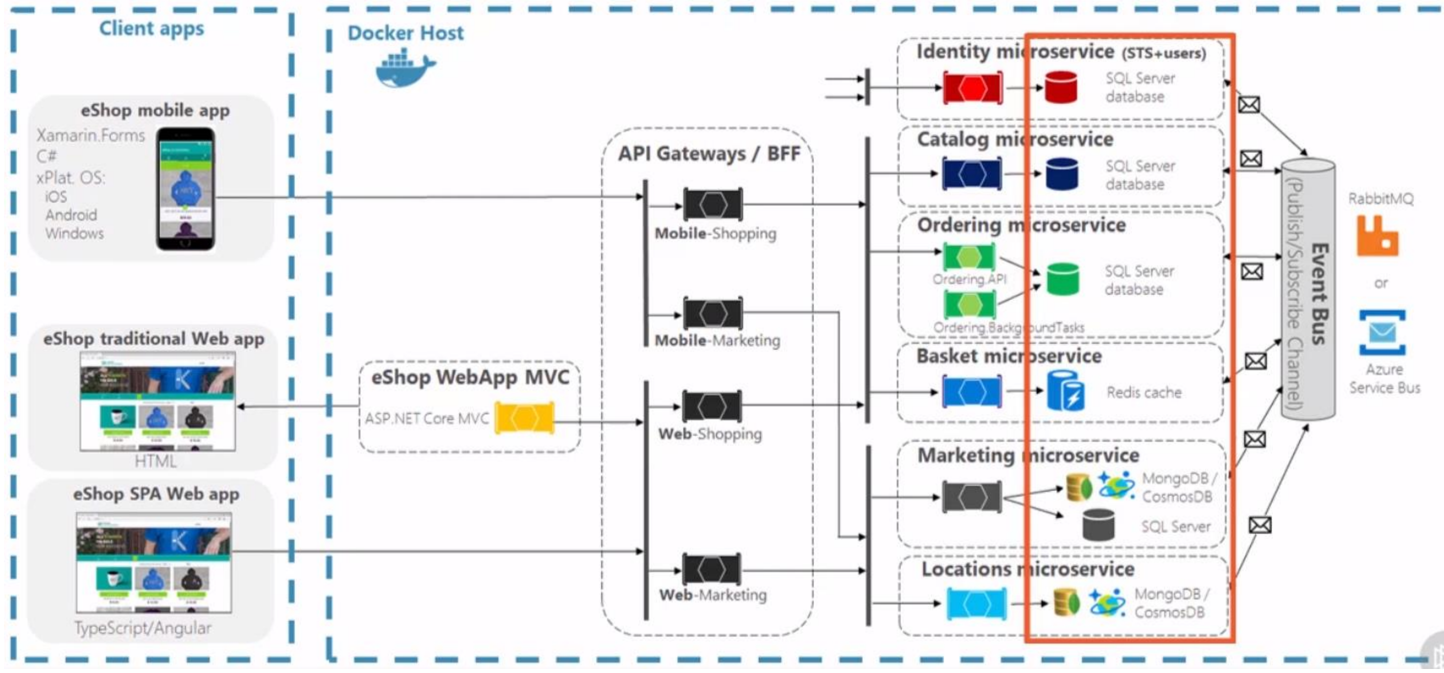
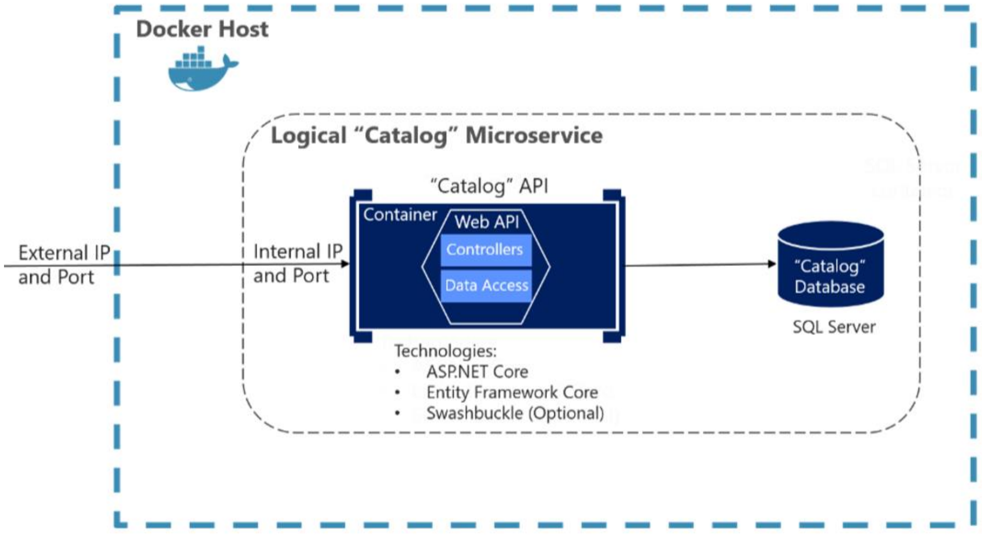
Sample Microservice Based Application



