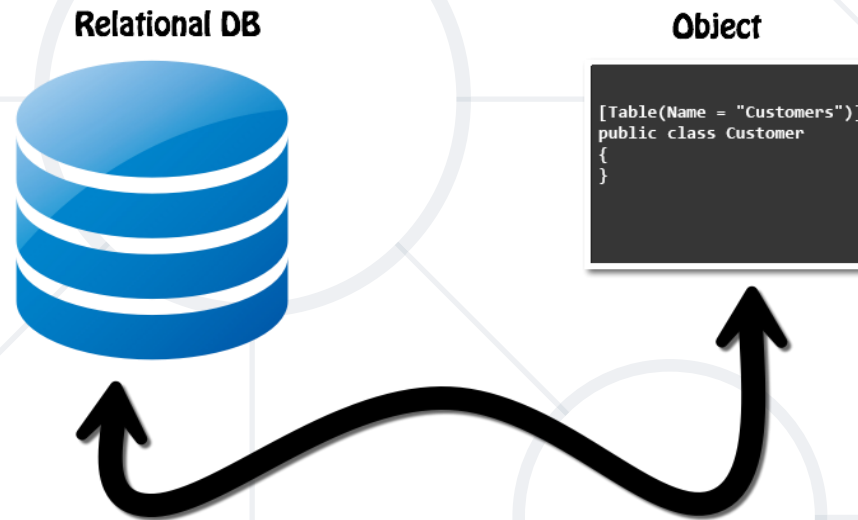


ORM Fundamentals

The ORM Concept, Config, CRUD Operations



SoftUni Team
Technical Trainers



SoftUni



Software University

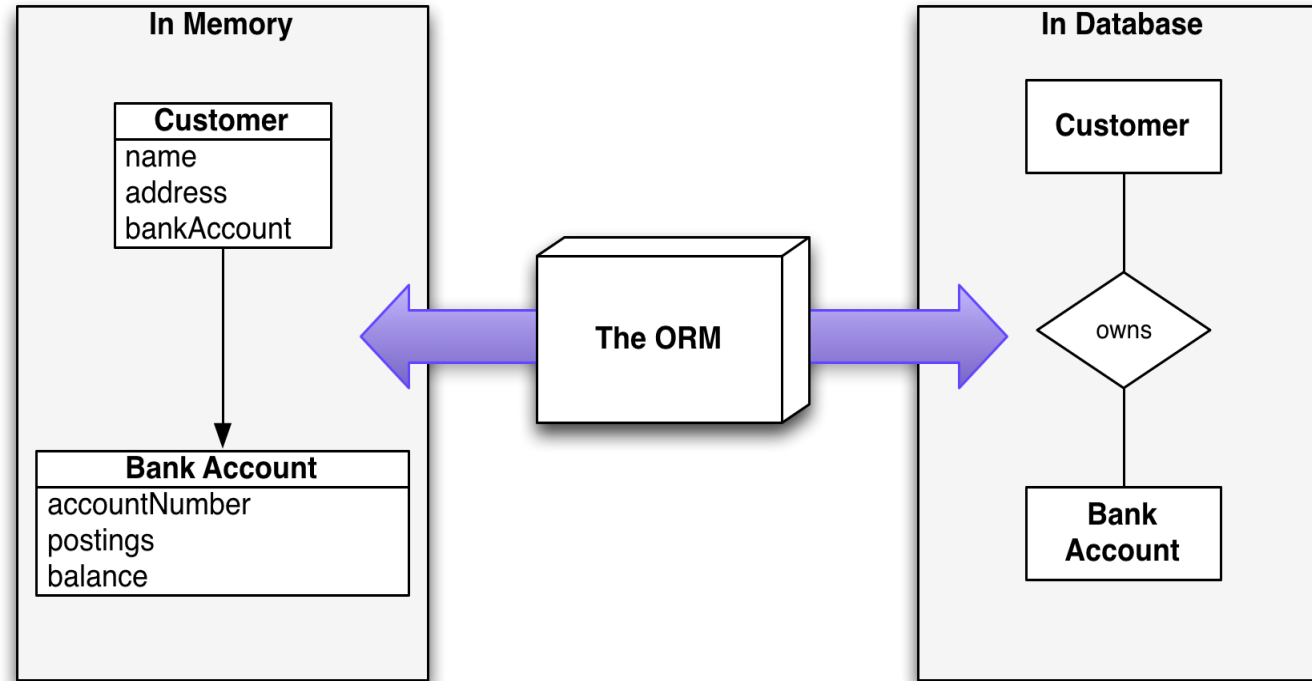
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- ORM Technologies: Basic Concepts
- ORM Advantages and Disadvantages
- ORM Features
 - Retrieving Entities from Database
 - Mapping Navigation Properties
 - Change Tracking
 - Generating SQL



