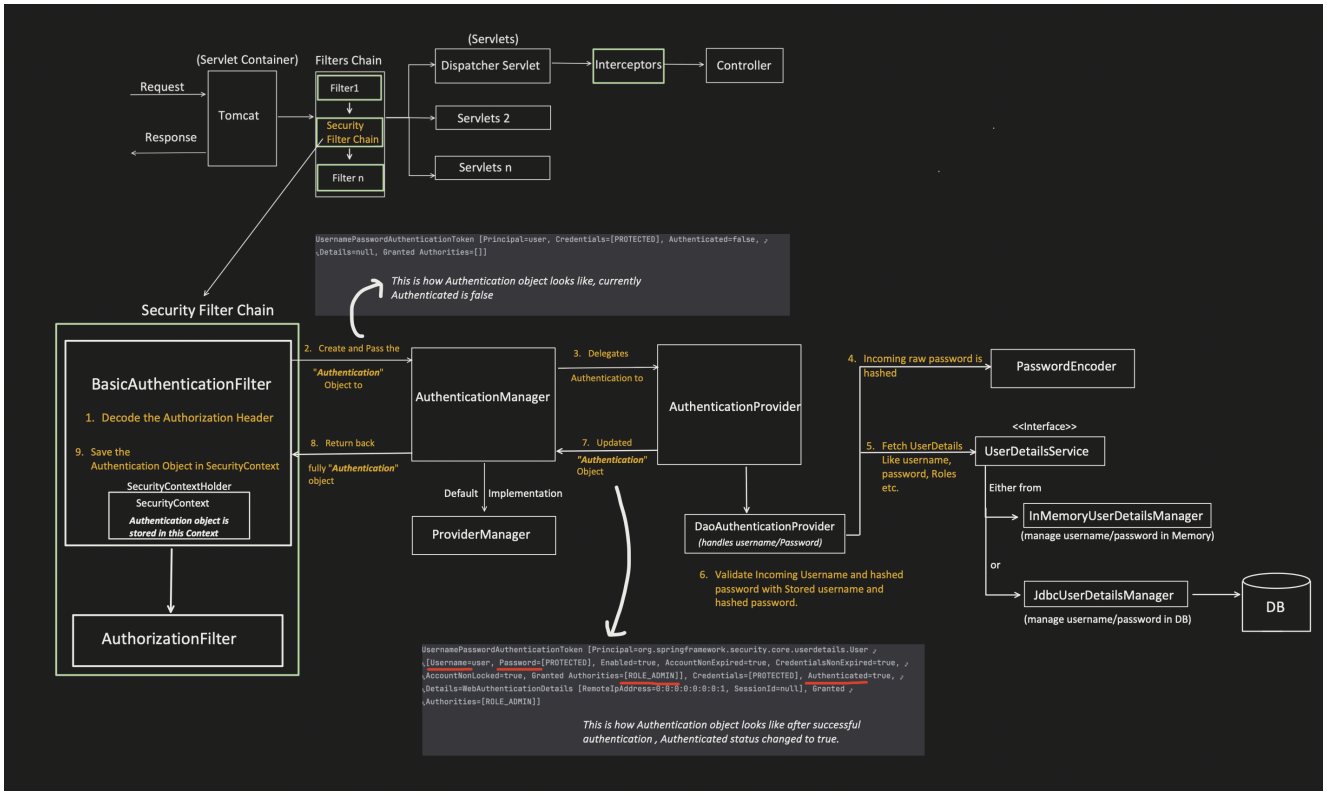
Role based Authorization - (Annotation)

- **We have already covered different type of Authentications.**
- **And with that, we have also covered, how at Security Filter layer itself we can do authorization.**

```java
@Configuration
@EnableWebSecurity
public class SecurityConfig {

    @Bean
    public SecurityFilterChain securityFilterChain(HttpSecurity http) throws Exception {
        http
                .authorizeHttpRequests(auth -> auth
                        .requestMatchers( ...patterns: "/users").hasRole("USER")
                        .anyRequest().authenticated()
                )
                .formLogin(Customizer.withDefaults());
        return http.build();
    }
}
```

- **But in large scale applications, where we might have 100s of APIs, in that scenarios managing the roles at Security Filter might become difficult and cause scalable issue.**

  That's where, Annotation based "Role Based Authorization" comes into the picture. And these annotations are used within our Controller class.



