Best Practices and Architecture

Useful Patterns and Code Structure

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#CSharpDB

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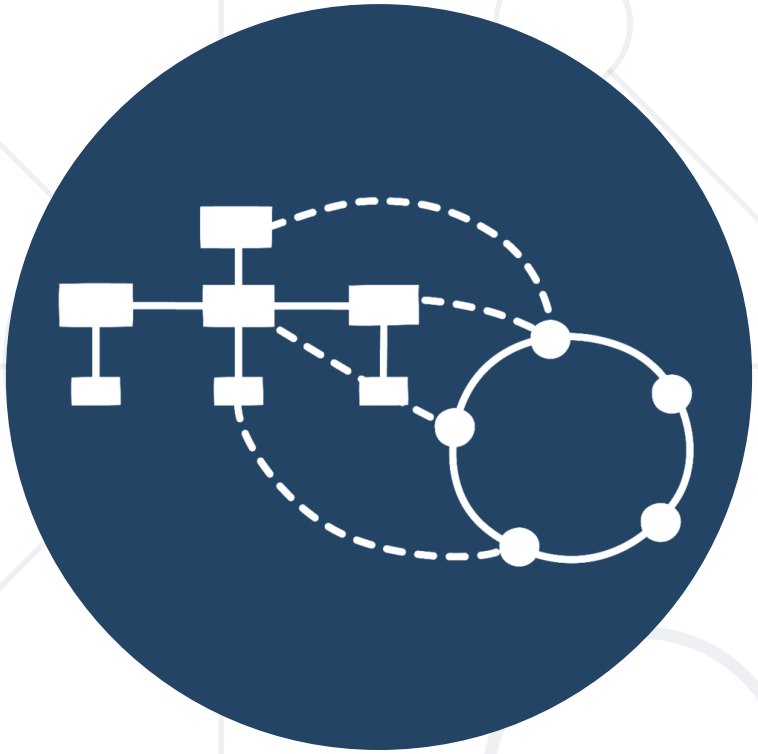


Project Structure

Organizing Solutions

Importance of Organized Code

- Scalability
- Maintainability
- Manageability
- Testability

S	Single Responsibility
O	Open / Closed
L	Liskov Substitution
I	Interface Segregation
D	Dependency Inversion

Project Organization

- Application code can be split into sections
  - **Data Layer** – database connection (context)
  - **Domain Models** – entity classes
  - **Client** – user-interaction and app logic
  - **Business Logic** – data validation, transformations
- Reasons
  - Easier to locate files when maintaining
  - Don't have to rebuild entire codebase after changes (DLLs)

Usage Optimization

Entity Framework Core Performance

Usage Optimization

- LINQ queries are **executed** each time the data is **accessed**
  - If materialized in a collection – `ToList()`
  - If the elements are aggregated – `Count()`, `Average()`, `First()`
  - When a property is accessed
- Try to delay execution (materialization) until you actually need the results
- You can monitor query execution using **Express Profiler**

Usage Optimization

- Only fetch **required data** by filtering and projecting your queries
  - Example

```
context.DbSetCollection
  .Where(x => x.Property </>/= value)
  .Select(e => new {
    e.Property1,
    e.Property2,
    e.PropertyN
  }
);
```

```
context.Employees
  .Where(e => e.Salary >= 15000)
  .Select(e => new {
    e.FirstName,
    e.LastName,
    e.Salary
  }
);
```

```
SELECT
    1 AS [C1],
    [Extent1].[FirstName] AS [FirstName],
    [Extent1].[LastName] AS [LastName],
    [Extent1].[Salary] AS [Salary]
    FROM [dbo].[Employees] AS [Extent1]
    WHERE [Extent1].[Salary] >= cast(15000 as decimal(18))
```

Usage Optimization

- EF will cache entities and compare the cache for changes
  - Use `Find()` with change detection disabled

```
try
{
    context.ChangeTracker.AutoDetectChangesEnabled = false;
    var entity = context.DbSetCollection.Find(entityId);
    ...
}
finally
{
    context.ChangeTracker.AutoDetectChangesEnabled = true;
}
```

Usage Optimization

- When adding or updating a record, Entity Framework makes a call to `DetectChanges()`
- Use `AddRange()` and `RemoveRange()` to reduce calls

```
List<Entity> entities = new List<Entity>()
  { entity1, entity2, entity3 };

context.DbSetCollection.AddRange(entities);
```

Works with any collection

Usage Optimization

- Entity Framework builds **associations** and **tracks changes** for every loaded entity
- If we **only** want to **display** data, this process is redundant
- Disable tracking

```
context.DbSetCollection
   .AsNoTracking()
   .Where(x => x.Property </>/= value)
   .ToList();
```

- Note this also **disables caching**!

