

Module 2.1: "Repository" (with Entity Framework)



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Agenda

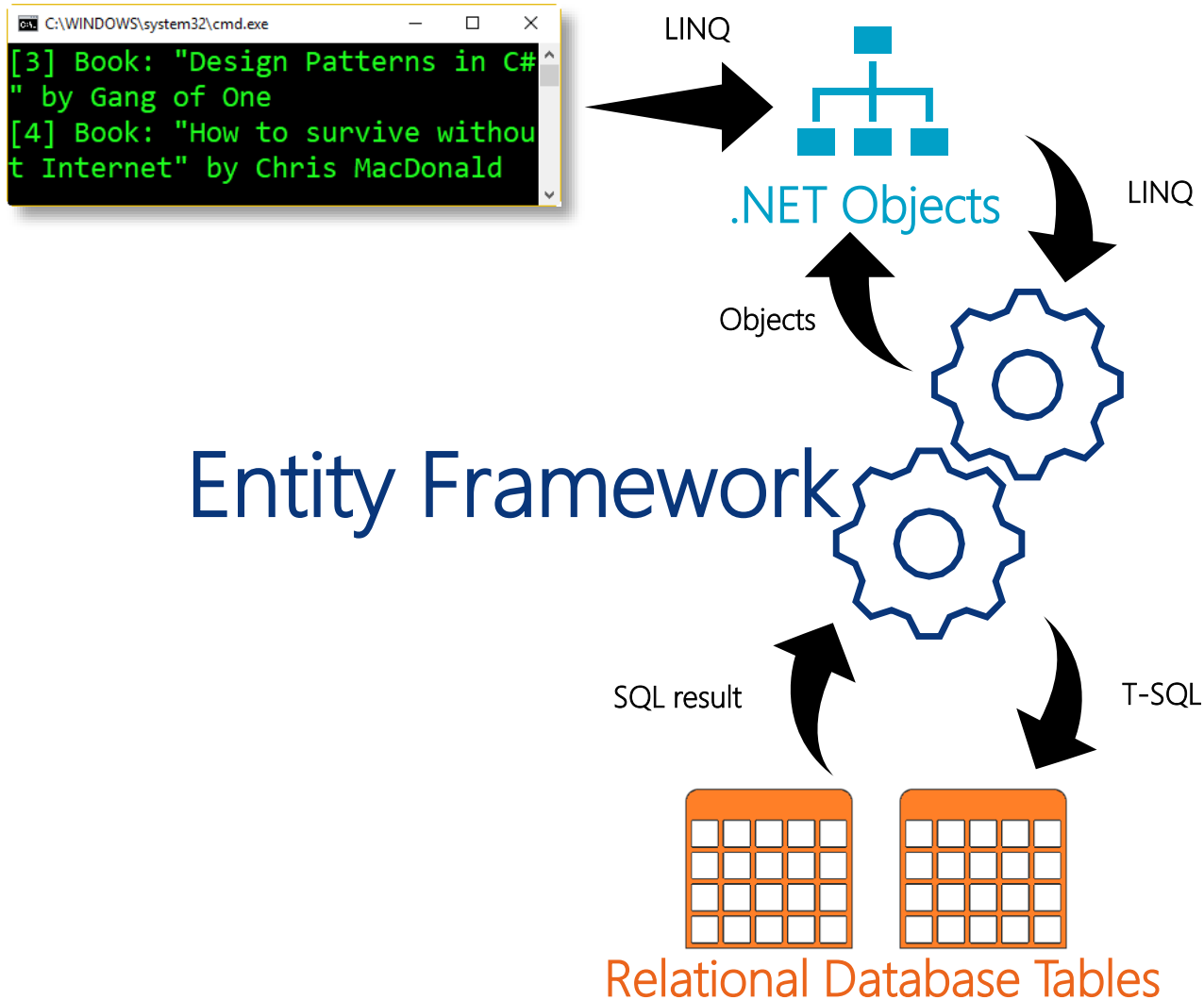
- ▶ Introductory Example: Products and Data Access
- ▶ Background: Entity Framework and **IQueryable<T>**
- ▶ Challenges
- ▶ Pattern: Repository
- ▶ 1. "Simple" Repository
- ▶ 2. Repository returning **IQueryable<T>**
- ▶ 3. Generic Repository Interface
- ▶ 4. Generic Repository Implementation
- ▶ Overview 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
 - Encapsulate data access
 - Separate the actual data source from business logic 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> GetAllBooks();
    //void Add( Product product );
    //void Remove( Product product );
}
```

- ▶ Can implement interface for other data sources, e.g. unit tests
- ▶ But... What about **GetAllNintendoProducts()** ?

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 “unevaluated” **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> GetAll( Expression<Func<Product, bool>> filter );
    void Add( Product product );
    void Remove( Product product );
}
```

- ▶ In-memory implementations can use **AsQueryable()** extension
- ▶ Beware: Data access logic might drift into business logic

3. Generic Repository Interface

- ▶ Abstract element type to be any entity with an **Id** property
- ▶ Ensures a high degree of consistency and reusability

```
interface IRepository<T> where T : IEntity
{
    T GetById( int id );
    IQueryable<T> GetAll();
    IQueryable<T> GetAll( Expression<Func<T, bool>> filter );
    void Add( T product );
    void Remove( T product );
}
```

```
interface IEntity
{
    int Id { get; }
}
```