Creating a simple data-driven CRUD microservice

An example of this kind of simple data-drive service is the catalog microservice from the sample application.

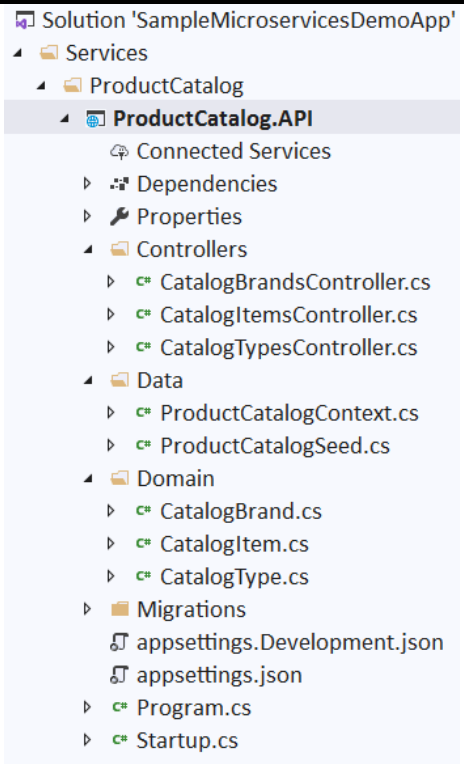
This type of service implements all its functionality in a single ASP.NET Core Web API project that includes classes for its data model, its business logic, and its data access code. It also stores its related data in a database running in SQL Server (as another container for dev/test purposes), but could also be any regular SQL Server host.



Microservice Code Responsibilities

- Incoming Requests
    1. HTTP request Messages
    2. RESTful = URL + HTTP Method + Data(json)
- Domain Logic
    1. Business Rules
    2. e.g. Sales Tax / GST Calculation
- Data Access
    1. Queries and Updates
- Integrate
    1. Publishing messages
    2. Third party services

ProductCatalog Monolithic – Single Layer



```
Solution 'SampleMicroservicesDemoApp'
  Services
    ProductCatalog
      ProductCatalog.API
        Connected Services
        Dependencies
        Properties
        Controllers
          CatalogBrandsController.cs
          CatalogItemsController.cs
          CatalogTypesController.cs
        Data
          ProductCatalogContext.cs
          ProductCatalogSeed.cs
        Domain
          CatalogBrand.cs
          CatalogItem.cs
          CatalogType.cs
        Migrations
        appsettings.Development.json
        appsettings.json
        Program.cs
        Startup.cs
```

1. Visual Studio → File → New Project → Blank Solution → Next
2. Project name = MyMicroserviceDemoSolution → Create
3. Go to Windows Explorer and create d:\DemoSolution\Services\ProductCatalog folder
4. Visual Studio → Solution Explorer → Right on Solution → Add Solution Folder → Services
5. Visual Studio → Solution Explorer → Right on Solution → Add Solution Folder → **ProductCatalog**

6. Right Click on **Services** folder → Add New Project → ASP.NET Core Web Application → Project Name = **ProductCatalog.API**, Location = d:\DemoSolution\Services → Template = Web API → Create

Adding Domain Classes

7. Add following files and folders from Sample Application
   a) Domain\CatalogType.cs

```
public class CatalogType
{
    public int Id { get; set; }
    public string Type { get; set; }
}
```

   b) Domain\CatalogBrand.cs

```
public class CatalogBrand
{
    public int Id { get; set; }
    public string Brand { get; set; }
}
```

   c) Domain\CatalogItem.cs

```
public class CatalogItem
{
    public int Id { get; set; }
    public string Name { get; set; }
    public string Description { get; set; }
    public decimal Price { get; set; }
    public string PictureFileName { get; set; }
    public int CatalogTypeId { get; set; }
    public int CatalogBrandId { get; set; }
    public CatalogBrand CatalogBrand { get; set; }
    public CatalogType CatalogType { get; set; }
}
```

8. Build the application
9. Go to **Solution Explorer**, right click on the *Controllers Folder* →**Add** → **New Scaffolded Item**. → **API Controller with actions, using Entity Framework** → Add

10. Select the Model class = "CatalogItem", Data context class: Click +, New data context type: ProductCatalogContext → Add
11. Examine the code generated.

