- 2 types of tokens should be there: **access token** (short validity; around 10 min) and **refresh token** (long validity; like 6 months)
  - When the *access token* is expired, the **refresh token** will be used to get a new *access token*.
  - Usually, **refresh token** is stored in the cookies, and get the *refresh token* from the cookies from backend (not in request payload) and validate the *refresh token*;
  - If the *refresh token* is valid then generate one new **access token** and return in response.
  - Use **http-only** cookies to store refresh token.

```
LoginResponseDto responseDto = authService.login(loginDto);

Cookie cookie = new Cookie( name: "refreshToken",  value: responseDto.getRefreshToken());
cookie.setHttpOnly(true);
  cookie.setSecure(true);

response.addCookie(cookie);

return ResponseEntity.ok( body: responseDto);
```

  - Just keep **user id** in the refresh token, no need to keep everything there.

```
public String generateRefreshToken( @NotNull User user) {  1 usage   Alok Ranjan Joshi
    return Jwts.builder()
            .subject( s: user.getId().toString())
            .issuedAt( date: new Date())
            .expiration( date: new Date( date: System.currentTimeMillis() + 1000L *60*60*24*30*6))
            .signWith(getSecretKey())
            .compact();
}
```

  - **Login service method** should get the user from **principal** not from ***database***

```
Authentication authentication = authenticationManager.authenticate(
        authentication: new UsernamePasswordAuthenticationToken( principal: loginDto.getEmail(),  credentials: loginDto.getPassword()));

User user = (User) authentication.getPrincipal();
String accessToken = jwtService.generateAccessToken(user);

String refreshToken = jwtService.generateRefreshToken(user);

return new LoginResponseDto(accessToken, refreshToken);
```

    - For this, **user** should be stored as principal instead of **username**.
  -

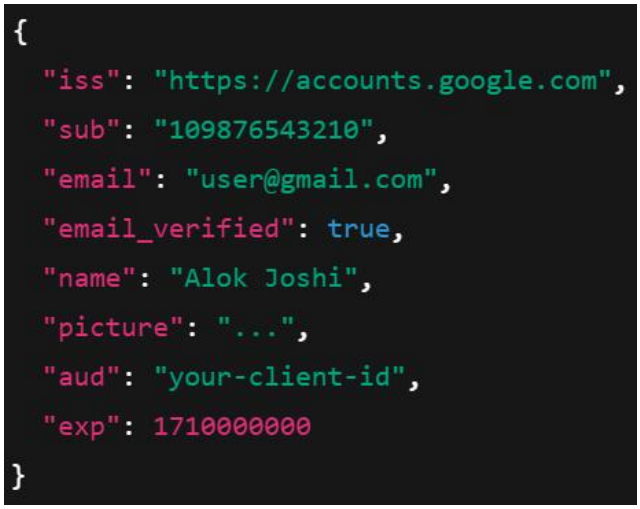
➢ Frontend & Backend in Google OAUTH2 (in general)

- In case of **"sign in with google",** There are **2** backends involved
  - Our own backend
  - Google's backend
- After clicking on that "sign in with google" button, the ***frontend*** triggers one request which is:
  - **GET /oauth2/authorization/google** (this is our backend's path; not google's)
  - We don't write this end point by our self; this is **auto-created** by Spring Security OAuth2 Client.
  - Internally it is handled by: **OAuth2AuthorizationRequestRedirectFilter**
- Now, our backend reads from ***application.yml*** file
  -
```yaml
spring:
  security:
    oauth2:
      client:
        registration:
          google:
            client-id: xxx
            client-secret: yyy
            scope: email, profile
```
  - Now, our backend knows about:
    - which provider (google)
    - client_id
    - scopes
    - redirect_uri template
- Now, our backend will build a **url having proper query parameters which will be sent as response to which the browser will redirect.**
  - The URL will look something like this
  -
```
https://accounts.google.com/o/oauth2/v2/auth
  ?client_id=123456789.apps.googleusercontent.com
  &response_type=code
  &scope=openid%20email%20profile
  &redirect_uri=https://your-backend.com/login/oauth2/code/google
  &state=KJH7823HJDS
```
  - Note: **redirect_uri** is present in this URL.

