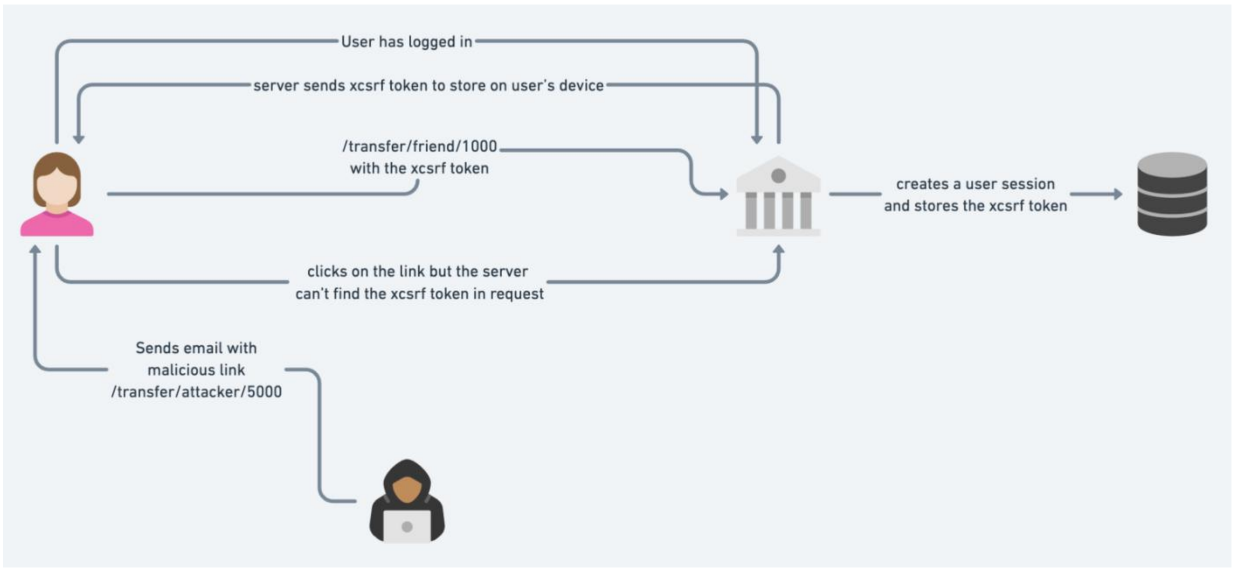
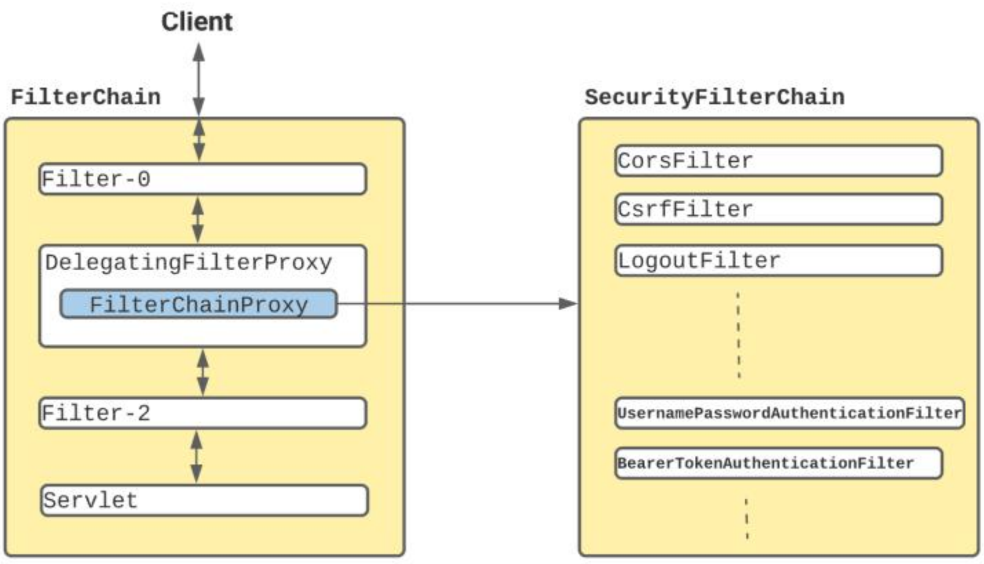
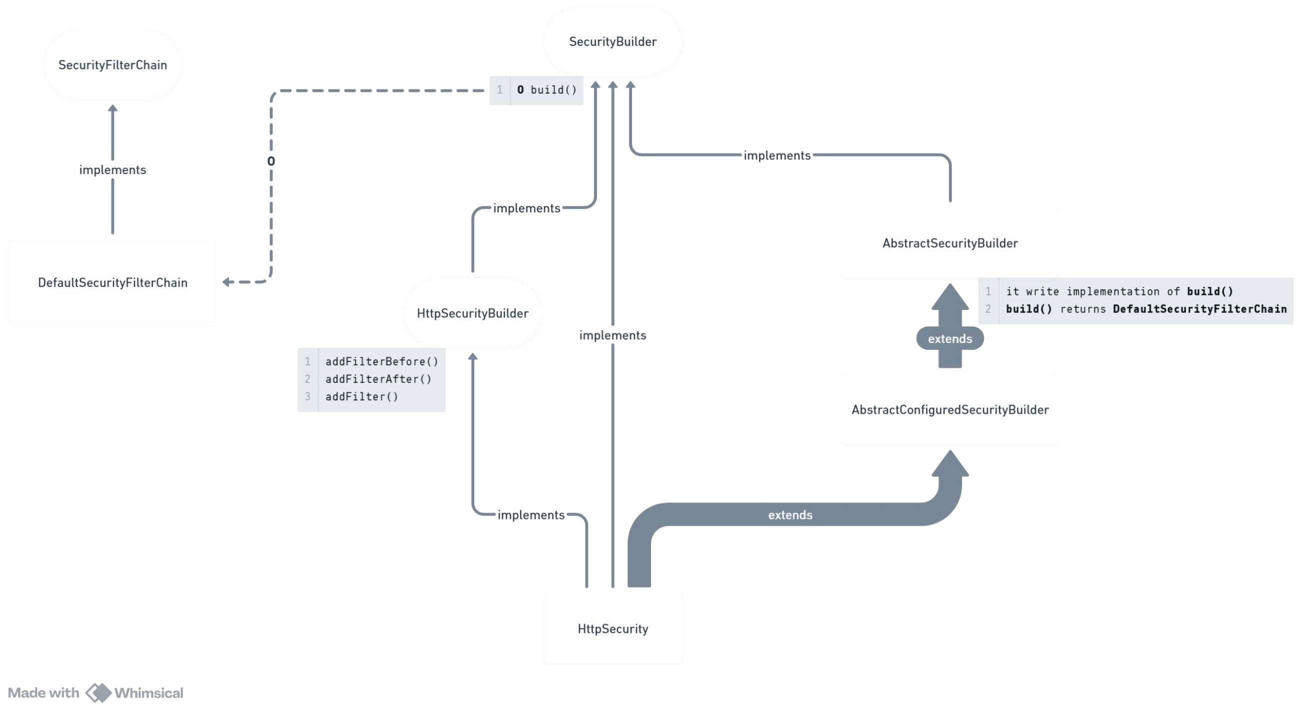
- **CSRF**
  - CSRF (Cross-Site Request Forgery) is an attack where a malicious website tricks a logged-in user's browser into sending an unauthorized request to a trusted website using the user's existing session/cookies.
  - So basically, **CSRF** attacks doesn't steal password; It uses user's cookies stored in the browser to steal the data/money.
  - So, to prevent CSRF, either you need to pass some unique token in the request headers or make the request bind with a particular website (means other website cannot send that request)
  - Someone can steal your cookies, but they don't have your headers.
- With **csrf** token, it can be prevented.
  - 
User has logged in
server sends xcsrf token to store on user's device
/transfer/friend/1000 with the xcsrf token
creates a user session and stores the xcsrf token
clicks on the link but the server can't find the xcsrf token in request
Sends email with malicious link /transfer/attacker/5000
-

