Retail Manager Development Manual

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Contents

1 Introduction

1.1 Project Summary

The goal of tkhis project is to build a dektop app that runs a cash register, handles inventory and manages an entire retail store. Creating and implementing a **WebAPI layer**, will allow the whole project to grow. This lauyer will be able to serve each kind of application (desktop, mobile, web, ...).

2 Initial Plan

2.1 Outline

The App is going to be build as a MVP (Minimum Viable Product) that can be expanded to cover all of the features, which are needed over time - so it can grow into a full featured application. First step is getting all of the major pieces set up, including:

- Git on Azure DevOps
- SQL Database (SSDT)
- WebAPI with Authentification
- WPF application that can log into the API

2.2 Technologies

- Unit Testing
- Dependency Injection
- WPF
- MVVM with Caliburn Micro
- ASP.NET MVC (Web Frontend)
- .NET Framework
- .NET Core 3.0
- SSDT - SQL Server Data Tools
- Git
- Azure DevOps
- Async
- Reporting
- WebAPI
- Logging
- Data Validation
- HTML
- CSS
- JavaScript
- Authentication

3 Initial Setup in Visual Studio

1. Setting up a Git-Repository, including README, GitIgnore (for VS) and License
2. Creating a **Blank Solution**: Other Project Types → Blank Solution
   Such type of sulution isn't language specific.

4 Creating a WebAPI with Authentification

1. Adding new Project to the Solution:

   Web → ASP.NET Web Application (.NET Framework) → WebAPI

   Add folders and references for:

   - MVC
   - Web API

   Change Authentication to

   - Individual User Accounts

2. Upgrading all NuGet-Packages

4.1 Indentity Configuration

App_Start → IdentityConfig.cs

In there are some settings for setting up the WebAPI, especially for authentication:

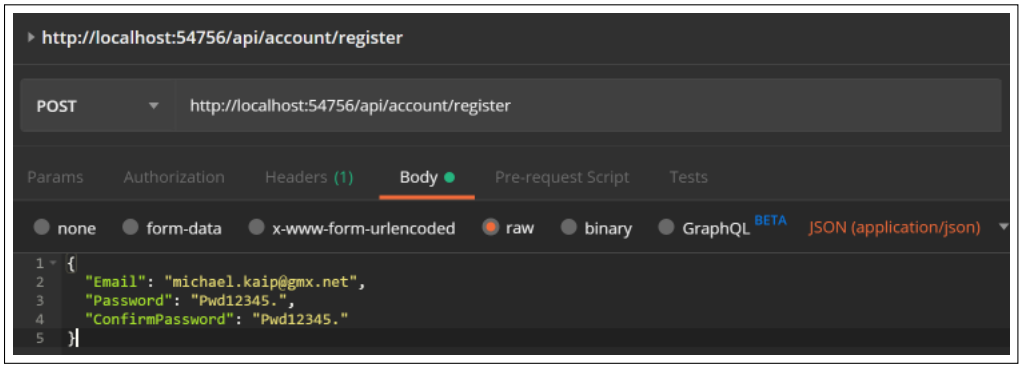
- UserValidator
- PasswordValidator

4.2 Getting authorized for development

4.2.1 Postman

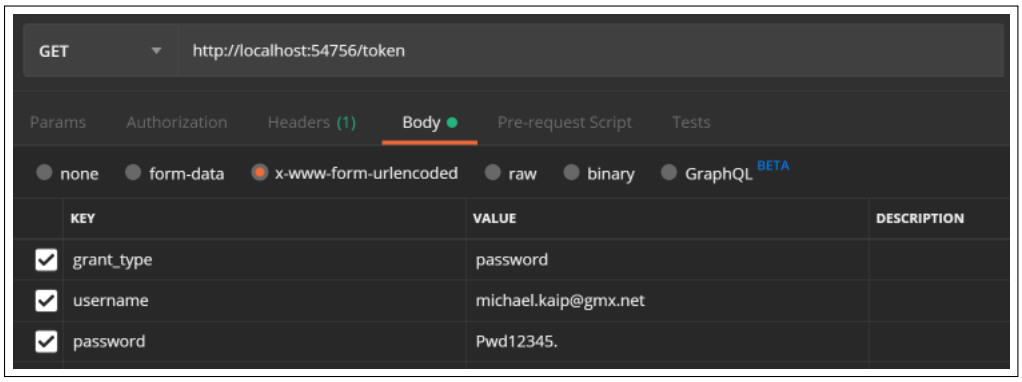
The following calls has to be applied in the given order:

1. **POST**



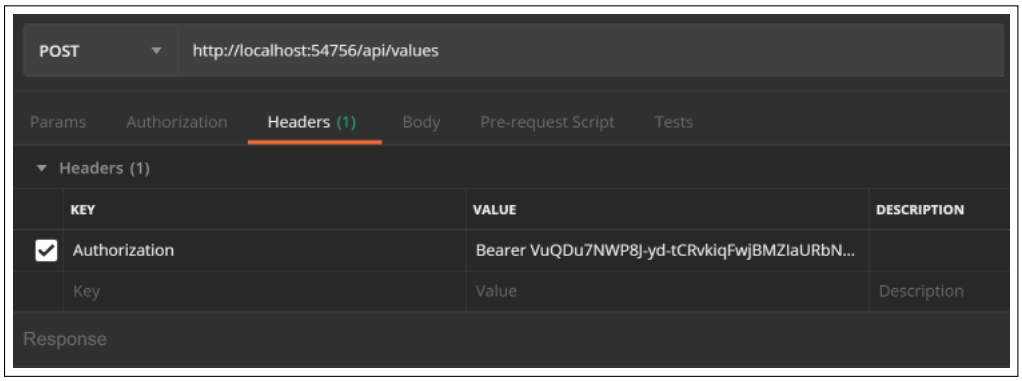
   Creates a new user account and stores this information into the user database.
   If **Status: 200 OK**, username and password has been succesfully created.

2. **GET**



It will return an **access_token** which is, by default, valid for 14 days. Token is needed for all further interaction with the server. Can be also configured for shorter valid periods.

3. **POST**



4.2.2 Getting User Information

In order to get the Identity of users returned, some changes have to be implemented. Through this it's becomes possible to apply different accesibility rules, based on the user-group a certain user is part of.

1. *RMDataManager.Controllers.ValuesController*

```
using System.Web.Http;
using Microsoft.AspNet.Identity; // Needed for getting information about the user

namespace RMDataManager.Controllers
{
    [Authorize]
    0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
    public class ValuesController : ApiController
    {
        // GET api/values
        0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
        public IEnumerable<string> Get()
        {
            // Stores the ID of each user
            var userId = RequestContext.Principal.Identity.GetUserId();
            return new string[] { "value1", "value2", userId };
        }
```

5 Installing and configuring SWAGGER

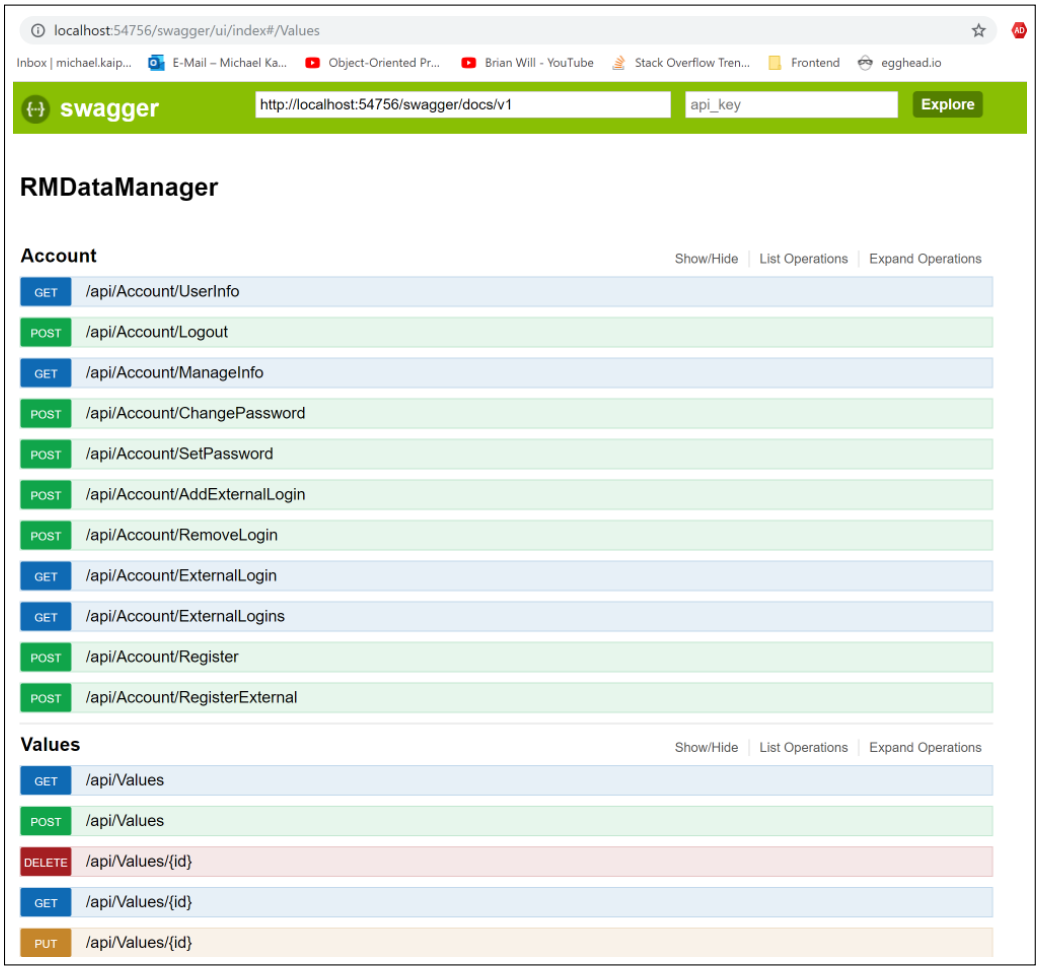
SWAGGER is an API documentation and demonstration tool.

5.1 Installing SWAGGER

1. NuGet-Manager

   Adds a SWAGGER to WebAPI-Projects.

2. Starting SWAGGER



5.2 Channging the configuration of SWAGGER

RMDataManager.App_Start.SwaggerConfig.cs

1. Changing title

```
// Use "SingleApiVersion" to describe a single version API. Swagger 2.0 includes an "Info" object to
// hold additional metadata for an API. Version and title are required but you can also provide
// additional fields by chaining methods off SingleApiVersion.
//
c.SingleApiVersion("v1", title: "Retail Manager API"); // Changed to a propper name
```

2. Enabling propper printing of ducuments

```
// If you want the output Swagger docs to be indented properly, enable the "PrettyPrint" option.
//
c.PrettyPrint(); // enabled
```

3. Treating Enums as Strings

```
// In accordance with the built in JsonSerializer, Swashbuckle will, by default, describe enums as integers.
// You can change the serializer behavior by configuring the StringToEnumConverter globally or for a given
// enum type. Swashbuckle will honor this change out-of-the-box. However, if you use a different
// approach to serialize enums as strings, you can also force Swashbuckle to describe them as strings.
//
c.DescribeAllEnumsAsStrings(); // enabled
```

