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Working with Dagger and Kotlin



Introduction



 DevFest.cz
2019



What is Dagger



In Java

In Java, for Java

In Java, for Java, by Java

In Java, for Java, by Java, with Java developers

**In Java, for Java, by Java, with Java
developers, for Ja....**

Java





Code Generation



AutoValue

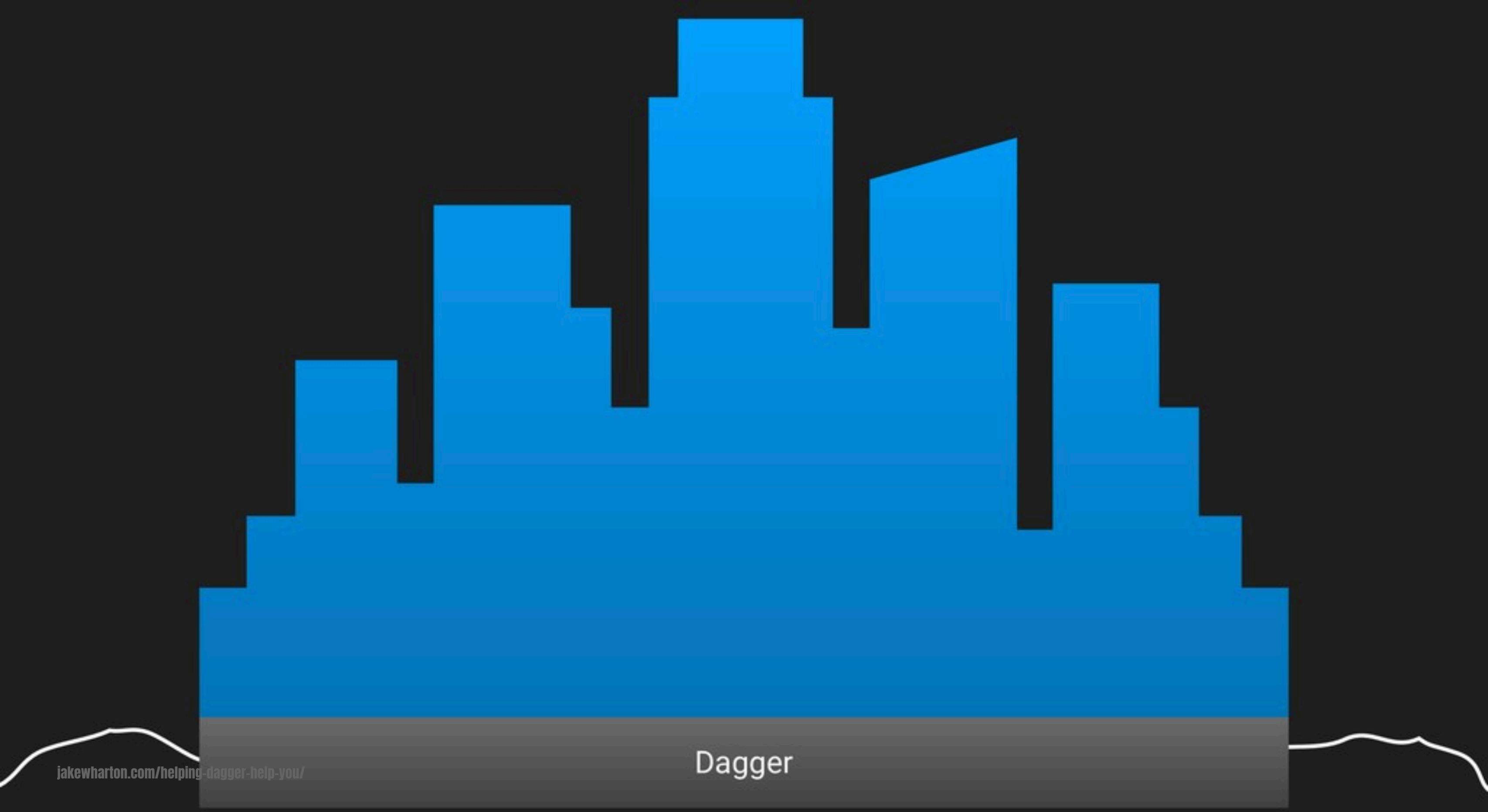


Lombok



Dagger





History



Guice



(Pronounced 'juice')

Dagger

(JSR-330)

Dagger 2 G

(Sans-Reflection)



(noun: freakin' awesome)

Dagger 2



Kotlin ❤

Dagger Qualifiers

Qualifiers used to identify dependencies with identical signatures

- **Factories use qualifiers to decide the instance use**
- **Can create your own qualifier annotations, or just use @Named.**
- **Apply qualifiers by annotating the field or parameter of interest.**
- **The type and qualifier annotation will both be used to identify the dependency.**

Retention Annotation

Use Kotlin retention annotations instead of Java retention

- **Java retention support is deprecated in Kotlin**
- **At least BINARY retention but RUNTIME is ideal**
- **Dagger 2 doesn't operate on source files**
- **Annotations are necessary for kapt**

Constructor injection

```
class Game @Inject constructor(  
    @Named("P1") private val player1: Player,  
    @Named("P2") private val player2: Player  
)
```

Constructor injection

```
public final class Game {  
    private final Player player1;  
    private final Player player2;  
  
    @Inject public Game(  
        @Named("P1") Player player1,  
        @Named("P2") Player player2) {  
        super();  
        this.player1 = player1;  
        this.player2 = player2;  
    }  
}
```

