EventBus
- Saving and restoring instance state: Icepick
- Easily deal with the result from an activity started for result: OnActivityResult
- and so on: `http://android-arsenal.com/tag/166`

Write custom annotation processors

Concepts

- Provide a robust annotation API
- Implement the algorithm to search for your annotations and deal with it

Generate Java source files: JavaPoet

- Powerful and complete API to describe
  - static imports,
  - classes, interfaces, enums, anonymous inner classes,
  - fields, parameters, variables,
  - methods, constructors,
  - annotations, javadoc
- Specific wildcards to format the output code
- Test generated files with Google's *Compile Testing* and *Truth*

```java
MethodSpec main = MethodSpec
  .methodBuilder("main")
  .addModifiers(Modifier.PUBLIC,
                Modifier.STATIC)
  .returns(void.class)
  .addParameter(String[].class, "args")
  .addStatement("$T.out.println($S)",
                System.class,
                "Hello, JavaPoet!")
  .build();
```

to

```java
public static void main(String[] args) {
    System.out.println("Hello, JavaPoet!");
}
```

A must-read article: ANNOTATION PROCESSING 101 by Hannes Dorfmann

Conclusion

Conclusion

- Performance: machine and/or human
- Readable
- Maintainable