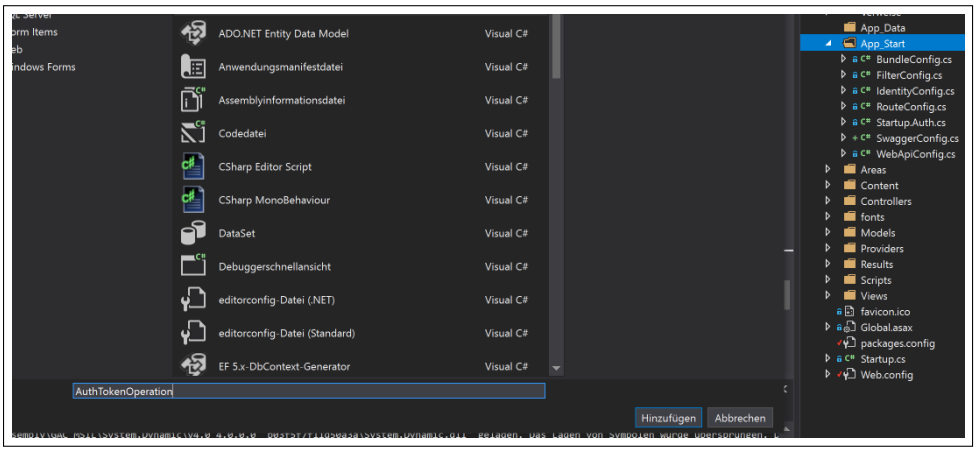
4. Changing document title

```
.EnableSwaggerUi(configure: c =>
    {
        // Use the "DocumentTitle" option to change the Document title.
        // Very helpful when you have multiple Swagger pages open, to tell them apart.
        //
        c.DocumentTitle("RM API"); // changed the name
```

5.3 Adding OAuth ability

1. Enabling token endpoint allowance in the SWAGGER documentation

   (a) Adding a new Class to $RMDataManager.App\_Start$



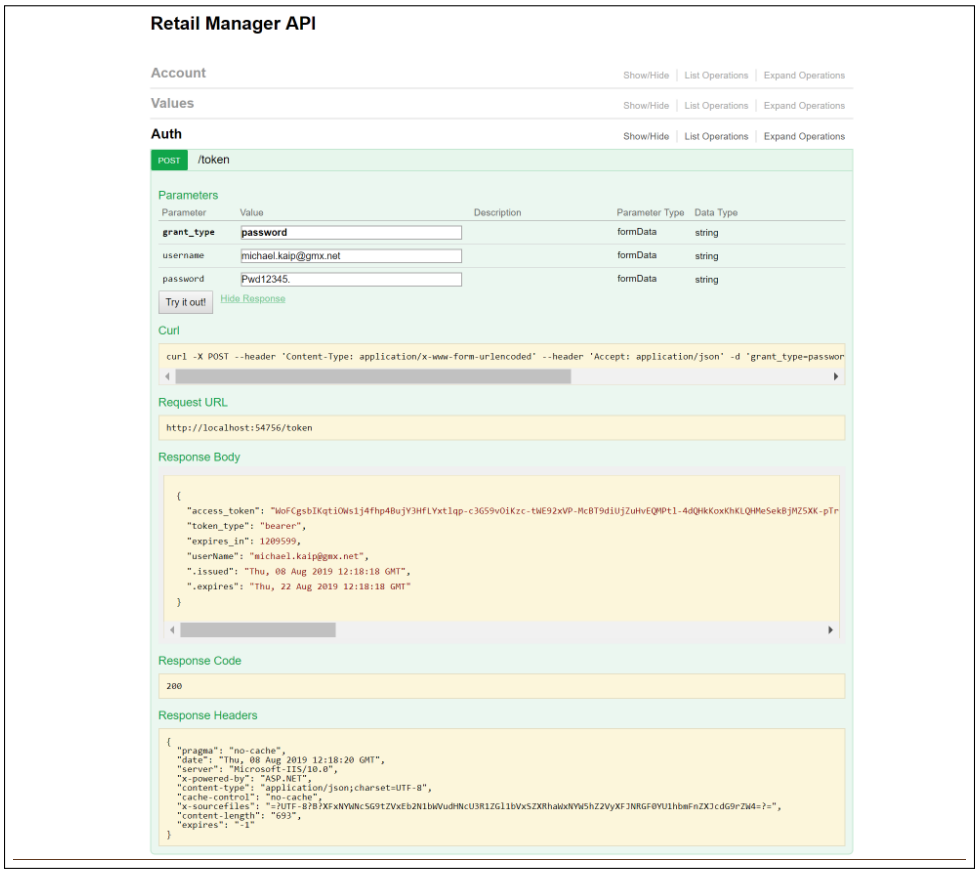
(b) Implementing the required Interface

```
public class AuthTokenOperation : IDocumentFilter
{
    0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
    public void Apply(SwaggerDocument swaggerDoc, SchemaRegistry schemaRegistry, IApiExplorer apiExplorer)
    {
        swaggerDoc.paths.Add("/token", new PathItem
        {
            post = new Operation
            {
                tags = new List<string> { "Auth" },
                consumes = new List<string>
                {
                    "application/x-www-form-urlencoded"
                },
                parameters = new List<Parameter>
                {
                    new Parameter
                    {
                        type = "string",
                        name = "grant_type",
                        required = true,
                        @in = "formData",
                        @default = "password"
                    },
                    new Parameter
                    {
                        type = "string",
                        name = "username",
                        required = false,
                        @in = "formData"
                    },
                    new Parameter
                    {
                        type = "string",
                        name = "password",
                        required = false,
                        @in = "formData"
                    }
                }
            }
        });
    }
}
```

(c) Applying it to SwaggerConfig.cs

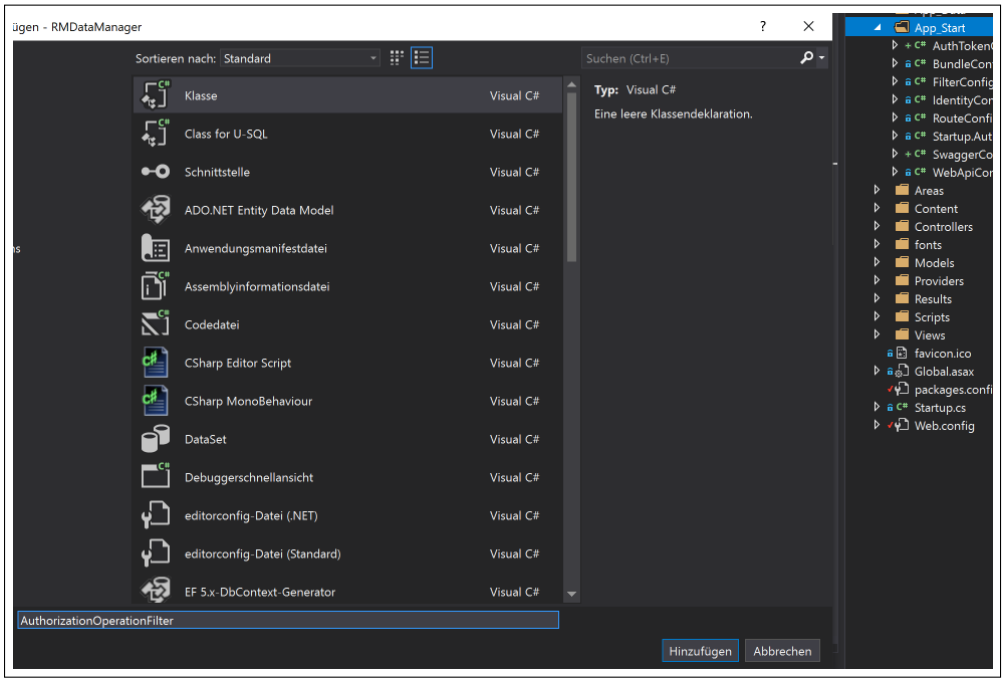
```
GlobalConfiguration.Configuration
    .EnableSwagger(configure: c =>
        {
            c.DocumentFilter<AuthTokenOperation>(); // adding the implemented document filter
```

(d) Logging into the application using SWAGGER and get the token



2. Enabling to paste in the bearer token in order to authorize restricted commands

   (a) Adding a new Class to *RMDataManager.App_Start*



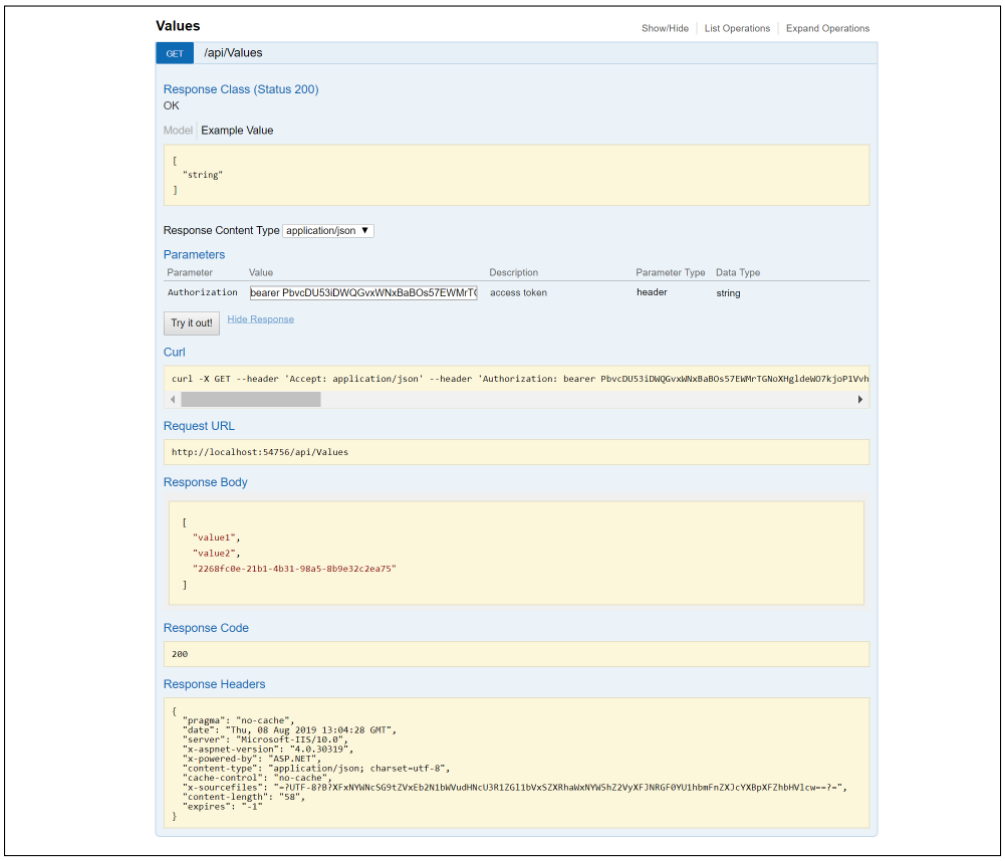
   (b) Implementing the required Interface

```
0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
public class AuthorizationOperationFilter : IOperationFilter
{
    0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
    public void Apply(Operation operation, SchemaRegistry schemaRegistry, ApiDescription apiDescription)
    {
        // Adding a parameter to each operation.
        if (operation.parameters == null)
        {
            operation.parameters = new List<Parameter>();
        }

        operation.parameters.Add(new Parameter
        {
            name = "Authorization",
            @in = "header",
            description = "access token",
            type = "string"
        });
    }
}
```