Constructor Injection

```
public final class Game {  
    private final Player player1;  
    private final Player player2;  
  
    @Inject public Game(  
        @Named("P1") Player player1,  
        @Named("P2") Player player2) {  
        super();  
        this.player1 = player1;  
        this.player2 = player2;  
    }  
}
```

Field Injection: lateinit var



```
class Game @Inject constructor() {  
    @Inject @Named("P1") lateinit var player1: Player  
    @Inject @Named("P2") lateinit var player2: Player  
}
```

Decompiled lateinit var

```
public final class Game {  
    @Inject public Player player1;  
    @Inject public Player player2;  
  
    @Named("P1") public static void player1$annotations0 {}  
  
    public final Player getPlayer10 { ... }  
  
    public final void setPlayer1(Player var1) {...}  
  
    @Named("P2") public static void player2$annotations0 {}  
  
    public final Player getPlayer20 { ... }  
  
    public final void setPlayer2(Player var1) {...}
```

Decompiled lateinit var

```
public final class Game {  
    @Inject public Player player1;  
    @Inject public Player player2;  
  
    @Named("P1") public static void player1$annotations0 {}  
  
    public final Player getPlayer10 { ... }  
  
    public final void setPlayer1(Player var1) {...}  
  
    @Named("P2") public static void player2$annotations0 {}  
  
    public final Player getPlayer20 { ... }  
  
    public final void setPlayer2(Player var1) {...}
```



Specify Annotations

- **@field:...**
- **@set:...**
- **@get:...**
- **@param:...**
- **@property:...**
- **@setparam:...**
- **@receiver:...**
- **@delegete:...**



Specify Annotations

```
class Game @Inject constructor() {  
    @Inject @field:Named("P1") lateinit var player1: Player  
    @Inject @field:Named("P2") lateinit var player2: Player  
}
```

Specify Annotations

```
public final class Game {  
  
    @Inject @Named("P1") public Player player1;  
    @Inject @Named("P2") public Player player2;  
  
    public final Player getPlayer1() {...}  
  
    public final void setPlayer1(Player var1) {...}  
  
    public final Player getPlayer2() {...}  
  
    public final void setPlayer2(Player var1) {...}  
}
```



Constructor vs Property injection

- **Constructor val**
 - **Easier to use**
 - **Reliable dependency injection**
 - **Compilation safety**
- **Property lateinit var injection**
 - **Synthetic property accessors**
 - **Unclear where the annotation is applied**
 - **Dont forget to use with @field:**

Scope Annotations



@Scope

```
@Documented
@Retention(RetentionPolicy.RUNTIME)
@Target(ElementType.ANNOTATION_TYPE)
public @interface Scope {
}
```

@Singleton

@Singleton != Singleton Pattern

@Singleton != Singleton Pattern

```
public final class Singleton {
```

```
    private static final Singleton INSTANCE = new Singleton();
```

```
    private Singleton() {  
    }
```

```
    public static Singleton getInstance() {  
        return INSTANCE;  
    }  
}
```

@Singleton != Singleton Pattern

object Singleton

@Scope

@Scope

@MustBeDocumented

@Retention(AnnotationRetention.RUNTIME)

annotation class ActivityScope

@Scope

@Module

internal object ApplicationModule {

@Provides

@JvmStatic

@ActivityScope

fun context(application: Application): Context = application

}

@ActivityScope



@Scope



@ActivityScope // Don't do this!

```
class ActivityRepository @Inject constructor()
```

@Reusable

Double Check

```
public final class DoubleCheck<T> implements Provider<T>, Lazy<T> {
    private static final Object UNINITIALIZED = new Object();

    private volatile Provider<T> provider;
    private volatile Object instance = UNINITIALIZED;

    private DoubleCheck(Provider<T> provider) { /* ... */ }

    @Override
    public T get() {
        Object result = instance;
        if (result == UNINITIALIZED) {
            synchronized (this) {
                result = instance;
                if (result == UNINITIALIZED) {
                    result = provider.get();
                    instance = reentrantCheck(instance, result);
                    provider = null;
                }
            }
        }
        return (T) result;
    }

    public static Object reentrantCheck(Object currentInstance, Object newInstance) { /* ... */ }
}
```

Double Check

```
public final class DoubleCheck<T> implements Provider<T>, Lazy<T> {
    private static final Object UNINITIALIZED = new Object();

    private volatile Provider<T> provider;
    private volatile Object instance = UNINITIALIZED;

    private DoubleCheck(Provider<T> provider) { /* ... */ }

    @Override
    public T get() {
        Object result = instance;
        if (result == UNINITIALIZED) {
            synchronized (this) {
                result = instance;
                if (result == UNINITIALIZED) {
                    result = provider.get();
                    instance = reentrantCheck(instance, result);
                    provider = null;
                }
            }
        }
        return (T) result;
    }

    public static Object reentrantCheck(Object currentInstance, Object newInstance) { /* ... */ }
}
```

Single Check

```
public final class SingleCheck<T> implements Provider<T> {
    private static final Object UNINITIALIZED = new Object();

    private volatile Provider<T> provider;
    private volatile Object instance = UNINITIALIZED;

    private SingleCheck(Provider<T> provider) { /* ... */ }

    @Override
    public T get() {
        Object local = instance;
        if (local == UNINITIALIZED) {
            Provider<T> providerReference = provider;
            if (providerReference == null) {
                local = instance;
            } else {
                local = providerReference.get();
                instance = local;
                provider = null;
            }
        }
        return (T) local;
    }
}
```