Examine the context generated context class: Data/ProductCatalogApi.cs

```
using Microsoft.EntityFrameworkCore;


namespace ProductCatalogApi.Models
{
    public class ProductCatalogContext : DbContext
    {
        public ProductCatalogContext (DbContextOptions<ProductCatalogContext> options)
            : base(options)
        {
        }
        public DbSet<ProductCatalogApi.Domain.CatalogBrand> CatalogBrands { get; set; }
        public DbSet<ProductCatalogApi.Domain.CatalogType> CatalogTypes { get; set; }
        public DbSet<ProductCatalogApi.Domain.CatalogItem> CatalogItems { get; set; }
    }
}
```

Examine the context registered with dependency injection:

Open **Program.cs and note the following lines of code.**

```
services.AddDbContext<ProductCatalogContext>(options =>
        options.UseSqlServer(Configuration.GetConnectionString("ProductCatalogContext")));
```

Examine the appsettings.json file

```
"ConnectionStrings": {
    "ProductCatalogContext":
"Server=.\\sqlexpress;Database=ProductCatalogDb;Trusted_Connection=True;MultipleActiveResultSets=true"
  }
```

12. **In Controller:** Edit **GetCatalogItem** Method as below

```
public async Task<ActionResult<IEnumerable<CatalogItem>>> GetCatalogItem()
{
    return await _context.CatalogItems.Include("CatalogType").Include("CatalogBrand").ToListAsync();
}

[HttpGet("{id}")]
public async Task<ActionResult<CatalogItem>> GetCatalogItem(int id)
{
    var catalogItem =  await _context.CatalogItems.Include("CatalogType").Include("CatalogBrand").Where(item =>
item.Id == id).FirstOrDefaultAsync();

    if (catalogItem == null)
    {
        return NotFound();
    }

    return catalogItem;
}
```

13. Goto Package Manager Console

    Add-Migration "Intial Script"