   (c) Applying it to SwaggerConfig.cs

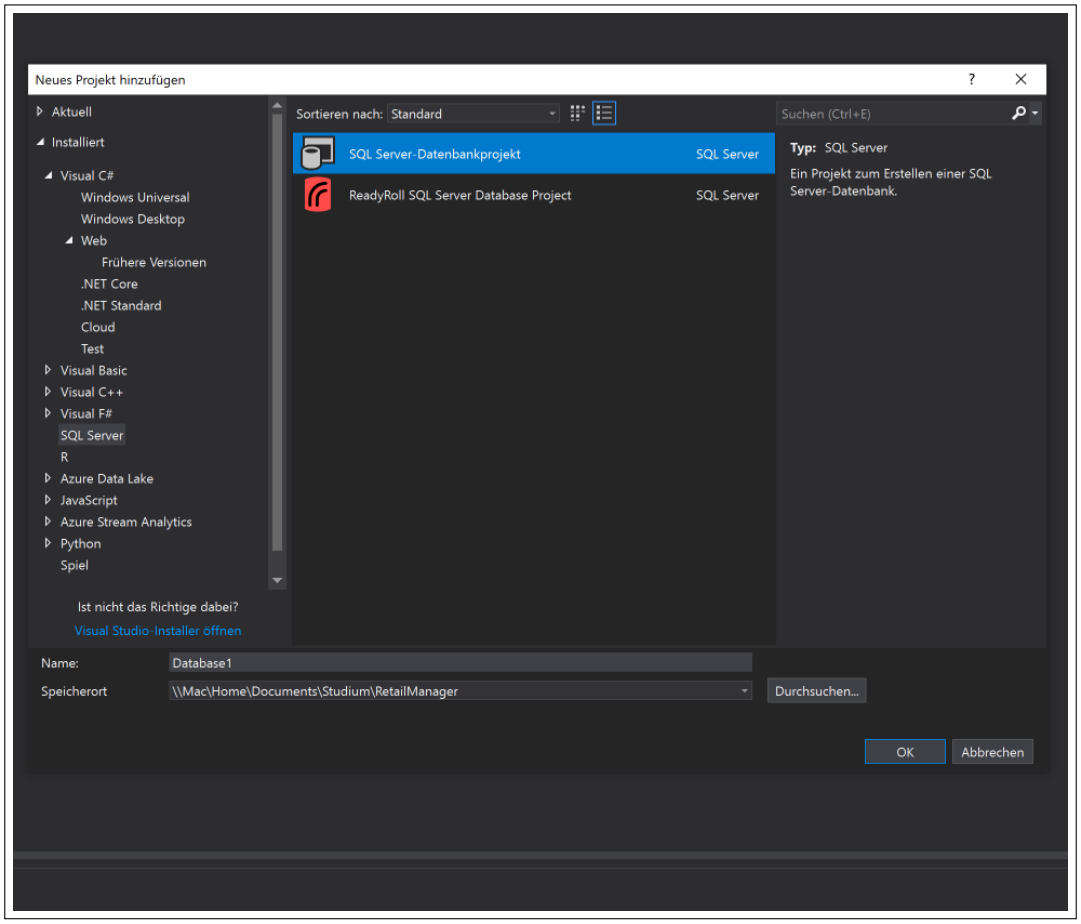
```
.EnableSwagger( configure: c =>
    {
        c.DocumentFilter<AuthTokenOperation>(); // adding the implemented document filter
        c.OperationFilter<AuthorizationOperationFilter>(); // adding the implented operation filter
```

   (d) Get user information from the application via SWAGGER using the token

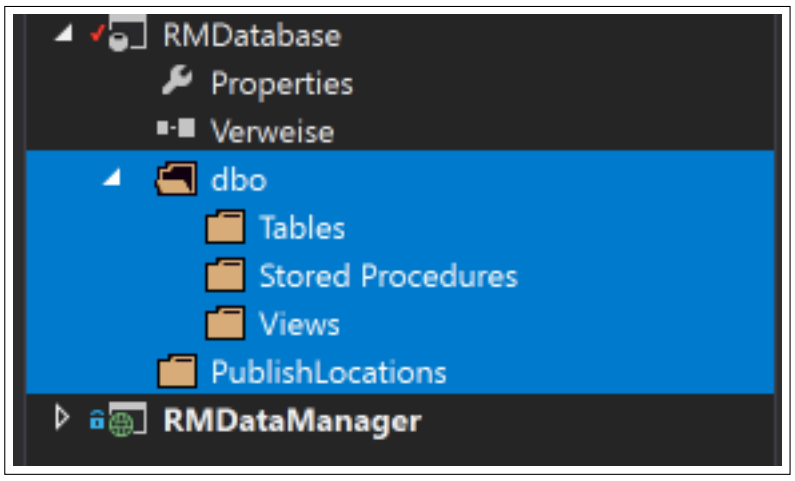

Values
Show/Hide | List Operations | Expand Operations
GET /api/Values
Response Class (Status 200)
OK
Model Example Value
[
"string"
]
Response Content Type application/json
Parameters
Parameter Value Description Parameter Type Data Type
Authorization bearer PbvcDU53iDWQGvxWNxBaBOs57EWMrT(access token header string
Try it out! Hide Response
Curl
curl -X GET --header 'Accept: application/json' --header 'Authorization: bearer PbvcDU53iDWQGvxWNxBaBOs57EWMrTGNoXHgldeWO7kjoP1Vvh
Request URL
http://localhost:54756/api/Values
Response Body
[
"value1",
"value2",
"2268fc0e-21b1-4b31-98a5-8b9e32c2ea75"
]
Response Code
200
Response Headers
{
"pragma": "no-cache",
"date": "Thu, 08 Aug 2019 13:04:28 GMT",
"server": "Microsoft-IIS/10.0",
"x-aspnet-version": "4.0.30319",
"x-powered-by": "ASP.NET",
"content-type": "application/json; charset=utf-8",
"cache-control": "no-cache",
"x-sourcefiles": "=?UTF-8?B?XFxNYWNcSG9tZVxEb2N1bWVudHNcU3R1ZGl1bVxSZXRhaWxNYW5hZ2VyXFJNRGF0YU1hbmFnZXJcYXBpXFZhbHV1cw==?=",
"content-length": "58",
"expires": "-1"
}