Kotlin: Lazy

```
private val viewModel by lazy(NONE) { SampleViewModel() }
```

```
fun <T> lazy(mode: LazyThreadSafetyMode, initializer: () -> T): Lazy<T> =  
    when (mode) {  
        LazyThreadSafetyMode.SYNCHRONIZED -> SynchronizedLazyImpl(initializer)  
        LazyThreadSafetyMode.PUBLICATION -> SafePublicationLazyImpl(initializer)  
        LazyThreadSafetyMode.NONE -> UnsafeLazyImpl(initializer)  
    }
```

Favour `@Reusable` over `@Scope`

- Great for expensive dependencies
- Work great in single thread environments
- Not guaranteed same instance in multiple threads
- Prefer to keep your Dagger graph stateless
- Use `@Scope` if you absolutely need to store state

Dagger: Modules

Status Quo



```
@Module
public abstract class ApplicationModule {

    @Binds
    abstract Context context(Application application);

    @Provides
    static SampleRepository repository(String name) {
        return new SampleRepository(name);
    }
}
```

Dagger: Modules

```
@Module  
abstract class ApplicationModule {  
  
    @Binds  
    abstract fun context(application: Application): Context  
  
    @Module  
    companion object {  
  
        @Provides  
        @JvmStatic  
        fun repository(name: String): SampleRepository = SampleRepository(name)  
    }  
}
```

Dagger: Modules

```
public abstract class ApplicationModule {
    public static final ApplicationModule.Companion Companion = new ApplicationModule.Companion0();

    @Binds
    @NotNull
    public abstract Context context(@NotNull Application var1);

    @Provides
    @JvmStatic
    @NotNull
    public static final SampleRepository repository(@NotNull String name) {
        return Companion.repository(name);
    }

    @Module
    public static final class Companion {
        @Provides
        @JvmStatic
        @NotNull
        public final SampleRepository repository(@NotNull String name) {
            return new SampleRepository(name);
        }

        private Companion0 {
        }
    }
}
```

Dagger: Modules

```
object ApplicationModule {  
  
    @Provides  
    @JvmStatic  
    fun context(application: Application): Context = application  
  
    @Provides  
    @JvmStatic  
    fun repository(name: String): SampleRepository = SampleRepository(name)  
}
```

Dagger: Modules

```
public final class ApplicationModule {  
    public static final ApplicationModule INSTANCE = new ApplicationModule0;  
  
    @Provides  
    @JvmStatic  
    @NotNull  
    public static final Context context(@NotNull Application application) {  
        return (Context)application;  
    }  
  
    @Provides  
    @JvmStatic  
    @NotNull  
    public static final SampleRepository repository(@NotNull String name) {  
        return new SampleRepository(name);  
    }  
  
    private ApplicationModule0 {  
    }  
}
```

Dagger: Modules

```
@file:JvmName("ApplicationModule")
```

```
@file:Module
```

```
@Provides
```

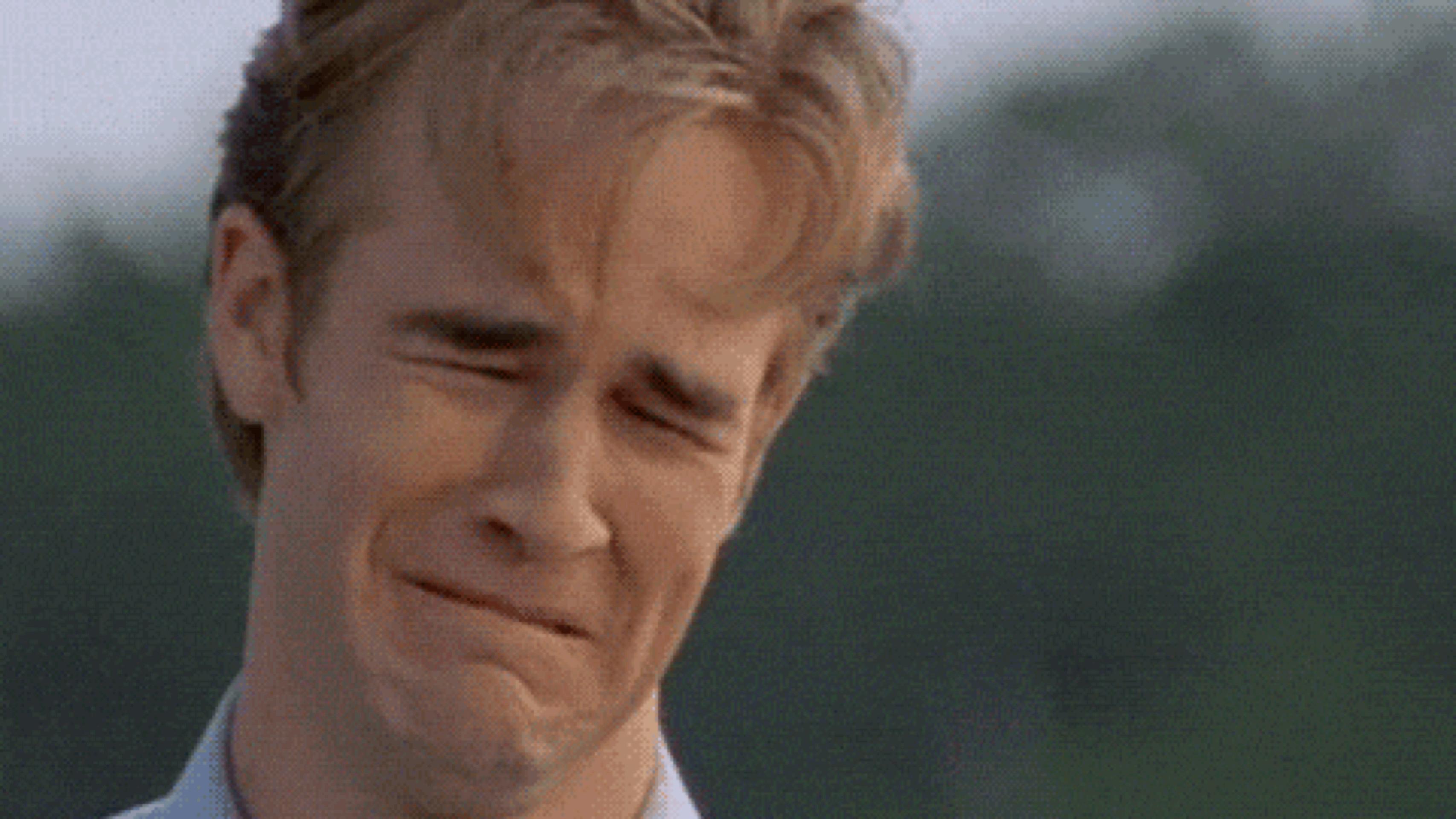
```
fun context(application: Application): Context = application
```

```
@Provides
```

```
fun repository(name: String): SampleRepository = SampleRepository(name)
```

