Dagger & Kotlin

Ash Davies

DevFest.cz
2019

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What is dependency injection? 🤔

Dependency Injection

```
class Car {

  private val engine = Engine()

  fun start() {
    engine.start()
  }
}

fun main(args: Array) {
  val car = Car()
  car.start()
}
```

developer.android.com/training/dependency-injection

Dependency Injection

```
class Car {

  private val engine = Engine()

  fun start() {
    engine.start()
  }
}

fun main(args: Array) {
  val car = Car()
  car.start()
}
```

developer.android.com/training/dependency-injection

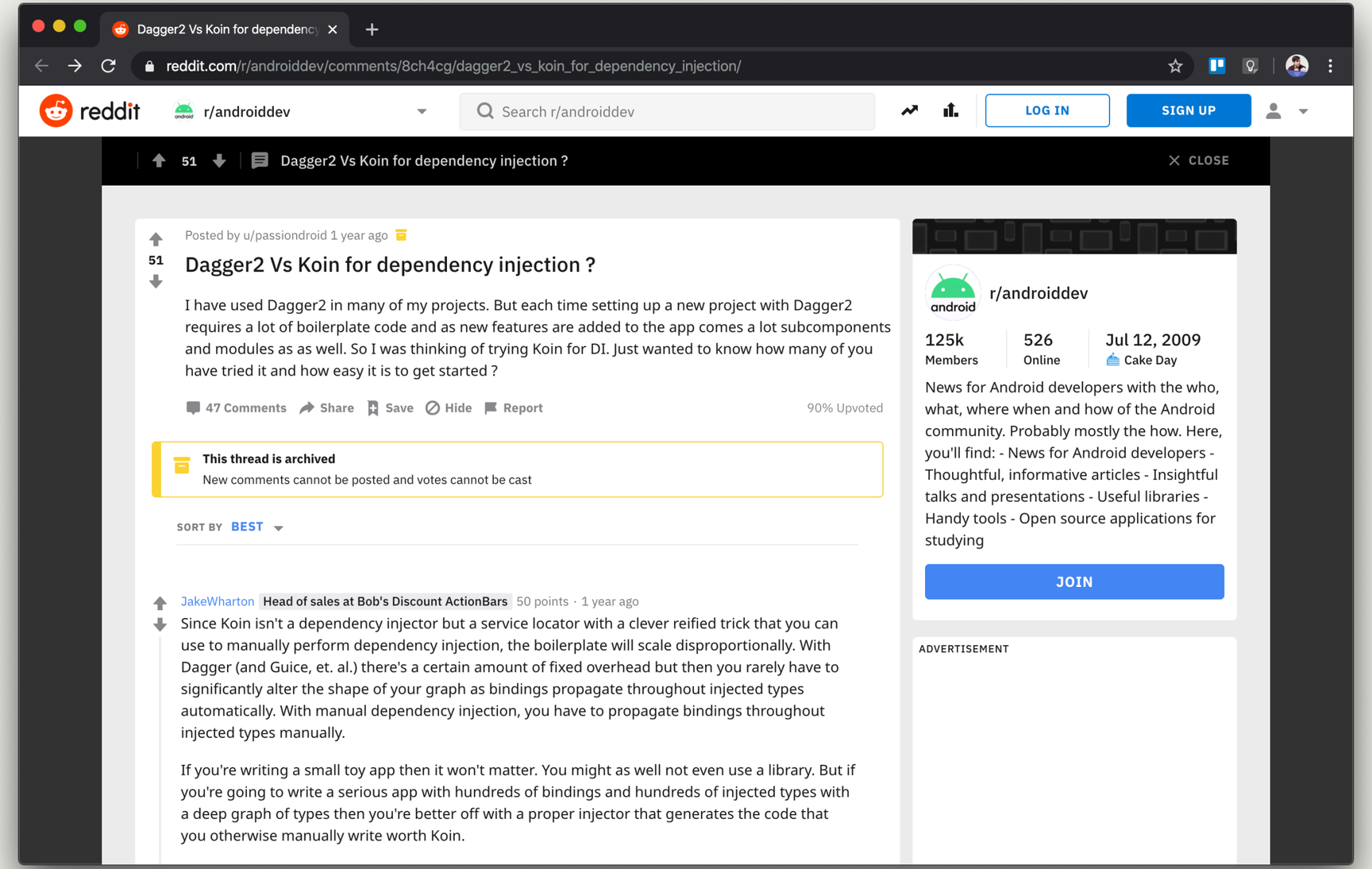
Dependency Injection

```
class Car(private val engine: Engine) {

  fun start() {
    engine.start()
  }
}

fun main(args: Array) {
  val engine = Engine()
  val car = Car(engine)
  car.start()
}
```

