

# Module 3:

# "Managing Dependencies"



**TEKNOLOGISK**  
**INSTITUT**

# Agenda

- ▶ **Classifying Dependencies**
- ▶ Dependency Injection Patterns
- ▶ Workshop A.4: A Test of Time in the Domain Layer
- ▶ Anti-Pattern: Ambient Context
- ▶ *Pattern: Null Object*
- ▶ Test Spies
- ▶ (Optional) Workshop A.5: Create a Null User Context

# Volatile Dependencies

- ▶ Out-of-process or unmanaged resources
- ▶ Nondeterministic resources
- ▶ Resources to be
  - Replaced
  - Intercepted
  - Decorated
  - Mocked

# Examples of Volatile Dependencies

- ▶ Databases
- ▶ File system
- ▶ Web services
- ▶ Security contexts
- ▶ Message Queues
- ▶ **System.Random** (or similar)

# Stable Dependencies

- ▶ A dependency is *stable* if it's not volatile...!

```
interface IUserRoleParser
{
    bool Parse(string role);
}
```

```
class MovieViewModel
{
    public string DisplayText { get; }

    public MovieViewModel(MovieShowing movie) { ... }
}
```

# To Inject or Not To Inject?

*Dependency Injection applies exclusively to Volatile Dependencies.*

*Don't inject Stable Dependencies!*

# Never Make Dependencies Optional!

- ▶ You should usually always require a dependency
  - Only exception is if it has a Local Default
  - If it is not present (yet?) then use a Null Object
- ▶ Local Default
  - A default implementation of a dependency which resides in the same module or layer of the application
  - (As opposed to Foreign Default)
- ▶ Note:
  - A Local Default cannot have any Foreign Defaults

# Agenda

- ▶ Classifying Dependencies
- ▶ **Dependency Injection Patterns**
- ▶ Workshop A.4: A Test of Time in the Domain Layer
- ▶ Anti-Pattern: Ambient Context
- ▶ *Pattern: Null Object*
- ▶ Test Spies
- ▶ (Optional) Workshop A.5: Create a Null User Context



# Pattern: Composition Root

- ▶ *The Composition Root is the single, logical location in your application where the modules and dependencies are composed together.*
- ▶ Outline
  - This is as near as possible to the application's entry point
  - If using a DI container this is the only place where you reference the container
- ▶ See:  
"Dependency Injection Principles, Practices, and Patterns"  
Steven van Deursen and Mark Seemann (2019)

# Examples of Composition Root

- ▶ Console applications
  - **Main()** in **Program.cs**
- ▶ WPF / UWP applications
  - **App.xaml.cs**
- ▶ ASP.NET applications
  - **Application\_Start()** in **Global.asax.cs**
    - + Setting the **DependencyResolver** for controllers

# Pattern: Constructor Injection

- ▶ *Constructor Injection is the act of statically defining the list of required dependencies by specifying them as parameters to the class' constructor.*
- ▶ Outline
  - Explicitly list the dependencies needed by the component
  - Keep the constructor free of any other logic
  - Note: This is always the preferred choice of injection
- ▶ See:  
"Dependency Injection Principles, Practices, and Patterns"  
Steven van Deursen and Mark Seemann (2019)

# Constructor Injection

## ► Advantages

- Dependencies are always present when object constructed.
- Make the dependencies needed by the component obvious in a declarative manner
- Very easy to implement

## ► Disadvantages

- Does not work well with late-binding frameworks with Constrained Constructions

# Pattern: Method Injection

- ▶ *Method Injection supplies a consumer with a dependency by passing it as method argument on a method called outside the Composition Root.*
- ▶ Outline
  - Used when the dependency is short-lived or varies
- ▶ See:  
“Dependency Injection Principles, Practices, and Patterns”  
Steven van Deursen and Mark Seemann (2019)

# Method Injection

## ► Advantages

- Allows dependencies to be injected into data objects which are not created in the Composition Root
- Allows the caller to provide operation-specific context

## ► Disadvantages

- Rarely needed or used
- Passing dependencies in methods can make dependency part of API

# Pattern: Property Injection

- ▶ *Property Injection allows a Local Default to be replaced via a public settable property. Property Injection is also known as Setter Injection.*
- ▶ Outline
  - Best used with optional dependencies
  - Allows Local Default to be overridden in a simple way
- ▶ See:  
“Dependency Injection Principles, Practices, and Patterns”  
Steven van Deursen and Mark Seemann (2019)