6 SQL Database Setup

6.1 Adding new Database Project to the solution

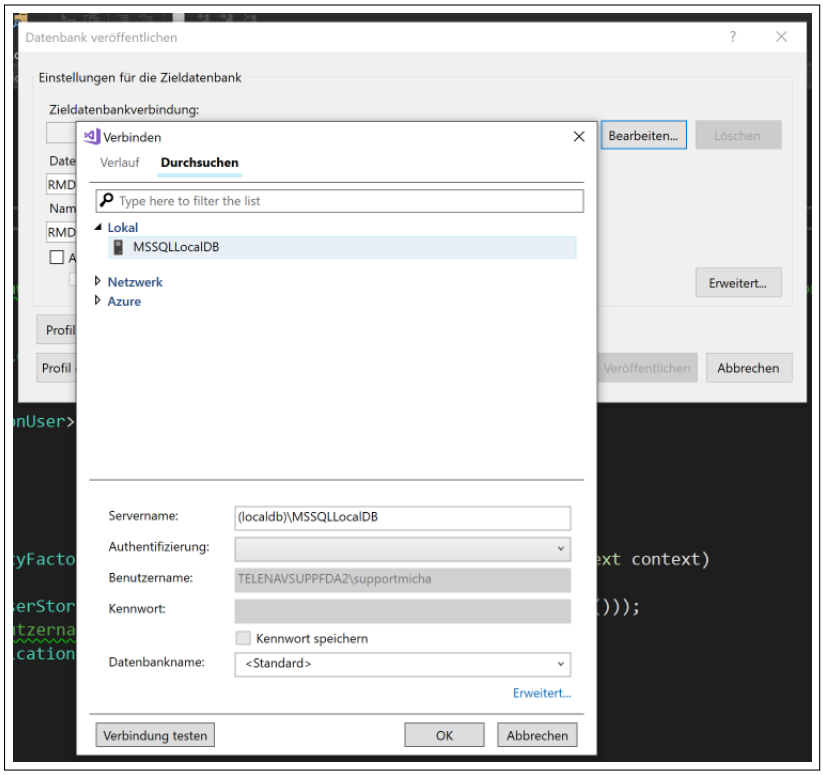


6.2 Adding several folders to the project

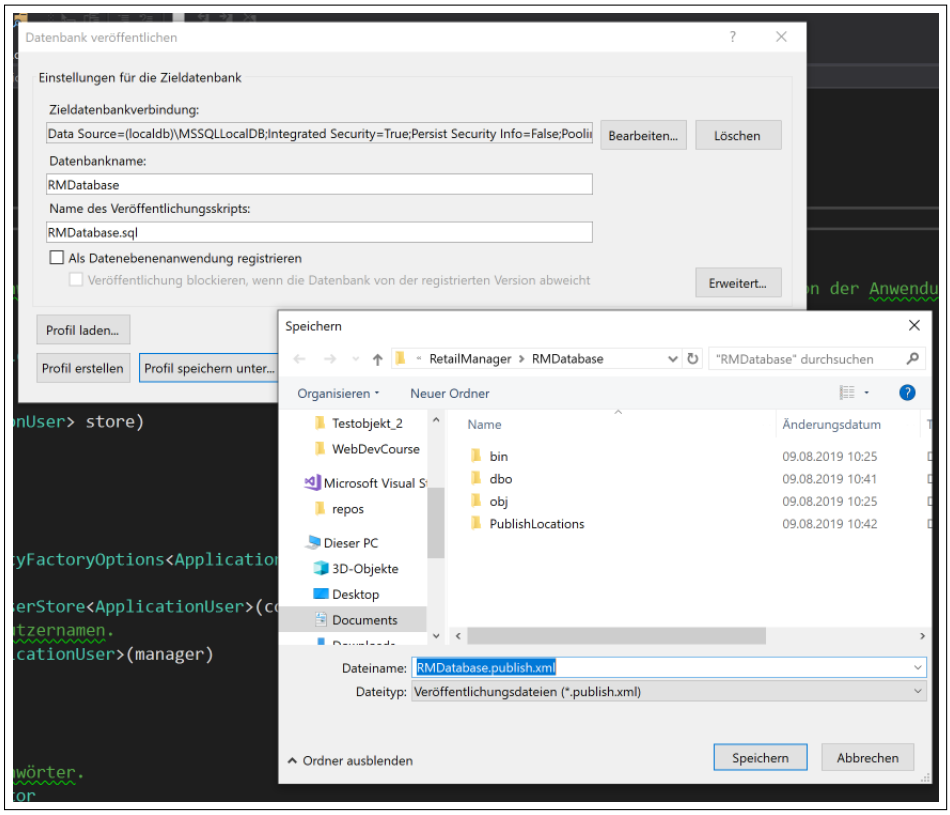


6.3 Creating a profile and publishing the Database

1. *RightClick on RMDatabase → Publish → Edit → Browse*

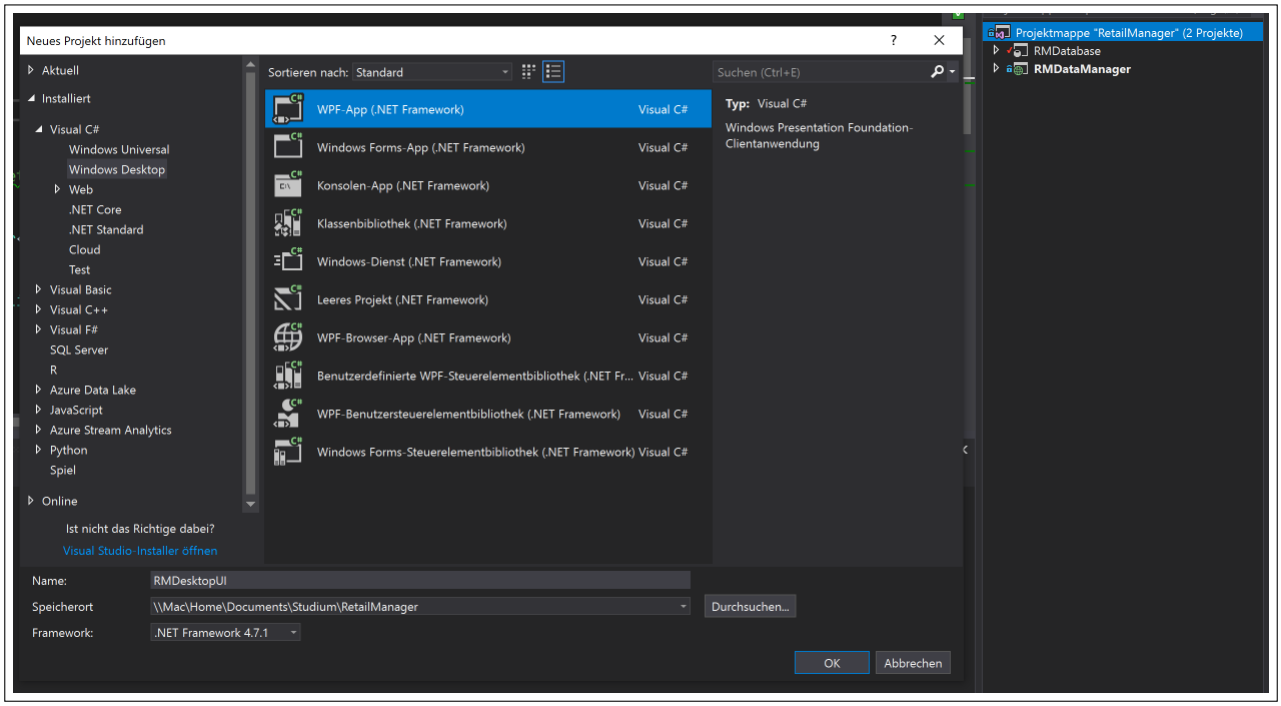


2. Naming and saving profile to PublishLocations

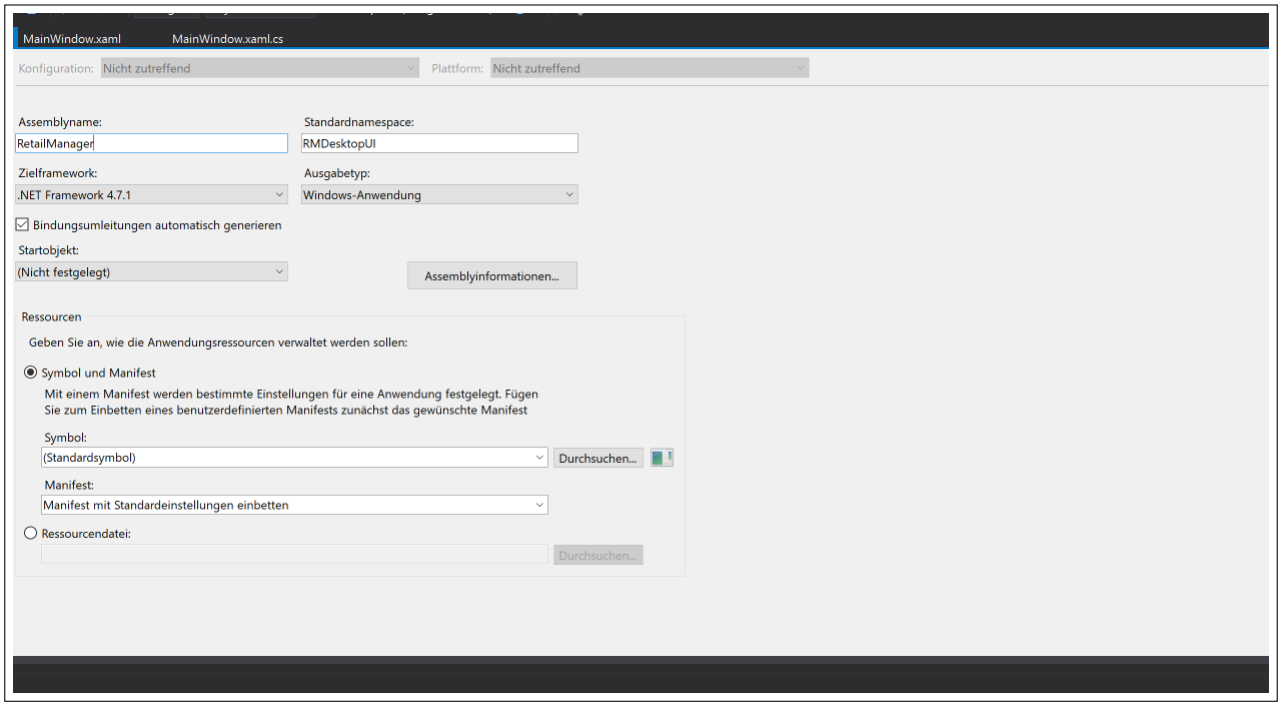


7 WPF with MVVM Project Setup

7.1 Adding the WPF Project to the solution



7.2 Changing the Assambly Name to the name of the solution in Properties

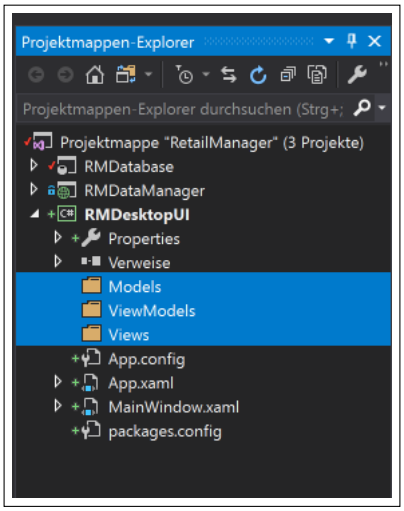


Also set project as the default startup-project.

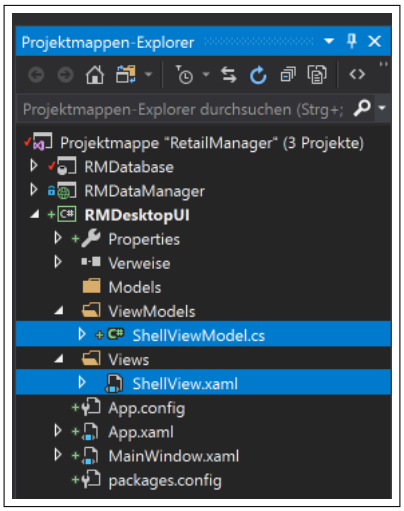
7.3 Adding Caliburn Micro MVVM-Framework

Add NuGet-Package to references.

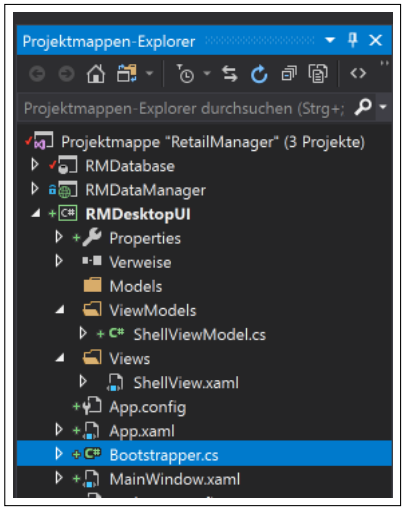
7.3.1 Adding the folder structure for the MVVM-Framework



7.3.2 Adding a new ShellViewModel class and a SchellView window

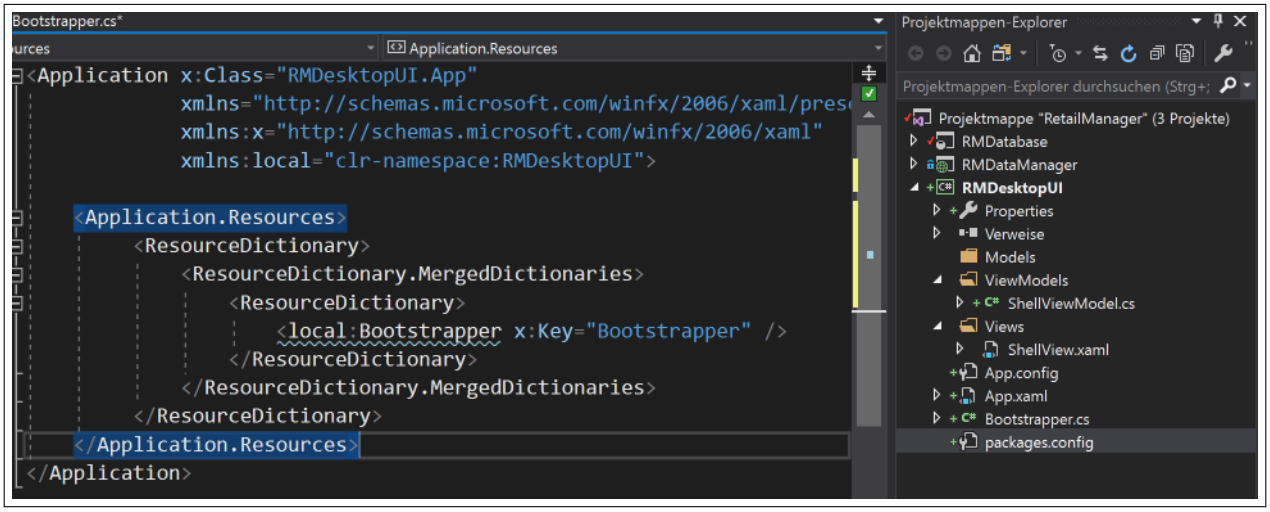


7.3.3 Adding a Bootstrapper class to DesktopUI




```
using System.Windows;
using Caliburn.Micro;
using RMDesktopUI.ViewModels;

namespace RMDesktopUI
{
    1-Verweis | 0 Änderungen | 0 Autoren, 0 Änderungen
    public class Bootstrapper : BootstrapperBase
    {
        // Constructor
        0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
        public Bootstrapper()
        {
            Initialize();
        }

        // Enables, that on start up ShellViewModel is getting launched as the base view.
        0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
        protected override void OnStartup(object sender, StartupEventArgs e)
        {
            DisplayRootViewFor<ShellViewModel>();
        }
    }
}
```

7.3.4 Removing StartUpURI from App.xaml and adding a new Ressource Dictionary



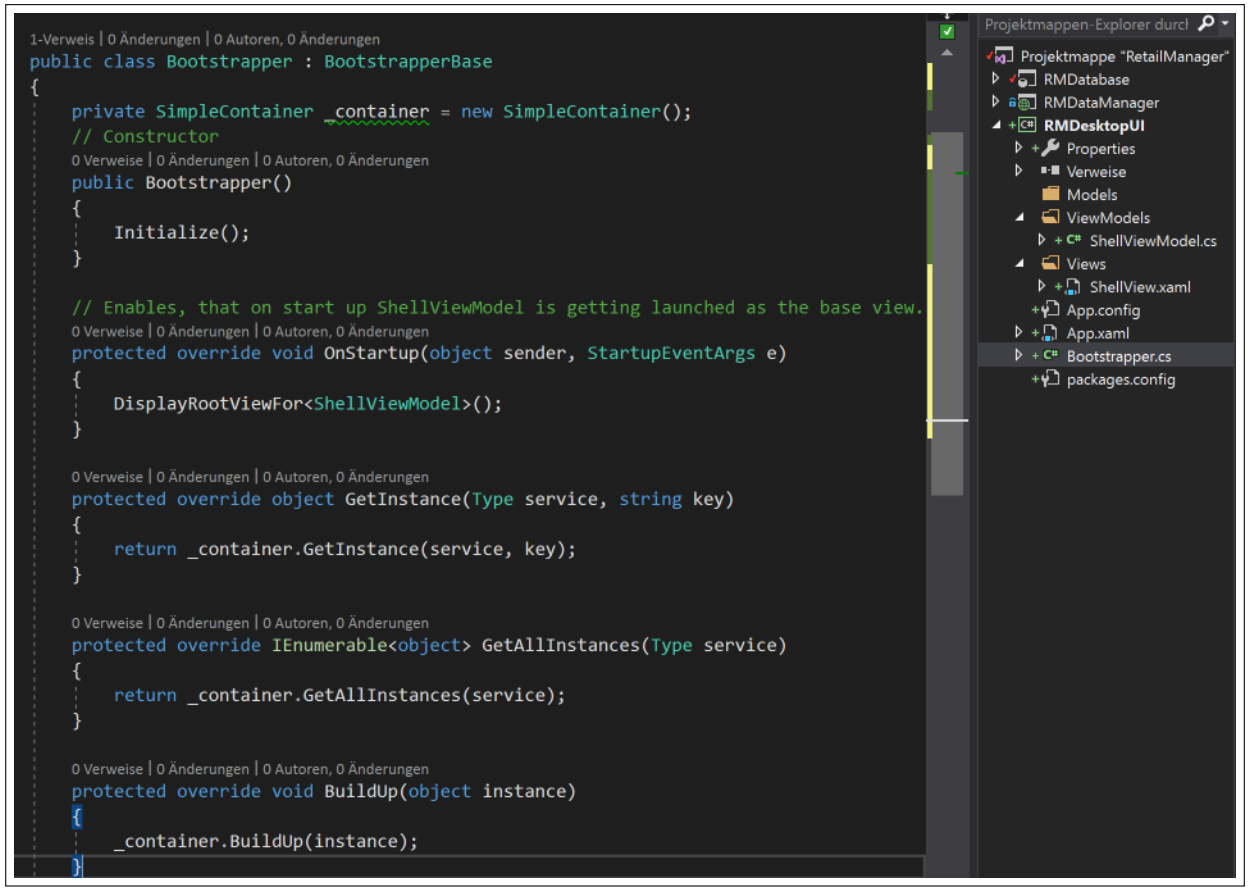
MainWindow.xaml can be deleted afterwards!!!