sli.do

#csharp-db




Introduction to ORM

Object-Relational Mapping

What is ORM?

- **Object-Relational Mapping (ORM)** allows manipulating databases **using common classes and objects**
- **Database Tables → C#/Java/etc. classes**



Employees	
	Id
	FirstName
	MiddleName
	LastName
	IsEmployed
	DepartmentId



```
public class Employee
{
    public int Id { get; set; }
    public string FirstName { get; set; }
    public string MiddleName { get; set; }
    public string LastName { get; set; }
    public bool IsEmployed { get; set; }
    public Department Department { get; set; }
}
```

- **ORM frameworks** typically **provide** the following functionality
 - **Automatically generate SQL** to perform data operations

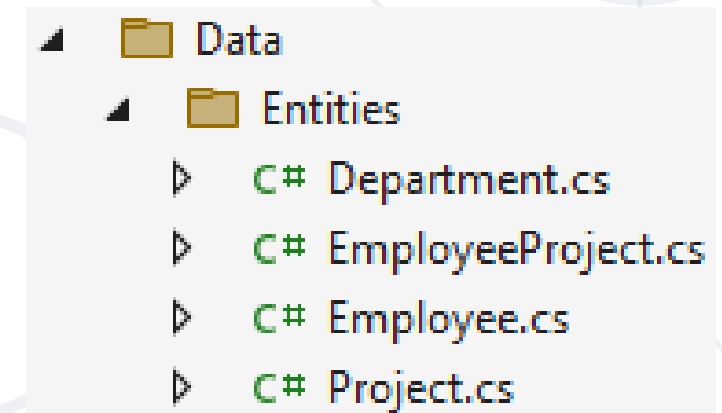
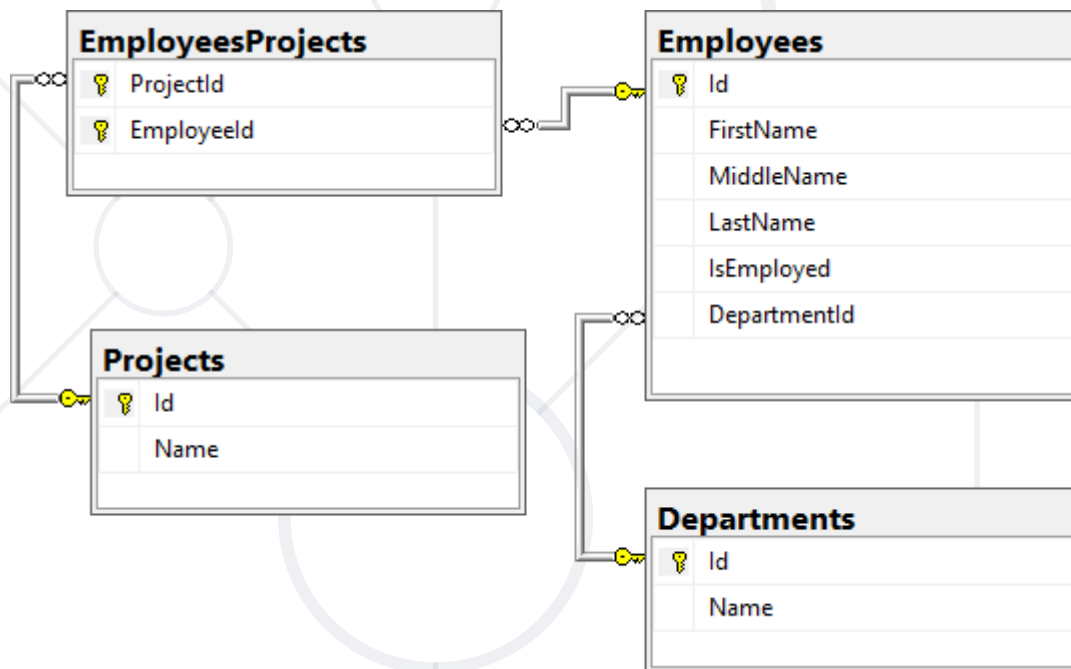
```
database.Employees.Add(new Employee  
{  
    FirstName = "George",  
    LastName = "Peterson",  
    IsEmployed = true    });
```