Annotations for "Role Based Authorization"

@PreAuthorize

Does Authorization, before execution of the API.

@PostAuthorize

Does Authorization after execution of the API but before sending the response back to the user.

Lets create User First (Dynamic one)

We have already seen its implementation


```java
@Entity
@Table(name = "user_login")
public class UserLoginEntity implements UserDetails {

    @Id
    @GeneratedValue(strategy = GenerationType.IDENTITY)
    private Long id;

    @Column(unique = true, nullable = false)
    private String username;

    @Column(nullable = false)
    private String password;

    private String role; // e.g., {"ROLE_USER" or "ROLE_ADMIN"

    @OneToMany(cascade = CascadeType.ALL, fetch = FetchType.EAGER)
    private List<UserPermissionEntity> permissions = new ArrayList<>();

    @Override
    public Collection<? extends GrantedAuthority> getAuthorities() {
        Set<GrantedAuthority> authorities = new HashSet<>();

        authorities.add(new SimpleGrantedAuthority(role));

        permissions.forEach(permission ->
                authorities.add(new SimpleGrantedAuthority(permission.getName())));

        return authorities;
    }

    @Override
    public String getPassword() {
        return password;
    }

    @Override
    public String getUsername() {
        return username;
    }
```

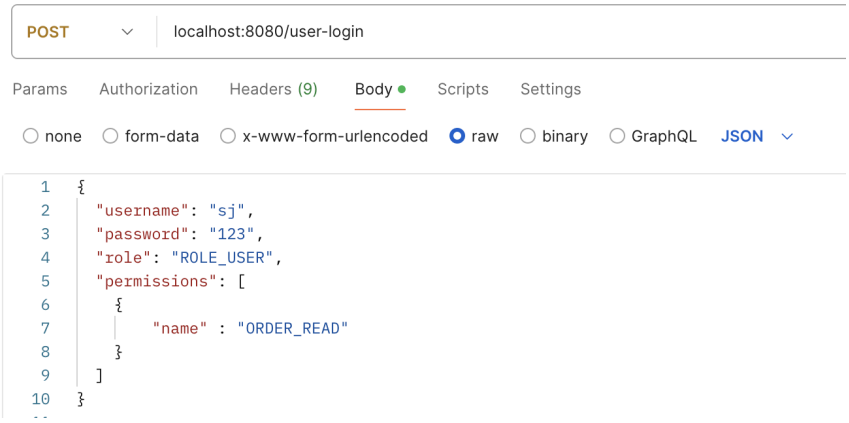
```java
@Entity
@Table(name = "user_permission")
public class UserPermissionEntity {

    @Id
    @GeneratedValue(strategy = GenerationType.IDENTITY)
    private Long id;

    private String name; // e.g., ORDER_READ, SALES_READ

    public Long getId() {
        return id;
    }

    public void setId(Long id) {
        this.id = id;
    }

    public String getName() {
        return name;
    }

    public void setName(String name) {
        this.name = name;
    }
}
```

```java
@RestController
public class UserLoginController {

    @Autowired
    UserLoginEntityService userLoginEntityService;

    @Autowired
    PasswordEncoder passwordEncoder;

    @PostMapping("/user-login")
    public ResponseEntity<String> login(@RequestBody UserLoginEntity userLoginEntity) {
        // Hash the password before saving
        userLoginEntity.setPassword(passwordEncoder.encode(userLoginEntity.getPassword()));

        userLoginEntityService.save(userLoginEntity);

        return ResponseEntity.ok( body: "User registered successfully!");
    }
}
```

```java
@Service
public class UserLoginEntityService implements UserDetailsService {

    @Autowired
    private UserLoginEntityRepository userLoginEntityRepository;

    @Override
    public UserDetails loadUserByUsername(String username) throws UsernameNotFoundException {
        return userLoginEntityRepository.findByUsername(username)
                .orElseThrow(() -> new UsernameNotFoundException("user not found"));
    }

    public UserDetails save(UserLoginEntity userLoginEntity) {
        return userLoginEntityRepository.save(userLoginEntity);
    }

}
```

```java
@Repository
public interface UserLoginEntityRepository extends JpaRepository<UserLoginEntity, Long> {

    Optional<UserLoginEntity> findByUsername(String username);
}
```