8 Dependency Injection in WPF

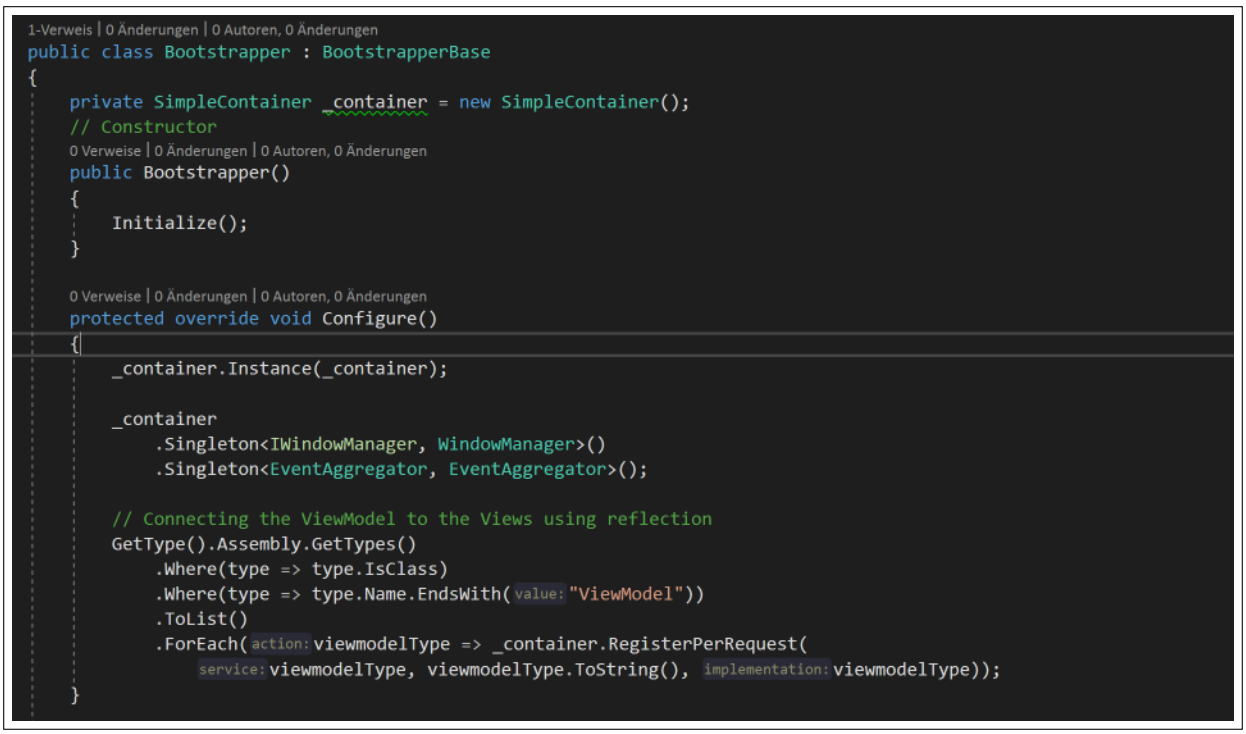
8.1 SimpleContainer in Caliburn Micro

Caliburn.Micro comes pre-bundled with a Dependency Injection container called SimpleContainer. A dependency injection container is an object that is used to hold dependency mappings for use later in an app via Dependency Injection. Dependency Injection is actually a pattern typically using the container element instead of manual service mapping.

8.1.1 Implementing SimpleContainer in Bootstrapper.cs



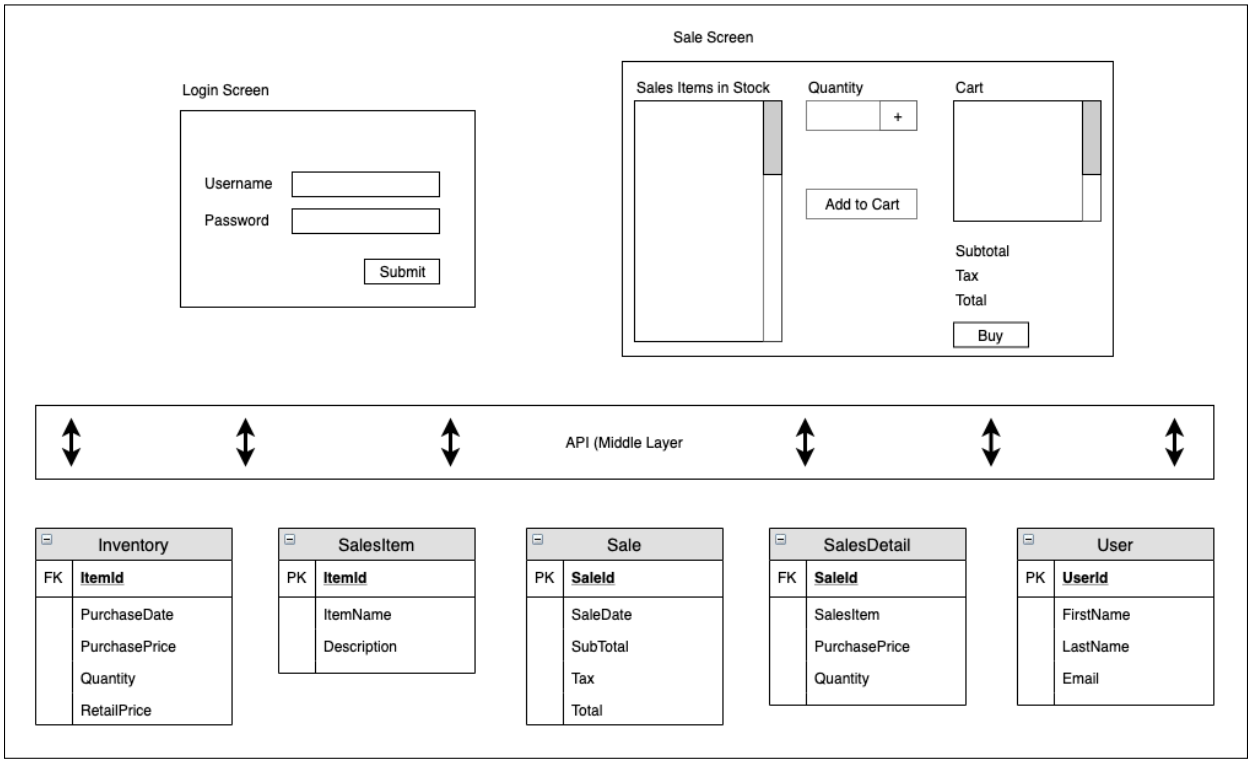
8.2 Overriding Configure() Method for the container



```
1-Verweis | 0 Änderungen | 0 Autoren, 0 Änderungen
public class Bootstrapper : BootstrapperBase
{
    private SimpleContainer _container = new SimpleContainer();
    // Constructor
    0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
    public Bootstrapper()
    {
        Initialize();
    }

    0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
    protected override void Configure()
    {
        _container.Instance(_container);

        _container
            .Singleton<IWindowManager, WindowManager>()
            .Singleton<EventAggregator, EventAggregator>();

        // Connecting the ViewModel to the Views using reflection
        GetType().Assembly.GetTypes()
            .Where(type => type.IsClass)
            .Where(type => type.Name.EndsWith(value: "ViewModel"))
            .ToList()
            .ForEach(action: viewmodelType => _container.RegisterPerRequest(
                service: viewmodelType, viewmodelType.ToString(), implementation: viewmodelType));
    }
```

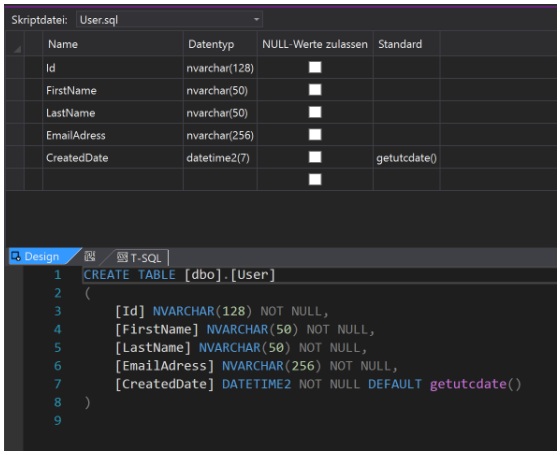
9 Datamodel - planning and setup

9.1 Planning the Register

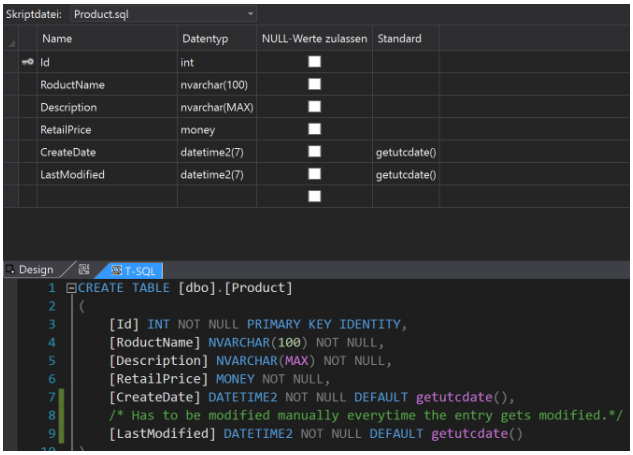


9.2 SQL Database Table Creation

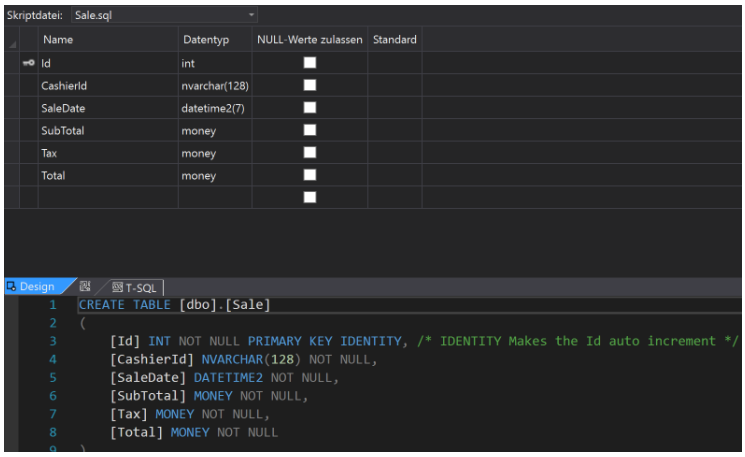
User.sql



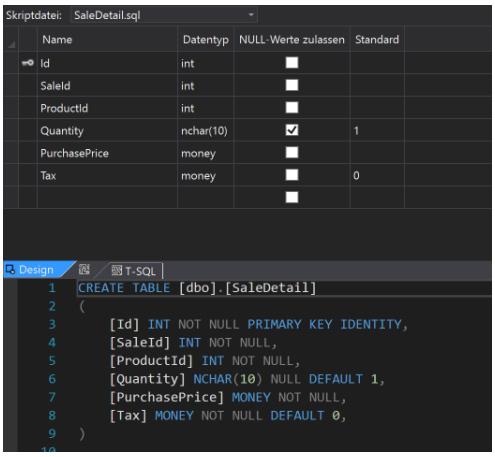
Product.sql



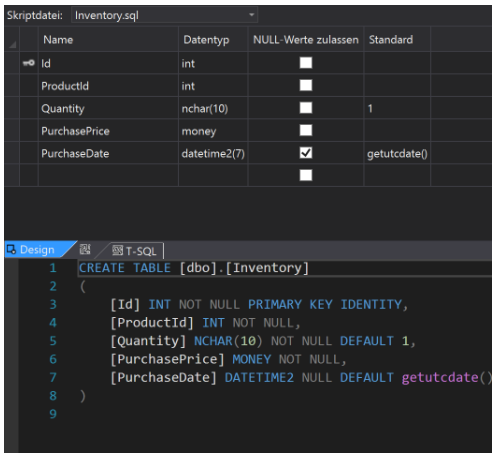
Sale.sql



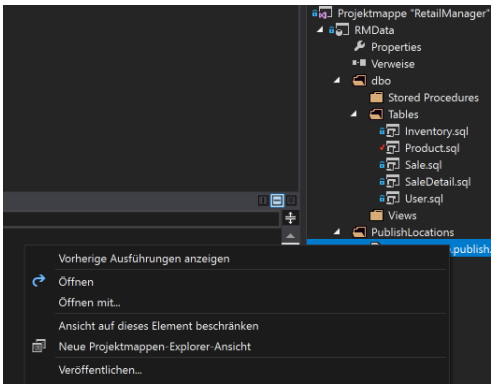
SaleDetail.sql



Inventory.sql



!!! **Publishing Tables** !!!



