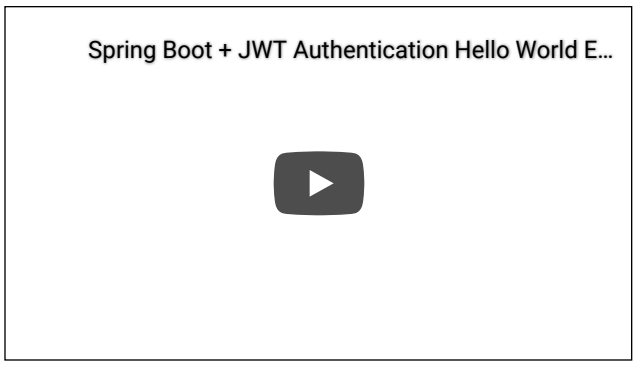
Spring Boot Security + JWT "Hello World" Example

(/users/3692891/ridashaikh.html) by Rida Shaikh (/users/3692891/ridashaikh.html) · May. 24, 19 · Security Zone (/application-web-network-security) · Tutorial

In this tutorial, we will be developing a Spring Boot application that makes use of JWT authentication for securing an exposed REST API. In this example, we will be making use of hard-coded user values for user authentication. In the next tutorial, we will be implementing Spring Boot + JWT + MYSQL JPA for storing and fetching user credentials. (https://www.javainuse.com/spring/boot-jwt-mysql) Any user will be able to consume this API only if it has a valid JSON Web Token (JWT). In a previous tutorial, we learned what is JWT and when and how to use it. (https://www.javainuse.com/spring/jwt)

This tutorial is explained in the following video:



For better understanding, we will be developing the project in stages:

Develop a Spring Boot application that exposes a simple REST GET API with mapping /hello.

Configure Spring Security for JWT. Expose REST POST API with mapping/authenticate using which User will get a valid JSON Web Token. And then, allow the user access to the API /hello only if it has a valid token

Spring Boot JWT Workflow

Develop a Spring Boot Application That Exposes a GET REST API

Develop a Spring Boot Application That Exposes a GET REST API

The Maven project will look as follows:


Spring Boot REST

The pom.xml is as follows:

```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">
<modelVersion>4.0.0</modelVersion>
<groupId>com.javainuse</groupId>
<artifactId>spring-boot-jwt</artifactId>
<version>0.0.1-SNAPSHOT</version>

<parent>
<groupId>org.springframework.boot</groupId>
<artifactId>spring-boot-starter-parent</artifactId>
<version>2.1.1.RELEASE</version>
<relativePath /> <!-- lookup parent from repository -->
</parent>

<properties>
<project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
<project.reporting.outputEncoding>UTF-8</project.reporting.outputEncoding>
<java.version>1.8</java.version>
</properties>

<dependencies>
<dependency>
<groupId>org.springframework.boot</groupId>
<artifactId>spring-boot-starter-web</artifactId>
</dependency>
</dependencies>

</project>
```

Create a `Controller` class for exposing a GET REST API:

```
package com.javainuse.controller;

import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RestController;

@RestController
public class HelloWorldController {

@RequestMapping({ "/hello" })
public String firstPage() {
return "Hello World";
}

}
```

Create the bootstrap class with the `SpringBoot` annotation:

```
package com.javainuse;

import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;

@SpringBootApplication
public class SpringBootHelloWorldApplication {

public static void main(String[] args) {
SpringApplication.run(SpringBootHelloWorldApplication.class, args);
}
}
```

Compile and then run the SpringBootHelloWorldApplication.java as a Java application.

Go to **localhost:8080/hello**

Spring Boot REST output

Spring Security and JWT Configuration

We will be configuring Spring Security and JWT to perform two operations:

Generating JWT: Expose a POST API with mapping **/authenticate**. On passing the correct username and password, it will generate a JSON Web Token (JWT).

Validating JWT: If a user tries to access the GET API with mapping **/hello**, it will allow access only if a request has a valid JSON Web Token (JWT).

The Maven project will look as follows:

Spring Boot JWT REST

The sequence flow for these operations will look as follows:

Generating JWT

Spring Boot JWT Generate Token

Spring Boot Security Authentication Manager

Validating JWT

Spring Boot JWT Validate Token

Add the Spring Security and JWT dependencies:

```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">
<modelVersion>4.0.0</modelVersion>
<groupId>com.javainuse</groupId>
<artifactId>spring-boot-jwt</artifactId>
<version>0.0.1-SNAPSHOT</version>

<parent>
<groupId>org.springframework.boot</groupId>
<artifactId>spring-boot-starter-parent</artifactId>
<version>2.1.1.RELEASE</version>
<relativePath /> <!-- lookup parent from repository -->
</parent>

<properties>
<project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
<project.reporting.outputEncoding>UTF-8</project.reporting.outputEncoding>
<java.version>1.8</java.version>
</properties>

<dependencies>
<dependency>
<groupId>org.springframework.boot</groupId>
<artifactId>spring-boot-starter-web</artifactId>
</dependency>
<dependency>
<groupId>org.springframework.boot</groupId>
<artifactId>spring-boot-starter-security</artifactId>
</dependency>
<dependency>
<groupId>io.jsonwebtoken</groupId>
<artifactId>jjwt</artifactId>
<version>0.9.1</version>
</dependency>
</dependencies>

</project>
```

