Entity Relations

Customizing Entity Models

SoftUni Team

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#csharp-db

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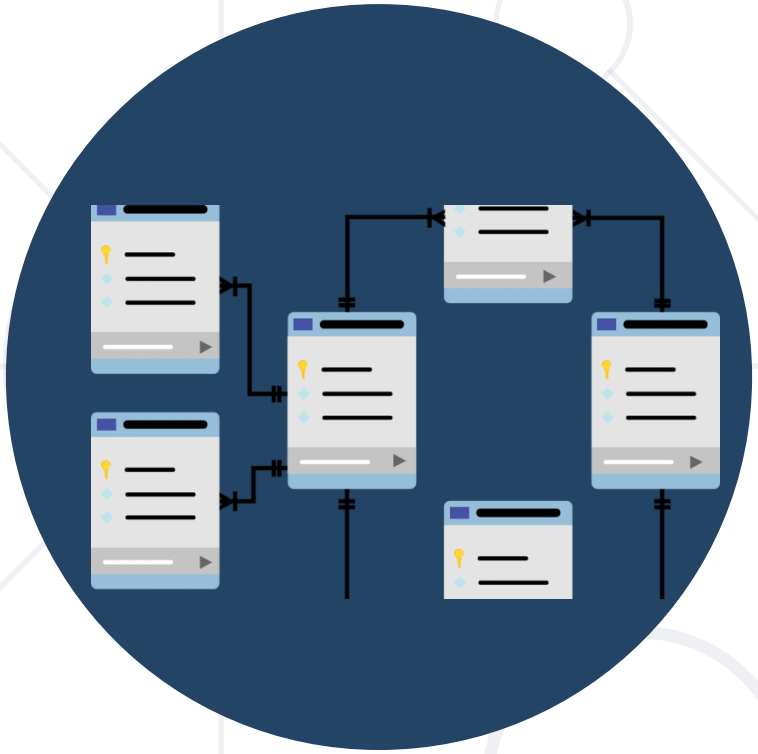
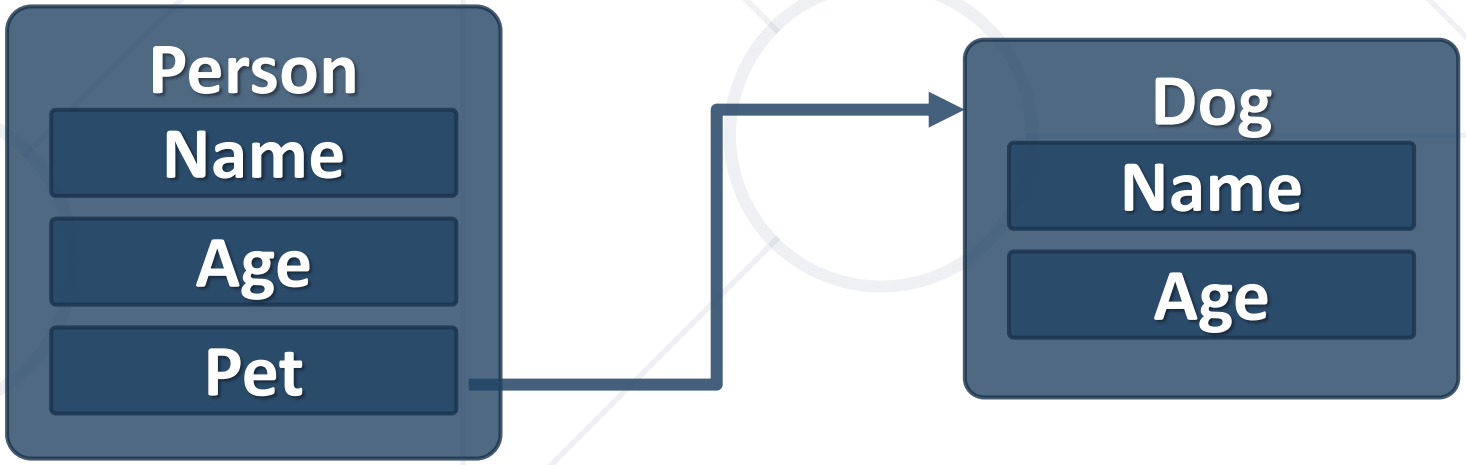