Dagger: Modules

```
public final class ApplicationModule {  
  
    @Provides  
    @NotNull  
    public static final Context context(@NotNull Application application) {  
        return (Context)application;  
    }  
  
    @Provides  
    @NotNull  
    public static final SampleRepository repository(@NotNull String name) {  
        return new SampleRepository(name);  
    }  
}
```



Kotlin: Generics<? : T>



Kotlin: Generics<? : T>

Kotlin: Generics<? : T>

Java Interoperability

Kotlin: Generics<? : T>

Java Interoperability

```
interface Collection<E> extends Iterable<E> {
```

```
    boolean addAll(Collection<? extends E> collection);
```

```
}
```

Kotlin: Generics<? : T>

Java Interoperability

```
interface Collection<E> extends Iterable<E> {
```

```
    boolean addAll(Collection<E> collection);
```

```
}
```

Kotlin: Generics<? : T>

Java Interoperability

List<String> : List<Object>

Kotlin: Generics<? : T>

Java Interoperability

~~List<String> : List<Object>~~

Kotlin: Generics<? : T>

Java Interoperability

```
List<String> strings = new ArrayList<String>();
```

```
List<Object> objs = strings;
```

```
objs.add(1);
```

```
String string = strings.get(0);
```

Kotlin: Generics<? : T>

Java Interoperability

```
List<String> strings = new ArrayList<String>();
```

```
List<Object> objs = strings;
```

```
objs.add(1);
```

```
String string = strings.get(0); // 🔥🔥🔥
```

Kotlin: Generics<? : T>

Java Interoperability

```
interface Collection<E> extends Iterable<E> {
```

```
    boolean addAll(Collection<? extends E> collection);
```

```
}
```

Kotlin: Generics<? : T>

Java Interoperability

```
List<String> box(String value) { /* ... */ }
```

```
String unbox(List<? extends String> boxed) { /* ... */ }
```

Kotlin: Generics<? : T>

Java Interoperability

```
class ListAdapter @Inject constructor(strings: List<String>)
```

Kotlin: Generics<? : T>

Java Interoperability

```
public final class ListAdapter {  
    @Inject  
    public ListAdapter(@NotNull List<? extends String> strings) {  
        Intrinsics.checkNotNull(strings, "strings");  
        super();  
    }  
}
```

Kotlin: Generics<? : T>

Dagger Multi-Binding

```
@Module  
object ListModule {
```

```
    @IntoSet  
    @Provides  
    @JvmStatic  
    fun hello(): String = "Hello"
```

```
    @IntoSet  
    @Provides  
    @JvmStatic  
    fun world(): String = "World"  
}
```

Build Failed...



Kotlin: Generics<? : T>

Java Interoperability

```
class ListAdapter @Inject constructor(strings: @JvmSuppressWildcards List<String>)
```