10 WPF Login Form Creation

10.1 Inheritance from the conductor class in Caliburn Micro

```
ShellViewModel.cs*
RMDesktopUI.ViewModels.ShellViewModel
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using Caliburn.Micro;

namespace RMDesktopUI.ViewModels
{
    1-Verweis | 0 Änderungen | 0 Autoren, 0 Änderungen
    public class ShellViewModel : Conductor<object> // Could also be set up more specifically
                                                    // for certain types, or even use an interface.
    {
    }
}
```

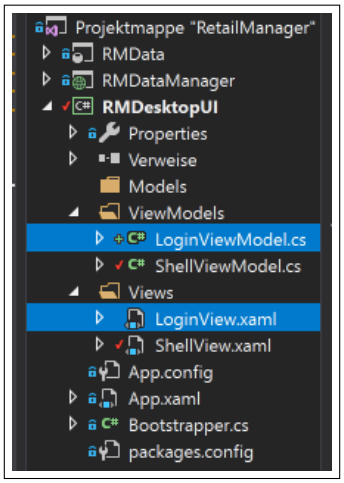
Conductor is a base class which inherits from Screen. Its responsibility is to conduct other objects by managing an active item and maintain a strict lifecycle of this conducted item. The conductor exists in multiple variants such as the one item conductor simple called Conductor, the multiple item conductors such as *Conductor.Collection.OneActiveandConductor.Collection.AllActive*.

10.2 Implementing the menue bar

```
<Window x:Class="RMDesktopUI.Views.ShellView"
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
        xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
        xmlns:local="clr-namespace:RMDesktopUI.Views"
        mc:Ignorable="d"
        Title="ShellView" Height="450" Width="800">
    <DockPanel>
        <Menu DockPanel.Dock="Top" FontSize="14">
            <MenuItem Header="_File">

            </MenuItem>
            <MenuItem Header="_Account">
                <MenuItem x:Name="LoginScreen" Header="_Login"/>
            </MenuItem>
        </Menu>
        <Grid>

        </Grid>
    </DockPanel>
</Window>
```

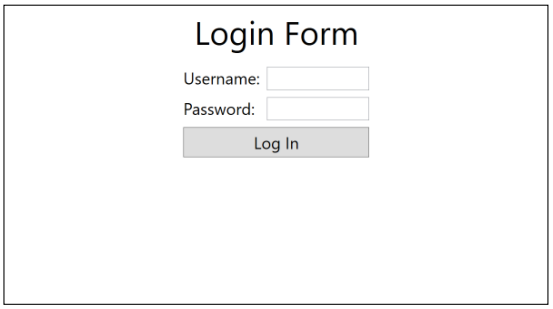
10.3 Adding a UserControl

10.3.1 Adding a class LoginViewModel (public) and UserControl LoginView



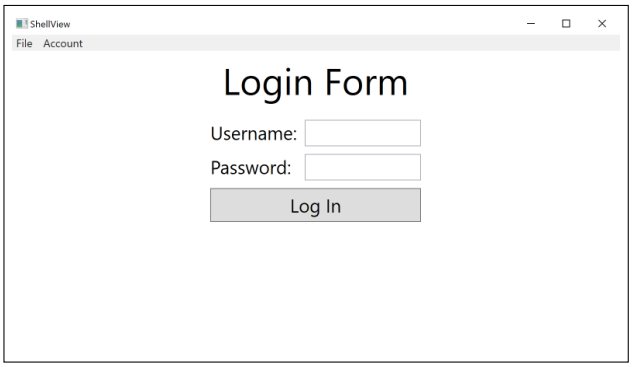
10.3.2 Designing the UserControl

```
<UserControl x:Class="RMDesktopUI.Views.LoginView"
             xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
             xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
             xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
             xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
             xmlns:local="clr-namespace:RMDesktopUI.Views"
             mc:Ignorable="d" Background="White" FontSize="24"
             d:DesignHeight="425" d:DesignWidth="800">
    <Grid>
        <Grid.ColumnDefinitions>
            <ColumnDefinition Width="*"/>
            <ColumnDefinition Width="Auto"/>
            <ColumnDefinition Width="Auto"/>
            <ColumnDefinition Width="*"/>
        </Grid.ColumnDefinitions>
        <Grid.RowDefinitions>
            <RowDefinition Height="Auto"/>
            <RowDefinition Height="Auto"/> <!-- Username -->
            <RowDefinition Height="Auto"/> <!-- Password -->
            <RowDefinition Height="Auto"/> <!-- Button -->
            <RowDefinition Height="*"/>
        </Grid.RowDefinitions>
        <TextBlock Grid.Row="0" Grid.Column="1" Grid.ColumnSpan="2"
                   HorizontalAlignment="Center" FontSize="48" Margin="0 0 0 20">
            Login Form
        </TextBlock>

        <!-- Username Row -->
        <TextBlock Grid.Row="1" Grid.Column="1" Margin="0 0 10 10">
            Username:
        </TextBlock>
        <TextBox x:Name="userName" Grid.Row="1" Grid.Column="2" MinWidth="150"
                 Margin="0 0 0 10"/>

        <!-- Password Row -->
        <TextBlock Grid.Row="2" Grid.Column="1" Margin="0 0 10 10">
            Password:
        </TextBlock>
        <TextBox x:Name="password" Grid.Row="2" Grid.Column="2" MinWidth="150"
                 Margin="0 0 0 10"/>

        <!-- Button Row -->
        <Button Grid.Row="3" Grid.Column="1" Grid.ColumnSpan="2" Padding="10 5"
                HorizontalContentAlignment="Center" x:Name="loginButton">
            Log In
        </Button>
    </Grid>
</UserControl>
```



10.3.3 Activating the LoginView on startup in the ShellView

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using Caliburn.Micro;

namespace RMDesktopUI.ViewModels
{
    2 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
    public class ShellViewModel : Conductor<object> // Could also be set up more speci
                                                    // for certain types, or even use
    {
        // Using constructor injection to pass in a new instance of loginVm
        private LoginViewModel _loginVm;
        0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
        public ShellViewModel(LoginViewModel loginVm)
        {
            _loginVm = loginVm;
            ActivateItem(_loginVm);

        }

        // Preventing from inheritance, because of virtual member call in constructor
        1-Verweis | 0 Änderungen | 0 Autoren, 0 Änderungen
        public sealed override void ActivateItem(object item)
        {
            base.ActivateItem(item);
        }
    }
}
```



Sealed is used to restrict the users from inheriting. A class can be sealed by using the sealed keyword or a single method. The keyword tells the compiler that class or method cannot be extended. No class can be derived from a sealed class.

10.3.4 Implementing LoginViewModel.cs

.cs PasswordBoxHelper.cs LoginView.xaml LoginViewModel.cs*

opUI RMI

```
using System;
using Caliburn.Micro;

namespace RMDesktopUI.ViewModels
{
    2 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
    public class LoginViewModel : Screen
    {
        /*
         * Backing fields
         */
        private string _userName;
        private string _password;

        /*
         * Public properties
         */
        2 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
        public string UserName
        {
            get => _userName;
            set
            {
                _userName = value;
                // It's going to be fired every time we change the user value
                NotifyOfPropertyChange(() => UserName);
            }
        }

        2 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
        public string Password
        {
            get => _password;
            set
            {
                _password = value;
                NotifyOfPropertyChange(() => Password);
            }
        }

        0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
        public bool CanLogIn(string userName, string password)
        {
            // Includes checking for null (?)
            var output = UserName?.Length > 0 && Password?.Length > 0;

            return output;
        }

        0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
        public void LogIn(string userName, string password)
        {
            Console.WriteLine(); // Just for now
        }
```

10.3.5 Connecting the LoginViewModel to Caliburn.Micro

1. Adding a helper class (PasswordBoxHelper.cs) to RMDesktopUI

```
using System.Reflection;
using System.Windows;
using System.Windows.Controls;

namespace RMDesktopUI.Helpers
{
    /*
     * The aim of this class is to include a binding convention so that binding in Caliburn.Mic
     * Source: https://stackoverflow.com/questions/30631522/caliburn-micro-support-for-password
     */
    1-Verweis | 0 Änderungen | 0 Autoren, 0 Änderungen
    public static class PasswordBoxHelper
    {
        public static readonly DependencyProperty BoundPasswordProperty =
            DependencyProperty.RegisterAttached(name: "BoundPassword",
                propertyType: typeof(string),
                ownerType: typeof(PasswordBoxHelper),
                new FrameworkPropertyMetadata(defaultValue: string.Empty, OnBoundPasswordChanged));

        2 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
        public static string GetBoundPassword(DependencyObject d)
        {
            if (!(d is PasswordBox box)) return (string) d.GetValue(dp: BoundPasswordProperty);

            // this funny little dance here ensures that we've hooked the
            // PasswordChanged event once, and only once.
            box.PasswordChanged -= PasswordChanged;
            box.PasswordChanged += PasswordChanged;

            return (string)d.GetValue(dp: BoundPasswordProperty);
        }

        1-Verweis | 0 Änderungen | 0 Autoren, 0 Änderungen
        public static void SetBoundPassword(DependencyObject d, string value)
        {...
```

2. Adding some lines to the constructor of Bootstrapper.cs

```
1-Verweis | 0 Änderungen | 0 Autoren, 0 Änderungen
public class Bootstrapper : BootstrapperBase
{
    private readonly SimpleContainer _container = new SimpleContainer();
    // Constructor
    0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
    public Bootstrapper()
    {
        Initialize();