- Now, our Backend responds with one thing only
  - ```
    302 Redirect
    Location: https://accounts.google.com/o/oauth2/v2/auth?client_id=...
    ```
  - It is browser's rule: **If response status is 3xx and Location header is present → automatically navigate to that URL.**
  - There is no involvement of ***frontend*** in this case.
- Now, the browser redirects to **accounts.google.com** …. page directly.
  - Here there is no role of our backend, it is completely backed by **Google's backend**.
- Now, the user will interact with the ***google's UI*** and give the necessary permissions of the required details.
- Then, Google will authenticate the user and redirect the browser to ***our backend's path*** Using the same **redirect_uri** that your backend sent earlier
  - ```
    https://your-backend.com/login/oauth2/code/google?code=XYZ&state=ABC
    ```
  - This full path (not just backend's domain) is registered in Google console.
  - Note: **state** & **code** is present here.
  - **NOTE** ----------
  - So, in the Google Console you can register as many URIs you want, that will be treated as the allowed redirect URIs
  - And you need to pass the **redirect_uri** in the response so that google will get to know to which **uri** it has to redirect.
  - First Google will check if the given **uri** in the request URL is present in the access list, if present then it'll redirect back to that URI after authenticating the user.
  -
- Now, our backend's end point "**/login/oauth2/code/google**" will receive the request.
  - This endpoint is ALSO **auto-created** by Spring Security OAuth2 Client
  - Handled by: **OAuth2LoginAuthenticationFilter**
- Now, our backend validate the **state**
  - state is a random, unpredictable value generated by YOUR backend before redirecting the user to Google.
  - ```
    state = a8f9c2e4b3...
    ```
  - If the **state** matches, then continue; otherwise **reject**.
- Now **our Backend** exchanges **code** with **tokens**
  - code is an authorization code issued by Google after the user successfully authenticates and consents.
    ```

- Think of it as a one-time, short-lived voucher that your backend can exchange for token.
- Backend makes **server-to-server** call.
- It sends **client_id, client_secret, code, redirect_uri** and receives **access_token, id_token, expires_in**

- **id_token** is a JWT which contains the user details within it like the below



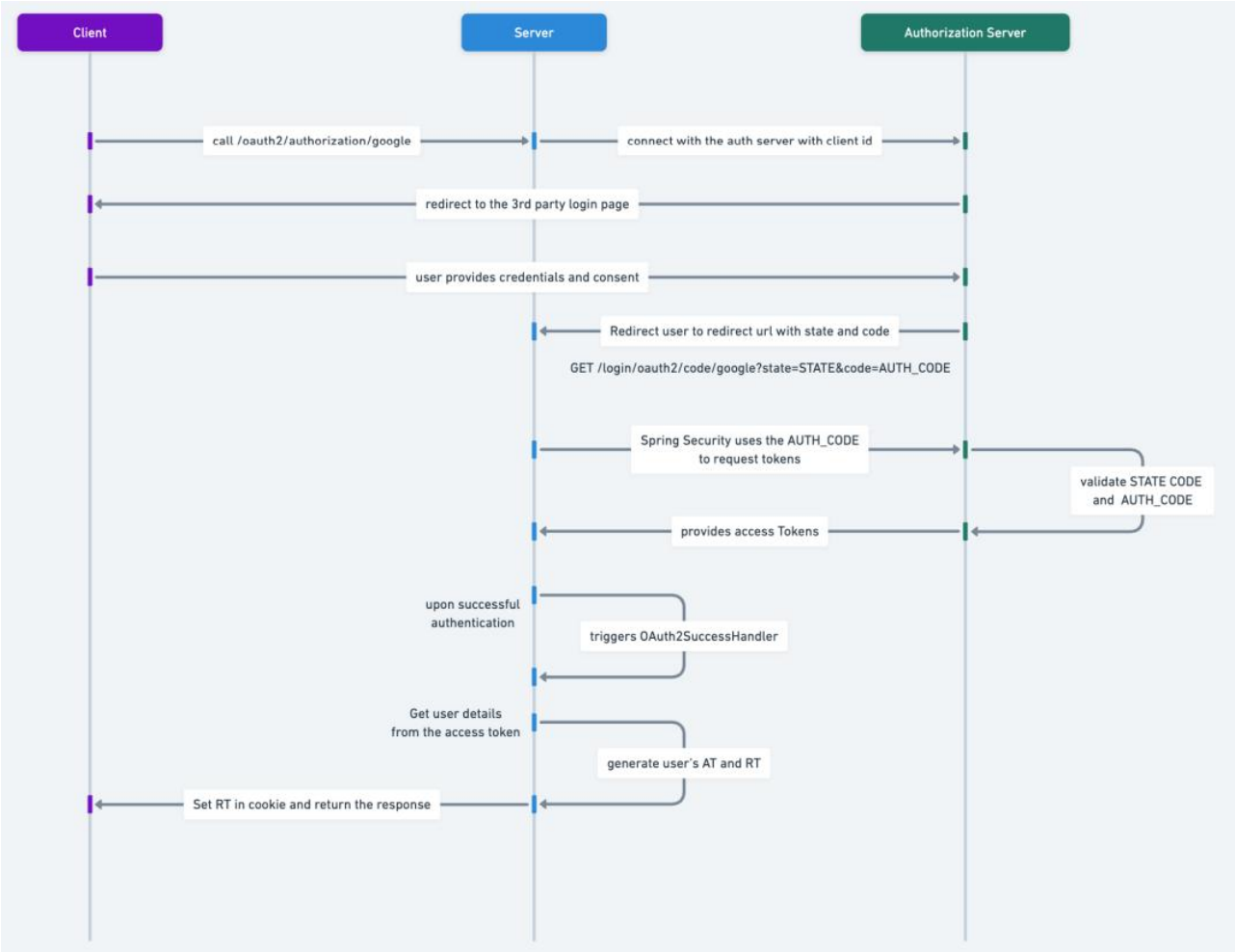
- You "use" only the authorization code; the **access_token** is returned because **OAuth** requires it, but if you don't call Google APIs, it is perfectly normal that it is never used.

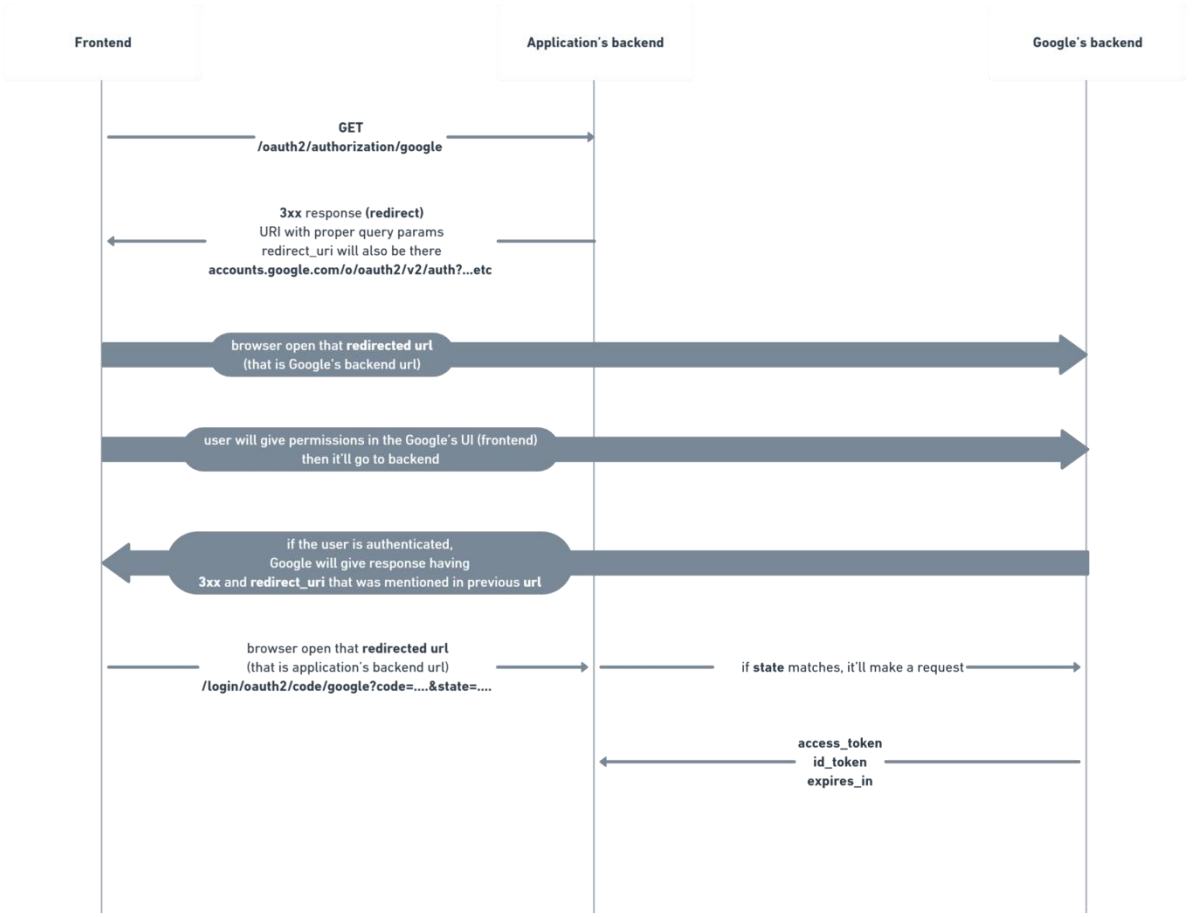
➢ Now, you can implement the normal login in our backend after getting those details.

➢ In one sentence:

- In Google OAuth login, the frontend only triggers navigation. The backend **constructs the authorization request**, redirects the **browser to Google**, and later receives the **authorization code**. Google authenticates the user, validates the redirect URI against its allow-list, and redirects back **to the backend**. The backend validates **state**, exchanges the **code for tokens**, extracts user identity, and then performs normal application login logic.