Jetpack

Jetpack

ViewModel

Jetpack

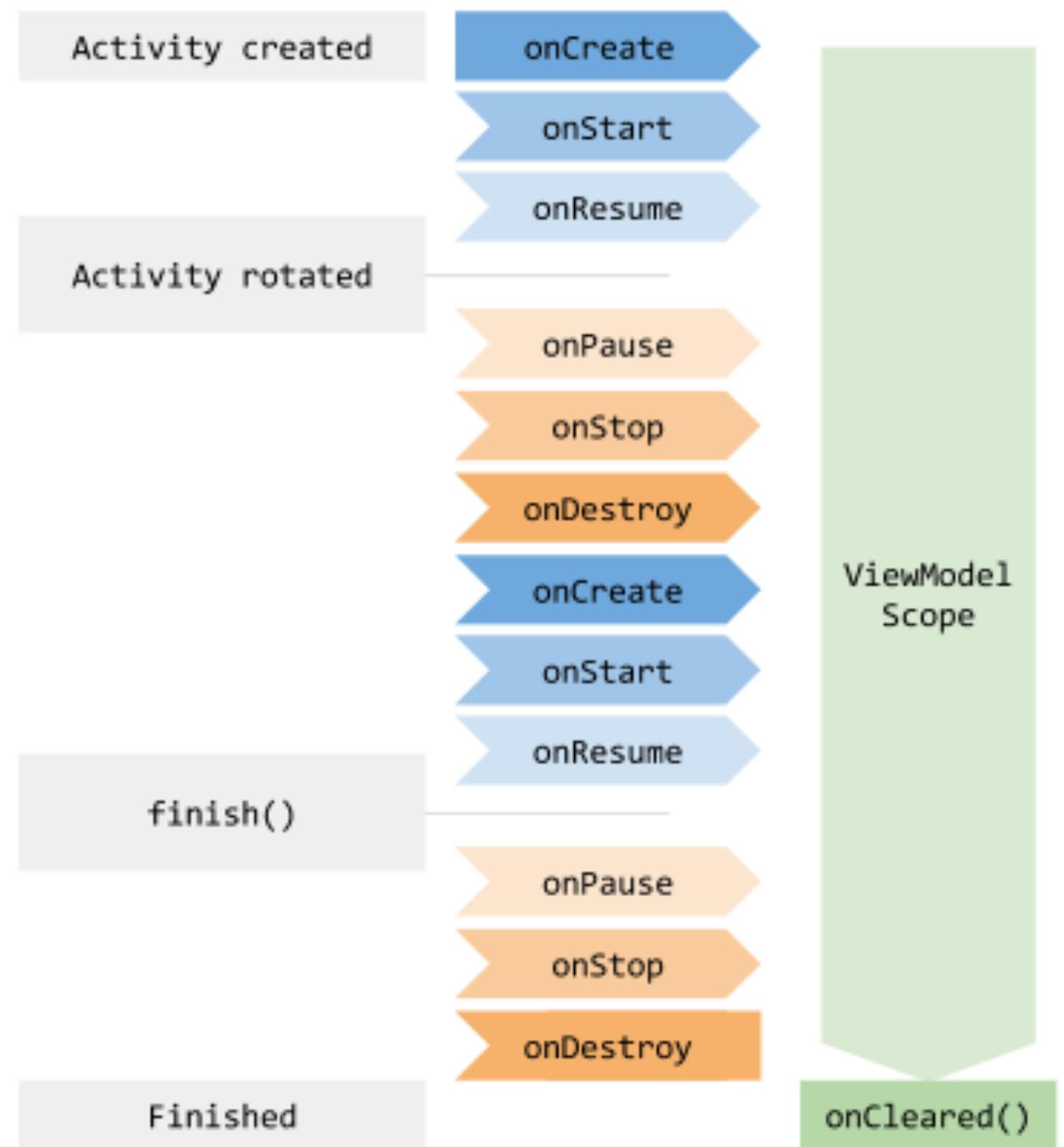
ViewModel

- **Introduced at Google IO 2018**
- **Bootstrap Android development**
- **Opinionated implementations**
- **Break up support libraries**
- **Migrate to androidx namespace**



Jetpack

ViewModel



Jetpack

ViewModel

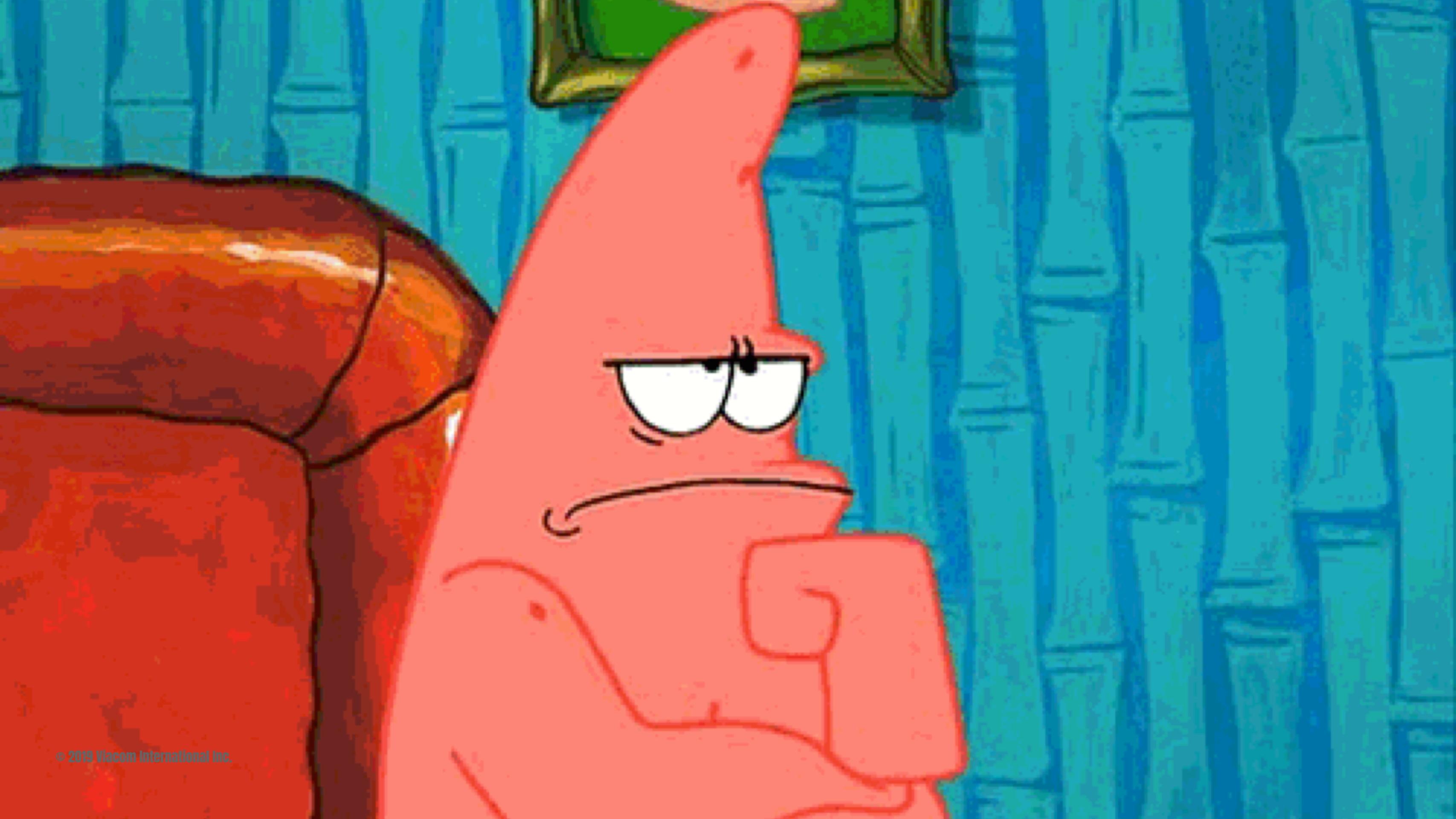
- **Android Application created**
- **Android Activity created**
- **Dagger @Component created**
- **Androidx ViewModel created**
- **Androidx Fragment created**