Initialize with Seed Data

14. Data\ProductCatalogSeed.cs

```
namespace ProductCatalog.API.Domain
{
    public class ProductCatalogSeed
    {
        public static async Task SeedAsync(ProductCatalogContext context)
        {
            if (!context.CatalogBrands.Any())
            {
                context.CatalogBrands.AddRange(GetPreconfiguredCatalogBrands());
                await context.SaveChangesAsync();
            }
            if (!context.CatalogTypes.Any())
            {
                context.CatalogTypes.AddRange(GetPreconfiguredCatalogTypes());
                await context.SaveChangesAsync();
            }
            if (!context.CatalogItems.Any())
            {
                context.CatalogItems.AddRange(GetPreconfiguredItems());
                await context.SaveChangesAsync();
            }
        }

        static IEnumerable<CatalogBrand> GetPreconfiguredCatalogBrands()
        {
            return new List<CatalogBrand>()
            {
                new CatalogBrand() { Brand = "Addidas"},
                new CatalogBrand() { Brand = "Puma" },
                new CatalogBrand() { Brand = "Nike" }
            };
        }

        static IEnumerable<CatalogType> GetPreconfiguredCatalogTypes()
        {
            return new List<CatalogType>()
            {
                new CatalogType() { Type = "Running"},
                new CatalogType() { Type = "Basketball" },
                new CatalogType() { Type = "Tennis" },
            };
        }
        static IEnumerable<CatalogItem> GetPreconfiguredItems()
        {
            return new List<CatalogItem>()
            {
                new CatalogItem() {PictureFileName="demo.jpg",CatalogTypeId=2,CatalogBrandId=3, Description =
"Shoes for next century", Name = "World Star", Price = 199.5M },
                new CatalogItem() {PictureFileName="demo.jpg",CatalogTypeId=1,CatalogBrandId=2, Description = "Will
make you world champions", Name = "White Line", Price= 88.50M },
            new CatalogItem() {PictureFileName="demo.jpg",CatalogTypeId=2,CatalogBrandId=3, Description = "You have already won gold medal", Name = "Prism White Shoes", Price = 129},
            new CatalogItem() {PictureFileName="demo.jpg",CatalogTypeId=2,CatalogBrandId=2, Description = "Olympic runner", Name = "Foundation Hitech", Price = 12 },
            new CatalogItem() {PictureFileName="demo.jpg",CatalogTypeId=2,CatalogBrandId=1, Description = "Roslyn Red Sheet", Name = "Roslyn White", Price = 188.5M },
            new CatalogItem() {PictureFileName="demo.jpg",CatalogTypeId=2,CatalogBrandId=2, Description = "Lala Land", Name = "Blue Star", Price = 112},
            new CatalogItem() {PictureFileName="demo.jpg",CatalogTypeId=2,CatalogBrandId=1, Description = "High in the sky", Name = "Roslyn Green", Price = 212},
            new CatalogItem() {PictureFileName="demo.jpg",CatalogTypeId=1,CatalogBrandId=1, Description = "Light as carbon", Name = "Deep Purple", Price = 238.5M },
            new CatalogItem() {PictureFileName="demo.jpg",CatalogTypeId=1,CatalogBrandId=2, Description = "High Jumper", Name = "Addidas<White> Running", Price = 129 },
            new CatalogItem() {PictureFileName="demo.jpg",CatalogTypeId=2,CatalogBrandId=3, Description = "Dunker", Name = "Elequent", Price = 12},
            new CatalogItem() {PictureFileName="demo.jpg",CatalogTypeId=1,CatalogBrandId=2, Description = "All round", Name = "Inredeible", Price = 248.5M },
            new CatalogItem() {PictureFileName="demo.jpg",CatalogTypeId=2,CatalogBrandId=1, Description = "Pricesless", Name = "London Sky", Price = 412 },
            new CatalogItem() {PictureFileName="demo.jpg",CatalogTypeId=3,CatalogBrandId=3, Description = "Tennis Star", Name = "Elequent", Price = 123 },
            new CatalogItem() {PictureFileName="demo.jpg",CatalogTypeId=3,CatalogBrandId=2, Description = "Wimbeldon", Name = "London Star", Price = 218.5M},
            new CatalogItem() {PictureFileName="demo.jpg",CatalogTypeId=3,CatalogBrandId=1, Description = "Rolan Garros", Name = "Paris Blues", Price = 312 }
          };
        }
    }
}
```

15. Edit the Code in Main as below

    var app = builder.Build();

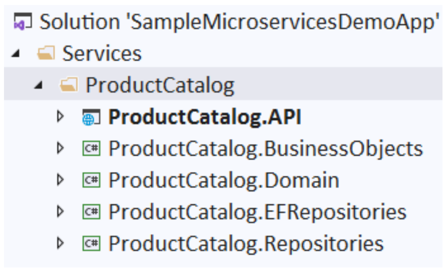
```
using (var scope = app.Services.CreateScope())
{
    var services = scope.ServiceProvider;
    var context = services.GetRequiredService<ProductCatalogContext>();
    context.Database.Migrate();
    ProductCatalogSeed.SeedAsync(context).Wait();
}
```

16. Navigate to http://localhost:1234/**swagger/v1**/swagger.json, open the document and view in VS.NET
17. Navigate to http://localhost:1234/swagger and you will find Swagger UI has been enabled on the API.
18. Using the Swagger UI, we can test the API created.

ProductCatalog Monolithic – Multi Layer

Splitting into Multiple Projects

19. Add the **Standard Class Library** Projects as shown below



```
Solution 'SampleMicroservicesDemoApp'
  Services
    ProductCatalog
      ProductCatalog.API
      ProductCatalog.BusinessObjects
      ProductCatalog.Domain
      ProductCatalog.EFRepositories
      ProductCatalog.Repositories
```