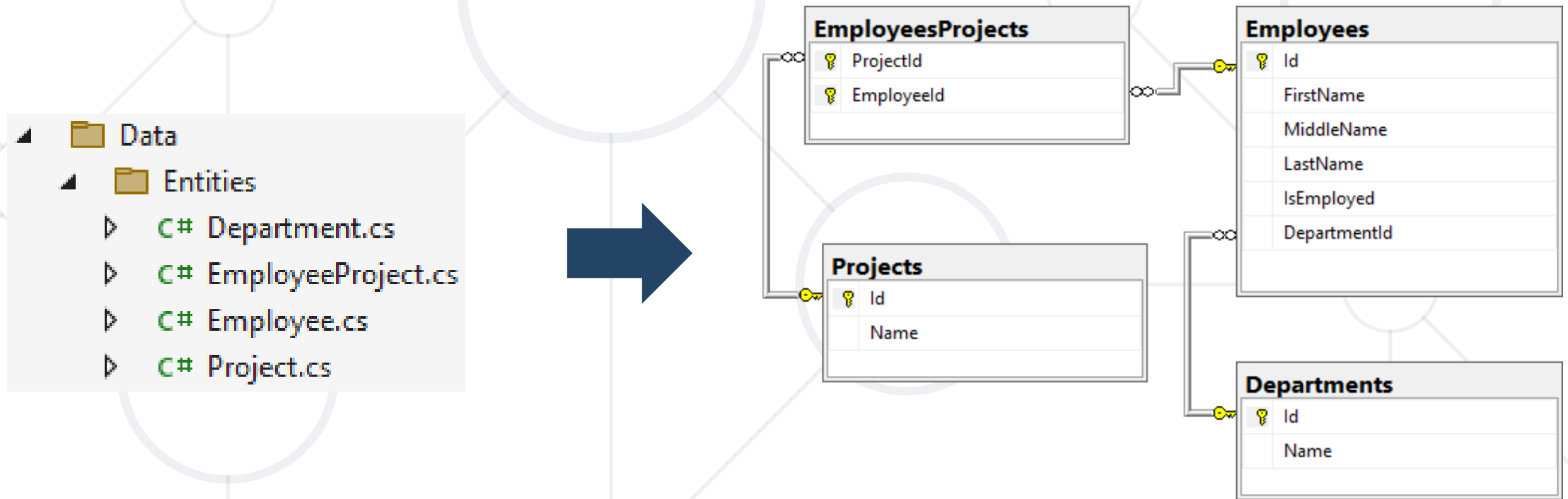
```
INSERT INTO Employees  
(FirstName, LastName, IsEmployed)  
VALUES  
( 'George ', 'Peterson', 1)
```

- **Create object model from database schema** (DB First model)
- **Create database schema from object model** (Code First model)
- **Query data by object-oriented API** (e.g., LINQ queries)

- **Database First model** - models the entity classes after the database



- **Code-first model** - begins with classes that describe the model and then the ORM generates a database