Jetpack

ViewModel

- Android Application created ←
- ~~Android Activity created~~ 💀
- ~~Dagger @Component created~~ 💀
- AndroidX ViewModel created ←
- AndroidX Fragment created ←

 **Caution: A ViewModel must never reference a view, Lifecycle, or any class that may hold a reference to the activity context.**



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JetPack

ViewModel

```
class SampleViewModel @Inject constructor(): ViewModel {  
}
```

```
class Activity : DaggerAppCompatActivity {  
    @Inject lateinit var model: SampleViewModel  
}
```

JetPack

ViewModel

```
class SampleViewModel @Inject constructor() : ViewModel {  
}
```

```
class Activity : DaggerAppCompatActivity {  
    @Inject lateinit var model: SampleViewModel  
}
```

ONE DOES NOT SIMPLY



INJECT A VIEWMODEL

Jetpack: ViewModel

Dagger Multi-Binding

Jetpack: ViewModel

Dagger Multi-Binding

```
class ActivityViewModel @Inject constructor(): ViewModel {  
}
```

Jetpack: ViewModel

Dagger Multi-Binding

```
@MapKey  
@Retention(RUNTIME)  
annotation class ViewModelKey(val value: KClass<out ViewModel>)
```

```
@Module  
interface ActivityViewModelModule {  
  
    @Binds  
    @IntoMap  
    @ViewModelKey(ViewModel::class)  
    fun model(model: ActivityViewModel): ViewModel  
}
```

Jetpack: ViewModel

Dagger Multi-Binding

```
class ViewModelFactory @Inject constructor(
    private val creators: Map<Class<out ViewModel>,
    @JvmSuppressWildcards Provider<ViewModel>>
) : ViewModelProvider.Factory {

    @Suppress("UNCHECKED_CAST")
    override fun <T : ViewModel> create(kls: Class<T>): T {
        var creator: Provider<out ViewModel>? = creators[kls]

        creator ?: creators.keys.firstOrNull(kls::isAssignableFrom)?.apply { creator = creators[this] }
        creator ?: throw IllegalArgumentException("Unrecognised class $kls")

        return creator.get() as T
    }
}
```

Jetpack: ViewModel

Dagger Multi-Binding

```
class ViewModelActivity : DaggerAppCompatActivity {

    private lateinit var model: ActivityViewModel

    @Inject internal lateinit var factory: ViewModelFactory

    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)

        ...

        model = ViewModelProviders
            .of(this, factory)
            .get(ActivityViewModel::class.java)
    }
}
```

Jetpack: ViewModel

androidx.activity:activity-ktx:1.0.0

```
class ViewModelActivity : DaggerAppCompatActivity {

    private val model: ActivityViewModel by viewModels { factory }

    @Inject internal lateinit var factory: ViewModelFactory

    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        ...
    }
}
```

Jetpack: ViewModel

bit.ly/view-model-factory

- **Uses Dagger Multi-Binding to build map of Provider's**
- **Global Factory to create all ViewModel's**
- **Factory injected into Activity to create ViewModel**
- **Complicated initial set-up configuration**
- **Needs map binding @Module for every ViewModel**
- **Application graph polluted with all Factory's**