```
Frontend
  ↓
/oauth2/authorization/google   (our backend)
  ↓
accounts.google.com            (Google backend)
  ↓
/login/oauth2/code/google      (our backend)
  ↓
frontend/dashboard
```





Made with Whimsical

```
id_token contains the details that are required like email, name etc etc
```

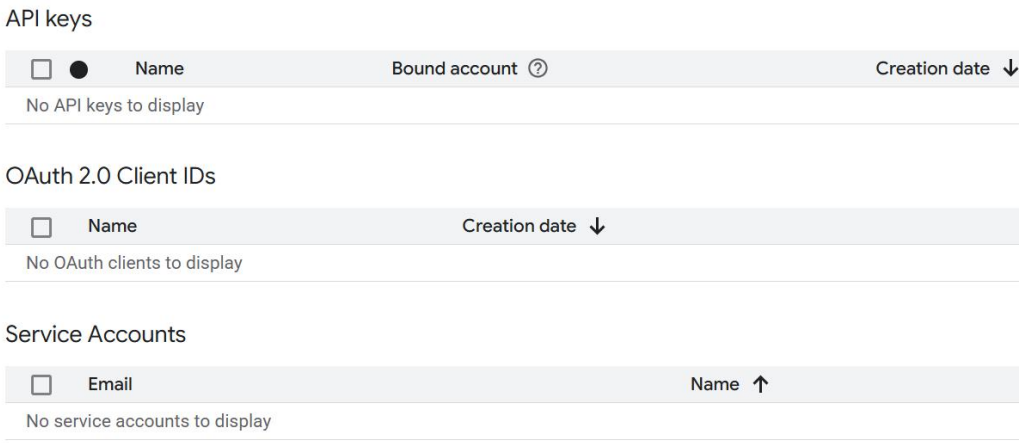
```
if http status is 3xx and location is present in response then browser will redirect that by default
```

Made with Whimsical

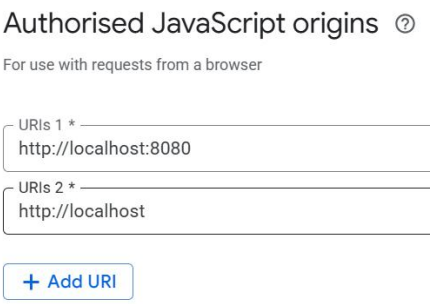
Steps

Google Console Setup

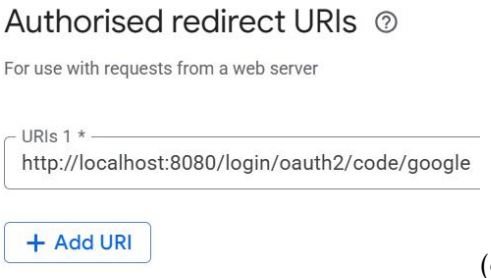
- Select the project in Google Console; and go to Dashboard
- API & Services >> Credentials



- **Create Credentials >> OAuth Client ID**
- **Configure Consent Screen**
  - You need to configure all the things separately.
  - Audience: either you can setup some test user or publish. Publish means anyone can try to login.
  - Data access: it is the scopes like which data do you want to access from google.
  - Clients: create the OAuth2 client;



    - It means Requests coming from a browser whose origin is "http://localhost:8080" are allowed to start OAuth.



    - (default URL of spring security)

- After creating the **Client**, you'll get the **client id** and **client secret**, copy those and paste in the *application.properties* or *application.yml* file.
- ---------- Google Console set-up done ----------
- **Application codes**
- Add the **oauth2Login** filter in the custom filter chain

```
httpSecurity
        .authorizeHttpRequests( authorizeHttpRequestsCustomizer: auth -> auth
                .requestMatchers( ...patterns: "/auth/**").permitAll()
                .anyRequest().authenticated())
        .csrf( csrfCustomizer: csrfConfig -> csrfConfig.disable())
        .sessionManagement( sessionManagementCustomizer: sessionManagementConfig -> sessionManagementConfig
                .sessionCreationPolicy( sessionCreationPolicy: SessionCreationPolicy.STATELESS))
        .addFilterBefore(jwtFilter,  beforeFilter: UsernamePasswordAuthenticationFilter.class)
        .oauth2Login( oauth2LoginCustomizer: oauth2Config -> oauth2Config
                .failureUrl( authenticationFailureUrl: "/login?error=true"));
```

- You need to also add the **success** handler, otherwise even after getting the response from authorization server (google in our case) it'll not do the required things after authenticating the user.
  - There is a class **SimpleUrlAuthenticationSuccessHandler**, that decides what to do after the authentication success.
  - Authentication can be of any type i.e. **OAuth**, **Form login**, **Username/password login** ..etc
  - This class contains one method **onAuthenticationSuccess** which is executed after the authentication gets succeeded.
  - So, if we create a **Bean** of a class extending **SimpleUrlAuthenticationSuccessHandler** class and overriding the method **onAuthenticationSuccess** then we can handle the authentication success case.
  - I created the below class:

```
@Slf4j  2 usages
@Component
@RequiredArgsConstructor
public class OAuth2SuccessHandler extends SimpleUrlAuthenticationSuccessHandler {
```

- Now just add that class's object in the SecurityFilterChain

```
.oauth2Login( oauth2LoginCustomizer: oauth2Config -> oauth2Config
        .failureUrl( authenticationFailureUrl: "/login?error=true")
        .successHandler(oAuth2SuccessHandler));
```

- I just checked if the user is present in the database, if present then do signup otherwise just create **access** and **refresh** token and send in response.