Loading Methods

- Payload size and number of roundtrips to the database are inversely proportional
  - **Lazy** – less data, more queries
  - **Eager** – more data, less queries
- There is no best approach – performance depends on usage scenario

Loading Methods

- Do you need to access many **navigation properties** from the fetched entities?
  - **No** – **Lazy** for large payloads, **Eager** for small
  - **Yes** – **Eager** loading for up three entities, **Lazy** for more
- Do you know exactly what data will be needed at run time?
  - **No** – **Lazy**
  - **Yes** – **Eager** at first unless, **Lazy** if loading lots of data

Loading Methods

- Is your code executing far from your database? (increased network latency)
  - **No** – **Lazy** will simplify your code; don't take database proximity for granted
  - **Yes** – Depending on scenario **Eager** will require fewer round trips
- Always test application-wide performance, only optimize if results aren't satisfactory

Design Patterns

Solving Problems More Easily

Design Patterns

- **Singleton** – Ensure a class has only one instance and provide a global point of access to it
- **Service Locator** – Make a service available globally and decouple the calling class from the dependent object
- **Dependency Injection** - no client code has to be changed simply because an object it depends on needs to be changed to a different one
- **Command** – Encapsulate a request as an object, allowing delayed execution, undo and replay
- **Repository** – Separates the data access logic and maps it to the entities in the business logic
- **Unit of work** – Used to group one or more into a single transaction or "unit of work", so that all operations either pass or fail as one

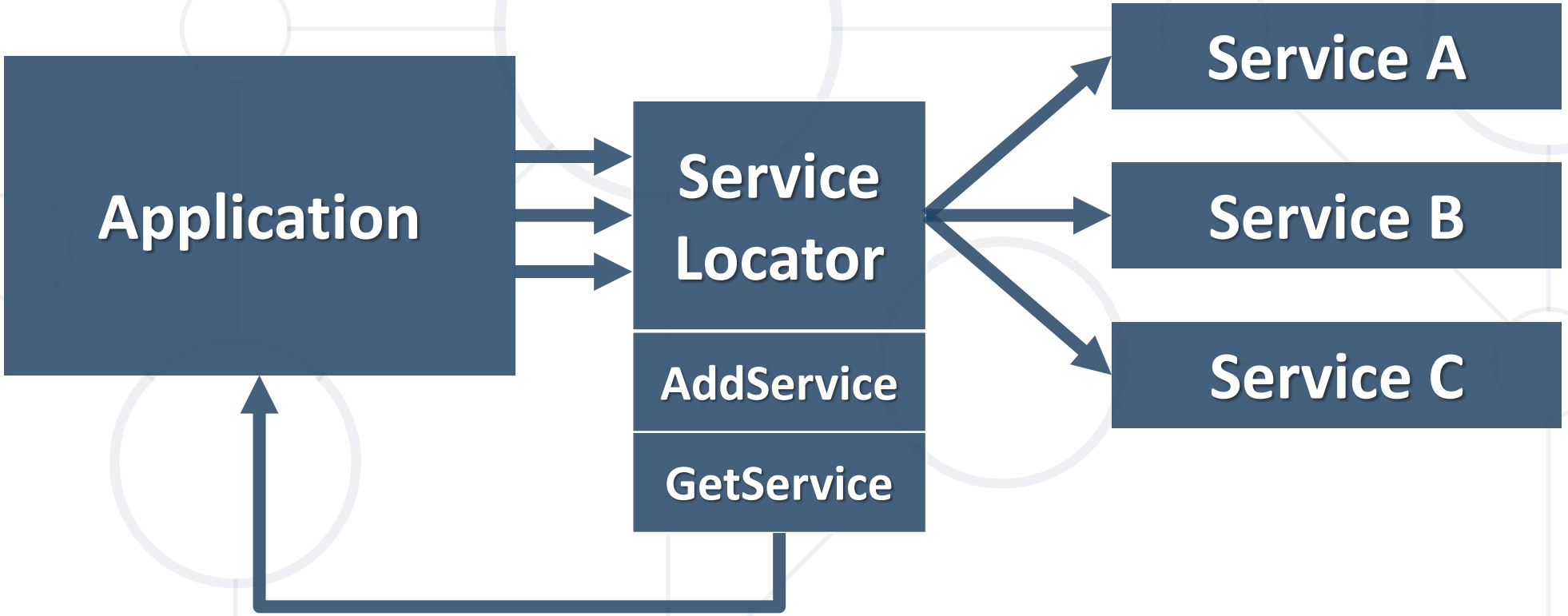
Singleton Pattern

```
public class Authenticator
{
  private static Authenticator instance;
  private Authenticator() { … }
  public static Authenticator Instance
  {
    get
    {
      if (instance == null)
        instance = new Authenticator();
      return instance;
    }
  }
}
```