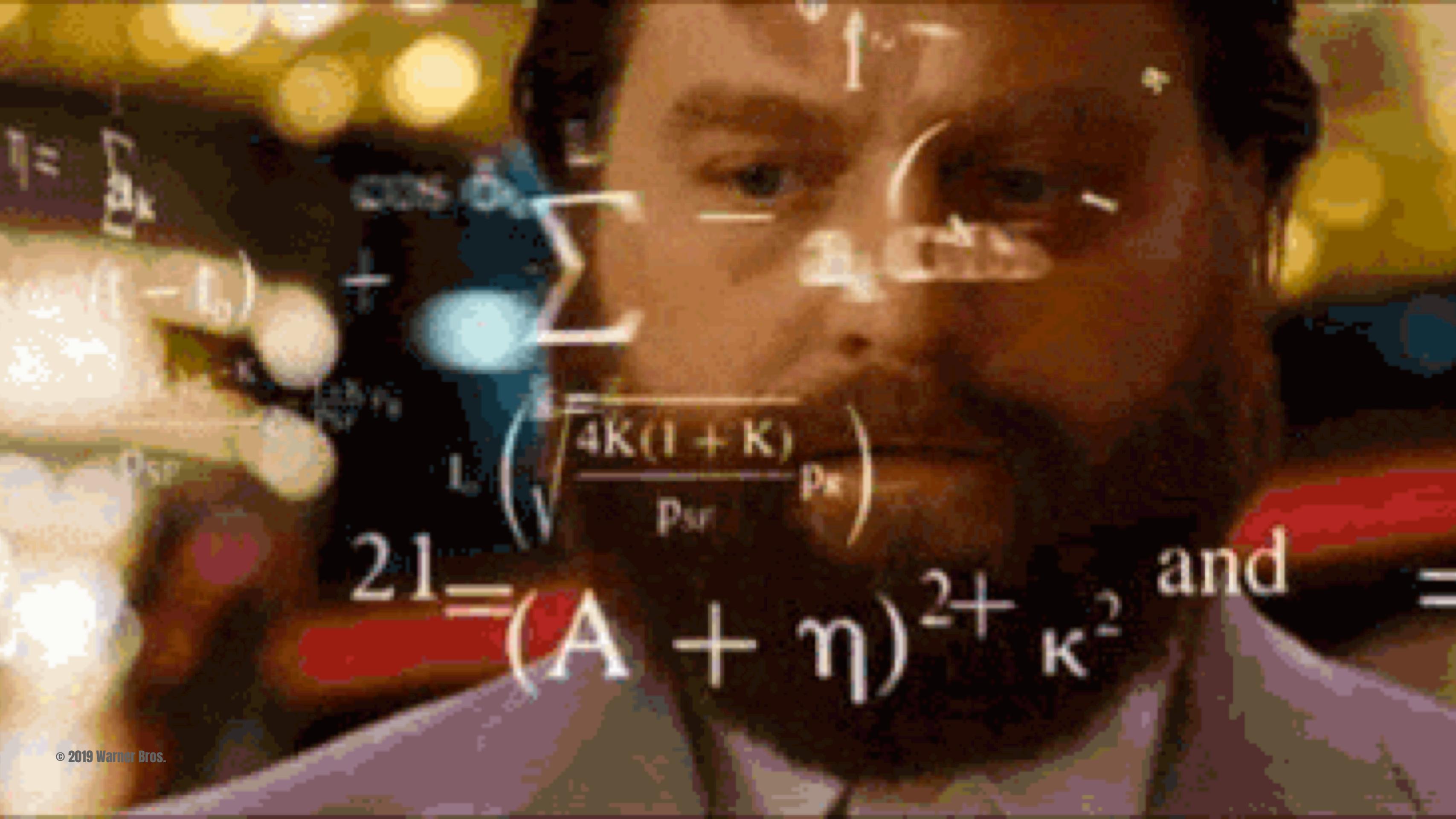
Good: HomeViewModelFactory

```
class HomeViewModelFactory @Inject constructor(
    private val dataManager: DataManager,
    private val designerNewsLoginRepository: LoginRepository,
    private val sourcesRepository: SourcesRepository,
    private val dispatcherProvider: CoroutinesDispatcherProvider
) : ViewModelProvider.Factory {

    @Suppress("UNCHECKED_CAST")
    override fun <T : ViewModel?> create(modelClass: Class<T>): T {
        if (modelClass != HomeViewModel::class.java) {
            throw IllegalArgumentException("Unknown ViewModel class")
        }
        return HomeViewModel(
            dataManager,
            designerNewsLoginRepository,
            sourcesRepository,
            dispatcherProvider
        ) as T
    }
}
```

Not So Good: OtherViewModelFactory

```
internal class OtherViewModelFactory @Inject constructor() : ViewModelProvider.Factory {  
  
    @Inject lateinit var otherViewModel: OtherViewModel  
  
    @Suppress("UNCHECKED_CAST")  
    override fun <T : ViewModel?> create(modelClass: Class<T>): T {  
        return if (modelClass.isAssignableFrom(OtherViewModel::class.java)) {  
            otherViewModel as T  
        } else {  
            throw IllegalArgumentException(  
                "Class ${modelClass.name} is not supported in this factory."  
            )  
        }  
    }  
}
```



$$21 = A + m^2 + \kappa^2 \text{ and}$$
$$P_{\text{eff}} = \frac{4K(1+K)}{P_0}$$

Jetpack: ViewModel

bit.ly/view-model-provider

```
internal class ViewModelFactory(
    private val provider: Provider<out ViewModel>
) : ViewModelProvider.Factory {

    @Suppress("UNCHECKED_CAST")
    override fun <T : ViewModel> create(modelClass: Class<T>): T {
        return try {
            provider.get() as T
        } catch (exception: ClassCastException) {
            throw IllegalArgumentException(
                "Class ${modelClass.name} is not supported by this factory",
                exception
            )
        }
    }
}
```

Jetpack: ViewModel

bit.ly/view-model-provider

```
class ActivityViewModel @Inject constructor() : ViewModel()
```

```
class Factory @Inject constructor(  
    provider: Provider<ActivityViewModel>  
) : ViewModelFactory(provider)  
}
```

```
class ViewModelActivity : DaggerAppCompatActivity {  
  
    private val model: ActivityViewModel by viewModels { factory }  
  
    @Inject internal lateinit var factory: ActivityViewModel.Factory  
}
```

PE MÍS CHI CHIS

NAE TOQUEM
HUEVOS

SERGÁ ES FT
ENIA.