Internal Working Of Spring Security

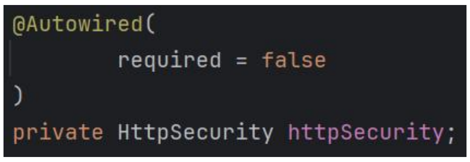
- The dependency **spring-boot-starter-security** has to be added in pom.xml which groupId is **org.springframework.boot**
- After that spring-boot will auro-configure the security with sensible defaults defined in **WebSecurityConfiguration** class.



-
    - In Spring Boot application, **SecurityFilterAutoConfiguration** automatically registers the **DelegatingFilterProxy** filter with the name **springSecurityFilterChain**.
    - Once the request reaches to **DelegatingFilterProxy**, Spring delegates the processing to **FilterChainProxy** bean that utilizes the **SecurityFilterChain** to execute the list of all filters to be invoked for the current request.
- Default behaviour of Spring-Security
    - Creates a bean named **springSecurityFilterChain** & registers the ***filter*** with a bean named **springSecurityFilterChain** with the Servlet container for every request.
    -

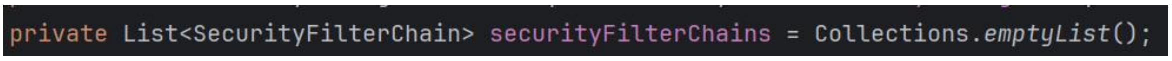
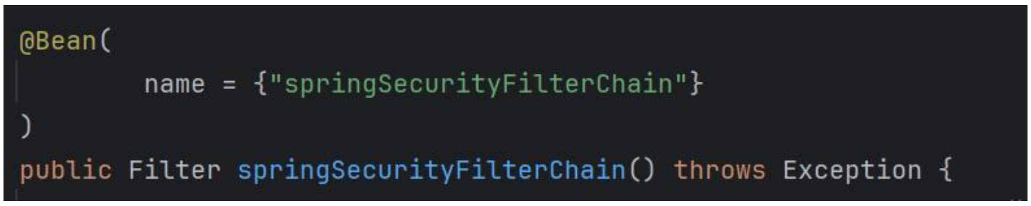
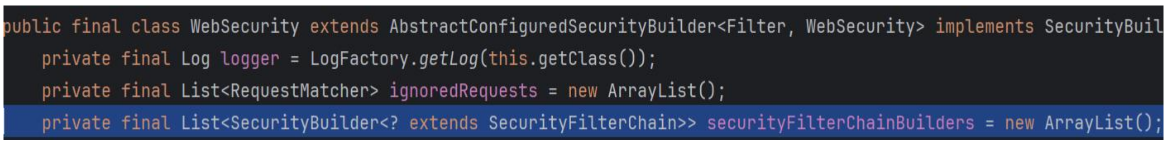
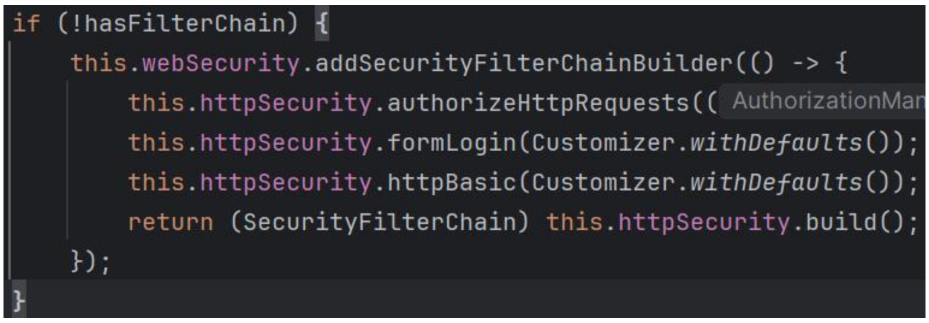
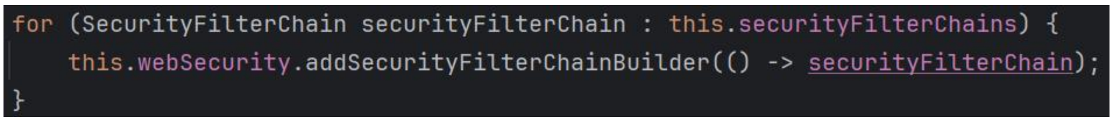
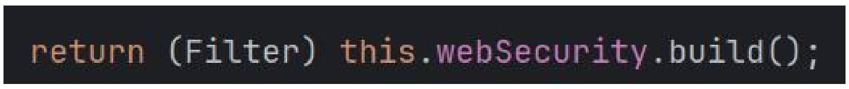