```
if(user == null) {
    User newUser = User.builder()
            .email(email)
            .name( name: oAuth2User.getAttribute( name: "name"))
            .build();
    user = userService.save(newUser);
}
String accessToken  = jwtService.generateAccessToken(user);
String refreshToken  = jwtService.generateRefreshToken(user);


Cookie cookie = new Cookie( name: "refreshToken",  value: refreshToken);
cookie.setHttpOnly(true);
cookie.setSecure("production".equals(deployEnv));
response.addCookie(cookie);

String frontendUrl = "http://localhost:8080/home.html?token=" + accessToken;
response.sendRedirect( s: frontendUrl);
```

-
  - It is inside the **onAuthenticationSuccess** method.
  - **response.sendRedirect()** will send a redirect-response so that the browser will redirect to this specific url.
  - **home.html** is nothing but a static file.
- F

➢ OAuth2 flow in Spring Security

- There are 2 filters which are important:
  - **OAuth2AuthorizationRequestRedirectFilter**
    - backend to google before authentication
  - **OAuth2LoginAuthenticationFilter**
    - google to backend after authentication
- OAuth2AuthorizationRequestRedirectFilter consists of 2 things
  - One is to create the final object which is having ***state, client id, client secret, redirect uri*** etc etc every details that should be present in the request (for backend to google redirect).
    - This final object is of type **OAuth2AuthorizationRequest**
  - Another is to save that object while the control goes to google.
  - It generates the default oauth login end point, like **/oauth2/authorization/google**
  -

```
public class OAuth2AuthorizationRequestRedirectFilter extends OncePerRequestFilter {  21 usages
    public static final String DEFAULT_AUTHORIZATION_REQUEST_BASE_URI = "/oauth2/authorization";
    private final ThrowableAnalyzer throwableAnalyzer;
    private RedirectStrategy authorizationRedirectStrategy;
    private OAuth2AuthorizationRequestResolver authorizationRequestResolver;
    private AuthorizationRequestRepository<OAuth2AuthorizationRequest> authorizationRequestRepository;
    private RequestCache requestCache;
```

- There is a class called **ClientRegistration**,
  - It contains everything like *clientId, clientSecret, registrationId* (google, github ..etc), *redirectUri*
  - It doesn't contains state because it is generated after starting the application after reading the **application.yml** or **application.properties** file.
  - Here *redirectUri* will be in format
    - "{baseUrl}/login/oauth2/code/{registrationId}"
    -

```
public final class ClientRegistration implements Serializable {
    private static final long serialVersionUID = 620L;
    private String registrationId;
    private String clientId;
    private String clientSecret;
    private ClientAuthenticationMethod clientAuthenticationMethod;
    private AuthorizationGrantType authorizationGrantType;
    private String redirectUri;
    private Set<String> scopes = Collections.emptySet();
    private ProviderDetails providerDetails = new ProviderDetails();
    private String clientName;
```

- The objects of **ClientRegistration** are stored in **ClientRegistrationRepository**.
  - **InMemoryClientRegistrationRepository** implements **ClientRegistrationRepository** is having one *Map* of *registrationId* to *ClientRegistration*
    - github : clientRegistration
    - google : clientRegistration
    - …. like this
  - ```
    public final class InMemoryClientRegistrationRepository implements Cl
        private final Map<String, ClientRegistration> registrations;
    ```
- Now it comes **OAuth2AuthorizationRequestResolver**
  - It create objects of type **OAuth2AuthorizationRequest** using **ClientRegistration** object.
  - It contains **state** as well and remaining things that ClientRegistration contains.
  - Here the *redirectUri* will be in the form:
    - "http://localhost:8080/login/oauth2/code/google"
    - It is complete URL.
- Now, the final object is there, it just needs to be stored in a safe place for future use. **AuthorizationRequestRepository** is used to store that.
  - It doesn't store in any *map* or *list*, it just store the AuthorizationRequest object in the ***session*** of the ***request*** object.
  - ```
    public void saveAuthorizationRequest( @Nullable OAuth2AuthorizationRequest authorizationRequest, @N
        Assert.notNull( object: request, message: "request cannot be null");
        Assert.notNull( object: response, message: "response cannot be null");
        if (authorizationRequest == null) {
            this.removeAuthorizationRequest(request, response);
        } else {
            String state = authorizationRequest.getState();
            Assert.hasText( text: state, message: "authorizationRequest.state cannot be empty");
            request.getSession().setAttribute( s: this.sessionAttributeName, o: authorizationRequest);
        }
    }
    ```
- Now, everything is done; our backend will send a redirect response to frontend, after seeing which the browser will redirect to that particular url (accounts.google.com ….)
- **OAuth2LoginAuthenticationFilter**
  - It contains an object of type **AuthorizationRequestRepository** and get the **OAuth2AuthorizationRequest** object from it.
  - It gets the response from OAuth2 provider and validate that with **OAuth2AuthorizationRequest** object, like **state** matching and all.
  - If any mismatch is there then it'll reject that.

- Then it create one token of type **OAuth2LoginAuthenticationToken** (just like UsernamePasswordAuthenticationToken in DaoAuthenticationProvider) and call the **authenticationManager.authenticate()** method.
- Now just like username password authentication flow, this **authenticate()**method call delegates to AuthenticationProvider's **authenticate()** method and here the AuthenticationProvider is **OAuth2LoginAuthenticationProvider** .
- **OAuth2LoginAuthenticatoinProvider** is the one who exchange the **code** to get the **tokens** .
  - It is done with the help of **DefaultAuthorizationCodeTokenResponseClient**
-

- Now, where is the filter that create the default login page for username password login form, oauth2 default login page.
  - The filter is **DefaultLoginPageGeneratingFilter**
  - It generates the default login pages.

```
private @NotNull String generateLoginPageHtml( @NotNull HttpServletRequest request, boolean loginError, boolean log
    String errorMsg = loginError ? this.getLoginErrorMessage(request) : "Invalid credentials";
    String contextPath = request.getContextPath();
    StringBuilder sb = new StringBuilder();
    sb.append("<!DOCTYPE html>\n");
    sb.append("<html lang=\"en\">\n");
    sb.append("  <head>\n");
    sb.append("    <meta charset=\"utf-8\">\n");
    sb.append("    <meta name=\"viewport\" content=\"width=device-width, initial-scale=1, shrink-to-fit=no\">\n")
    sb.append("    <meta name=\"description\" content=\"\">\n");
    sb.append("    <meta name=\"author\" content=\"\">\n");
    sb.append("    <title>Please sign in</title>\n");
    sb.append("    <link href=\"https://maxcdn.bootstrapcdn.com/bootstrap/4.0.0-beta/css/bootstrap.min.css\" rel=
    sb.append("    <link href=\"https://getbootstrap.com/docs/4.0/examples/signin/signin.css\" rel=\"stylesheet\"
    sb.append("  </head>\n");
    sb.append("  <body>\n");
    sb.append("     <div class=\"container\">\n");
    if (this.formLoginEnabled) {...}

    if (this.oauth2LoginEnabled) {...}

    if (this.saml2LoginEnabled) {...}
```

  -
  - F

NOTE ----------

- The redirected URIs are matches at the **filter** level, not **servlet level**. Spring Security is completely ***filter based***.