        // Source: https://stackoverflow.com/questions/30631522/caliburn-micro-support-for-passwordbox
        ConventionManager.AddElementConvention<PasswordBox>(
            bindableProperty: PasswordBoxHelper.BoundPasswordProperty,
            parameterProperty: "Password",
            eventName: "PasswordChanged");
    }
```

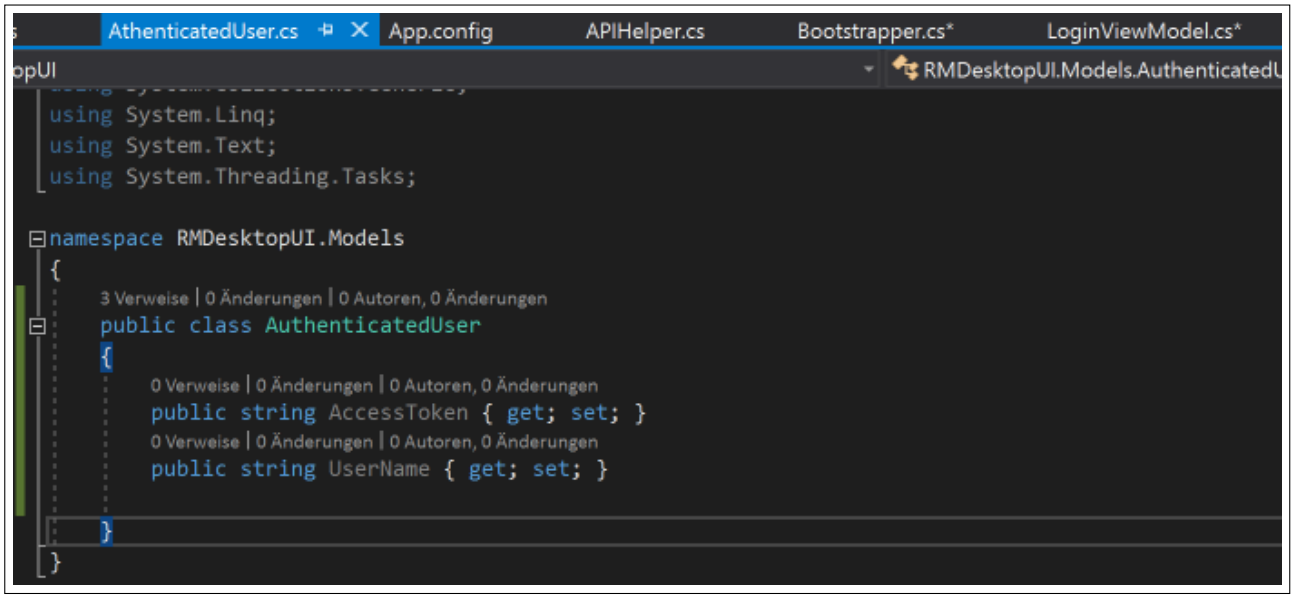
See the example on stackoverflow.com...

11 Wiring up the WPF Login Form

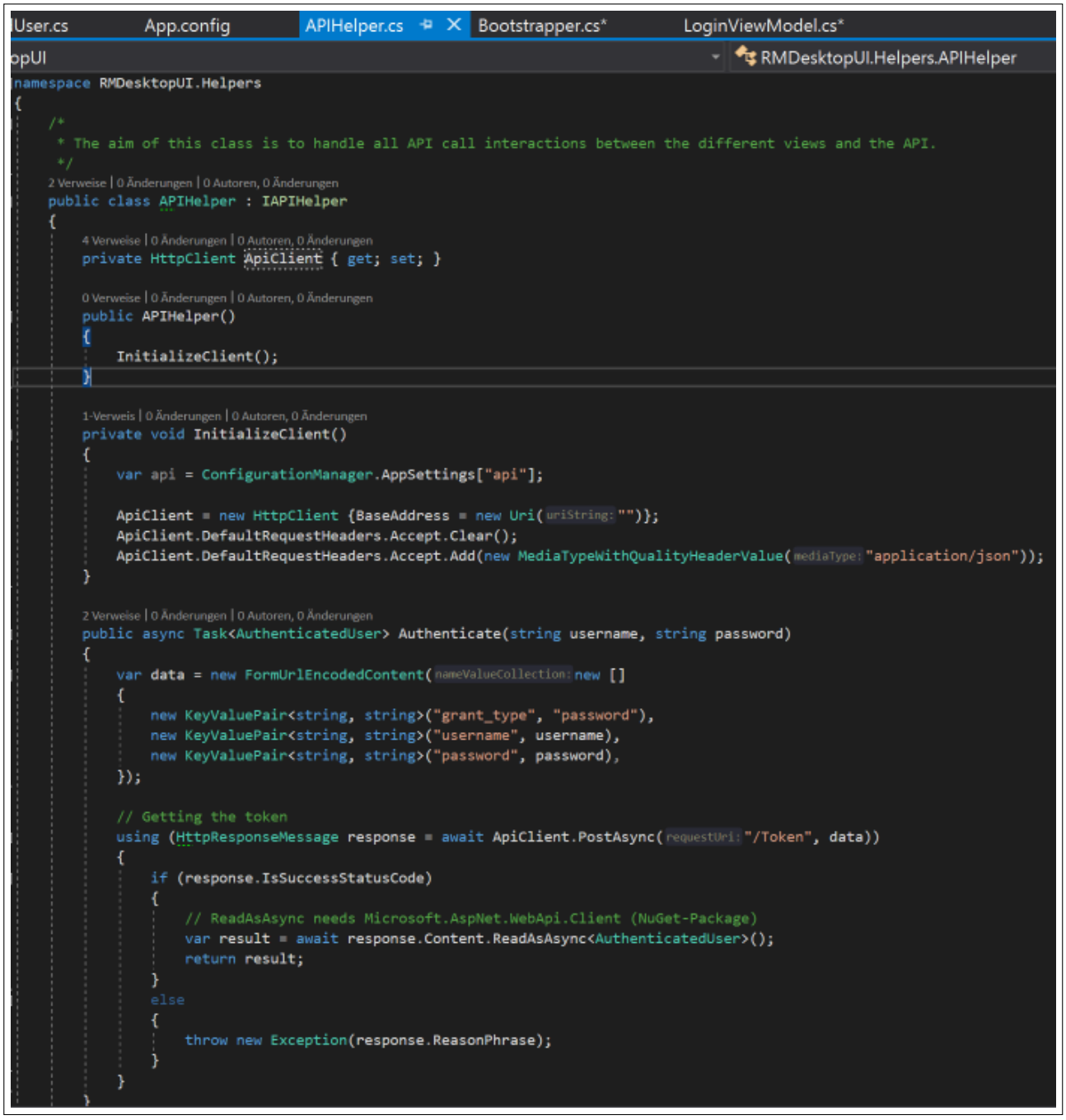
Connecting the login form button to the authentication API endpoint (/token). Gets back the bearer token or an exception if failed.

11.1 Implementing a class AuthenticatedUser.cs

Holds the information for already authenticated users.

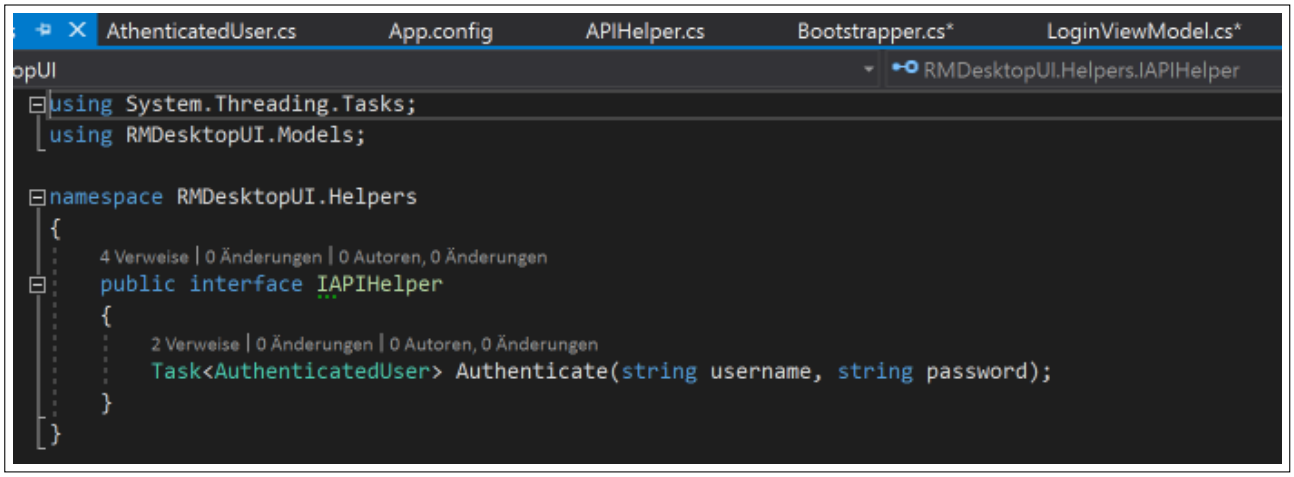


11.2 Implementing a helper class to handle API call interactions

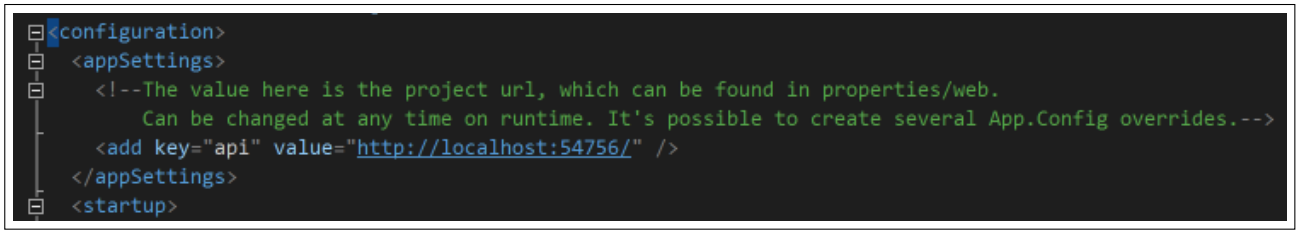


11.3 Implementing a Interface IAPIHelper.cs

Needed for dependency injection, in order to add it to the Configure() method in Bootstrapper.cs



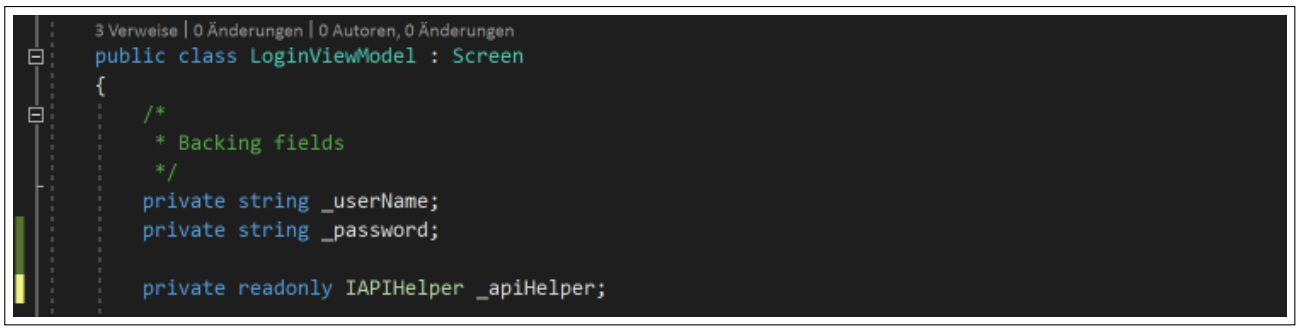
11.4 Adding <appsettings> to App.Config



11.5 Adding APIHelper and IAPIHelper to the container in Bootstrapper.cs

11.6 Applying some changings to LoginViewModel.cs

11.6.1 Adding a new private property as a backing field



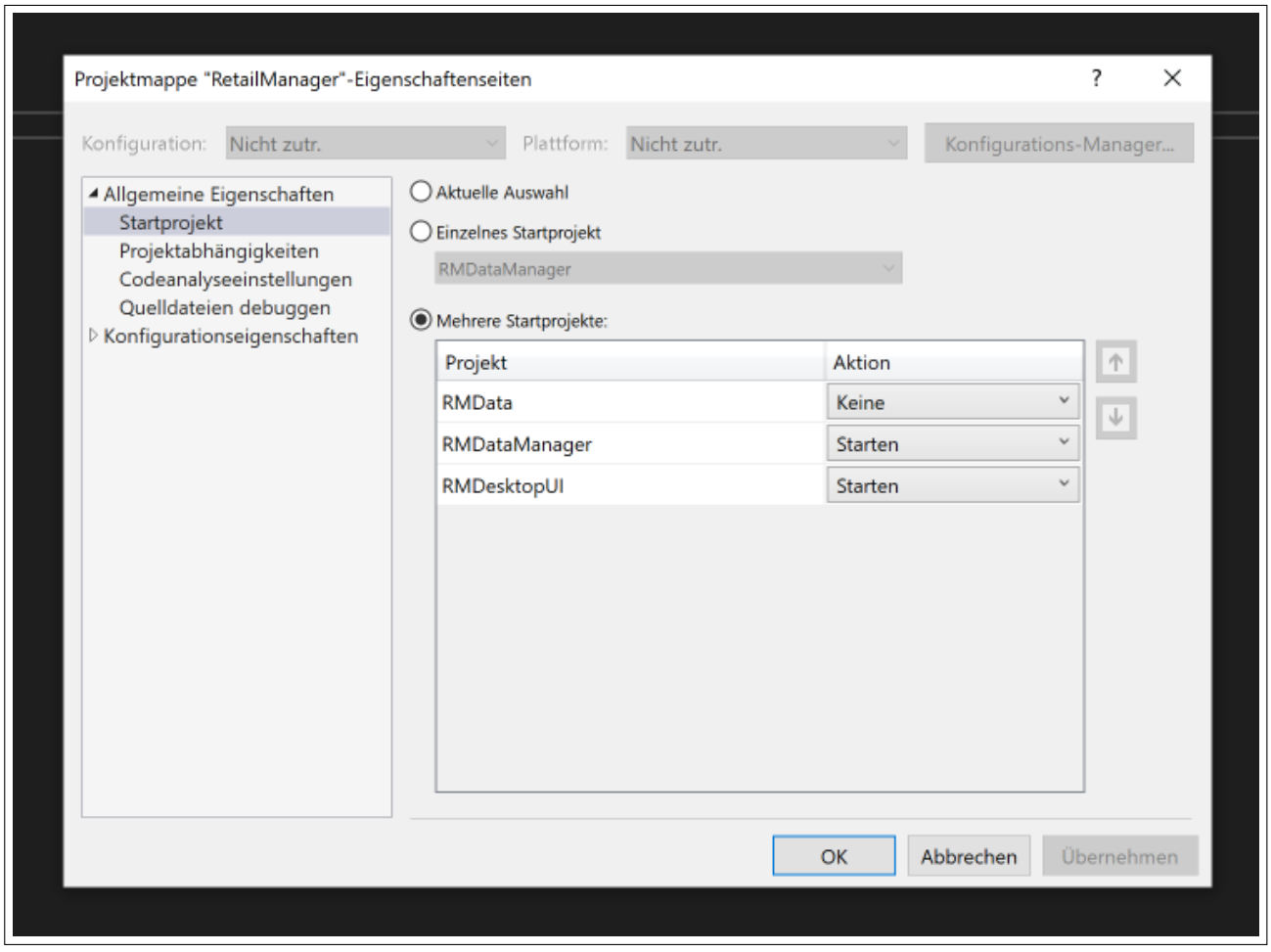
11.6.2 Adding a constructor and initializing the property from within

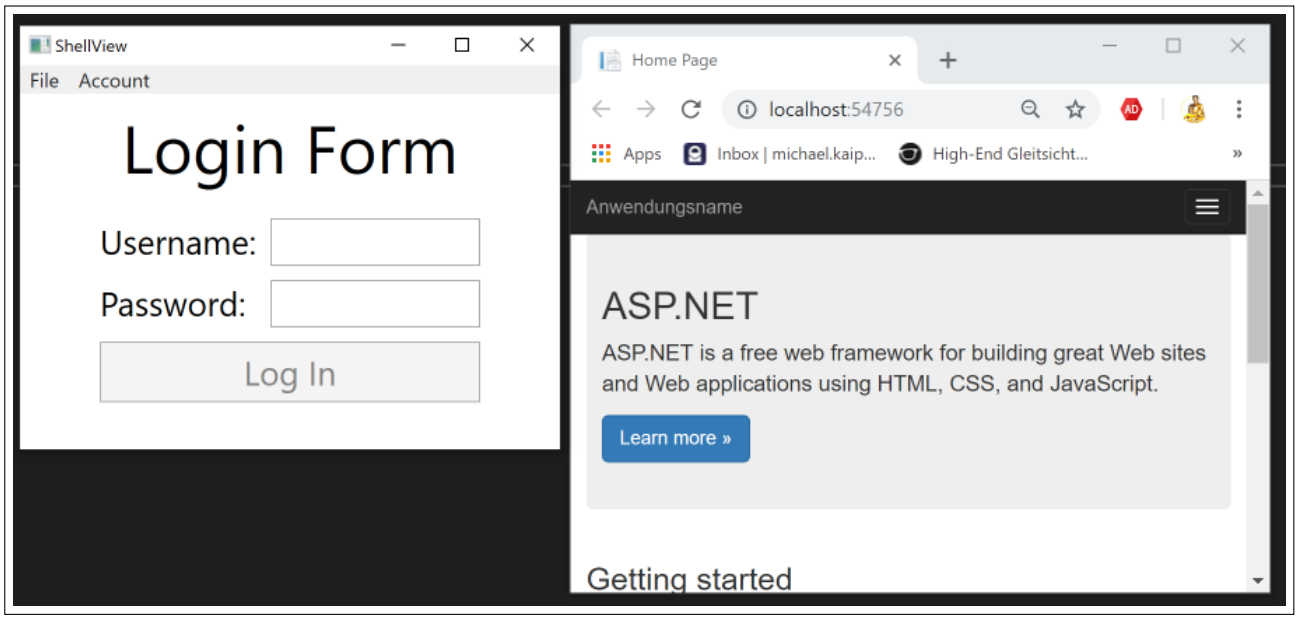
```
/*
 * Constructor
 */
0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
public LoginViewModel(IAPIHelper apiHelper)
{
    _apiHelper = apiHelper;
}
```

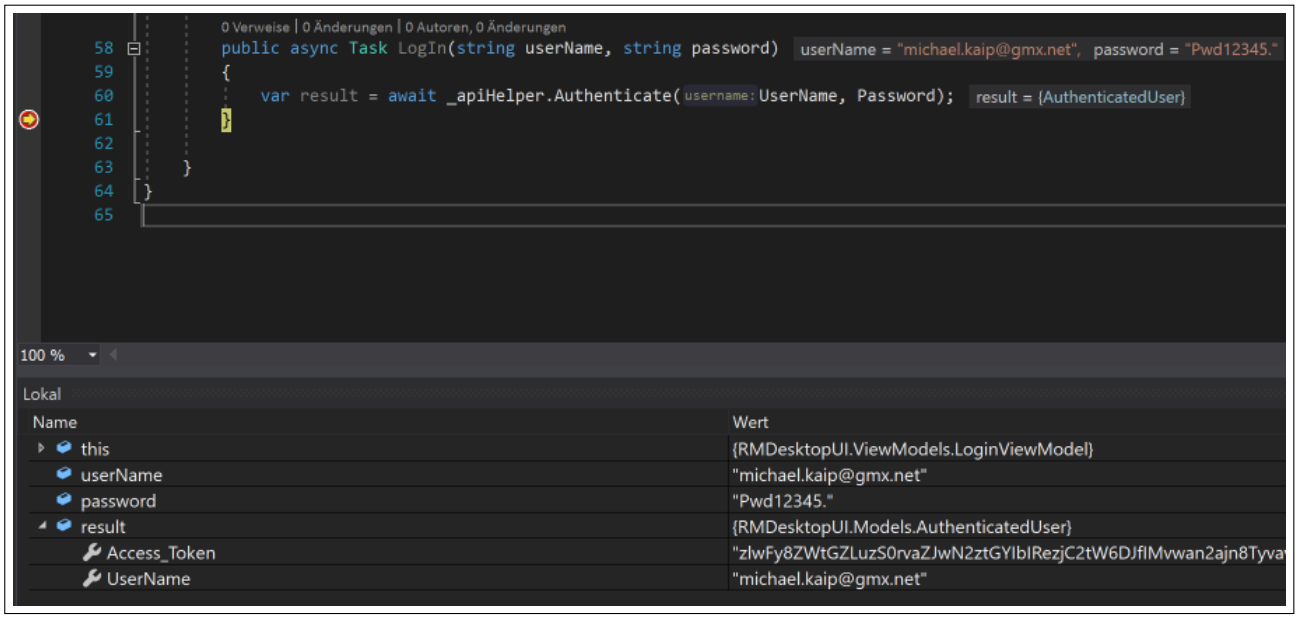
11.6.3 Implementig the Login() method