20. Following references must be added to each project

ProductCatalog.Repositories should refer to

- ProductCatalog.Domain

ProductCatalog.EFRepositories should refer to

- ProductCatalog.Repositories
    - ProductCatalog.Domain

ProductCatalog.BusinessObjects should refer to

- ProductCatalog.Repositories
    - ProductCatalog.Domain

ProductCatalog.API should refer to

- ProductCatalog.BusinessObjects
    - ProductCatalog.Domain
- ProductCatalog.Repositories
    - ProductCatalog.Domain
- ProductCatalog.EFRepositories
    - ProductCatalog.Repositories

a) ProductCatalog.Domain

21. Move the following from **ProductCatalog.API** project to **ProductCatalog.Domain** Project and change the namespace accordingly
    - CatalogBrand.cs
    - CatalogType.cs
    - CatalogItem.cs
    - ProductCatalogContext.cs
    - ProductCatalogSeed.cs
22. Delete the Migration folder from the API project and also Drop the database using SQL Server Object Explorer
23. To the project **ProductCatalog.Repositories** add interface **ICatalogItemRepository**

```
public interface ICatalogItemRepository
{
  Task<IEnumerable<CatalogItem>> GetCatalogItems();
  Task<CatalogItem> GetCatalogItemDetails(int id);
  Task<CatalogItem> Add(CatalogItem item);
  Task Update(CatalogItem item);
  Task Delete(int id);
}
```

24. To the project **ProductCatalog.EFRepositories** add interface **CatalogItemRepository**

```
public class CatalogItemRepository : ICatalogItemRepository
{
  ProductCatalogContext _context;
  public CatalogItemRepository(ProductCatalogContext context)
  {
    _context = context;
  }
  public async Task<CatalogItem> Add(CatalogItem item)
  {
    _context.CatalogItems.Add(item);
    await _context.SaveChangesAsync();
    return item;
  }

  public async Task Delete(int id)
```

```
    {
        var catalogItem = await _context.CatalogItems.FindAsync(id);
        if (catalogItem == null)
        {
            throw new ApplicationException("Not Found");
        }
        _context.CatalogItems.Remove(catalogItem);
        await _context.SaveChangesAsync();
    }

    public async Task<CatalogItem> GetCatalogItemDetails(int id)
    {
        var catalogItem = await
_context.CatalogItems.Include("CatalogType").Include("CatalogBrand").FirstAsync(item => item.Id == id);

        if (catalogItem == null)
        {
            throw new ApplicationException("Not Found");
        }

        return catalogItem;
    }

    public async Task<IEnumerable<CatalogItem>> GetCatalogItems()
    {
        return await _context.CatalogItems.Include("CatalogType").Include("CatalogBrand").ToListAsync();
    }

    public async Task Update(CatalogItem item)
    {
        _context.Entry(item).State = EntityState.Modified;
        await _context.SaveChangesAsync();
    }
}
```

25. To the project **ProductCatalog.BusinessObjects** add interface **ICatalogItemBO and CatalogItemBO**

```
public interface ICatalogItemBO
{
    Task<IEnumerable<CatalogItem>> GetCatalogItems();
    Task<CatalogItem> GetCatalogItemDetails(int id);
    Task<CatalogItem> Add(CatalogItem item);
    Task Update(CatalogItem item);
    Task Delete(int id);
}

public class CatalogItemBO : ICatalogItemBO
{
    ICatalogItemRepository _repository;
    public CatalogItemBO(ICatalogItemRepository repository)
    {
        _repository = repository;
    }
    public async Task<CatalogItem> Add(CatalogItem item)
    {
        await _repository.Add(item);
        return item;
    }

    public async Task Delete(int id)
    {
        await _repository.Delete(id);
    }

    public async Task<CatalogItem> GetCatalogItemDetails(int id)
    {
        return await _repository.GetCatalogItemDetails(id);
    }

    public async Task<IEnumerable<CatalogItem>> GetCatalogItems()
    {
        return await _repository.GetCatalogItems();
    }

    public async Task Update(CatalogItem item)
    {
        await _repository.Update(item);
    }
}
```

26. To the project **ProductCatalog.BusinessObjects** add interface **ICatalogItemBO and CatalogItemBO**
27. Add the following to **ProductCatalog.API\Startup.cs -> ConfigureService Method**

```
services.AddTransient<ICatalogItemBO, CatalogItemBO>();
services.AddTransient<ICatalogItemRepository, CatalogItemRepository>();
```