developer.android.com/training/dependency-injection

Wtf 🤷‍♀️

Dagger sounds confusing, I'll just use something else



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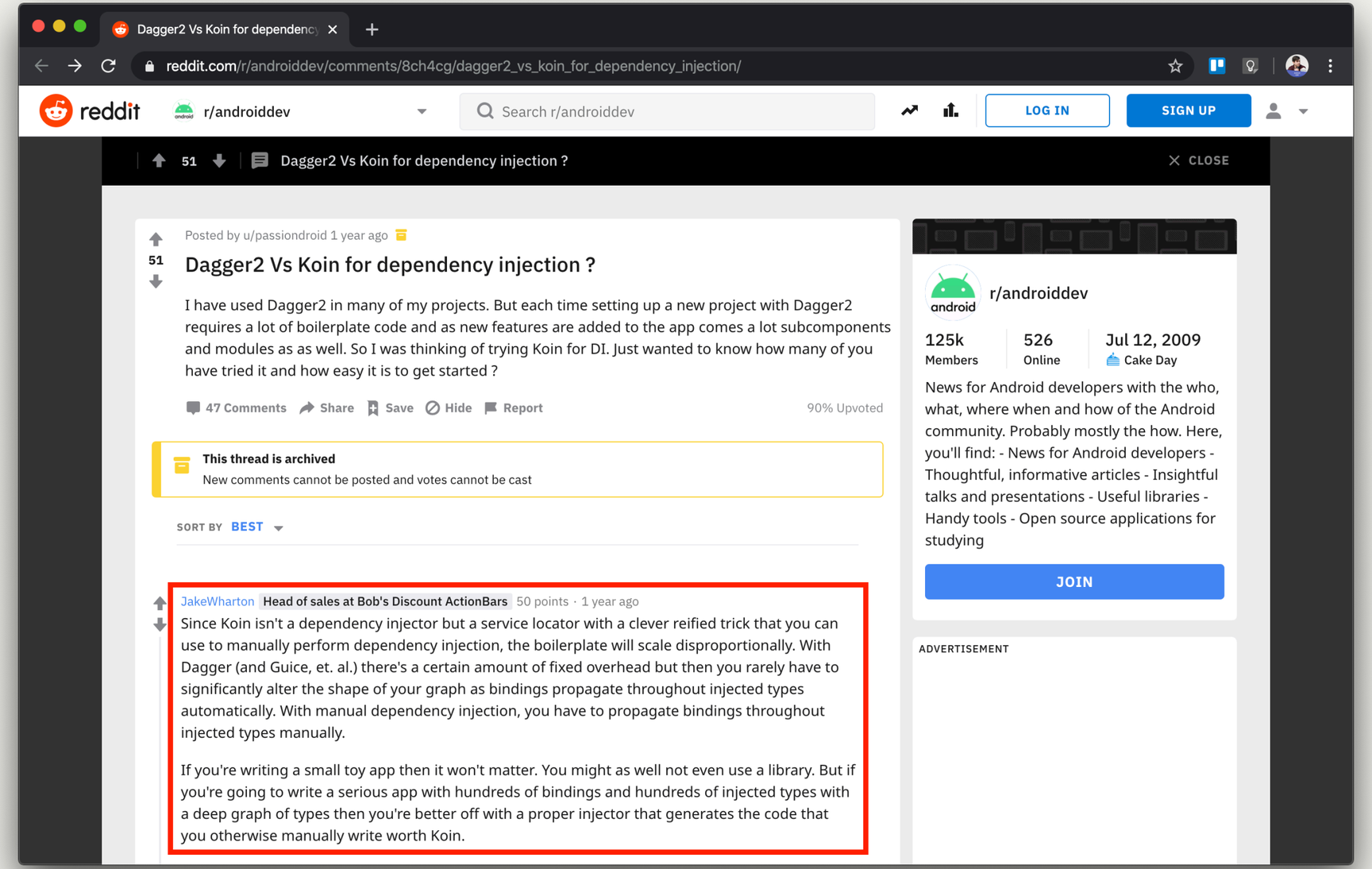

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TRIGGERED

Service Locator

```
object ServiceLocator {

  fun getEngine(): Engine = Engine()
}

class Car {

  private val engine = ServiceLocator.getEngine()

  fun start() {
    engine.start()
  }
}
```

developer.android.com/training/dependency-injection

What is Dagger 🗡️

- Dependency injection implementation
- Generates code for injection
- Compile time - sans reflection