WAIT, WAIT,
THERE'S MORE.



Android: *Factory

- **AppComponentFactory**

Android Pie 

- **FragmentManager**

fragmentx:1.1.0

- **AbstractSavedStateVMFactory**

lifecycle-viewmodel-savedstate:1.0.0-alpha05

- **LayoutInflater.Factory2**

Android Cupcake 

Android: LayoutInflater.Factory2

github.com/square/AssistedInject

```
class ImageLoaderView @AssistedInject constructor(  
    @Assisted context: Context,  
    @Assisted attrs: AttributeSet,  
    private val loader: ImageLoader  
) : ImageView(context, attrs) {  
  
    @AssistedInject.Factory  
    interface Factory {  
  
        fun create(  
            context: Context,  
            attrs: AttributeSet  
        ): ImageLoaderView  
    }  
}
```

Android: LayoutInflater.Factory2

github.com/square/AssistedInject

```
class ApplicationLayoutInflaterFactory @Inject constructor(  
    private val imageLoaderFactory: ImageLoaderView.Factory  
) : LayoutInflater.Factory {  
  
    override fun onCreateView(  
        name: String,  
        context: Context,  
        attrs: AttributeSet  
    ): View? {  
        if (name == ImageLoaderView::class.java.name) {  
            return imageLoaderFactory.create(context, attrs)  
        }  
        return null  
    }  
}
```

Kotlin: Experimental



Kotlin: Experimental



Inline Classes

- Wrapping types can introduce runtime overhead
- Performance worse for primitive types
- Initialised with single backing property
- Inline classes represented by backing field at runtime
- Sometimes represented as boxed type...

Kotlin: Experimental



Inline Classes

- Dagger recognises inline class as it's backing type
- Module @Provide not complex enough to require wrapper
- @Inject sites not complex enough to require wrapper
- Can cause problems if backing type not qualified
- Operates the same for typealias

@Binds

@Binds

@Module

```
interface MySuperAwesomeHappyFantasticModule {
```

@Binds

```
fun activity(activity: FragmentActivity): MySuperAwesomeHappyFantasticActivity
```

```
}
```

@Binds

@Module

abstract class MySuperAwesomeHappyFantasticModule {

@Binds

abstract fun activity(activity: FragmentActivity): MySuperAwesomeHappyFantasticActivity
}

@Binds

@Module

```
interface MySuperAwesomeHappyFantasticModule {
```

@Binds

```
fun activity(activity: FragmentActivity): MySuperAwesomeHappyFantasticActivity
```

```
}
```

Defaults



Inlined method bodies in Kotlin

- **Kotlin return types can be inferred from method body**
- **Android Studio shows inlining return types**
- **Return types to hide implementation detail easily missed**
 - **Interface vs Implementation**
- **Best practice to explicitly specify return type**
- **Easier to review, easier to understand, avoids compiler errors**
- **Framework types (Fragment.context) can be assumed nullable**

Keeping internal implementation internal

internal class Player

```
class Game @Inject constructor(  
    @Named("P1") private val player1: Player,  
    @Named("P2") private val player2: Player  
)
```

Keeping internal implementation internal

internal class Player

```
class Game @Inject internal constructor(  
    @Named("P1") private val player1: Player,  
    @Named("P2") private val player2: Player  
)
```

Default Parameters?

Default Parameters?



@JvmOverloads

@JvmOverloads



Hope 🙏

bit.ly/dagger-kotlin-support

Further Reading



- [Dave Leeds: Inline Classes and Autoboxing](#)
<https://typealias.com/guides/inline-classes-and-autoboxing/>
- [Kotlin: Declaration Site Variance](#)
<https://kotlinlang.org/docs/reference/generics.html#declaration-site-variance>
- [Kotlin: Variant Generics](#)
<https://kotlinlang.org/docs/reference/java-to-kotlin-interop.html#variant-generics>
- [Jake Wharton: Helping Dagger Help You](#)
<https://jakewharton.com/helping-dagger-help-you/>
- [Dagger: Kotlin Dagger Best Practices](#)
<https://github.com/google/dagger/issues/900>
- [Fred Porciúncula: Dagger 2 Official Guidelines](#)
<https://proandroiddev.com/dagger-2-on-android-the-official-guidelines-you-should-be-following-2607fd6c002e>
- [Warren Smith: Dagger & Kotlin](#)
<https://medium.com/@naturalwarren/dagger-kotlin-3b03c8dd6e9b>
- [Nazmul Idris: Advanced Dagger 2 w/ Android and Kotlin](#)
<https://developerlife.com/2018/10/21/dagger2-and-kotlin/>

Thanks!



IMMOBILIEN
SCOUT 24