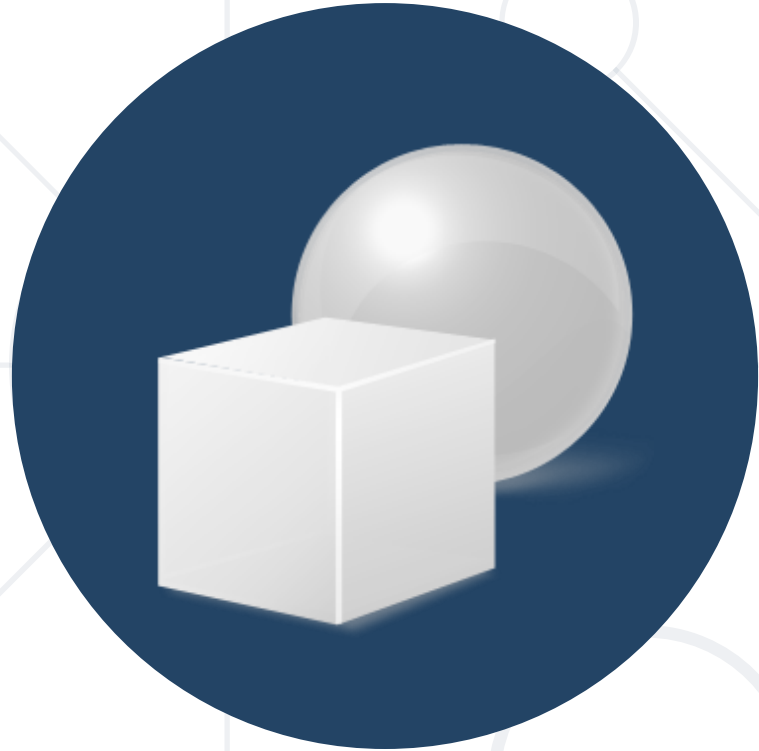


■ Advantages

- Developer productivity – **writing less code**
- Abstract from differences between object and relational world
- **Manageability of the CRUD operations** for complex relationships
- **Easier maintainability**

■ Disadvantages

- **Reduced performance** (due to overhead or autogenerated SQL)
- **Reduces flexibility** (some operations are hard to implement)





Entity Classes

Data Holders

Entity Classes

- **Entity classes** are regular **C# classes**
- Used for **storing** the **data** from the DB **in-memory**



Employees	
	Id
	FirstName
	MiddleName
	LastName
	IsEmployed
	DepartmentId



```
public class Employee
{
    public int Id { get; set; }
    public string FirstName { get; set; }
    public string MiddleName { get; set; }
    public string LastName { get; set; }
    public bool IsEmployed { get; set; }
    public Department Department { get; set; }
}
```

Entity Classes: Navigation Properties (1)

- Reference type properties
- Point to relevant object, connected by foreign key
- Set by the framework
- Example: Employee's Department

```
public class Employee
{
    public int Id { get; set; }
    ...
    public int DepartmentId { get; set; }
    public Department Department { get; set; }
}
```

Entity Classes: Navigation Properties (2)

- Navigation Properties can also be collections
- Usually of type **ICollection<T>**
- Hold all of the objects whose **foreign keys** are the same as the entity's **primary key**
- Set by the ORM framework

```
public class Department
{
    public int Id { get; set; }
    public ICollection<Employee> Employees { get; set; }
}
```



DbSet<T>

Specialized Collections

DbSet<T> Class

- Generic collection with additional features
- Each **DbSet<T>** corresponds to a single database table
- Inherits from **ICollection<T>**
 - **foreach**-able
 - Supports **LINQ** operations
- Usually several **DbSets** are a part of a **DbContext**



- Each **DbSet** tracks its own entities through a change tracker
- Has every other feature of an **ICollection<T>**
 - **Accessing** the elements (LINQ)
 - **Adding/Updating** elements
 - **Removing** an entity/a range of entities
 - **Checking** for element **existence**
 - Accessing the **count** of elements



DbContext

DbContext Class

- Holds several **DbSet<T>**
- Responsible for **populating** the **DbSets**
- Users create a **DbContext**, which **inherits** from **DbContext**
 - Using one **DbSet** per database table

```
public class SoftUniDbContext : DbContext
{
    public DbSet<Employee> Employees { get; set; }
    public DbSet<Department> Departments { get; set; }
    public DbSet<Project> Projects { get; set; }
}
```