28. Edit **ProductCatalog.API\Controllers\CatalogItemController.cs** as below

```
[Route("[controller]")]
[ApiController]
public class CatalogItemsController : ControllerBase
{
    ICatalogItemBO _boCatalogItem;
    public CatalogItemsController(ICatalogItemBO boCatalogItem)
    {
       // _context = context;
        _boCatalogItem = boCatalogItem;
    }

    [HttpGet]
    public async Task<ActionResult<IEnumerable<CatalogItem>>> GetCatalogItem()
    {
        var items = await _boCatalogItem.GetCatalogItems(); ;
        return Ok(items);
    }

    [HttpGet("{id}")]
    public async Task<ActionResult<CatalogItem>> GetCatalogItem(int id)
```

```
{
    var catalogItem = await _boCatalogItem.GetCatalogItemDetails(id);
    if (catalogItem == null)
    {
        return NotFound();
    }
    return catalogItem;
}

  [HttpPut("{id}")]
public async Task<IActionResult> PutCatalogItem(int id, CatalogItem catalogItem)
{
    if (id != catalogItem.Id)
    {
        return BadRequest();
    }
    try
    {
        await _boCatalogItem.Update(catalogItem);
    }
    catch (ApplicationException ex)
    {
        if (ex.Message == "Not Found")
        {
            return NotFound();
        }
        else
        {
            throw;
        }
    }
    return NoContent();
}

[HttpPost]
```

```
    [ProducesResponseType(StatusCodes.Status201Created)]
    public async Task<ActionResult<CatalogItem>> PostCatalogItem(CatalogItem catalogItem)
    {
        await _boCatalogItem.Add(catalogItem);
        return CreatedAtAction("GetCatalogItem", new { id = catalogItem.Id }, catalogItem);
    }

    [HttpDelete("{id}")]
    public async Task DeleteCatalogItem(int id)
    {
        await _boCatalogItem.Delete(id);
    }
}
```

29. Exclude from project **CatalogTypeController.cs and CatalogBrandController.cs** files as they are not yet updated
30. Go to Menu Tools → NuGet Package Manager → **NuGet Package Manager Console**
31. In package Manage Window → Change Defaut project to **ProductCatalog.Domain** and execute following command

```
Add-Migration "Initial Database"
```

32. Run the Application and Test the o/p in Swagger UI

~~**Writing Generic Repository**~~

~~33. Add the following to **ProductCatalog.Repository\IGenericRepository.cs**~~

```
~~public interface IGenericRepository<T> where T:class~~
~~{~~
~~    Task<IEnumerable<T>> GetAll();~~
~~    Task<T> GetById(int id);~~
~~    Task<T> Add(T item);~~
~~    Task Update(T item);~~
~~    Task Delete(int id);~~
~~}~~
```

~~**34.** Add the following to **ProductCatalog.EFRepository\GenericRepository.cs**~~

```
~~using Microsoft.EntityFrameworkCore;~~
```

```
~~using ProductCatalog.Repositories;~~
~~using System;~~
~~using System.Collections.Generic;~~
~~using System.Text;~~
~~using System.Threading.Tasks;~~

~~namespace ProductCatalog.EFRepositories~~
~~{~~
    ~~public class GenericRepository<T> : IGenericRepository<T> where T : class~~
    ~~{~~
        ~~private readonly DbContext _context;~~
        ~~DbSet<T> dbSet;~~
        ~~public GenericRepository(DbContext context)~~
        ~~{~~
            ~~_context = context;~~
            ~~dbSet = _context.Set<T>();~~
        ~~}~~
        ~~public async virtual Task<T> Add(T item)~~
        ~~{~~
            ~~dbSet.Add(item);~~
            ~~await _context.SaveChangesAsync();~~
            ~~return item;~~
        ~~}~~
        ~~public async virtual Task Delete(int id)~~
        ~~{~~
            ~~T entity = await dbSet.FindAsync(id);~~
            ~~dbSet.Remove(entity);~~
            ~~await _context.SaveChangesAsync();~~
        ~~}~~
        ~~public async virtual Task<IEnumerable<T>> GetAll()~~
        ~~{~~
            ~~return await dbSet.ToListAsync<T>();~~
        ~~}~~
        ~~public async virtual Task<T> GetById(int id)~~
        ~~{~~
```

```
            return await dbSet.FindAsync(id);
        }
        public async virtual Task Update(T item)
        {
            _context.Entry<T>(item).State = EntityState.Modified;
            await _context.SaveChangesAsync();
        }
    }
}
```

~~35. Add the following Interfaces to **ProductCatalog.Repository** Project~~

~~**ICatalogTypeRepository.cs**~~

```
public interface ICatalogTypeRepository : IGenericRepository<CatalogType>
{ }
```

~~**ICatalogBrandRepository.cs**~~

```
public interface ICatalogBrandRepository : IGenericRepository<CatalogBrand>
{ }
```

~~**ICatalogItemRepository.cs**~~

```
public interface ICatalogItemRepository : IGenericRepository<CatalogItem>
{ }
```

