Bearer Token Sicherheit

mit ASP.NET Core

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Agenda

- Grundlagen
  - Was ist Bearer Token Security
  - Was ist JWT?
- Claims
- Token
  - Erstellen
  - Übermitteln
  - Prüfen
- Authorization
- API-Key

Verwendete Software

Software-Versionen

- Entwicklungsumgebungen
  - Visual Studio 2022 (17.4.0+)
  - Visual Studio Code
  - JetBrains Rider
  - …
- .NET (Core)
  - .NET 5.0+

Grundlagen

Grundlagen- die Ausweispapiere bitte

- “Give access to the bearer of this token.”
- Jeder Request liefert einen Bearer, ein Token mit
  - „Normalerweise“ via Header `Authorization: Bearer <Token>`
  - Wird normalerweise von einem Server bei der Anmeldung erzeugt
  - JWT (Json Web Token) wird oft verwendet, nehmen wir auch

https://www.pexels.com

`https://swagger.io/docs/specification/authentication/bearer-authentication/`

Was sollte im “Token” stehen? Was nicht?

- Unveränderliche Informationen
  - Name
  - EmailAdresse
  - (Relevante)Rollen-/ Gruppenzugehörigkeiten

- Veränderliche Informationen
  - Alter
- Blobs
  - Foto
- Sensibles
  - Kennwörter
  - PINs

Sicherheitsmerkmale

- Herausgeber
  - Issuer
- Signatur des Herausgebers
  - IssuerSigningKey
- Gültigkeit
  - LifeTime
- …

Struktur des Ausweises - Schema

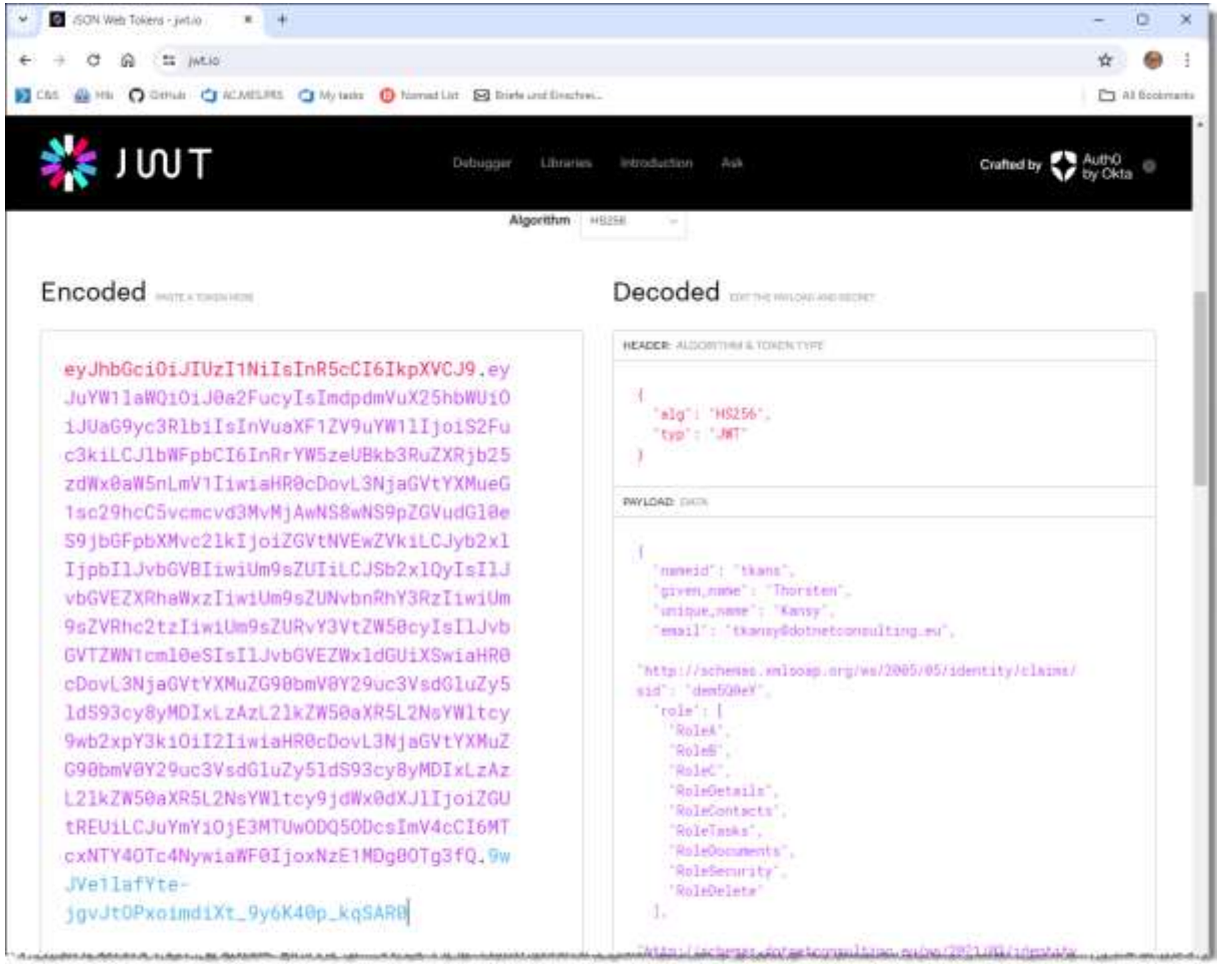
- JWT Json Web Token
  - Base64 kodiertes JSON

```
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJuYW1laWQiOiJ0a2FucyIsImdpdmVuX25hbWUiOiJUaG9yc3RlbiIsInVuaXF1ZV9
uYW1lIjoiS2Fuc3kiLCJlbWFpbCI6InRrYW5zeUBkb3RuZXRjb25zdWx0aW5nLmV1IiwiaHR0cDovL3NjaGVtYXMueG1sc29hcC5vcmc
vd3MvMjAwNS8wNS9pZGVudGl0eS9jbGFpbXMvc2lkIjoiZGVtNVEwZVkiLCJyb2xlIjpbIlJvbGVBIiwiUm9sZUIiLCJSb2xlRGV0YWl
scyIsIlJvbGVDb250YWN0cyIsIlJvbGVUYXNrcyIsIlJvbGVEb2N1bWVudHMiLCJSb2xlU2VjdXJpdHkiLCJSb2xlRGVsZXRlIl0sImh
0dHA6Ly9zY2hlbWFzLmRvdG5ldGNvbnN1bHRpbmcuZXUvd3MvMjAyMS8wMy9pZGVudGl0eS9jbGFpbXMvcG9saWN5IjoiNiIsImh0dHA
6Ly9zY2hlbWFzLmRvdG5ldGNvbnN1bHRpbmcuZXUvd3MvMjAyMS8wMy9pZGVudGl0eS9jbGFpbXMvY3VsdHVyZSI6ImRlLURFIiwibmJ
mIjoxNjYyNzEzNTA0LCJleHAiOjE2NjMzMTgzMDQsImlhdCI6MTY2MjcxMzUwNH0.2VnHoVtbo6Vbr5Q9fKbuBifPUVc8Y84g9GgSYWS
EGGw
```

