ID AND ACCESSCONTROL

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GITHUB REPO

https://github.com/kenneth-fossen/kefo-aspnet-security.git

$ WHOAMI

```
$ whoami
{
    name: Kenneth Fossen,
    dep: Dragefjellet@Bouvet,
    email: kenneth.fossen@bouvet.no,
    edu: [
        Bachelor i Datatryggleik
        Master i Programvare Utvikling
    ],
    work: [
        Helse Vest IKT Drift & Sikkerhet
    ]
    current: [
        Software Developer,
        Security Champion,
        #rustaceans
    ]
}
```

Dette er Boisy →

AGENDA

- Part i - Theory Covers
  - Why this is important
  - Acronyms
  - Access Control Types
  - Access Control in ASP.NET WebAPI
- Part i - Coding

AGENDA - CONT

- Part ii - Theory Covers
  - What is OAuth / OpenID Connect
  - Tokens (JWT, ID Tokens, Access Tokens)
  - Scopes
  - Flows
    - Implicit Flow
    - Auth Code Grant
- Part ii - Coding

PART I

Theory AccessControl

WHY IS THIS IMPORTANT?

- OWASP Top 10 2021
  - No 1 issue
  - Moving up from the fifth position,
  - 94% of applications were tested for some form of broken access control"
  - Confused Deputy problem
  - PoLP

CONFUSED DEPUTY

Confused deputy problem. (2022, August 5). In Wikipedia.
https://en.wikipedia.org/wiki/Confused_deputy_problem

EVIL USER

USER
1. Request
in: APP.RS
out: /billing/EVE.csv
The Compiler
Request
Billing
Work
User land
/HOME/EVE/APP.RS
2. Read
sensitiv land
3. write
4. write
/billing/eve.csv

POLP / POLA

Principle of Least Privilege / Access

ACRONYMS

- principal
- subject
- authentication (AuthN)
- authorization (AuthZ)
- scopes
- authority
- claims
- tokens /JWT bearer

JWT TOKEN


```
 eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9
.eyJzdWIiOiIxMjM0NTY3ODkwIiwibmFtZSI6IkpvaG4gRG9lIiwiaWF0IjoxNTE2MjM5MDIyfQ
.SflKxwRJSMeKKF2QT4fwpMeJf36POk6yJV_adQssw5c
```


```
{
  "alg": "HS256",
  "typ": "JWT"
},
{
  "sub": "1234567890",
  "name": "John Doe",
  "iat": 1516239022,
}
```

Use JWT.io to inspect tokens: https://jwt.io/

ACCESS CONTROL TYPES

ACL, RBAC, ABAC, CBAC, RBA

ACCESS CONTROL LISTS

```
> ls -la
total 0
drwxr-xr-x    5 kenneth  staff 160  Apr  5 10:48 .  # this directory
drwxr-xr-x  153 kenneth  staff 4896 Apr  5 10:48 .. # partent directory
-r-xr-xr-x    1 kenneth  staff 0    Apr  5 10:48 read_execute_file.txt
-r--r--r--    1 kenneth  staff 0    Apr  5 10:48 read_file.txt
--w-------    1 kenneth  staff 0    Apr  5 10:48 write_file.txt
-rw---xr--    1 kenneth  staff 0    Apr  5 10:48 own_readwrite_everyone_read.txt
>
```

```
{-}{r-x}{ r-x}{r-x}
{type}{owner}{group}{everyone}
```

ROLE-BASED ACCESS CONTROL

https://sites.google.com/site/cacsolin/role-based-access-control

ATTRIBUTE-BASED ACCESS CONTROL

https://privacera.com/blog/what-is-attribute-based-access-control/

ABAC INFRASTRUCTURE

- **Policy Decision Point (PDP)**
- **Policy Enforcement Point (PEP)**
- **Policy Information Point (PIP)**
- **Policy Administration Point (PAP)**

https://fallbackstatus.com/what-is-attribute-based-access-control/

CAPABILITY-BASED ACCESS CONTROL

University of Bergen
Department of informatics

Exploring Capability-based security in software design with Rust

Author: Kenneth Fossen
Supervisor: Håkon Robbestad Gylterud

UNIVERSITETET I BERGEN
Det matematisk-naturvitenskapelige fakultet

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CAPABILITIES

RISK-BASED AUTHENTICATION

https://riskbasedauthentication.org/

IP: Home
Chrome
Windows 10
...
Username
Password
„Same behavior as always"
Risk Classification
Low