~~**36.** Add the following to **ProductCatalog.EFRepository\CatalogItemRepository.cs**~~

```
public class CatalogItemRepository : GenericRepository<CatalogItem>, ICatalogItemRepository
{
    private readonly ProductCatalogContext _context;

    public CatalogItemRepository(ProductCatalogContext context) : base (context)
    {
        _context = context;
    }

    public async override Task<IEnumerable<CatalogItem>> GetAll()
    {
        return await _context.CatalogItems.Include("CatalogType").Include("CatalogBrand").ToListAsync();
    }

    public async override Task<CatalogItem> GetById(int id)
    {
        return await _context.CatalogItems.Include("CatalogType").Include("CatalogBrand").Where(item1 => item1.Id
== id).FirstOrDefaultAsync<CatalogItem>();
    }
}
```

~~**37.** Add the following to **ProductCatalog.EFRepository**\CatalogTypeRepository.cs~~

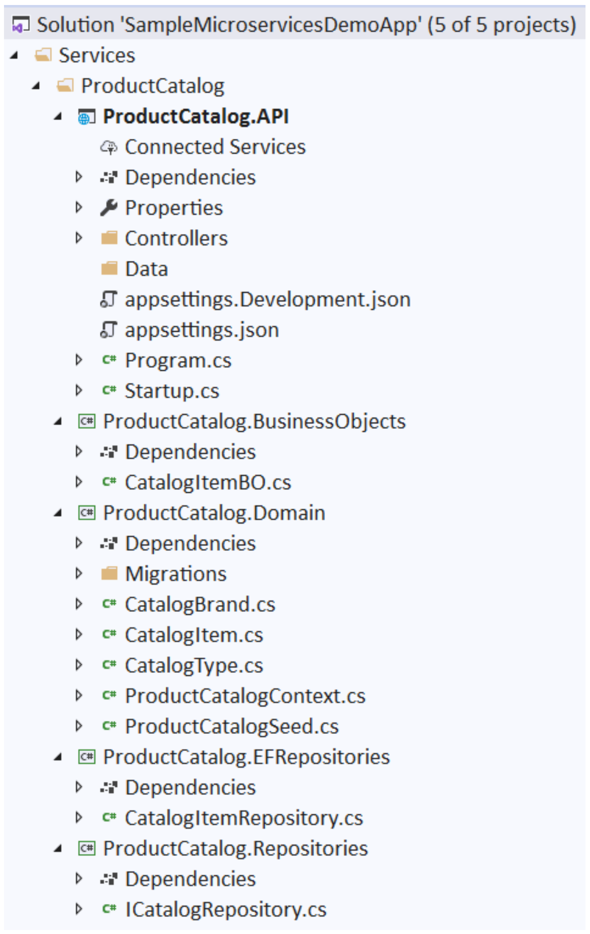
```
public class CatalogTypeRepository : GenericRepository<CatalogType>, ICatalogItemRepository
{
    public CatalogTypeRepository(ProductCatalogContext context) :base(context)
    { }
}
```

~~**38.** Add the following to **ProductCatalog.EFRepository**\CatalogBrandRepository.cs~~

```
public class CatalogBrandRepository : GenericRepository<CatalogBrand>, ICatalogItemRepository
{
    public CatalogBrandRepository(ProductCatalogContext context) :base(context)
    { }
}
```

~~39. Edit BO classes and resolve errors by replacing the method names from GenericRepository~~

~~Final Layout of Projects in Solution Explorer~~



Solution 'SampleMicroservicesDemoApp' (5 of 5 projects)
- Services
  - ProductCatalog
    - **ProductCatalog.API**
      - Connected Services
      - Dependencies
      - Properties
      - Controllers
      - Data
      - appsettings.Development.json
      - appsettings.json
      - Program.cs
      - Startup.cs
    - ProductCatalog.BusinessObjects
      - Dependencies
      - CatalogItemBO.cs
    - ProductCatalog.Domain
      - Dependencies
      - Migrations
      - CatalogBrand.cs
      - CatalogItem.cs
      - CatalogType.cs
      - ProductCatalogContext.cs
      - ProductCatalogSeed.cs
    - ProductCatalog.EFRepositories
      - Dependencies
      - CatalogItemRepository.cs
    - ProductCatalog.Repositories
      - Dependencies
      - ICatalogRepository.cs