Reading Data

Querying the DB Using ORM

- First create instance of the **DbContext**

```
var context = new SoftUniDbContext();
```

- In the constructor, you can pass a database connection string
- **DbContext properties**
 - All **entity classes** (tables) are listed as **properties**
 - e.g., **DbSet<Employee> Employees { get; }**

- Executing **LINQ-to-Entities** query over entity

```
var context = new SoftUniDbContext()

var employees = context.Employees
    .Where(e => e.JobTitle == "Design Engineer")
    .ToList();
```

- **Employees** property in the **DbContext**

```
public class SoftUniDbContext : DbContext
{
    public DbSet<Employee> Employees { get; }
    public DbSet<Project> Projects { get; }
    public DbSet<Department> Departments { get; }
}
```

- We can also use **extension methods** for constructing the query

```
var context = new SoftUniDbContext()
var employees = context.Employees
    .Where(c => c.JobTitle == "Design Engineering")
    .Select(c => c.FirstName)
    .ToList();
```

- Find element by **ID**

```
var context = new SoftUniEntities()
var project = context.Projects
    .FirstOrDefault(p => p.Id == 2);
Console.WriteLine(project.Name);
```

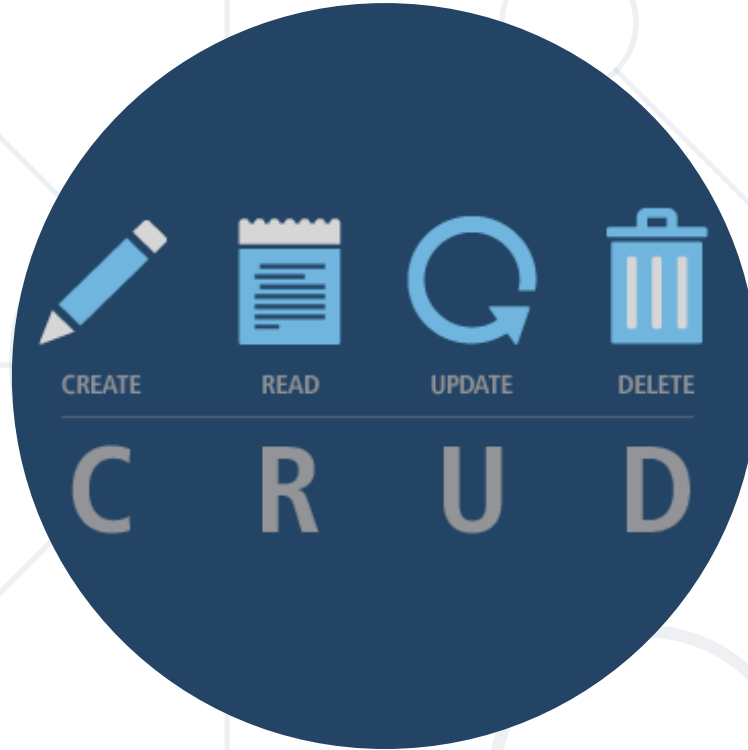


Change Tracking

Change Tracking

- Each **DbContext** instance tracks changes made to entities
 - These tracked entities in turn drive the changes to the database when **SaveChanges** is called
- Entity instances become tracked when they are
 - Returned from a query, executed against the database
 - Explicitly attached to the **DbContext** by **Add**, **Attach**, **Update** or similar methods
 - Detected as new entities connected to existing tracked entities





CRUD Operations

- To create a new table row use the method **Add(...)** of the **corresponding DbSet**

```
var project = new Project()  
{  
    Name = "Judge System"  
};
```

Create a new
Project object

```
context.Projects.Add(project);  
context.SaveChanges();
```

Add the object to the DbSet

Execute SQL statements

- **DbContext** allows modifying entity properties and persisting them in the database
 - Just load an entity, modify it and call **SaveChanges()**
- The **DbContext** automatically tracks all **changes** made on its entity **objects**

```
var employee =  
    context.Employees.FirstOrDefault();  
employee.FirstName = "Alex";  
context.SaveChanges();
```