- This is the flow of **Security Filters**.
- In the class **WebSecurityConfiguration**, the beans are created.
  - The bean of **HttpSecurity** is created.

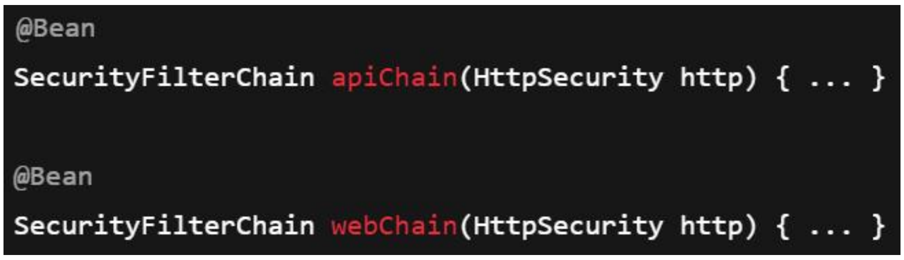


```
@Autowired(
        required = false
)
private HttpSecurity httpSecurity;
```

  - One **HttpSecurity** type of object can build only **one SecurityFilterChain**.

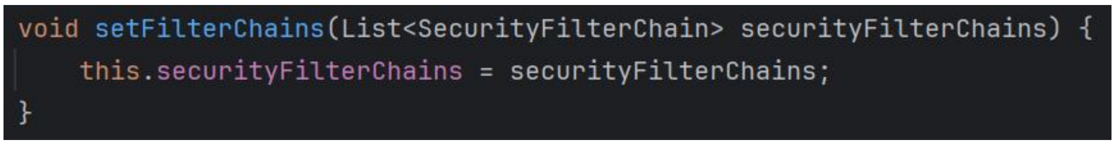
- **HttpSecurity** contains **build()** method that returns object of type **DefaultSecurityFilterChain**. Then why Spring needs to create a bean of **SecurityFilterChain** ?
    - **WebSecurityConfiguration** has a list of **SecurityFilterChain**
        - 
```
private List<SecurityFilterChain> securityFilterChains = Collections.emptyList();
```
    - Here one method is there to create the bean named as **springSecurityFilterChain**.
        - 
```
@Bean(
        name = {"springSecurityFilterChain"}
)
public Filter springSecurityFilterChain() throws Exception {
```
        - But here, **Filter** is the return type; confusing; will discuss at the end :)
    - If there is no filter chains, it'll add the default chain from *HttpSecurity* build() method.
        - it'll not add the default chain to the list i.e. **securityFilterChains**, rather it is beind added to **webSecurity** object.
        - 
```
public final class WebSecurity extends AbstractConfiguredSecurityBuilder<Filter, WebSecurity> implements SecurityBuil
    private final Log logger = LogFactory.getLog(this.getClass());
    private final List<RequestMatcher> ignoredRequests = new ArrayList();
    private final List<SecurityBuilder<? extends SecurityFilterChain>> securityFilterChainBuilders = new ArrayList();
```
        - It is being added here (WebSecurity class).
        - 
```
if (!hasFilterChain) {
    this.webSecurity.addSecurityFilterChainBuilder(() -> {
        this.httpSecurity.authorizeHttpRequests(( AuthorizationMan
        this.httpSecurity.formLogin(Customizer.withDefaults());
        this.httpSecurity.httpBasic(Customizer.withDefaults());
        return (SecurityFilterChain) this.httpSecurity.build();
    });
}
```
    - If filter chains are already there, then it add those filter chains to **webSecurity** object.
        - 
```
for (SecurityFilterChain securityFilterChain : this.securityFilterChains) {
    this.webSecurity.addSecurityFilterChainBuilder(() -> securityFilterChain);
}
```
    - At the end it'll return an object of type **Filter**
        - 
```
return (Filter) this.webSecurity.build();
```