```
if (request.getRequestURI().equals("/oauth2/authorization/google")) {
    // handle here
}
```

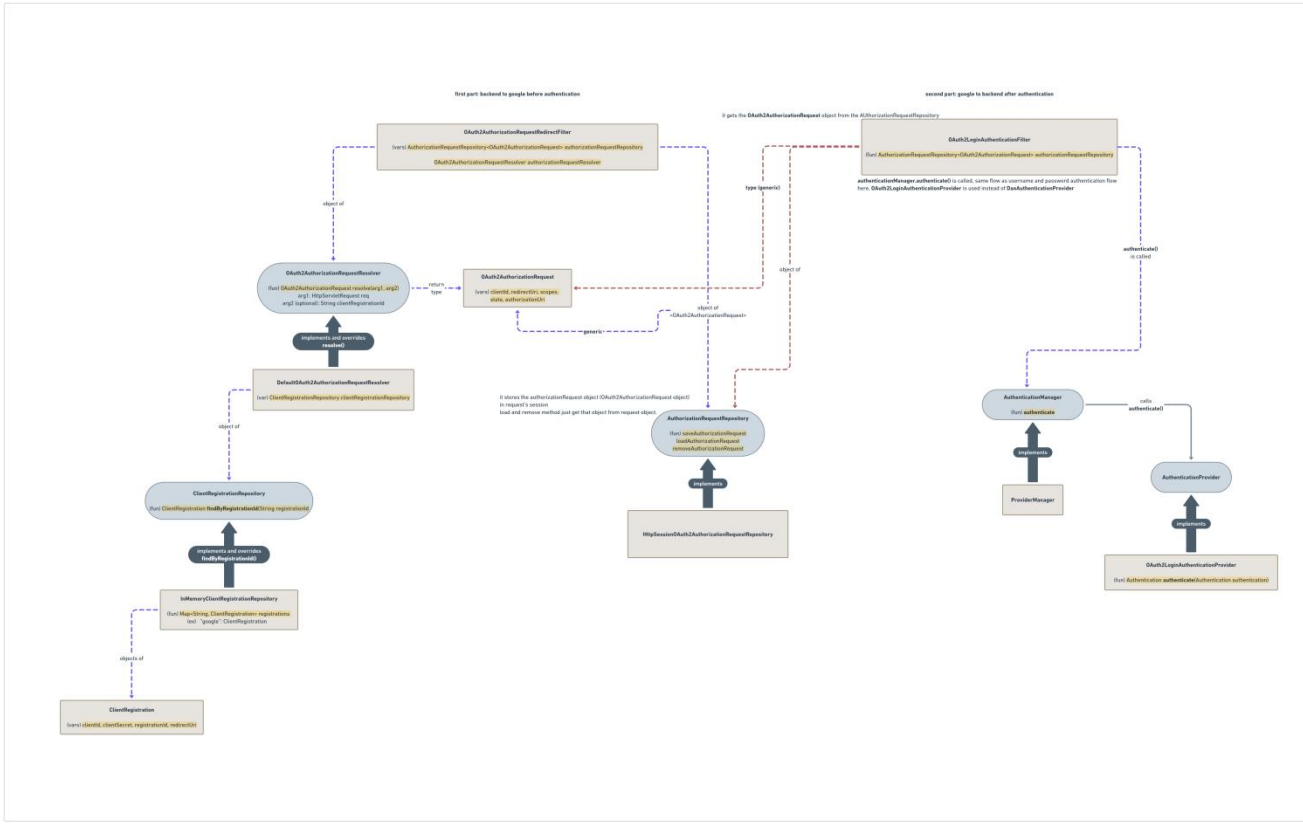
-

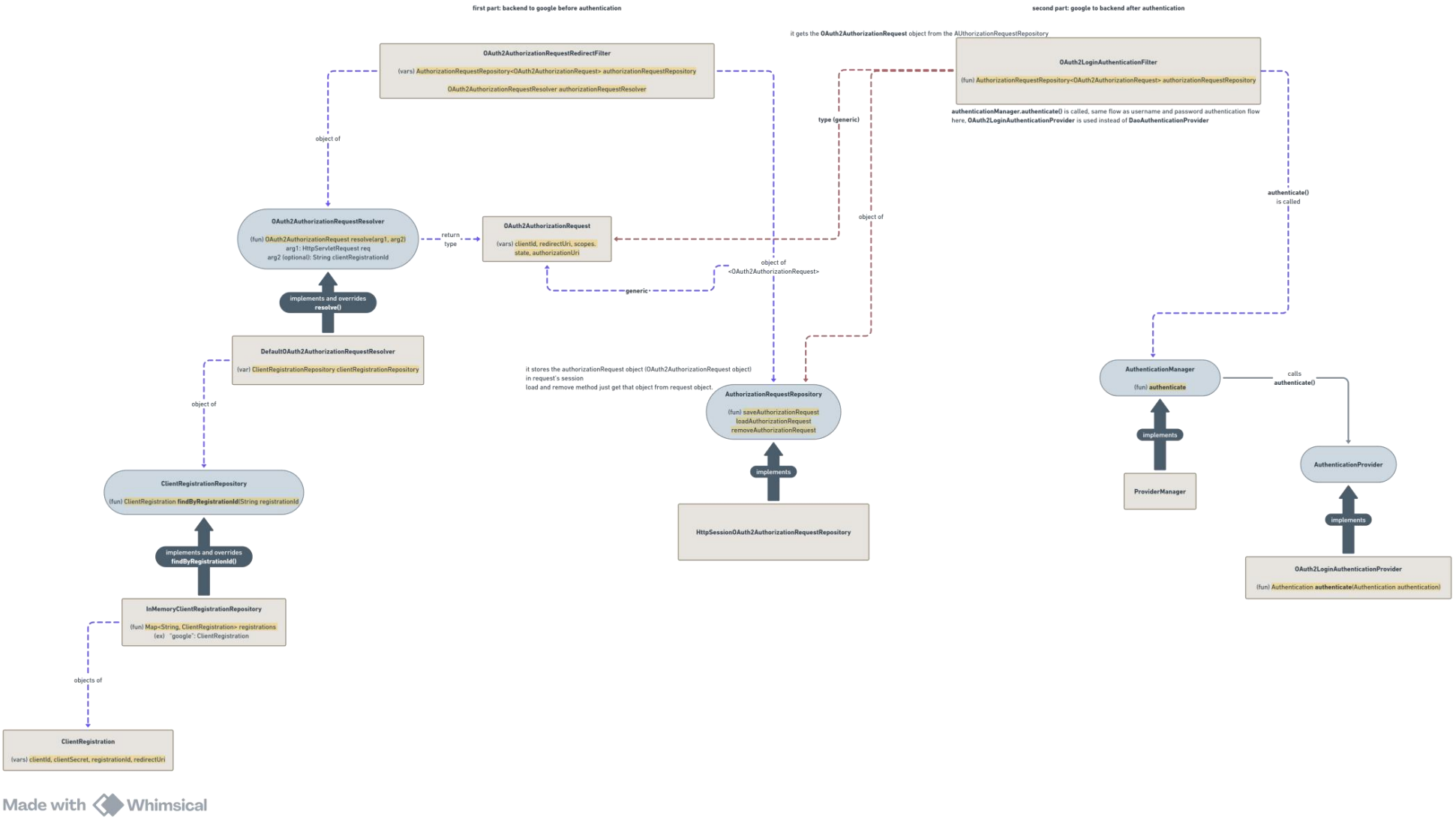
OAuth2 work-flow in general (I am taking **google** as OAuth2 provider)

- 2 backend are involved here: **google's backend, our application backend**
- first, when the **signin with google** (or any other provider) button is clicked in the frontend, it'll call a **GET** request to **Application Backend**
  - in spring, this url is: **oauth2/authorization/google**
- now, **Application Backend** creates a proper url having client_id, client_secret, redirect_uri, state etc etc.
  - note **redirect_uri** and **state** here, it'll be used later....