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 

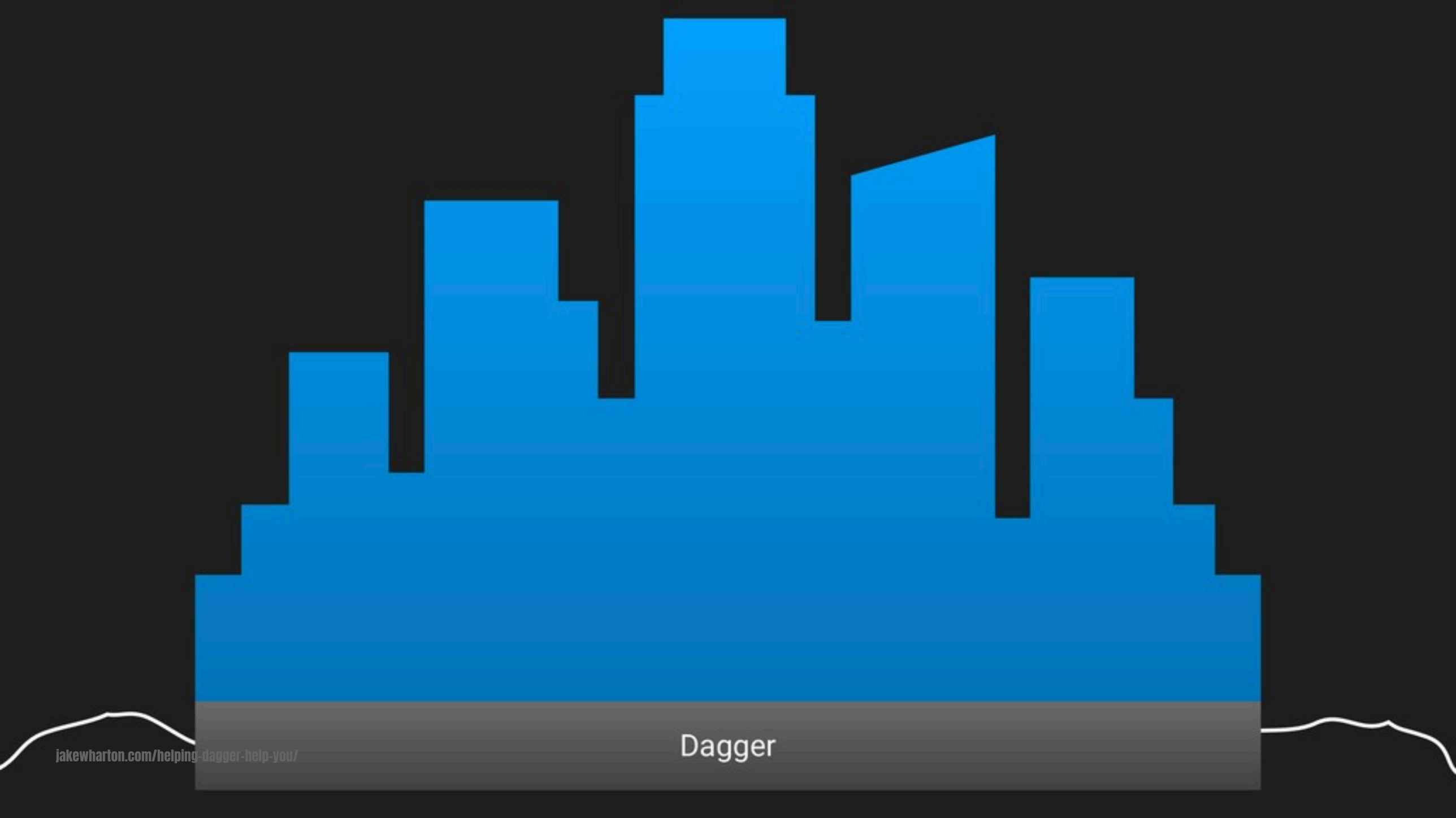

HBO

Code Generation 

AutoValue 

Lombok 

Dagger 



jakewharton.com/helping-dagger-help-you/

History 

Guice 

(Pronounced 'juice')

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Dagger

(JSR-330)

Dagger 2 

(Sans-Reflection)

youtube.com/watch?v=oK_XtfXPkqw

Kotlin 

(noun: freakin' awesome)