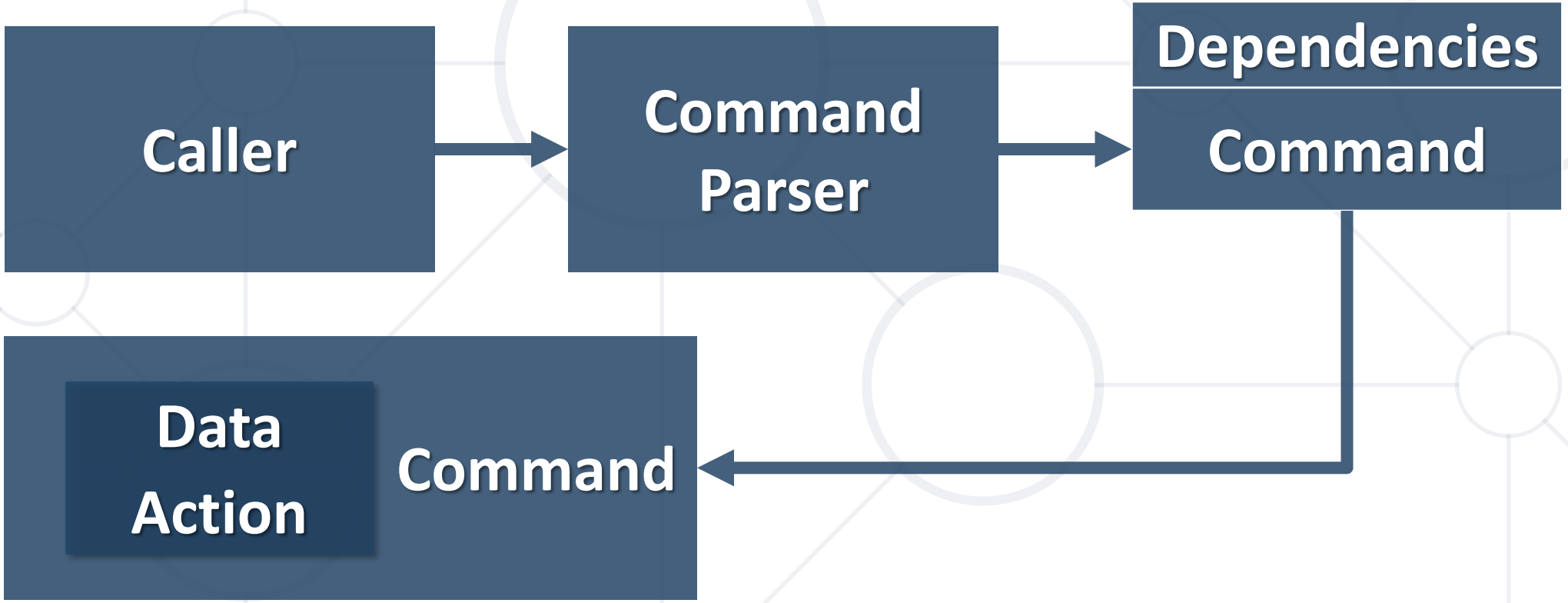
Private Constructor

Instantiate when first accessed

Service Locator



Command Pattern



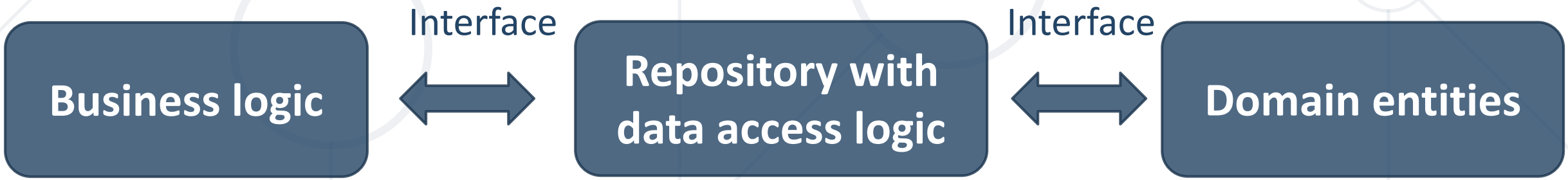
Repository Pattern

- It works with the **domain entities** and performs **data access logic**
- The domain entities, the data access logic and the business logic talk to each other **using interfaces**
- It **hides the details** of data access from the business logic
- Business logic **can access** the data object without having knowledge of the underlying data access architecture