Object Composition

Describing Database Relationships

Object Composition

- Object composition denotes a "**has-a**" relationship
  - e.g., the **car** has an **engine**
- Defined in C# by one object having a property that is a reference to another



Navigation Properties

- Navigation properties create a **relationship** between entities
  - Either an **Entity Reference** (one-to-one-or-zero) or an **`ICollection`** (one-to-many or many-to-many)
- They provide **fast querying** of related records
- Can be **modified** by **directly** setting the reference

f() => API

Fluent API

Working with Model Builder

Fluent API

- **Code First** maps your POCO (**P**lain **O**ld **C**LR **O**bjects) classes to tables using a **set of conventions**
  - e.g., property named "`Id`" maps to the **Primary Key**
- Can be customized using **annotations** and the **Fluent API**
- Fluent API (Model Builder) allows **full control** over DB mappings
  - Custom names of objects (columns, tables, etc.) in the DB
  - Validation and data types
  - Define complicated entity relationships

Working with Fluent API

- Custom mappings are placed inside the **OnModelCreating** method of the DB context class

```
protected override void OnModelCreating(ModelBuilder modelBuilder)
{
 modelBuilder.Entity<Student>()
        .HasKey(s => s.StudentKey);
}
```

Fluent API: Renaming DB Objects

- Specifying Custom Table name

```
modelBuilder.Entity<Order>()
        .ToTable("OrderRef", "Admin");
```

Optional schema name

- Custom Column name/DB Type

```
modelBuilder.Entity<Student>()
   .Property(s => s.Name)
   .HasColumnName("StudentName")
   .HasColumnType("varchar");
```

Fluent API: Column Attributes

- Explicitly set Primary Key

```
modelBuilder
      .Entity<Student>()
      .HasKey("StudentKey");
```

- Other column attributes

```
modelBuilder.Entity<Person>()
   .Property(p => p.FirstName)
   .IsRequired()
   .HasMaxLength(50)
```

```
modelBuilder.Entity<Post>()
   .Property(p => p.LastUpdated)
   .ValueGeneratedOnAddOrUpdate()
```

Fluent API: Miscellaneous Config

- Do not include property in DB (e.g., business logic properties)

```
modelBuilder
      .Entity<Department>()
      .Ignore(d => d.Budget);
```

- Disabling cascade delete
  - If a FK property is non-nullable, cascade delete is **on by default**

```
modelBuilder.Entity<Course>()
   .HasRequired(t => t.Department)
   .WithMany(t => t.Courses)
   .HasForeignKey(d => d.DepartmentID)
   .OnDelete(DeleteBehavior.Restrict);
```

Throws exception on delete

Specialized Configuration Classes

- Mappings can be placed in entity-specific classes

```
public class StudentConfiguration
   : IEntityTypeConfiguration<Student>
{
   public void Configure(EntityTypeBuilder<Student> builder)
   {
      builder.HasKey(c => c.StudentKey);
   }
}
```

Specify target model

- Include in **OnModelCreating**

```
builder.ApplyConfiguration(new StudentConfiguration());
```

Attributes

Custom Entity Framework Behavior

Attributes

- EF Code First provides a set of **DataAnnotation attributes**
  - You can override default Entity Framework behavior
- Access nullability and size of fields

```
using System.ComponentModel.DataAnnotations;
```

- Access schema customizations

```
using System.ComponentModel.DataAnnotations.Schema;
```

- For a full set of configuration options you need the **Fluent API**

Key Attribute

- **[Key]** – explicitly specify **primary key**
  - When your PK column doesn't have an "**Id**" or "**<TypeName>Id**" suffix

```
[Key]
public int StudentKey { get; set; }
```

- **Composite key** is defined using **Fluent API**

```
builder.Entity<Car>()
        .HasKey(c => new { c.State, c.LicensePlate });
```