Dagger 2 🗡

Kotlin ♥

Dagger Qualifiers

Qualifiers used to identify dependencies with identical signatures

Retention Annotation

Use Kotlin retention annotations instead of Java retention

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;
  }
}
```


STOP.
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OH MY GOD
THAT'S SO YESTERDAY !
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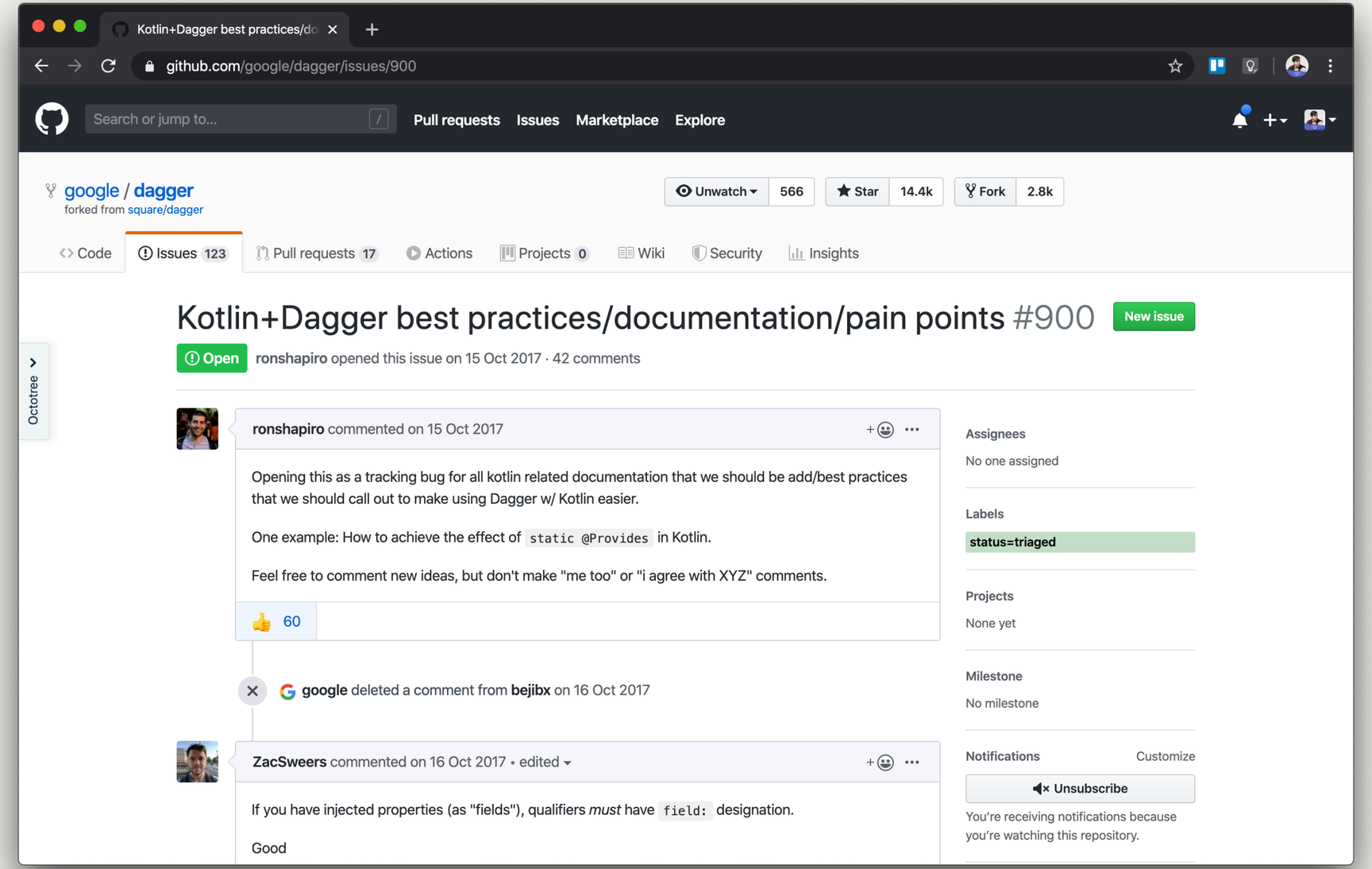

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Field Injection: lateinit var 🛑

```
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$annotations() {}

   public final Player getPlayer1() { ... }

   public final void setPlayer1(Player var1) {...}

   @Named("P2") public static void player2$annotations() {}

   public final Player getPlayer2() { ... }

   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$annotations() {}

  public final Player getPlayer1() { ... }

  public final void setPlayer1(Player var1) {...}

  @Named("P2") public static void player2$annotations() {}

  public final Player getPlayer2() { ... }

  public final void setPlayer2(Player var1) {...}
```

Specify Annotations

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

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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 injection

- Immutable 💪
- Easy to use 😅
- Reliable injection 🧱
- Compilation safety 🛠️

Constructor vs Property injection

Property injection

- Mutable (lateinit) properties 💔
- Annotation target unclear 🤷‍♂️
- Difficult to configure tests 📐

Property injection

Android

- Activity
- Fragment
- Service

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
    @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) { /* … */ }
}
```


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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) { /* … */ }
}
```


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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;
  }
}
```

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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.Companion();

  @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 Companion() {
    }
  }
}
```

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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 ApplicationModule();

  @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 ApplicationModule() {
  }
}
```

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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);
  }
}
```

But wait...

Dagger 2.25.2 🥳

Kotlin support

- Qualifier annotations on fields can now be understood without the need for @field:MyQualifier (646e033)
- @Module object classes no longer need @JvmStatic on the provides methods. (0da2180)


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Qualifier annotations