Repository Pattern

- Without repository

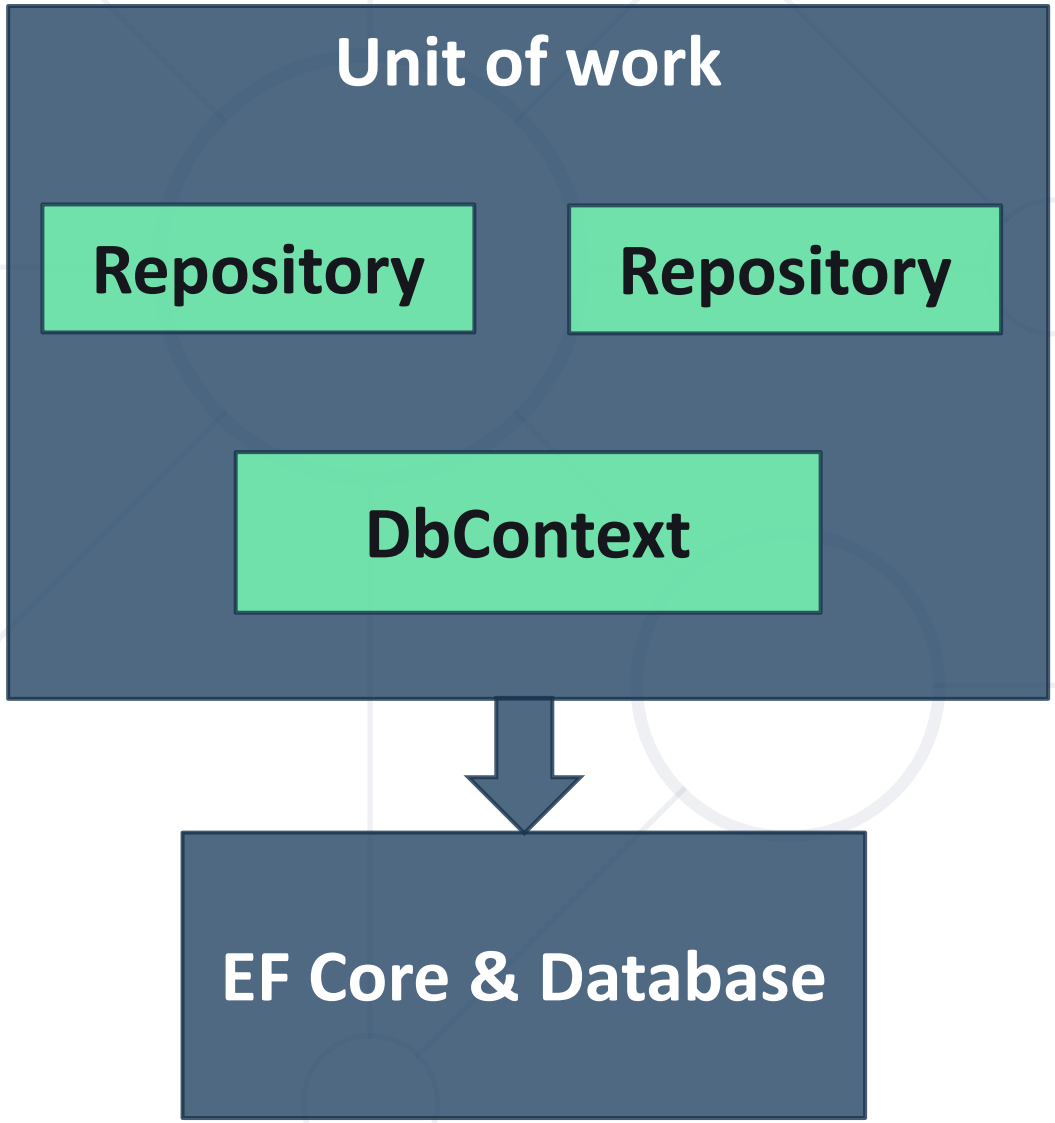
- With repository



Unit of Work

- **Serves one purpose** – to make sure that when you use multiple repositories, they share a **single** database context
- With a Unit of Work, you might also choose to implement **Undo** / **Rollback** functionality
  - When using Entity Framework Core, the recommended approach to undo is to **discard your context** with the changes you are interested in undoing