(732 Bytes)

https://jwt.io

JWT.io

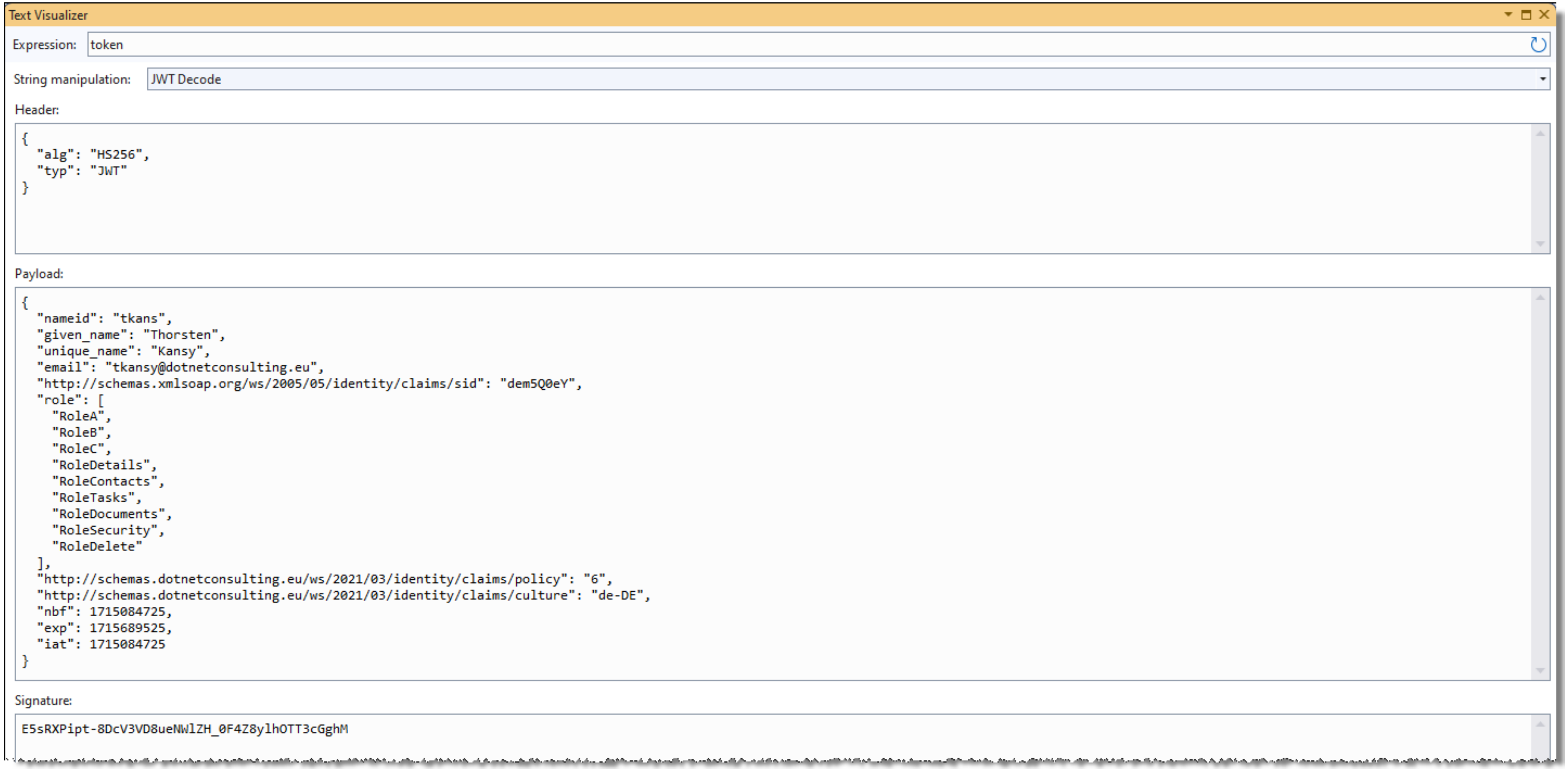


```
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.ey
JuYW1laWQiOiJ0a2FucyIsImdpdmVuX25hbWUiO
iJUaG9yc3RlbiIsInVuaXF1ZV9uYW1lIjoiS2Fu
c3kiLCJlbWFpbCI6InRrYW5zeUBkb3RuZXRjb25
zdWx0aW5nLmV1IiwiaHR0cDovL3NjaGVtYXMueG
1sc29hcC5vcmcvd3MvMjAwNS8wNS9pZGVudGl0e
S9jbGFpbXMvc2lkIjoiZGVtNVEwZVkiLCJyb2xl
IjpbIlJvbGVBIiwiUm9sZUIiLCJSb2xlQyIsIlJ
vbGVEZXRhaWxzIiwiUm9sZUNvbnRhY3RzIiwiUm
9sZVRhc2tzIiwiUm9sZURvY3VtZW50cyIsIlJvb
GVTZWN1cml0eSIsIlJvbGVEZWxldGUiXSwiaHR0
cDovL3NjaGVtYXMuZG90bmV0Y29uc3VsdGluZy5
ldS93cy8yMDIxLzAzL2lkZW50aXR5L2NsYWltcy
9wb2xpY3kiOiI2IiwiaHR0cDovL3NjaGVtYXMuZ
G90bmV0Y29uc3VsdGluZy5ldS93cy8yMDIxLzAz
L2lkZW50aXR5L2NsYWltcy9jdWx0dXJlIjoiZGU
tREUiLCJuYmYiOjE3MTUwODQ5ODcsImV4cCI6MT
cxNTY4OTc4NywiaWF0IjoxNzE1MDg0OTg3fQ.9w
JVe1lafYte-
jgvJtOPxoimdiXt_9y6K40p_kqSAR0
```

```
{
  "alg": "HS256",
  "typ": "JWT"
}
```

```
{
  "nameid": "tkans",
  "given_name": "Thorsten",
  "unique_name": "Kansy",
  "email": "tkansy@dotnetconsulting.eu",
 "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/
sid": "dem5Q0eY",
  "role": [
    "RoleA",
    "RoleB",
    "RoleC",
    "RoleDetails",
    "RoleContacts",
    "RoleTasks",
    "RoleDocuments",
    "RoleSecurity",
    "RoleDelete"
  ],
 "http://schemas.dotnetconsulting.eu/ws/2021/03/identity
```