```
class Game @Inject constructor() {

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

Qualifier annotations

```
class Game @Inject constructor() {

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

Dagger: Modules

```
object ApplicationModule {

    @Provides
    @JvmStatic
    fun context(application: Application): Context = application

    @Provides
    @JvmStatic
    fun repository(name: String): SampleRepository = SampleRepository(name)
}
```

Dagger: Modules

```
object ApplicationModule {

    @Provides
    fun context(application: Application): Context = application

    @Provides
    fun repository(name: String): SampleRepository = 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.checkParameterIsNotNull(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"
}
```

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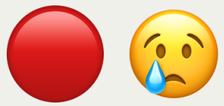
Build Failed...



Kotlin: Generics<? : T>

Java Interoperability

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

Kotlin: Generics<? : T>

Java Interoperability

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

Jetpack

Jetpack

ViewModel

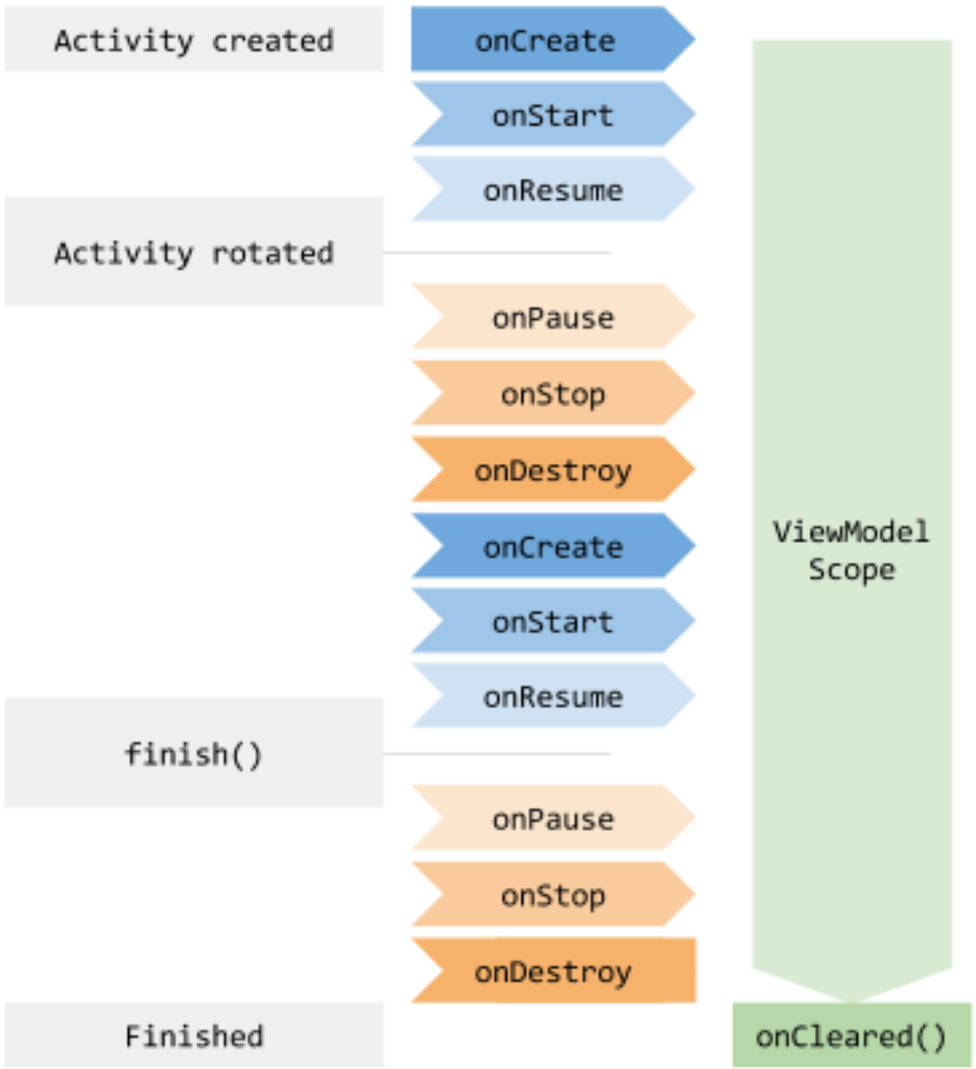
Jetpack

ViewModel

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

Jetpack

ViewModel



Jetpack

ViewModel

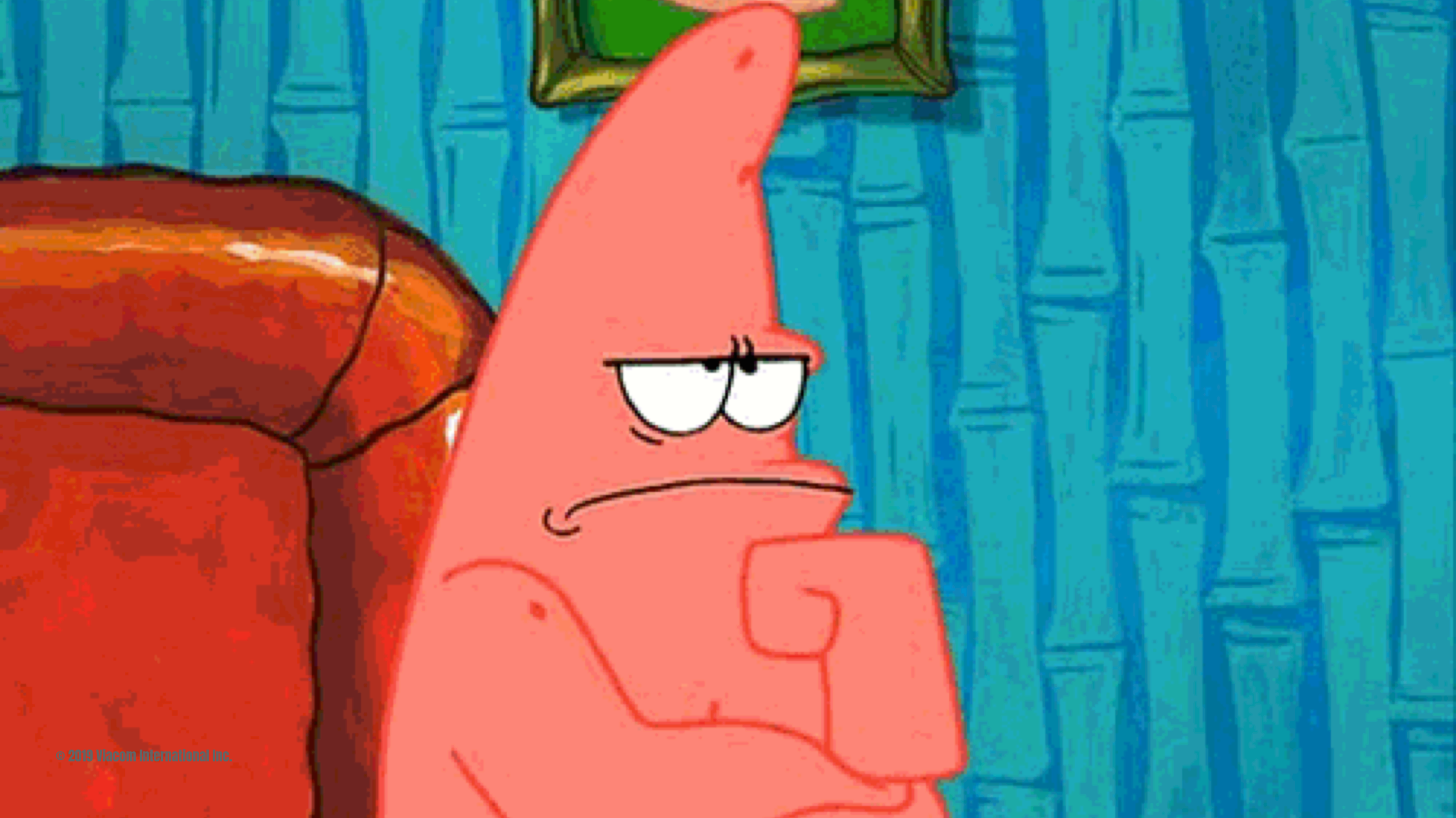
- Android Application created
- Android Activity created
- Dagger @Component created
- Androidx ViewModel created
- Androidx Fragment created

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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© 2019 20th Century Fox

JetPack

ViewModel

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

class Activity : DaggerAppCompatActivity {

    @Inject lateinit var model: SampleViewModel
}
```