# Example of Property Injection

```
public class Consumer
{
    public IDependency Dependency { get; set; }
    public void UseDependency()
    {
        Dependency.DoStuff();
    }
}
```

```
Consumer consumer = new Consumer();
consumer.Dependency = new Implementation1();
consumer.UseDependency();
consumer.Dependency = new Implementation2();
consumer.UseDependency();
```



# Property Injection

- ▶ Advantages
  - Easy to understand..! 😊
- ▶ Disadvantages
  - Causes temporal coupling
  - Can change during lifetime (unless subtle logic is implemented)
  - Very limited applicability, e.g. reusable libraries

# Agenda

- ▶ Classifying Dependencies
- ▶ Dependency Injection Patterns
- ▶ **Workshop A.4: A Test of Time in the Domain Layer**
- ▶ Anti-Pattern: Ambient Context
- ▶ *Pattern: Null Object*
- ▶ Test Spies
- ▶ (Optional) Workshop A.5: Create a Null User Context

# Workshop A.4: A Test of Time in the Domain Layer



# Discussion: Possible Approaches?

- ▶ Time is one of the most common sources of errors
- ▶ Which solution did you implement?
- ▶ Why?

# Agenda

- ▶ Classifying Dependencies
- ▶ Dependency Injection Patterns
- ▶ Workshop A.4: A Test of Time in the Domain Layer
- ▶ **Anti-Pattern: Ambient Context**
- ▶ *Pattern: Null Object*
- ▶ Test Spies
- ▶ (Optional) Workshop A.5: Create a Null User Context

# Anti-Pattern: Ambient Context

- ▶ *An Ambient Context supplies application code outside the Composition Root with global access to a Volatile Dependency by means of static members.*

```
ITimeProvider timeProvider = TimeProvider.Current;  
DateTime now = timeProvider.Now;
```

- ▶ See:  
“Dependency Injection Principles, Practices, and Patterns”  
Steven van Deursen and Mark Seemann (2019)

# Agenda

- ▶ Classifying Dependencies
- ▶ Dependency Injection Patterns
- ▶ Workshop A.4: A Test of Time in the Domain Layer
- ▶ Anti-Pattern: Ambient Context
- ▶ ***Pattern: Null Object***
- ▶ Test Spies
- ▶ (Optional) Workshop A.5: Create a Null User Context

# Agenda

- ▶ Classifying Dependencies
- ▶ Dependency Injection Patterns
- ▶ Workshop A.4: A Test of Time in the Domain Layer
- ▶ Anti-Pattern: Ambient Context
- ▶ *Pattern: Null Object*
- ▶ **Test Spies**
- ▶ (Optional) Workshop A.5: Create a Null User Context



# Test Spies

- ▶ Test Spy
  - An object that records its interaction with other objects
  - When deciding if a test was successful based on the state of available objects alone is not sufficient
  - Can be useful for making assertions on things e.g.
    - the number of calls
    - elements sent
    - arguments passed to specific functions, and return values
- ▶ Related to Null Object, but different!

# Agenda

- ▶ Classifying Dependencies
- ▶ Dependency Injection Patterns
- ▶ Workshop A.4: A Test of Time in the Domain Layer
- ▶ Anti-Pattern: Ambient Context
- ▶ *Pattern: Null Object*
- ▶ Test Spies
- ▶ **(Optional) Workshop A.5: Create a Null User Context**



# (Optional) Workshop A.5: Create a Null User Context



# Discussion: What Have We Learned?

- ▶ Cascading change adding NullUserContext instance?
- ▶ What was unit tested? And how?
- ▶ What kinds of DI Patterns were applied?
- ▶ Is the new design still maintainable?
- ▶ Does SOLID enhance team collaboration?
- ▶ How would realistic user contexts be implemented?

# Summary

- ▶ Classifying Dependencies
- ▶ Dependency Injection Patterns
- ▶ Workshop A.4: A Test of Time in the Domain Layer
- ▶ Anti-Pattern: Ambient Context
- ▶ *Pattern: Null Object*
- ▶ Test Spies
- ▶ (Optional) Workshop A.5: Create a Null User Context



WINCUBATE

Jesper Gulmann Henriksen

PhD, MCT, MCSD, MCPD

Phone : +45 22 12 36 31

Email : [jgh@wincubate.net](mailto:jgh@wincubate.net)

WWW : <http://www.wincubate.net>

Ringgårdsvej 4A

8270 Højbjerg

Denmark