Spring Filter Behind the Scene

- What we see, **chain of filters are being executed in between Servlet Container and Servlet**.
  - One **servlet containers** can have many filters, many servlets; but in case of spring we have only one Servlet which is **DispathcerServlet**.
  - And, its not by limitation, but by design spring make sures only one **Filter** should be there in between **Servlet Container** (tomcat in our case) and **Servlet** (DispatcherServlet).
  - So, only **one Filter** should be able to handle **multiple Filter Chains** where **each chain contains multiple Filters**.
    - its like **one object** is equivalent to **list of *list of the same object***.
  - So, **FilterChainProxy** was introduced which implements **Filter**. And it contains the list of **SecurityFilterChain** objects.
    - And the thing is, this ***SecurityFilterChain*** class contains a method **getFilters()** which returns a list of **Filter** objects.
  - So now, we can return **FilterChainProxy** object instead of **Filter** because *FilterChainProxy* is nothing but the child of *Filter*.
    - And also it contains *list of SecurityFilterChain* which means ***list of (list of (Filter))***.
- If you want to create your own **filter chains**.
  - Don't override the bean creation of the bean **springSecurityFilterChain**, otherwise spring will only create your bean and all the necessary steps like the below will be skipped.
    - Adding the filter chain to **webSecurity**.
    - **customize** using the **Customizer** object..
  - This all will have to be implemented in your own bean creation method.
  - So, create beans of type **SecurityFilterChain**
    - 

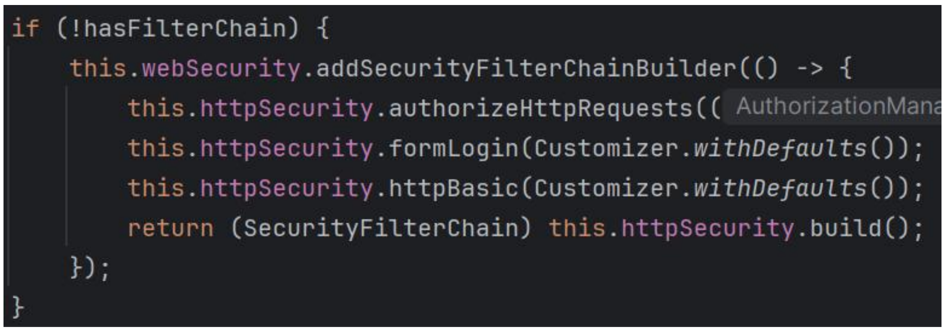
```
@Bean
SecurityFilterChain apiChain(HttpSecurity http) { ... }

@Bean
SecurityFilterChain webChain(HttpSecurity http) { ... }
```

    - Now you might be thinking, if we are creating **multiple beans of same type**, spring will be confused which bean has to be created; but in this case we spring has **list of SecurityFilterChain** not a single object of *SecurityFilterChain*, so all the beans will be added to that list.

- 

```
void setFilterChains(List<SecurityFilterChain> securityFilterChains) {
    this.securityFilterChains = securityFilterChains;
}
```

- This method is inside **WebSecurityConfiguration** class.
- All the **SecurityFilterChain** objects that you created beans of, will be passed to this ***setFilterChains*** method.

- Now, when the list i.e. **securityFilterChains** (present inside WebSecurityConfiguration.class) has already some elements present, so the default **filter chain** will not be added to this.
  - 

```
if (!hasFilterChain) {
    this.webSecurity.addSecurityFilterChainBuilder(() -> {
        this.httpSecurity.authorizeHttpRequests(( AuthorizationMana
        this.httpSecurity.formLogin(Customizer.withDefaults());
        this.httpSecurity.httpBasic(Customizer.withDefaults());
        return (SecurityFilterChain) this.httpSecurity.build();
    });
}
```