```
https://accounts.google.com/o/oauth2/v2/auth
  ?client_id=123456789.apps.googleusercontent.com
  &response_type=code
  &scope=openid%20email%20profile
  &redirect_uri=https://your-backend.com/login/oauth2/code/google
  &state=KJH7823HJDS
```

  status code **3xx** (which is meant for redirect)
  -
  - `every browser's default behaviour is that it the response contains http status code 3xx and there is a location field there, then it'll redirect it to that location; there is no involvement of frontend here, its completely at the browser level.`
- now the browser will redirect to **accounts.google.com/.....** and user will get a screen to select the google account, and grant the consents.
- After authenticating successfully, **google** will send a response (**3xx** and **location**) and location will contain that **redirect_uri** which was sent earlier.
- so now, browser will redirect to that **redirect_uri** which goes to **Application Backend**.
  - this **redirect_uri** will be
    - "https://www.your-backend.com/**login/oauth2/code/google?code=abc&state=xyz** "
- now this **state** will be checked, it should match with the **state** that was send to google before authentication.
- if validation are successful, then **application backend** will use that **code** and make one **POST** request to google to get the **tokens**.





Part-1: application backend to oauth2 provider's backend

- First the request come to **OAuth2AuthorizationRequestRedirectFilter**
- It contains 2 parts:
  - one part builds the **OAuth2AuthorizationRequest** object (which is the final object which will be sent to oauth2 provider)
  - another part will save that object when the control goes to OAuth2 provider.
- **ClientRegistration** is a class that contains all the details of the Client i.e. client id, client secret, registrationId, redirectUri etc; but it *doesn't contain the state*.
  - here **redirectUri** is in the form: *"{baseUrl}/login/oauth2/code/{registrationId}"*
- There is a repository that stores all the **ClientRegistration** objects, which is **ClientRegistrationRepository**.
  - It contains a method **findByRegistrationId** which gives the ClientRegistration object for the particular registrationId (registrationId is nothing but "google", "facebook", "github")
- So, now we have all the objects os **ClientRegistration**, but we need to make the object proper to send in the request to OAuth2 provider.
  - because it has only templates kind of things. like you can see **redirectUri** is just a template, there is no **state** present here.
  - So, there is a **resolver** class which is named as **DefaultOAuth2AuthorizatoinRequestResolver** which takes the **ClientRegistration** object and create a **OAuth2AuthorizationRequest** object which contains fully ready values that can be sent to OAuth2 provider directly.
  - here **state** will be present.
  - here the **redirectUri** will be in the form of: "http://localhost:8080/login/oauth2/code/google"
- Now, everything is completed, just the request has to be sent to OAuth2 provider; but we need to keep the object somewhere to validate after getting the response from OAuth2 provider.
  - So, there is a repository **AuthorizationRequestRepository** is there to store the **OAuth2AuthorizationRequest** object.
  - it doesn't store those objects in any list or map, it just creates one attribute in the **request** object and store there.

Part-2: oauth2 provider to application's backend

- **OAuth2LoginAuthenticationFilter** is the first filter in this case.
- it gets the **OAuth2AuthorizationObject** from the **AuthorizationRequestRepository** .
- then it validate the details from the response of OAuth2 provider with the OAuth2AuthorizationObject, for example **state** will be checked.
- if any mismatch is there, then it'll reject it.
- after that it'll simply call the **authenticate()** method of **authenticationManager**, just like we do in case of **username and password authentication**.
  - here the authentication token will be of type: **OAuth2LoginAuthenticationToken**
- then this **authentication()** method call will be delegated to **AuthenticationProvider**'s **authenticaion()** method and in case of OAuth2, the *AuthenticationProvider* is **OAuth2LoginAuthenticationProvider**.
- this **OAuth2LoginAuthenticationProvider** exchange the **code** that was gotten from OAuth2 provider's response and get the **tokens** like id_token, accessToken etc etc.
- this **id_token** contains the necessary details about the user that we want like username, email etc etc.
- after that it just store the authentication object in security context and we can get the details using **getPrincipal()** method just like username and password authentication.

➢ Authorization

➢ @ElementCollection

- If we write this annotation on a field inside the entity, it'll create a separate table in database and store those.
- It is only used in case of collections like **list, set** ..etc.
- You can say it is like **one-to-many** relation type, but that's not correct;
  - In case of relation (one-to-many or many-to-one), both the entities are having their own **primary keys**, but in this case, the field that is being stores as a collection is not having any primary key.
- Relation are created where both the entities are independent and both are having their own primary keys, but **@ElementCollection** just store the values not the new entity.
-
```
@ElementCollection(fetch = FetchType.EAGER)
@Enumerated(value = EnumType.STRING)
private Set<Role> roles;
```
- Here **Role** is just a enum, not an entity and it doesn't have its own identity.
-

user_id	roles
10	ADMIN
10	USER
10	CREATOR

- It is the **user_roles** table which is created due to **@ElementCollection**, it doesn't have any primary key; it just map the **user_id** to a particular value.
- As I have set **@Enumerated** here for **EnumType.STRING**, so the values are being stored in the database; otherwise the ordinals i.e. 0,1,2,… would have been stored.

- Role is the main concept for **authorization**. Depending upon the role of the user, it'll be decided that what are the thing he/she can access.
- We can the particular *routes* as authorized for some particular type of users
-
```
httpSecurity
        .authorizeHttpRequests( authorizeHttpRequestsCustomizer: auth -> auth
                .requestMatchers( ...patterns: "/auth/**", "/error", "/home.html").permitAll()
                .anyRequest().authenticated())
```

- Here we are simply writing **permitAll** and remaining request as authenticated.

```
@ElementCollection(fetch = FetchType.EAGER)
@Enumerated(value = EnumType.STRING)        // to store them as a string, by defau
private Set<Role> roles;

@Override  Anuj Kumar Sharma *
public Collection<? extends GrantedAuthority> getAuthorities() {
    return this.roles.stream()  Stream<Role>
            .map( mapper: role -> new SimpleGrantedAuthority( role: role.toString()))
            .toList();
}
```

- Here just return the **SimpleGrantedAuthority** type of object.
- Because the return type is something that extends **GrantedAuthority** and SimpleGrantedAuthority is the basic implementation of GrantedAuthority.

- In the JWT filter while creating the **UsernamePasswordAuthenticationToken**, make sure to set the **authorities** field, otherwise no user will be having any authorities.
  - Spring Security calls **auth.getAuthorities()** (auth is the Authentication object) and validate the authorities.