IP: Known Spammer
PhantomJS
New OS
...
Username
Password
„That's a hacker for sure"
Risk Classification
High

ACCESS CONTROL IN ASP.NET WEBAPI

- ClaimsBased
- PolicyBased

ABAC is what Microsoft calls: policy-based access control (PBAC) or claims-based access control (CBAC)

JWT

```
{
  "aud": "api://1851a809-314c-4d44-9844-382ce9f64f85",
  "iss": "https://sts.windows.net/e5d441e9-b0fb-4458-a4d7-15d2b4cfc193/",
  "iat": 1681404264,
  "nbf": 1681404264,
  "exp": 1681408164,
  "idp": "https://sts.windows.net/e5d441e9-b0fb-4458-a4d7-15d2b4cfc193/",
  "oid": "b3da45cf-872e-41af-b1b6-713852002cac",
  "scp": [
    "profile",
    "email",
  ],
  "roles": [
    "ConsoleClientRole"
  ],
  "sub": "b3da45cf-872e-41af-b1b6-713852002cac",
  //..
}
```

CLAIMS


```
iss:https://sts.windows.net/e5d441e9-b0fb-4458-a4d7-15d2b4cfc193/
iat:1681444727
nbf:1681444727
exp:1681448627
aio:E2ZgYFhy8uvSUm2J0PWhC2NffE7RAQA=
appid:f44c4125-7493-4ea0-8a91-77a15e9995df
appidacr:1
idp:https://sts.windows.net/e5d441e9-b0fb-4458-a4d7-15d2b4cfc193/
oid:b3da45cf-872e-41af-b1b6-713852002cac
rh:0.AYEA6UHU5fuwWESk1xXStM_BkwmoURhMMURNmEQ4LOn2T4WBAAA.
roles:ConsoleClientRole
sub:b3da45cf-872e-41af-b1b6-713852002cac
tid:e5d441e9-b0fb-4458-a4d7-15d2b4cfc193
uti:eqdCjChDh0qEAdbXP-o3AA
ver:1.0
```

CLAIMSTRANSFORMATION

```
public class SecuredApiTransformClaims : IClaimsTransformation
public Task<ClaimsPrincipal> TransformAsync(ClaimsPrincipal principal)
```

AUTHN AND AUTHZ

```
app.UseAuthentication()
app.UseAuthorization()
```

EXAMPLE: MIDDLEWARE ORDER

```
var builder = WebApplication.CreateBuilder(args);

// Add services to the container.
...
var app = builder.Build();

// Configure the HTTP request pipeline.
if (app.Environment.IsDevelopment())
{
    app.UseMigrationsEndPoint();
}
else
{
    app.UseExceptionHandler("/Error");
    app.UseHsts();
}

app.UseHttpsRedirection();
app.UseStaticFiles();
// app.UseCookiePolicy();

app.UseRouting();
// app.UseRequestLocalization();
// app.UseCors();

app.UseAuthentication(); // Always before Authorization
app.UseAuthorization();
// app.UseSession();
// app.UseResponseCompression();
// app.UseResponseCaching();

app.MapRazorPages();
app.MapControllerRoute(
    name: "default",
    pattern: "{controller=Home}/{action=Index}/{id?}");

app.Run();
```

Request
Response
ExceptionHandler
HSTS
HttpsRedirection
Static Files
Routing
CORS
Authentication
Authorization
Custom middlewares
Custom1
Custom ...
Endpoint