-
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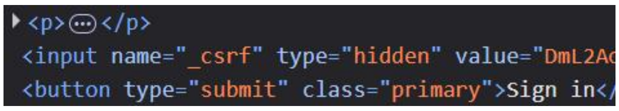
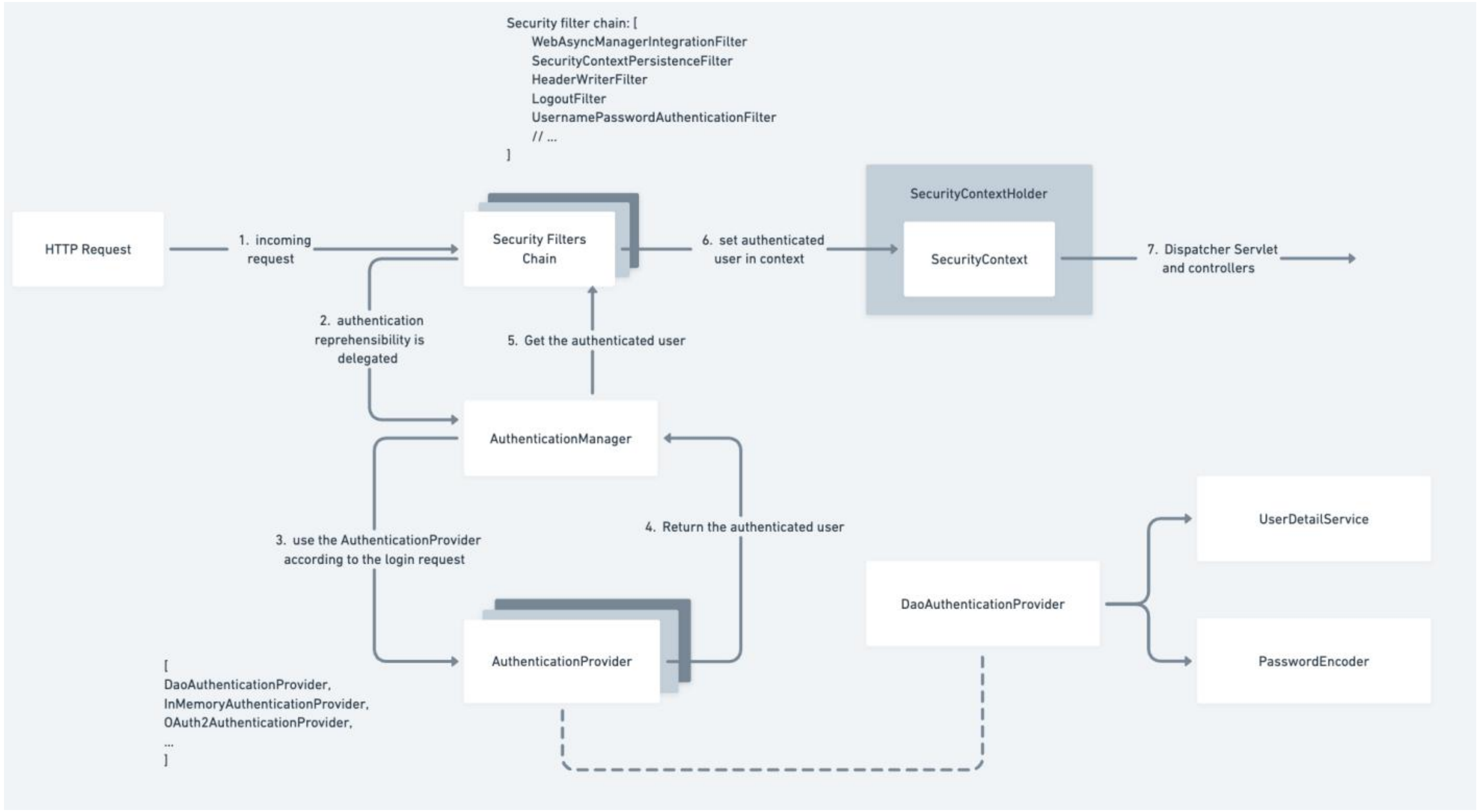
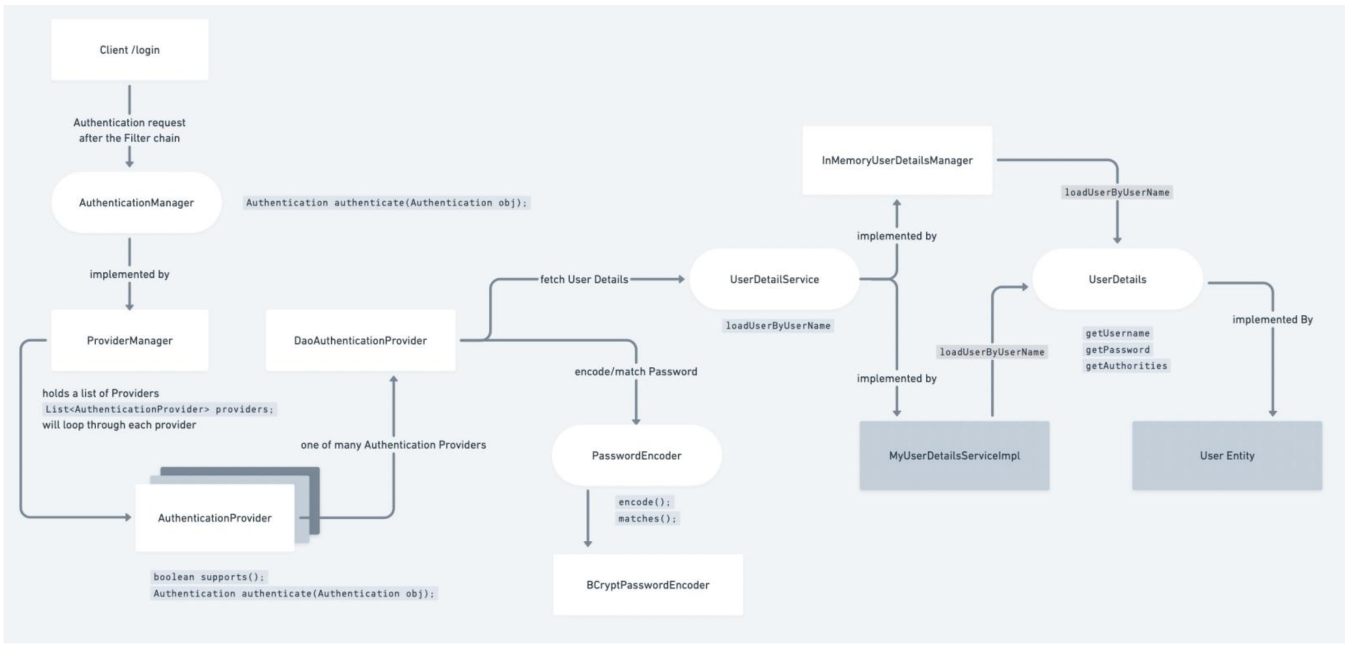
-

- When you run the application after including the dependency **spring-boot-starter-security**, by default one login page will appear to authenticate you.
  - If you inspect that, you'll find one *hidden input* field containing the csrf token as its value which is being attached to request.
  - 

