# Advanced Interface Topics

## WHERE TO GO NEXT

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# Overview

## Best Practices

- Interface Segregation Principle
- Choosing Between Abstract Class and Interface
- Updating Interfaces

# Overview

## Advanced Topics

**Dependency Injection**

**Mocking**

# Interface Segregation Principle

```
public class List<T> : IList<T>,
        ICollection<T>, IList, ICollection,
        IReadOnlyList<T>, IReadOnlyCollection<T>,
        IEnumerable<T>, IEnumerable
```

"Clients should not be forced to depend upon methods that they do not use. Interfaces belong to clients, not hierarchies"

Martin & Martin. *Agile Principles, Patterns, and Practices in C#*. Pearson Education, 2006

We should have granular interfaces that only include the members that a particular function needs.

# List<T> Interfaces

```
public class List<T> : IList<T>,
        ICollection<T>, IList, ICollection,
        IReadOnlyList<T>, IReadOnlyCollection<T>,
        IEnumerable<T>, IEnumerable
```

| | |
|---|---|
| IEnumerable | GetEnumerator() |
| IEnumerable<T> | GetEnumerator() |

# List<T> Interfaces

```
public class List<T> : IList<T>,
        ICollection<T>, IList, ICollection,
        IReadOnlyList<T>, IReadOnlyCollection<T>,
        IEnumerable<T>, IEnumerable
```

**ICollection<T>**

- Count
- IsReadOnly
- Add()
- Clear()
- Contains()
- CopyTo()
- Remove()

**Plus, everything in**

- IEnumerable<T>
- IEnumerable

# List<T> Interfaces

```
public class List<T> : IList<T>,
        ICollection<T>, IList, ICollection,
        IReadOnlyList<T>, IReadOnlyCollection<T>,
        IEnumerable<T>, IEnumerable
```

**IList<T>**

- Item / Indexer
- IndexOf()
- Insert()
- RemoveAt()

**Plus, everything in**

- ICollection<T>
- IEnumerable<T>
- IEnumerable

# Granular Interfaces

`IEnumerable<T>`

**If We Need to**

- Iterate over a Collection / Sequence
- Data Bind to a List Control
- Use LINQ functions

# Granular Interfaces

`ICollection<T>`

**If We Need to**

- Add/Remove Items in a Collection
- Count Items in a Collection
- Clear a Collection

# Granular Interfaces

`IList<T>`

**If We Need to**

- Control the Order Items in a Collection
- Get an Item by the Index

# IEnumerable Implementations

List<T>

Array

ArrayList

SortedList<TKey, TValue>

HashTable

Queue / Queue<T>

Stack / Stack<T>

Dictionary<TKey, TValue>

ObservableCollection<T>

+ Custom Types

# IEnumerable<T> Implementations

List<T>

Array

SortedList<TKey, TValue>

Queue<T>

Stack<T>

Dictionary<TKey, TValue>

ObservableCollection<T>

+ Custom Types

# ICollection<T> Implementations

List<T>

SortedList<TKey, TValue>

Dictionary<TKey, TValue>

+ Custom Types

# IList<T> Implementations

List<T>

+ Custom Types

# Program at the Right Level

`IEnumerable<T>`

**If We Need to**

- Iterate over a Collection / Sequence
- Data Bind to a List Control

`ICollection<T>`

**If We Need to**

- Add/Remove Items in a Collection
- Count Items in a Collection
- Clear a Collection

`IList<T>`

**If We Need to**

- Control the Order Items in a Collection
- Get an Item by the Index

# IPersonRepository

```
public interface IPersonRepository
{
    IEnumerable<Person> GetPeople();
    Person GetPerson(string lastName);
    void AddPerson(Person newPerson);
    void UpdatePerson(string lastName, Person updatedPerson);
    void DeletePerson(string lastName);
    void UpdatePeople(IEnumerable<Person> updatedPeople);
}
```

# Better Segregation

```
public interface IReadOnlyPersonRepository
{
    IEnumerable<Person> GetPeople();

    Person GetPerson(string lastName);
}
```

# Better Segregation

```
public interface IPersonRepository : IReadOnlyPersonRepository
{
    void AddPerson(Person newPerson);

    void UpdatePerson(string lastName, Person updatedPerson);

    void DeletePerson(string lastName);

    void UpdatePeople(IEnumerable<Person> updatedPeople);
}
```

# Comparison Summary

| Abstract Classes | Interfaces |
| --- | --- |
| May contain implementation code | May not contain implementation code |
| A class may inherit from a single base class | A class may implement any number of interfaces |
| Members have access modifiers | Members are automatically public |
| May contain fields, properties, constructors, destructors, methods, events and indexers | May only contain properties, methods, events, and indexers |




# Regular Polygon

```
public abstract class AbstractRegularPolygon
{
    public int NumberOfSides { get; set; }
    public int SideLength { get; set; }
    public AbstractRegularPolygon(int sides, int length)
    {
        NumberOfSides = sides;
        SideLength = length;
    }
    public double GetPerimeter()
    {
        return NumberOfSides * SideLength;
    }
    public abstract double GetArea();
}
```