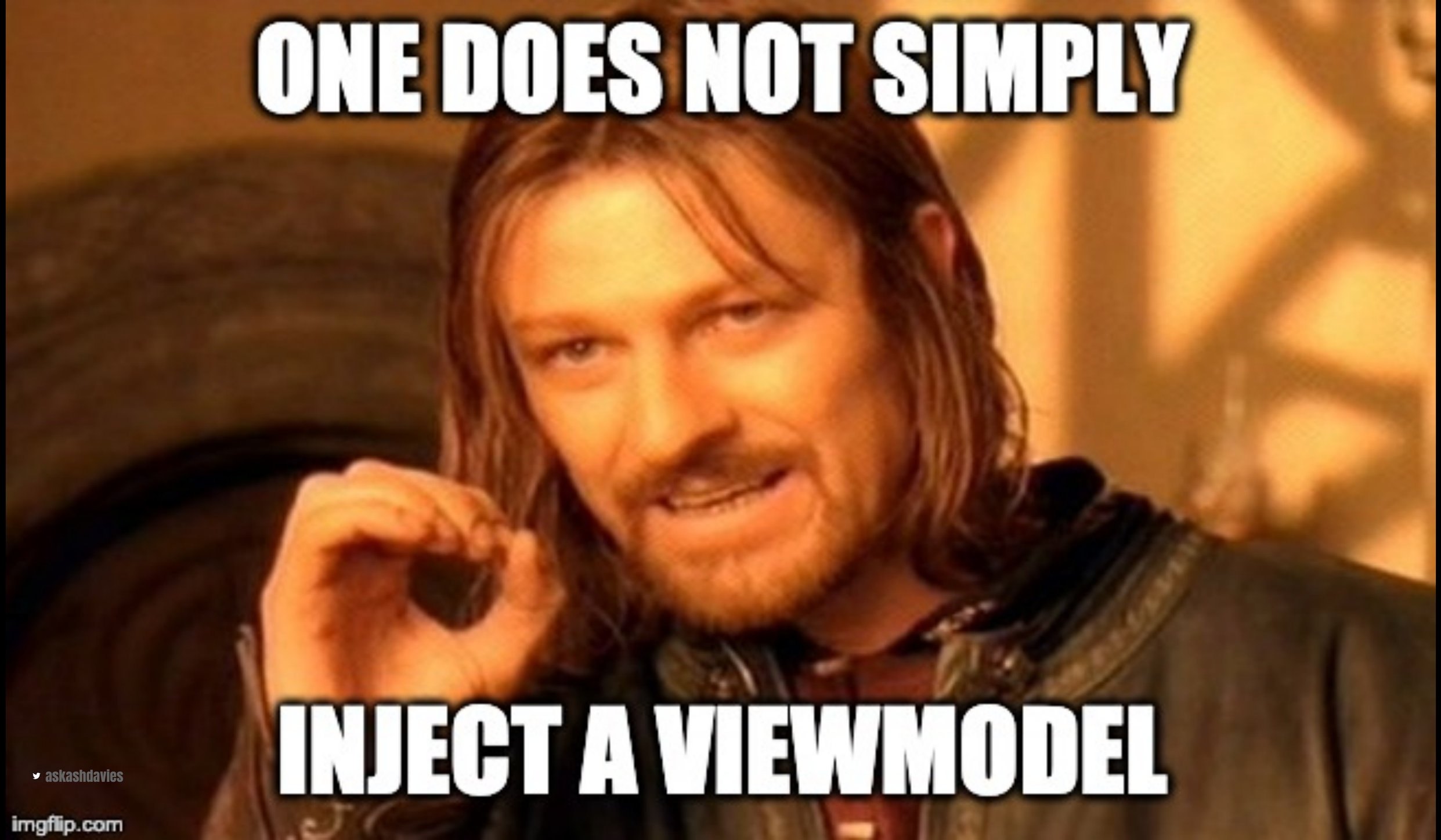
JetPack

ViewModel

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

class Activity : DaggerAppCompatActivity {

    @Inject lateinit var model: SampleViewModel
}
```


ONE DOES NOT SIMPLY
INJECT A VIEWMODEL
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imgflip.com

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
    }
}
```

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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)
    }
}
```

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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
    }
}
```