Web Client

1. Right Click on Solution → Add → New Solution Folder, Name=MyWebApp
2. Right Click on WebApp → Add → New Project → ASP.NET Core Web Application → Next
3. Project Name = WebMVC → Location=D:\DemoSolution\MyWebApp → Create
4. Select Web Application (Model-View-Controller) → Create

5. Add following **Models** (Same as in ProductCatalogAPI Microservice)

```
public class CatalogType

{

   public int Id { get; set; }

   public string Type { get; set; }

}

public class CatalogBrand

{

   public int Id { get; set; }
```

```
    public string Brand { get; set; }
}
public class CatalogItem
{
    public string Id { get; set; }
    public string Name { get; set; }
    public string Description { get; set; }
    public decimal Price { get; set; }
    public string PictureUri { get; set; }
    public int CatalogBrandId { get; set; }
    public CatalogBrand CatalogBrand { get; set; }
    public int CatalogTypeId { get; set; }
    public CatalogType CatalogType { get; set; }
}
```

6. Edit appsettings.json

```
{
  . . .
  "CatalogAPIUrl": "https://localhost:44341"
}
```

7. Add ICatalogService.cs

```
public interface ICatalogService
{
    Task<IEnumerable<CatalogItem>> GetCatalogItems(int? brand, int? type);
    Task<CatalogItem> GetItemDetails(int id);
    Task<IEnumerable<SelectListItem>> GetBrands();
    Task<IEnumerable<SelectListItem>> GetTypes();
}
```

8. Add Services/CatalogService.cs

```
public class CatalogService : ICatalogService
{
    private readonly string _remoteServiceBaseUrl;
    public CatalogService(IConfiguration config)
```

```
  {
     _remoteServiceBaseUrl = config["CatalogAPIUrl"];
  }
  public async Task<IEnumerable<CatalogItem>> GetCatalogItems(int? brand, int? type)
  {
     var client = new HttpClient();
     var result = await client.GetAsync(_remoteServiceBaseUrl + "/CatalogItems/");
     var dataString = await result.Content.ReadAsStringAsync();
     return JsonConvert.DeserializeObject<IEnumerable<CatalogItem>>(dataString);
  }
  public async Task<CatalogItem> GetItemDetails(int id)
  {
      HttpClient client = new HttpClient();
      string strjson = await client.GetStringAsync(_remoteServiceBaseUrl + "/CatalogItems/" + id);
      CatalogItem items = JsonConvert.DeserializeObject<CatalogItem>(strjson);
      return items;
  }
  public async Task<IEnumerable<SelectListItem>> GetBrands()
     {
        var client = new HttpClient();
        var result = await client.GetAsync(_remoteServiceBaseUrl + "/api/CatalogBrand/");
        var dataString = await result.Content.ReadAsStringAsync();
        var catalogBrands = JsonConvert.DeserializeObject<IEnumerable<CatalogItem>>(dataString);
        return new SelectList(catalogBrands, "Id", "Brand");
     }

  public async Task<IEnumerable<SelectListItem>> GetTypes()
     {
        var client = new HttpClient();
        var result = await client.GetAsync(_remoteServiceBaseUrl + "/api/CatalogType/");
        var dataString = await result.Content.ReadAsStringAsync();
        var catalogTypes = JsonConvert.DeserializeObject<IEnumerable<CatalogItem>>(dataString);
        return new SelectList(catalogTypes, "Id", "Type");
     }
}
```

9. Add the following to Startup.ConfigureService so that is can be injected.

```
services.AddTransient<ICatalogService, CatalogService>();
```

10. Right Click on Controllers Folder → Add → Controller… → MVC Controller – Empty → Add → Controller name = **CatalogController**
11. Edit CatalogController.cs

```
public class CatalogController : Controller
{
    // GET: Catalog
    ICatalogService _catalogService;
    public CatalogController(ICatalogService catalogService)
    {
        _catalogService = catalogService;
    }
    public async Task<ActionResult> Index()
    {
        IEnumerable<CatalogItem> items = await _catalogService.GetCatalogItems(null, null);
        return View(items);
    }
    // GET: Catalog/Details/5
    public async Task<ActionResult> Details(int id)
    {
        CatalogItem item = await _catalogService.GetItemDetails(id);
        return View(item);
    }
}
```

12. Right Click on **Index** method → Add View… → View name=Index, Template=**List**, Model class= CatalogItem (WebMvc.Models) → Add
13. Right Click on **Details** method → Add View… → View name=Index, Template=**Details**, Model class= CatalogItem (WebMvc.Models) → Add