```
0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
public async Task LogIn(string userName, string password)
{
    try
    {
        var result = await _apiHelper.Authenticate(username:UserName, Password);
    }
    catch (Exception ex)
    {

        Console.WriteLine(ex.Message);
    }
}
```

11.7 Enabling the solution to start multiple projects




ShellView
File Account
Login Form
Username:
Password:
Log In
Home Page
localhost:54756
Apps
Inbox | michael.kaip...
High-End Gleitsicht...
Anwendungsname
ASP.NET
ASP.NET is a free web framework for building great Web sites and Web applications using HTML, CSS, and JavaScript.
Learn more »
Getting started


0 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
public async Task LogIn(string userName, string password)
userName = "michael.kaip@gmx.net", password = "Pwd12345."
{
var result = await _apiHelper.Authenticate(username: UserName, Password);
result = {AuthenticatedUser}
}
100 %
Lokal
Name
Wert
this
{RMDesktopUI.ViewModels.LoginViewModel}
userName
"michael.kaip@gmx.net"
password
"Pwd12345."
result
{RMDesktopUI.Models.AuthenticatedUser}
Access_Token
UserName
"michael.kaip@gmx.net"

12 Login Form Error Handling

12.1 Displaying an login error message within the login form

```
<Grid.RowDefinitions>
    <RowDefinition Height="Auto"/>
    <RowDefinition Height="Auto"/> <!-- Error Message -->
    <RowDefinition Height="Auto"/> <!-- Username -->
    <RowDefinition Height="Auto"/> <!-- Password -->
    <RowDefinition Height="Auto"/> <!-- Button -->
    <RowDefinition Height="*"/>
</Grid.RowDefinitions>
<TextBlock Grid.Row="0" Grid.Column="1" Grid.ColumnSpan="2"
           HorizontalAlignment="Center" FontSize="48" Margin="0 0 0 20">
    Login
</TextBlock>

<!-- Error Message Row -->
<TextBlock x:Name="ErrorMessage"
           Grid.Row="1" Grid.Column="1" Grid.ColumnSpan="2"
           Margin="0 0 0 20" Foreground="Red" MaxWidth="270"
           Visibility="{Binding IsErrorVisible, Converter={StaticResource BooleanToVisibilityConverter}}"
           FontSize="12" TextWrapping="Wrap"/>

<!-- Username Row -->
```

Through $\boxed{Visibility}$ the funktionality of collapsing the error message space in case of no error is going to be displayed is added. In case of an error the field expands and the error is going to be displayed. To make it work, first the $\boxed{BooleanToVisibilityConverter}$ has to be added to the RessourceDictionary in App.xaml:

```
                <local:Bootstrapper x:Key="Bootstrapper" />
            </ResourceDictionary>
        </ResourceDictionary.MergedDictionaries>
        <BooleanToVisibilityConverter x:Key="BooleanToVisibilityConverter"/>
    </ResourceDictionary>
</Application.Resources>
</Application>
```

Afterwards properties for $\boxed{ErrorMessage}$ and $\boxed{IsErrorVisible}$ has to be implemented in LoginViewModel.cs:

```
1-Verweis | 0 Änderungen | 0 Autoren, 0 Änderungen
public bool IsErrorVisible
{
    get
    {
        var output = ErrorMessage?.Length > 0;

        return output;
    }
}

private string _errorMessage;
2 Verweise | 0 Änderungen | 0 Autoren, 0 Änderungen
public string ErrorMessage
{
    get => _errorMessage;
    set
    {
        _errorMessage = value;
        NotifyOfPropertyChange(() => _errorMessage);
        NotifyOfPropertyChange(() => IsErrorVisible);
    }
}
```

And finally the Login() method has to be changed in the way, that in case of an exception, the exception message is stored into the $\boxed{ErrorMessage}$ property:

```
public async Task LogIn(string userName, string password)
{
    try
    {
        var result = await _apiHelper.Authenticate(username:UserName, Password);
    }
    catch (Exception ex)
    {

        ErrorMessage = ex.Message;
    }
}
```