Now, we should be able to create user, and in this one User can have 1 role like ROLE_ADMIN, ROLE_USER etc.
But we can give many permissions like ORDER_READ, SALES_DELETE etc.... (more granular level permissions)



Now, User Creation part is done, lets update our Security Config file.

```java
@Configuration
@EnableWebSecurity
@EnableMethodSecurity(prePostEnabled = true)
public class SecurityConfig{

    @Bean
    public PasswordEncoder passwordEncoder(){
        return new BCryptPasswordEncoder();
    }

    @Bean
    public SecurityFilterChain securityFilterChain(HttpSecurity http) throws Exception {

        http.authorizeHttpRequests(auth -> auth
                        .requestMatchers( ...patterns: "/user-login").permitAll()
                        .anyRequest().authenticated())
                .sessionManagement(session -> session
                        .sessionCreationPolicy(SessionCreationPolicy.STATELESS))
                .csrf(csrf -> csrf.disable())
                .httpBasic(Customizer.withDefaults());
        return http.build();
    }
}
```

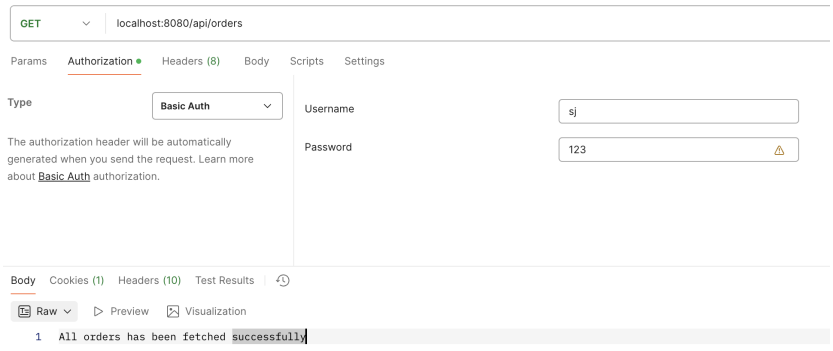
Without enabling this, @PreAuthorize and @PostAuthorize annotations will be ignored.

Now, lets create 2 Controller class, one for ORDER and another for SALES for testing purpose

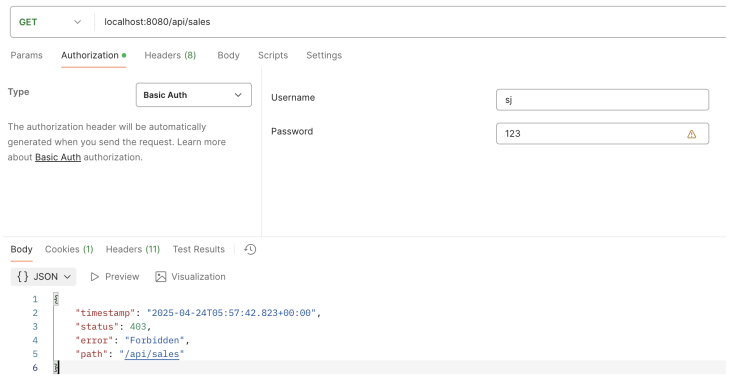
```java
@RestController
@RequestMapping("/api")
public class OrderController {

    @GetMapping("/orders")
    @PreAuthorize("hasRole('USER') and hasAuthority('ORDER_READ')")
    public ResponseEntity<String> readOrders() {
        return ResponseEntity.ok( body: "All orders has been fetched successfully");
    }
}
```

```java
@RestController
@RequestMapping("/api")
public class SalesController {

    @GetMapping("/sales")
    @PreAuthorize("hasAuthority('SALES_READ')")
    public ResponseEntity<String> readSalesDetails() {
        return ResponseEntity.ok( body: "All Sales details has been fetched successfully");
    }
}
```

Above we have created user, who has both the permissions ROLE_USER and ORDER_READ, so API is successfully executed.



Now, when we try to access /sales API, which above user do not have permission, request has thrown exception.



