Module 2.1: "Repository" (with Entity Framework)





Agenda

- Introductory Example: Products and Data Access
- ▶ Background: Entity Framework and IQueryable<T>
- Challenges
- Pattern: Repository
- ▶ 1. "Simple" Repository
- 2. Repository returning IQueryable<T>
- ▶ 3. Generic Repository Interface
- 4. Generic Repository Implementation
- Overview of Repository



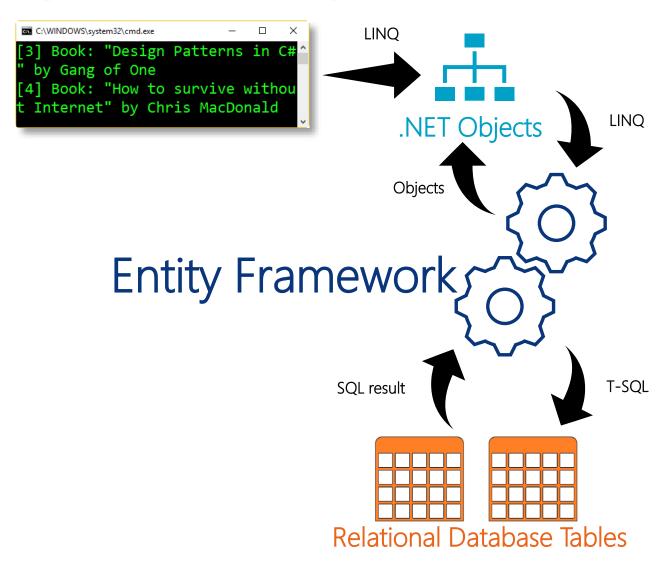
Introductory Example: Products and Data Access

```
public class Product
{
    public int Id { get; set; }
    public string Name { get; set; }
    public string Manufacturer { get; set; }
    public Category? Category { get; set; }
}
```

```
using (ProductsContext context = new ProductsContext())
{
   var query = context.Products.Where(p => p.Category == Category.Book);
   foreach (var product in query)
   {
       Console.WriteLine(product);
   }
}
```



Background: Entity Framework





Challenges

- How do we separate
 - Business logic
 - Data access logic?
- ▶ How can we make the business logic testable?
- ▶ What if we decide to employ another data source?



Pattern: Repository

 Mediates between the domain and data mapping layers using a collection-like interface for accessing domain objects

Outline

- Separate the actual data source from business logic code
- Avoid repetition of queries code
- Ensure testability and maintainability of data-driven code

Origin:

- Martin Fowler (2003)
- Eric Evans (2004)



1. "Simple" Repository

- Implement a specialized repository for each business object or entity
- Disregard any methods not used..! (YAGNI)

```
interface IProductRepository
{
    Product GetById( int id );
    IEnumerable<Product> GetAll();
    IEnumerable<Product> GetForCategory( Category? category );
    //void Add( Product product );
    //void Remove( Product product );
}
```

- Can implement interface for other data sources, e.g. unit tests
- ▶ But... Isn't most stuff of this not generic to every repository?



Background: **IQueryable<T>**

Remember the Expression class?

```
public interface IQueryable : IEnumerable
{
    Type ElementType { get; }
    Expression Expression { get; }
    IQueryProvider Provider { get; }
}
```

```
public interface IQueryable<out T>
   : IEnumerable<T>, IEnumerable, IQueryable
{
}
```

• IQueryable<T> represents an AST for an IEnumerable<T>



2. Repository returning **IQueryable<T>**

- Incredibly flexible and elegant
- Can efficiently be further queried...!

```
interface IProductRepository
{
    Product GetById( int id );
    IQueryable<Product> GetAll();
    IQueryable<Product> Find( Expression<Func<Product, bool>> filter );
    void Add( Product product );
    void Remove( Product product );
}
```

- ▶ In-memory implementations can use AsQueryable() extension
- <u>Beware</u>: Data access (and logic) might drift into business logic



3. Generic Repository Interface

- We reuse as much as possible, but leak no IQueryable<T>
- ▶ Ensures a high degree of consistency and reusability

```
interface IRepository<TEntity> where TEntity : class
{
    TEntity GetById( int id );
    IEnumerable<TEntity> GetAll();
    IEnumerable<TEntity> Find( Expression<Func<TEntity,bool>> filter );
    void Add( TEntity entity );
    void AddRange( IEnumerable<TEntity> entities );
    void Remove( TEntity entity );
    void RemoveRange( IEnumerable<TEntity> entities );
}
```