```
UsernamePasswordAuthenticationToken authenticationToken = new UsernamePasswordAuthenticationToken(
        principal: user,  credentials: null, user.getAuthorities()
);
```

- You can also set authorization for different type of request i.e. GET, POST, ..etc

```
httpSecurity
        .authorizeHttpRequests( authorizeHttpRequestsCustomizer: auth -> auth
                .requestMatchers( ...patterns: publicRoutes).permitAll()
                .requestMatchers( method: HttpMethod.GET,  ...patterns: "/posts/**").permitAll()
                .requestMatchers( method: HttpMethod.POST,  ...patterns: "/posts/***").hasRole( role: Role.ADMIN.name())
```

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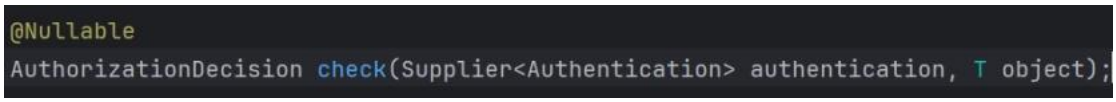
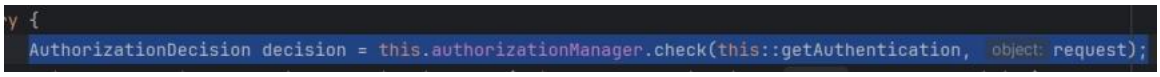
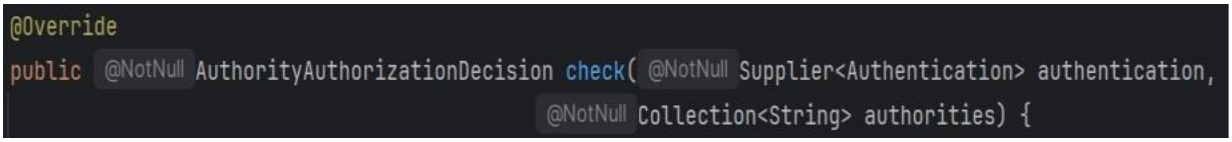
- **The flow happens like the below**
  - **AuthorizationFilter** is the first one that comes in case of authorization.
  - Just like AuthenticationManager, one interface **AuthorizationManager** is also there that contains one method **check()**
    - 
      ```
      @Nullable
      AuthorizationDecision check(Supplier<Authentication> authentication, T object);
      ```
  - **AuthorizationFilter** is having the method **doFilter** which calls this **check()** method of **AuthorizationManager**
    - 
      ```
      y {
        AuthorizationDecision decision = this.authorizationManager.check(this::getAuthentication,  object: request);
      ```
  - The class **RequestMatcherDelegatingAuthorizationManager** implements **AuthorizationManager** passing the generics as **HttpServletRequest** so it get called.
    - 
      ```
      public final class RequestMatcherDelegatingAuthorizationManager implements AuthorizationManager<HttpServletRequest> {
      ```
  - After this, **check()** method of this *RequestMatcherDelegatingAuthorizationManager* calls the **check()** method of **AuthoritiesAuthorizationManager** (it is another child class of **AuthorizationManager** and it implements marking the generics as **Collection<String>**) and here the authorities are checked.
    - 
      ```
      public final class AuthoritiesAuthorizationManager implements AuthorizationManager<Collection<String>> {
      ```
    - 
      ```
      @Override
      public  @NotNull AuthorityAuthorizationDecision check( @NotNull Supplier<Authentication> authentication,
                                                              @NotNull Collection<String> authorities) {
      ```
    - It gets the **authentication** object and **authorities**
    - Here **authorities** means the authorities required to access the *route*.
    - It'll fetch the **authorities** from the **authentication** object, and check if any of those authorities is present in the ***required authorities*** list.
  -
-
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-

- **hasRole vs hasAuthorities**
  - **hasRole("ADMIN")** is just a syntactic sugar for **hasAuthorities("ROLE_ADMIN")**
  - If you are storing the roles with the prefix **ROLE_** then **hasRole()** is handy.
  - For example: ROLE_USER, ROLE_ADMIN … are the roles present inside database.
    - Here we can just write **hasRole("USER")** --- it'll automatically add the prefix ROLE_ and check i.e. it'll be checked as **ROLE_USER**.
    - If you write **hasAuthorities("USER")** then it'll be checked as **USER** only.
- **Role** is kind of top-level authorization like which type of user can access what.

  Authority is bottom level authorization, like more granular authorization.
  - Lets suppose USER, ADMIN are the roles.
  - USER can view the things, you can give it the authorities like VIEW_POST, VIEW_USER
  - ADMIN can do everything, so you can give it the authorities like CREATE_POST, DELETE_POST etc etc.
  - In simpler terms, **role** is top level permissions; after role **authorities** decide the low level permissions.
- I created one **Authority** enum and implemented the below:
  -

```
@ElementCollection(fetch = FetchType.EAGER)
@Enumerated(value = EnumType.STRING)                    // to store them as a string, b
private Set<Role> roles;

@ElementCollection(fetch = FetchType.EAGER)
@Enumerated(value = EnumType.STRING)
private Set<Permissions> permissions;

@Override  Alok Ranjan Joshi +1 *
public Collection<? extends GrantedAuthority> getAuthorities() {
    Set<SimpleGrantedAuthority> authorities = this.roles.stream() Stream<Role>
            .map( mapper: role -> new SimpleGrantedAuthority( role: "ROLE_" + role.name()))
            .collect( collector: Collectors.toSet());

    permissions.forEach( action: permission -> {
        authorities.add(new SimpleGrantedAuthority( role: permission.name()));
    });

    return authorities;
}
```

```
public enum Permissions {  2 usages
    POST_VIEW, POST_CREATE, POST_UPDATE, POST_DELETE,
    USER_VIEW, USER_CREATE, USER_UPDATE, USER_DELETE
}
```

- Now you have to add those authorization in the custom filter chain

```
httpSecurity
        .authorizeHttpRequests( authorizeHttpRequestsCustomizer: auth -> auth
                .requestMatchers( ...patterns: publicRoutes).permitAll() AuthorizationMa
                .requestMatchers( method: HttpMethod.GET,  ...patterns: "/posts/**") Au
                    .hasAuthority( authority: Permission.POST_VIEW.name()) Authorizatio

                .requestMatchers( method: HttpMethod.POST,  ...patterns: "/posts/**") A
                    .hasAnyRole( ...roles: Role.ADMIN.name(), Role.CREATOR.name()) Au

                .requestMatchers( method: HttpMethod.POST,  ...patterns: "/posts/***")
                    .hasAnyAuthority( ...authorities: Permission.POST_CREATE.name()) Au

