

Dependency injection made easy with Dagger2

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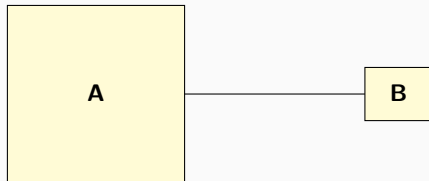
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Agenda

1. Dependency injection principles
2. Dagger2
3. Dagger2 Android
4. Alternative patterns

Dependency injection principles

What is a dependency?



```
/** Class A (the client) */
```

```
class A {
```

```
    // ....
```

```
    fun doSomething() {
```

```
        b.log("text")
```

```
    }
```

```
}
```

```
/** Class B (dependency/service) */
```

```
class B {
```

```
    fun log(text : String) {
```

```
    }
```

```
}
```

```
// Option 1 - static methods
```

```
class A {  
    fun doSomething() {  
        B.log("text") // <- static method  
    }  
}
```

```
class B {  
    companion object {  
        fun log(text: String) {  
        }  
    }  
}
```

Examples:

- Helper classes
- Utils classes
- Manager classes, etc. . .

Drawbacks:

- *A* not testable in isolation (integration test of *A* & *B*)
- *A* *strongly coupled* to *B* (hardcoded dependency, no way to override/replace it)
- Lack of encapsulation (backdoor)
- *Hidden* dependency

More Examples:

- `Application.getStaticContext()`
- in order to move one class to a different module, you have to move “hundreds” of classes. . .

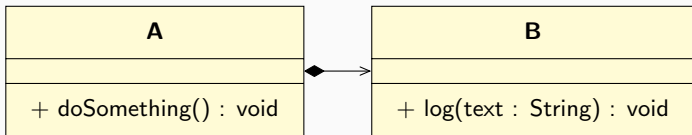
```
// Option 2 - singletons
```

```
class A {  
    fun doSomething() {  
        B.log("text") // <- singleton  
    }  
}
```

```
object B {  
    fun log(text: String) {  
    }  
}
```

```
// Option 3 - composition
```

```
class A {  
    private val b : B = B() // <-- instantiate  
  
    fun doSomething() {  
        b.log("text")  
    }  
}  
  
class B {  
    fun log(text: String) {  
    }  
}
```



The *life* of the child is completely controlled by the parent.

Example:

- Custom views or adapters instantiating objects
- `Date date = new Date()\`
-

Drawbacks:

- A is in charge of instantiating B (additional responsibility)
- A can't be tested in isolation (integratin test of A and B together)
- A is strongly coupled to B (can't replace B rom outside and/or in testing)

```
// Externalise the dependency

class A(private val b : B) {
    fun doSomething() {
        b.log("text")
    }
}

class B {
    fun log(text: String) {
    }
}

//
val b : B = B()
val a : A = A(b) // <-- plug b
```

We can do even better...


```
class A(private val b : B) {  
    fun doSomething() {  
        b.log("text")  
    }  
}  
  
interface B {  
    fun log(text: String);  
}  
  
class AmazingB : B {  
    override fun log(text : String) {  
    }  
}  
  
//  
val b : B = AmazingB()  
val a : A = A(b)
```

Now we have:

- Full decoupling
- A loosely coupled to B (A knows anything about B but the contract)
- Inversion of control¹: it's no longer responsibility of A to get its own dependencies

¹Not yet actually. . . We miss an ingredient

There is a problem:

```
class C {  
    fun qhdouwh() {  
        val b = AmazingB() // <-- not good  
        val a = A(b) // <-- not good  
        a.doSomething()  
    }  
}
```

We want (recursively)

```
class C(private a : A) { // A being now an interface
    fun qhdouwh() {
        a.doSomething()
    }
}
```

Antipattern: we want...

```
class MainActivity : AppCompatActivity() {  
  
    lateinit var presenter : Presenter  
  
    override fun onCreate(bundle: Bundle?) {  
        super.onCreate(savedInstanceState)  
        setContentView(R.layout.activity_main)  
        presenter.doSomething()  
    }  
}
```

...instead we get

```
class MainActivity : AppCompatActivity() {  
  
    lateinit var presenter : Presenter  
  
    override fun onCreate(bundle: Bundle?) {  
        super.onCreate(savedInstanceState)  
        setContentView(R.layout.activity_main)  
        val okHttp : OkHttp = /*...*/  
        val gson : Gson = GsonBuilder = /*...*/  
        val retrofit : Retrofit = /*...*/  
        val repository : Repository = /*...*/  
        val usecase : UseCase = /*...*/  
        val presenter : Presenter = /*...*/  
        presenter.doSomething()  
  
    }  
}
```

Question

If

- A is not in charge of getting B
- C should not be in charge of instantiating A and B

who is in charge?

In software engineering, dependency injection is a technique whereby one object supplies the dependencies of another object. A dependency is an object that can be used (a service). An injection is the passing of a dependency to a dependent object (a client) that would use it. The service is made part of the client's state. Passing the service to the client, rather than allowing a client to build or find the service, is the fundamental requirement of the pattern.