@PreAuthorize("hasRole('USER') and hasAuthority('ORDER_READ')")

Spring Boot, treat both "hasRole" and "hasAuthority" in a similar way, only difference is that :

For "hasRole" : "ROLE_" is appended

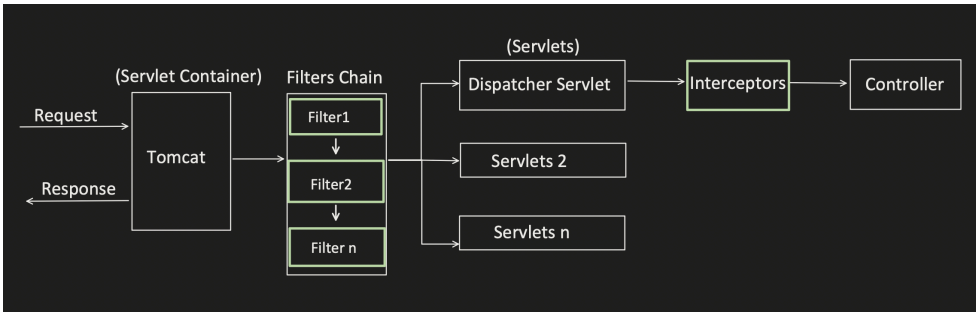
SecurityExpressionRoot.java

```
private String defaultRolePrefix = "ROLE_";
```

```
@Override
public final boolean hasAuthority(String authority) {
    return hasAnyAuthority(authority);
}

@Override
public final boolean hasAnyAuthority(String... authorities) {
    return hasAnyAuthorityName( prefix: null, authorities);
}

@Override
public final boolean hasRole(String role) {
    return hasAnyRole(role);
}

@Override
public final boolean hasAnyRole(String... roles) {
    return hasAnyAuthorityName(this.defaultRolePrefix, roles);
}

private boolean hasAnyAuthorityName(String prefix, String... roles) {
    Set<String> roleSet = getAuthoritySet();
    for (String role : roles) {
        String defaultedRole = getRoleWithDefaultPrefix(prefix, role);
        if (roleSet.contains(defaultedRole)) {
            return true;
        }
    }
    return false;
}
```

Now, one question comes to mind is, how this Authorization methods invokes before invocation of the Controller method.

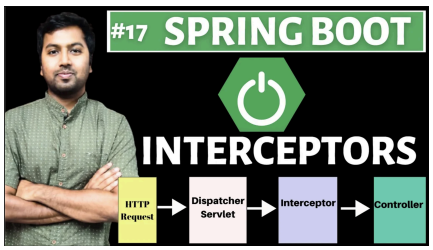
Its because of INTERCEPTORS

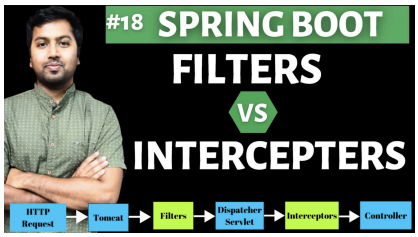


@PreAuthorize Annotation is intercepted by

AuthorizationManagerBeforeMethodInterceptor

What and how Interceptors works and how they are different from filters?
We have already covered both the topics in depth.






```
@PreAuthorize("hasRole('USER') and hasAuthority('ORDER_READ')")
```

This expression uses SpEL (i.e. Spring Expression Language)

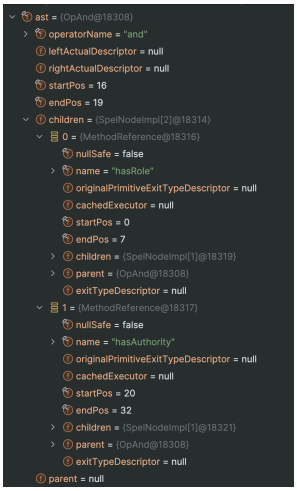
Spring framework has *SpelExpressionParser* class, which help in compilation of these strings.

Below is the high level flow:

AuthorizationManagerBeforeMethod Interceptor

1. Reads String from @PreAuthroize annotation → `@PreAuthorize("hasRole('USER') and hasAuthority('ORDER_READ')")`

2. Parse it using SpelExpressionParser → **Converts String into AST(Abstract Syntax Tree)**



3. Resolves the above Expression → **• References are resolved Which are encountered in above expression.**

OpAnd.java

```java
@Override
public TypedValue getValueInternal(ExpressionState state) throws EvaluationException {
    if (!getBooleanValue(state, getLeftOperand())) {
        // no need to evaluate right operand
        return BooleanTypedValue.FALSE;
    }
    return BooleanTypedValue.forValue(getBooleanValue(state, getRightOperand()));
}
```