Visual Studio



Expression: token

String manipulation: JWT Decode

Header:

```
{
  "alg": "HS256",
  "typ": "JWT"
}
```

Payload:

```
{
  "nameid": "tkans",
  "given_name": "Thorsten",
  "unique_name": "Kansy",
  "email": "tkansy@dotnetconsulting.eu",
  "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/sid": "dem5Q0eY",
  "role": [
    "RoleA",
    "RoleB",
    "RoleC",
    "RoleDetails",
    "RoleContacts",
    "RoleTasks",
    "RoleDocuments",
    "RoleSecurity",
    "RoleDelete"
  ],
  "http://schemas.dotnetconsulting.eu/ws/2021/03/identity/claims/policy": "6",
  "http://schemas.dotnetconsulting.eu/ws/2021/03/identity/claims/culture": "de-DE",
  "nbf": 1715084725,
  "exp": 1715689525,
  "iat": 1715084725
}
```

Signature:

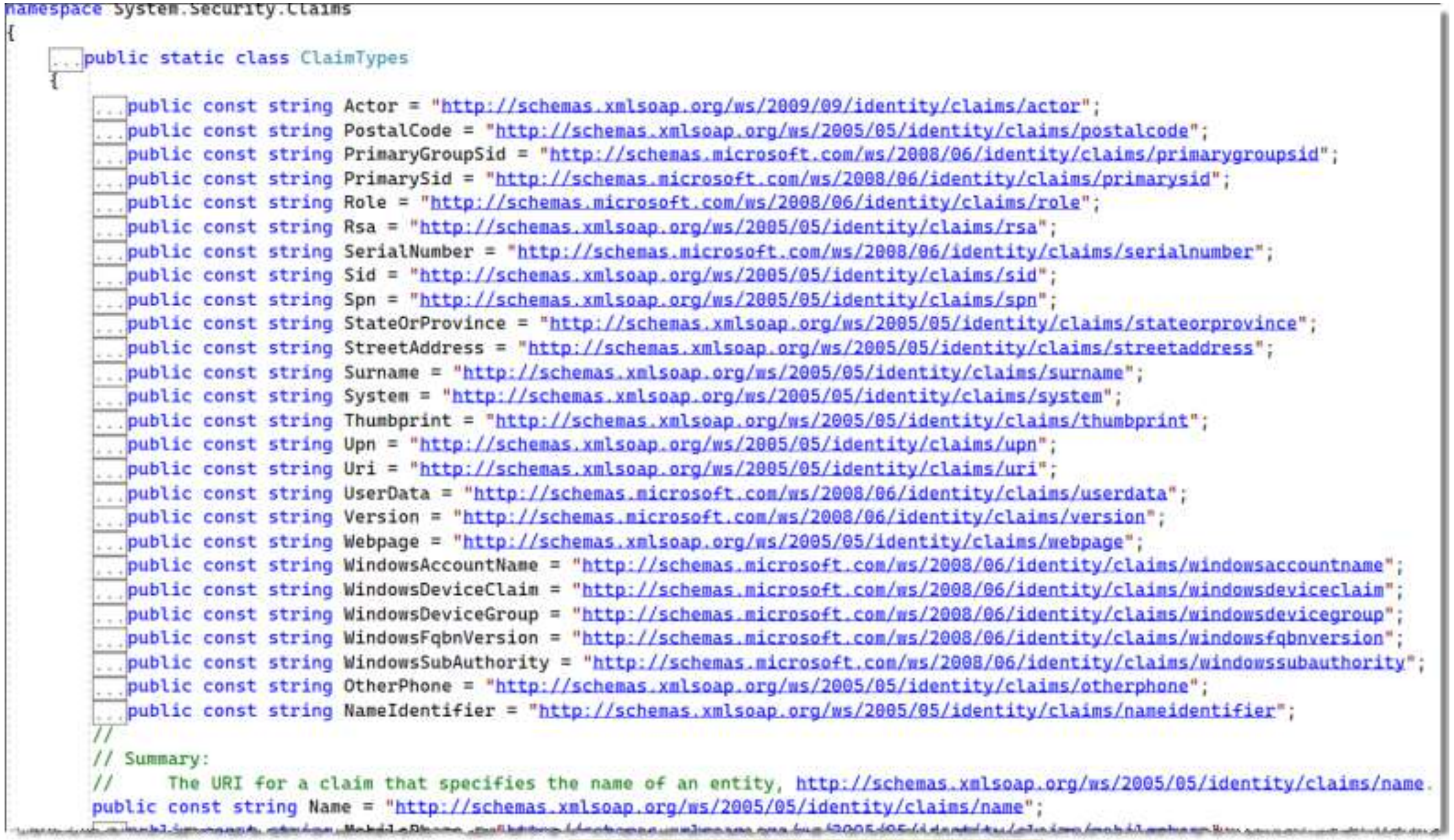
```
E5sRXPipt-8DcV3VD8ueNWlZH_0F4Z8ylhOTT3cGghM
```