[AUTHORIZE] AND POLICIES

```
[AllowAnonymous]

[Authorize]
[Authorize(Policy = "ConsoleClientRole")]

[Authorize(Roles = "HRManager,Finance")]

[Authorize(Roles = "PowerUser")]
[Authorize(Roles = "ControlPanelUser")]
```

```
builder.Services.AddAuthorization(options =>
{
    options.AddPolicy("ConsoleClientRole", policy =>
    {
        policy.RequireRole("ConsoleClientRole");
    });
```

PART I - BREAK BEFORE CODING

PART I - CODING

Tasks for Part i

PART II

Theory OAuth and Azure

OAUTH

- What is OAuth
- OpenID

Source: https://aaronparecki.com/2019/12/12/21/its-time-for-oauth-2-dot-1

OAUTH ACRONYMS

- Audience
- Issuer
- Scope
- Subject

JWT


```
{
  "aud": "api://1851a809-314c-4d44-9844-382ce9f64f85",
  "iss": "https://sts.windows.net/e5d441e9-b0fb-4458-a4d7-15d2b4cfc193/",
  "iat": 1681404264,
  "nbf": 1681404264,
  "exp": 1681408164,
  "idp": "https://sts.windows.net/e5d441e9-b0fb-4458-a4d7-15d2b4cfc193/",
  "oid": "b3da45cf-872e-41af-b1b6-713852002cac",
  "scp": [
    "profile",
    "email",
  ],
  "roles": [
    "ConsoleClientRole"
  ],
  "sub": "b3da45cf-872e-41af-b1b6-713852002cac",
  //..
}
```

- Tokens
  - Id Tokens
  - Access Tokens
  - Scopes

FLOWS

- Implicit Grant Flow
- Authorization Code Grant (PCKE)

IMPLICIT GRANT FLOW

```
GET https://localhost:8085/oauth/authorize?
           response_type=token& #request type
           client_id=application_id&
           redirect_uri=https%3A%2F%2Fweb.application.domain%2Flogin
```

```
https://web.application.domain/login#
      access_token=jauej28slah2&
      expires_in=3599
```

AUTHORIZATION CODE GRANT (PCKE)

- RedirectURIs
  - Common Mistake Open Redirect

https://learn.microsoft.com/en-us/azure/active-directory/develop/v2-oauth2-auth-code-flow

Auth Code Flow

```
// Line breaks for legibility only

https://login.microsoftonline.com/{tenant}/oauth2/v2.0/authorize?
client_id=6731de76-14a6-49ae-97bc-6eba6914391e
&response_type=code
&redirect_uri=http%3A%2F%2Flocalhost%2Fmyapp%2F
&response_mode=query
&scope=https%3A%2F%2Fgraph.microsoft.com%2Fmail.read
&state=12345
&code_challenge=YTFjNjI1OWYzMzA3MTI4ZDY2Njg5M2RkNmVjNDE5YmEyZGRhOGYyM2IzNjdmZWFhMTQ1ODg3NDcxY2Nl
&code_challenge_method=S256
```

```
Location: http://localhost/myapp/?code=AwABAAAAvPM1KaPlrEqdFSBzjqfTGBCmLdgfSTLEMPGYuNHSUYBrq..
```

```
GET http://localhost?
code=AwABAAAAvPM1KaPlrEqdFSBzjqfTGBCmLdgfSTLEMPGYuNHSUYBrq...
&state=12345
```

https://learn.microsoft.com/en-us/azure/active-directory/develop/v2-oauth2-auth-code-flow

AZUREAD

- Service Principals / AppRegistrations
  an identity created for use with applications, hosted services, and automated tools to access Azure resources
  Users have to manage secrets and passwords
- Managed Identity
  Same as a service principal, just managed
- Users

PART II - BREAK BEFORE CODING

PART II - CODING

Coding

Tasks for Part ii

SOURCES

- OAuth 2.0 implicit grant flow
- Microsoft identity platform and OAuth 2.0 authorization code flow
- ASP.NET Core Middleware
- Azure.Identity Nuget
- Microsoft Identity Platform Documentation
- MsC: Capability Bases Access Control