4. → **Validates the result and decide whether to invoke the method or not**

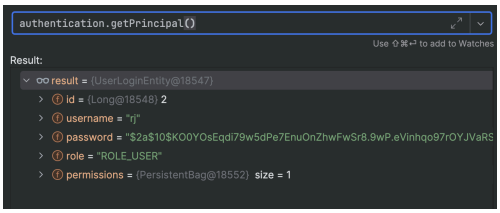
More Logical Operators

Operator	Description	Example
and	Logical AND	hasRole('ADMIN') and hasAuthority('READ')
or	Logical OR	hasRole('ADMIN') or hasRole('USER')
not	Logical NOT	not hasRole('ADMIN')
!	Also logical NOT	!hasAuthority('DELETE')

Relational Operators

Operator	Description	Example
==	Equal	#value == 15
!=	Not equal	#value != 15
<	Less than	#value < 100
>	Greater than	#value > 100
<=	Less than or equal	#value <= 15
>=	Greater than or equal	#value >= 90

```
@PreAuthorize("#id == authentication.principal.id")
@GetMapping("/users/{id}")
public User fetchUserDetails(@PathVariable Long id) {
    return userServiceObject.fetchUserDetails(id);
}
```



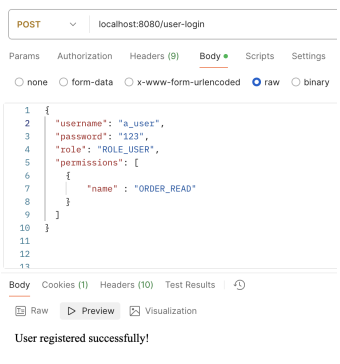
@PostAuthorize

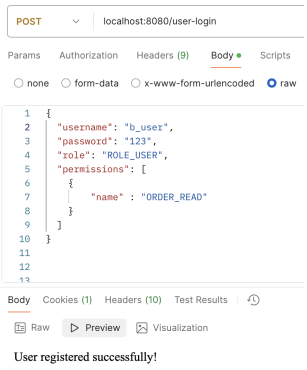
- Does Authorization after execution of the API but before sending the response back to the user.

- AuthorizationManagerAfterMethodInterceptor, is the one which intercept the @PostAuthorize annotation.

Let's see with an example

Created 2 Users





SELECT * FROM USER_LOGIN

SELECT * FROM USER_LOGIN;

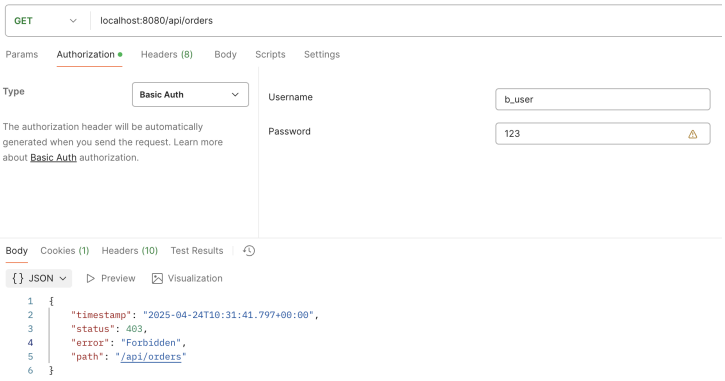
ID	PASSWORD	ROLE	USERNAME
1	$2a$10$oLOsKKtsbEsC63.MmGuNbO2CYqN8kvcCZW8/fwMvBB0p6mtKnQZ5u	ROLE_USER	a_user
2	$2a$10$Eb/CtlSeC0uUpTd09iyTUOcXDjdKTNiX.9C6CjZj2zZ9L2Ol0YW.m	ROLE_USER	b_user

(2 rows, 6 ms)

```java
@RestController
@RequestMapping("/api")
public class OrderController {

    @GetMapping("/orders")
    @PreAuthorize("hasRole('USER') and hasAuthority('ORDER_READ')")
    @PostAuthorize("returnObject.userID == authentication.principal.id")
    public OrderDTO readOrders() {
        OrderDTO orderDTO = new OrderDTO();
        orderDTO.userID = 1l; //hardcoding for now
        orderDTO.orderID = 10000l;
        return orderDTO;
    }
}
```

For testing purpose, I have hardcoded the user ID, and added the userID of "a_user"

Now, try to invoke this api with "b_users" credentials



Now, try to invoke this api with "a_users" credentials