  - **[PrimaryKey]** available **only** in EF7

ForeignKey Attribute

- `[ForeignKey]` – explicitly **link** navigation property and foreign key property within the same class
- Works in **either direction** (FK to navigation property or navigation property to FK)
  - `[ForeignKey(NavigationPropertyName)]` – on the foreign key scalar property in the dependent entity
  - `[ForeignKey(ForeignKeyPropertyName)]` – on the related reference navigation property in the dependent entity
  - `[ForeignKey(ForeignKeyPropertyName)]` – on the navigation property in the principal entity

ForeignKey Attribute – Example

- [ForeignKey(NavigationPropertyName)]

```
public class Order
{
  …
  [ForeignKey(nameof(Client))]
  public int ClientId { get; set; }
  public Client Client { get; set; }
}
```

- [ForeignKey(ForeignKeyPropertyName)]

```
public class Order
{
  …
  public int ClientId { get; set; }
  [ForeignKey(nameof(ClientId))]
  public Client Client { get; set; }
}
```

```
public class Client
{
  …
  public ICollection<Order> Orders { get; set; }
}
```

Renaming Objects (1)

- **Table** – manually specify the name of the table in the DB

```
[Table("StudentMaster")]
public class Student
{
   …
}
```

```
[Table("StudentMaster", Schema = "Admin")]
public class Student
{
   …
}
```

Renaming Objects (2)

- **Column** – manually specify the name of the column in the DB
  - You can also specify order and explicit data type

```
public class Student
{
  …
  [Column("StudentName", Order = 2, TypeName="varchar(50)")]
  public string Name { get; set; }
}
```

Optional parameters

Entity Validation

- **`Required`** – mark a nullable property as **NOT NULL** in the DB
  - Will throw an exception if not set to a value
  - Non-nullable types (e.g., **`int`**) will **not throw** an exception (will be set to language-specific default value)
- **`MinLength`** – specifies min length of a string (client validation)
- **`MaxLength`** / **`StringLength`** – specifies max length of a string (both client and DB validation)
- **`Range`** – set lower and/or upper limits of numeric property (client validation)

Other Attributes

- **Index** – create index for column(s)
  - Primary key will always have an index

```
[Index(nameof(Url))]
public class Student {
    public string Url { get; set; }
}
```

- **NotMapped** – property will not be mapped to a column
  - For business logic properties

```
[NotMapped]
public string FullName => this.FirstName + this.LastName;
```

Table Relationships

Expressed As Properties and Attributes

One-to-Zero-or-One

- Expressed in SQL Server as a shared primary key
- Relationship direction must be explicitly specified with a **`ForeignKey`** attribute
- **`ForeignKey`** is placed above the key property and contains the **`name`** of the navigation property and vice versa

One-to-Zero-or-One: Implementation (1)

- Using the **ForeignKey** Attribute

```
public class Student
{
  [Key]
  public int Id { get; set; }
  public string Name { get; set; }
  [ForeignKey("Address")]
  public int AddressId { get; set; }
  public Address Address { get; set; }
}
```

Attributes

One-to-Zero-or-One: Implementation (2)

- Using the **ForeignKey** Attribute

```
public class Address
{
  public int Id { get; set; }
  public string Text { get; set; }
  [ForeignKey(nameof(Student))]
  public int StudentId { get; set; }
  public Student Student { get; set; }
}
```