Define the application.properties. As see in previous JWT tutorial, we specify the secret key, which we will be using for the hashing algorithm (https://www.javainuse.com/spring/jwt) The secret key is combined with the header and the payload to create a unique hash. We are only able to verify this hash if you have the secret key.

```
jwt.secret=javainuse
```

JwtTokenUtil

The `JwtTokenUtil` is responsible for performing JWT operations like creation and validation. It makes use of the io.jsonwebtoken.Jwts for achieving this.

```
package com.javainuse.config;

import java.io.Serializable;
import java.util.Date;
import java.util.HashMap;
import java.util.Map;
import java.util.function.Function;

import org.springframework.beans.factory.annotation.Value;
import org.springframework.security.core.userdetails.UserDetails;
import org.springframework.stereotype.Component;

import io.jsonwebtoken.Claims;
import io.jsonwebtoken.Jwts;
import io.jsonwebtoken.SignatureAlgorithm;

@Component
public class JwtTokenUtil implements Serializable {

private static final long serialVersionUID = -2550185165626007488L;

public static final long JWT_TOKEN_VALIDITY = 5 * 60 * 60;

@Value("${jwt.secret}")
private String secret;

//retrieve username from jwt token
public String getUsernameFromToken(String token) {
return getClaimFromToken(token, Claims::getSubject);
}

//retrieve expiration date from jwt token
public Date getExpirationDateFromToken(String token) {
return getClaimFromToken(token, Claims::getExpiration);
}

public <T> T getClaimFromToken(String token, Function<Claims, T> claimsResolver) {
final Claims claims = getAllClaimsFromToken(token);
return claimsResolver.apply(claims);
}
    //for retrieveing any information from token we will need the secret key
private Claims getAllClaimsFromToken(String token) {
return Jwts.parser().setSigningKey(secret).parseClaimsJws(token).getBody();
}

//check if the token has expired
private Boolean isTokenExpired(String token) {
final Date expiration = getExpirationDateFromToken(token);
return expiration.before(new Date());
}

//generate token for user
public String generateToken(UserDetails userDetails) {
Map<String, Object> claims = new HashMap<>();
return doGenerateToken(claims, userDetails.getUsername());
}

//while creating the token -
//1. Define  claims of the token, like Issuer, Expiration, Subject, and the ID
//2. Sign the JWT using the HS512 algorithm and secret key.
//3. According to JWS Compact Serialization(https://tools.ietf.org/html/draft-ietf-jose-json-web-signature-41#section-3.1)
//   compaction of the JWT to a URL-safe string
private String doGenerateToken(Map<String, Object> claims, String subject) {
```

```
return Jwts.builder().setClaims(claims).setSubject(subject).setIssuedAt(new Date(System.currentTimeMillis()))
.setExpiration(new Date(System.currentTimeMillis() + JWT_TOKEN_VALIDITY * 1000))
.signWith(SignatureAlgorithm.HS512, secret).compact();
}

//validate token
public Boolean validateToken(String token, UserDetails userDetails) {
final String username = getUsernameFromToken(token);
return (username.equals(userDetails.getUsername()) && !isTokenExpired(token));
}
}
```

