

Module 3:

"Managing Dependencies"



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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 Name { get; }
    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

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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

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- ▶ 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?

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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)

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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!

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(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

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