Unit of Work


Unit of work
Repository
Repository
DbContext
EF Core & Database

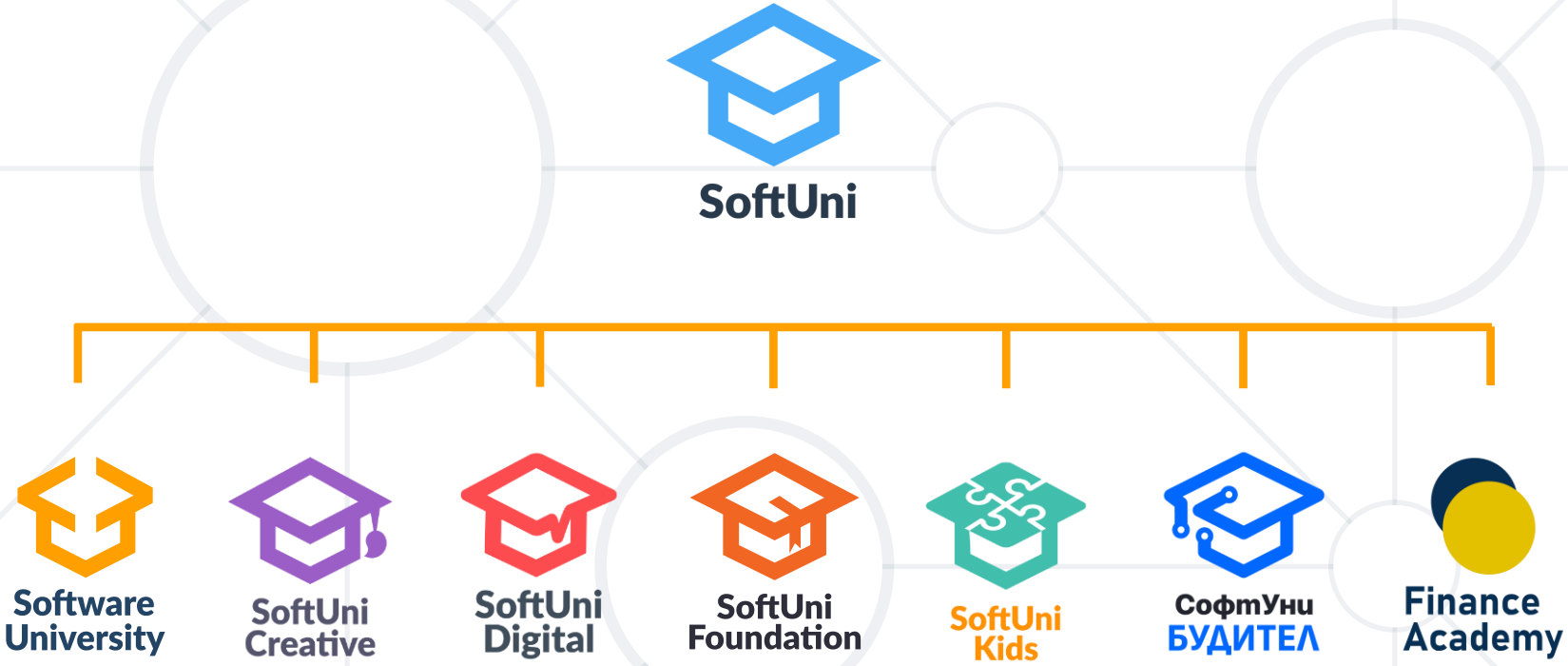
Best Practices and Architecture

Live Demo

Summary

- **Project structure** is important as an application is scaled
- Entity Framework Core **performance** can be improved by following certain guidelines
- **Design Patterns** define a common approach to solving certain development problems

Questions?



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