JwtAuthenticationController

Expose a POST API /authenticate using the `JwtAuthenticationController`. The POST API gets the username and password in the body. Using the Spring Authentication Manager, we authenticate the username and password. If the credentials are valid, a JWT token is created using the `JWTTokenUtil` and is provided to the client.

```
package com.javainuse.controller;

import java.util.Objects;

import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.http.ResponseEntity;
import org.springframework.security.authentication.AuthenticationManager;
import org.springframework.security.authentication.BadCredentialsException;
import org.springframework.security.authentication.DisabledException;
import org.springframework.security.authentication.UsernamePasswordAuthenticationToken;
import org.springframework.security.core.userdetails.UserDetails;
import org.springframework.web.bind.annotation.CrossOrigin;
import org.springframework.web.bind.annotation.RequestBody;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RequestMethod;
import org.springframework.web.bind.annotation.RestController;
import com.javainuse.service.JwtUserDetailsService;


import com.javainuse.config.JwtTokenUtil;
import com.javainuse.model.JwtRequest;
import com.javainuse.model.JwtResponse;

@RestController
@CrossOrigin
public class JwtAuthenticationController {

@Autowired
private AuthenticationManager authenticationManager;

@Autowired
private JwtTokenUtil jwtTokenUtil;

@Autowired
private JwtUserDetailsService userDetailsService;

@RequestMapping(value = "/authenticate", method = RequestMethod.POST)
public ResponseEntity<?> createAuthenticationToken(@RequestBody JwtRequest authenticationRequest) throws Exception {

authenticate(authenticationRequest.getUsername(), authenticationRequest.getPassword());

final UserDetails userDetails = userDetailsService
.loadUserByUsername(authenticationRequest.getUsername());

final String token = jwtTokenUtil.generateToken(userDetails);

return ResponseEntity.ok(new JwtResponse(token));
}

private void authenticate(String username, String password) throws Exception {
try {
authenticationManager.authenticate(new UsernamePasswordAuthenticationToken(username, password));
} catch (DisabledException e) {
throw new Exception("USER_DISABLED", e);
} catch (BadCredentialsException e) {
throw new Exception("INVALID_CREDENTIALS", e);
}
}
}
```

JwtRequest

This class is required for storing the username and password we received from the client.

```
package com.javainuse.model;

import java.io.Serializable;

public class JwtRequest implements Serializable {

private static final long serialVersionUID = 5926468583005150707L;

private String username;
private String password;

//need default constructor for JSON Parsing
public JwtRequest()
{

}

public JwtRequest(String username, String password) {
this.setUsername(username);
this.setPassword(password);
}

public String getUsername() {
return this.username;
}

public void setUsername(String username) {
this.username = username;
}

public String getPassword() {
return this.password;
}

public void setPassword(String password) {
this.password = password;
}
}
```

JwtResponse

This class is required for creating a response containing the JWT to be returned to the user.

```
package com.javainuse.model;

import java.io.Serializable;

public class JwtResponse implements Serializable {

private static final long serialVersionUID = -8091879091924046844L;
private final String jwttoken;

public JwtResponse(String jwttoken) {
this.jwttoken = jwttoken;
}

public String getToken() {
return this.jwttoken;
}
}
```

JwtRequestFilter

The `JwtRequestFilter` extends the Spring Web Filter `OncePerRequestFilter` class. For any incoming request, this `Filter` class gets executed. It checks if the request has a valid JWT token. If it has a valid JWT Token, then it sets the authentication in context to specify that the current user is authenticated.

```
package com.javainuse.config;

import java.io.IOException;

import javax.servlet.FilterChain;
import javax.servlet.ServletException;
import javax.servlet.http.HttpServletRequest;
import javax.servlet.http.HttpServletResponse;

import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.security.authentication.UsernamePasswordAuthenticationToken;
import org.springframework.security.core.context.SecurityContextHolder;
import org.springframework.security.core.userdetails.UserDetails;
import org.springframework.security.web.authentication.WebAuthenticationDetailsSource;
import org.springframework.stereotype.Component;
import org.springframework.web.filter.OncePerRequestFilter;

import com.javainuse.service.JwtUserDetailsService;

import io.jsonwebtoken.ExpiredJwtException;

@Component
public class JwtRequestFilter extends OncePerRequestFilter {

@Autowired
private JwtUserDetailsService jwtUserDetailsService;

@Autowired
private JwtTokenUtil jwtTokenUtil;

@Override
protected void doFilterInternal(HttpServletRequest request, HttpServletResponse response, FilterChain chain)
throws ServletException, IOException {

final String requestTokenHeader = request.getHeader("Authorization");

String username = null;
String jwtToken = null;
// JWT Token is in the form "Bearer token". Remove Bearer word and get
// only the Token
if (requestTokenHeader != null && requestTokenHeader.startsWith("Bearer ")) {
jwtToken = requestTokenHeader.substring(7);
try {
username = jwtTokenUtil.getUsernameFromToken(jwtToken);
} catch (IllegalArgumentException e) {
System.out.println("Unable to get JWT Token");
} catch (ExpiredJwtException e) {
System.out.println("JWT Token has expired");
}
} else {
logger.warn("JWT Token does not begin with Bearer String");
}

// Once we get the token validate it.
if (username != null && SecurityContextHolder.getContext().getAuthentication() == null) {

UserDetails userDetails = this.jwtUserDetailsService.loadUserByUsername(username);

// if token is valid configure Spring Security to manually set
// authentication
if (jwtTokenUtil.validateToken(jwtToken, userDetails)) {

UsernamePasswordAuthenticationToken usernamePasswordAuthenticationToken = new UsernamePasswordAuthenticationToken(
userDetails, null, userDetails.getAuthorities());
usernamePasswordAuthenticationToken
.setDetails(new WebAuthenticationDetailsSource().buildDetails(request));
// After setting the Authentication in the context, we specify
// that the current user is authenticated. So it passes the
// Spring Security Configurations successfully.
SecurityContextHolder.getContext().setAuthentication(usernamePasswordAuthenticationToken);
}
}
chain.doFilter(request, response);
}

}
```

