# Design for Unit Testing

DEVELOPMENTOR

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## Agenda

- Tight coupling
- Loose coupling with interfaces
- Dependency Injection
- Slicing
- Inversion of Control Containers

## The Problem with Tight Coupling

- Tight coupling makes testing very difficult
  - How do I write a test that doesn’t need the database?
  - new indicates a potential issue

```
public Account(int accountNumber)
{
    var repository = new AccountRepository();

    this.actualBalance =
repository.GetBalance(accountNumber);
}
```

# Statics also Lead to Tight Coupling

- Static members couple types together

```
private int accountNumber;
public Account(decimal initialBalance)
{
    this.accountNumber =
Account.GetNextAccountNumber();
    this.initialBalance = initialBalance;
}
```

## Coding to Abstraction

- Using abstract types allows you to provide different implementations
  - Can vary implementation as required
  - Can provide an implementation that satisfies the test conditions

```
public Account(int accountNumber)
{
    IAccountRepository repository = ???

    this.actualBalance =
repository.GetBalance(accountNumber);
}
```

## A Problem

- Where does the implementation of the abstraction come from?
  - Using new will tightly couple
- Need to "inject" the implementation
  - Allows implementation to vary at runtime
- Technique is called Dependency Injection

## Dependency Injection

- Three different models for Dependency Injection
  - Parameter Injection
  - Property Injection
  - Constructor Injection

## Parameter Injection

- Pass implementation as method parameter
  - Good for dependencies that vary over the lifetime of an object

```
public Credit(decimal amount, IAccountRepository
repository )
{
    repository.CreditBalance(accountNumber, amount);
}
```

## Property Injection

- Assign property with dependency
  - Good for optional dependencies

```
public IAccountRepository Repository {get; set;}

public Account(int accountNumber)
{
    if(Repository != null)
    {
        this.actualBalance = 
Repository.GetBalance(accountNumber);
    }
}
```

## Constructor Injection

- Good for dependencies that are fixed for the lifetime of an object
  - Most common type of dependency injection

```
private IAccountRepository repository;

public Account(int accountNumber,
IAccountRepository repository)
{
    this.repository = repository;
    this.actualBalance =
this.repository.GetBalance(accountNumber);
}
```

## Dealing with Statics

- Interfaces and abstract base classes don’t solve the static problem
  - Cannot override a static implementation
- Two mechanisms for dealing with statics
  - Wrap static in a service
  - Inject a delegate

# Wrapping Statics in an Interface

- Create an interface that models the static behavior
  - Interface can be injected
- Create "real" version of interface that hands off to static

```
public interface IAccountService
{
    int GetNextAccountNumber();
}

public class RealAcccountService :
IAccountService
{
    public int GetNextAccountNumber()
    {
        return Account.GetNextAccountNumber();
    }
}
```

## Injecting a Delegate to Wrap a Static

- A lightweight way to abstract a static is to wrap it in a delegate
  - Means increasing the public “interface” of a class
  - Sometimes called “slicing”

```
public Account(decimal initialBalance)
    :this(initialBalance,
Account.GetNextAccountNumber)
{
}

public Account(decimal initialBalance, Func<int>
accountNumberProvider)
{
    accountNumber = accountNumberProvider();
    this.initialBalance = initialBalance;
}
```

## Another Problem – How to Construct You Application

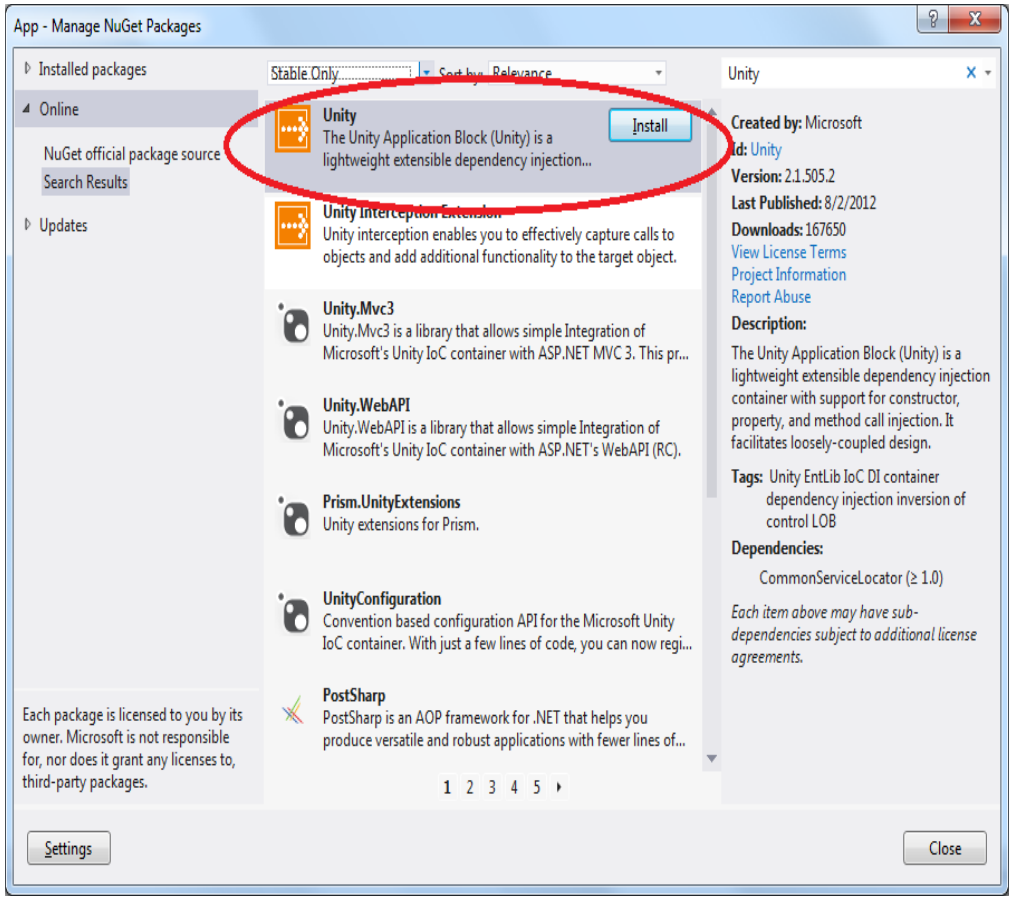
- How do you inject dependencies?
  - What if the dependencies have dependencies?
- Need a reflection framework that knows how to resolve dependencies
  - Can walk a dependency tree
- Inversion of Control means external code creates dependencies
  - In effect Inversion of Control (IoC) = Dependency Injection
- An IoC Container is a tool to wire up dependencies
  - Used to construct application, not generally in testing