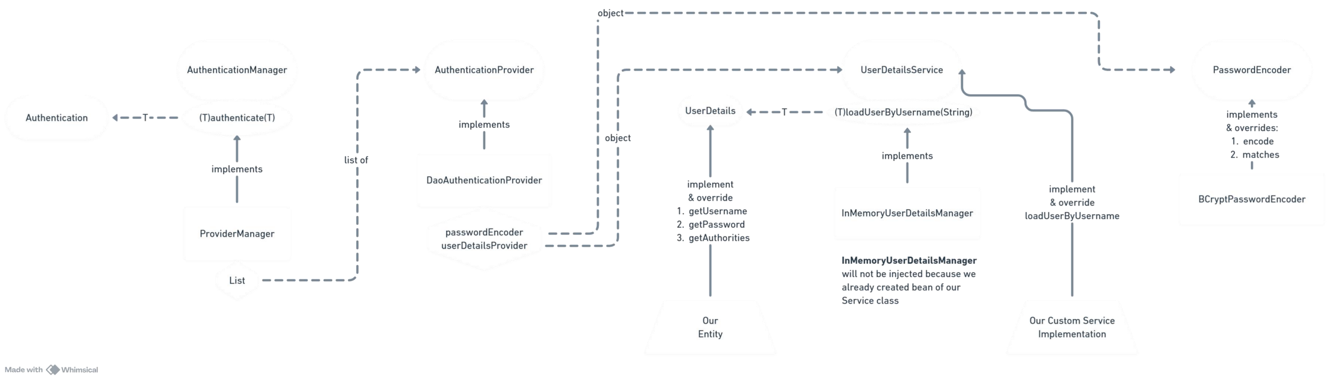
```
▸ <p>⋯</p>
  <input name="_csrf" type="hidden" value="DmL2Ac
  <button type="submit" class="primary">Sign in</
```

  - Means every time any request being sent, **session id** (cookie) along with **csrf token** (request header) are also sent.
- Default Security Filters configurations
  - **SecurityFilterChain** is an interface containing list of filters.
    - **DefaultSecurityFilterChain** *implements SecurityFilterChain* and initializes the filters inside its constructor.
    - But someone needs to call this constructor passing the **filters** as argument to initialize the filters.
  - **HttpSecurity** class extends **AbstractSecurityBuilder** class which contains **build()** method which returns an object of type **DefaultSecurityFilterChain**.
  -

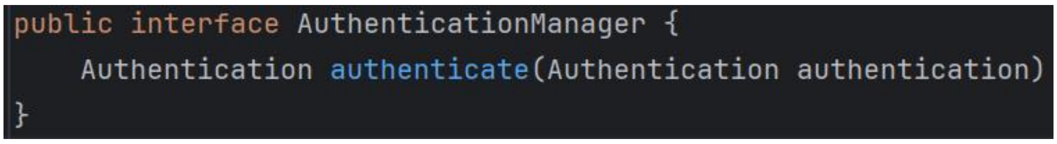
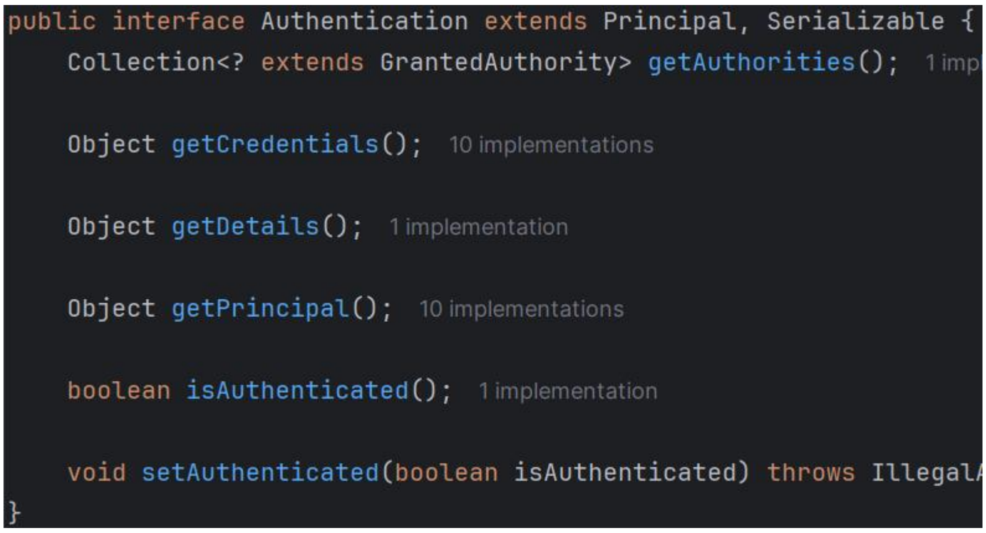

Security filter chain: [
WebAsyncManagerIntegrationFilter
SecurityContextPersistenceFilter
HeaderWriterFilter
LogoutFilter
UsernamePasswordAuthenticationFilter
// ...
]
HTTP Request
1. incoming request
Security Filters Chain
6. set authenticated user in context
SecurityContextHolder
SecurityContext
7. Dispatcher Servlet and controllers
2. authentication reprehensibility is delegated
5. Get the authenticated user
AuthenticationManager
3. use the AuthenticationProvider according to the login request
4. Return the authenticated user
AuthenticationProvider
[
DaoAuthenticationProvider,
InMemoryAuthenticationProvider,
OAuth2AuthenticationProvider,
...
]
DaoAuthenticationProvider
UserDetailService
PasswordEncoder