One-to-Zero-or-One: Fluent API

- **HasOne → WithOne**

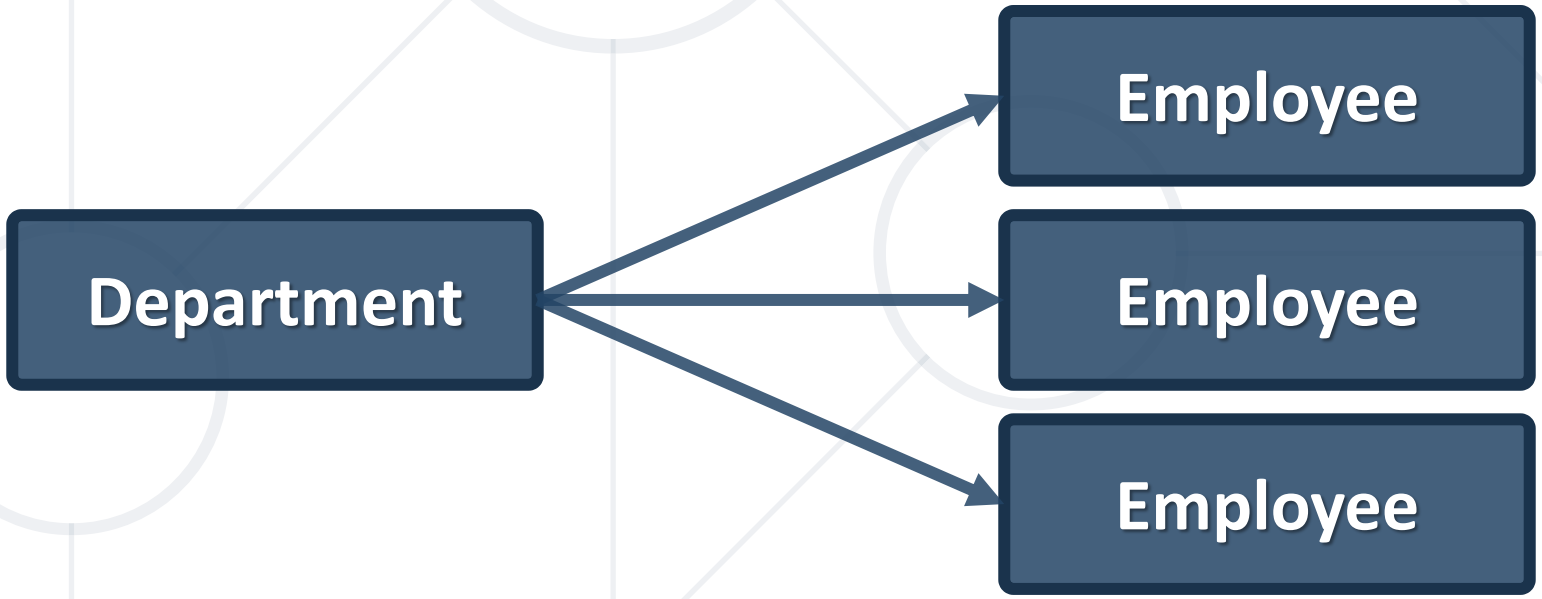
```
modelBuilder.Entity<Address>()
    .HasOne(a => a.Student)
    .WithOne(s => s.Address)
    .HasForeignKey<Student>(a => a.StudentId);
```

Address contains FK to Student

- If **StudentId** property is **nullable** (**int?**), relation becomes **One-To-Zero-Or-One**

One-to-Many

- Most common type of relationship
- Implemented with a **collection** inside the **parent entity**
  - The collection should be **initialized** in the **constructor**!



One-to-Many: Implementation (1)

- **One department** has **many employees**

```
public class Department
{
  public int Id { get; set; }
  public string Name { get; set; }

  public ICollection<Employee> Employees { get; set; }
}
```

One-to-Many: Implementation (2)

- **Each employee** has one **department**

```
public class Employee
{
  public int Id { get; set; }
  public string FirstName { get; set; }
  public string LastName { get; set; }

  public int DepartmentId { get; set; }
  public Department Department { get; set; }
}
```