## IoC Containers

- There are many IoC containers for .NET
  - Unity
  - StructureMap
  - Ninject
  - Spring.NET
  - Autofac
  - Castle Windsor
  - … many others
- All have similar basic functionality
  - Register mappings of concrete types to abstractions
  - Request implementation of abstraction
  - Container walks dependency tree creating instances from abstractions to wire up objects

# Unity – an Example IoC Container

- Unity is an IoC Container from Microsoft Patterns and Practices
- Install as a Nuget Package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The Unity Application Block (Unity) is a lightweight extensible dependency injection...
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Unity interception enables you to effectively capture calls to objects and add additional functionality to the target object.

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Unity.Mvc3 is a library that allows simple Integration of Microsoft's Unity IoC container with ASP.NET MVC 3. This pr...

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Unity

**Created by:** Microsoft
**Id:** Unity
**Version:** 2.1.505.2
**Last Published:** 8/2/2012
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**Description:**
The Unity Application Block (Unity) is a lightweight extensible dependency injection container with support for constructor, property, and method call injection. It facilitates loosely-coupled design.
**Tags:** Unity EntLib IoC DI container dependency injection inversion of control LOB
**Dependencies:**
CommonServiceLocator (≥ 1.0)

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## Unity Basics – Mapping Abstraction to Concrete - 1

- You can map an abstraction to a concrete type with RegisterType
  - By default new instance created on demand

```
IUnityContainer container = new UnityContainer();

container.RegisterType<IAccountRepository,
EFAccountRepository>();
```

## Unity Basics – Mapping Abstraction to Concrete - 2

- You can map an abstraction to an instance with RegisterInstance
  - Reuses same instance by default

```
IUnityContainer container = new UnityContainer();

var repository = new
EFAccountRepository(connectionString, pageSize);

container.RegisterInstance<IAccountRepository>(reposi
tory);
```

## Unity Basics – Creating Multiple Mappings

- You can map same abstraction to multiple concrete types
  - Must name the mapping

```
container.RegisterType<ILogger,
EventLogLogger>("system");

container.RegisterType<ILogger,
FileLogger>("tracing");
```

## Unity Basics – Retrieving Objects

- You can request an instance of a mapped type using Resolve
  - Simply state the abstraction you need
- Can also request instance via mapping name

```
IAccountRepository repo =
container.Resolve<IAccountRepository>();

ILogger traceLogger =
container.Resolve<ILogger>("tracing");
```

## Using Config for Mappings

- Can declare mapping in config file
  - Unity has own configuration section
- Config allows mapping to vary without compilation
  - Extra flexibility
- Do you really want uncontrolled remapping?
  - Normally better to register a map to a factory
  - Allows flexibility with greater control

```
container.RegisterType<ILoggerFactory,
FlexibleLoggerFactory>();
```

```
ILoggerFactory factory =
container.Resolve<ILoggerFactory>();

ILogger logger = factory.Create(LogLevel.Fatal);
```

## Can Override Default Lifetime Management

- Pass LifetimeManager when registering
  - Singleton (container)
  - Transient
  - PerResolve
  - PerThread
  - …

```
container.RegisterType<IAccountRepository, EFAccountRepository>(
                                                                 new
ContainerControlledLifetimeManager());
```

## Summary

- Coding to abstraction decouples your code
- Dependencies injected into classes
- IoC containers can simplify application wireup