It directly contrasts with the service locator pattern, which allows clients to know about the system they use to find dependencies.

Source: https://en.wikipedia.org/wiki/Dependency_injection

Ingredients:²

modules : it contains recipes (methods) to instantiate the dependencies

injector/component : wiring and feed the target with the dependencies it needs



- Often, the injector is also responsible of instantiating the client itself. Sometimes this is not possible (e.g., Android)
- Modules are pluggable in the injector

²Preparing the ground for dagger terminology, but here we are not using dagger yet

Injector

- ensures inversion of control (i. e., *duality*):
 - You reverse the control of the object dependencies from the object to the one who is calling the object
- restores single responsibility principle

```
// injector (wiring things up)
interface Component {
    fun inject(activity : MainActivity)
}

// provides the dependencies
class Module {
    fun providePresenter(): Presenter {

    }
}
```

```
class MainActivity : AppCompatActivity() {  
  
    @Inject  
    lateinit var presenter : Presenter  
  
    override fun onCreate(bundle: Bundle?) {  
        val injector = InjectorImplementation();  
        injector.inject(this);  
        super.onCreate(savedInstanceState)  
        setContentView(R.layout.activity_main)  
        presenter.doSomething()  
    }  
}
```

Activity accepts the dependencies from an injector. It is no longer responsible for creating the dependencies needed, or to delegate instantiation to another object

The screenshot shows a web browser window with the address bar displaying `https://docs.oracle.com/javaee/6/api/javax/inject/inject.html`. The page title is "inject (Java EE 6)". The navigation bar includes links for "Overview", "Package", "Class", "Tree", "Deprecated", "Index", and "Help". The "Class" link is highlighted. Below the navigation bar, there are links for "PREV CLASS", "NEXT CLASS", "SUMMARY", "REQUIRED", and "OPTIONAL". The main content area is titled "Annotation Type Inject" and includes the following information:

- Target:** `(value={METHOD, CONSTRUCTOR, FIELD})`
- Retention:** `(value=RUNTIME)`
- Documentation:** `#Documented`
- Interface:** `public interface Inject`

Identifies injectable constructors, methods, and fields. May apply to static as well as instance members. An injectable member may have any access modifier (private, package-private, protected, public). Constructors are injected first, followed by fields, and then methods. Fields and methods in superclasses are injected before those in subclasses. Ordering of injection among fields and among methods in the same class is not specified.

Injectable constructors are annotated with `@Inject` and accept zero or more dependencies as arguments. `@Inject` can apply to at most one constructor per class.

```
@Inject ConstructorModifiers<T> SimpleTypeName(FormalParameterList<T>) Throws<T> ConstructorBody
```

`@Inject` is optional for public, no-argument constructors when no other constructors are present. This enables injectors to invoke default constructors.

```
@Inject<T> Annotations<T> public SimpleTypeName() Throws<T> ConstructorBody
```

Injectable fields:

- are annotated with `@Inject`.
- are not final.
- may have any otherwise valid name.

```
@Inject FieldModifiers<T> Type VariableDeclarators;
```

Injectable methods:

- are annotated with `@Inject`.
- are not abstract.
- do not declare type parameters of their own.
- may return a result
- may have any otherwise valid name.
- accept zero or more dependencies as arguments.

```
@Inject MethodModifiers<T> ResultType Identifier(FormalParameterList<T>) Throws<T> MethodBody
```

https:
//docs.oracle.com/javaee/6/api/javax/inject/Inject.html

```
// provides the dependencies
class Module {
    fun providePresenter(): Presenter {
        val okHttp : OkHttp = ...
        val gson : Gson = GsonBuilder = ...
        val retrofit : Retrofit = ...
        val repository : Repository = /*...*/
        val usecase : UseCase = /*...*/
        return Presenter(usecase)
    }
}
```

We can be more granular:

```
class Module {  
    fun providesOkHttp() : OkHttp = /*...*/  
    fun providesGson() : Gson = /*...*/  
    fun providesRetrofit(gson:Gson, okHttp : OkHttp)  
        : Retrofit = /*...*/  
    fun providesRepository(retrofit : Retrofit)  
        : Repository = /*...*/  
    fun providesUseCase(repository:Repository)  
        : UseCase = /*...*/  
  
    fun providePresenter(useCase: UseCase)  
        : Presenter = PresenterImpl(usecase)  
}
```

The end... (really?)

Caution!!

Combinatorial explosion when chaining mutual dependencies

Dependency injection frameworks help to *manage* the graph of dependencies.

Few famous ones for Java:

- Pivotal's Spring Core Container (autowiring)
- Google's Guava
- Square's Dagger1
- Google's Dagger2

Two strategies (common in java):

- Reflection (runtime)
- Annotation processing (compile time)

Pros/cons...

Dagger2

Dagger is

- fully static
- compile-time
- annotation processing based
- dependency injection framework
- for Java/Android
- that organises dependencies into a *directed acyclic graph* (DAGger)

Dagger2 Android

Alternative patterns

- Cake pattern
- Reader monad
- Implicits (Scala)

Questions?