Demo

Claims

Einträge in dem Ausweis - Claims

Standards unter `System.Security.Claims.ClaimTypes`



```
namespace System.Security.Claims
{
    ...public static class ClaimTypes
    {
        ...public const string Actor = "http://schemas.xmlsoap.org/ws/2009/09/identity/claims/actor";
        ...public const string PostalCode = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/postalcode";
        ...public const string PrimaryGroupSid = "http://schemas.microsoft.com/ws/2008/06/identity/claims/primarygroupsid";
        ...public const string PrimarySid = "http://schemas.microsoft.com/ws/2008/06/identity/claims/primarysid";
        ...public const string Role = "http://schemas.microsoft.com/ws/2008/06/identity/claims/role";
        ...public const string Rsa = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/rsa";
        ...public const string SerialNumber = "http://schemas.microsoft.com/ws/2008/06/identity/claims/serialnumber";
        ...public const string Sid = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/sid";
        ...public const string Spn = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/spn";
        ...public const string StateOrProvince = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/stateorprovince";
        ...public const string StreetAddress = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/streetaddress";
        ...public const string Surname = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/surname";
        ...public const string System = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/system";
        ...public const string Thumbprint = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/thumbprint";
        ...public const string Upn = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/upn";
        ...public const string Uri = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/uri";
        ...public const string UserData = "http://schemas.microsoft.com/ws/2008/06/identity/claims/userdata";
        ...public const string Version = "http://schemas.microsoft.com/ws/2008/06/identity/claims/version";
        ...public const string Webpage = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/webpage";
        ...public const string WindowsAccountName = "http://schemas.microsoft.com/ws/2008/06/identity/claims/windowsaccountname";
        ...public const string WindowsDeviceClaim = "http://schemas.microsoft.com/ws/2008/06/identity/claims/windowsdeviceclaim";
        ...public const string WindowsDeviceGroup = "http://schemas.microsoft.com/ws/2008/06/identity/claims/windowsdevicegroup";
        ...public const string WindowsFqbnVersion = "http://schemas.microsoft.com/ws/2008/06/identity/claims/windowsfqbnversion";
        ...public const string WindowsSubAuthority = "http://schemas.microsoft.com/ws/2008/06/identity/claims/windowssubauthority";
        ...public const string OtherPhone = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/otherphone";
        ...public const string NameIdentifier = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/nameidentifier";
        //
        // Summary:
        //     The URI for a claim that specifies the name of an entity, http://schemas.xmlsoap.org/ws/2005/05/identity/claims/name.
        public const string Name = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/name";
        ...public const string MobilePhone = "http://schemas.xmlsoap.org/ws/2005/05/identity/claims/mobilephone";
```

Einträge in dem Ausweis - Claims

Eigene Claims möglich

```
public static class JwtCustomClaims
{
    public const string Culture =
                            "http://schemas.dotnetconsulting.eu/ws/2021/03/identity/claims/culture";
    public const string TransactionId =
                            "http://schemas.dotnetconsulting.eu/ws/2021/03/identity/claims/transid";
    public const string Policy =
                            "http://schemas.dotnetconsulting.eu/ws/2021/03/identity/claims/policy";
}
```

Einträge in dem Ausweis - Claims

Claims können mehrfach vorkommen

```
public static string? UserId(this ClaimsPrincipal ClaimsPrincipal)
{
    return ClaimsPrincipal?.Claims?
       .FirstOrDefault(w => w.Type! == ClaimTypes.NameIdentifier)?.Value;
}
```

Demo

Token

Token erstellen

Microsoft.IdentityModel.Tokens.SecurityTokenDescriptor

```
SecurityTokenDescriptor tokenDescriptor = new()
{
    Subject = new ClaimsIdentity(new Claim[]
    {
            // Claims
            new Claim(ClaimTypes.Email, "tkansy@dotnetconsulting.eu"),
            // Custom types
            new Claim(JwtCustomClaims.Culture, "de-DE")
    }),

    Expires = DateTime.UtcNow.AddSeconds(3600),
    SigningCredentials = new SigningCredentials(new SymmetricSecurityKey(key), SecurityAlgorithms.HmacSha256Signature)
};
```