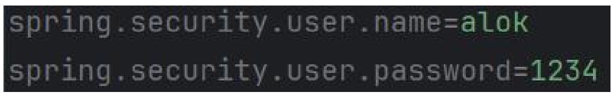
(rectangles: classes, ellipse: interfaces)



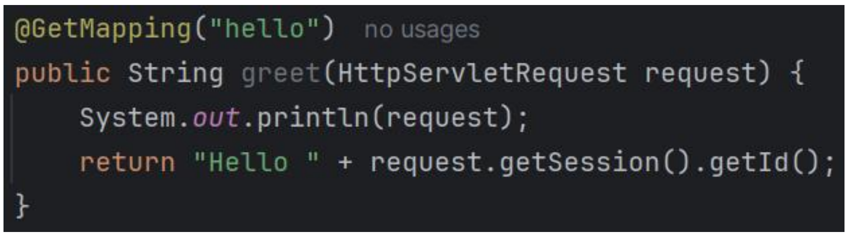
Flowchart of Authentication

- **AuthenticationManager** is an interface.
  - 
    ```
    public interface AuthenticationManager {
        Authentication authenticate(Authentication authentication)
    }
    ```
  - **Authentication** is also an interface containing necessary methods
    - 
      ```
      public interface Authentication extends Principal, Serializable {
          Collection<? extends GrantedAuthority> getAuthorities();  1 imp

          Object getCredentials();  10 implementations

          Object getDetails();  1 implementation

          Object getPrincipal();  10 implementations

          boolean isAuthenticated();  1 implementation

          void setAuthenticated(boolean isAuthenticated) throws IllegalA
      }
      ```
    - After the authentication done,
    - **isAuthenticated** will be marked as true.
- Now, so many classes implement **AuthenticationManager**, one of those is ***ProviderManager***
  - It holds a *list* of **AuthenticationProvider** (which is also an interface)
- **DaoAuthenticationProvider** implements **AuthenticationProvider**
  - It holds the **UserDetailsService** and **PasswordEncoder** type of objects.
- **UserDetailsService**
  - We will implement this interface from our custom **Service** class and implement the **loadUserByUsername** method.
  - This method use **UserDetails** type of object.
- **UserDetails**
  - Our entity should implement this interface.
  -
  - F
  - F
  - F

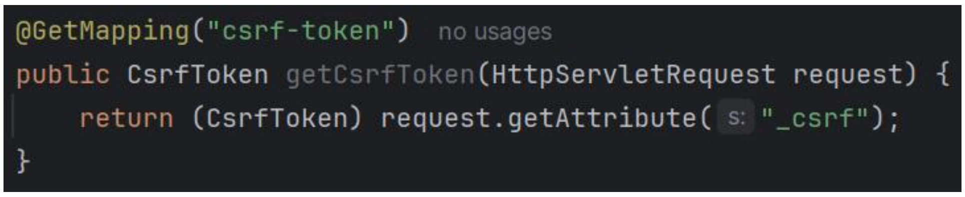
Udemy Part

- **Client** --- **Servlet Container** --- filter-1 --- filter-2 --- …. --- filter-N --- **Servlet**
  - 2 way (request and response)
- If you include **spring-boot-starter-security**, whenever you'll try to hit any api endpoint, it'll redirect you to the login page;
  - You need to authenticate yourself with username and password then one **session id** will be generated and will be stored in the *browser cookies* .
  - whenever you'll hit any end-point, that **session id** will also be attached with the request.
  - By default username id **user** and password will be generated when you'll run the spring boot application.
  - For customized username and password, you can write those in the **application.properties** file.
    - 

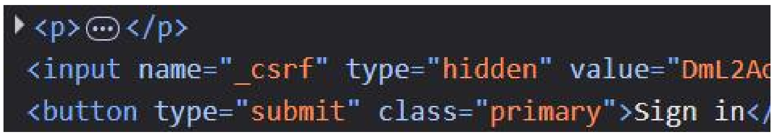
```
spring.security.user.name=alok
spring.security.user.password=1234
```

- In the controller, you can get **HttpServletRequest** type of object which contains details like session id and all.
  - 

```
@GetMapping("hello")  no usages
public String greet(HttpServletRequest request) {
    System.out.println(request);
    return "Hello " + request.getSession().getId();
}
```

- Get request working; post not working because we are not sending csrf token;
- When you trigger get request, **csrf** token is not required because its read-only;
  - But, for remaining operations, you need to pass **csrf** token in the *headers*.
  - 

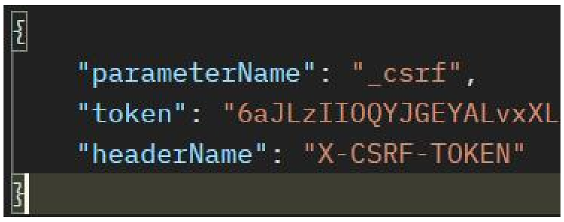
```
@GetMapping("csrf-token")  no usages
public CsrfToken getCsrfToken(HttpServletRequest request) {
    return (CsrfToken) request.getAttribute( s: "_csrf");
}
```

  - I created this end-point to get the **csrf** token.
  - 