- ▶ **IProductRepository** can add **Product**-specific methods

4 .Generic Repository Implementation

- **IRepository<T>** can be implemented generically for EF-contexts

```
class Repository<T> : IRepository<T> where T : class, IEntity
{
    private readonly DbContext _context;

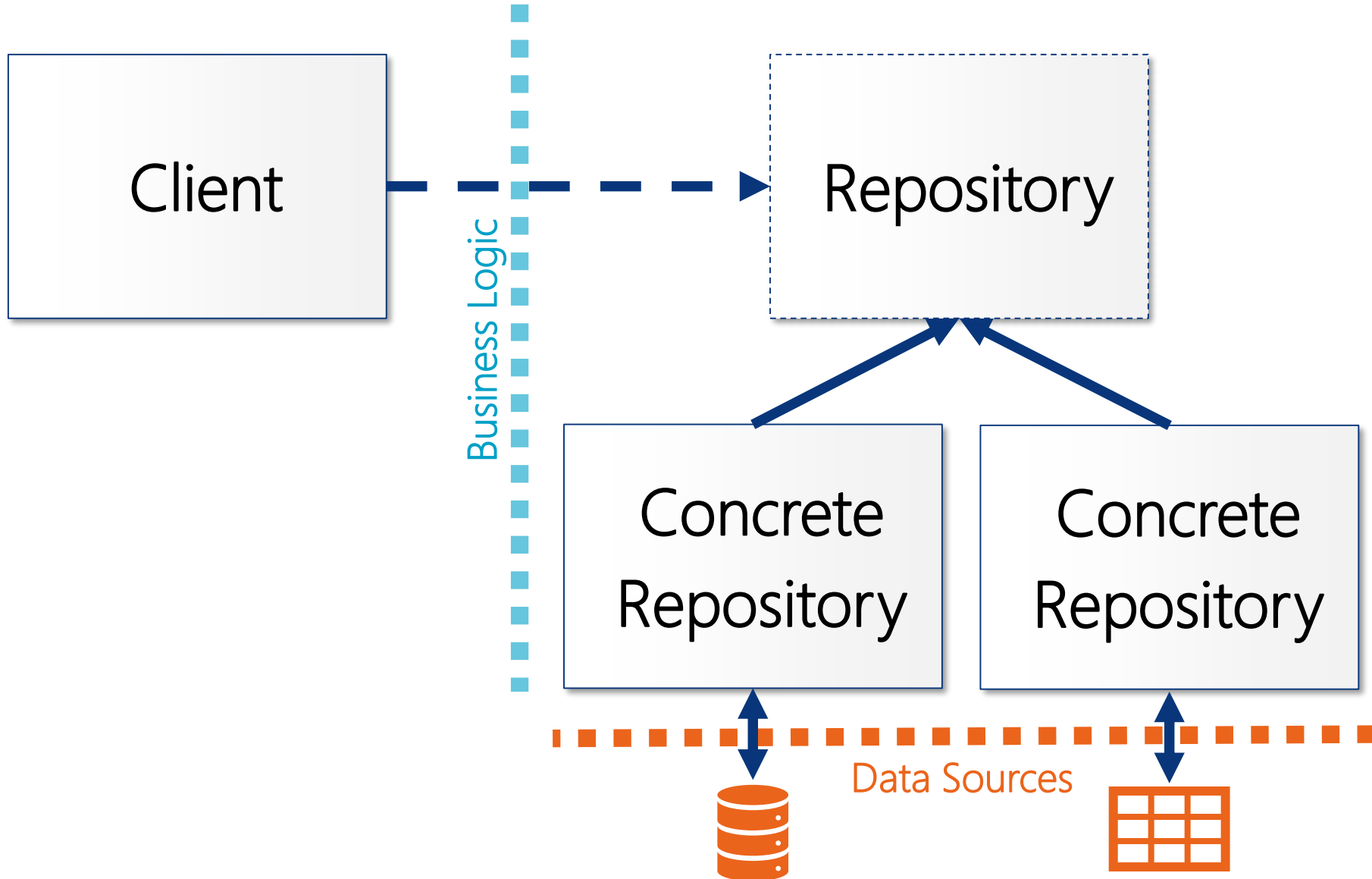
    public Repository( DbContext context ) { _context = context; }

    public T GetById( int id )
        => _context.Set<T>().Single(p => p.Id == id);

    public IQueryable<T> GetAll( Expression<Func<T, bool>> filter )
        => _context.Set<T>().Where(filter);

    ...
}
```

Overview of Repository Pattern



Overview of Repository Pattern

- ▶ Client
 - Queries and updates data through the Repository Interface
 - Only know the general Repository interface

- ▶ Repository
 - Interface or base class exposing data access logic in a persistence-independent description

- ▶ Concrete Repository
 - Concrete repository class implementing Repository interface
 - Implements persistence-dependent data access code for a specific concrete data source

Discussion

- ▶ Simple Repository
 - Implement a specialized repository for each business object
 - Disregard any methods not used! (YAGNI)
- ▶ **IQueryable**-based Repository
 - Flexible and efficient
 - Beware: Data access logic might drift into business logic
- ▶ Generic interfaces and implementation
 - High degree of consistency and reusability
- ▶ Note:
 - Can of course do generic interfaces and implementations based on **IEnumerable<T>** (and not **IQueryable<T>**), if preferred
- ▶ Unit of Work pattern for more complex situations



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