IProductRepository can add Product-specific methods



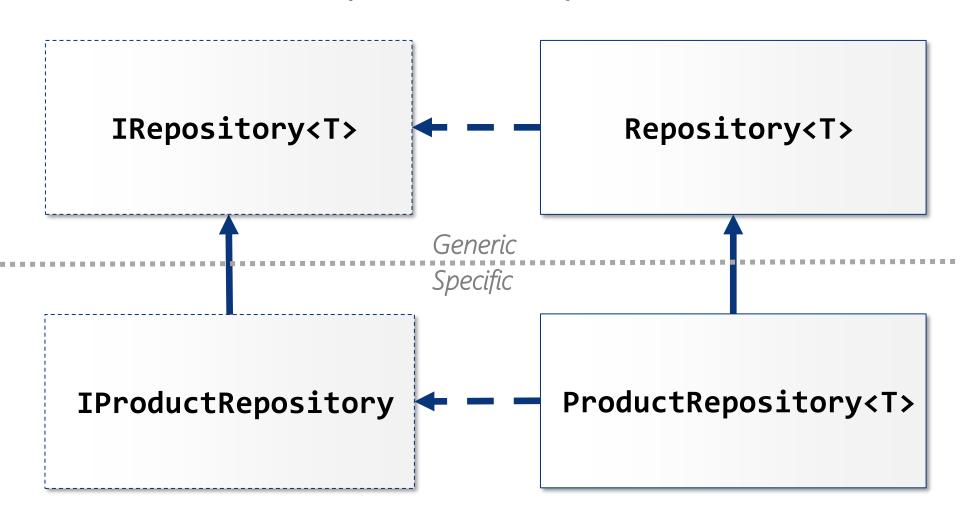
4 .Generic Repository Implementation

IRepository<TEntity> can be implemented generically for EFcontexts

```
class Repository<TEntity> : IRepository<TEntity> where TEntity : class
   protected DbContext Context { get; }
   public Repository( DbContext context ) { Context = context; }
   public TEntity GetById( int id )
        => Context.Set<TEntity>().Single(p => p.Id == id);
     public IEnumerable<TEntity> Find( Expression<Func<TEntity,bool>> f )
        => Context.Set<TEntity>().Where(f);
```

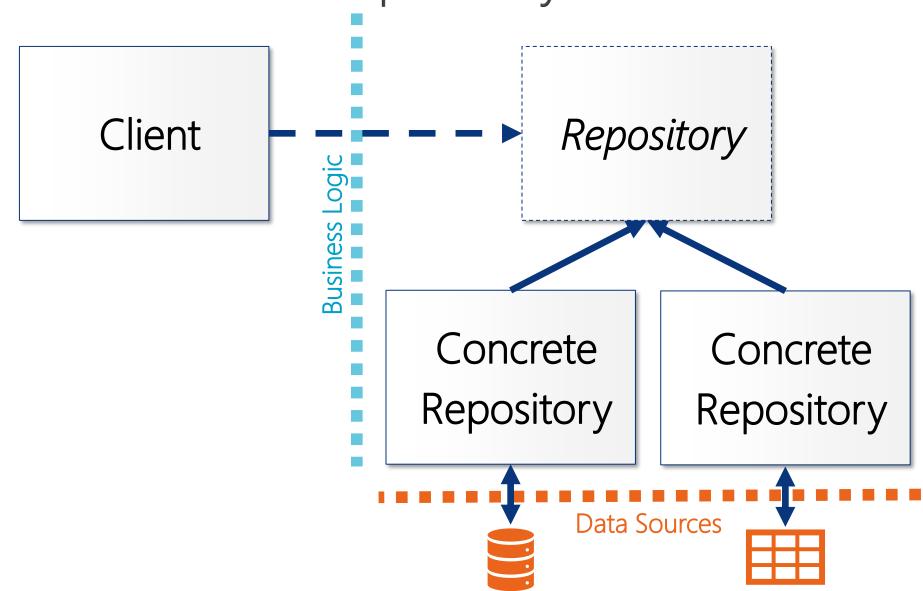


Generic vs. Specific Implementation





Overview of Repository Pattern





Overview of Repository Pattern

- Client
 - Queries and updates data through the Repository Interface
 - Only knows the general Repository interface
- Repository
 - Interface or base class exposing data access logic in a collection-styled persistence-independent description
- Concrete Repository
 - Concrete repository class implementing Repository interface
 - Implements persistence-dependent data access code for a specific concrete data source



Related: Unit of Work

- Unit of Work pattern for more complex situations
- Widely misunderstood implementations
 - Collection-like vs. Persistence-specific
 - Mixes Repository and Unit of Work
- Controversy
 - Repository should not have Save() Unit of Work has!
 - Repository should not have Update() Not collection-like!