```
▸<p>⋯</p>
 <input name="_csrf" type="hidden" value="DmL2A
 <button type="submit" class="primary">Sign in</
```

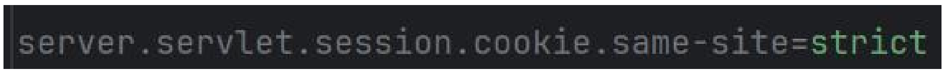
    - If you see the default login page generated by **spring security**, the name will be **_csrf** here.

- So the attribute name is **_csrf**



```
{
    "parameterName": "_csrf",
    "token": "6aJLzIIOQYJGEYALvxXL
    "headerName": "X-CSRF-TOKEN"
}
```

- While triggering POST request via *postman*, you need to pass **X-CSRF-TOKEN** in the headers.
- It is one way of solving CSRF issue; other way is "Don't allow any other website to use your session ID"

    ```
    server.servlet.session.cookie.same-site=strict
    ```

    - Add this in your **application.properties** file and it'll restrict other website to use your session id.

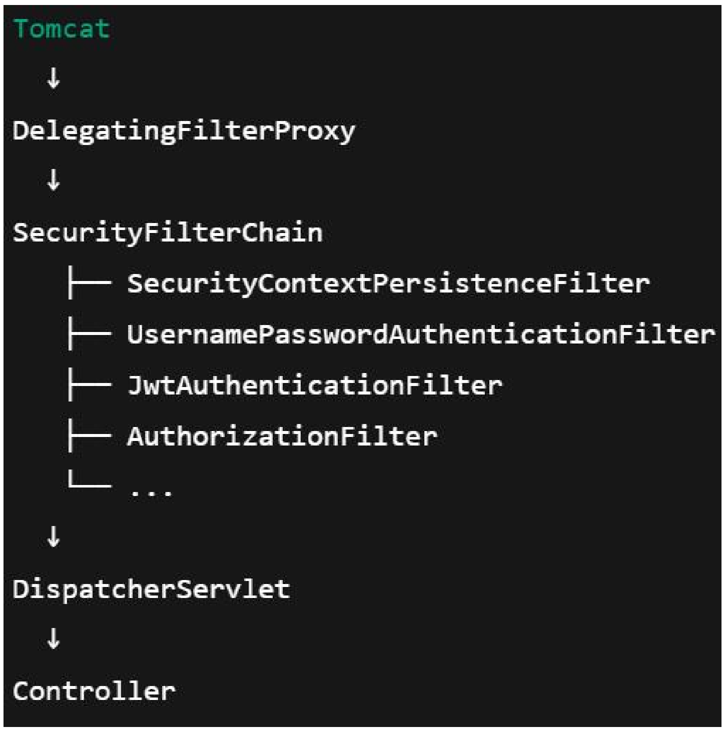
➢ There are 2 types of application: **stateful** and **stateless**.

- The one we were using now was **stateful**, because it was using same *session ID* for all the requests.
- In case of **stateless** we need to pass the **username** & **password** in each request; so there is no need of **csrf token** here.

➢

➢ Spring Security Working

➢ The filters are present in between the **Tomcat** and **DispatcherServlet**'



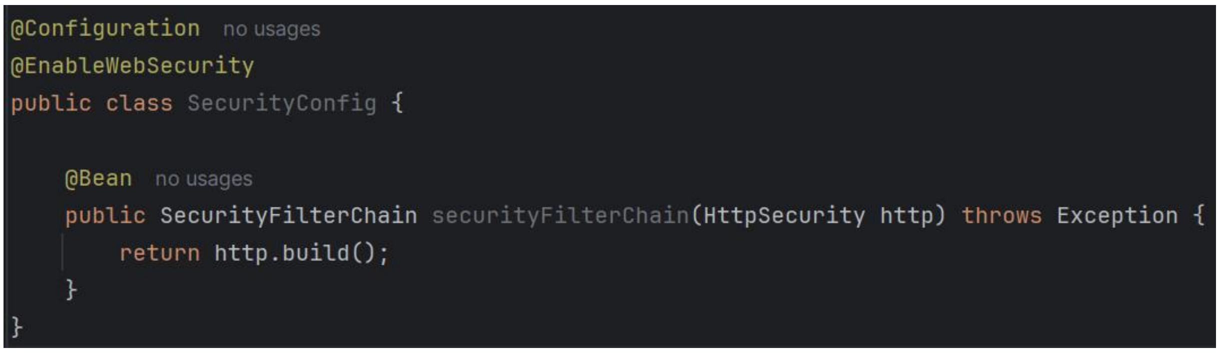
```
Tomcat
  ↓
DelegatingFilterProxy
  ↓
SecurityFilterChain
    ├── SecurityContextPersistenceFilter
    ├── UsernamePasswordAuthenticationFilter
    ├── JwtAuthenticationFilter
    ├── AuthorizationFilter
    └── ...
  ↓
DispatcherServlet
  ↓
Controller
```

➢ **@EnableWebSecurity**

- It tells Spring "Activate Spring Security's filter chain for web requests".
- Without it, no security filters are applied.

➢ In **Spring Boot**, spring security filters are auto-configured if the dependency **spring-boot-starter-security** is present in the pom.xml

➢ If you create a **bean** of type SecurityFilterChain then Spring will not create bean; menas basically you did override the bean creation.



```java
@Configuration  no usages
@EnableWebSecurity
public class SecurityConfig {

    @Bean  no usages
    public SecurityFilterChain securityFilterChain(HttpSecurity http) throws Exception {
        return http.build();
    }
}
```

- Now the filters will not be executed; you need to mention those filters.

➢

➢ F

➢ F

➢ F

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- F
- F
- F
- F
- F
- vf