                .anyRequest().authenticated())
```

  - You can write **hasAuthority()** or **hasAnyAuthority()** and **hasRole()** or **hasAnyRole()** with the same ***requestMatchers()***, you need to write one ***requestMathcer()*** for ***role*** or ***authority***.
  - You can give multiple authorities like this way.

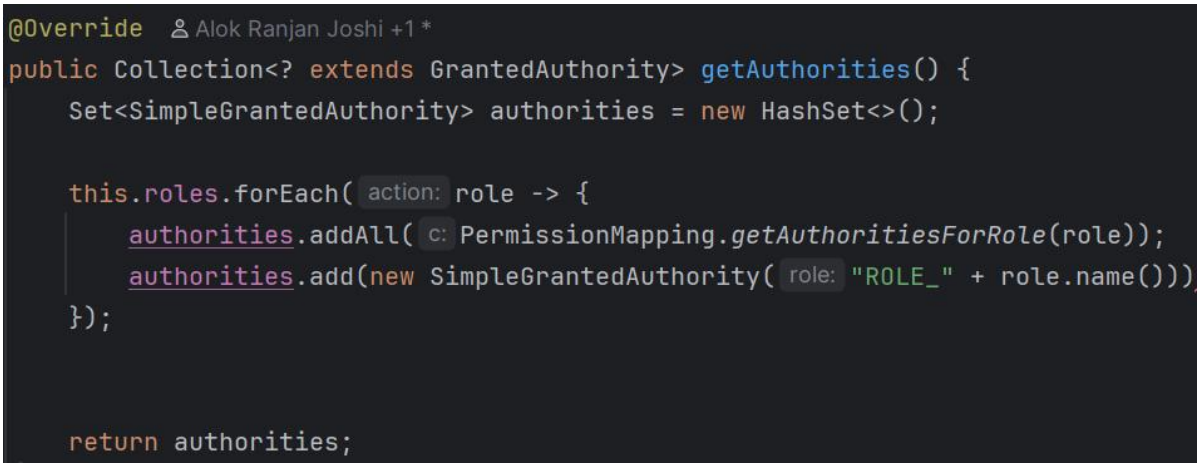
- Otherwise you can create a hard-coded maps of **roles** with **permissions** like some particular role user can have some particular set of permissions.

```
import static com.example.demo4.SecurityApp.entities.enums.Permission.*;
import static com.example.demo4.SecurityApp.entities.enums.Role.*;

public class PermissionMapping {  no usages
    private static Map<Role, Set<Permission>> map = Map.of(  1 usage
        k1: USER,  v1: Set.of(USER_VIEW, POST_VIEW),
        k2: CREATOR,  v2: Set.of(USER_VIEW, POST_VIEW, USER_UPDATE, POST_UPDATE),
        k3: ADMIN,  v3: Set.of(USER_VIEW, POST_VIEW, USER_UPDATE, POST_UPDATE, USER_DELETE, POST_DELETE)
    );

    public static Set<SimpleGrantedAuthority> getAuthoritiesForRole(Role role) {  no usages
        return map.get(role).stream() Stream<Permission>
                .map( mapper: permission -> new SimpleGrantedAuthority( role: permission.name())) Stream<
                .collect( collector: Collectors.toSet());
    }
}
```

  - NOTE: You can import **enum values** directly using **import static**
  - Now you don't need to store the ***permissions*** in the database.


@Override Alok Ranjan Joshi +1 *
public Collection<? extends GrantedAuthority> getAuthorities() {
Set<SimpleGrantedAuthority> authorities = new HashSet<>();
this.roles.forEach(action: role -> {
authorities.addAll(c: PermissionMapping.getAuthoritiesForRole(role));
authorities.add(new SimpleGrantedAuthority(role: "ROLE_" + role.name()))
});
return authorities;

- As we can see, writing this many logic in the **WebSecurityConfig** is creating overhead and messy.
  - In case of real world project, there will be so many paths, roles, permissions and if we write all those authorization then it'll be very complicated.
  - Therefore **@Secured** and **@PreAuthorize** and **@PostAuthorize** are used.
  - These are used for **method level authorization**, we just need to write these with the methods.
  - **@EnableMethodSecurity** is required to use these annotations. Just write once on any **Component** class (you can write with any class having *@Configuration* or *@Component*)
  - For using **@Secured**, you need to write

```
@EnableMethodSecurity(securedEnabled = true)
```

  - For using **@PreAuthorize** or **@PostAuthorize**, you need to write

```
@EnableMethodSecurity(prePostEnabled = true)
```

    - By default **prePostEnabled** is **true** only, so even if you don't mention this explicitly, it'll work.

- **@Secured**
  - It'll only work for **roles**, i.e. having **ROLE_** prefix.
  - It'll not work for any other permissions like POST_VIEW, POST_DELETE etc etc.
  - **ROLE_** must be there otherwise it'll not work.

```
@Secured({"ROLE_ADMIN"})  no usages  A
@GetMapping
public List<PostDTO> getAllPosts() {
    return postService.getAllPosts();
}
```

    - Now the users having roles other than **ADMIN** will not be able to access this.
  - NOTE: You need to write **ROLE_ADMIN** here, only **ADMIN** will not work.

```
@Secured({"POST_VIEW"})  no usages  An
@GetMapping
public List<PostDTO> getAllPosts() {
    return postService.getAllPosts();
}
```

- I wrote this POST_VIEW and tried to access the posts from the user who has POST_VIEW permission. But it didn't work.

- So, permissions having prefix **ROLE_** will only work in case of **@Secured**

➢ **@PreAuthorized**

- It is widely used; @Secured is used very rarely (negligible)
- It can access the **arguments of the method**.
- It supports **role**, **permissions**, **conditions** (and, or etc), **parameters** (method arguments)
- You can write **hasRole**, **hasAnyRole**, **hasAuthority**, **hasAnyAuthority** …etc etc inside it.

```
@PreAuthorize("hasRole('ADMIN') or hasAnyAuthority('POST_VIEW', 'USER_VIEW')")
@GetMapping
public List<PostDTO> getAllPosts() {
    return postService.getAllPosts();
}
```

- We can write the query like this. You can use **and** or **or** and write multiple filters (authorizing filters; not spring filters…) here.

```
@PreAuthorize("#postId == 2")  no usages  Anuj Kumar Sharma
@GetMapping("/{postId}")
public PostDTO getPostById(@PathVariable Long postId) {
    return postService.getPostById(postId);
}
```

- You can also access the method arguments using **#**
- In here I accessed *postId* using **#postId**

- Also you can access **authentication** object inside **@PreAuthorize**.

```
@PreAuthorize("authentication.principal.id == 10")  no us
@GetMapping("/{postId}")
public PostDTO getPostById(@PathVariable Long postId) {
    return postService.getPostById(postId);
}
```

- NOTE: here don't make getter function call;
- Just write **authentication.principal.id** or something like that.
- But, if the **authentication** is null, then it'll fail ***silently***.

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