Abstract Class

Lots of Shared Code

# Person Repository

**CSV Repository**

```
public IEnumerable<Person> GetPeople()
{
    var people = new List<Person>();
    if (File.Exists(path))
        using (var sr = new StreamReader(path))
        {
          string line;
          while ((line = sr.ReadLine()) != null)...
              people.Add(per);
        }
            }
            return people;
        }
```

# Person Repository

**SQL Repository**

```
public IEnumerable<Person> GetPeople()
{
    using (var ctx = new PeopleEntities())
    {
        var people = from p in ctx.DataPersons
                     select new Person...

        return people.ToList();
    }
}
```

# Person Repository

**Service Repository**

```
public IEnumerable<Person> GetPeople()
{
     return serviceProxy.GetPeople();
}
```

**Interface**

**No Shared Implementation Code**

# Interfaces & Abstract Classes in the .NET BCL

Abstract Classes with Shared Implementation

**MembershipProvider, RoleProvider**

**CollectionBase**

# Interfaces & Abstract Classes in the .NET BCL

Interfaces to Add Pieces of Functionality

**IDisposable**

**INotifyPropertyChanged, INotifyCollectionChanged**

**IEquatable<T>, IComparable<T>**

**IObservable<T>**

**IQueryable<T>, IEnumerable<T>**

# Interfaces & Abstract Classes in the .NET BCL

Base Classes that Implement Interfaces / Inherit from Abstract Classes

**SqlMembershipProvider**

**SqlConnection, OdbcConnection, EntityConnection**

**List<T>, ObservableCollection<T>**

# Updating Interfaces


**Interfaces are a Contract**

- No changes after Contract is signed

**Adding Members Breaks Implementation**

**Removing Members Breaks Usage**

**Inheritance is a Good Way to Add to an Interface**

# Adding Members with Inheritance

```
public interface ISaveable
{
    string Save();
}
```

```
public interface ISaveable
{
    string Save();
    string Save(string name);
}
```

**Breaks Existing Implementers**

```
public interface INamedSaveable :
    ISaveable
{
    string Save(string name);
}
```

**Existing ISaveable Still Works**

# Dependency Injection

**Loosely Coupled Code**

**Make "Something Else" Responsible for Dependent Objects**

**Design Patterns**

- Constructor Injection
- Property Injection
- Method Injection
- Service Locator

**Dependency Injection Containers**

- Unity, StructureMap, Autofac, Ninject, Castle Windsor, and many others

# Mocking

**Create "Placeholder" Objects**

- In-Memory
- Only Implement Behavior We Care About

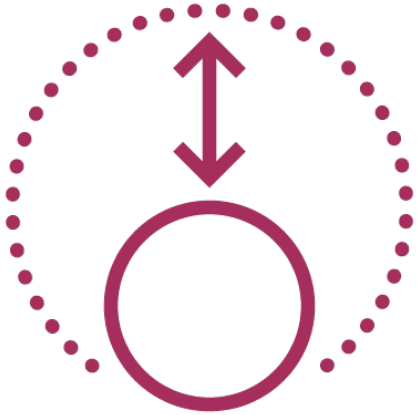
**Great for Unit Testing**

**Mocking Frameworks**

- RhinoMocks
- Microsoft Fakes
- Moq

# Why Interfaces?

**Maintainable**



**Extensible**

**Easily testable**

# Goals

**Learn the 'Why"**

- Maintainability
- Extensibility

**Implement Interfaces**

- .NET Framework Interfaces
- Custom Interfaces

# Goals

**Create Interfaces**

- Add Abstraction

**Peek at Advanced Topics**

- Mocking
- Unit Testing
- Dependency Injection

# Summary


The “What” of Interfaces

# Summary

## Best Practice

**Program to an abstraction rather than a concrete type**

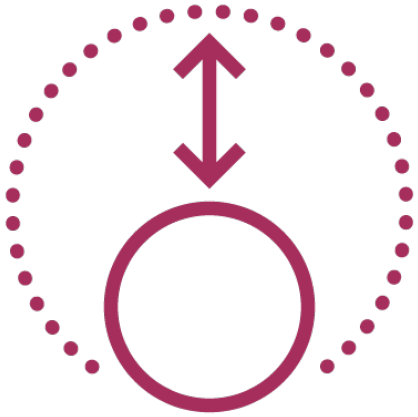
# Summary


**Program to an interface rather than a concrete class**

# Summary

## Create Maintainable Code

# Summary



**Create & Implement a Custom Interface**

- Use Abstraction to add Extensibility

# Summary

**Dynamic Loading & Unit Testing**

- Fake Repository for Testability

# Summary

## Advanced Topics

**Interface Segregation Principle**

**Dependency Injection**

**Mocking**

**Further Courses:**

- Dependency Injection
- Solid Design Principles
- Model View / View Model Pattern
- Unit Testing
- Test-Driven Development
- Mocking