One-to-Many: Fluent API

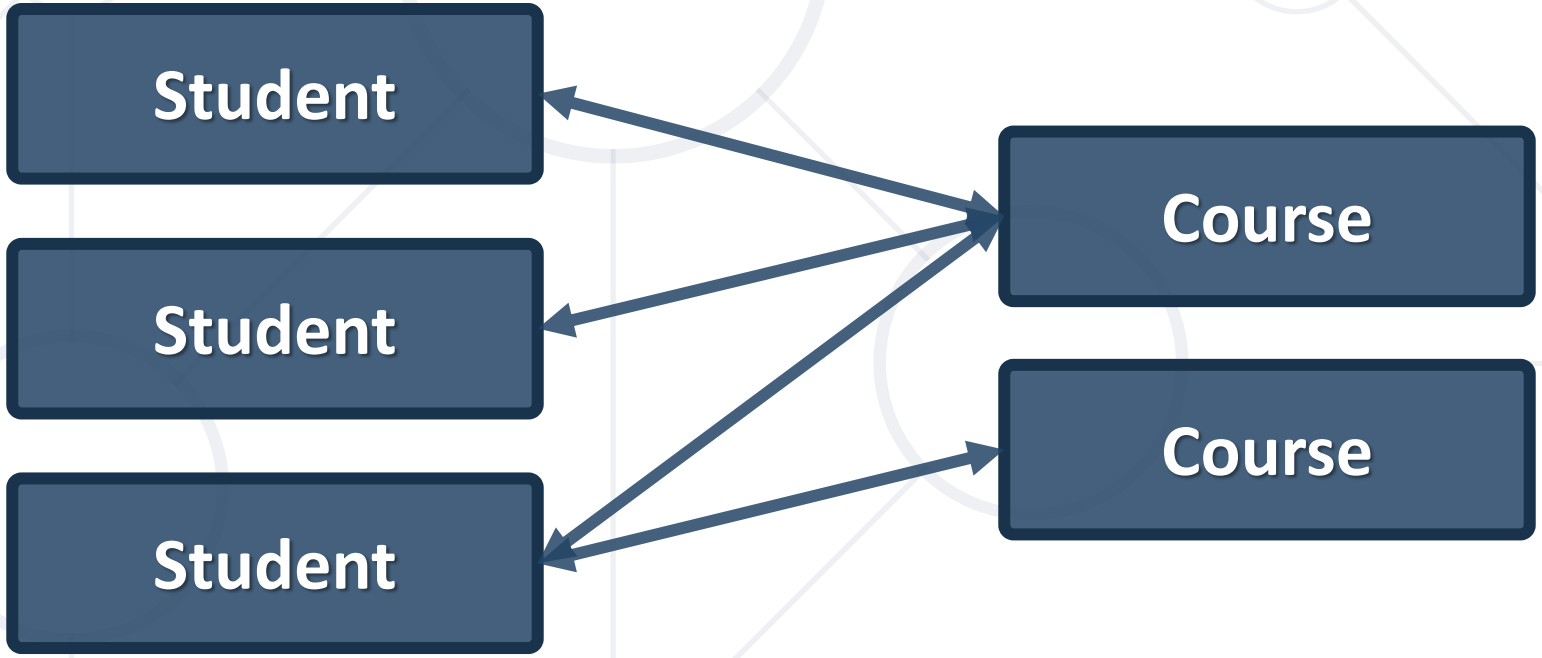
- HasMany → WithOne / HasOne → WithMany

```
modelBuilder.Entity<Department>()
   .HasMany(d => d.Employees)
   .WithOne(e => e.Department)
   .HasForeignKey(e => e.DepartmentId);
```

```
modelBuilder.Entity<Employee>()
   .HasOne(e => e.Department)
   .WithMany(d => d.Employees)
   .HasForeignKey(e => e.DepartmentId);
```

Many-to-Many

- Requires a **collection navigation property on both sides**
  - Implemented with collections in each entity, referring the other



Many-to-Many Implementation (1)

```
public class Course
{
  public string Name { get; set; }

  public ICollection<Student> Students { get; set; }
}
```

```
public class Student
{
  public string FirstName { get; set; }
  public string LastName { get; set; }

  public ICollection<Course> Courses { get; set; }
}
```

Many-to-Many: Fluent API (1)

- Mapping **both sides** of relationship

```
builder.Entity<Student>()
  .HasMany(s => s.Courses)
  .WithMany(s => s.Students)
  .UsingEntity<Dictionary<string, object>>(
        "StudentCourse",
        r => r
             .HasOne<Course>()
             .WithMany()
             .HasForeignKey("CourseId")
             .HasConstraintName("FK_StudentCourse_Courses_CourseId")
             .OnDelete(DeleteBehavior.Cascade),
        r => r
             .HasOne<Student>()
             .WithMany()
             .HasForeignKey("StudentId)
             .HasConstraintName("FK_StudentCourse_Students_StudentId")
             .OnDelete(DeleteBehaviour.Cascade),
        j =>
        {
             j.HasKey("StudentId", "CourseId");
             j.ToTable("StudentsCourses");
             j.IndexerProperty<int>("StudentId").HasColumnName("StudentId");
             j.IndexerProperty<int>("CourseId").HasColumnName("CourseId");
        });
```