SELECT the first
employee

Execute an SQL
UPDATE

Deleting Existing Data

- Delete is done by **Remove()** on the specified entity collection
- **SaveChanges()** method performs the delete action in the database

```
var employee =  
    context.Employees.First();  
context.Employees.Remove(employee);  
context.SaveChanges();
```

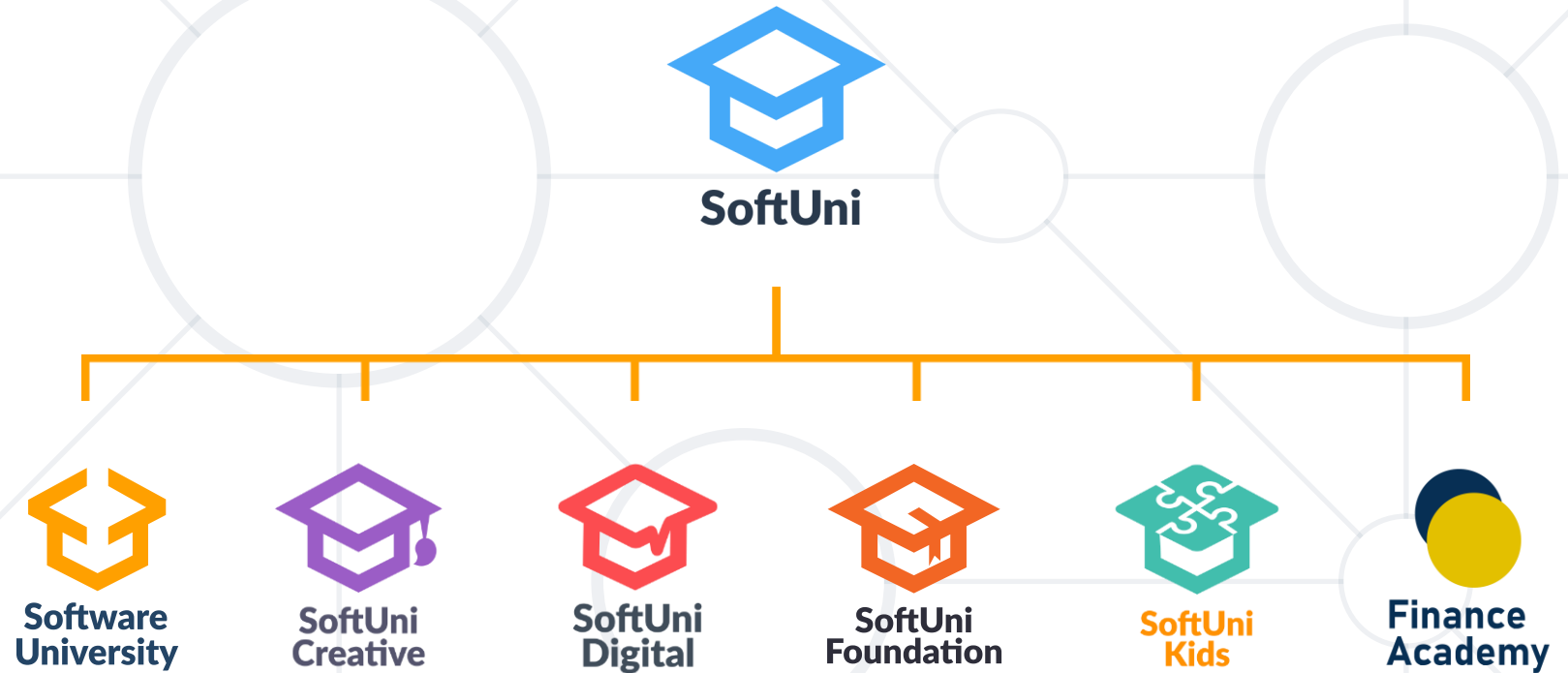
Mark the entity for deleting at the next save

Execute the SQL DELETE command

- **ORM frameworks** map database schema to objects in a programming language
- **LINQ** can be used to query the DB through the **DB Context**



Questions?



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