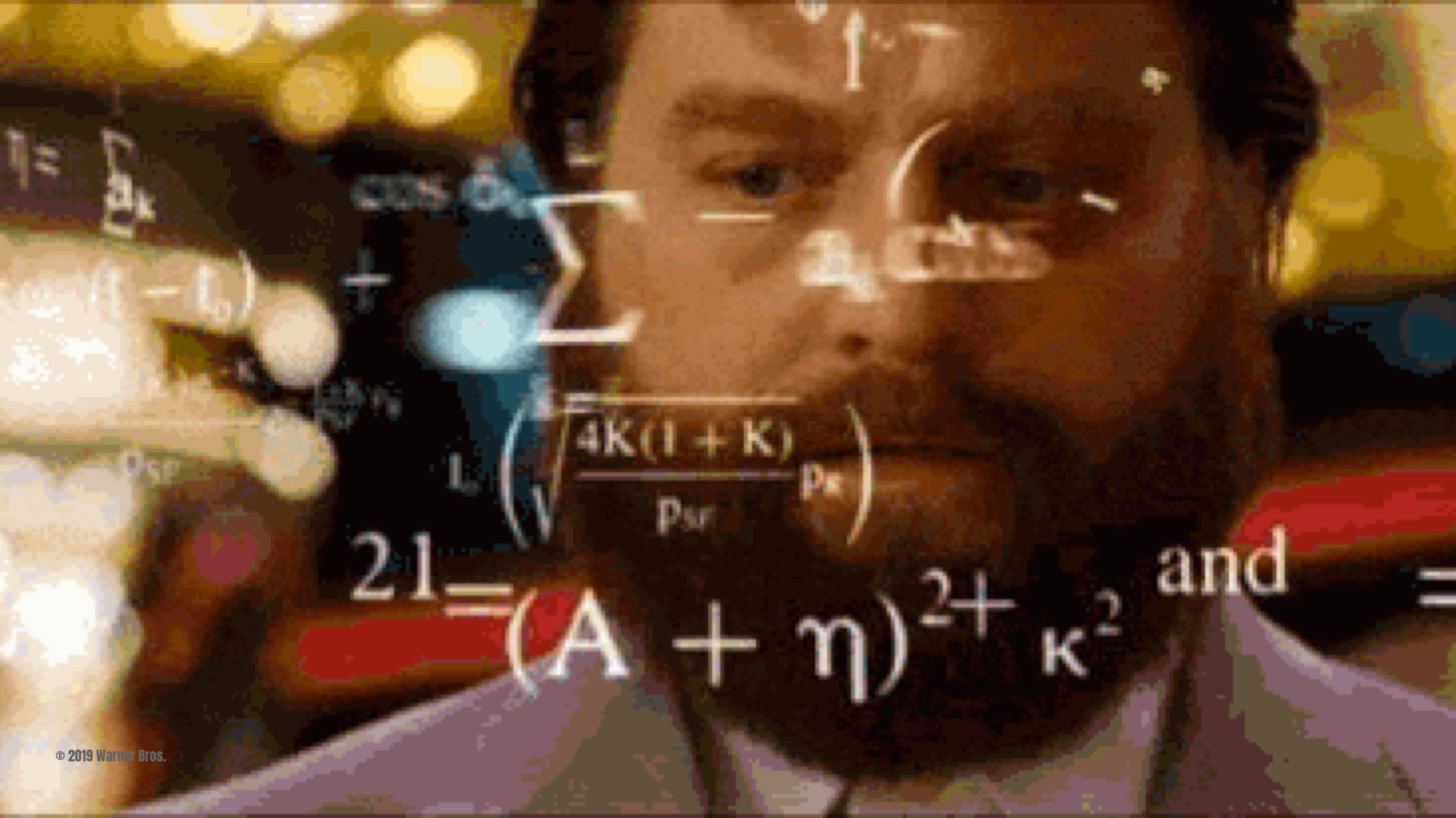
github.com/android/plaid/blob/master/app/src/main/java/io/plaidapp/ui/HomeViewModelFactory.kt

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."
            )
        }
    }
}
```



© 2019 Warner Bros.

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
            )
        }
    }
}
```

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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
}
```

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PE MIS CHI CHIS
ME TOQUEM
HUEVOS
VERGA ES FE
ENA.
WAIT, WAIT,
THERE'S MORE.
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Android: *Factory

- AppComponentFactory

  Android Pie 🥧

- FragmentFactory

  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
    }
}
```

askashdavies

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
}
```

Default Implementations?

```
interface ApplicationModule {

    @Provides
    @JvmStatic
    @ActivityScope
    fun context(application: Application): Context = application
}
```


HAHAHA

Inlined method bodies in Kotlin

Kotlin return types can be inferred from method body

Default Parameters?

~~Default Parameters?~~ 

@JvmOverloads

~~@JvmOverloads~~ 

Hope 🙏

bit.ly/dagger-kotlin-support

#AndroidDevSummit

Dependency Injection on Android

youtube.com/watch?v=o-ins1nvbDg

dagger.android 🙅

@ContributesAndroidInjector

dagger.android is NOT deprecated. At #AndroidDeveloperSummit, we communicated that we won't be adding new features (major improvements) to the library but we're committed to maintaining it until a suitable stable replacement is available.

Manuel Vivo @manuelvicnt
5:52pm - 28 Oct 2019

Further Reading 📖

- Manuel Vivo: An Opinionated Guide to Dependency Injection on Android
  youtube.com/watch?v=o-ins1nvbDg
- Google Codelab: Using Dagger in your Android app
  codelabs.developers.google.com/codelabs/android-dagger/
- Dave Leeds: Inline Classes and Autoboxing
  typealias.com/guides/inline-classes-and-autoboxing/
- Jake Wharton: Helping Dagger Help You
  jakewharton.com/helping-dagger-help-you/
- Dagger: Kotlin Dagger Best Practices
  github.com/google/dagger/issues/900
- Fred Porciúncula: Dagger 2 Official Guidelines
  proandroiddev.com/dagger-2-on-android-the-official-guidelines-you-should-be-following-2607fd6c002e
- Zac Sweers: Dagger Party tricks
  zacsweers.dev/dagger-party-tricks-deferred-okhttp-init/

Thanks! 👋🍻

DevFest.cz
2019

askashdavies