Composite Primary Key

Many-to-Many Implementation (2)

- You can optionally create a **join entity type**

```
public class Course
{
 public string Name { get; set; }
 public string Teacher { get; set; }

 public List<StudentCourse> StudentsCourses { get; set; }
}
```

```
public class Student
{
 public string FirstName { get; set; }
 public string LastName { get; set; }

 public List<StudentCourse> StudentsCourses { get; set; }
}
```

```
public class StudentCourse
{
  public int CourseId { get; set; }
  public Course Course { get; set; }

  public int StudentId { get; set; }
  public Student Student { get; set; }
}
```

Many-to-Many: Fluent API (2)

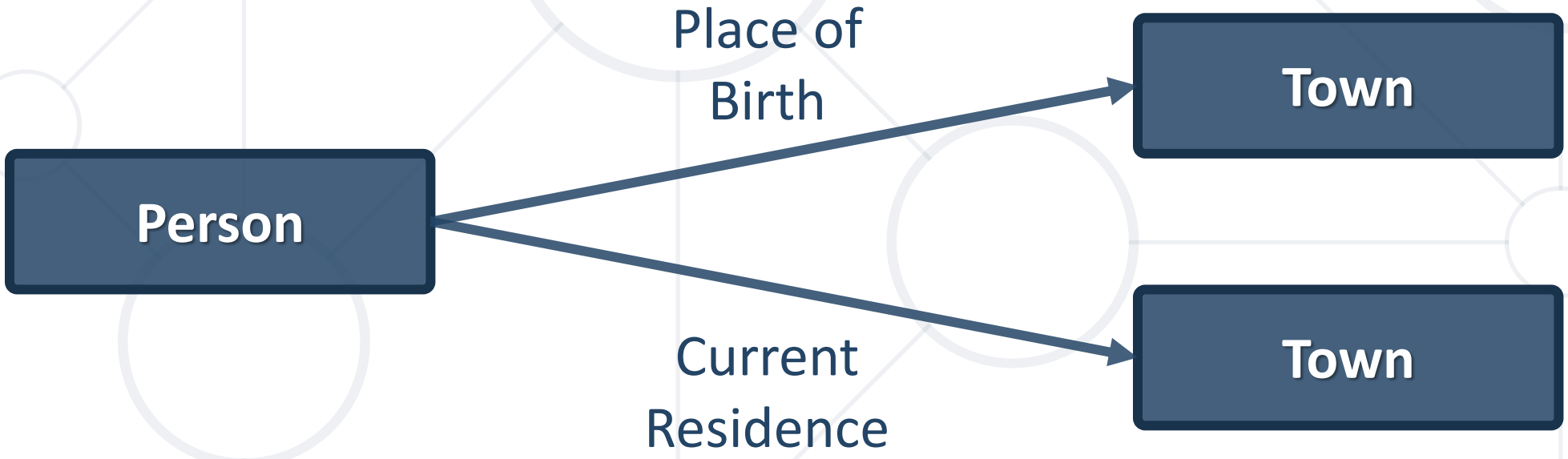
- **Indirect** many-to-many relationships

```
modelBuilder.Entity<StudentCourse>()
   .HasKey(sc => new { sc.StudentId, sc.CourseId });

builder.Entity<StudentCourse>()
   .HasOne(sc => sc.Student)
   .WithMany(s => s.StudentCourses)
   .HasForeignKey(sc => sc.StudentId);

builder.Entity<StudentCourse>()
   .HasOne(sc => sc.Course)
   .WithMany(s => s.StudentCourses)
   .HasForeignKey(sc => sc.CourseId);
```

Composite Primary Key

Multiple Relations

- When two entities are related by more than one key
- Entity Framework needs help from **Inverse Properties**



Multiple Relations Implementation (1)