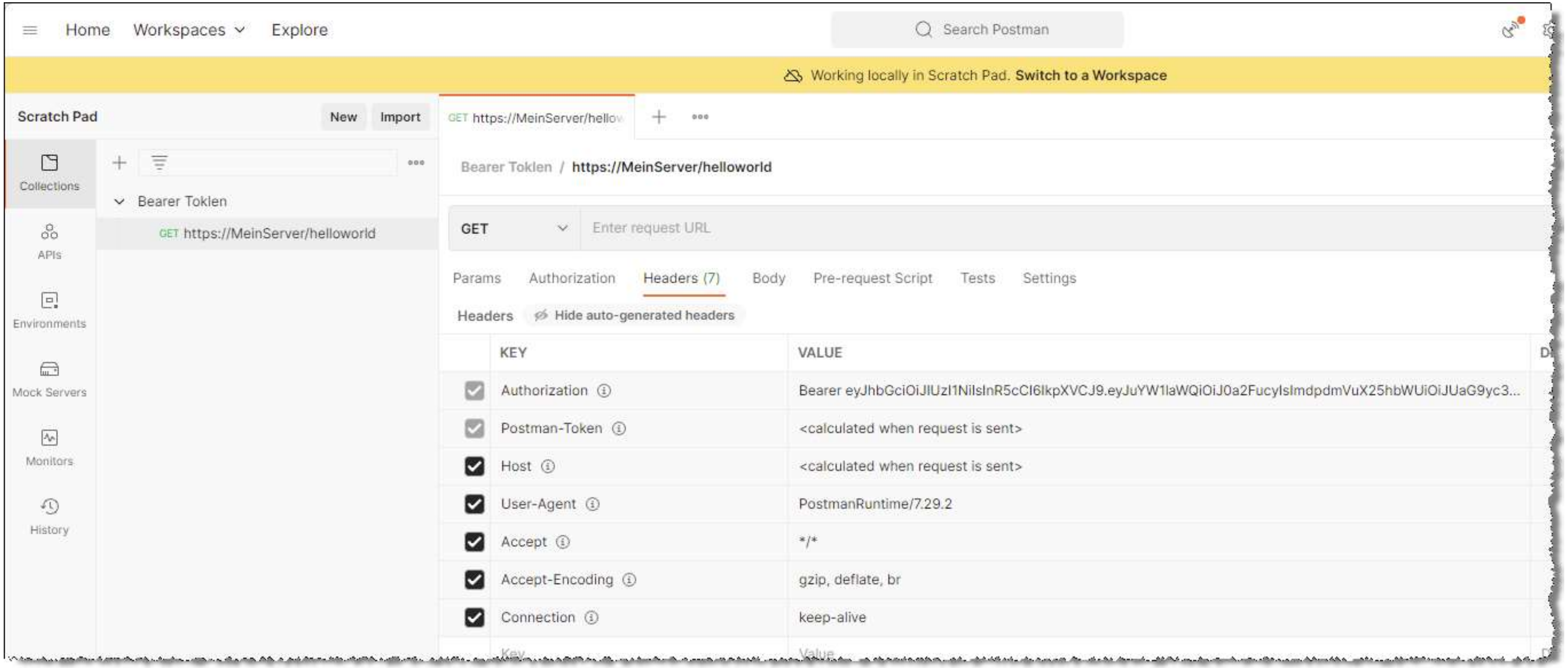
Demo

Token übermitteln/ speichern

Freie Wahl der Übermittlung/ Bereitstellung

- Header
- Body
- Code/ Datei
- …

Authorization Header



	KEY	VALUE
☑	Authorization ⓘ	Bearer eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJuYW1laWQiOiJ0a2FucyIsImdpdmVuX25hbWUiOiJUaG9yc3...
☑	Postman-Token ⓘ	<calculated when request is sent>
☑	Host ⓘ	<calculated when request is sent>
☑	User-Agent ⓘ	PostmanRuntime/7.29.2
☑	Accept ⓘ	*/*
☑	Accept-Encoding ⓘ	gzip, deflate, br
☑	Connection ⓘ	keep-alive
	Key	Value

Custom Cookie

`Microsoft.AspNetCore.Authentication.JwtBearer. JwtBearerEvents`

```
options.Events = new JwtBearerEvents()
{
    OnMessageReceived = context =>
    {
        string tokenKey = context.Request.Query["t"];
        if (tokenKey is null)
            context.Fail(new JwtValidationException());
        context.Token = context.Request.Cookies[$"JwtToken-{tokenKey}"];

        // Oder fest codiert?
        context.Token = "eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9. ";
        return Task.CompletedTask;
    }
};
```