JwtAuthenticationEntryPoint

JwtAuthenticationEntryPoint

This class will extend Spring's `AuthenticationEntryPoint` class and override its method to commence. It rejects every unauthenticated request and sends error code 401.

```
package com.javainuse.config;

import java.io.IOException;
import java.io.Serializable;

import javax.servlet.http.HttpServletRequest;
import javax.servlet.http.HttpServletResponse;

import org.springframework.security.core.AuthenticationException;
import org.springframework.security.web.AuthenticationEntryPoint;
import org.springframework.stereotype.Component;

@Component
public class JwtAuthenticationEntryPoint implements AuthenticationEntryPoint, Serializable {

private static final long serialVersionUID = -7858869558953243875L;

@Override
public void commence(HttpServletRequest request, HttpServletResponse response,
AuthenticationException authException) throws IOException {

response.sendError(HttpServletResponse.SC_UNAUTHORIZED, "Unauthorized");
}
}
```

WebSecurityConfig

This class extends the `WebSecurityConfigurerAdapter`. This is a convenience class that allows customization to both `WebSecurity` and `HttpSecurity`.

```
package com.javainuse.config;

import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.context.annotation.Bean;
import org.springframework.context.annotation.Configuration;
import org.springframework.security.authentication.AuthenticationManager;
import org.springframework.security.config.annotation.authentication.builders.AuthenticationManagerBuilder;
import org.springframework.security.config.annotation.method.configuration.EnableGlobalMethodSecurity;
import org.springframework.security.config.annotation.web.builders.HttpSecurity;
import org.springframework.security.config.annotation.web.configuration.EnableWebSecurity;
import org.springframework.security.config.annotation.web.configuration.WebSecurityConfigurerAdapter;
import org.springframework.security.config.http.SessionCreationPolicy;
import org.springframework.security.core.userdetails.UserDetailsService;
import org.springframework.security.crypto.bcrypt.BCryptPasswordEncoder;
import org.springframework.security.crypto.password.PasswordEncoder;
import org.springframework.security.web.authentication.UsernamePasswordAuthenticationFilter;

@Configuration
@EnableWebSecurity
@EnableGlobalMethodSecurity(prePostEnabled = true)
public class WebSecurityConfig extends WebSecurityConfigurerAdapter {

@Autowired
private JwtAuthenticationEntryPoint jwtAuthenticationEntryPoint;

@Autowired
private UserDetailsService jwtUserDetailsService;

@Autowired
private JwtRequestFilter jwtRequestFilter;

@Autowired
public void configureGlobal(AuthenticationManagerBuilder auth) throws Exception {
// configure AuthenticationManager so that it knows from where to load
// user for matching credentials
// Use BCryptPasswordEncoder
auth.userDetailsService(jwtUserDetailsService).passwordEncoder(passwordEncoder());
}

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

```
@Bean
@Override
public AuthenticationManager authenticationManagerBean() throws Exception {
return super.authenticationManagerBean();
}

@Override
protected void configure(HttpSecurity httpSecurity) throws Exception {
// We don't need CSRF for this example
httpSecurity.csrf().disable()
// dont authenticate this particular request
.authorizeRequests().antMatchers("/authenticate").permitAll().
// all other requests need to be authenticated
anyRequest().authenticated().and().
// make sure we use stateless session; session won't be used to
// store user's state.
exceptionHandling().authenticationEntryPoint(jwtAuthenticationEntryPoint).and().sessionManagement()
.sessionCreationPolicy(SessionCreationPolicy.STATELESS);

// Add a filter to validate the tokens with every request
httpSecurity.addFilterBefore(jwtRequestFilter, UsernamePasswordAuthenticationFilter.class);
}
}
```

Then, start the Spring Boot application.

Generate a JSON Web Token

Create a POST request with URL localhost:8080/authenticate. The body should have a valid username and password. In our case, the username is javainuse and the password is password.

Spring Boot JWT Tutorial

Validate the JSON Web Token

Try accessing the URL localhost:8080/hello using the above-generated token in the header as follows:

Spring Boot JSON Web Token

And there you have it! We hope you enjoyed this demonstration on how to implement Spring Boot security via a JSON Web Token (JWT).

Topics: SPRING BOOT, JSON WEB TOKEN, JWT AUTHENTICATION, HELLO WORLD, SPRING BOOT SECURITY OAUTH2, SPRING BOOT SECURITY, SPRING SECURITY 5, SPRING SECURITY OAUTH, SECURITY

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