- **Person** Domain Model – defined as usual

```
public class Person
{
  public int Id { get; set; }
  public string Name { get; set; }

  public Town PlaceOfBirth { get; set; }
  public Town CurrentResidence { get; set; }
}
```

Multiple Relations Implementation (2)

- **Town** Domain Model

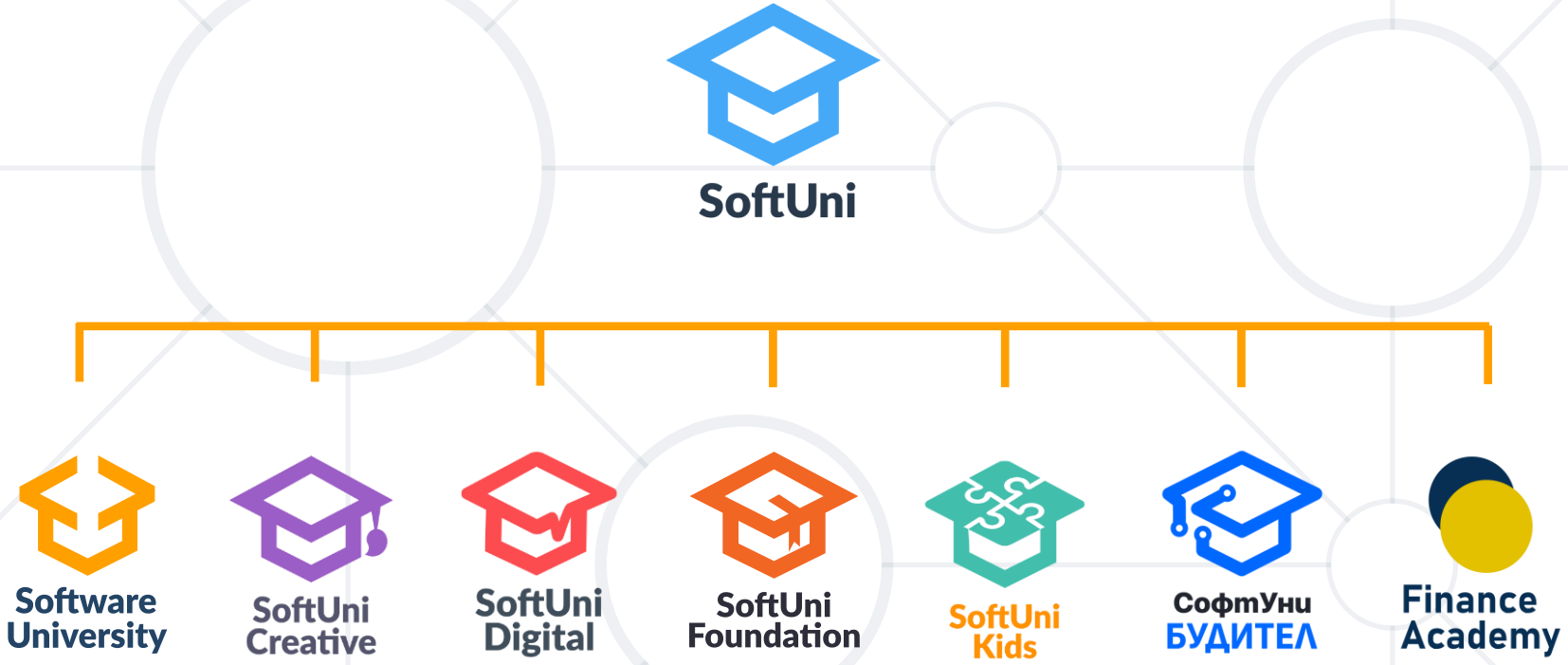
```
public class Town
{
  public int Id { get; set; }
  public string Name { get; set; }
  [InverseProperty("PlaceOfBirth")]
  public ICollection<Person> Natives { get; set; }
  [InverseProperty("CurrentResidence")]
  public ICollection<Person> Residents { get; set; }
}
```

Point towards related property

Summary

- The **Fluent API** gives us full control over Entity Framework object mappings
- **Attributes** can be used to express special table relationships and to customize entity behaviour
- Objects can be composed from other objects to represent complex **relationships**

Questions?



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