Demo

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Token validieren

`Microsoft.AspNetCore.Authentication.JwtBearer.JwtBearerOptions`

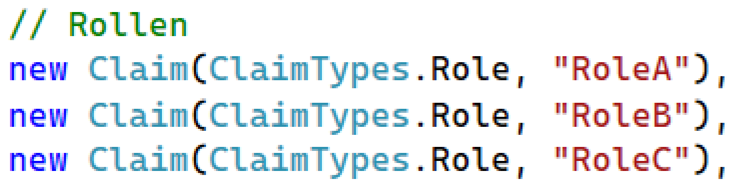
```
...
options.RequireHttpsMetadata = false;
options.SaveToken = true;
options.TokenValidationParameters = new()
{
    ValidateIssuerSigningKey = true,
    IssuerSigningKey = new SymmetricSecurityKey(key),
    ValidateIssuer = false,
    ValidateAudience = false,
    ValidateLifetime = true
};
...
```

Demo

Roles+Authorization

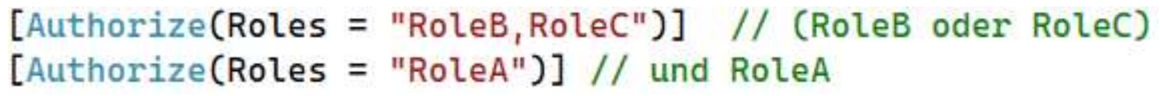
Roles + Authorize-Attribute

ClaimTypes.Role



```
// Rollen
new Claim(ClaimTypes.Role, "RoleA"),
new Claim(ClaimTypes.Role, "RoleB"),
new Claim(ClaimTypes.Role, "RoleC"),
```

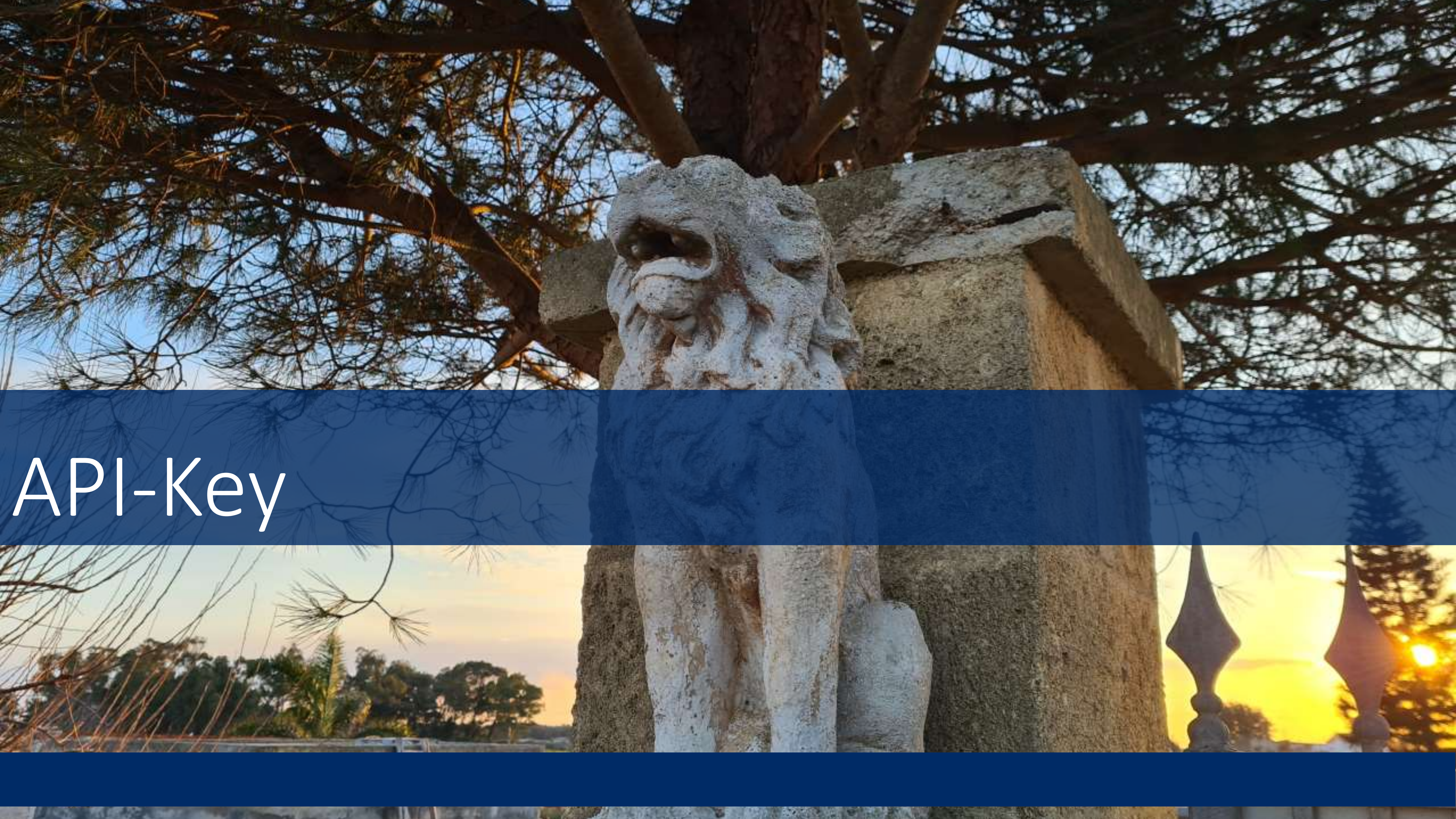
Authorize-Attribute



```
[Authorize(Roles = "RoleB,RoleC")]  // (RoleB oder RoleC)
[Authorize(Roles = "RoleA")] // und RoleA
```

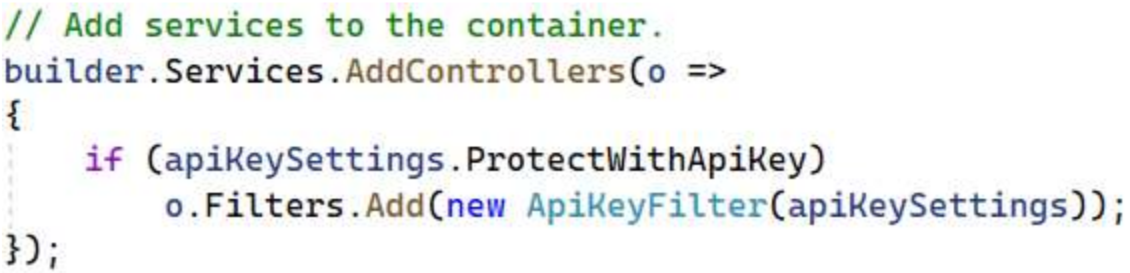
Demo

API-Key



Kombination mit anderen Sicherheits-Schemata

z.B. API-Key



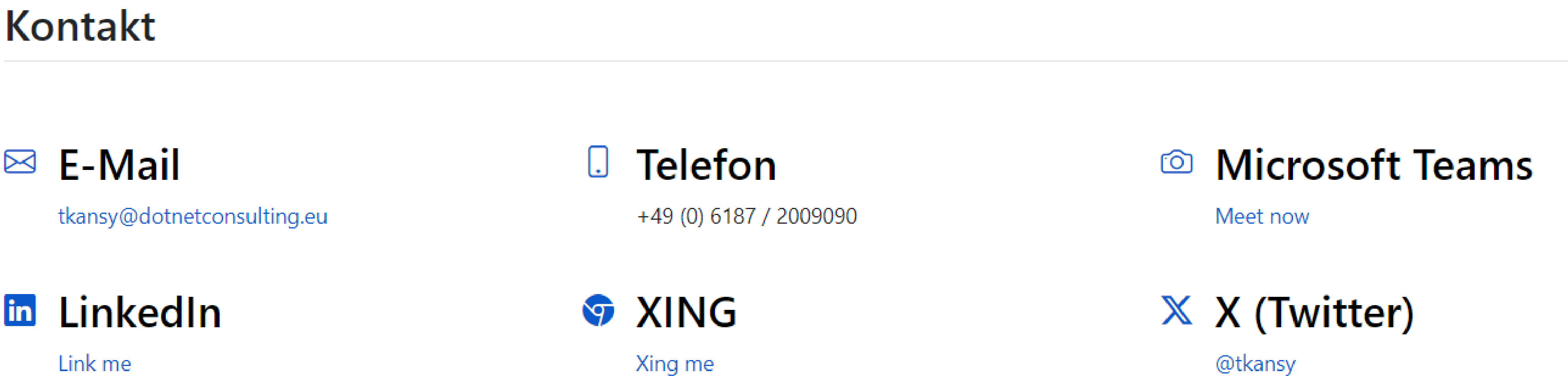
```
// Add services to the container.
builder.Services.AddControllers(o =>
{
    if (apiKeySettings.ProtectWithApiKey)
        o.Filters.Add(new ApiKeyFilter(apiKeySettings));
});
```

```
public void OnAuthorization(AuthorizationFilterContext context)
{
    ...
    // Verify API key
    string apiKey = context.HttpContext.Request.Headers[APIKEYNAME].ToString();

    if (string.Compare(_apiKey, apiKey) != 0)
        context.Result = new UnauthorizedResult();
}
```

Demo

Fragen? Jetzt oder später!



Kontakt

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Link me

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Xing me

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@tkansy

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Ich berate, coache und trainiere im Bereich Entwicklung von .NET (Core) Anwendungen mit Microsoft SQL Server- mit Allem, was dazu gehört- und was man vielleicht weglassen sollte.